

**CLEAN AIR ACT:
PROPOSED REGIONAL HAZE REGULATIONS**

HEARING
BEFORE THE
SUBCOMMITTEE ON
CLEAN AIR, WETLANDS, PRIVATE PROPERTY AND
NUCLEAR SAFETY
AND THE
COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE
ONE HUNDRED FIFTH CONGRESS
SECOND SESSION

APRIL 23, 1998

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CLEAN AIR ACT: PROPOSED REGIONAL HAZE REGULATIONS

THURSDAY, APRIL 23, 1998

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON CLEAN AIR, WETLANDS,
PRIVATE PROPERTY, AND NUCLEAR SAFETY,
Washington, DC.

The subcommittee met, pursuant to notice, at 9 a.m. in room 406, Senate Dirksen Building, Hon. James M. Inhofe (chairman of the subcommittee) presiding.

Present: Senators Inhofe, Allard, Sessions, and Kempthorne.
Also present: Senator Baucus.

OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. I will call the meeting to order.

We are going to move rapidly here because, unfortunately, Governor, we don't have the controls around here that you have in your State, and we're going to have three stacked votes starting at 9:30, which means we can stay here until about 9:40.

So what I would like to do is get through our opening statements and get through your opening statement, and actually get to some questions, before we have to go for the votes.

Senator Baucus is here. Senator, I understand we have three votes at 9:30, so we're going to try to get through our statements.

The purpose of today's hearing is to examine the proposed regional haze regulations that the EPA announced last July. The regional haze rule is supposed to address the problems of haze in our National Parks and wilderness areas that decreases the visibility in these important scenic areas. The regional haze rule came right after the PM_{2.5} rule came last July.

I want to identify the witnesses for today's hearing. We will be receiving testimony from Federal and State officials, including Governor Leavitt of Utah. This is an important point because since the regulation was proposed, over 40 States have requested major changes in the rule. Because the States are supposed to manage the haze program, it is important for the subcommittee to understand where the conflicts exist between the States and the EPA and how they can be resolved.

Today's hearing is the first one of this subcommittee to be held on regional haze since passage of the 1990 Clean Air Act amendments. I don't expect the committee to reach any conclusions today,

but we want to get a good start on it and have the information for the members.

As I read over the comments submitted by the States to the EPA, I notice many of the same concerns being raised by different States—different States spread all over the United States.

No. 1, the implementation schedule—and I would like to have all the witnesses who are here right now who will be testifying in the second panel, as well as Governor Leavitt, try to address these—the implementation schedule for the haze rule does not match the implementation for the PM_{2.5}, even though we are talking about the same particles. In Mr. Seitz' testimony he states that the EPA will coordinate the two; my concern is how the EPA will do this and whether or not that will meet the States' needs.

No. 2, how will prescribed burnings affect the haze rule? The Forest Service has announced a dramatic increase in prescribed burnings. How do we treat this without throwing States into non-compliance or causing even more drastic emission cuts in other areas?

No. 3, how will reasonable progress be measured without penalizing Western States that are already relatively clean? A "one-size-fits-all" standard never seems to work. The current EPA proposal for "reasonable progress" appears to be much closer to a visibility standard amendment offered during the 1990 Clean Air Act debate that was rejected by Congress, than the provisions that were passed into law.

No. 4, along the same lines, how will the "deciview" work and how will it be used by the EPA?

No. 5, what requirements will be made by the States under Best Available Retrofit Technology (BART)? Is there enough flexibility in the rule for the States to develop their own programs?

No. 6, the last but certainly not the least important question, is how does the proposal take into account the recommendations of the Grand Canyon Visibility Commission.

We want to address these six issues, as well as other questions that will arise.

At this time I would recognize Senator Baucus for comments or an opening statement that he would like to make.

**OPENING STATEMENT OF HON. MAX BAUCUS, U.S. SENATOR
FROM THE STATE OF MONTANA**

Senator BAUCUS. Thank you, Mr. Chairman.

I must say, this hearing brings back some very vivid memories of the 1990 Clean Air Act conference. I don't know how many on this subcommittee were involved, but one of the last moments in that conference—I think it was the last issue in the 1990 Clean Air Act—was this issue, and it was a heated debate, perhaps the most rancorous portion of the conference. It was finally settled at 3 a.m.

There were some who wanted EPA to set the regulations for regional haze in the West, and there were others that wanted for the States to be more of a full partner in the setting of standards and how we deal with the question of western regional haze. I pushed strenuously for the second alternative, and finally prevailed, but I have to tell you, it was a knock-down, drag-out battle to get that accomplished.

So we are here today to determine how well all that has been working. Before we do that, though, I would like to step back for a moment and say that I think it is very important to improve visibility, particularly in the West. We know it's not simple. This isn't like other Clean Air Act issues. It can't be translated into cancer deaths or asthma cases or cranked into a risk assessment and cost-benefit analysis. It can't be analyzed that way. We all know, nevertheless, that it's very important.

Now, we're going to hear a lot of technical jargon today, things like "deciviews" and so forth, but step back a moment and think about it. There's something much more to it than that. I'm from Montana; we call ourselves the Big Sky State. For Montanans, our views, the vistas, the sense of broad, open space, helps define us. I think the same is true of most everywhere in the country, not only in the West, but all around the country. The American character has been formed by a sense of open space and wide horizons.

But this sense of space is diminishing. In 1993 the National Academy of Sciences reported that the average visual range in most of the Western United States—that includes National Parks and wilderness areas—was about 60 to 100 miles, and that's about half to two-thirds of what you would see naturally. In most of the East, including parklands, you can see less than 20 miles, or about one-fifth of what is natural. Obviously, these figures can be improved.

In 1970 we also insisted that States be full partners in planning visibility improvements. I am pleased by the efforts of the Grand Canyon Visibility Transport Commission. When we created this Commission, some predicted that it wouldn't work. They said that the collaboration among States, the Federal Government, industry, and environmentalists would produce nothing but bickering. As we know now, they were wrong.

As we will hear today, the Commission has made a valuable contribution in creating a foundation for success. The report lays out some solid recommendations on how we can clear the air and improve visibility, but we have to go beyond the report state.

First, EPA must ensure that the final rule permits implementation of the Commission's long-term strategy; I don't think the draft rule does that.

Second, States must carry out the strategy aggressively.

I look forward to hearing from the witnesses on both of these points, and I am particularly happy to see, as our first witness, Governor Leavitt from Utah, who has worked very hard on this and I must say, Mr. Chairman, I think has done a great job in trying to work with all the various interests in trying to find a reasonable common-sense solution that people can live with to advance the ball forward, rather than taking extreme—some might say demagogic—positions. Instead, he has taken a very reasonable and balanced position, and it is his work, frankly, which has helped move this issue along as far as it has.

Senator INHOFE. Thank you, Senator Baucus.

Senator Sessions.

**OPENING STATEMENT OF HON. JEFF SESSIONS, U.S. SENATOR
FROM THE STATE OF ALABAMA**

Senator SESSIONS. Thank you, Mr. Chairman.

I am very interested in the issues that are implicated here. As a new member of the Senate, I was not involved in the history of this, and I want to ascertain what are going to be the burdens placed upon the States to comply with the regulations. What is the connection between haze and parks and the areas around them? Will anything be required in their behavior? Why don't we have a coordinated relationship between haze issue and the particulate matter and ozone issue that we've recently been dealing with, and can we eliminate some of the duplications.

Mr. Chairman, I am interested in learning more about this issue. I want to be sure that we're not using this issue as a way around the goals that we have set for ozone and particulate matter by imposing a major new burden at an accelerated timeframe, even faster than we've decided to do for health reasons.

So thank you for your leadership.

Senator INHOFE. Thank you, Senator Sessions.

I do agree with that. This panel has spent a year and a half working on the problems associated with particulate matter and ozone in the National Ambient Air Quality Standards changes, and you're exactly right. As I said in my opening statement, we're dealing with the same thing in PM_{2.5} here.

Senator Allard.

**OPENING STATEMENT OF HON. WAYNE ALLARD, U.S. SENATOR
FROM THE STATE OF COLORADO**

Senator ALLARD. Mr. Chairman, I want to thank you for holding this hearing on the issue, which is of critical importance to the West—EPA's regional haze proposal. I agree with my colleague from Montana, that we in Colorado are very proud of our vistas. However, one of the concerns that I must raise is that Federal agencies apply actions in neighboring States that sometimes affect our haze in the State of Colorado. They allow forests to burn, or they actually burn forests for management reasons; this creates a really serious haze problem. Yet, they are exempted. They don't have to live under the same provisions that many other entities in the country are expected to live under.

The impact of this regulation on economic activity could be large. Before it is made final, I think it is important that we go through it in detail.

While this proposal has a laudable goal—to increase visibility in Class I areas around the country—it is a different goal than protecting human health. As such, we should not rush into approval and implementation of new regulations until we fully understand the impact.

While many parts of this proposed rule cause me concern, my main focus has been on its applicability to Federal agencies. This committee has a long history of treating the Federal Government the same as any ordinary citizen. As evidence of that I would point to the Federal Facility Compliance Act of 1992, which amended RCRA to ensure Federal compliance, and also the amendment that

I had offered was accepted in the Superfund markup several weeks ago clarifying the applicability of CERCLA on Federal agencies.

I believe this rule needs to state, clearly and unambiguously, that Federal agency actions will be subject to any controls that a State or regional group determines is necessary to meet the standards established in any final regulation. If, in fact, Federal land management agencies are concerned with Class I area visibility, then they should have State approval for letting a fire burn on Federal land or following a policy of prescribed burning. In fact, any action they take that could impact a Class I area should be subject to State approval. If this isn't the case, my misgivings about this regulation will only deepen.

Thank you, Mr. Chairman. I look forward to today's hearing.

Senator INHOFE. Thank you, Senator Allard.

Governor Leavitt, we are delighted to have you here. I agree with Senator Baucus that you are the appropriate witness: you are on the Grand Canyon Commission; and you have gone back to the very roots of this. You are co-chairman of the Western Region Air Partnership. So we are delighted that you took the time to come. As will be the case with all the witnesses, we would like to have you try to confine your statement to 5 minutes. We will, of course, have your full statement submitted as part of the record.

Governor Leavitt.

**STATEMENT OF HON. MICHAEL O. LEAVITT, GOVERNOR,
STATE OF UTAH**

Governor LEAVITT. Thank you, Senator. I will summarize the written statement that I have submitted.

Let me acknowledge what Senator Baucus said. This has been a lengthy process, one that was established by Congress in 1991 as part of the debate. It was a rancorous part of the debate, I understand. It set forward a 5-year process, and it was a very challenging process. We brought eight States together, five Indian tribal nations, three Federal agencies, and the private sector, with the objective of being able to find a way that we could agree to clean up the air over the Grand Canyon. Over the 5 years there were regional advisory groups appointed from each State. It was a very democratic, almost arduous process. We held hearing after hearing after hearing. We had input from everyone. Frankly, there were many times through the course of this process that I think all of us thought that this was an impossible task. But there were magic moments along the way where, suddenly, we started to agree, and we emerged at the end of that period of time with not just an agreement, but a consensus, essentially, among eight States, five Indian tribal nations, three Federal agencies, and the private sector on a means by which we could cleanup the air over the Grand Canyon.

It was an exhilarating, remarkable moment. It was a time when we stood on the rim of the Grand Canyon and agreed on how it would be cleaned up. It has been a very powerful process. Originally we submitted our plan to the EPA with the full expectation that it would be implemented. Regrettably, at least the original proposed regional air regulations haven't been consistent with that. We are optimistic and feeling good about the fact that EPA is hear-

ing our concerns, and we are very anxious that when the final rule is offered that it will, in fact, include our suggestions and our recommendations.

I would like to say in passing that we have come up with a plan that I believe will work to clean up the air over the Grand Canyon. But more importantly, I believe we discovered a process that States, tribal nations, and Federal agencies can come together to develop regional solutions that are far more powerful than the top-down solution that would be offered from Washington—not that we are smarter, but that we are more in tune with the individual situations that go on in our States.

And what has emerged from this is, essentially, a new environmental management doctrine that has been adopted by the western Governors. It outlines a group of principles. The principles are very well illustrated in this Grand Canyon process and indicate what we would like to do now as we move forward into our further efforts in regional haze. We have come together to put together a Western Regional Air Group that would like to continue implementing these, and that would go further.

I would like to quickly review with you the key principles of this new environmental doctrine that we are developing as a result of this.

The first principle is “Collaboration, not polarization.” It was very clear from the beginning that there were sides of this that would polarize, and as long as we spent our time protecting either our partisan or financial interests, we were not coming together. But we found that if we collaborated and didn’t polarize, that there was a middle ground where we could find a solution.

The second is “Reward results, not programs.” When we finally got down to the point of starting to ask, “What are we trying to achieve here,” and started to focus and measure results and not programs, we made progress.

The third is “Science for facts, process for priorities.” It became very clear to us that where in some cases there was competing science, we could ultimately come up with a set of facts that we could agree upon, and then we used a very deliberate process to use those facts to spell out what the priorities should be. And there are competing priorities. We found that we could use process to sort through the competing priorities, but that we ought to use science for facts.

“Markets before mandates”—it is very clear to us in the West, as it is in other places, that the command and control means of environmental management does not work, but that if we use market forces, it can. The plan over the Grand Canyon, and plans that I believe would ultimately be developed in our regional air process, would include the market forces that would ultimately change and clean up the air.

The next one is “Change a heart, change a nation.” That was our way of recognizing that environmental education is critical.

The sixth principle is “Recognize both costs and benefits.” This was a classic example of where we had to weigh what the costs were and the benefits.

The last one is, “Solutions transcend political boundaries.” It was very clear that this problem could not be solved by prescribing a

group of “one-size-fits-all” standards, “one-size-fits-all” solutions. What happened in California in backyards affected what went over the Grand Canyon. What happens in Utah with the weather affects the air over the Grand Canyon. The solutions have to transcend political boundaries.

So even as my colleagues and I flesh out this new environmental doctrine, we are moving ahead. I mentioned this Western Regional Air Partnership, known as WRAP. It is a partnership between States, tribes, the EPA, and the Department of the Interior. Our purpose is to implement the Grand Canyon strategies, but also to work now on other air quality issues.

My written statement talks about some of the things that we've talked with EPA about changing. EPA needs to be a participant in the Regional Air Partnerships. They need to be at the table as the process goes forward. There needs to be a specific process for the creation and adoption of alternate regional strategies to define and obtain reasonable process.

The deciview target is just not workable as a regulatory measure because of the large uncertainty in the relationship between the measure and the identification of related controllable emission sources. We have had significant trouble with BART, Best Available Retrofit Technology. Its requirements are incompatible with other more efficient State and tribal strategies. We've had a lot of discussion—it's been mentioned here—with prescribed burns and the need for coordination. It has been very discouraging at times to look at all of the things that could be implemented, and then to find out that the largest source of pollution over the Grand Canyon has, in fact, been that.

That would conclude my remarks.

Senator INHOFE. Thank you, Governor LEAVITT. I do apologize for the voting that's coming up. It is making us hurry more than we want.

When you were talking about who all was involved in the Grand Canyon process as was prescribed by the Clean Air Act, I didn't hear you say it—maybe you did—but the EPA was a participant all the way through this process with you folks?

Governor LEAVITT. EPA was a very productive and helpful partner as we went through it. They were part of the consensus, and for that reason we fully expected, when we submitted our report to the national level, that it would be adopted with some completeness. And while that didn't occur in the first draft, we feel they've been very willing to listen to us and hear our points of view, and we're very hopeful that the recommendations that they participated in developing will be fully incorporated.

Senator INHOFE. That's why we're here, and we hope the same thing, Governor. You are familiar with the proposed EPA haze rule. I guess I would have to ask you, just to make sure we have it on the record, even though I think you answered it, can the Grand Canyon Commission recommendations be implemented if the proposed EPA haze rule is finalized as it is written now?

Governor LEAVITT. In a word, no.

Senator INHOFE. All right, sir.

When the Clean Air Act called for the creation of the Grand Canyon Commission and required the Administrator of the EPA to

issue regulations based upon the recommendations, in proposing the regional haze rule, did the EPA follow—the haze rule as it is right now, would you say, since you were involved in the process, that that did follow the recommendations of the Commission?

Governor LEAVITT. The initial rule did not incorporate the recommendations of the Commission.

Senator INHOFE. The term is used, “reasonable progress.” Under the Commission report, will the Western States make reasonable progress in obtaining the national goal for visibility——

Governor LEAVITT. It is very clear that——

Senator INHOFE [continuing]. Under the Commission report?

Governor LEAVITT. The answer to that is yes.

Senator INHOFE. All right, sir.

Does the EPA proposal for reasonable progress allow the Western States the flexibility that would be necessary to develop their alternative approaches?

Governor LEAVITT. The original rule did not. We are hopeful that the final rule will.

Senator INHOFE. I think you answered the question—I had several questions concerning deciview, but you have responded to those.

I would now yield to Senator Baucus for his questions.

Senator BAUCUS. Thank you, Mr. Chairman.

Governor, Nevada is not participating in this, as I understand it?

Governor LEAVITT. They were participating in the process of the Grand Canyon. They have not chosen to go forward with respect to the Western Regional Air Partnership.

Senator BAUCUS. And California is a reluctant participant?

Governor LEAVITT. They continue to come to the meetings, but at this moment they are not participants. We hope that that will change in time. Ultimately they are going to need some kind of regional effort to meet their own standards.

Senator BAUCUS. That is my next question. Your suggestion as to how the regional matter should be addressed—if, as I understand it, some of the haze that comes into Utah is from that part of the country, how are we going to deal with all of this?

Governor LEAVITT. This is such a common-sense approach. The bottom line is that if anybody is going to meet their standards, they’re going to have to cooperate. We’re at a point where we’re going to have to adopt a mantra of “central coordination, but local control.” We have to coordinate and we have to have the power to do that, and we have to have the national government implement—or be willing to allow us to implement—whatever we come up with as an agreement. California and Nevada currently are not part of it, but I think as they get further into their process they will find that they will find it is absolutely necessary that we have such a process.

Senator BAUCUS. Did you have other regional transport commissions’ work?

Governor LEAVITT. There are a number of others. We have identified a number of issues, particularly in this whole area of regional haze. You can’t cleanup a vista in the West without cooperating, and that’s the reason that this is of such importance. We’ve got to have the capacity to have delegated authority from the national

government to coordinate. We're not asking for EPA to give up the authority; we're asking them to delegate the responsibility for us to come up with a solution, that when we do come up with a solution, that could be an agreement among six or eight States, Indian tribal nations, the Federal agencies who have been at the table, that we would be able to see that incorporated into the rule. It's a very common-sense approach and we believe it works far better than what currently exists.

Senator BAUCUS. Do you need help from the Federal Government to include Nevada and California?

Governor LEAVITT. I think anytime a State—I think the Federal Government has done the thing that the Federal Government ought to do, and that's establish a standard. The States are going to have to meet that standard, and all of the States will find in time that we need each other. I believe that California and Nevada ultimately will voluntarily join with us, or at least coordinate in being able to come up with a solution.

Senator BAUCUS. So you're saying that there should be a Federal haze standard?

Governor LEAVITT. We need to have standards. Those have been established, but we need to have the flexibility, and I believe that States and tribal nations and Federal agencies voluntarily coming together to coordinate their efforts to meet those standards will be far more effective than if we have one solution that is established, a prescriptive standard from Washington.

Senator BAUCUS. This is the old dilemma, power, and freedom. How do we draw the line here to accomplish our objective?

Governor LEAVITT. I think the good news is that when you drew the line in 1991 and said to the States, "Go out and find a solution," we did. We brought it back, and I think we've got a plan that is far superior to what would have emerged if it had been just the old process of the Federal agencies coming up with a plan, implementing it, the States objecting, filing plans, and ending up in litigation. We would spend the next 20 years in litigation had it been the old system; as it is now, we have a clear-cut plan on which everyone has agreed. That's the power of being able to have collaboration, not polarization. Top-down solutions feed nothing but polarization; bottom-up solutions create collaboration, and that's what we have here.

Senator BAUCUS. What if portions of the bottom don't participate, California and Nevada, for example?

Governor LEAVITT. They still need to meet the standard. And I think what they're going to find is that without cooperation, they're not going to meet their standard.

Senator BAUCUS. Which standard is this, again?

Governor LEAVITT. This would be the standards that have been established by the national government.

Senator BAUCUS. So you're basically saying that it has to be both?

Governor LEAVITT. It does have to be both. I've always seen the need for standards to be established, but they have to be flexible standards, recognizing that there are differences in areas.

Senator BAUCUS. Instead of technology-based standards, some kind of performance-based standard—is that something that you are striving toward?

Governor LEAVITT. We really ought to be measuring results, not the process. A phrase I like is “national standards, neighborhood strategies.” You can’t solve the problem simply by establishing a standard. Yes, there has to be a standard; yes, there has to be coordination; but there has to be a means by which we can acknowledge the fact that every area is different. There are so many conditions that exist that affect us.

Senator BAUCUS. They’re different, all right.

One final question, Mr. Chairman.

What is the most legitimate concern that you think EPA has with your approach?

Governor LEAVITT. What’s the most legitimate concern that they have with the approach?

Senator BAUCUS. That you’re taking—that is, with WRAP basically calling the shots.

Governor LEAVITT. I think the most legitimate concern is if they thought we were in some way asking for them to give up their authority. We’re not. We are——

Senator BAUCUS. They’re going to come next. Isn’t the EPA witness next?

Senator INHOFE. Yes.

Senator BAUCUS. Here’s your chance to tell them.

Governor LEAVITT. If they were suggesting—or thought—that we were asking them to give up their statutory responsibility, that would be a legitimate concern. That’s not what we’re doing. We are only asking them to exercise their responsibility at the table, not after the fact.

Senator BAUCUS. I’m not quite sure if I know what that means.

Governor LEAVITT. They were at the table when we developed the Grand Canyon Visibility Transport Commission’s recommendations. They were a collaborator. It was a very hard-negotiated process, where all of the factors were in play. When we submitted the recommendations, of which they were a part, we fought our way through this with the full expectation that it would be implemented as part of the rule.

This kind of environmental management, this kind of cooperative and collaborative environmental management, that has proven effective will never go forward if those who participate over a 5-year period get to the end of the day and find out that all of that work is for naught. There is no reason to come to the table again. The only thing for us to do is polarize and fight and litigate. Once we become interested in finding a solution, we can.

Senator BAUCUS. Thank you.

My time is up.

Senator INHOFE. Thank you, Senator Baucus.

We are going to try our best to get through this first round of questioning, but I’m afraid we’re going to ask you to stay until after this series of three votes.

Senator Kempthorne, if you don’t object, if you could withhold your opening statement until after we get the first line of questions?

Senator KEMPTHORNE. Sure, Mr. Chairman. In fact, if I could make that part of the record, that would be satisfactory.

Senator INHOFE. Without objection. I also place in the record Senator Boxer's statement.

[The prepared statements of Senators Kempthorne and Boxer follow:]

STATEMENT OF HON. DIRK KEMPTHORNE, U.S. SENATOR FROM THE STATE OF IDAHO

Mr. Chairman, I thank you for the opportunity to address the Environmental Protection Agency's proposed rule on Regional Haze. Quality of life is something we prize highly in Idaho, where we are fortunate to have some of the cleanest air and most spectacular vistas in the Nation. In Idaho, people are enthusiastic about finding innovative ways to preserve the quality of our environment. But we are adamant about crafting solutions which target our unique environmental challenges and make the best use of the resources we have available.

EPA is mandating States to meet a new Federal standard of one "deciview" improvement in visibility within 10 or 15 years. For States like Idaho, that standard is not appropriate. And while the rule offers States the option of developing alternative reasonable progress targets, it does so without providing the necessary guidelines and funding. States like Idaho will be forced to develop their own tools which EPA may or may not find satisfactory a few years down the road. Under EPA's proposal, alternatives to the deciview standard are expensive and logistically unfeasible. Idaho's Air Quality Program is already over-worked and underfunded. This new regional haze program adds a number of new tasks for overburdened State agencies, such as the revision of State Implementation Plans every three years. This unfunded mandate sets my State up for failure.

But funding and alternatives aren't the only obstacles complicating the Federal regional haze rule. Believe it or not, the Federal Government is a major contributor to haze in Idaho. On the one hand, Idaho is being asked to make major economic sacrifices to achieve that little bit of improvement we could make towards natural visibility conditions. At the same time, the Federal Government is using prescribed burns as a forest management tool. These fires are the single biggest contributor to haze in Idaho—yet Federal land managers want to be exempted! The Forest Service is currently burning the hills just north of Boise, and I've already heard complaints from folks in Idaho about how the smoke is affecting health and visibility. Now, I understand the reasons behind using prescribed fire as a forest management tool, but the regional haze regulations need to address the impact of prescribed fires on reasonable progress targets in the West. Otherwise, it makes little sense to ask Idaho to work hard for improvements that are totally masked by the kind of haze which is currently clogging Boise. The Forest Service should consider alternatives which are more consistent with the regional haze rule, like selective harvest. At the very least, one hand of the Federal Government needs to take into account what the other hand is doing as we consider these regulations. Again, Mr. Chairman, thank you for this opportunity. I look forward to seeing these issues addressed as we work toward preserving visibility in our national treasures.

PREPARED STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR FROM THE STATE OF CALIFORNIA

Mr. Chairman, the spectacular vistas and natural beauty of our national parks and wilderness areas draws some 265 million visitors annually. The experience that brings Americans to Yosemite, Redwood and Sequoia in California year after year is of great intrinsic value. It is also of significant economic value to the small communities surrounding these areas which depend on the tourism dollars generated by our devotion to our national parks. Despite our historic commitment to protecting our national park and wilderness areas, however, today our view of them is fading in the haze caused by man-made air pollution.

The National Academy of Sciences, in its 1993 report entitled *Protecting Visibility in National Parks and Wilderness Areas*, outlined the proportions of the problem we face. In the Western United States, Americans are able to appreciate only about one-half to two-thirds of the view they would otherwise enjoy in the absence of this haze. In the East, the range of visibility is only one-fifth the distance it would be in the absence of such pollution.

Over twenty years ago, Congress recognized the importance of this problem, and took steps to protect against it. In the Clean Air Act amendments of 1977, we estab-

lished the national goal of remedying and preventing visibility problems in 156 national parks and wilderness areas. Congress also directed EPA to make "reasonable progress" toward accomplishing this goal.

EPA took a modest step toward this goal in 1980 by acting to address discrete sources of such pollution. Nonetheless, it deferred action on the regional sources of pollution that are the predominant cause of the current problem, citing a lack of scientific knowledge on how to measure and deal with the problem.

Frustrated by this slow progress, Congress spoke to the issue again in the 1990 amendments to the Clean Air Act. In those amendments, we reaffirmed our commitment to the national goal of improving and protecting visibility in our national parks and wilderness areas. Once again, we directed EPA to take concrete steps to advance that goal.

Since the 1990 amendments, the committee of scientists convened by the National Academy in 1993—experts in meteorology, atmospheric chemistry, air pollution monitoring and modeling, statistics, control technology—have found that current scientific knowledge and control technologies are finally available to address regional haze. EPA has responded by proposing the first-ever rule to combat regional haze.

The proposed rule would establish presumptive targets against which reasonable progress toward improving visibility may be measured. While EPA would provide States with the flexibility to determine how to meet these presumptive standards, EPA should ensure that enforcing those presumptive standards is the rule rather than the exception. That is, the provision for allowing a State unable to meet the presumptive standards to propose alternate standards should be a narrow one. EPA's proposed rule also properly asks States to demonstrate, at reasonable intervals, that they are making progress toward meeting these goals. After waiting twenty years to begin to correct the problem of regional haze in our parks, we need to know that we are taking meaningful steps in this direction.

In recent random survey polling conducted by the National Parks and Conservation Association, 88 percent of respondents supported the reduction of air pollution affecting our parks and wilderness areas. Importantly, those polled supported such measures even if imposed at a cost to them. EPA's current proposal is a reasonable approach which will begin to remove the cloud of haze that now hangs over some of our most spectacular natural treasures. Those treasures—among them Yosemite, the Grand Canyon, and Yellowstone—deserve no less.

Thank you, Mr. Chairman.

Senator INHOFE. Thank you, Senator.

Senator SESSIONS.

Governor LEAVITT. Governor Leavitt, I am new to this Capitol. I am sitting here wondering how it is, with all the challenges facing us concerning the environment and all, that we've had a massive effort that doesn't affect health, but affects haze over the Grand Canyon, and how much time and effort is spent in that project, presumably to the exclusion of other projects that might be more valuable.

We just tend to accept national standards. I think good national standards are good. Have you given any thought to whether or not if you were starting afresh in trying to improve the environment in your State, you would have approached it from this angle, haze over the Grand Canyon? Is that a rational way to approach it?

Governor LEAVITT. This is not the only environmental problem we wrestle with, but it's an important goal. We could all express why it's important, but that area is an international treasure, and I think it is a symbol of our commitment to clean up air over the parks, our wilderness areas, and our vistas.

But frankly, one of the values that it has provided is that you can't clean up the air over the Grand Canyon without cleaning up the air over Salt Lake City and Phoenix and Los Angeles—

Senator SESSIONS. I understand that. I understand that. I understand that is a more valid goal. I wonder how we get started—I mean, we've got the Sipsey Forest in Alabama which apparently will be one of the areas that we want to clean the air over, but if

I were developing an air policy for the State of Alabama, I wouldn't focus on the Sipsey Forest necessarily.

I mean, is this the right way for us—we have to set that policy; you have to live with it, but we are the ones who are empowered and elected to set those policies. Do you have any thought that that's a good way for us to require action, collaborative action, by the States?

Governor LEAVITT. Senator, I just have two comments. One is that the priority of the Grand Canyon is one that I think we should all support. It's one that—

Senator SESSIONS. It is particularly unique, I will admit that.

Governor LEAVITT. But I will tell you that whether or not it was the right priority—and I kind of believe it should have been a priority—one of the real values that came out of this was learning a new process of environmental management, and I think that process will apply in the State of Alabama as well as it does in the West. What I am here to argue is that what we need is a means by which we can all do our part. The national government can do its part, but we can allow these collaborative forces to go forward. If you want to clean the air up over that forest in Alabama, what we have learned here will be of great value to you.

Senator SESSIONS. I would rather clean it up over Birmingham, where there are 650,000 people.

Well, I did a lot of effort in a collaborative neighborhood effort, the “weed and seed” effort, to deal with crime and unemployment and bad living conditions, and I agree with you. It is a thrilling thing when all agencies come together and get committed, barriers get broken down, things can be accomplished that you never dreamed possible.

I really do believe that, Mr. Chairman. And I think this concept of “from the bottom up” is precisely the way we need to set public policy in America, and not a “one-size-fits-all” from Washington. You are correct there.

I am just wrestling—since we are talking at this hearing about whether or not and how—I anticipated that the collaborative process would be how to get ozone and particulate standards met, and not how to deal with the forest issue.

My time is up, Mr. Chairman.

Governor LEAVITT. I would like to say that one of the reasons we have such a problem with this deciview target, is that there's a disconnect between what you're measuring in the Grand Canyon and what has been going on in other cities. So your point is a good one with respect to that.

Senator SESSIONS. And my basic feeling, and what I understand that science supports, is that as we reduce particulate matter—which we are committed to and have some stringent standards on—that will help eliminate the haze, also.

Senator INHOFE. Thank you, Senator Sessions.

The buzzer has gone off and we have a rollcall vote in 15 minutes, but we will have a good 10 more minutes here for questions before we do our recess.

Senator Allard.

Senator ALLARD. Mr. Chairman, I am going to be very brief, and maybe my colleague from Idaho can use my time to ask the necessary questions.

Let me say, first of all, that I think your leadership in this area is tremendous and I listened very closely to your comments. Obviously, your group has recognized that predominantly the winds come from the West, blowing east, and that the Rocky Mountains do create sort of a dam on those air currents, so you have things tend to dam up against the Rocky Mountains. That's why I am so interested in it from a Colorado perspective.

I would appreciate it if you could review the materials that you have and actually submit a written record, a written position, to this committee's deliberations here.

Thank you, Mr. Chairman, and I will conclude and turn the rest of my time over to my colleague from Idaho.

Senator INHOFE. Senator Kempthorne.

Senator KEMPTHORNE. Mr. Chairman, thank you very much.

Governor Leavitt, I want to commend you for your leadership on this issue and many issues in the West. Again, I think a great deal of wisdom comes from our States.

Let me ask you this. We experience this in the State of Idaho, but here we are, dealing with a Federal standard, Federal regulation, and yet we find that the Federal Government actually impacts that negatively—for example, in the prescribed burns that they now conduct on our National Forests that are within our State boundaries, which probably has the greatest single impact on the haze in Idaho, the prescribed burn that the Federal Government calls for, and yet they want to be exempted from this.

Could you comment on that aspect?

Governor LEAVITT. That was a revealing experience to me. We sorted through everything from backyard barbecues in California to Mexico and back to cars in Phoenix and power plants in Arizona and people driving the Strip in Las Vegas, in terms of having an impact on the Grand Canyon.

Frankly, we concluded that if we could do miracles in being able to clean all of those things up and change the weather and everything else, there would still be a problem because the single largest contributor was the prescribed burns and the smoke that came from them.

Now, there is a rational reason why those were made, and that's not an illogical policy. But you can't have a clean air plan that doesn't acknowledge and recognize that that's a substantial contributor to it, and if Federal agencies want to say, "We're just going to conduct a policy in one department of the Government, and then on the other hand we're going to hold you accountable for what happens over the Grand Canyon, and we're going to use a measure called deciview, and it's going to measure what happens right here, not here, here, and here," it's illogical. We're talking about something that isn't even logical.

So what we've asked is that the Federal agencies that were participants here recognize that if you're going to conduct prescribed burns, it's going to have an impact. If you're going to have fire, it will have smoke; and if you're going to have smoke, you're going to cut the visibility down. If the goal here isn't a bunch of proc-

esses, a bunch of plans, if it's cleaning up the air, you have to participate. And, gratefully, what's happened here is that we've started to get people working together toward a goal of actually cleaning up the air. Our big worry is that now we've gotten everybody together, this common-sense approach can't prevail, and nobody is ever going to come to the table again, Federal agencies or otherwise.

Senator KEMPTHORNE. Mr. Chairman, I think that points out, too—it really calls for us to examine some of the other Federal policies. Yes, a prescribed burn—we're getting a fuel load that's building up, and it jeopardizes—we may see hundreds of thousands of acres of forest lost, so somehow we need to deal with this. Selective harvest may be a way to go, and helicopter harvest. There is a variety of ways that we can be doing this which do not then contribute to impacting one of these Federal regulations.

And too, one of the interesting things that I've found, Governor Leavitt, is that in coming out here to the East, when people from this area go to the Western States and see the mountains that we have, they then realize the topography and that you have these majestic peaks, but that they form a bowl. And once you get this smoke in that bowl, if you don't have a good wind, it's going to stay there. During the winters you get the inversions that put the cap on it. I know that Salt Lake City is hit with that terribly.

I appreciate that, and in light of the time I will withhold any further questions, Mr. Chairman.

Senator INHOFE. Thank you, Senator Kempthorne.

I wanted to get around to my favorite subject. I was in a similar position to you—not in the lofty position of being a Governor, but I was the mayor of a major city for three terms, and the villain at that time was not crime in the streets or welfare reform; it was unfunded mandates.

I am concerned about the EPA's estimate of the cost of the haze rule. I think their estimate was \$2.7 billion if they did it over a 15-year period—or \$2.1 billion, I think it was—and then \$2.7 billion if they tried to compress that into a 10-year period.

But I remember so well, as this panel has shared with you, that we went through a year and a half of hearings, seven hearings, on the proposed PM_{2.5}. That was estimated originally by the EPA to cost \$6 billion; then the President's economic advisors came out and said it was going to be \$60 billion; then the Reason Foundation out in California put together an extensive study, and the range was somewhere between \$90 billion and \$150 billion.

So I am concerned about two things. No. 1 is the accuracy of the cost of this. No. 2 is the fact that we are supposed to end the era of unfunded mandates to political subdivisions, in which case you have been told, I understand, that if there is a cost, this will be picked up by the EPA through grants. In the case of the monitoring costs, those grants actually did come out—or are proposed to come out—to the States, but they are taken away from other grants that the States would have.

So I would like to have your response to those two questions—first of all, the accuracy of the amount, as nearly as you can determine it; and second, on how you think you would be compensated.

Governor LEAVITT. I am not in a position to give you an exact dollar amount, but I will tell you that we have done considerable study on what the large picture costs will be. It costs money to clean up the air; I don't think there's any question about that. But our estimate is, on the Grand Canyon Visibility Transport Commission, that we will clean the air up at literally half the cost with the collaborative approach, over what it would be with the top-down mandate approach. This is clean air at half the cost.

Senator INHOFE. OK. You're saying then that your approach, after all the studying that you have done and the recommendations that you are making, comparing that to the proposed rule by the EPA, you believe it to be half the cost?

Governor LEAVITT. That is correct.

Senator INHOFE. When you say half the cost, are you talking about half of their projected costs?

Governor LEAVITT. Yes.

Senator INHOFE. Which would be, say, \$2.7 billion if it were over a 10-year period?

Governor LEAVITT. That estimate was made by the eight States, six Indian tribal nations, and the three Federal agencies. That takes all of the costs of all of the agencies and the private sector. When we measure cost, we ought not to be measuring the Government's cost; we ought to be measuring the citizens' cost in. And by being able to go after those most efficient ways of cleaning up the air, it costs half as much to clean up the air as it would otherwise. Plus you get the air cleaned up, and we're not convinced that you would get it the other way.

Senator INHOFE. OK. How comfortable are you, out in your State, that these costs would be picked up without jeopardizing other State grants?

Governor LEAVITT. I do not share that.

Senator BAUCUS. Mr. Chairman, if I may, very briefly?

Senator INHOFE. Yes.

Senator BAUCUS. These cost questions are very important. It is also important to note that there are great benefits in the Clean Air Act. Congress in 1990—I forget what year it was, in this decade—asked EPA to do a congressionally mandated study to compare the benefits and the costs of the Clean Air Act, concluding that the benefits outweigh the costs by a ratio of 40 to 1. That study has never been disputed.

Now, in the interest of full disclosure, I will say that that's up through 1990. The study does not include assessments since 1990. But it is important to remember that there are tremendous benefits under the Clean Air Act in addition to the costs, and I think any responsible businessman or businesswoman would know that clean air and clean water is good for business all the way around.

We have to be mindful of the costs; I'm not trying to say that we shouldn't be mindful of the costs, but there is also a balance here, and the balance is benefits, also, in addition to the costs.

Senator ALLARD. Would the Senator from Montana yield briefly?

Senator BAUCUS. Sure.

Senator ALLARD. The way I interpret his testimony, we're talking about the same benefits, but he's saying we cut the costs for the same benefits.

Senator BAUCUS. I'm not disputing that. I'm saying that when you talk about costs, it is also important to talk about the benefits.

Senator ALLARD. If I could interject one comment, an observation, I'm glad we're talking about cost-benefits. I've been trying to do that now for the 4 years I've been here.

Senator SESSIONS. Mr. Chairman, I think the last estimate you mentioned on the particulate matter, \$140 billion, was basically what this highway bill is going to cost. It is a lot of money, and we do need to make sure that we get the absolute most benefit when we impose a cost in a regulation, and a requirement on the States. We need to be sure that that requirement gets the most possible benefit in terms of aesthetics and health.

Senator INHOFE. Senator Kempthorne.

Senator KEMPTHORNE. Mr. Chairman, I would make the point, too, that our Safe Drinking Water Act, which was passed last year, is the first piece of environmental legislation that contains cost-benefit analysis, for the first time. And I hope it's not the last time.

Senator BAUCUS. Also, visibility rules, by definition, include costs, unlike the health standards—

Senator INHOFE. We have 3 minutes left in the vote. Governor Leavitt, if you could remain for just a few minutes after the vote, there may be some final questions.

Thank you very much. We are in recess for about 20 minutes.

[Recess.]

Senator INHOFE. I would ask the second panel to come to the table.

While the panel is coming up—by the way, we're back in session—we do have four States represented here. We were supposed to have a fifth State, the Commonwealth of Virginia, but they had to cancel at the last minute. I think their testimony would have been important because it would have offered the Eastern States' concerns with the haze rule, and there is some diversity of opinion by the Eastern States.

I would also like to mention a few key points from their comments.

No. 1, the haze timeline needs to be coordinated with the PM_{2.5} program, as we discussed in the last panel.

No. 2, there needs to be an alternative to the BART program; more flexibility is needed.

No. 3, the proposal does not encourage States to work together in regional commissions. It should provide incentives by allowing the direct implementation of programs developed through such commissions.

Our second panel consists of Mr. John Seitz, Director, Office of Air Quality Planning and Standards for the U.S. Environmental Protection Agency; Ms. Christine Shaver, National Park Service; Mr. Randolph Wood, director of the Nebraska Department of Environment Quality; Mr. Kenneth Colburn, director, New Hampshire Air Resources Division; and Ms. Lynn Terry, Deputy executive officer, California Air Resources Board.

We are going to hear from all five of you, and we would like to have you adhere, if you would, to our 5-minute rule on opening statements. Your entire statements will be made part of the record. We will be joined by at least two other Senators, and for the bene-

fit of those who are here, I would suggest that we do have the staff of all of the members of the committee so that your testimony will reach the ears of all the members of the committee.

Mr. Seitz, why don't we start with you?

And if you folks would try to adhere to the timeline, we would appreciate it very much.

STATEMENT OF JOHN S. SEITZ, DIRECTOR, OFFICE OF AIR QUALITY PLANNING AND STANDARDS, ENVIRONMENTAL PROTECTION AGENCY

Mr. SEITZ. Thank you, Mr. Chairman. Thank you for inviting me here today to talk about EPA's proposed regional haze rule, and I will try to cover the points you addressed in your opening statement as I go through my opening statement.

Senator INHOFE. That would dramatically shorten my questions, then.

Mr. SEITZ. I hope to cover them all. I may go a little more than 5 minutes to cover them all, but if that's OK with you, I will try to touch on each and every one of them.

As you know, there has been significant documentation across the country showing how haze has significantly impaired visibility in a lot of our National Parks and Wilderness Areas. Haze is caused by a variety of pollutants that are emitted from industrial sources, as varied as manufacturing, chemical facilities, and automobiles. And the problem, as we all know, is they are transported long distances and impact these particular areas that were designated for protection under the Clean Air Act, called Class I areas.

We also know that the causes and severity of regional haze differ dramatically between east and west. The normal visual range in the West is some 60 to 90 miles, while in the East—normally it is probably one-half to two-thirds what the visual range would be without the pollution—and in the East it is 15 to 30 miles, or one-sixth to one-third of what it should be.

The real problem in this issue, as the Governor mentioned, is the mix of pollutants that are causing this problem are emitted from a wide variety of sources over a large geographical range. In the 1977 amendments to the Clean Air Act, Congress set the national goal for visibility: "prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution."

As you know, in the 1990 amendments Congress reinforced this goal and directed the Agency to tackle the issue of regional haze. To that end the Agency established the Grand Canyon Visibility Transport Commission, and they concluded their work in June, 1996 with a report to the Agency.

Based upon that report, reports from the National Academy of Sciences, and input from the Agency's Clean Air Act Advisory Committee, on July 31 we proposed the rule. The public comment period closed on December 5, and we hope to finalize that rule sometime this summer.

As you have indicated, I will submit a written statement covering many points in the rule, but now I will try to address the points you have raised.

One of the issues concerning the rule was that we directed the States to improve visibility on the worst days, and try to prevent degradation of visibility on the best days. This would occur through a two-part process. First, States would have to establish an overall visibility improvement goal for each Class I area. EPA proposed a presumptive goal, and specifically allowed for States to propose an alternative.

Let me say—and this is one of the first points made—that is not a national standard. It is an analytical point. It is not a standard. The States have the ability to choose an alternative goal.

Second, and most importantly, the second part of the program is for the States using that goal to put in place an emission reduction strategy that would be enforceable, that would realize improvement to visibility.

Together, the goal of visibility improvement and the emission reduction strategy would equal reasonable progress.

In addition, EPA proposed to express the goal in terms of a deciview as measurement, and there has been a lot of comment on the deciview. EPA proposed and is taking comment on the deciview. We proposed the deciview as a concept because, like the decibel scale, it is an easy measure to examine the clarity of the air—if you will, from the cleanest to the dirtiest days.

A change in one deciview is a very small change, but is considered to be perceptible in our National Parks and the vistas in these parks.

Using the deciview scale, in addition States have the flexibility to be able to take a look at what emissions are causing impairment to visibility and address their control strategies to the most directly impact visibility improvement.

EPA also provides flexibility to the States by allowing them, as I mentioned, to address and develop an alternative target. Specifically, the Act provides for the consideration of the cost of compliance; time necessary for compliance; and remaining useful life of these air pollution sources in this alternative goal. So the States have the ability, using the very factors set forth in the statute, to develop an alternative goal that meets these “reasonable progress” requirements.

Since visibility impairment is caused primarily by fine particles, and this goes to another point that you raise, it was intended in the proposal to integrate the planning and implementation requirements of the PM-Fine program with the regional haze program. We specifically addressed in the preamble that the intent was to ensure that the control programs for PM-Fine come in at the same time that regional haze is done. So we intended to do that; we’re taking comment on that, and we are committed to continuing that.

One of the next issues that you addressed was the Grand Canyon Visibility Transport Commission. As the Governor mentioned and other witnesses have mentioned, we were committed to the Canyon report. We were at the table with them, we committed technical resources, we committed financial resources. The intent of the Agency is to ensure, in the final report, that the recommendations of the Canyon are implemented through this rule. We stand committed to doing that; as the Governor mentioned, the final piece of this, the Western Regional Air Partnership, is attempting to put together

those elements that go into the specific State implementation plan, and we stand ready to work with them to develop that.

One important issue that I ask you to remember, however, is that the Grand Canyon is only 16 areas. There are an additional 140 areas across this Nation that this rule must address, and the Agency, in putting this rule together, tried to develop a rule that provided flexibility for States to develop goals and strategies that enabled them to achieve reasonable progress in a way that would fit the criteria in the statute. We did not try to have a "one-size-fits-all" approach to this. We want to ensure that visibility is the objective, as well as the enforceable programs on emission reductions.

So in conclusion, Senator, I think I covered most of the points. The EPA is still reviewing the public comments. We intend to complete that process, develop options, and come out with a rule that hopefully will address the intent of the Clean Air Act and the States, Federal agencies, and tribal entities that are working with us on it.

Senator INHOFE. Thank you, Mr. Seitz. I will have a follow-up question on that.

Ms. Shaver.

**STATEMENT OF CHRISTINE L. SHAVER, NATIONAL PARK
SERVICE, DEPARTMENT OF THE INTERIOR**

Ms. SHAVER. Thank you, Senator. Good morning. My name is Christine Shaver. I am the chief of the National Park Service's Air Resources Division, and I thank you for the opportunity to speak to you today.

We are legally mandated to protect the resources and values of all our National Parks and Wilderness Areas, consistent with the high public value placed on these areas. These mandates come from the National Park Service Organic Act; the Wilderness Act; the enabling legislation for each park unit; and the Clean Air Act, which gives us an affirmative responsibility to protect our quality-related values, including visibility, in our Class I areas. The National Park Service manages 48 of those Class I areas in the United States.

The public loves its parks. In 1997, there were approximately 275 million recreational visits to units of the National Park Service. To put that number in perspective, that's roughly one visit per person in the population.

Travel-related expenditures alone have been estimated at \$10 billion to \$19 billion a year. Surveys conducted at several of our parks have documented that clean, clear air is one of the most important attributes in our parks, and even people who never visit parks and never intend to visit parks place an extremely high value on knowing that those resources are being protected as part of our legacy to future generations.

The National Park Service has been monitoring visibility parameters for up to 20 years in some of our areas. Based on the monitoring data collected, we know that visibility in the Western United States is generally one-half what it should be under natural conditions, whereas visibility in the East is one-fifth what it should be and what it was only 50 years ago.

Based on this data, in 1985 the Department of the Interior certified to EPA that we had existing visibility impairment in all the Class I areas managed by both the National Park Service and the Fish and Wildlife Service. We reaffirmed that certification to EPA in our comments on the regional haze rule late last year.

Congress has told Federal land managers to assume an aggressive role in protecting these resources, yet we generally lack the regulatory authority to bring about the emission reductions that are needed to carry out our stewardship responsibility. Therefore we applaud EPA's decision to develop regional haze regulations. We need strong, clear guidance from EPA and sustained performance from the States and tribes to ensure that reasonable progress toward a national visibility goal is made.

We recognize, and are encouraged, that progress may result from other air quality programs that are already in place or expected to occur over the next several years, but we need, and our National Parks and Wilderness Areas deserve, the kind of insurance policy that would be provided through a regional haze regulation.

EPA's proposal provides a good foundation for the development of those emission management programs that will be needed to unveil the spectacularly scenic resources that are so important to our public.

I would like to highlight a few issues related to EPA's regional haze proposal and touch on some of the points that you mentioned in your opening remarks, Senator.

First, we support the use of the deciview metric as a means of tracking visibility conditions so that we will know if the emission strategies that have been taken are working, and so that we can tell the public whether the visibility in our parks is getting better or worse over the long term.

However, we also believe that tracking emission changes and implementation of specific programs is extremely useful in assessing accountability, as well as progress, in the short term.

Second, with respect to what constitutes "reasonable progress," we have questioned whether EPA's suggested "no degradation" approach for the best days is really adequate, particularly in some of our eastern parks, where our best days are still substantially degraded.

In addition, EPA's proposed "reasonable progress" target for the dirtier days would allow up to 220 to 330 years to meet the visibility goal in our National Parks in the East. This is not acceptable to the people who visit our parks, and it is not acceptable to the people who think we are protecting these parks for future generations. I don't think they meant "future generations" 10 generations from now should be the only ones to enjoy these spectacular visits.

Third, we support EPA's promotion of a regional approach to establishing emission reduction objectives, tracking progress, and allocating responsibility among sources and jurisdictions. Some of our parks straddle State lines, and the specter of individual States coming up with their own goals, their own strategies, their own methods of tracking not only creates a considerable duplication of effort, but potential inconsistencies. Nonetheless, we recognize and highlight that the States and tribes are the ones that have the responsibility for implementing and enforcing these strategies.

With respect to the work of the Grand Canyon Visibility Transport Commission, the Department of the Interior was an active participant in this process. We devoted significant time and resources, just like others did, to help form the consensus that emerged. We support the "reasonable progress" objectives adopted by the Commission, and we agree with the recommendation. But those recommendations, while comprehensive, need to be translated into enforceable strategies that demonstrate compliance with the objectives—that is, continuous emission reductions, steady visibility improvement, and no perceptible degradation.

We encourage EPA to provide the States and tribes with an incentive to proceed expeditiously with the activities and the actions that they have committed to take and the reductions that they have committed to produce.

Finally, on the issue of prescribed fire, and in an effort to perhaps decrease the number of questions on this issue, Secretary Babbitt testified before the House Resources Committee on September 30, 1997, regarding the Federal Government's wildland fire policy and the need for that policy, including a great deal of detail on what was involved. If you would like, I could submit that testimony for the record, or provide it for you separately.

I think the issue that has been of concern here today is the impact of fire on visibility, and I wanted to state for the record that the National Park Service, as well as other bureaus within the Department of the Interior, do have memorandums of understanding with many States—with any State that has asked—that determine how and when we can burn, determine whether or not we will get permits, determine how we will manage smoke from fires to minimize or avoid unacceptable visibility impacts, determine consequences of our failure to perform. We are happy to enter into those agreements with any State that asks.

More specifically, the Grand Canyon Visibility Transport Commission had some very specific recommendations related to fire that we are actively involved in developing an action plan for implementing—not only for the Grand Canyon Commission States, but for the entire country. We recognize that we will need to do some training of our field personnel who have operated differently in the past, but generally speaking, we are committed to taking care of the part of the so-called problem that we are causing and being held accountable for doing that. We do not believe the prescribed fire activities will interfere with any reasonable progress goals; the fires are episodic in nature, they don't occur every day, and with a metric target such as a deciview a decade, it is very unlikely that a fire in one place will cause that metric to be disturbed.

In any event, we do not believe that any other source category should be held accountable for making up for the visibility impairment that we might cause through this very natural process.

I would be happy to answer your questions.

Senator INHOFE. Thank you, Ms. Shaver.

Ms. Terry.

**STATEMENT OF LYNN TERRY, DEPUTY EXECUTIVE OFFICER,
CALIFORNIA AIR RESOURCES BOARD**

Ms. TERRY. Thank you for the opportunity to be here today.

In California, the Air Resources Board is charged with overseeing the State's implementation of the Federal Clean Air Act, as well as California's own Clean Air Act. We are committed to protecting and enhancing visibility, as well as meeting health-based air quality standards. It is important that these two activities be done in concert.

So while we support efforts to improve visibility, we strongly oppose the regulatory framework that was outlined in EPA's proposed regulation.

In terms of making the program successful, the regulatory framework needs to be sensible, be scientifically sound, and be sure that it compliments our health-based air quality standards. In our evaluation, EPA's proposed regional haze regulation does not meet these criteria. I would like to highlight four key areas and recommendations that need to be addressed in the final regulation from our standpoint.

The first and most critical issue is that EPA should drop the deciview approach as the test for visibility progress, and replace it with steady emission reductions in the emissions of pollutants that are shown to contribute to regional haze. As Governor Leavitt indicated earlier, the Grand Canyon Visibility Transport Commission, including California, wrestled with the question, "What is reasonable progress?" The Commission ultimately defined reasonable progress as continuous emission reductions. This parallels the Clean Air Act's approach for progress toward health-based air quality standards.

Although the proposed regulation purports to offer States flexibility to choose an appropriate progress target, States must demonstrate to the satisfaction of EPA that even obvious alternatives are justified. California knows all too well how difficult and expensive it can be to pursue EPA approval for alternatives when there are federally prescribed approaches, no matter how innovative or effective those alternatives may be.

In California, as in other parts of the country, regional haze, fine particulate matter, and ozone share common components, so our existing and planned air quality programs to address ozone pollution will cut particulate matter pollution and improve visibility throughout California and in downwind areas. California and States in other situations should be able to satisfy the "reasonable progress" requirements by reducing emissions to meet the progress requirements for the health-based standards, until those health-based standards are achieved.

The deciview metric, in our view, is too subjective to be the basis for holding States accountable for visibility improvement. The technical tools for translating emissions into increments of visibility into visibility improvements are just not available.

Congress created the Grand Canyon Visibility Transport Commission to advise EPA on strategies for improving visibility at National Parks and Wilderness Areas on the Colorado plateau. The Commission process resulted in the conclusion that emission reductions are the appropriate progress target for visibility. EPA should not ignore this conclusion.

I would comment that California is committed to implementing the recommendations of the Grand Canyon Commission, and I

would be happy to answer any follow-up questions regarding our participation.

Our second recommendation is that EPA should change the timing for planning and implementation of the regional haze program to parallel and compliment the schedule for fine particles. The timelines in the proposed regulation would preclude a thoughtful and efficient approach to visibility improvement. Most of the extensive technical work needed for fine particles is also critical to support visibility planning. The schedule should allow States to integrate these efforts to capitalize on the overlap between the sources of fine particle and haze pollution.

Third, new funding must be provided to support efforts to meet the Federal requirements for regional haze. Visibility plans will be extremely resource-intensive, including monitoring, inventory, modeling, technology assessment, control measure development, public review, agency adoption, and implementation. States, tribes, and local agencies should not be asked to divert funds from existing programs focused on health-based standards in order to implement a regional haze program.

And finally, Federal agencies must be full partners in visibility solutions. You heard that discussed extensively earlier. National emission standards for Federal sources are key to meeting all of our air quality goals, health-based standards as well as visibility. While we are encouraged by the Federal Government's actions to require lower emitting diesel engines in trucks, off-road equipment, and locomotives, a more proactive approach is needed to make progress on cleaner engines for ships and aircraft. Clearly, in terms of prescribed burning, we also need improved coordination and responsibility and accountability with Federal land managers. Land managers and air agencies have to work together to accommodate increased burning needed for public safety and forest health without smoking out downwind communities.

California intends to improve our own smoke management programs to address both visibility and public health concerns. Federal land managers must be a partner in that process.

In conclusion, EPA has an opportunity to create a sound framework to support visibility improvement through the next century, but the structure must be rebuilt to ensure a common-sense implementation that is integrated with existing air quality programs and our focus on public health-based standards.

We appreciate the opportunity to share our comments on that goal. California will continue to implement our State's clean air plan for achieving health-based standards and will incorporate additional strategies to meet the new ozone and particulate matter standards. These efforts will clearly improve visibility, as well. In fact, our Board has a very aggressive regulatory agenda this year to continue to pursue the emission reductions under our authority, primarily mobile sources, and we will be looking at an enhanced low-emission motor vehicle program later this year that will continue to reduce the emissions from motor vehicles and several other types of mobile sources.

Thank you very much.

Senator INHOFE. Thank you, Ms. Terry.

Mr. Wood.

**STATEMENT OF RANDOLPH WOOD, DIRECTOR, DEPARTMENT
OF ENVIRONMENTAL QUALITY**

Mr. WOOD. Thank you, Mr. Chairman.

Much like Oklahoma, Nebraska is a Midwest State. We are neither a Western, nor an Eastern State, and there has been much discussed today about the problems in the West and the problems in the East. We are often described as those transition States that are somewhere between those Eastern States that have funny kinds of borders, and the Western States which have square kinds of borders. So we are sometimes schizophrenic about that.

But therein, I think, lies part of the problem as EPA's proposal applies to the State of Nebraska. I want to make several points, and then I want to give you an example.

The point I want to make first is that there is a lack of rationale, scientifically sound rationale, for the program as EPA has proposed it that would apply to the State of Nebraska. We believe in the State of Nebraska that whenever we write regulations, they must pass either what we call the "front page test" or the "straight-faced test," and we do not believe that EPA's proposal as it applies to Nebraska meets those tests.

We have a frustration of not being able to do everything that we need to do in the State of Nebraska with respect to the environment, yet we face this proposal from EPA that would require us to spend a lot of our resources and spread those even more thinly in an exercise which we fail to see will accomplish anything.

Third, there is an apparent lack of regard for the need—as you have already asked a question about—for coordination between the fine particulate standards and regional haze, and we would go even further and talk about the ozone program. It is not apparent to us how EPA would, in fact, integrate those programs. There has been discussion that, yes, they would want to do that, but we're not really sure in fact how they would integrate those things.

Finally, a point that I want to make is that I know because I am appearing here today, and we are providing negative testimony regarding EPA's proposal. We will be characterized by some as being insensitive to the environment and not dedicated to the protection of our environment, and I want to say for the record that nothing can be further from the truth.

Let me rush on, given the short amount of time. I have covered a lot of the rest of the things in my written testimony, which you have read. I want to talk about an example in Nebraska that I think is characteristic of the problems of EPA's proposal with respect to Nebraska.

We have a county in the northeastern corner of Nebraska called Cumming County. That county is 750 miles, or 1,250 kilo-meters, south-southeast of Voyager National Park in the State of Minnesota on the Canadian-United States border. The wind doesn't blow much from the south-southwest to that area. However, Cumming County, which covers 575 square miles with a population of 10,000 people, is an agricultural county which produces crops. It has no industrial sources as EPA talked about industrial emissions causing regional haze. This is not a bastion of smokestack industry. The only emissions from that county are rural fugitive dust emissions and fugitive emissions, whatever they

might be, from agricultural operations. And under the stretch of anybody's imagination, as ground level emissions under most modeling scenarios, you wouldn't expect those emissions to travel very far before they are either precipitated out or they are translated into something else, much less travel 1,250 kilometers.

EPA's analysis indicates that Cumming County's fugitive emissions contribute 0.23 percent to the regional haze in Voyager National Park, which is 1,250 kilometers distant. EPA calculates that the total visibility reduction in Voyager National Park is a total of 1.642 micrograms per cubic meter. If you relate that to the various standards, you will know that that is a very, very small number.

What this means is that Cumming County is responsible for 0.0032 micrograms per cubic meter in the Voyager National Park. I believe that most of us would question the veracity of the analysis and would scoff at a calculation of this parameter, to the fourth decimal place.

My first impression, and one that has not been dissolved by anything that I have heard or read in the recent timeframe, is that it was very important for EPA to somehow figure out a way to include every State in the requirement to have a regional haze visibility program, and the way to do this was to calculate that every State had some contribution to a visibility reduction and regional haze in at least some Class I area, regardless of the rationality of the numbers.

I would say that it reminds me a little bit of a problem that we've been talking about in Washington as well as the States for a number of years in the Superfund Program, and that is where in some sites, local Pizza Huts or local pizza cookeries have had to spend tens of thousands of dollars just to prove that they don't ship PCBs and did not ship PCBs to landfills in the past. Under EPA's proposal, what the State of Nebraska would have to do is to dedicate numerous resources that we don't have, that are not forthcoming and will not be forthcoming from the Federal Government, to prove that we don't have a problem. They have in fact, as I said in my written testimony, indicated to us, "Well, all you have to do is write an implementation plan that says that you have an insignificant impact, and then you don't have to do anything further, except every 3 years you have to rewrite that implementation plan or revisit it."

I would suggest to you that that's not a common-sense kind of thing to do as we in the Midwest like to think that we ought to do things. Our suggestion is that EPA needs to totally revisit this issue, particularly as it reflects these kinds of issues, and come forth with a proposed rule that is more rationally and more technically sound.

Thank you, sir.

Senator INHOFE. Thank you, Mr. Wood.

Mr. Colburn.

STATEMENT OF KENNETH A. COLBURN, DIRECTOR, AIR RESOURCES DIVISION, NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SCIENCES

Mr. COLBURN. Thank you, Mr. Chairman.

As an initial comment, whatever our differences as States, I suspect that we all concur in our appreciation for your vigilance, Senator, and that of your colleagues in ensuring that the Federal commitment to fully fund the new PM monitoring network is honored. Please maintain that vigilance.

Though haze is often considered to be a western issue, pervasive visibility impairment is actually two to three times worse in the East. We don't have as many Class I airsheds, but the wilderness areas that we do have are very important recreational resources for our densely populated region. All of our wilderness areas are significantly impacted by haze and will benefit from regional efforts to improve visibility, as these pictures show.

The White Mountain National Forest, with its two Class I airsheds, has 7 million visitor-days per year, more than Yellowstone and Yosemite National Parks combined—

Senator INHOFE. Could you identify these two pictures?

Mr. COLBURN. Senator, these pictures were just provided to me by the Appalachian Mountain Club. I do not know for certain at this time whether they represent the top 5 percent and bottom 5 percent, top 20 percent or worst 20 percent. I can find out that information for you, and I have copies—

Senator INHOFE. It's my understanding that we didn't receive these as advance testimony, so it would be helpful if you would identify those for the record.

Mr. COLBURN. I would be pleased to do so, Senator.

[Information to be supplied follows:]

The two photographs provided to the subcommittee depict the Great Gulf Wilderness, a Class I airshed located in the White Mountain National Forest in New Hampshire. While provided to Mr. Colburn by the Appalachian Mountain Club, the photographs were actually taken by the U.S. Forest Service visibility camera at Camp Dodge in the Great Gulf Wilderness.

Dirtier Photograph

The dirtier photograph was taken on August 4, 1988, at noon. It shows 39 deciviews, or visibility of only 8 kilometers (approximately 5 miles). On such days, there is essentially no vista. The 10-hour daytime sample for this date had a fine particulate matter (PM_{2.5}) reading of 81 micrograms per cubic meter (μg/m³). Relative humidity was 82 percent. The identification number of this photograph is #1120.

Cleaner Photograph

The cleaner photograph was taken on August 19, 1988, at noon. It shows 6 deciviews, or visibility of 221 kilometers (approximately 137 miles). On such days, the Adirondack Mountains, 133 miles distant, are visible from the summit of Mt. Washington. The 10-hour daytime sample for this date had a PM_{2.5} reading of 2 μg/m³. Relative humidity was 68 percent. The identification number of this photograph is #1010.

Mr. COLBURN. One-quarter of the population of the United States lives within a day's drive of the White Mountains, and 48 million sightseers spend over \$2.5 billion annually in New Hampshire. Tourism directly supports 1 out of 12 jobs in the State and contributes almost \$150 million in taxes to our State budget. Clearly, visibility is important to New Hampshire.

Surveys show that hikers in the White Mountains not only notice haze, but are physically affected by it. The public sees haze as a sign of unhealthy air, and they're right; that's why New Hampshire supports EPA's efforts to address this problem. We agree with EPA that a framework should be established for steady, perceptible

progress in reducing haze, and that all States throughout the East should be included.

We also support EPA's use of the deciview metric. The Clean Air Act requires visibility to be protected, and deciviews are an appropriate visibility yardstick.

EPA should not, however, impose identical requirements across the country. The causes of haze in the West are complex and vary from place to place. The causes of haze in the East are well-understood and much the same throughout the region. The haze problem is more manageable in the East because it is dominated by the same sources and same pollutants that we already know how to control cost-effectively.

The key is sulfates. They comprise more than half of eastern haze. We are making an important dent with the acid rain program, but further reductions will be necessary, even after Phase II is implemented. Ten to 15 million tons of sulfur dioxide will still be going into the air each year, creating continued acid rain, fine particles, and regional haze throughout the East. EPA's NO_x Transport SIP call, while essential for reducing ozone, also won't do much for visibility because nitrates contribute little to haze in the East. And the new fine particle standard may not help much if it targets mainly urban hotspots rather than overall particulate levels.

Thus, while EPA's proposed rule is a good first step in taking national visibility goals seriously, its progress target for the East is far too modest. It would take longer for many areas to achieve this goal than the United States has been a Republic. EPA should require more rapid progress in the hazier east—say, two to three deciviews per decade—than in the cleaner west. Alternatively, EPA could require a percentage improvement in deciviews, say, 10 percent per decade, to achieve the same impact.

There are a few other things that Congress and the EPA could do to improve the regional haze program as well. First, give States the flexibility to integrate their efforts on regional haze with those on fine particles, acid rain, and ozone.

Second, keep visibility improvement the primary measure of success, but require SIPs every 5 years or whenever progress is lacking.

Third, develop Federal standards for Best Available Retrofit Technology to reduce the burden of case-by-case analysis, and to finally start addressing the problem of grandfathered old sources that pollute at far greater rates than new sources.

Fourth, provide strong Federal leadership on national control measures, like new car and truck standards and lower sulphur fuel.

Fifth, since fine haze particles can be transported thousands of miles, provide strong Federal oversight of interstate efforts and make sure that all areas do their parts to reduce regional haze.

Sixth, seek similar emission reductions from other Federal agencies and from Canada and Mexico.

And finally, provide adequate resources to implement an effective program.

Senator I would like to introduce into the hearing record, with your permission, a letter from the New Hampshire Clean Air Strat-

egy Public Advisory Committee which simply indicates that these sentiments are supported by New Hampshire's business and environmental communities.

Senator INHOFE. Without objection, that will be entered as part of the record, Mr. Colburn.

Mr. COLBURN. Thank you.

[The referenced letter follows:]

NEW HAMPSHIRE CLEAN AIR STRATEGY ADVISORY COMMITTEE,
December 4, 1997.

Hon. CAROL M. BROWNER, *Administrator,*
Environmental Protection Agency,
Washington, DC.

RE: COMMENTS ON PROPOSED REGIONAL HAZE REGULATIONS

DEAR MS. BROWNER: New Hampshire's Clean Air Strategy Advisory Committee (Advisory Committee) has reviewed the EPA's Proposed Regional Haze Regulations. The Advisory Committee is a joint public-private group consisting of representatives from business and industry, environmental and health groups, State agencies (including DES), State legislators, and others. The group was convened in August 1996 to update the first edition of the *New Hampshire Clean Air Strategy* (published in 1994) and to address other important air concerns regarding public health and the environment. The comments expressed in this letter attempt to reflect a consensus of the group. Individual members of the Advisory Committee may also be submitting comments that reflect individual perspectives.

The Advisory Committee supports the EPA's Proposed Regional Haze Regulations. There are several Class I areas in New Hampshire comprising more than 100,000 acres of land. Protection of these natural resources is vital to New Hampshire, not only for the environment, which supports wildlife and plant ecosystems, but also the economy, which depends in large part on the scenic qualities of our wilderness areas, particularly the White Mountains and Presidential Range in northern New Hampshire. To improve vistas in our protected Class I areas in New Hampshire and nationwide, the Advisory Committee supports: (1) the proposed applicability of these regulations to all Class I wilderness areas, national parks and wildlife refuges in the United States, in addition to areas in the Colorado Plateau that were part of the Grand Canyon Visibility Transport Commission process; and (2) the setting of a target using a humanly perceptible progress metric using the deciview scale to identify and reduce emissions from all sources that contribute to visibility impairment in Class I areas.

The Advisory Committee is concerned, however, that New Hampshire, due to its downwind location, could continue to bear the brunt of emissions reduction responsibilities while upwind jurisdictions—the source of much of the emissions that lead to visibility impairment in the Class I areas of New Hampshire—could continue to evade similar reduction responsibilities. New Hampshire will continue to do its fair share to reduce its emissions, but if upwind sources do not do their fair share, the opportunity for significant improvement in the vistas in New Hampshire's Class I areas may be lost. The Advisory Committee asks EPA to work towards a resolution of this circumstance of the current regulatory scheme as soon as possible.

The Advisory Committee urges EPA to address the implementation of these regulations by ensuring that any and all implementation requirements achieve improved visibility through fair, reasonable, flexible, and cost-effective measures. Please let us know if the Clean Air Strategy Advisory Committee can be of further assistance in this effort.

Sincerely,

HENRY VEILLEUX, *Vice-President,*
Business & Industry Association of N.H.
L. BRUCE HILL, *Senior Staff Scientist,*
Appalachian Mountain Club.

Senator INHOFE. Thank you very much.

Mr. Seitz, when you—I didn't get this from your written testimony, but you said in the final remarks of your abbreviated statement that you are coordinating with the PM_{2.5} program. You've heard this stated by Governor Leavitt and the rest that there is not a coordination between the two.

I would like to have you elaborate on that because that's a major item that everyone is concerned with.

Mr. SEITZ. Thank you, Senator.

Clearly, in the proposal—and we've heard this again; we have a proposal that solicited comments, and we have heard this from all commenters—that there is a need to coordinate these activities, not only across PM but ozone as well, to ensure that both the control strategies that are considered and the implementation timelines that are used are coordinated so that the most efficient utilization of State resources goes to identifying and addressing this problem.

As a matter of fact, in the preamble I think we even said in there that we put a target date for the submission of the control strategies for the haze, and put parentheses and said, "or at the time the PM control strategies were done." So clearly it was our intent at the proposal to ensure that these control programs and strategies were developed together so that they could be submitted together and coordinated.

Senator INHOFE. Well, the timeline, Mr. Seitz, is what I'm concerned with. It is my understanding—of course, you are familiar with the timeline insofar as the NAAQS is concerned, and with my amendment to ISTEA that locks in those timelines of 9 years, in this case. Unless my staff has all of a sudden become very inefficient, I've been told that the timeline here is somewhere around 5 years.

Are you suggesting, since you did specifically mention timeline in coordinating the two programs, that the timeline would be the same?

Mr. SEITZ. Once again, in terms of the proposal and taking comment and the comments you've heard today——

Senator INHOFE. I'm talking about from now to implementation, will it be the same?

Mr. SEITZ. Let me go to that specifically. Since I don't know what your staff is telling you, let me review the timeline to ensure that there is no confusion.

There is a requirement under the Clean Air Act that 1 year after the rule is final, a submission has to come in from the State. That is a requirement of the statute. What we are trying to say in that submission is that it is a planning submission. The State basically will come in and give us a timeline that coordinates that planning activity. So it is our intent to coordinate those and harmonize those schedules together.

So the answer is yes.

Senator INHOFE. So then your final implementation would meet the timeline of the final implementation of the NAAQS PM_{2.5}?

Mr. SEITZ. It would coordinate the SIP control submissions, which would be at the same time, and then the implementation would be at the same time, yes.

Senator INHOFE. The implementation would be at the same time?

Mr. SEITZ. You have State-to-State laws that govern when rules apply, etc.

Senator INHOFE. But that's true also with NAAQS.

Mr. SEITZ. Yes.

Senator INHOFE. What I'm saying is—I'm trying to get this on line, and you are representing, on behalf of the EPA, that it wouldn't be the same?

Mr. SEITZ. I am representing that the intent of the rule was to harmonize it. I will also say, Senator, that some of the comments that we have received in the public comment period have objected to that. They have suggested that in some areas of this country, PM-Fine is not an issue, ozone is not an issue, haze is an issue, and you shouldn't wait for those.

So as you've heard here at this table today, public comment elicits and gets different views. It was our intent, on proposal, to harmonize them. This is still our intent. We have received comment on both sides of the issue.

Senator INHOFE. Is there any reaction to that comment by any of the other members of this panel, from the States?

Mr. WOOD. Mr. Chairman, our comment is that, first, that continues to assume that States like Nebraska are contributing to a problem of regional haze in Class I areas. Now, we don't have any Class I areas in Nebraska. We have some beautiful vistas and we have very clean air. We are, perhaps, one of the few States that do not have any nonattainment areas at this point in time.

So starting with that assumption, that we have a problem, yes, I would disagree that that's an appropriate approach, to say that we have to develop a SIP when in fact there is no rational demonstration that we contribute to a problem.

Senator INHOFE. OK.

Mr. SEITZ. Could I respond to that, sir?

Senator INHOFE. Yes.

Mr. SEITZ. Let me say that Mr. Wood brings up another issue of administrative burden. We took into consideration in the public comments that paper for paper's sake does not make sense, and the Agency agrees with that. You are caught on the issue that the Governor mentioned here, and Mr. Wood takes a little bit of a different viewpoint. Does the Federal Government prescribe who is in? Or does collective deliberation decide that?

Senator INHOFE. Mr. Seitz, I am going to turn over to Senator Allard, since he has a time he has to leave, to use the remaining time until you have to leave, and then I have some questions. I want to get into this whole cost area and some of the other areas that we need to elaborate on.

Senator Allard.

Senator ALLARD. Thank you, Mr. Chairman. I appreciate your indulgence and everyone else's as far as my time is concerned.

I would like to follow up on Mr. Wood's testimony and direct a question to Mr. Seitz in that regard.

In your view, what are emissions from field burning from agricultural activities, and how do they contribute to regional haze?

Mr. SEITZ. Again, with your permission, I would like to submit a detailed answer for the record.

[The information follows:]

ENVIRONMENTAL PROTECTION AGENCY, OFFICE OF AIR QUALITY AND
RADIATION,
Research Triangle Park, NC, June 16, 1998.

HONORABLE JAMES M. INHOFE, *Chairman*
Subcommittee on Clean Air, Wetlands, Private Property and Nuclear Safety
Committee on Environment and Public Works
United States Senate
Washington, DC 20510

DEAR MR. CHAIRMAN: As follow-up to my testimony before your subcommittee on April 23, I indicated that I would be sending you more information for the record. During the course of the hearing, I promised two items, which I have enclosed.

The first insert relates to how the emissions from field burning associated with agricultural activities may contribute to regional haze. The second insert relates to the exact factors that we used as the basis for our monetary benefits calculation for the proposed regional haze rule. As noted in my testimony, the benefits include health benefits that are above and beyond those attributed to meeting the national ambient air quality standard. The calculation of the categories of benefits for the proposed regional haze rule can be found in Chapter 12. The benefits specific to the regional haze provisions are summarized in Chapter 13, Section 13.3.3. I have included a copy of both chapters for the record.¹

Please let me know if you have any questions or require additional information.

Sincerely,

JOHN SEITZ
Director, Office of Air Quality Planning and Standards, EPA

RESPONSE TO SENATOR ALLARD'S QUESTION

Question: In your view, what are emissions from field burning from agricultural activities, and how do they contribute to regional haze?

Response: It is important to note that emissions from fire (including wildfire, prescribed fire and agricultural burning) all are episodic contributors to visibility-impairing aerosols (these include organic carbon, elemental carbon, and fine particles (PM_{2.5}). The impacts of emissions from agricultural burning are difficult to quantify directly for several reasons. For example, there is a current lack of air quality monitoring data; there are confounding emissions from other combustion sources with similar chemical composition such as the other burning categories; and because of the episodic nature of the burning activities which varies across the country. Our current best estimate of the emissions is based on the 1985 National Acid Precipitation Assessment Program (NAPAP) inventory for PM₁₀. The PM value is scaled according to a particle size distribution for combustion sources to arrive at PM_{2.5} estimates. There has been some controversy surrounding this approach and we are working with USDA and their Agriculture Air Quality Task Force (AAQTF) to develop emission estimates that both agencies can agree will give the best estimates possible. In the mean time, using the NAPAP inventory approach and applying a Bureau of Economic Analysis growth factor for the farm sector, we estimate that the direct emissions from this source category in 1996 were 99,233 tons of PM₁₀, of which approximately 90,211 tons were PM_{2.5}. Once new emission estimates are available, which may or may not be significantly different from the current estimates, we will provide them to you. We expect the new estimates to be available next year.

With respect to the impact of open burning emissions on visibility impairment, the Grand Canyon Visibility Transport Commission recommended, and I agree, that all types of fire must be addressed equitably as a part of a comprehensive visibility protection strategy. Some States already use a permit system for open burning activities that allows the State to manage burning in order to keep smoke out of populated areas, and to avoid too many burns occurring in the same area at the same time. Some include requirements to follow smoke management programs to minimize smoke impacts. Not all States do this, and not all States regulate all open burning categories. Whether States will need to regulate open burning more stringently is a matter for the States to decide individually or in partnership arrangements. EPA does have policies to deal with prescribed burning emissions and wildfires. The EPA does not have a policy for agricultural burning emissions. How-

¹This information is reproduced later in the hearing record, following the prepared statement by Mr. Seitz.

ever, the EPA has agreed to work with the USDA and take recommendations from the AAQTF on a policy for these emissions.

Mr. SEITZ. I would agree that in some of the aspects of the agricultural community, they would not be a significant contributor to regional haze as indicated in a lot of the data that I have seen. I think we've said that previously.

Senator ALLARD. From field burning, to sort of put things in layman's terms, if it's weeds or cleaning ditches or whatever, basically it's smoke? I mean, there's nothing more than just, in common terms, smoke. Is that right?

Mr. SEITZ. Well, I was not talking about agricultural burning. I was thinking of the question in terms of timber. If you bring up the issue——

Senator ALLARD. No, no. I'm talking in terms of field burning from agricultural activity. So this is things like burning a ditch or cleaning out a field for one reason or another.

Mr. SEITZ. I would say that any burning activity has the potential to produce particles that could contribute to regional haze.

Senator ALLARD. OK.

Mr. SEITZ. That does not necessarily say that, in the end, that is the area that is controlled. I think as a matter of fact, right now, the U.S. Department of Agriculture has a task force in place to develop policy on this exact issue.

Senator ALLARD. But we're not talking about ozone. We're not talking about sulfur dioxide. We're not talking about anything except, basically, suspended particulate matter——

Mr. SEITZ. Fine particles.

Senator ALLARD [continuing]. Commonly defined as smoke. Is that correct? Do you agree with that?

Mr. SEITZ. If you're trying to say the common definition of smoke, consists of a lot of particles, including small particles, yes.

Senator ALLARD. OK.

Now, we have the same type of emissions with trees burning or forested areas burning, I would assume. Would you agree with that?

Mr. SEITZ. We have a variety of emissions——

Senator ALLARD. But we don't have sulfur dioxide, we don't have ozone, we don't have a lot of——

Mr. SEITZ. I'm not in a position to comment on the technical makeup of the two types of smoke, but my initial answer would have to be no.

Senator ALLARD. OK.

Mr. SEITZ. Any time you're dealing with agricultural burning, you're dealing with potentially——

Senator ALLARD. Particulate matter, basically?

Mr. SEITZ. You're dealing with particulate matter, which could also carry a lot of other materials with it. So the issue of agricultural burning goes way beyond just the issue of fine particles, as you know.

Senator ALLARD. Yes. OK.

In your calculations, will emissions from Federal lands be calculated into baseline conditions that States would have to work from, should the proposed rule become final? In other words, with

the final rule, will there be figured in emissions from Federal lands?

Mr. SEITZ. The rule requires that before the final control SIP comes in, which will be integrated with the PM-Fine, the baseline will be developed by the States. So the total emission inventory, which will include all sources, would come out at that time.

Senator ALLARD. So a State like Colorado, which may be impacted by a forest fire that was set by the Forest Service in Idaho, for example, and that haze sets into our mountains for 3 weeks, that would be figured into the baseline? Or else Colorado has the option of figuring it into that baseline, and I would see no reason why Colorado wouldn't figure it in? Is that correct?

Mr. SEITZ. I'm not sure I follow.

Senator ALLARD. If we have a forest fire that was set—it was a fire that was not natural, but was set by the Forest Service in Idaho, and this is a real case situation, by the way—it creates a haze in Colorado for 3 to 4 weeks. The State of Colorado could move that into their baseline and say, “Look, our communities should not be penalized for Federal agency activities in another State that impacted the haze standards in our State”?

Mr. SEITZ. There are three or four answers to that. No. 1, I go back to Ms. Shaver's comment that the Federal Government has no intention of penalizing any individual State or area—

Senator ALLARD. I know you don't have that intention, but I want to make sure that you understand and won't do it.

Mr. SEITZ. Well, that goes to the second issue of the wildland fire. Let me talk about the wildland fire issue, the policy that was agreed to that Christine talked about between the Department of the Interior and the Department of Agriculture, which was endorsed by EPA.

As a follow-up to that, there are three pieces. There is the activity that Ms. Shaver talked about, which is training for smoke management and prescribed burning activities, coordinated with the States, and in this case on a regional issue, which would be regional-scale burning, hopefully across Colorado to, for example, Utah—whatever your example was—

Senator ALLARD. Well, it happened in Idaho, but the same thing can happen in Utah and any of the States. We've had volcanic haze, which is natural, from Oregon, for example. But go ahead.

Mr. SEITZ. That coordination is required to take place. And then in addition, the Agency is working with the State Air Directors to put into place smoke management planning activities, which would then go to ensure that there are plans in place that are coordinated with the activities and the Federal land managers, to ensure that to the extent possible, this burn activity is considered and done in such a way that it will not impact the regional haze levels in those other States. If it does, our response to that is not to sanction the State, but our response, as the policy is being put in place, is to go back and review the planning for why the burn took place.

But clearly, we will not be going after stationary services to make it up, or punish the receiving State for that.

Senator ALLARD. Particularly in the western side of Colorado, in the Rocky Mountains, this is one of the major problems, forest fires in the west of the State. There are other activities, too, that come

in that are not part of activities in Colorado. So that's why I wanted to get some type of definitive answer from you in that regard.

Mr. SEITZ. Senator, I appreciate your comment. It has been—as you've heard from the Governor and the testimony here, it's one of the biggest comments we've heard from Western States on how to deal with fire. So we hope to put these plans in place. We're looking and want to consider it in the final rule.

Your question about the baseline really goes to the 3- to 5-year period. We put this baseline in place before the control strategies go in. Again, as going back to the testimony from Ms. Shaver, we don't believe that prescribed burns, done correctly—taking a look at that baseline—will have an adverse impact.

Senator ALLARD. Will be figured in in the baseline as an adverse impact. They do have an impact. I want to make sure that you have it as part of your formula so that Colorado—if a Federal agency decides to burn a forest west of our borders, our communities are not penalized from that.

Are we on the same track on that?

Mr. SEITZ. I'm hearing you, Senator.

Senator ALLARD. OK. Very good.

Ms. Shaver, you want to exempt the Park Service from the visibility protection program of the Clean Air Act?

Ms. SHAVER. Oh, not at all, Senator.

Senator ALLARD. OK.

Is that EPA's position also?

Mr. SEITZ. Correct.

Senator ALLARD. OK.

Ms. SHAVER. If I may, I would like to further note that the Clean Air Act as currently written does hold the Federal Government responsible for complying with all the State and local regulations to the same extent as any nongovernmental agency.

Senator ALLARD. OK.

Ms. SHAVER. We agree with that.

Senator ALLARD. And I appreciate your clarifying that for the record. That's most helpful.

OK. I was interested in your testimony from New Hampshire, Mr. Colburn. Your areas are not Class I visibility areas? Are they Class II or something, and they have some lesser standard than what the West would be dealing with?

Mr. COLBURN. I'm sorry, Senator, we have two Class I airsheds in the White Mountains, yes.

Senator ALLARD. And your testimony was directed to those Class I areas? Or was it directed to other areas that had a lesser classification than Class I?

Mr. COLBURN. No, it was primarily directed to those Class I areas, and then to the region at large.

Senator ALLARD. On your Class II areas, do you want a tighter restriction on Class II?

Mr. COLBURN. I am not in a position to comment on that at this point, Senator. I haven't studied that issue.

Senator ALLARD. Do you have a problem with air moving between Class II and Class I areas?

Mr. COLBURN. Senator, as you might expect, for the Northeast dealing with ozone and particulates for, lo, these many years, re-

gional haze is a relatively new issue for us, and my staff has focused my education on Class I areas. So I can't comment really intelligently on Class II areas.

Senator ALLARD. In listening to your testimony my question was, how do we clear up your Class I problems? You said you wanted tougher—if you don't do anything with Class II, if you have the air moving between Class II and Class I areas, and you haven't done anything to clean up Class II—

Mr. COLBURN. Certainly, the transport of pollutants is a substantial problem throughout the East. Due to New Hampshire's position as a north-south State, with winds coming from west to east, most of that is from interstate transport, Senator.

Senator ALLARD. Thank you very much.

Mr. Chairman, I believe that's all the questions I have. Thank you.

Senator INHOFE. Thank you, Senator Allard. Your questions have cut down the time of my questions because you asked some of the same things.

I do want to get back to the cost question that we're talking about. First of all, one of the unique things about the issue addressed in the 1990 Clean Air Act amendments was that future haze regulations should also address cost as an important factor in determining any final decision. It is not my intention to argue cost benefit here, but rather try to understand how much cost should weigh in the final decision.

Mr. Seitz, how do you adequately determine the cost-benefit ratio of a deciview of improvement in terms of the proposed regional haze regulation?

Mr. SEITZ. Again, I think the assumption is that the deciview of improvement is the place where that is applied. Once again, going back to the intent of the proposal, there are two parts of "reasonable progress," and reasonable progress is where you apply your test. The statute provides, I believe, four factors to determine whether or not the cost and whether reasonable progress has been achieved. One of those factors is cost of compliance. That is a straight analysis of the cost of compliance of the facilities, or the strategy that you are putting in place as a stationary source strategy, a mobile source strategy, whatever that strategy is. There are costs associated with that strategy.

Another issue you look at is the continued life of the sources where you are imposing the strategy. It's a factor to consider. Do you impose those costs on facilities whose useful life may only be several more years?

There are, I believe, two other factors set forth in the statute. So as you correctly point out, the statute provides that as you develop—and the Grand Canyon did this—you take a look at your emission reduction strategies; you take a look at the cost factors; and if in fact those analyses result in that this is unreasonable cost, then you adjust the deciview goal.

Senator INHOFE. You've addressed the cost side. I'm really thinking of the cost and the benefit. Now, it's my understanding that the EPA has come up with a range of—is it from \$0 to \$5.7 billion in terms of benefits?

Mr. SEITZ. I believe that's right, \$0 to \$5.7 billion. That is correct.

Senator INHOFE. Then how do you measure benefits? What benefits are you measuring?

Mr. SEITZ. Well, for instance, one of the factors here that clearly benefits is that as you reduce these fine particles, which are constituents to regional haze, they also have an immediate effect over and beyond the PM-Fine. So you have significant benefits associated with health effects that are tangential to the reduction of the haze.

Senator INHOFE. But the benefits of the health effects have already been addressed in our NAAQS issue.

Mr. SEITZ. No, this is incremental over the standard that we're talking about, depending on how you go over the standard.

In addition, there are benefits equated to some of the measurements as far as the vistas and the issues associated with some of these parks, the Park Service and the visits that we've talked about. If you'd like, I can submit for the record the exact benefits analysis factors that we used in it. I am not fully versed on all of them, but I would be more than pleased to submit it to you.

[Excerpts of the EPA report, *Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule*, are reproduced following Mr. Seitz' prepared statement:]

Senator INHOFE. You were here, I assume, when Governor Leavitt was here and you heard his testimony and my questions to him. Were you here?

Mr. SEITZ. Yes, sir.

Senator INHOFE. We talked about the costs that had been estimated by the EPA as being approximately \$2.1 billion or \$2.7 billion, depending on whether we're using 15 years or 10 years. Is that accurate?

Mr. SEITZ. That's correct.

Senator INHOFE. And I also contrasted that with their projected anticipated costs during our NAAQS debate, being \$6 billion; and then when the President's Economic Council came up with their figure for the same exposure, it was \$60 billion, and then the group out in California that did the extensive study that came up with a range of between \$90 billion and \$150 billion.

I guess the question I would ask you is, you may be having the same people making these estimates. How comfortable are you with this estimate of \$2.1 billion?

Mr. SEITZ. Let me say again, since this particular portion of the statute provides specifically for costs to be a factor that is applied before the strategy, to be correct, I believe the range in the Regulatory Impact Analysis (RIA) was \$0 to \$2.7 billion, depending on whether it was based on 10 to 15 years, because we cannot here say what the predicted strategies would be. We costed out strategies in that RIA that we thought were reasonable. I think one of the issues the Governor was talking about, was the \$2.7 billion. If I'm not mistaken on this, he was answering questions to you with respect to the Grand Canyon deliberation, which is the cost in 16 parks, rather than our national costs. So the \$0 to \$2.7 billion range that we refer to is the national cost.

Senator INHOFE. The national cost, overall?

Mr. SEITZ. Overall. The Governor was referring to—that in implementing market-based approaches, that they are suggesting in the Grand Canyon report, which the Agency endorses, that there can be significant cost savings. We do not disagree with the Governor on that issue.

Senator INHOFE. Well, I'd like to get a State response to this.

Mr. Colburn, you had expressed your gratitude to this commitment, that everything is fully funded, so we will start with you. Do you feel, first of all—I don't know whether you've had time to look into what you think costs would be, but do you find any major disagreement with what Mr. Seitz has said? And then, following up, give me your comfort level as to the commitment as you understand it from the EPA to fully fund this.

Mr. COLBURN. Senator, I am not in a position to comment on the EPA's overall cost total because I can only reflect from the eastern perspective. As you have heard, the difficulties in the West with haze are much more complex and difficult to relate between cost and emission reduction and actual deciview.

In the East, however, there is as much greater ability to relate reductions to deciviews and to costs, and those costs have actually gone the opposite of the cost scenario that you indicated. For sulfur reductions, the industry initially estimated that costs would be in the neighborhood of \$1,600 to \$1,800 a ton. I think even EPA estimated that they would be on the order of \$500 to \$600 a ton. The sulfur market, however, has traded in the last year between \$65 and \$130 or so per ton. We believe the real cost of technology to be about \$300, on the order of only 20 percent of initial industry estimates.

We believe the same story holds true with NO_x, so that the nitrate fraction of eastern particulate will be similarly controlled at a reasonable price. Industry estimates are between \$1,000 and \$2,000 a ton. New Hampshire has controlled for \$400 a ton. We believe that those numbers will typically come in under \$500.

Senator INHOFE. Mr. Wood.

Mr. WOOD. Mr. Chairman, I don't get a great deal of comfort from EPA's analysis of the cost and the benefits, particularly as you start talking about the ancillary benefits in terms of health versus the PM and the ozone standards. As I remember the Clean Air Act, properly, it requires EPA to establish ambient air quality standards which are requisite for protection of the public health, with an adequate margin of safety. And as they have done that in the past, they have added up a large benefit column, and yet they seem to be either double-counting some of that now, or they are saying, "Well, we are looking at additional benefits because we're going to have a reduction in fine particles that we didn't count over there," but if they dealt with their duty under the Clean Air Act, they should have already counted whatever was necessary to improve public health.

So I'm not comfortable at all with the cost and benefit analysis that I hear.

Senator INHOFE. Ms. Terry.

Ms. TERRY. From California's standpoint, obviously we have major public health issues to deal with, so we will be spending a

lot of money to clean the air from a purely public health standpoint. I can't speak to the national costs of the program, but nonetheless, despite what we are doing for public health, I have concern about if EPA remains on the deciview track, it would be very uncertain, even from California's standpoint, what the costs might be because of the inability to say exactly what emissions would need to be reduced to meet an absolute target of one deciview, for example.

So even though we're spending, in many cases, more than \$10,000 a ton control for the last increments of control in California, it is impossible to say what ultimately the costs would be in the West because we cannot make that direct connection between what sources and how many reductions will be needed to meet the specific target that has been proposed.

Senator INHOFE. But regardless of what it is, and staying with the three of you, you have heard and apparently have been led to believe that this is going to be not an unfunded mandate but something that would be paid for by the Federal Government. Is that your understanding?

Mr. WOOD. Mr. Chairman, I would say that I haven't had that kind of assurance, that the Federal Government is going to at least pay all of the administrative processes. Clearly, they have said, "We're going to pay for all of the PM_{2.5} monitors." And at all PM_{2.5} monitoring stations—

Senator INHOFE. So you are saying that there are costs over and above the assurances that you were given that you would—that would be imposed upon your State?

Mr. WOOD. That is correct.

Senator INHOFE. The other two of you, if you could kind of shorten your answer, do you agree with that?

Mr. COLBURN. Yes, we would concur with that.

Senator INHOFE. Ms. Terry.

Ms. TERRY. Yes.

Senator INHOFE. Mr. Seitz, this is a concern. I think I mentioned when the Governor was here that I was in a similar position, and unfunded mandates are a subject that I am very sensitive to.

Would you agree that the policy of the EPA as you understand it, in terms of reimbursement, is that it still would not reimburse all the costs of the States for implementation of these standards?

Mr. SEITZ. Well, I think it is important that we go back to the funding mechanism that is being used. Frankly, just to be clear, I'm a little confused. We seem to be going between the economic analysis and the RIA and the benefits that are realized from the immediate reductions associated with haze, which is the comment that Mr. Wood raised. We will go back and review Nebraska's comments on the RIA to ensure that we did not double-count and that we did that RIA in accordance with established governmental procedures. So that is one issue.

The issue that we are now talking about on the administrative costs associated with implementation of the PM program. As you have alluded to, and you have an amendment to solidify the Agency's intention here, we will be—particularly in the early years of this—doing our part in funding the monitoring network as far as

tools, models, technical issues that need to be put in place. We will be totally funding that.

Senator INHOFE. You will be funding that. What will the mechanism be? Will it be grants?

Mr. SEITZ. Well, there are two issues here. The one mechanism is the monitors. We have worked with all the States. We have a national contract in place that, on behalf of the Government, we are using at their request, 105 grant moneys, to purchase these monitors. That program is well under way and in place.

The second issue goes to EPA's contract dollars that are being used to develop regional models that are used to develop the control strategies.

The final piece that has been talked about here is the administrative burden associated with preparing the SIP. I think the issue here is that we've taken comment on the rule—and the Agency has heard in numerous comments from the States—I think you mentioned in your introductory remarks that 44 States raised comments concerning the proposed rule. A great number of those comments were directed exactly at this issue. They weren't opposing the rule; they were suggesting how to do things differently to reduce the costs, to reduce the administrative burden, so they can be done efficiently. We have heard that.

And then in addition, the Administrator has committed to work with the States to identify the costs and take a look at the mechanisms—

Senator INHOFE. I'm trying to keep within our timeframe here.

Would you say on behalf of the EPA that insofar as the grants are concerned, that those grants would come and would not replace other grants that otherwise would be going to the States? In other words, this would be new money for a new program that would come from the EPA, from here in Washington, and not just be replacing other grants that are perhaps for other purposes?

Mr. SEITZ. We're talking about the year 2000 and the budget process that is underway. I think that's what I was saying, that, working with the States, we would develop those budget proposals.

Senator INHOFE. OK. As far as—

Mr. SEITZ. But I feel compelled to respond to this.

If we are saying that 105 money is here, as you know, there is a required match by the States on those funds. In addition, I think it is incumbent upon the Agency—and the Governor would be the first one to agree—that we should have a joint partnership in assuring correct use of those moneys, and if that requires a budget initiative, the Agency—

Senator INHOFE. This answers the questions. Thank you very much.

On the issue of the timeline, for the three States here, you have heard what Mr. Seitz has said concerning that. Would you respond to that as to your degree of comfort? Because all three of you had this as one of your concerns.

Ms. Terry.

Ms. TERRY. I was happy to hear Mr. Seitz say that that was the intent in the preamble language, so we certainly would expect them to follow through. It is an absolutely critical issue, given the complexity of the problem and the relationship with—

Senator INHOFE. Would that assurance make your trip here worthwhile?

Ms. TERRY. The results would.

Senator INHOFE. Thank you.

Mr. Colburn. Or Mr. Wood; either.

Mr. COLBURN. I would echo Ms. Terry's comments, Senator.

Senator INHOFE. All right.

Mr. Wood.

Mr. WOOD. Same answer.

Senator INHOFE. All right.

Just one last thing. We are down to about three more minutes here before we have to vacate this room.

Mr. Colburn, in your statement you said that the East and the West should be treated differently regarding control requirements, and that the same standards should not apply because the East has more experience in reducing emissions, and that the western haze is more complex. So I would assume by that that you are saying that the East probably is ahead in that area and that it wouldn't take us long?

Mr. COLBURN. Senator, I can't ascribe it to our leadership in this regard. I have to ascribe it to chemistry, that our problem is different, mostly sulfates, and we do have more experience with how to reduce sulfates.

So it is not leadership; in fact, our problem is much worse. So while I think a national program is appropriate, applying the same standard—the same requirements—across the country is inappropriate. The East should have a greater burden than the West.

Senator INHOFE. New York claims in the comments that were filed with the EPA that the West has more experience with haze and the East should be allowed to have time to bring their programs up to speed. Do you agree with the comments of the State of New York?

Mr. COLBURN. Certainly, in terms of institutional memory and the learning curve, but not in terms of need. The haze problems are worse in the East.

Senator INHOFE. All right.

Since we are out of time here, I would like to offer each one of you the opportunity to make any further comments, if you keep it very brief, on things that perhaps were not asked of you that you would like to offer at this time for the record. Later on, the record will be kept open for your written comments to be included as part of the record.

Why don't we start with Mr. Seitz?

Mr. SEITZ. Just one comment, Senator. Again, the Agency is in the comment period. We are going to consider all comments before going final. Clearly, our intent was not "one-size-fits-all." It is a flexible approach that we strive to achieve, and I think that was supported by the November 1997 Congressional Research Service article on this where they commended the Agency for it and recommended that the Agency was being flexible in its approach.

Senator INHOFE. One thing that was kind of interesting, you were here when Governor Leavitt—I asked him this line of questioning about what he thought; they had gone through this thing with the Grand Canyon Commission, in which he had been very

much involved. And then, of course, with the follow-up commission, on which he is the co-chair. And his response to my question, "Is the EPA rule consistent with that, as was mandated by the Clean Air Act?" And his answer was no.

Do you disagree with Governor Leavitt?

Mr. SEITZ. Yes. Again, it's a proposal, and clearly we signaled in the proposal that we intended to recognize and endorse. I would agree with the Governor that the way that we did that was not to his satisfaction. We have had numerous meetings with him and his staff since then and hope to satisfy that concern on final.

Senator INHOFE. Ms. Shaver, any further comments?

Ms. SHAVER. Only one comment, Senator, which is that we look forward in the National Park Service to working with the States, whether it is individually or collectively, in developing the kinds of programs that we need to protect our National Parks. We have a history of doing that. We have a lot of data, and we are very anxious to be working with all the stakeholders on this issue.

Senator INHOFE. All right.

Ms. Terry.

Ms. TERRY. Just one final clarification. While California is not officially a member of the follow-up organization to the Commission's work, we are technically involved in all the committees. We are supportive. We will work to implement the recommendations, and when some structural issues relative to voting are ultimately sorted out, I am optimistic that our participation may be expanded.

In closing I would like to say that the emphasis on emission reductions is what we would like to see in terms of the progress target. That's what cleans the air, that's what gets us to health-based standards as well as visibility, and we want to see that concept that was agreed upon by the Commission be followed through in EPA's final regulation.

Senator INHOFE. Thank you.

Mr. Wood.

Mr. WOOD. Mr. Chairman, the two comments that we would like to make are, No. 1, that the focus to a large extent has been on point source emissions. Mr. Colburn talks about sulfate in the East, and the source of that is power plants and other industrial sources.

With respect to Nebraska's concern, that's not an issue. The issue is rural fugitive emissions. Senator Allard talked about burning of fields; that's not the problem in Nebraska. It's normal farming kinds of activities.

The second comment is one that hasn't been mentioned here, which is that—almost academically speaking—burning of forests, either prescribed burning or unprescribed burning in the Forest System, is something that I think we need to think about more theoretically as being almost an investment that was made in the past because we didn't have the natural burning that took place in the past. You can almost make an argument that any burning in the Forest System is and does contribute what should be considered part of the natural background, because in the past it either burned this year or it burned last year or it burned 30 years later. And as I think Ms. Shaver would agree, what we have done, both in the Forest Service as well as the National Park Service, is over

the last 50 years not allowed that burning to take place. We have increased the fuel loads, as Senator Allard talks about.

So the question is, do we get charged now for that regional haze or that air pollution that results from what has historically been a natural activity?

Senator INHOFE. Thank you. That's very helpful.

Mr. Colburn.

Mr. COLBURN. Thank you, Senator, just two comments.

The first is to respond somewhat to Senator Sessions' earlier question about why anybody would address any concern other than public health. I think the real goal isn't simply public health, but it is quality of life, which might be characterized as physical health, bodily health, but also environmental health, such that one can have adequate recreational opportunities and enjoy life. And economic health, such that you don't have to worry about your next meal.

At least in New Hampshire's case, we believe that the regional haze initiative put forth by EPA, as modified by many of the comments for flexibility and such today, meets the purpose of addressing and improving quality of life.

The second comment is simply that I am pleased that EPA has gone on the record today indicating that flexibility. We look forward to it.

Senator INHOFE. Yes. Well, I am pleased with their going on the record with that, as well as the timeline, as well as some of the other things that they have stated here on behalf of the EPA, and I appreciate it very much.

I think Senator Sessions—I want you all to understand what we've been through here for a year and a half. What he's trying to do, I think, is get health off the table right now and deal with this in a way that we don't have some of the hysteria, with kids coming in with masks, in spite of the fact that the scientific community doesn't agree with the relationship between NAAQS and respiratory diseases and all these things, and that a number of people are going to die prematurely and all this.

So that's really where he's coming from. He was saying, "Let's try to get that over here. We've already addressed that; let's talk about this, isolate this problem."

Again, we are saved by the bell. We have 5 more minutes left in the vote.

I appreciate very much the time that you have taken, you folks who are here, you folks who have come here from far away. I appreciate it very much. You have made a great contribution. I would remind you that any comments you want to make for the record can still be submitted. You will be receiving some questions from members of this committee whose staff is represented here today; I know there are a lot of questions that they will be sending to you that will become part of the record, and we will be able to use that as this issue progresses.

Thank you very much for being here.

[Whereupon, at 12:30 p.m., the subcommittee was adjourned, to reconvene at the call of the chair.]

[Additional statements submitted for the record follow:]

PREPARED STATEMENT OF GOVERNOR MICHAEL O. LEAVITT, STATE OF UTAH

Good morning. I am Governor Mike Leavitt of Utah and lead governor for air quality issues for the Western Governors' Association. I also serve as Co-Chair of the Western Regional Air Partnership (WRAP) with Governor Reginald Pasqual of the Pueblo of Acoma. Thank you for the opportunity to provide testimony regarding the Environmental Protection Agency's proposed regional haze regulation.

This issue is important to western governors. As governors, we are keenly aware of the need to protect visibility in parks and wilderness areas in our part of the country. We recognize the inherent social and spiritual value of the breathtaking vistas in the West. Our matchless visibility is important to our residents and tourists alike. We support efforts to protect this visibility. And we applaud Congress for its foresight. When Congress enacted the Clean Air Act Amendments of 1990, you created a remarkable opportunity for visibility protection through regional partnership. You directed the EPA Administrator to create the Grand Canyon Visibility Transport Commission (Commission). This Commission, of which I was Vice Chair, was charged to determine how to make progress toward the visibility goal established in the Clean Air Act of 1977. Neither Congress nor EPA told us how we were to do this job. Instead, you left us with flexibility and a challenge. I am proud to say we met that challenge.

We brought together a partnership of States, tribes, Federal agencies, industry and business, environmental representatives, local government officials, and academicians, and charged them with developing consensus recommendations on how to protect visibility at the Grand Canyon and at 15 other parks and wilderness areas on the Colorado Plateau. EPA was a valued and effective player in this process. We reached consensus on a set of responsible recommendations to manage air quality in the West, so that we, as a region, could make the required "reasonable progress" toward the national visibility goal. On June 10, 1996, in a moving ceremony on the rim of the Grand Canyon, we delivered those recommendations to EPA. We have since also delivered them to Congress.

However, we are very concerned the EPA's originally-proposed regional haze regulation is not consistent with the intent of Congress and does not create a framework for accepting the work of the Grand Canyon Commission. We have shared our concerns with EPA. Let me quote from a letter Governor Romer of Colorado and I recently sent to EPA Administrator Carol Browner on behalf of the Western Governors' Association. I have attached the letter to my testimony.

As you are aware, Western Governors are vitally interested in the rule the EPA will soon issue regarding regional haze. In particular, we urge that it allow and facilitate regional, State and tribal strategies such as the widely endorsed recommendations of the Grand Canyon Visibility Transport Commission (Commission) and its successor, the Western Regional Air Partnership (WRAP).

We strongly encourage EPA to take a bold step toward better environmental performance by accepting our recommendations for the regional haze rule. By doing so, EPA will not only set in motion a mechanism developed and agreed to by national and Western stakeholders to improve visibility in the West, but it will also send a strong signal that a new, more effective partnership for protecting the environment is underway.

We learned a lot from this regional effort. There is a better way of doing the important business of environmental protection. Rather than following the old paradigm of prescriptive Federal laws and regulations, followed by State action, followed by often contentious Federal review, followed all too often by third party litigation, participants in the Commission's process focused jointly on problems and solutions.

Based on the Commission experience, and faced with increasing environmental pressures of growth in the West, western governors have recently set about defining a new, shared environmental doctrine for our region. We will use the principles in this doctrine to guide us in seeking solution to a broad array of environmental and natural resource problems facing the West. Key principles include:

- Collaboration, Not Polarization—Use Collaborative Process to Break Down Barriers and Find Solutions.

Working collaboratively as we did in the Grand Canyon Commission process was key to our success.

- Reward Results, Not Programs—Move to a Performance-based System.

Everyone wants a clean and safe environment. Federal and State policies should encourage "outside the box" thinking in the development of strategies to achieve desired outcomes. Solving problems rather than just complying with programs should be rewarded.

- Science For Facts, Process For Priorities—Separate Subjective Choices from Objective Data Gathering.

As we found in the Commission work, there is a time in the collaborative process when interested stakeholders must evaluate the scientific evidence on which there may be disagreement and make difficult policy decisions.

- Markets Before Mandates—Replace Command and Control with Economic Incentives Whenever Appropriate.

The Commission recommended that emission reductions should be guaranteed through implementation of a regional emissions trading program if committed reductions were not realized after the year 2000.

- Change A Heart, Change A Nation—Environmental Education is Crucial.
- A healthy environment is critical to the social and economic health of the Nation. One important way for government to promote individual responsibility is by rewarding those who meet their stewardship responsibilities, rather than imposing additional restrictions on their activities.

- Recognition of Benefits and Costs—Make Sure Environmental Decisions are Fully Informed.

Implementation of environmental policies and programs should be guided by an assessment of the costs and benefits of different options and a determination of the feasibility of implementing the options.

- Solutions Transcend Political Boundaries—Use Appropriate Geographic Boundaries for Environmental Problems.

We recognize that regional haze problems cannot be solved without working on the regional level across State, Federal, and tribal boundaries. The problem cannot be solved with singular solutions from Washington, DC, or anywhere else. The western airshed is distinctly different from the eastern airshed in meteorology and pollutant characteristics.

Even as my colleagues and I flesh out this new environmental doctrine, we have already moved ahead, with our Commission partners and new partners, and formed the Western Regional Air Partnership, known as the WRAP. The WRAP is a partnership between States, tribes, EPA and the U.S. Departments of the Interior and Agriculture. Its purpose is to promote the implementation of the Grand Canyon Commission's recommendations and, when warranted, to address other air quality issues needing regional solutions. Like the Commission, the WRAP has invited interest groups and individuals to the table to develop consensus approaches for moving forward on current and future issues.

We expected EPA, through its regional haze rule, to create a clear and unambiguous path for State implementation of the Commission's recommendations. We also expected that the regulation would create incentives for other commissions and processes like the Grand Canyon Commission and WRAP, to encourage and reward States that collaborate, seriously involve partners and stakeholders, and develop innovative regional approaches to regional haze.

As EPA revises its proposed regulation, we hope the following concerns will be resolved:

- EPA needs to be a participant in regional environmental partnerships which develop the strategies and recommendations for addressing regional haze.

- Additional language is needed to define a clear and specific process for creation and adoption of alternative regional strategies to define and attain "reasonable progress" under the Clean Air Act. Specifically, when EPA concurs with the partnership's strategies for addressing regional haze, States and tribes expect approval of those strategies in their Plans. Implementation of the Commission's recommendations meets the Clean Air Act's requirement of making "reasonable progress" towards the national visibility goal. We are asking EPA to support the consensus recommendations of regional commissions in which they participate, prior to having those recommendations included in State and Tribal Implementation Plans (SIPs and TIPS).

- The "deciview target" is not a workable regulatory measure because of the large uncertainty in the relationship between the measure and the identification of related, controllable emission sources. The proposed regulation has a presumptive requirement that each Class I area achieve a fixed increment of improvement of one deciview every 10 years. There are two problems with this requirement. First, it establishes a set of criteria to be used in determining what would constitute reasonable progress for each Class I area. These criteria include such things as cost and energy impacts. Setting a fixed requirement for each Class I area is contrary to this concept of evaluating what is reasonable for each Class I area. Secondly, there is significant uncertainty in measuring visibility. It makes much more sense to identify what emission reductions are needed for reasonable progress and hold States to making those reductions.

- Group BART (Best Available Retrofit Technology) requirements are incompatible with other more effective State and tribal strategies. The proposed regulation

has a requirement for evaluating whether specific technological controls should be required of certain major point sources. The Grand Canyon Commission opted to establish a decreasing emissions cap which includes emissions from these sources. If the cap is exceeded, a market trading program will go into place to bring emissions back under the cap. This is a much more efficient means of meeting "reasonable progress," requirements. Furthermore, in assessing "reasonable progress," we used the same criteria that would be used to determine if technological controls should be required. BART should remain as a possible tool in the State and tribal "toolbox" of regulatory options. However, the market-trading proposal from the Commission is a much more efficient strategy for regional haze.

- Prescribed fires, those fires planned by Federal and State land managers, will have a significant impact on visibility and regional haze in the West. Procedures, to coordinate the reduction in impacts from prescribed fires, are critical to the effectiveness of the regional haze regulation.

We have identified a number of other issues which need to be corrected in the proposed regulation. These have been submitted to EPA under the auspices of both the Western Governors' Association and the WRAP. These comments are available to you upon request. Our success is dependent on a workable regulation and the investment of resources—time and money—in regional strategies.

I recognize that EPA cannot give up the statutory responsibilities you have bestowed upon it. We are not asking for that. We are only asking that EPA exercise its responsibility at the table, not after the fact, in inefficient, prolonged reviews. On the plus side, we have had positive discussions with EPA on these issues. I have met with John Seitz, Director of the Office of Air Quality Planning and Standards and received his assurances they have heard our concerns.

In summary, the issue here is not about whether we want a visibility regulation or not, it is about developing the best way for protecting visibility. Western governors need the flexibility to develop strategies that meet the social, economic and environmental needs of States and tribes in the West. We want to protect our western skies using approaches that are cheaper and better.

At the same time we want to address these issues in partnership with EPA and other Federal agencies, but we want the "partnership" to be real. Our western parks and wilderness areas are there to be enjoyed by all Americans. We will never protect them by engaging in endless bickering and litigation. EPA and other Federal agencies were good partners in the Grand Canyon Visibility Transport Commission. We need to return to that model. If we are serious about reinventing environmental management, let's start right here and now.

Thank you for inviting me to testify.

WESTERN GOVERNOR'S ASSOCIATION,
Denver, CO, April 8, 1998.

Hon. CAROL M. BROWNER, *Administrator,*
U.S. Environmental Protection Agency,
Washington, DC.

DEAR ADMINISTRATOR BROWNER: As you are aware, Western Governors are vitally interested in the rule the EPA will soon issue regarding regional haze. In particular, we urge that it allow and facilitate regional, State and tribal strategies such as the widely endorsed recommendations of the Grand Canyon Visibility Transport Commission (Commission) and its successor, the Western Regional Air Partnership (WRAP). Individual Western States, the Western Governors' Association (WGA), and the WRPA all have provided comments. The WGA comments suggested specific language to allow and facilitate EPA's review and acceptance of regional strategies. We are supported in our efforts by the thirty member Western States Senate Coalition, who have also written urging you to write the final regional haze rule in a way that will specifically allow for incorporation of the Commission's recommendations. Because of the importance of this issue, we would like to meet with you at your earliest convenience to discuss these recommendations.

Since 1991, governors, tribal leaders, State and Federal agencies, industry and interest groups in the West have invested an extraordinary amount of time, money and political capital in reaching a consensus on strategies for improving visibility in national parks and wilderness areas on the Colorado Plateau. In doing so, we also arrived at a new paradigm for creating and implementing environmental policy that may finally change our environmental protection system from one centered on denial and costly adversarial actions by the participants to one centered on acceptance, innovation, performance and efficiency. If the EPA fails to adopt the recommendations of the Commission, it will stymie not only innovative efforts to im-

prove visibility in our national parks and wilderness areas, but also other collaborative processes in the environmental arena.

We applaud EPA's participation in the Commission's process. During the Commission's deliberations, EPA scientists and technical experts sat at the same table with colleagues from other Federal agencies, State agencies, tribes, academia, industry and the environmental community to both share and defend their science, data and opinions. The Western Governors viewed this frank and professional collaboration as a breakthrough toward better environmental performance in the West. For the first time, an environmental process vested in our region created a more robust set of data and concomitantly a greater understanding about regional haze among a wide variety of public and private constituencies. Moreover, the process fostered a willingness among those same constituencies to solve the problem before it became severe.

The Commission was able to carry out an extensive public process, create a comprehensive set of 70 recommendations, and set in motion a process to implement them with a minimum of EPA oversight and staff participation and only a modest amount of financial support. For example, 75 Federal, State, tribal, local government, industry and environmental representatives participated in the Commission's Public Advisory Committee where the consensus recommendations were created. We believe this is a sign of success in the State-Federal partnership and a true step toward the performance-based system that the States, Congress, and the Administration have been seeking. The collaborative process, where the synergy of diverse groups working together produced recommendations by the Commission that went beyond any one agency's statutory requirements, bolstered EPA's credibility and produced valuable results.

EPA is part of the success, and you share the credit for your role in this effort. By bringing together diverse and talented individuals, far more expansive and creative technical findings and policy options were produced than would have been the case using the usual process of action plans by State and Federal governments, with a comment period from interest groups. However, all will be for naught if the final haze rule does not provide a clear and positive process for the adoption of regional strategies.

We are also concerned that EPA's air division has been without a Presidential appointee for over eight months. It is at this level that the extraordinary consensus which the Commission achieved and the WRAP is attempting to implement, had been most clearly recognized. Those achievements have been undervalued in the proposed rule in favor of traditional, prescriptive strategies more amenable to highly centralized, bureaucratic control. The Western Governors believe that improved environmental outcomes are the true objectives of the Administration and Congress and that performance, not control, is the issue at hand.

Based on lessons from the Commission, the Western Governors have committed to develop a shared environmental doctrine for the West to consecrate this new way of doing business. We intend to develop other partnerships to address natural resource management and environmental policy making. Western Governors unanimously adopted a resolution establishing principles to guide future efforts. These principles have bi-partisan support and are in keeping with the goals established by the Administration's National Partnership for Reinventing Government, particularly as they apply to developing partnerships. We are committed to future collaborative efforts if given the flexibility to undertake them and implement the results. But there will be little incentive to proceed or to bring other partners to the table in the West if our first major effort is quashed by the final Federal haze rule.

In closing, we want to commend and thank your air quality planning staff for their willingness to explain the proposed rule and listen to our concerns. Mr. John Seitz and his staff have been gracious and professional. We believe they are seriously debating whether to recommend acceptance of our recommendations. However, we fear that without your personal understanding and intervention, tradition may outweigh innovation and squelch the Commission's achievements. We strongly encourage EPA to take a bold step toward better environmental performance by accepting our recommendations for the regional haze rule. By doing so, EPA will not only set in motion a mechanism developed and agreed to by national and Western stakeholders to improve visibility in the West, but it will also send a strong signal

that a new, more effective partnership for protecting the environment is underway. We look forward to meeting with you to discuss these important matters.

Sincerely,

MICHAEL O. LEAVITT,
Governor of Utah.

ROY ROMER,
Governor of Colorado.

PREPARED STATEMENT OF JOHN S. SEITZ, DIRECTOR, OFFICE OF AIR QUALITY PLANNING AND STANDARDS, OFFICE OF AIR AND RADIATION, ENVIRONMENTAL PROTECTION AGENCY

Mr. Chairman, members of the subcommittee, thank you for inviting me to discuss the Environmental Protection Agency's (EPA's) proposed rule to improve visibility and reduce regional haze in our Nation's national parks and wilderness areas.

As you know, in July 1997 EPA revised the national ambient air quality standards for ground-level ozone and particulate matter. These updated standards have the potential to prevent as many as 15,000 premature deaths each year, and up to hundreds of thousands of cases of significantly decreased lung function and aggravated asthma in children. In the review of the standards, EPA concluded that the most appropriate way to address the visibility impairment associated with particulate matter would be to establish a regional haze program in conjunction with setting secondary PM standards equivalent to the suite of primary standards. EPA proposed new regulations addressing regional haze in July 1997 as well.

Mr. Chairman, as you know, virtually all of our national parks and wilderness areas are subject to some degree of regional haze visibility impairment. This fact has been extensively documented by monitoring conducted by the National Park Service, EPA, the United States Forest Service, and other agencies since 1978. Haze obscures the clarity, color, texture, and form of what we see, and it is caused by natural and anthropogenic pollutants that are emitted to the atmosphere through a number of activities, such as electric power generation, various industrial and manufacturing processes, car and truck emissions, burning activities, and so on. These emissions often are transported long distances to affect visibility in certain parks and wilderness areas that have been identified for protection by Congress under the Clean Air Act. The areas are known as "Class I" areas.

We also know that the causes and severity of regional haze vary greatly between the East and the West. Average standard visual range in most of the Western U.S. is 60 to 90 miles, or about one-half to two-thirds of the visual range that would exist without manmade air pollution. In most of the East, the average standard visual range is 15 to 30 miles, or about one-sixth to one-third of the visual range that would exist under natural conditions. One of the major challenges associated with this problem is that these conditions are often caused not by one single source or group of sources near each park or wilderness area, but by mixing of emissions from a wide variety of sources over a broad region.

BACKGROUND

The Clean Air Act established special goals for visibility in many national parks, wilderness areas, and international parks. Section 169A, of the 1977 Amendments to the Clean Air Act, sets a national goal for visibility of the "prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas which impairment results from manmade air pollution." This section also calls for EPA to issue regulations to assure "reasonable progress" toward meeting the national goal. EPA issued regulations in 1980 to address the part of the visibility problem that is "reasonably attributable" to a single source or group of sources. These rules were designed to be the first phase in EPA's overall program to protect visibility. At that time, EPA deferred action addressing regional haze impairment until improved monitoring and modeling techniques could provide more source-specific information, and EPA could gain further knowledge about the pollutants causing impairment.

As part of the 1990 Amendments, Congress added section 169B to focus on regional haze issues. Under this section, EPA was required to establish a visibility transport commission for the region affecting the visibility of the Grand Canyon National Park. EPA established the Grand Canyon Visibility Transport Commission in 1991 to examine regional haze impairment for the 16 mandatory Class I Federal areas on the Colorado Plateau, located near the Four Corners area of New Mexico, Colorado, Utah and Arizona. After several years of technical assessment and policy

development, the Commission completed its final report in June 1996. The Commission's recommendations covered a wide range of control strategy approaches, planning and tracking activities, and technical findings which address protection of visibility in the Class I areas in the vicinity of the Grand Canyon National Park.

Under the 1990 Amendments, Congress required EPA to take regulatory action within 18 months of receiving the Commission's recommendations. EPA proposed the regional haze rules in July of last year, in conjunction with the final national ambient air quality standards for particulate matter. In developing the proposed regulations, EPA took into account the findings of the Grand Canyon Visibility Transport Commission, as well as findings from a 1993 National Academy of Sciences Report, and information developed by the EPA Clean Air Act Advisory Committee.

The National Academy of Sciences formed a Committee on Haze in National Parks and Wilderness Areas in 1990 to address a number of regional haze-related issues, including methods for determining the contributions of man-made sources to haze as well as methods for considering alternative source control measures. In 1993, the National Academy of Sciences issued a report entitled, "Protecting Visibility in National Parks and Wilderness Areas," discussed the science of regional haze. Among other things, the Committee concluded that "current scientific knowledge was adequate and available control technologies exist to justify regulatory action to improve and protect visibility." The Committee also concluded that progress toward the national goal will require regional programs operating over large geographic areas. Further, the Committee felt strategies should be adopted that consider many sources simultaneously on a regional basis.

In developing the proposed regional haze rule, EPA also took into consideration recommendations and discussions related to regional haze from our Clean Air Act Federal Advisory Committee and its Subcommittee on Ozone, Particulate Matter, and Regional Haze Implementation Programs. The Subcommittee included wide representation from States, local and Tribal governments, industry, environmental groups and academia. This Subcommittee met regularly over the past 2½ years to consider a variety of implementation issues associated with the revised national ambient air quality standards and the proposed regional haze rule. It also focused discussions on how best to develop more cost-effective, flexible strategies for implementing these requirements.

EPA'S PROPOSED REGIONAL HAZE RULE

EPA's proposed regional haze rule is designed to establish a program to address visibility impairment in the Nation's most treasured national parks and wilderness areas. In this rule, EPA is proposing to improve visibility, or visual air quality, in 156 important natural areas found in every region of the country. These areas range from Grand Canyon, Mesa Verde, and Bryce Canyon in the southwest; to Yellowstone, Glacier, and Mt. Rainier in the northwest; to Shenandoah and the Great Smokies in the Appalachians; to Yosemite, Sequoia, and Point Reyes in California; to Acadia, Lye Brook, and Great Gulf in the northeast; to the Everglades and Sipsey Wilderness in the southeast; to Big Bend, Wichita Mountains, Badlands, and the Boundary Waters in the central States. More than 60 million visitors experience the spectacular beauty of these areas annually. The proposed regional haze rule in conjunction with implementation of other Clean Air Act programs would significantly improve visibility in these areas. Further EPA expects visibility to improve well beyond these areas, across broader regions of the United States.

The National Academy of Sciences report and other studies show that emissions from sources such as power plants, industrial sources, and motor vehicles generally span broad geographic areas and can be transported hundreds of miles, creating haze across large regions of the country. Therefore, the proposed regional haze regulations would require participation by all States throughout the country. This includes States which do not have Class I parks or wilderness areas because emissions from these States may contribute to impairment in downwind Class I areas in other States.

The regional haze proposal establishes a requirement for States to implement strategies to meet "reasonable progress targets" for improving visibility in each Class I area. These targets would be designed to improve visibility on the worst days, and to prevent degradation of visibility on the best days. EPA is proposing to express the progress targets in a way that provides flexibility from one region of the country to another, by using the "deciview" as a measurement. The deciview index expresses the overall effect on visibility resulting from changing levels of the key components of fine particulate matter (sulfates, nitrates, organic and elemental carbon, soil dust) which contribute to the degradation of visibility. These compo-

nents are routinely measured by an interagency visibility monitoring network that has been in place for several years in national parks and forests. Like the decibel scale which is used to measure sound, the deciview index measures perceived changes across the range of possible conditions (for example, from clean to dirty days). A change of one to two deciviews is considered to be perceptible by the average person for a typical complex view. Visibility monitoring data shows that over the past several years, visibility impairment on the worst days ranges from 27 to 34 deciviews in eastern locations and 13 to 25 in western locations. A deciview of zero represents pristine conditions, meaning the absence of natural or manmade impairment in visibility.

EPA's proposed presumptive "reasonable progress target" has two elements: (1) for the 20 percent of the days having the worst visibility, the target is a rate of improvement equal to 1.0 deciview over either a 10-year or 15-year period [we asked for comments on each option]; and (2) for the 20 percent of the days having the best visibility, the target is no degradation. For example, in a place like the Shenandoah National Park, where ambient fine particle levels for the worst days average 20 micrograms per cubic meter, a reduction of up to 2 micrograms per cubic meter would be needed to achieve a 1 deciview improvement. Whereas in the Grand Canyon, where ambient fine particle levels for the worst days average about 5 micrograms per cubic meter, a reduction of up to one-half a microgram would be sufficient to achieve a 1 deciview improvement.

EPA's proposed rule also provides important flexibility to States by allowing them to propose alternate progress targets for EPA approval, as well. An alternate target can be proposed for a Class I area if the State can demonstrate that achieving the presumptive targets would not be reasonable. States can consider such factors as the availability and costs of controls, the time necessary for compliance, and the remaining useful life of the air pollution sources in determining whether achieving the target would be reasonable. Alternatively, some States may find they can go further and achieve up to a 2-3 deciview improvement at some parks or wilderness areas, or that programs already adopted or in the process of being implemented will achieve such an improvement. The proposal suggests that States consult with other contributing States, the Federal land managers, and EPA in developing alternate targets.

Consistent with the requirements in the Clean Air Act, under EPA's proposal States would submit an initial revision to their implementation plans for visibility protection within 12 months after EPA issues the final regional haze rule. These initial implementation activities would require that State plans provide for adoption at a later date of any specific emission management strategies that may be necessary to meet the progress targets. These initial State plans would not require States to include emission reduction strategies, but merely provide for their future adoption. Initially, States would address a number of planning activities for implementing their regional haze programs. Since visibility impairment is caused primarily by fine particles, many planning activities could have benefits for implementation of the PM_{2.5} standard where applicable as well. Our goal is to coordinate the State plan deadlines under the regional haze rule with those required for meeting the PM_{2.5} standard. The proposal also encouraged States to work cooperatively to develop modeling approaches, emission inventories, and regional implementation strategies.

We also proposed that either every 3 or 5 years thereafter (EPA has taken comment on both options), States would review progress in each Class I area in relation to the relevant progress targets. States would also be expected to include a plan for expanding the current visibility monitoring network so that it is "representative" of all 156 Class I areas. EPA is working with the States and Federal land managers to coordinate this network expansion with the deployment of the new monitoring network for the national air quality standard for fine particulates. EPA is evaluating ways to efficiently use resources such that existing and new visibility monitoring sites can also provide information about transport of fine particulate pollution as it relates to the newly revised national air quality standards. The new visibility monitoring sites should be deployed no later than December 1999.

Also as part of this initial State plan submittal, States would need to address important technical activities to pursue on a regional basis, such as improvements in particulate matter emission inventories and modeling capabilities, as well as plans for assessing sources potentially subject to Best Available Retrofit Technology (or BART). As specified in the Clean Air Act, sources potentially subject to BART are any sources, from 1 of 26 groups of industrial "source categories," which began operation between 1962 and 1977, and which have the potential to individually emit 250 tons per year or more of any pollutant that impairs visibility. The 26 source categories include such sources as electric utilities, smelters, petroleum refineries, and

pulp and paper mills. If a State determines it is necessary to control any of these facilities, a BART determination would include an examination of the availability of control technologies, the costs of compliance, the energy and non-air environmental impacts of compliance, any pollution control equipment in use at the source, the remaining useful life of the source, as well as the degree of improvement in visibility as a result of compliance. As with all aspects of this proposal, we requested comments on how to develop BART and will incorporate these comments into the final rule.

Under the proposed regional haze rule, State plans would provide for adoption of emission management strategies concurrently with other strategies for PM_{2.5} non-attainment areas. These submittals would include measures to reduce emissions from sources located within the State, including provisions addressing the BART requirement, if applicable. I would like to make two important points about the emissions reduction strategy. First, it can take into account air quality improvements due to implementation of other programs, such as the acid rain program, mobile source programs, or the national ambient air quality standards program. And second, the emission reduction strategy can include a mix of strategies that address emissions from both stationary and mobile sources. EPA's proposed rule does not focus on stationary sources only, as some have claimed. The proposed planning framework provides States with flexibility in designing their overall program for improving visibility.

PROCESS FOR DEVELOPING THE FINAL REGIONAL HAZE RULE

EPA Administrator Browner signed the proposed haze rule on July 18, 1997. At that time, we made the proposed rule, as well as other related materials, available to the public on the Internet and through other means. It was published in the *Federal Register* on July 31. EPA held a public hearing that I chaired in Denver, Colorado, on September 18. In response to requests by the public, we extended the public comment period by about 6 weeks, to December 5, 1997. We have held other sessions around the country to discuss the regional haze proposal, including a national satellite broadcast for all State and local air pollution agencies during which we discussed the proposal and answered questions from the viewers. I also am actively participating in meetings of the Western Regional Air Partnership, a follow-up organization to the Grand Canyon Visibility Transport Commission that is co-chaired by Governor Shutiva of the Pueblo of Acoma and Governor Leavitt of Utah. This is a voluntary organization, established by several States and Tribes, which EPA will be working with to address western visibility issues. Following our careful review of the comments, we intend to issue a final regional haze rule this summer.

CONCLUSIONS

In summary, we believe that EPA's new proposed regional haze rule, when finalized, would establish a framework to improve visibility in our Nation's parks and wilderness areas, as the Congress intended in the Clean Air Act. Over the past several months, we have been busy reviewing public comments and considering options for addressing the concerns of various commenters. At the request of various interested parties, including the Western Governors Association, STAPPA/ALAPCO, NESCAUM, and industry and environmental groups, we have held additional meetings to discuss issues related to the rule. I want to be clear that we still have not made final decisions on these matters. Our goal is to ensure that these new requirements are implemented in a common sense, cost-effective and flexible manner. We intend to continue working closely with State and local governments, other Federal agencies and all other interested parties to accomplish this goal.

Mr. Chairman, this concludes my written statement. I will be happy to answer any questions that you might have.

[Executive Summary of a Report Prepared for the EPA on Regional Haze, July 16, 1997]

REGULATORY IMPACT ANALYSES FOR THE PARTICULATE MATTER AND OZONE
NATIONAL AMBIENT AIR QUALITY STANDARDS AND PROPOSED REGIONAL HAZE RULE

(Prepared by Innovative Strategies and Economics Group, Office of Air Quality Planning and Standards, Environmental Protection Agency, Research Triangle Park, NC)

EXECUTIVE SUMMARY

Purpose

The Clean Air Act (CAA) directs the Environmental Protection Agency (EPA) to identify and set national standards for pollutants which cause adverse effects to public health and the environment. The EPA is also required to review these health and welfare-based standards at least once every five years to determine whether, based on new research, revisions to the standards are necessary to continue to protect public health and the environment. Recent evidence indicates that two pollutants, ground level ozone and particulate matter (PM), (specifically fine particles which are smaller than $2.5 \mu\text{g}/\text{m}^3$ in diameter, termed $\text{PM}_{2.5}$ are associated with significant health and welfare effects below current regulated levels. As a result of the most recent review process, EPA is revising the primary (health-based) and secondary (welfare-based) National Ambient Air Quality Standards (NAAQS) for both of these pollutants. In addition, in the final action on PM, EPA recognized that visibility impairment is an important effect of PM on public welfare. The EPA concluded that the most appropriate approach for addressing visibility impairment is the establishment of secondary standards for PM identical to the suite of primary standards, in conjunction with a revised visibility protection program to address regional haze in certain large national parks and wilderness areas.

To some degree, the problems of ground level ozone, PM and regional haze all result from commonly shared elements. Pollutants which are precursors to ozone formation are also precursors to the formation of fine PM. Both ozone and fine PM are components of regional haze. These similarities clearly provide management opportunities for optimizing and coordinating monitoring networks, emission inventories and air quality models, and for creating opportunities for coordinating and minimizing the regulatory burden for sources that would otherwise be required to comply with separate controls for each of these pollutants. Thus, these new standards are likely to be considered jointly by the various authorities responsible for their implementation. With this in mind, EPA has developed an economic impact analysis which looks at the coordinated implementation of all of these new rules. Pursuant to Executive Order 12866, this Regulatory Impact Analysis (RIA) assesses the potential costs, economic impacts, and benefits associated with illustrative implementation scenarios of these NAAQS for ozone and PM, including monitoring for these pollutants. It also assesses the costs, economic impacts, and benefits associated with the implementation of alternative regional haze programs.

In setting the primary air quality standards, EPA's first responsibility under the law is to select standards that protect public health. In the words of the CAA, for each criteria pollutant EPA is required to set a standard that protects public health with "an adequate margin of safety." As interpreted by the Agency and the courts, this decision is a health-based decision that specifically is not to be based on cost or other economic considerations. However, under the CAA, cost can be considered in establishing an alternative regional haze program.

This reliance on science and prohibition against the consideration of cost in setting of the primary air quality standard does not mean that cost or other economic considerations are not important or should be ignored. The Agency believes that consideration of cost is an essential decision making tool for the cost-effective implementation of these standards. Over time, EPA will continue to update this economic analysis as more information on the implementation strategies becomes known. However, under the health-based approach required by the CAA, the appropriate place for cost and efficiency considerations is during the development of implementation strategies, strategies that will allow communities, over time, to meet the health based standards. The implementation process is where decisions are made—both nationally and within each community—affecting how much progress can be made, and what time lines, strategies and policies make the most sense. For example, the implementation process includes the development of national emissions standards for cars, trucks, fuels, large industrial sources and power plants, and

through the development of appropriately tailored state and local implementation plans.

In summary, this RIA and associated analyses are intended to generally inform the public about the potential costs and benefits that may result when the promulgated revisions to the ozone and PM NAAQS are implemented by the States, but are not relevant to establishing the standards themselves. This RIA also presents the benefits and costs of alternative regional haze goals which may be relevant to establishing provisions of the regional haze rule.

General Limitations of this Analysis

Cost-benefit analysis provides a valuable framework for organizing and evaluating information on the effects of environmental programs. When used properly, cost-benefit analysis helps illuminate important potential effects of changes in policy and helps set priorities for closing information gaps and reducing uncertainty. However, nonmonetized benefits are not included here. Executive Order 12866 is clear that unquantifiable or nonmonetizable categories of both costs and benefits should not be ignored. It is particularly important to note that there are many unquantifiable and nonmonetizable benefits categories. Including many health and welfare effects.

Several specific limitations need to be mentioned. The state of atmospheric modeling is not sufficiently advanced to adequately account for all the interactions between these pollutants and the implementation strategies which may be used to control them. Additionally, significant shortcomings exist as to the data available for these analyses. While containing uncertainties, the models used by EPA and the assumptions in the analysis are thought to be reasonable based on the available evidence.

Another major limitation is the illustrative implementation scenario which EPA uses in this analysis to measure the cost of meeting the new standards. The strategies used are limited in part because of our inability to predict the breadth and depth of the creative approaches to implementing these new NAAQS, and in part by technical limitations in modeling capabilities. These limitations, in effect, force costs to be developed based on compliance strategies that may reflect suboptimal approaches to implementation, and therefore, may reflect higher potential costs for attaining the new standards. This approach renders the result specifically useful as an incentive to pursue lower cost options, but not as a precise indicator of likely costs.

Another dimension adding to the uncertainty of this analysis is time. In the case of air pollution control, thirteen years is a very long time over which to carry assumptions. Pollution control technology has advanced considerably in the last thirteen years and can be expected to continue to advance in the future. Yet there is no clear way model this advance for use in this analysis.

Furthermore, using 2010 as the analytical year for our analysis may not allow sufficient time for all areas to reach attainment. This analysis recognizes this by not arbitrarily assuming all areas reach attainment in 2010. Because 2010 is earlier than many areas are likely to be required to attain, especially for PM_{2.5}, the result is a snapshot in time, reflecting progress and partial attainment but not complete attainment.

What we know about 2010 is limited by several factors. This is because EPA's modeling was not able to identify specific measures sufficient to attain the standards in all areas by the analytical year. Further, in EPA's effort to realistically model control measures which might actually be put into practice, our analysis excludes control measures which historically have been seen to be cost-ineffective.

However, even though the control measures identified in our models may be insufficient to reduce pollutants to reach the standards in all areas, there is sufficient evidence to predict that technological innovation and innovative policy mechanisms over the 13 years will make substantial progress towards improving techniques to remove pollutants in these areas in a cost-effective fashion. Chapter 9 of the RIA provides examples of how technological innovation has improved air pollution control measures over the last 10 years and lists emerging technologies which may be available in the year 2010. It also provides a rough estimate of full attainment costs that might result from the implementation of these and other control technologies yet to be developed.

It is important to recognize that with the finalization of the new ozone and PM standards, the Act, and the implementation package accompanying the standards, allow for flexibility in the development of implementation strategies, both for control strategies as well as schedules. The actual determination of how areas or counties will meet the standards is done by States during the development of their State Implementation Plans (SIPs). These SIPs are generally based on the results from more detailed area specific models using more complete information than is available to

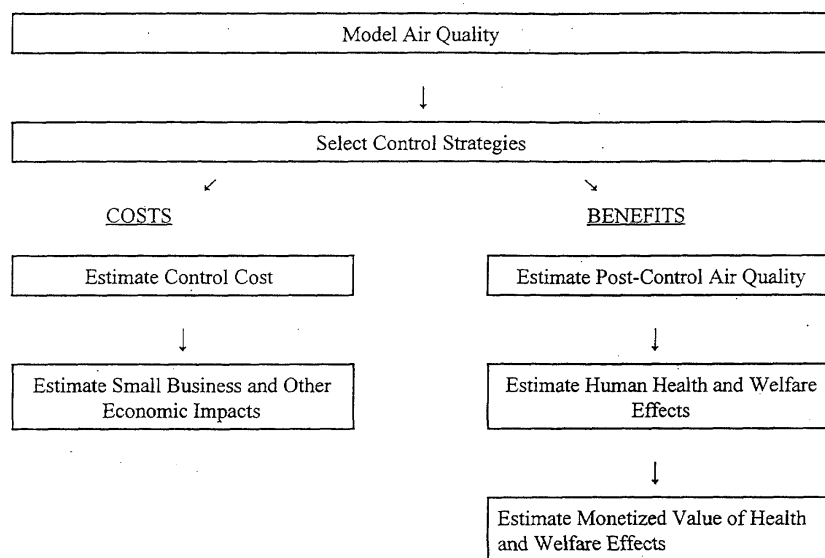
EPA for the development of its national analysis. For this reason, while EPA believes that this RIA is a good approximation of the national costs and benefits of these rules (subject to the limitations described elsewhere), this analysis cannot accurately predict what will occur account for what happens in individual areas. In addition, this RIA does not take into account all the creativity and flexibility which a State will have when actually implementing these standards. Thus, cheaper ways of implementing the new standards and obtaining the same amount of benefits may well be found.

Qualitative and more detailed discussions of the above and other uncertainties and limitations are included in the analysis. Where information and data exists, quantitative characterizations of these and other uncertainties are included. However, data limitations prevent an overall quantitative estimate of the uncertainty associated with final estimates. Nevertheless, the reader should keep all of these uncertainties and limitations in mind when reviewing and interpreting the results.

Overview of RIA Methodology: Inputs and Assumptions

The potential costs, economic impacts and benefits have been estimated for each of the three rules. The flow chart below summarizes the analytical steps taken in developing the results presented in this RIA.

FIGURE ES-1: Flowchart of Analytical Steps



The assessment of costs, economic impacts and benefits consists of multiple analytical components, dependent upon emissions and air quality modeling. In order to estimate baseline air quality in the year 2010, emission inventories are developed for 1990 and then projected to 2010, based upon estimated national growth in industry earnings and other factors. Current CAA-mandated controls (e.g., Title I reasonably available control measures, Title II mobile source controls, Title III air toxics controls, Title IV acid rain sulfur dioxide (SO₂) controls) are applied to these emissions to take account of emission reductions that should be achieved in 2010 as a result of implementation of the current PM and ozone requirements. These 2010 CAA emissions in turn are input to an air quality model that relates emission sources to county-level pollutant concentrations. This modeled air quality is used to identify projected counties, based on these assumptions, that exceed the alternative pollutant concentration levels¹. A cost optimization model is then employed to deter-

¹For the purposes of this RIA, the term "attain" or "attainment" is used to indicate that the air quality level specified by the standard alternative is achieved. Because the analyses in this

mine, based on a range of assumptions, the least cost control strategies to achieve the alternatives in violating counties. Given the estimated costs of attaining alternative standards, the potential economic impacts of these estimated costs on potentially affected industry sectors is subsequently analyzed. Potential health and welfare benefits are also estimated from modeled changes in air quality as a result of control strategies applied in the cost analysis. Finally, benefits and costs are compared.

This RIA presents results for the coordinated implementation of these three rules as well as providing an estimate of their costs and benefits separately. Due to the lack of an integrated air quality model, it is impossible to concurrently estimate the joint impacts. In an attempt to provide as much information as possible regarding joint impacts, EPA is able to model the two NAAQS sequentially by assuming first the imposition of controls to meet the new ozone standard, followed by the new PM standard and regional haze target but was unable to sufficiently model adequately the imposition of controls to meet the new PM standard, followed by the new ozone and regional haze standards. Neither approach correctly models the actual process which would be used by decision makers trying to simultaneously develop an optimal program to control all three pollutants. The coordinated implementation national results do not show much difference from the sum of the three rules. This is thought to occur due more to model limitations than a true result.

This analysis estimates the potential costs, economic impacts and benefits for three PM standard options, three ozone standard options and two regional haze options. The alternatives analyzed include:

For PM₁₀

- the promulgated PM₁₀ standard set at 50 µg/m³ annual mean, and 150 µg/m³, 99th percentile 24-hour average

For PM_{2.5}

- the promulgated PM_{2.5} standard set at 15 µg/m³, spatially averaged annual mean, and 65 µg/m³, 98th percentile 24-hour average and two alternatives: 1) an annual standard set at 15 µg/m³, in combination with a 24-hour standard set at 50 µg/m³; and 2) an annual standard set at 16 µg/m³, in combination with a 24-hour standard set at 65 µg/m³.

For Ozone

- the promulgated ozone standard set at .08 parts per million (ppm) in an eight hour concentration based fourth highest average daily maximum form, and two alternatives: 1) .08 ppm in an eight hour concentration based third highest average daily maximum form; and 2) .08 ppm in an eight hour concentration based fifth highest average daily maximum form.

For Regional Haze

- a regional haze visibility target reduction of 0.67 and 1 deciview. These reductions are analyzed incremental to the implementation of the new PM_{2.5} standard.

The RIA analyses have been constructed such that benefits and costs are estimated incremental to those derived from the combined effects of implementing both the 1990 CAA Amendments and the current PM₁₀ and ozone NAAQS as of the year 2010. These analyses provide a "snapshot" of potential benefits and costs of the new NAAQS and regional haze rule in the context of (1) implementation of CAA requirements between now and 2010, (2) the effects on air quality that derive from economic and population growth, and (3) the beneficial effects on air quality that the Agency expects will result from a series of current efforts to provide regional level strategies to manage the long range transport of NO_x and SO₂. It should be kept in mind that 2010 is earlier than attainment with the new standards will be required.

This RIA does not attempt to force its models to project full attainment of the new standards in areas not predicted to achieve attainment by 2010. However, farther calculations are performed to attempt to project full attainment benefits and costs in this RIA. For the benefit estimates, the same general methodology used in our base analysis is extended to derive the estimates and are reported within this RIA. For the cost estimates a limited methodology is used to predict potential costs of full attainment, with the last increment of reductions being "achieved" through the use of unspecified measures having an average emission cost-effectiveness of \$10,000 per ton. It is important to recognize that EPA has much less confidence in

RIA are based on one-year of air quality data, they are only estimates of actual attainment; all standard alternatives are specified as 3-year averages.

these cost estimates because of the length of time over which full attainment would be achieved.

In that regard, the \$10,000 cost estimate for these reductions is intended to provide an ample margin to account for unknown factors associated with fixture projections, and may tend to overestimate the final costs of attainment. In fact, EPA will encourage, and expects that States will utilize, market based approaches that would allow individual sources to avoid incurring costs greater than \$10,000/ton. Chapter 9 discusses EPA's particular interest in applying the concept of a Clean Air Investment Fund that would allow individual sources to avoid incurring costs greater than \$10,000 per ton. Based on this analysis, EPA believes that a large number of emissions reductions are available at under \$10,000 a ton; sources facing higher control costs could finance through such a fund. Compliance strategies like this will likely lower costs of compliance through more efficient allocation, and can serve to stimulate technology innovation.

The estimation of benefits from environmental regulations poses special challenges. The include the difficulty of quantifying the incidence of health, welfare, environmental endpoints of concern, and the difficulty of assigning monetized values to these endpoints. As a result, many categories of potential benefits have not been monetized at all, and those that have been are given in ranges. Specifically, this RIA has adopted the approach of presenting a "plausible range" of monetized benefits to reflect these uncertainties by selecting alternative values for each of several key assumptions. Taken together, these alternative sets of assumptions define a "high end" and a "low end" estimate for the monetized benefits categories.

In choosing alternative assumptions, EPA has tried to be responsive to the many comment it received on the RIAs that accompanied the proposed rules. It should be emphasized, however, that the high and low ends of the plausible range are not the same as upper and lower bounds. For many of the quantitative assumptions involved in the analysis, arguments could be made for an even higher or lower choice, which could lead to an even greater spread between the high end and low end estimates. The analysis attempts to present a plausible range of monetized benefits for the categories that have been analyzed. Again, it must be stressed that many benefits categories have not been monetized at all, because of both conceptual and technical difficulties in doing so. These benefits are in addition to the plausible range of monetized benefits considered here.

SUMMARY OF RESULTS

Direct Cost and Economic Impact Analyses

Potential annual control costs (in 1990 dollars) are estimated for attainment of each alternative standard. Potential administrative costs of revising the PM₁₀ monitoring network and the costs of a new PM_{2.5} monitoring network as well as the administrative costs of implementing the new rules are also reported.

Possible economic impacts based on these control costs are estimated for the same alternative standards. This impacts analysis also include a screening analysis providing estimated annual average cost-to-sales ratios for all potentially affected industries.

Key Results and Conclusions

Ozone

Estimated annual identifiable control costs corresponding to the partial attainment of the promulgated ozone standard is \$1.1 billion per year incremental to the current standard. This estimate is based on the adoption, where needed, of all currently identifiable reasonably available control technologies for which EPA has cost data, and which cost less than \$10,000/ton.

Under the partial attainment scenario, there are estimated to be 17 potential residual nonattainment areas, 7 of which are also in residual nonattainment for the current ozone standard.

The implication of residual nonattainment is that areas with a VOC or NO_x deficit will likely need more time beyond 2010; new control strategies (e.g., regional controls or economic incentive programs); and/or new technologies in order to attain the standard.

Under the illustrative scenario selected, at least one or more establishments (e.g. industrial plant) in up to 227 of U.S. industries (as defined by 3-digit SIC codes) which are estimated to have cost-to-sales ratios of at least 0.01 percent by the chosen standard. Approximately 25 of these are industries which have some establishments which are estimated to have cost-to-sales ratios exceeding 3 percent, and therefore may experience potentially significant impacts. These results are highly sensitive to the choice of control strategy.

A very small proportion of establishments are potentially affected for most of the SIC codes affected by the new ozone standard. The number of establishments potentially affected is 0.13 percent of all establishments in affected SIC codes for the selected standard.

This RIA does not attempt to force its models to project full attainment of the new standard in areas not predicted to achieve attainment by 2010. However, full attainment costs of the selected standard are estimated at \$9.6 billion per year incremental to the current standard. It is important to recognize that EPA has much less confidence in these cost estimates because of the inherent uncertainties in attributing costs to new technologies.

PM

Estimated annual identifiable control costs corresponding to the partial attainment of the selected PM standard are \$8.6 billion per year incremental to the current PM_{10} standard. This estimate is based on the adoption of the majority of currently identifiable control measures for which EPA had cost-effectiveness data. For the PM analysis, a \$1 billion/ $\mu g/m^3$ cut-off is used to limit the adoption of control measures. Control measures providing air quality improvements are less than \$1 billion/ $\mu g/m^3$ are adopted where the air quality model and cost analysis identify control measures as being necessary.

Under the partial attainment scenario, an estimated 30 potential residual nonattainment counties, 11 of which are also in residual nonattainment for the current PM_{10} standard.

The implication of residual nonattainment is that counties with $PM_{2.5}$ levels above the standard will likely need more time beyond 2010; new control strategies (e.g., regional controls or economic incentive programs); and/or new technologies in order to attain the standard.

Under the illustrative scenario selected, at least one or more establishments (e.g. industrial plant) in up to 198 of U.S. industries (as defined by 3-digit SIC codes) which are estimated to have cost-to-sales ratios of at least 0.01 percent by the chosen standard. Approximately 86 of these are industries which have some establishments which are estimated to have cost-to-sales ratios exceeding 3 percent, and therefore may experience potentially significant impacts. These results are highly sensitive to the choice of control scenario.

A small proportion of establishments are potentially affected for most of the SIC codes affected by the new PM standards. The average number of establishments potentially affected is about 2.7 percent in total affected SIC codes for the selected standard.

The year 2010 is prior to the time that full attainment is required under the CAA. This RIA does not attempt to force its models to project full attainment of the new standard in areas not predicted to achieve attainment by 2010. However, full attainment costs of the selected $PM_{2.5}$ standard in 2010 are estimated at \$37 billion per year incremental to the current standard. It is important to recognize that EPA has much less confidence in these cost estimates because of the inherent uncertainties in attributing costs to new technologies.

Regional Haze

The expected annual control cost for the year 2010 associated with the proposed regional haze rule ranges from \$0 to a maximum of \$2.7 billion. The additional cost of implementation of the proposed regional haze rules will vary depending on the visibility targets selected by States. If targets are adjusted through that process to parallel the implementation programs for the new ozone and PM standards, the costs for meeting the adjusted targets in those areas will be borne by the ozone and PM programs. The proposed rule, however, includes a presumptive target of 1.0 Deciview improvement over either 10 or 15 years (on the 20 percent worst days); any adjustments to this target must be justified by States on a case-by-case basis. The high end costs in this analysis assume that 76 mandated Class I areas will need additional reductions to meet the 10 year presumptive target from 2000 to 2010. The additional control cost associated with meeting the presumptive 1.0 deciview target in 10 years in 48 of these areas, and partial achievement in 28 areas is estimated to be \$2.7 billion. If the 1.0 deciview improvement in 15 years target is promulgated, this analysis projects that 58 Class I areas would not meet this target with NAAQS controls alone. To fully attain a 0.67 deciview improvement between 2000 and 2010 in 41 of these areas and partially attain the 0.67 target in 17 areas would cost an estimated \$2.1 billion.

Benefit Analysis

Health and welfare benefits are estimated for attainment of the PM and ozone standards and visibility improvements resulting from the proposed regional haze

program. The estimated change in incidence of health and welfare effects is estimated for each air quality change scenario as defined by the 2010 baseline and post-attainment air quality distributions. These estimated changes in incidence are then monetized by multiplying the estimated change in incidence of each endpoint by its associated dollar value of avoiding an occurrence of an adverse effect. These endpoint-specific benefits are then summed across all counties to derive an estimate of total benefit. Because there are potentially significant categories for which health and welfare benefits are not quantified or monetized due to a lack of scientific and economic data, the benefit estimates presented in this analysis are incomplete.

Tables ES-1 and ES-2 list the anticipated health and welfare benefit categories that are reasonably associated with reducing PM and ozone in the atmosphere, specifying those for which sufficient quantitative information exists to permit benefit calculations. Because of the inability to monetize some existing benefit categories, such as changes in pulmonary function and altered host defense mechanisms, some categories are not included in the calculation of the monetized benefits.

Table ES-1 PM and Regional Haze Benefits Categories

	PM Health and Welfare Benefit Categories	
	Unquantified Benefit Categories	Quantified Benefit Categories (incidences reduced and/or dollars)
Health Categories	Changes in pulmonary function Morphological changes Altered host defense mechanisms Cancer Other chronic respiratory disease Infant Mortality Mercury Emission Reductions	Mortality (acute and long-term) Hospital admissions for: all respiratory illnesses congestive heart failure ischemic heart disease Acute and chronic bronchitis Lower, upper, and acute respiratory symptoms Respiratory activity days Minor respiratory activity days Shortness of breath Moderate or worse asthma Work loss days
Welfare Categories	Materials damage (other than consumer cleaning cost savings) Damage to ecosystems (e.g., acid sulfate deposition) Nitrates in drinking water Brown Clouds	Consumer Cleaning Cost Savings Visibility Nitrogen deposition in estuarine and coastal waters

Table ES-2 Ozone Benefits Categories

	Ozone Health and Welfare Benefit Categories	
	Unquantified Health Benefit Categories	Quantified Benefit Categories (in terms of incidences reduced or dollars)
Health Categories	Airway responsiveness Pulmonary inflammation Increased susceptibility to respiratory infection Acute inflammation and respiratory cell damage Chronic respiratory damage/ Premature aging of lungs	Coughs Pain upon deep inhalation Mortality Hospital admissions for: all respiratory illnesses pneumonia chronic obstructive pulmonary disease (COPD) Acute respiratory symptoms Restricted activity days Lower respiratory symptoms Self-reported asthma attacks Cancer from air toxics Change in lung function
Welfare Categories	Ecosystem and vegetation effects in Class I areas (e.g., national parks) Damage to urban ornamentals (e.g., grass, flowers, shrubs, and trees in urban areas) Reduced yields of tree seedlings and non-commercial forests Damage to ecosystems Materials damage (other than consumer cleaning cost savings) Nitrates in drinking water Brown Clouds	Commodity crops Fruit and vegetable crops Commercial forests Consumer Cleaning Cost Savings Visibility Nitrogen deposition in estuarine and coastal waters Worker productivity

Key Results and Conclusions

There are a number of uncertainties inherent in the underlying functions used to produce quantitative estimates. Some important factors influencing the uncertainty associated with the benefits estimates are: whether a threshold concentration exists below which associated health risks are not likely to occur, the valuation estimate applied to premature mortality and the estimation of post-control air quality. Additionally, there is greater uncertainty about the existence and the magnitude of estimated excess mortality and other effects associated with exposures as one considers increasingly lower concentrations approaching background levels. The high and low end benefits estimates, as discussed above, attempt to bracket a plausible range that accounts for some of these uncertainties.

Ozone

Partial attainment of the selected ozone standard results in estimated monetized annual benefits in a range of \$0.4 and \$2.1 billion per year incremental to the current ozone standard. The estimate includes from 0 to 330 incidences of premature mortality avoided.

The major benefit categories that contribute to the quantified benefits include mortality, hospital admissions, acute respiratory symptoms and welfare effects. Mortality benefits represent about 90 percent of the high end benefits estimates. However, this analysis excludes a number of other benefit categories.

Full attainment of the preferred ozone standard results in estimated monetized benefits of in a range of \$1.5 to \$8.5 billion per year incremental to the current ozone standard. The estimate includes 0 to 1,300 incidences of premature mortality avoided (corresponding to long-term mortality, respectively).

There are benefits from ozone control that could not be monetized in the benefits analysis, which in turn, affect the benefit-cost comparison. Nonmonetized potential

benefits categories include: effects in lung function; chronic respiratory damage and premature aging of the lungs; increased susceptibility to respiratory infection; protection of ornamental plants, mature trees, seedlings, Class I areas, and ecosystems; reduced nitrates in drinking water, and reduced brown cloud effects. The effect of our inability to monetize these benefits categories leads to an underestimation of the monetized benefits presented in this RIA.

PM

Partial attainment of the selected PM_{2.5} standard results in estimated monetized annual benefits in a range of \$19 to \$104 billion per year incremental to the current PM₁₀ standard, including 3,300 to 15,600 incidences of premature mortality avoided.

The major benefit categories that contribute to the quantified benefits include mortality, hospital admissions, acute respiratory symptoms and welfare effects. Mortality benefits represent about 12 percent to 70 percent of the benefits estimates. However, this analysis excludes a number of other benefit categories.

Full attainment of the preferred PM_{2.5} standard results in estimated monetized benefits of in a range of \$20 and \$110 billion per year incremental to the current PM₁₀ standard, including 3,700 to 16,600 incidences of premature mortality avoided (corresponding to short-term and long-term mortality, respectively). These numbers are significant underestimates because EPA has no procedure to predict full attainment benefits outside nonattainment county boundaries for PM_{2.5}.

There are benefits from PM control that could not be monetized in the benefits analysis, which in turn affect the benefit-cost comparison. Nonmonetized potential benefits categories include: effects in pulmonary function; increased susceptibility to respiratory infection; cancer; infant mortality; effects associated with exposure to mercury; protection of ecosystems; reduced acid sulfate deposition; reduced materials damage; reduced nitrates in drinking water, and reduced brown cloud effects. The effect of our inability to monetize these benefit categories leads to an underestimation of the monetized benefits presented in this RIA.

Regional Haze

The expected visibility and associated health and welfare annual benefits for the year 2010 associated with the proposed regional haze rule ranges from \$0 to a maximum of \$5.7 billion. The amount of benefits from implementation of the proposed regional haze rules will vary depending on the visibility targets selected by States. If targets are adjusted-through that process to parallel the implementation programs for the new ozone and PM standards, the benefits for meeting the adjusted targets in those areas will not exceed those calculated for ozone and PM programs. The proposed rule, however, includes a presumptive target of a 1.0 Deciview improvement over either 10 or 15 years (on the 20 percent worst days); any adjustments to this target must be justified by States on a case-by-case basis. The high end benefits in this analysis assume that 76 mandated Class I areas will need additional emissions reductions to meet the 10 year presumptive target from 2000 to 2010. The additional benefits, resulting from 48 of the 76 areas meeting the presumptive 1.0 deciview target, and 28 of the 76 areas having partial achievement, are estimated to range from \$1.7 to \$5.7 billion. The additional benefits resulting from 41 Class I areas meeting the presumptive 0.67 deciview improvement target between 2000 and 2010, and 17 areas partially meeting the 0.67 deciview target range from \$1.3 to \$3.2 billion.

Monetized Benefit-Cost Comparison

Comparing the benefits and the costs provides one framework for comparing alternatives in the RIA. As noted above, both the Agency and the courts have defined the NAAQS standard setting decisions, both the initial standard setting and each subsequent review, as health-based decisions that specifically are not to be based on cost or other economic considerations. This benefit-cost comparison is intended to generally inform the public about the potential costs and benefits that may result when revisions to the ozone and PM NAAQS are implemented by the States. Costs and benefits of the proposed regional haze rule are also presented. Monetized benefit-cost comparisons are presented for both the full and partial attainment scenarios nonmonetized effects by definition cannot be included. In considering these estimates, it should be stressed that these estimates contain significant uncertainties as discussed throughout this analysis.

Estimated quantifiable partial attainment (P/A) benefits of implementation of the particulate matter (PM) and ozone NAAQS exceed estimated P/A costs. Estimated quantifiable net P/A benefits (P/A benefits minus P/A costs) for the combined PM_{2.5} 15/65 and ozone .08 ppm 4th max standards range from approximately \$10 to \$96 billion.

Considered separately, estimated quantifiable P/A benefits of PM_{2.5} standard far outweigh estimated P/A costs. Estimated quantifiable net P/A benefits of the selected PM_{2.5} 15/65 standard range from \$10 to \$95 billion. Estimated quantifiable full-attainment (F/A) benefits may or may not exceed estimated P/A costs for PM depending on whether the low end or high end estimates are used. Net benefits for the PM_{2.5} F/A scenario range from negative \$18 billion to positive \$67 billion. Estimated quantifiable P/A benefits of the ozone standard also exceed estimated quantifiable P/A costs, though by a smaller margin. Estimated quantifiable net P/A benefits of the ozone .08 ppm, 4th max standard range from \$-0.7 to \$1.0 billion. The full range of F/A benefit estimates are smaller than the F/A costs for ozone with net benefits ranging from negative \$1.1 billion to negative \$8.1 billion. Estimated quantifiable net benefits from the proposed regional haze program range from \$0 to \$3.0 billion.

**Table ES-3. Comparison of Annual Benefits and Costs of PM-Only
Alternatives in 2010* (1990\$)**

PM _{2.5} Alternative (µg/m ³)	Annual Benefits of Partial Attainment ^b (billion \$) (A)	Annual Costs of Partial Attainment (billion \$) (B)	Net Benefits of Partial Attainment (billion \$) (A - B)	Number of RNA Counties
16/65 (high end estimate) ^c	90	5.5	85	19
15/65 low end estimate ^d	19	8.6	10	
high end estimate	104		95	30
15/50 (high end estimate)	107	9.4	98	41

- a All estimates are measured incremental to the baseline of the current PM₁₀ standard (PM₁₀ µg/m³ annual/150 µg/m³ daily, 1 expected exceedance per year).
- b Partial attainment benefits based upon post-control air quality as defined in the control cost analysis.
- c The high end estimates are based on assumptions of effects down to 12 µg/m³ for PM mortality, down to background for chronic bronchitis, and a valuation approach to mortality benefits based on averting premature statistical deaths valued at \$4.8 million each.
- d The low-end estimates are based on assumptions of a threshold at 15 µg/m³ for PM mortality and chronic bronchitis, an assumption that two-thirds of short-term deaths are premature by only days or weeks, a valuation approach to mortality benefits based on life-years valued at \$120,000 each, and an adjustment to visibility benefits derived from a contingent valuation survey.

**Table ES-4. Comparison of Annual Benefits and Costs of Ozone-Only
Alternatives in 2010* (1990\$)**

Ozone Alternative (ppm)	Annual Benefits of Partial Attainment (billion \$) ^b (A)	Annual Costs of Partial Attainment (billion \$) (B)	Net Benefits of Partial Attainment (billion \$) (A - B)	Number of RNA Areas
0.08 5th Max (high end estimate) ^c	1.6	0.9	0.7	12
0.08 4th Max low end estimate ^d high end estimate	0.4 2.1	1.1	-0.7 1.0	17
0.08 3rd Max (high end estimate)	2.9	1.4	1.5	27

- a All estimates are measured incremental to the baseline current ozone standard (.12ppm, 1 expected exceedance per year).
- b Partial attainment benefits based upon post-control air quality estimates as defined in the control cost analysis.
- c The high-end estimates use a meta-analysis of epidemiological studies of associations between ozone and short-term mortality, and PM related benefits of ozone controls.
- d The low-end estimates are based on assumptions of no ozone mortality, and no ancillary PM-related benefits from ozone controls.

[Excerpts from Report, *Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule*, supplied in response to questions from Senator Inhofe)

12.0 BENEFITS OF NAAQS AND REGIONAL HAZE

12.1 Results in Brief

Partial attainment of the selected particulate matter (PM) National Ambient Air Quality Standards (NAAQS) is expected to yield national annual monetized benefits (health and welfare) of approximately \$15 billion to \$104 billion. Partial attainment of the selected ozone NAAQS is expected to yield national annual monetized benefits of approximately \$0.4 billion to \$2.1 billion. In addition, the benefits associated with the proposed regional haze (RH) rule are estimated to be either, zero, on the assumption that no controls beyond those needed for the NAAQS are imposed, a range of \$1.3 to \$3.2 billion, if all areas adopted a target of 1 d.v. in 15 years, or, \$1.7 to \$5.7 billion for 1 d.v. in 10 years. To the extent that these estimates fail to quantify many benefit categories, such as damage to ecosystems, damage to vegetation in national parks, damage to ornamental plants, damage to materials (e.g., consumer cleaning cost savings), and acid sulfate deposition, these understate actual benefits. The health and welfare benefits categories examined in this analysis and the methodology used to estimate the monetized benefits are presented below. Estimates of full attainment, though less certain than estimates for partial attainment, include a plausible range of benefits of \$60 to \$110 billion for PM_{2.5} and a plausible range of benefits for 0.08 4th max of \$5.2 to \$8.5 billion.

12.2 Introduction

This chapter presents the benefits methodology and results for the PM and ozone NAAQS and a proposed RH rule. In addition, this chapter also presents the methodology and results associated with visibility improvements due to a proposed RH rule. The analysis estimates the potential human health and welfare (all benefits

categories except human health) benefits associated with the PM, ozone, and RH rules. The emissions and air quality changes presented in Chapters 6, 7, and 8 are used as inputs to this benefits analysis. The following sections in this chapter include:

- The economic concept of benefits;
- The methodology for estimating post-control air quality changes;
- The methodology for estimating human health effects and the economic value associated with those effects;
- The methodology for estimating welfare effects and the economic value associated with those effects, where feasible;
- The health and welfare benefits associated with alternative PM, ozone, and RH rules;
- A discussion of potential benefit categories that are not quantifiable due to data limitations;
- A list of analytical uncertainties, limitations, and biases;

12.3 Updates and Refinements

The methodology for estimating health and welfare benefits associated with the PM and ozone NAAQS builds upon previous work conducted for the December 1996 PM and ozone draft regulatory impact analyses (RIAs). This analysis retains the majority of the concentration-response relationships used in the previous RIAs. However, a number of prominent revisions to the previous draft RIAs are made. Major updates and refinements include:

- Expansion of the plausible range of benefits by attempting to quantify several areas of uncertainty that were discussed qualitatively in the preamble and RIA to the proposed rules, through the adoption of a range of plausible assumptions for several key parameters in the analysis;
- Refined estimates of the high end of the plausible range of ozone-induced mortality through a meta-analysis of recently published studies;
- Consideration of PM-related benefits attributable to emission reductions associated with control strategies implemented to meet ozone NAAQS alternatives. These benefits are referred to as ancillary PM benefits;
- The estimation of ozone-related benefits in counties outside of defined ozone nonattainment areas;
- The concept of downwind transport areas is incorporated into the post-control ozone air quality;
- Refined estimates of willingness-to-pay values for benefits categories such as chronic bronchitis and visibility;
- Incorporation of a life-years extended approach to estimate and value premature PM mortality;
- Updated economic information for the agricultural models;
- The estimation of additional benefits categories such as: reduced nitrogen deposition in sensitive estuaries, tons reductions attributable to ozone controls, commercial forest protection in the western U.S., and visibility improvements in national parks;
- A sensitivity analysis on the air quality rollback procedure employed to simulate post-control ozone air quality;
- The application of the PM source-receptor matrix to post-control emissions on a nation-wide basis (rather than modeling region basis) to estimate PM post-control air quality. This step accounts for pollutant transport between 6 PM modeling regions.

12.4 OVERVIEW OF TO BENEFITS ANALYSIS METHODOLOGY

12.4.1 Introduction

The Clean Air Act requires EPA to set NAAQS and to regulate regional haze in order to provide benefits to society by enhancing (improving and protecting) human health and welfare. This chapter provides information on the types and levels of social benefits anticipated from the proposed rulemaking. This information includes: (1) background information on benefits assessment, describing benefits categories and issues in benefits estimation; (2) qualitative descriptions of the types of benefits associated with alternative standards; (3) quantitative estimates of benefits categories for which concentration-response information is available; and (4) monetized estimates of benefits categories for which economic valuation data are available.

12.4.2 Benefits Categories Applicable to the Regulation

To conduct a benefits analysis, the types or categories of benefits that apply need to be defined. Figure 12.1 provides an example of the types of benefits potentially observed as a result of changes in air quality. The types of benefits identified in

both the health and welfare categories can generally be classified as use benefits or non-use benefits.

Use benefits are the values associated with an individual's desire to avoid his or her own exposure to an environmental risk. Use benefits categories can embody both direct and indirect uses of affected ambient air. The direct use category embraces both consumptive and nonconsumptive activities. In most applications to air pollution scenarios, the most prominent use benefits categories are those related to human health risk reductions, effects on crops and plant life, visibility, and materials damage.

Non-use (intrinsic) benefits are values an individual may have for lowering air pollution concentrations or the level of risk unrelated to his or her own exposure. Improved environmental quality can be valued by individuals apart from any past, present, or anticipated future use of the resource in question. Such nonuse values may be of a highly significant magnitude; however, the benefit value to assign to these motivations often is a matter of considerable debate. While human uses of a resource can be observed directly and valued with a range of technical economic techniques, nonuse values must be ascertained through indirect methods, such as asking survey respondents to reveal their values.

Non-use values may be related to the desire to know that a clean environment be available for the use of others now and in the future, or may be related to the desire to know that the resource is being preserved for its own sake, regardless of human use. The component of non-use value that is related to the use of the resource by others in the future is referred to as the bequest value. This value is typically thought of as altruistic in nature. For example, the value that an individual places on reducing the general population's risk of PM and/or ozone exposure either now or in the future is referred to as the bequest value. Another potential component of non-use value is the value that is related to preservation of the resource for its own sake, even if there is no human use of the resource. This component of non-use value is sometimes referred to as existence value. An example of an existence value is the value placed on the ecological benefits of protecting areas known as wetlands because they play a crucial role in our ecological system, even if the wetlands themselves are not directly used by humans.

Figure 12.1 Examples of Potential Benefits of Air Quality Improvements

USE BENEFITS	EXAMPLES
Direct	*Human Health Risk Reductions (e.g., less incidences of coughing) *Increased Crop Yields
Indirect	*Non-Consumptive Use (e.g., improved visibility for recreational activities)
Option Value	*Risk Premium for Uncertain Future Demand *Risk Premium for Uncertain Future Supply (e.g., treating as insurance, the protection of a forest just in case a new use for a forest product will be discovered in the future)
Aesthetic	*Residing, working, traveling, and/or owning property in reduced smog locations
NON-USE BENEFITS	
Bequest	*Intergenerational Equity (e.g., an older generation wanting a younger generation to inherit a protected environment)
Existence	*Stewardship/Preservation/Altruistic Values (e.g., an individual wanting to protect a forest even if he knows that he will never use the forest) *Ecological Benefits

The majority of health and welfare benefits categories presented in this analysis can be classified as direct use benefits. These benefits are discussed in greater detail compared to other benefits categories presented in Figure 12.1 because more sci-

entific and economic information has been gathered for the direct use benefits category. For example, scientific studies have been conducted to discern the relationship between ozone exposure and subsequent effects on specific health risks and agricultural commodities. In addition, economic valuation of these benefits can be accomplished because a market exists for some categories (making it possible to collect supply, demand, and price information) or contingent valuation studies have been conducted for categories that people are familiar with (such as willingness-to-pay surveys for non-market commodities).

Detailed scientific and economic information is not as readily available for the remainder of the benefits categories listed in Figure 12.1. Information pertaining to indirect use, option value, aesthetic, bequest, and existence benefits is often more difficult to collect. For example, lowering ambient ozone concentrations in an area is expected to reduce physical damage to ornamental plants in the area. A homeowner living in the affected area with ornamental plants in his yard is expected to benefit from the reduced damage to his plants, with his plants possibly exhibiting an improved appearance or experiencing an extended life. Although scientific information can help identify the benefits category of decreased damage to urban ornamentals, lack of more detailed scientific and economic information (e.g., concentration-response relationships for urban ornamentals and values associated with specific types of injuries and mitigation) prevent quantification of this benefits category.

Another problem related to lack of information is the difficulty in identifying all benefits categories that might result from environmental regulation and in valuing those benefits that are identified. A cost analysis is expected to provide a more comprehensive estimate of the cost of an environmental regulation because technical information is available for identifying the technologies that would be necessary to achieve the desired pollution reduction. In addition, market or economic information is available for the many components of a cost analysis (e.g., energy prices, pollution control equipment, etc.). A similar situation typically does not exist for estimating the benefits of environmental regulation. The nature of this problem is due to the non-market characteristic of many benefits categories. Since many pollution effects (e.g., adverse health or agricultural effects) traditionally have not been traded as market commodities, economists and analysts cannot look to changes in market prices and quantities to estimate the value of these effects. This lack of observable markets may lead to the omission of significant benefits categories from an environmental benefits discussion.

The inability to quantify the majority of the benefits categories listed in Figure 12.1 as well as the possible omission of relevant environmental benefits categories may lead the quantified benefits presented in this report to be underestimated relative to total benefits. It is not possible to estimate the magnitude of this underestimate.

Tables 12.1 and 12.2 present the quantifiable and unquantifiable human health and welfare effects associated with exposure to PM, ozone, and RH. Note that since the pollutants contributing to RH formation are similar to those contributing to particulate formation, the health and welfare categories associated with PM are also associated with RH.

Table 12.1 PM and RH Benefits Categories

	PM Health and Welfare Benefit Categories	
	Unquantified Benefit Categories	Quantified Benefit Categories (incidences reduced and/or dollars)
Health Categories	Changes in pulmonary function Morphological changes Altered host defense mechanisms Cancer Other chronic respiratory disease Infant Mortality Mercury Emission Reductions	Mortality (acute and long-term) Hospital admissions for: all respiratory illnesses congestive heart failure ischemic heart disease Acute and chronic bronchitis Lower, upper, and acute respiratory symptoms Respiratory activity days Minor respiratory activity days Shortness of breath Moderate or worse asthma Work loss days
Welfare Categories	Materials damage (other than consumer cleaning cost savings) Damage to ecosystems (e.g., acid sulfate deposition) Nitrates in drinking water Brown Clouds	Consumer Cleaning Cost Savings Visibility Nitrogen deposition in estuarine and coastal waters

* There may be orders of magnitude differences in the size of these benefit categories.

Table 12.2 Ozone Benefits Categories

	Ozone Health and Welfare Benefit Categories	
	Unquantified Health Benefit Categories	Quantified Benefit Categories (in terms of incidences reduced or dollars)
Health Categories	Airway responsiveness Pulmonary inflammation Increased susceptibility to respiratory infection Acute inflammation and respiratory cell damage Chronic respiratory damage/ Premature aging of lungs	Coughs Pain upon deep inhalation Mortality Hospital admissions for: all respiratory illnesses pneumonia chronic obstructive pulmonary disease (COPD) Acute respiratory symptoms Restricted activity days Lower respiratory symptoms Self-reported asthma attacks Cancer from air toxics Change in lung function
Welfare Categories	Ecosystem and vegetation effects in Class I areas (e.g., national parks) Damage to urban ornamentals (e.g., grass, flowers, shrubs, and trees in urban areas) Reduced yields of tree seedlings and non-commercial forests Damage to ecosystems Materials damage (other than consumer cleaning cost savings) Nitrates in drinking water Brown Clouds	Commodity crops Fruit and vegetable crops Commercial forests Consumer Cleaning Cost Savings Visibility Nitrogen deposition in estuarine and coastal waters Worker productivity

* See footnote to Table 12.1 on page 12-8.

12.4.3 Economic Benefits

The general term “benefits” refers to any and all outcomes of the regulation that are considered positive; that is, that contribute to an enhanced level of social welfare. The economist’s meaning of “benefits” refers to the dollar value associated with all the expected positive impacts of the regulation; that is, all regulatory outcomes that lead to higher social welfare. If the benefits are associated with market goods and services, the monetary value of the benefits is approximated by the sum of the predicted changes in “consumer (and producer) surplus.” These “surplus” measures are standard and widely accepted terms of applied welfare economics, and reflect the degree of well-being enjoyed by people given different levels of goods and prices. If the benefits are non-market benefits (such as the risk reductions associated with environmental quality improvements), however, the other methods of examining changes in relevant markets must be used. In contrast to market goods, non-market goods such as environmental quality improvements are public goods, whose benefits are shared by many people. The total value of such a good is the sum of the dollar amounts that all those who benefit are willing to pay.

This conceptual economic foundation raises several relevant issues and potential limitations for the benefits analysis of the regulation. First, the standard economic approach to estimating environmental benefits is anthropocentric—all benefits values arise from how environmental changes are perceived and valued by people in present-day values. Thus, all near-term as well as temporally distant future physical outcomes associated with reduced pollutant loadings need to be predicted and then translated into the framework of present-day human activities and concerns. Second, as noted above, it may not be possible to quantify the value of all benefits resulting from environmental quality improvements.

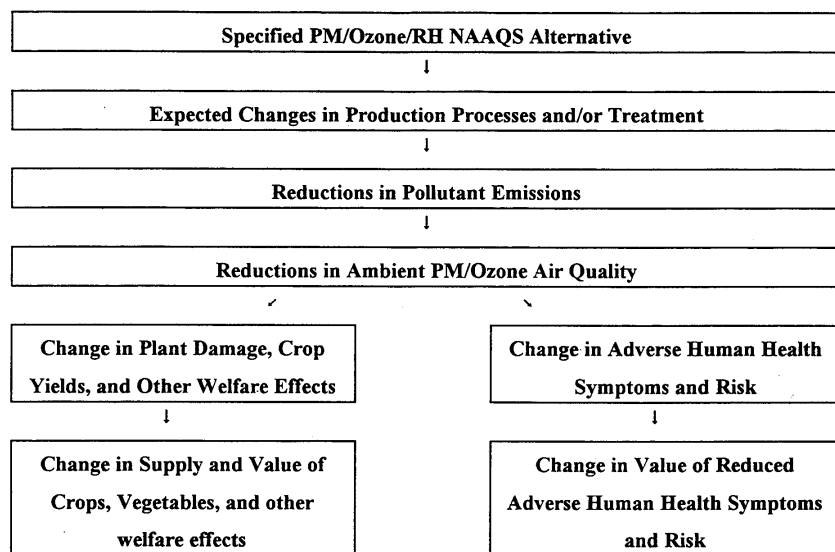
12.4.4 Linking the Regulation to Beneficial Outcomes

Conducting a benefits analysis for anticipated changes in air emissions is a challenging exercise. Assessing the benefits of a regulatory action requires a chain of events to be specified and understood. As shown in Figure 12.2, which illustrates the causality for air quality related benefits, these relationships span the spectrum of: (1) institutional relationships and policy-making; (2) the technical feasibility of pollution abatement; (3) the physical-chemical properties of air pollutants and their consequent linkages to biologic/ecologic responses in the environment, and (4) human responses and values associated with these changes.

The first two steps of Figure 12.2 reflect the institutional and technical aspects of implementing the regulation (the improved process changes or pollutant abatement). The benefits analyses presented in this document begin at the step of estimating reductions in ambient ozone concentrations. The estimated changes in ambient PM or ozone concentrations are directly linked to the estimated changes in precursor pollutant emission reductions through the use of either a source-receptor matrix (see chapter 4) or an air quality rollback procedure given the predicted 2010 baseline air quality. Chapter 4 of this report presents the methodology used to estimate baseline ambient PM and ozone air quality in the year 2010.

This RIA presents two scenarios for analyzing reductions in ambient PM and ozone air quality. The first, referred to as the partial attainment scenario, is intended to reflect residual nonattainment information as presented in the partial attainment cost analysis. For each area identified as not having sufficient control measures to allow it to attain a particular standard, the post-control air quality estimated for each area is intended to reflect the degree of residual nonattainment for that area. The health and welfare benefits estimated for this partial attainment scenario represent the identifiable benefits expected to result from the application of control measures as identified in the partial attainment cost analysis. The second scenario, referred to as the full attainment scenario, relies on the assumption that all areas will be able to attain any PM or ozone NAAQS being evaluated. The health and welfare benefits presented under this scenario represent the identifiable benefits that should accrue if all areas in the United States could comply with the standard being analyzed. Note that the benefits presented for the full attainment scenario will always exceed the benefits presented for the partial attainment scenario since the partial attainment scenario accounts for residual nonattainment. Chapter 4 presents a discussion of the models used to estimate baseline PM and ozone air quality.

Figure 12.2 Example Methodology of a Benefits Analysis



Other information necessary for the analysis are the physical and chemical parameters and the consequent improvement in the environment (e.g., concentration-response data). Finally, the analysis reaches the stage at which anthropocentric benefits concepts begin to apply, such as reductions in human health risk and improvements in crop yields. These final steps reflect the focal point of the benefits analyses, and are defined by the benefits categories described above. Below, relevant benefits categories are described qualitatively, and where possible, quantitatively.

12.4.5 Plausible Range of Monetized Benefits

As discussed throughout this RIA, there are many sources of uncertainty in estimating both the costs and the benefits of complex regulatory programs such as those that will be required to implement the ozone and PM NAAQS. These include uncertainties about the effects of emissions reductions on air quality, uncertainties about the effects of changes in air quality on health and welfare endpoints of concern, and uncertainties about the economic valuation of these endpoints. For this reason, this RIA has adopted the approach of presenting a "plausible range" of monetized benefits that reflects these uncertainties by selecting alternative values for each of several key assumptions. Taken together, these alternative sets of assumptions define a "high end" and a "low end" estimate for the benefits that have been monetized in this analysis.

In choosing alternative assumptions, EPA has attempted to be responsive to the many comments received on the RIAs that accompanied the proposed rules. As a result, the ranges of benefits presented here are substantially wider than the ranges that were presented in the RIAs for the proposed rules. It should be emphasized, however, that the high and low ends of the plausible range are not the same as upper and lower bounds. For many of the quantitative assumptions involved in the analysis, arguments could be made for an even higher or lower choice, which could lead to an even greater spread between the high end and low end estimates. The analysis attempts to present a plausible range of monetized benefits for the categories that have been analyzed. It should also be noted, as discussed in greater detail above, that a number of benefits categories have not been monetized, because of both conceptual and technical difficulties in doing so. These benefits are in addition to the plausible range of monetized benefits considered here.

The uncertainties that have been incorporated into the analysis are noted throughout the discussion of the methodology that follows. However, a few key assumptions, which have a substantial impact on the analysis and which together ac-

count for most of the differences between the high and low end estimates are noted here.

For PM, one significant source of uncertainty is the possible existence of a threshold concentration below which no adverse health effects occur. As noted in the preamble to the rule, the epidemiological evidence for effects above the level chosen for the annual standard is substantially stronger than the evidence for effects below that level. As noted in the preamble, although the possibility of effects at lower annual concentrations cannot be excluded, the evidence for that possibility is highly uncertain and the likelihood of significant health risk, if any, becomes smaller as concentrations approach background. Consequently, in constructing the high and low end benefits estimates, the following alternative assumptions were used. The high end estimate assumes that health benefits from reductions in $PM_{2.5}$ occur all the way down to background levels for chronic bronchitis and $12 \mu g/m^3$ mean for long-term mortality. The low end estimate assumes that health benefits occur from $PM_{2.5}$ reductions only down to the level of the standard, or $15 \mu g/m^3$ for all endpoints. Based on the risk assessment for mortality, approximately 60 percent of mortalities are estimated to occur above $15 \mu g/m^3$; that adjustment is applied to all PM health benefits for the low end estimate.

There is also substantial uncertainty about the extent of reduced mortality that may be associated with ozone reductions. A number of studies documenting a possible relationship between ozone and premature mortality are newly available, but these studies were not available at the time of the CASAC review of the Criteria Document and Staff Paper, and thus were not reviewed by CASAC and were not used in establishing the basis for the new 8-hour standard. The high end estimate for ozone benefits is based on a meta-analysis (discussed in more detail below) of nine of the more complete of these recent epidemiological studies, while the low end estimate assumes no mortality benefits from ozone reductions.

Furthermore, in the RIAs for the proposed rules, benefits that result from reductions in fine particles were attributed only to the PM standard, and benefits that result from reductions in ozone were attributed only to the ozone standard. In fact, however, NO_x is a major precursor of both pollutants, so that control measures that reduce NO_x emissions may lead to significant reductions in both ozone and fine particulates. It follows that even in the absence of an ozone standard, there would be some ozone benefits from a fine PM standard, and conversely, there would be some PM benefits from an ozone standard even in the absence of a $PM_{2.5}$ standard. There is thus some ambiguity about where to assign benefits that result from control measures that contribute to the attainment of both standards. To account for this ambiguity, the high end benefits estimate for ozone attributes to the ozone standard ("ancillary" PM benefits), while the low end estimate for ozone does not include these ancillary benefits.

Finally, there is substantial disagreement about the appropriate method for valuing reductions in risk of premature mortality. The RIAs for the proposed rule used a value per statistical life saved (VSL) of \$4.8 million. This represents an intermediate value from a variety of estimates that appear in the economics literature. It is a value that EPA has frequently used in RIAs for other rules. However, it has been pointed out that a substantial fraction of the premature deaths "avoided" by reductions in fine PM may represent life shortening by as little as a few days or weeks among individuals already suffering from severe respiratory or cardiopulmonary disease. Further, the average age of individuals who die from causes associated with fine PM is significantly higher, and the age specific life expectancy correspondingly lower, than the average age and life-expectancy of individuals used in the studies from which estimates of VSL were derived.

An alternative approach to valuing reductions in premature mortality that addresses these concerns is to estimate total life years extended, rather than premature deaths avoided, and multiply the result by the value of a statistical life-year extended (VSLY). This approach attempts to estimate not only how many premature deaths are avoided, but by how long these deaths are postponed. It is consistent with, but less refined than, the approach recommended in 1993 by the U.S. Public Health Service Panel on Cost-Effectiveness in Health and Medicine, which is the incorporation of morbidity and mortality consequences into a single measure quality adjusted life years (Haddix, et. al., 1996). This alternative approach then assigns a value to each life-year extended, rather than to each death postponed. In this analysis, the high-end estimate for mortality benefits used the VSL approach, with a value of \$4.8 million per statistical life saved, while the low-end estimate uses the VSLY approach. While there is currently little quantitative evidence regarding the extent of life shortening reflected in the short term mortality studies, concerns have been raised that a significant fraction of this mortality may reflect life shortening by only a few days or weeks. In contrast, the CAA Section 812 Study notes that

the life expectancy of 65-74 year olds, among whom much of the PM-related mortality occurs, is 14 years. This figure does not account for the possibility that much of the premature mortality may occur among individuals who are already suffering from serious respiratory or cardiopulmonary disease. Consequently, in constructing the low-end estimate, the assumption is made that two-thirds of the PM-related mortality reductions estimated from short-term studies represent life shortening of no more than a few weeks, while one-third represents life shortening of 14 years. The resulting estimate of life years extended monetizes the life years lost estimate value of \$120,000 per year. This represents the midpoint value from the range of published estimates (Tolley et. al., 1994, p.3 13).

12.4.6 Comparison of RIA to NAAQS Risk Assessment

The process of proposing and promulgating a revised NAAQS requires the Agency to conduct a series of analyses, two of which examine the health and welfare implications of revising the NAAQS. The first of these analyses is the risk assessment and exposure analyses, summarized in the PM and ozone Staff Papers and supplemental analyses, which are part of the scientific rationale for these health-based standards. (U.S. EPA, 1996c, 1996d) The second is the benefits analysis included in this RIA. In general, this RIA adopts the basic methods employed in the exposure analyses and risk assessment but attempts to expand the scope of the exposure analyses and risk assessment in an effort to identify and quantify all potential benefits categories.

To the extent possible, this health benefits analysis is methodologically consistent with analyses conducted for the PM and Ozone Staff Papers; however, this RIA's health benefits analysis differs from the exposure analyses and risk assessment in five ways.

1. This updated benefits analysis includes a number of health and welfare endpoints that were not included in the risk assessments. The two analyses are different because they serve different purposes: the risk assessment is used to provide a scientific basis for revising the current NAAQS while the purpose of this benefits analysis is to identify all potential health and environmental benefits associated with alternative NAAQS levels. Therefore, this benefits analysis must provide discussions or estimates of all health and environmental effects believed to be associated with exposure to ozone and PM. In addition to expanding the types of endpoints that are included in the analysis, this analysis estimates PM-related benefits attributable to emission reductions associated with control strategies implemented to meet the ozone NAAQS alternatives. These benefits are referred to as ancillary PM benefits associated with the ozone NAAQS. All health and welfare endpoints that are listed for the PM benefits analysis are also estimated for the ozone NAAQS analysis if ozone control strategies reduce NO_x emissions, which also have an effect on PM air quality. The ancillary PM benefits occur mostly in areas that have PM concentrations below the 15 µg/m³ threshold assumed in the low-end estimate. Areas that have concentrations above 15 µg/m³ would be out of attainment for PM_{2.5}, and it is not clear how to "divide up" the PM benefits between the ozone and PM standards for these areas. Therefore, the PM ancillary benefits are not included in the low-end estimate.

2. This benefits analysis expands the geographical scope of the exposure analyses and risk assessment. The PM and ozone benefits are estimated for the continental U.S. (referred to as a national analysis) as opposed to the risk assessment's limited number of 2 cities for PM and 9 urban areas for ozone. In addition, the PM and ozone benefits are estimated for a full calendar year as opposed to the ozone risk assessments limitation to the ozone season (the PM risk assessment however, was also estimated for a full year). The scope of the benefits analysis is expanded because the NAAQS are nationally applicable rules and control strategies implemented to reduce emissions are typically operated all year.

3. The exposure analyses and risk assessments use population and air quality data from relatively current years (1990 to 1993) to estimate risk reductions. In contrast, this benefits analysis estimates health and welfare effects for projected populations and ambient PM and ozone reductions in the year 2010. The year 2010 is an appropriate time period of analysis for this RIA because the purpose of this analysis is to identify potential benefits and costs associated with the standards when they are implemented. The year 2010 is believed to be a representative year for the purposes of this RIA.

4. The risk and exposure analyses employs a proportional air quality rollback procedure for both the PM and ozone NAAQS (with alternative rollback procedures as sensitivity analyses for ozone). This benefits analysis employs the same proportional air quality rollback procedure for the PM full attainment analysis (an air quality model is used to estimate partial attainment PM concentrations) but applies

a hybrid version of the proportional rollback procedure, called quadratic rollback, to simulate post-control ozone air quality. The quadratic procedure is used for the ozone analysis because the scope of the benefits analysis, especially the time over which benefits are calculated (full year rather than ozone season only), is more broad compared to the ozone risk and exposure assessment. In response to public comments on the ozone exposure analyses and risk assessment, EPA has conducted sensitivity analyses using alternative air quality rollback procedures; including the quadratic rollback employed in this RIA. EPA believes the quadratic rollback procedure generally is more reflective of how ozone levels decreased for many geographic areas and thus, is more suitable for use in a national analysis for a full year. See section 12.6 for a more detailed explanation of the characteristics of the rollback procedures.

5. A significant difference between this benefits analysis and the PM and ozone risk and exposure assessment is the inclusion of the ozone-induced mortality category in the high-end estimate for this analysis. The inclusion of this category creates a significant difference in the benefits results because of the number of avoided mortality cases predicted in new epidemiological assessments and the monetary estimate used to value these avoided cases. A short discussion of the ozone mortality issue is presented here due to this significant difference between this benefits analysis and the risk and exposure assessment.

A number of community epidemiology studies have suggested a possible association of ozone with mortality. The ozone criteria document review of the literature concluded that although an association between high ozone levels and mortality has been suggested, the strength of any such association remained unclear (U.S. EPA, 1996a). However, although early studies of this issue are flawed (e.g., due to poor control for confounders), a significant number of new studies (21 peer-reviewed studies, 12 since CASAC closure) have been published recently that provides more support for an association between ozone exposure and mortality. Although this benefits analysis uses data from these new studies to quantitatively estimate the relationship between ozone exposure and mortality for the high-end estimate, it is important to distinguish the role of this benefits analysis in comparison to the NAAQS risk and exposure assessment.

Results generated by the NAAQS exposure analyses and risk assessment are directly used to determine the appropriate level at which to set a criteria pollutant standard such that public health is protected with "an adequate margin of safety." The exposure analyses and risk assessment use only studies that have been reviewed by the Clean Air Science Advisory Committee (CASAC). The purpose of this benefits analysis is to identify and quantify, to the extent possible, all potential benefits categories that might result from implementation of the revised standards.

The additional ozone mortality studies provide increasing evidence of associations between ozone exposure and daily mortality. While many of these studies show an association between ozone exposure and mortality, studies over longer time periods, which collect and use more data, show stronger statistical significance compared to studies conducted over relatively shorter time frames. See the Benefits Technical Support Document (TSD) (U.S. EPA, 1997a) for a more complete description of the ozone mortality meta-analysis. Because significant uncertainty still exists in the estimation of ozone-induced mortality, this category of benefits is included in the high-end estimate but excluded from the low-end estimate.

12.5 Scope of Analysis

The goal of this analysis is to estimate national-level benefits associated with the revised PM and ozone standards as well as the regional haze program for the year 2010. As was previously explained in this RIA, baseline PM air quality data are reported in two ways: an annual distribution and a daily distribution. Baseline hourly ozone air quality data are generated for the entire year in 2010. Both PM and ozone air quality are projected at their respective existing monitor sites. The monitor-site air quality data are then used to interpolate PM and ozone air quality for all unmonitored counties in the continental U.S. Post-control air quality is then estimated (using either the source-receptor matrix or the air quality rollback procedure) for each of the baseline air quality values. The air quality rollback procedure is applied to the appropriate baseline air quality values for the entire year.

This benefits chapter presents national-level summary results associated with the NAAQS and RH alternatives analyzed in this report. However, readers interested in smaller units of aggregation (e.g., each of the six PM regions or each of the ozone nonattainment areas) can refer to the Benefits TSD.

12.6 ESTIMATION OF POST-CONTROL AIR QUALITY

12.6.1 Introduction

The discussion accompanying Figure 12.2 explains that the starting point for this benefits analysis is the estimation of reductions in ambient concentrations of PM and Ozone. Previous chapters in this analysis have provided information on the development of baseline emissions and air quality as well as the estimation of emission reductions and costs associated with implementation of the various NAAQS alternatives. This chapter continues the analysis by converting the estimated emission reductions into decreased ambient PM and ozone concentrations. The air quality change is defined by two scenarios: (1) Partial Attainment (to reflect air quality improvement expected given the adoption, where needed, of reasonably cost-effective emissions controls for which adequate cost-effectiveness data exist, and (2) Full Attainment (to reflect the potential benefits if all areas are able to meet the standards).

12.6.2 Derivation of Annual Distribution of Daily PM Concentrations

As described in Chapter 4, baseline PM air quality predicted by the source-receptor matrix is used as input to the benefits analysis. Because the annual distribution of daily PM concentrations cannot be predicted by the model, they must be derived from other predicted information. A reasonable functional form for county-specific air quality distributions can be assumed, based on an examination of PM distributions in recent years for which actual data exist. Once a functional form is chosen, all that is unknown about a given county-specific distribution are the values of its parameters. The model-predicted statistics, the annual mean and the 98th or 99th percentile daily maximum, can then be used to estimate these parameters, for each county-specific distribution, completing the estimate of the county-specific distribution of daily PM concentrations in the year 2010. For the baseline PM₁₀ alternative, the fourth highest daily maximum value is used. For the selected PM₁₀ alternative, the 99th percentile daily maximum value is used. For the PM_{2.5} alternatives, the 3-year average 98th percentile daily maximum value is used. Daily PM concentrations are then generated from this estimated distribution.

To determine the most reasonable annual distributional form for the daily PM concentrations in each county in the United States for the year 2010, PM data for recent years in each of four locations (Philadelphia, PA; St. Louis, MO; Provo, UT; and El Paso, TX) were fit to a number of distributions (including, but not limited to, the lognormal, the beta and the gamma distributions). The gamma distribution was chosen because it generally provided the best fit. The above procedure was carried out for each county in the national analysis, generating 365 daily PM₁₀ and 365 daily PM_{2.5} concentrations for each county in the analysis. The procedure used to estimate the two parameters of the gamma distribution and to then generate a year's worth of daily PM concentrations from the fully specified distribution is described in detail in the Benefits TSD (U.S. EPA, 1997a).

12.6.3 Partial Attainment Air Quality Estimation

The partial attainment benefits scenario is assessed to account for the presence of residual nonattainment for both PM and ozone (as described in Chapters 6, 7, and 8). Under the partial attainment scenario, the goal is to approximate post-control air quality related to emission reductions achieved by the specific control measures identified in the cost analysis. The reader should keep in mind that even under this partial attainment scenario, there are some areas that the cost analysis estimates will be able to fully attain either the PM and/or the ozone standards. The difference between the full and partial attainment scenarios is that for the partial attainment scenario, under each alternative NAAQS evaluated, a number of areas are identified as residual nonattainment areas where insufficient control measures are identified to simulate full attainment. Given that the goal of the partial attainment benefits scenario is to link projected emission reductions, costs, and the resulting air quality improvements, the benefits results presented under the partial attainment scenario should be viewed as the results most comparable to the partial attainment cost estimates presented in Chapters 6, 7, and 8.

As described in chapter 4 and chapter 6, the source-receptor matrix and PM cost optimization model are used to estimate least-cost reductions of primary PM and PM precursors to attain alternative PM standards. Ambient PM concentrations are expected to be affected by both the type of emissions reduced [i.e., nitrogen oxides (NO_x), sulfur oxides (SO_x), volatile organic compounds (VOC), PM₁₀, PM_{2.5}, or ammonia] and the location of the emission reductions. Note that since NO_x and VOC are precursor emissions for both PM and ozone, the source-receptor matrix can be used to estimate ambient particulate reductions expected to result from controls im-

posed under both the PM and the ozone NAAQS. Once control measures are identified in the control strategy/cost analysis, post-control emissions are input to the source-receptor model to predict nationwide post-control PM air quality. This step is conducted to account for pollutant transport between the 6 modeling regions delineated in chapter 6.

The estimation of ambient ozone concentration reductions is more problematic compared to the PM procedure described above. Lack of a national ozone air chemistry model precludes creating a direct link between the imposition of pollution control strategies (as identified in the cost analysis) and the resulting ambient ozone concentration. Rather, this analysis relies on an air quality adjustment procedure (referred to as quadratic rollback) to reduce hourly baseline ozone concentrations. This approach uses a quadratic formula such that relatively higher ozone concentrations get reduced by a greater percentage than relatively lower ozone concentrations. The partial attainment air quality rollback procedure is intended to reflect the degree of nonattainment for each residual nonattainment area.

For each ozone standard analyzed, the cost analysis attempts to identify control strategies that will enable each nonattainment area to achieve its targeted emission reductions. Two outcomes are possible within the analysis: (1) emission reduction targets are achieved or (2) controls likely to be imposed do not fully achieve the emission reduction targets by 2010. Starting with the first example, if an area initially classified as nonattainment is projected to be able to meet its targeted emission reductions that area is classified as an initial nonattainment area that, with the implementation of additional control strategies, will be able to attain the standard. Under this example, the design value for the nonattainment area (i.e., the recorded monitor value that causes the area to be classified as a nonattainment area) is reduced by X percent to comply with the standard. All other monitor values within the nonattainment area are also reduced by some smaller percentage compared to X, as determined by the quadratic equation. Also, under this attainment case, the rounding convention of .005 parts per million (ppm) is employed in the air quality rollback procedure. For example, if the standard under evaluation is an 8-hour, .08 ppm standard, the quadratic rollback procedure is employed to reduce the design value ozone concentration to a value of .084 ppm.

The partial attainment scenario also contains a number of areas that belong in the second category. Since the area cannot be deemed to be able to attain the standard within the study period, the air quality rollback procedure must be modified to reflect the presence of residual nonattainment. Relevant information that is known for each nonattainment area includes: (1) the design value causing the area to be classified as nonattainment; (2) the targeted VOC and NO_x emission reductions believed to be necessary to enable the area to comply with the standard being analyzed; and (3) the total VOC and NO_x emission reductions thought to be possible given identifiable control measures. Using the above information along with an assumption of linearity between emission reductions and ambient ozone concentrations, it is possible to employ the quadratic rollback procedure to approximate partial attainment air quality. Targeted VOC and NO_x emission reductions are summed. Achieved NO_x and VOC emission reductions are treated equally. A ratio of total achieved to targeted emission reductions is then calculated. This ratio provides the degree of partial attainment that is then applied to the air quality rollback of the design value to meet a particular ozone standard. For example, if an area is estimated to be able to only achieve 50 percent of its targeted emission reductions, then the 50 percent value is used to reduce the design value to only 50 percent towards attainment of the standard (where 100 percent implies full attainment because the emission reductions targets are fully met). Downwind transport areas as described in chapter 4 are also rolled back the same amount as their upwind nonattainment areas. Once these partial attainment rollbacks are complete, the centroid model (see section 4.5.4) is re-run to provide nationwide post-control ozone air quality.

12.6.4 Full Attainment Air Quality Estimation

Because full attainment of the alternative NAAQS nationwide will require use of new technologies whose costs cannot yet be assessed accurately, full attainment of each alternative is simulated by changing the distribution of daily PM or ozone concentrations. The methods described below for adjusting baseline air quality to simulate full attainment apply to both the PM and ozone benefits analyses. The procedure used to adjust both the PM and ozone air quality is referred to as the air quality rollback procedure.

In the absence of historical PM_{2.5} air quality monitoring data, it may be reasonable to simulate full attainment of the PM alternatives by employing a proportional rollback procedure (i.e., by decreasing the appropriate baseline PM and ozone con-

centrations on all days by the same percentage). An assessment of the plausibility of estimating full attainment air quality by using a proportional (also referred to as linear) rollback procedure is presented in the PM risk assessment (Johnson, 1997). The assessment examines historic changes in $PM_{2.5}$ and concludes that the proportional rollback procedure is a good approximation for the historical decrease in PM levels.

As with the ozone partial attainment scenario, the quadratic air quality rollback procedure is employed to simulate full attainment of the ozone alternatives because historical monitoring data indicates that lower ozone concentrations may decrease by a smaller proportion compared to higher ozone concentrations when control strategies are implemented.

For the PM NAAQS, the full attainment benefits analysis begins where the partial attainment analysis ended. Under the PM full attainment benefits analysis, the proportional rollback procedure is employed to simulate full attainment in the residual nonattainment areas (i.e., by decreasing the appropriate baseline PM concentrations on all days by the same percentage). The PM percent reduction is determined by the controlling standard. For example, suppose both an annual and a daily $PM_{2.5}$ standard are proposed. Suppose P is the percent reduction required to attain the annual standard (i.e., the percent reduction of daily PM necessary to get the annual average at the monitor with the highest annual average down to the standard). Suppose P_d is the percent reduction required to attain the daily standard with one exceedance (i.e., the percent reduction of daily PM necessary to get the second-highest monitor-day down to the daily standard). If P_a is greater than P , then all daily average PM concentrations are reduced by P_a percent. If P is greater than P_d , then all daily average PM concentrations are reduced by P percent. A rounding convention is also employed in the rollback procedure. Using the proposed $PM_{2.5}$ standard of $15/50 \mu\text{g}/\text{m}^3$ as an example, the annual value is reduced to a value of $15.04 \mu\text{g}/\text{m}^3$ while the daily value would be reduced to a value of $50.4 \mu\text{g}/\text{m}^3$.

For ozone, the process is slightly simpler since there is only one standard to attain at any given time. For example, the design value for a nonattainment area (i.e., the recorded monitor value that causes the area to be classified as a nonattainment area) is reduced by X percent to comply with the standard. Accordingly, the quadratic air quality rollback procedure employed in the ozone partial attainment scenario is also employed in the full attainment scenario. The only difference between the two scenarios is that the ozone full attainment scenario always reduces each nonattainment area's design value to exactly the level of the evaluated standard. The full attainment scenario adheres to the same rounding convention of .005 ppm.

12.6.5 Air Quality Background Levels and Benefits Thresholds

The term background air quality refers to pollution caused by natural sources (as opposed to those caused by anthropogenic sources) and is defined as the distribution of air quality that would be observed in the U.S. in the absence of anthropogenic emissions of PM, VOC, NO_x , and SO_x in North America. For example, volcanoes emit sulfate precursors and trees emit VOC (i.e., terpenes), which each contribute to PM and ozone formation, respectively.

The health benefits estimation for PM uses two alternative assumptions about benefits from reductions below the level of the standard. The high-end estimate assumes benefits from fine particulate reductions down to $12 \mu\text{g}/\text{m}^3$ mean for mortality due to long-term exposure and reductions down to background levels for chronic bronchitis. The PM Staff Paper provides background values for PM_{10} versus $PM_{2.5}$ and west versus east (USEPA, 1996d). Midpoint background values for PM_{10} are estimated at $6 \mu\text{g}/\text{m}^3$ for the west and $8 \mu\text{g}/\text{m}^3$ for the east. Midpoint background values for $PM_{2.5}$ are estimated at $2.5 \mu\text{g}/\text{m}^3$ for the west and $3.5 \mu\text{g}/\text{m}^3$ for the east. This analysis uses background PM concentrations for benefits models that do not report a lowest-observed PM concentration or if the reported lowest-observed concentration is below background. For models that report a lowest-observed concentration (the lowest PM concentration at which the concentration-response function is supported) at a higher value than background levels, benefits estimates are only calculated for air quality changes down to the lowest observable level. For example, the Pope et al. study reports a lowest observed annual median $PM_{2.5}$ level as $9 \mu\text{g}/\text{m}^3$. Therefore, the concentration-response function is relied upon only down to the $9 \mu\text{g}/\text{m}^3$ annual median concentration. The short-term PM-mortality studies generally do not report lowest observed concentrations and are therefore, Estimated down to background concentrations. Similarly, most PM-mortality studies do not report lowest-observed levels and are also estimated down to background concentrations. As discussed in the preamble to the rule, benefits from reductions below the standard are significantly more uncertain than those from reductions above the level of the standard. The low-end estimate thus uses a threshold concentration of

15 $\mu\text{g}/\text{m}^3$, below which further reductions are not assumed to yield additional health benefits. This has the effect of reducing the incidence of estimated health benefits by about 40 percent.

A background level is also imposed on the ozone concentration-response models. A midpoint background value estimated in the ozone Staff Paper is 0.04 ppm (U.S. EPA, 1996c). This analysis accounts for background ozone concentrations by evaluating benefits models only down to the 0.04 level but not below this level. This limitation is placed on models that do not report thresholds or report thresholds below 0.04 ppm. For example, while most ozone-mortality studies report lowest observed ozone concentrations, the concentrations are uniformly lower than 0.04 ppm. Ozone concentration-response functions are therefore, estimated down to background levels. In addition, some clinical studies introduce additional thresholds which are above the assumed background level, in which case, benefits estimates are only calculated for air quality changes down to the reported threshold level.

12.6.6 Ozone Air Quality Rollback Sensitivity Analysis

As mentioned earlier when comparing this benefits analysis to the NAAQS risk and exposure assessment, a point of departure between the two analyses is the air quality rollback procedure applied to ozone data. The risk and exposure assessment applied a proportional air quality rollback procedure to ozone-season air quality values in 9 sample urban areas. In addition, the assessment also conducted several air quality rollback sensitivity analyses, comparing results using a weibull distribution as well as the quadratic rollback procedure.

As noted above, that the quadratic rollback procedure reduces non-peak ozone values (e.g., wintertime ozone values) by a smaller proportion compared to peak ozone values (e.g., ozone concentrations at design-value monitors). The quadratic rollback procedure is deemed to be appropriate for this benefits analysis because the procedure is employed to adjust baseline air quality values for a full calendar year. However, this benefits analysis also conducts a sensitivity analysis using the proportional air quality rollback procedure. In general, the use of a proportional air quality rollback procedure compared to the proportional rollback procedure yields results that are 2 times larger. See the Benefits TSD for more details (U.S. EPA, 1997a). The weibull rollback procedure is data intensive and lack of historical data on a national basis for the analysis year prevents a sensitivity analysis of the weibull rollback procedure to be conducted.

12.7 HUMAN HEALTH BENEFITS

12.7.1 Introduction

Exposure to PM, ozone, and RH can result in a variety of health and welfare effects. The relevant PM, ozone, and RH human health and welfare effects that are quantified (expressed in terms of incidences reduced) and monetized (expressed in terms of dollars) are presented in Tables 12.1 and 12.2. Note that since the pollutants contributing to RH formation are similar to those contributing to particulate formation, the health and welfare benefits categories associated with PM are also associated with RH. Additionally, note that all health and welfare effects identified for PM and RH in Table 12.1 are also applicable in the high-end estimate to ozone reductions because ozone control strategies may also reduce particulate concentrations through the control of NO_x emissions. All categories of benefits listed in Tables 12.1 and 12.2 that are monetized are also quantified. However, some quantified benefits categories are not monetized due to one of two reasons: (1) economic valuation information is not available or (2) a concern about double-counting or an overlapping of effects categories led to a decision to omit a particular benefits category from the aggregation scheme. These issues are discussed in greater detail in Appendix I of this RIA.

For benefits categories listed as unquantified, scientific data are not available for quantifying the relationship between ozone and incidences of each symptom. However, the unquantifiable health benefits categories are listed because evidence in the scientific literature creates a reasonable connection between PM and ozone exposure and these health and welfare effects categories. For example, the collective toxicologic data on chronic exposure to ozone garnered in animal exposure and human population studies provide a biologically plausible basis for considering the possibility that repeated inflammation associated with exposure to ozone over a lifetime may result in sufficient damage to respiratory tissue such that individuals later in life may experience a reduced quality of life. However, such relationships remain highly uncertain due to ambiguities in the data.

The result of having potentially significant gaps in the benefits calculations may lead to an underestimation of the monetized benefits presented in this report. The

effect of this potential underestimation is to limit the conclusions that can be reached regarding the monetized benefits and net benefits estimates of each of the PM, ozone, and RH alternative standards.

12.7.2 Health Benefits Methodology

As illustrated in Figure 12.2, the next step in this benefits analysis is to estimate the change in adverse human health effects expected to result from a decrease in ambient PM and/or ozone concentrations. To accomplish this task, a series of scientific studies evaluating the relationship between PM and/or ozone exposure and human health effects are identified. Statistical techniques are employed to estimate quantitative concentration-response relationships between pollution levels and health effects.

A correction has been made from the November DraD RIA in the calculation of the reductions in long-term exposure mortality associated with attainment (or partial attainment) of alternative PM_{2.5} standards. In the previous analysis, changes in long-term PM_{2.5} concentrations in each county were characterized by changes in the annual mean concentration for the county. Changes in the incidence of long-term exposure mortality associated with changes in annual mean concentrations were estimated using the concentration-response relationship reported by Pope et al., 1995. However, it appears that Pope et al. estimated the relationship between changes in mortality incidence and changes in the median, rather than the mean, of daily average concentrations across the year (or across several years). long-term exposure mortality incidence was re-estimated, based on changes in annual median concentrations rather than annual mean concentrations, for each scenario considered. The reductions in the estimates of monetized benefits associated with long-term exposure mortality reduction due to this correction are generally about 20 percent. The lowest observable value reported in the Pope et al. study is a 9 µg/m³ median value. A corresponding mean value is estimated to be approximately 12 µg/m³.

Of special interest is the mortality benefits category for both PM and ozone since this category contributes a major portion of the estimated total monetized benefits (except for the low-end estimate for ozone). As explained earlier, the PM concentration-response functions included in this analysis are generally consistent with the PM NAAQS risk and exposure assessment. The studies included in the analyses were reviewed by the CASAC and judged against a set of criteria (e.g., must be published) as detailed in the Benefits TSD (see Appendix I). Also, as explained earlier in this chapter, the relatively newer ozone mortality studies that have been published or accepted by a peer-reviewed journal, but have not yet been through the CASAC or Criteria Document review process. In the absence of this review, this analysis includes in the high-end estimate a detailed assessment of the new ozone mortality studies through a meta-analysis. A subset of 9 ozone mortality studies are chosen for this benefits analysis and are also cross-referenced to the list of PM mortality studies. See Appendix J for details on the studies and the selection criteria.

Of the 9 ozone mortality studies, only two studies providing information for PM-related mortality had not already been included in the PM analysis. One of these studies was conducted in Amsterdam while the other was conducted in Chile. It is believed that the mix of precursor and primary emissions contributing to particulate formation varies widely due to factors such as geography and human and economic activity. It is also believed that the health effects associated with PM exposure are dependent upon the chemical constituents of ambient PM concentrations. For these reasons, one of the criteria used to select studies for inclusion in the PM risk and exposure analysis (and therefore, the PM benefits analysis) is that the studies had to have been conducted in the U.S. or Canada, where the population and human and economic activity patterns are relatively similar. The use of this criterion eliminates the possibility of including data from studies conducted elsewhere, such as Europe or South America. Unlike PM, there are only two precursor emissions for ozone. Although the mix of these pollutants may vary from area to area, the difference of the mix is not believed to cause a significant difference in the type or degree of health effects believed to be associated with ozone exposure (USEPA, 1996b). Therefore, although the ozone mortality meta-analysis includes new studies published since review of the Criteria Document and conducted in areas outside the U.S. or Canada, the scope of the PM mortality analysis is not expanded to include the two new studies.

Tables I.1 and I.2 in Appendix I provide information on the studies this analysis uses to quantify health effects. Table I. 1 lists the studies relevant to PM exposure. Since the pollutants contributing to RH formation are similar to those contributing to PM formation, all studies listed for PM exposure are also applicable to the RH benefits analysis. As can be seen from the table, the various health and welfare effects studies have used different air quality indicators for particles. This analysis

assesses benefits for both PM₁₀ and PM_{2.5}. For functions using PM₁₀ as an indicator, PM₁₀ data for each alternative NAAQS is used. For functions using PM_{2.5} as an indicator, PM_{2.5} data for each alternative NAAQS is used. However, in the case of consumer cleaning cost savings, assumptions regarding the air quality indicator are necessary to evaluate the concentration-response function. (See section 12.8.2.5 for more details.)

Table I.2 lists the studies relevant to ozone exposure. The ozone benefits analysis uses data from a combination of clinical studies (where human subjects are exposed to various levels of air pollution in a carefully controlled and monitored laboratory situation) as well as epidemiological studies (where the relationship between ambient exposures to ozone and health effects in the human population are typically studied in a "natural" setting). The portion of the ozone benefits analysis using clinical studies evaluates the concentration-response functions for the total U.S. population as well as two sub-population groups: outdoor children and outdoor workers. These sub-populations are of particular interest because individuals in these sub-populations are believed to experience higher than average exposure to ozone due to the amount of time they spend outdoors as well as the level of physical activity they engage in while outdoors.

Not listed in Table I.2 but also included in the ozone benefits analysis is an additional health category related to toxic air pollutant emission reductions. This category is not listed in Table I.2 because a different methodology is used to estimate the benefits associated with this category. The Benefits TSD provides more information on this methodology (U.S. EPA, 1997a). As explained earlier, reductions in ozone concentrations are achieved by reducing emissions of VOC and NO_x. Many of the components of VOC are listed as hazardous air pollutants (HAP) under section 112 of the Clean Air Act (CAA). HAPs, also known as "air toxics," are associated with a variety of adverse human health effects such as cancer, reproductive and developmental effects, and neurological disorders, as well as adverse ecological effects. This analysis estimates the benefits of reduced exposure to carcinogens potentially resulting from implementation of a revised ozone NAAQS. The analysis focuses on three particular HAPs expected to account for almost all cancer benefits from reductions of VOC HAP emissions: benzene, 1,3-butadiene, and formaldehyde. Non-cancer human health benefits and ecological benefits resulting from reduced emissions of air toxics are not quantified due to lack of available methods and data.

Other than the air toxics analysis described above, the majority of the models used in both the PM and ozone benefits analysis are epidemiological models. For most concentration-response functions, baseline incidences of health effects are needed for evaluation of the functions. For example, in the case of mortality, county-specific mortality rates were obtained for each county in the United States from the National Center for Health Statistics. Because those studies that estimated concentration-response functions for short-term exposure mortality considered only non-accidental mortality, county-specific baseline mortality rates used in the estimation of PM-related short-term exposure mortality are adjusted to reflect a better estimate of county-specific non-accidental mortality. Each county-specific mortality rate is multiplied by the ratio of national non-accidental mortality to national total mortality. County-specific baseline mortality rates are left unadjusted when applied to long-term exposure mortality functions because the study estimating a concentration-response function for long-term exposure mortality included all mortality cases.

Baseline incidence rates used for the year 2010 baseline are projected using current baseline incidence rates. The extent to which these current rates correspond to projected incidence rates in the year 2010, given either 2010 baseline or post-control PM and/or ozone concentrations, is not known.

This RIA assesses benefits estimates for the year 2010. As explained above, much of the benefits projections are calculated on a county-specific basis. Therefore, county-level population projections must be estimated for the year 2010. This analysis relies on population projections reported by the U.S. Census for the year 2010. However, these projections are available at the State level only. To estimate county-specific 2010 populations, the benefits model distributes the State-level projections to census block groups using the proportion of the 1990 State population accounted for by each block group. Thus, the geographic distribution of each State's population is retained. The population of the continental United States in the year 2010 is projected to be approximately 295.5 million.

12.7.3 Economic Valuation

12.7.3.1 Introduction

The social benefits associated with a change in the environment is the sum of each individual's willingness to pay for (or to avoid) the change. This analysis em-

employs three techniques to value the social benefits resulting from reduced mortality and morbidity due to an environmental change.

One approach is called the "cost of illness" (COI) approach. This approach estimates the value of health improvements as the sum of the direct and indirect costs of illness: the health expenditures made and the loss of labor productivity. An advantage of the cost of illness approach is that economists can rely on observed human behavior. In addition, data are not difficult to collect. This method is commonly accepted by many researchers in the health care industry because it provides estimates for the value of a wide range of health effects. However, the COI approach does not provide a conceptually correct measure of willingness-to-pay (WTP) because it does not account for many factors associated with experiencing or avoiding an adverse health symptom (e.g., the value of discomfort an individual feels when experiencing an adverse health symptom). This analysis uses the COI approach to derive one component of the total value used to monetize the hospital admissions category but enhances that value by attempting to account for other components associated with illness, such as the value of avoiding pain caused by the illness.

The second approach involves conducting a survey and directly asking people what they would be willing to pay for a good, hypothetically assuming (contingent upon) the existence of a market for the good. This method, referred to as contingent valuation (CV), has been applied to a variety of non-market goods, including adverse health symptoms. CV is based on sophisticated survey techniques that may be able to yield valid and reliable WTP values. CV surveys also may address the issues of existence and bequest values because survey responses may include the moral satisfaction of contributing to public goods and charity. Although CV has been increasingly accepted in recent years, its application is controversial. Potential biases in willingness to pay estimates include hypothetical bias, strategic bias, starting point bias, vehicle bias, and information bias.

Finally, the value of a statistical life saved is based on a set of 26 studies, most of which are wage-risk studies. These studies attempt to estimate what workers are willing to pay to reduce their risks of premature mortality by statistical examinations of the wage premiums that are paid for higher risk jobs. The value of a statistical life year extended is based on the results of several studies that attempt to adjust the value of statistical lives saved by the life expectancy of individuals in the studies.

Each of the three methods discussed above is a method to estimate mean willingness to pay for a risk reduction or an adverse health effect avoided. WTP is the maximum amount of money an individual would pay such that the individual would be indifferent between having the good or service and having kept the money.

For both market and non-market goods, WTP values reflect individuals' preferences. Because preferences are likely to vary from one individual to another, WTP values for both market and non-market goods such as improvements in environmental quality are likely to vary from one individual to another. In contrast to market goods, however, non-market goods are public goods whose benefits are shared by many individuals. The individuals who "consume" the environmental quality improvement may have different WTP values for this non-market good. The total social value of the good is the sum of the WTP values of all individuals who consume the good.

If different subgroups of the population have substantially different WTP values for a unit risk reduction and substantially different numbers of units of risk reduction conferred upon them, then estimating the total social benefits by multiplying the population mean WTP value for a unit risk reduction by the predicted number of units of risk reduction could yield a biased result. For example, in the case of PM-induced premature mortality, there is evidence that most of those individuals receiving the benefits of a reduction in the probability of dying in the current year as a result of a reduction in ambient PM concentrations are the elderly. If WTP values for mortality risk improvement among the elderly are substantially different from WTP values for mortality risk improvement among younger individuals, then using the population mean WTP will give a biased result. This issue is addressed in this assessment of PM through the use of a statistical life-year extended approach in the low-end estimate. Unlike PM, there is not enough evidence at this time to assert that ozone mortality is age-dependent.

While the estimation of WTP values for a market good is not a simple matter, the estimation of a WTP value for a non-market good, such as a decrease in the risk of having a particular health problem, is substantially more difficult. Estimation of WTP values for decreases in specific health risks (e.g., WTP to avoid 1 day of coughing or WTP to avoid admission to the hospital for respiratory illness) is further limited by a paucity of information. Appendix I provides a brief description of the derivation of some of the more prominent WTP estimates used in this

analysis. A more detailed description of the methodology is provided in the Benefits TSD (USEPA, 1997a).

If exposure to pollution has any cumulative or lagged effects, then a given reduction in pollution concentrations in one year may confer benefits not only in that year, but in future years as well. Because this benefits analysis pertains to a single year only, any benefits achieved in other years are not included in this analysis. On the other hand, benefits even for a single year may not be fully realized until long after the year in which the exposure occurs. In this case it would be appropriate to discount such benefits. Because there is currently inadequate data to determine the lag with which various health benefits are realized, benefits are assumed to occur fully in the same year as exposure.

12.7.3.2 Valuation Estimates

Table 12.3 presents the WTP values available to monetize the reduced adverse health effects presented earlier in this chapter. Each value presented in Table 12.3 represents the point estimate of the monetary value associated with avoiding a unit of a given adverse health effect and is known as a unit dollar value. Although the WTP estimates presented in Table 12.3 are represented as point estimates, this analysis addresses the uncertainty associated with each of the unit dollar values. To further capture the plausible range of monetized values for premature mortality, the low-end estimate values these benefits using a life year extended rather than a lives saved approach. See Appendix I for more information on a sensitivity analysis of uncertainty.

The monetary values used in this analysis are generally consistent with monetary values reported in the Section 812(a) draft report, with the exception of the hospital admissions categories (U.S. EPA, 1997b). The section 812(a) analysis uses the COI approach to derive an economic value for the hospital admissions categories. However, since COI estimates do not measure values associated with pain and suffering (as well as other potential reductions in well-being) resulting from illness, they may significantly understate the true WTP value to avoid illness. For this reason, an adjustment factor is employed to scale the hospital admissions COI estimate upward to reflect a WTP estimate. Following the strategy employed by Chestnut, the hospital admissions COI estimate as reported in the section 812(a) draft report is multiplied by a factor of two. This factor is based on results from three studies providing evidence on COI/WTP ratios for the same study population addressing the same change in an air pollution-related effect. While this adjustment approach is based on limited evidence, the resulting hospital admissions valuation estimate is not clearly biased.

12.7.4 Health Benefits Aggregation Issues

Aggregation refers to the adding together of the monetized benefits associated with different health or welfare endpoints to derive a total monetized benefits attributable to a change in air quality. The dollar benefits from ozone reductions resulting from a specified air quality change is simply the sum of dollar benefits from the reductions in incidence of all non-overlapping health and welfare endpoints with which PM and/or ozone are associated.

Ideally, the effects of air pollution could be divided into mutually exclusive categories that, combined, account for all the effects. Even if health endpoint categories are overlapping, they are mutually exclusive, and can therefore be aggregated, if the populations for which their concentration-response functions are estimated are mutually exclusive. For example, respiratory illnesses among children and respiratory illnesses among adults are mutually exclusive categories. If two endpoints are overlapping, then adding the benefits associated with each endpoint results in double-counting some benefits. Although study-specific point estimates of dollar benefits associated with specific, possibly overlapping endpoints are reported separately in the technical supporting documentation to this RIA, the total benefits estimates presented in this chapter requires that only benefits from non-overlapping endpoints be included in the total calculation.

Table 12.3 Willingness-to-Pay Estimates (Mean Values)

Health Endpoint	Mean WTP Value per Incident (1990 \$)
Mortality	
Life saved	\$4.8 million
Life year extended	\$120,000
Hospital Admissions:	
All Respiratory Illnesses, all ages	\$12,700
Pneumonia, age ≥ 65	\$13,400
COPD, age ≥ 65	\$15,900
Ischemic Heart Disease, age ≥ 65	\$ 20,600
Congestive Heart Failure, age ≥ 65	\$ 16,600
Emergency Visits for Asthma	\$9,000
Chronic Bronchitis	\$260,000
Upper Respiratory Symptoms	\$19
Lower Respiratory Symptoms	\$12
Acute Bronchitis	\$45
Acute Respiratory Symptoms (any of 19)	\$18
Asthma	\$32
Shortness of Breath	\$5.30
Sinusitis and Hay Fever	not monetized
Work Loss Days	\$83
Restricted Activity Days (RAD)	
Minor RAD	\$38
Respiratory RAD	not monetized
Worker Productivity	\$1 per worker per 10% change in ozone
Visibility: residential recreational	\$14 per unit decrease in deciview per household Range of \$7.30 to \$11 per unit decrease in deciview per household (see U.S. EPA, 1997a)
Household Soiling Damage	\$2.50 per household per µg/m ³

*See the Benefits TSD for citations (U.S. EPA, 1997a).

Appendix I provides a summarized description of the aggregation procedure used in this RIA. In general, four non-overlapping broad categories of health and welfare endpoints are included in the estimation of total dollar benefits in this analysis: (1) mortality, (2) hospital admissions, (3) respiratory symptoms/illnesses not requiring hospital admissions, and (4) welfare endpoints.

12.7.5 National Health Benefits Results

National health benefits estimates for PM and ozone are presented in Tables 12.4 through 12.10. Tables 12.4 and 12.5 present incidence and monetized results, respectively, for alternative PM_{2.5} standards. Tables 12.6 and 12.7 present benefits results for the selected PM₁₀ standard. Tables 12.8 and 12.9 present incidence and monetized results, respectively, for alternative ozone standards. These results represent partial attainment of each alternative. PM benefits estimates are presented incremental from partial attainment of the current ozone and PM NAAQS. Ozone benefits estimates are presented incremental from partial attainment of the current ozone NAAQS, for the high-end estimate, and incremental from partial attainment of the current ozone and new PM NAAQS for the low-end estimate. Benefits estimates associated with the current standards are presented in Appendix C.

All health effects models are evaluated using baseline 2010 air quality and post-control or post-rollback air quality. Results produced by the benefits model represent the reduction in the number of incidences given imposition of a particular PM or ozone NAAQS upon the 2010 air quality baseline. These results are then monetized using WTP estimates.

Table 12.4 PM: National Annual Health Incidence Reductions^a
 Estimates are incremental to the current ozone and PM NAAQS: (year = 2010)

ENDPOINT ^b	Annual PM _{2.5} (µg/m ³)	Partial Attainment Scenario		
		High-end Est.	Low- to High-end Est.	High-end Est.
	Daily PM _{2.5} (µg/m ³)	16	15	15
*1. Mortality ^c : short-term exposure long-term exposure		4,900 14,000	3,300 - 15,600	5,700 15,900
*2. Chronic Bronchitis		56,000	45,000 - 75,000	80,000
Hospital Admissions:				
*3. all respiratory (all ages)		5,100	3,600 - 5,700	6,000
all resp. (ages 65+)		6,400	4,800 - 8,000	8,600
pneumonia (ages 65+)		2,300	1,800 - 2,900	3,100
COPD (ages 65+)		2,000	1,200 - 2,400	2,600
*4. congestive heart failure		1,700	1,200 - 2,100	2,300
*5. ischemic heart disease		1,900	1,200 - 2,400	2,600
*6. Acute Bronchitis		17,700	12,000 - 20,000	21,000
*7. Lower Respiratory Symptoms		265,000	179,000 - 299,000	320,000
*8. Upper Respiratory Symptoms		45,000	36,000 - 60,000	65,000
shortness of breath		93,000	80,000 - 134,000	137,000
asthma attacks		349,000	235,000 - 392,000	416,000
*9. Work Loss Days		2,799,000	1,900,000 - 3,148,000	3,313,000
*10. Minor Restricted Activity Days (MRADs)		23,244,000	15,697,000 - 26,128,000	27,499,000

^a numbers may not completely agree due to rounding

^b only endpoints denoted with an * are aggregated into total benefits estimates

^c mortality estimates must be aggregated using either short-term exposure or long-term exposure but not both due to double-counting issues

Table 12.5 PM : National Annual Monetized Health Benefits^a
 Estimates are incremental to the current ozone (0.12 ppm, 1-hr.) and PM
 NAAQS (50 µg/m³ annual; 150 µg/m³ daily)
 (billions of 1990 \$, year = 2010)

ENDPOINT*	Annual PM _{2.5} (µg/m ³)	Partial Attainment Scenario High-end Est.		
		High-end Est.	Low- to High-end Est.	High-end Est.
		16	15	15
	Daily PM _{2.5} (µg/m ³)	65	65	50
*Mortality ^c : short-term exposure		\$23.4	\$1.8 - \$75.1	\$27.5
long-term exposure		\$67.0		\$76.3
*Chronic Bronchitis		\$14.6	\$11.7 - \$19.4	\$20.9
Hospital Admissions:				
*all respiratory (all ages)		\$0.064	\$0.042 - \$0.072	\$0.076
all resp. (ages 65+)		\$0.080	\$0.060 - \$0.100	\$0.108
pneumonia (ages 65+)		\$0.036	\$0.030 - \$0.046	\$0.049
COPD (ages 65+)		\$0.031	\$0.024 - \$0.038	\$0.041
*congestive heart failure		\$0.028	\$0.030 - \$0.035	\$0.038
*ischemic heart disease		\$0.039	\$0.030 - \$0.049	\$0.053
*Acute Bronchitis		\$0.001	\$0.001 - \$0.001	\$0.001
*Lower Respiratory Symptoms		\$0.003	\$0.002 - \$0.004	\$0.004
*Upper Respiratory Symptoms		\$0.001	\$0.001 - \$0.001	\$0.001
shortness of breath		\$0.000	\$0.000 - \$0.001	\$0.001
asthma attacks		\$0.011	\$0.008 - \$0.013	\$0.015
*Work Loss Days		\$0.232	\$0.156- \$0.261	\$0.275
*Minor Restricted Activity Days (MRADs)		\$0.892	\$0.600 - \$1.000	\$1.100
TOTAL MONETIZED BENEFITS				
using short-term PM mortality		\$39	\$14.5 - \$96.1	\$50
using long-term PM mortality		\$83		\$99

^a numbers may not completely agree due to rounding

^b only endpoints denoted with an * are aggregated into total benefits estimates

^c mortality estimates must be aggregated using either short-term exposure or long-term exposure but not both due to double-counting issues

**Table 12.6 Proposed PM₁₀ Standard (50/150 µg/m³) 99th Percentile
National Annual Health Incidence Reductions^a**

Estimates are incremental to the current ozone and PM NAAQS: (year = 2010)

ENDPOINT ^b	Annual PM _{2.5} (µg/m ³)	Partial Attainment Scenario
		50
	Daily PM _{2.5} (µg/m ³)	150
*1. Mortality^c: short-term exposure		360
long-term exposure		340
*2. Chronic Bronchitis		6,800
Hospital Admissions:		
*3. all respiratory (all ages)		190
all resp. (ages 65+)		470
pneumonia (ages 65+)		170
COPD (ages 65+)		140
*4. congestive heart failure		130
*5. ischemic heart disease		140
*6. Acute Bronchitis		1,100
*7. Lower Respiratory Symptoms		10,400
*8. Upper Respiratory Symptoms		5,300
shortness of breath		18,300
asthma attacks		8,800
*9. Work Loss Days		106,000
*10. Minor Restricted Activity Days (MRADs)		879,000

^a numbers may not completely agree due to rounding

^b only endpoints denoted with an * are aggregated into total benefits estimates

^c mortality estimates must be aggregated using either short-term exposure or long-term exposure but not both due to double-counting issues

Table 12.7 Proposed PM₁₀ Standard (50/150 µg/m³) 99th Percentile National Annual Monetized Health Benefits Incidence Reductions^a
 Estimates are incremental to the current ozone (0.12 ppm, 1-hr.)
 (billions of 1990 \$; year = 2010)

ENDPOINT ^b	Annual PM _{2.5} (µg/m ³)	Partial Attainment Scenario High-end Est.
		50
	Daily PM _{2.5} (µg/m ³)	150
*1. Mortality^c: short-term exposure		\$1.7
	long-term exposure	\$1.6
*2. Chronic Bronchitis		\$1.8
Hospital Admissions:		
*3. all respiratory (all ages)		\$0.002
all resp. (ages 65+)		\$0.006
pneumonia (ages 65+)		\$0.003
COPD (ages 65+)		\$0.002
*4. congestive heart failure		\$0.002
*5. ischemic heart disease		\$0.003
*6. Acute Bronchitis		\$0
*7. Lower Respiratory Symptoms		\$0
*8. Upper Respiratory Symptoms		\$0
shortness of breath		\$0
asthma attacks		\$0
*9. Work Loss Days		\$0.009
*10. Minor Restricted Activity Days (MRADs)		\$0.034
TOTAL MONETIZED BENEFITS		
using long term mortality		\$3.4
using short term mortality		\$3.5

^a numbers may not completely agree due to rounding

^b only endpoints denoted with an * are aggregated into total benefits estimates

^c mortality estimates must be aggregated using either short-term exposure or long-term exposure but not both due to double-counting issues

Table 12.8 Ozone : National Annual Health Incidence Reductions^a

Estimates are incremental to the current ozone NAAQS
(year = 2010)

ENDPOINT ^b	Partial Attainment Scenario		
	0.08 5th Max High-end Est.	0.08 4th Max Low- to High-end Est.	0.08 3rd Max High-end Est.
Ozone Health:			
*1. Mortality	80	0 - 80	120
Hospital Admissions			
*2. all respiratory (all ages)	280	300 - 300	420
all respiratory (ages 65+)	2,300	2,330 - 2,330	1,570
pneumonia (ages 65+)	860	870 - 870	600
COPD (ages 65+)	260	260 - 260	200
emer. dept. visits for asthma	120	130 - 130	180
*3. Acute Respiratory Symptoms (any of 19)	28,510	29,840 - 29,840	42,070
asthma attacks	60	60 - 60	90
MRADs	620	650 - 650	920
*4. Mortality from air toxics	1	1 - 1	2
Ancillary PM Health:			
*1. Mortality^c: short-term exp.	60	0 - 80	110
long-term exposure	180	0 - 250	340
*2. Chronic Bronchitis	400	0 - 530	690
Hospital Admissions:			
*3. all respiratory (all ages)	70	0 - 90	120
all resp. (ages 65+)	50	0 - 60	80
pneumonia (ages 65+)	20	0 - 20	30
COPD (ages 65+)	10	0 - 20	20
*4. congestive heart failure	10	0 - 20	20
*5. ischemic heart disease	10	0 - 20	20
*6. Acute Bronchitis	290	0 - 400	530
*7. Lower Respiratory Symptoms	3,510	0 - 4,670	6,190
*8. Upper Respiratory Symptoms	320	0 - 430	570
shortness of breath	800	0 - 1,220	1,660
asthma attacks	4,210	0 - 5,510	7,200
*9. Work Loss Days	38,700	0 - 50,440	66,160
*10. Minor Restricted Activity Days (MRADs)	322,460	0 - 420,300	551,300

^a numbers may not completely agree due to rounding

^b only endpoints denoted with an * are aggregated into total benefits estimates

^c PM mortality estimates must be aggregated using either short-term exposure or long-term exposure but not both due to double-counting issues

Table 12.9 Ozone : National Annual Monetized Health Benefits Estimates^a

Estimates are incremental to the current ozone NAAQS (0.12 ppm, 1-hour)
(billions of 1990 \$; year = 2010)

ENDPOINT ^b	Partial Attainment Scenario		
	0.08 5th Max High-end Est.	0.08 4th Max Low- to High-end Est.	0.08 3rd Max High-end Est.
Ozone Health:			
*1. Mortality	\$0.370	\$0.000 - \$0.380	\$0.570
Hospital Admissions			
*2. all respiratory (all ages)	\$0.004	\$0.004 - \$0.004	\$0.006
all resp. (ages 65+)	\$0.029	\$0.029 - \$0.029	\$0
pneumonia (ages 65+)	\$0.014	\$0.014 - \$0.014	\$0.010
COPD (ages 65+)	\$0.004	\$0.004 - \$0.004	\$0.003
emer. dept. visits for asthma	\$0.001	\$0.001 - \$0.001	\$0.002
*3. Acute Respiratory Symptoms (any of 19)	\$0.001	\$0.001 - \$0.001	\$0.001
asthma attacks	\$0	\$0 - \$0	\$0
MRADs	\$0	\$0 - \$0	\$0
*4. Mortality from air toxics	\$0.003	\$0.006 - \$0.006	\$0.011
Ancillary PM Health:			
*1. Mortality^c: short-term exp.	\$0.300	\$0 - \$0.400	\$0.520
long-term exposure	\$0.870	\$0 - \$1.210	\$1.640
*2. Chronic Bronchitis	\$0.110	\$0 - \$0.140	\$0.180
Hospital Admissions:			
*3. all respiratory (all ages)	\$0.001	\$0 - \$0.001	\$0.001
all resp. (ages 65+)	\$0.001	\$0 - \$0.001	\$0.001
pneumonia (ages 65+)	\$0	\$0 - \$0	\$0
COPD (ages 65+)	\$0	\$0 - \$0	\$0
*4. congestive heart failure	\$0	\$0 - \$0	\$0
*5. ischemic heart disease	\$0	\$0 - \$0	\$0
*6. Acute Bronchitis	\$0	\$0 - \$0	\$0
*7. Lower Respiratory Symptoms	\$0	\$0 - \$0	\$0
*8. Upper Respiratory Symptoms	\$0	\$0 - \$0	\$0
shortness of breath	\$0	\$0 - \$0	\$0
asthma attacks	\$0	\$0 - \$0	\$0
*9. Work Loss Days	\$0.003	\$0 - \$0.004	\$0.005
*10. Minor Restricted Activity Days (MRADs)	\$0.012	\$0 - \$0.016	\$0.020
TOTAL MONETIZED BENEFITS			
using short-term PM mortality	\$0.790	\$0.056	\$1.300
using long-term PM mortality	\$1.400	\$1.785	\$2.400

^a numbers may not completely agree due to rounding

^b only endpoints denoted with an * are aggregated into total benefits estimates

^c PM mortality estimates must be aggregated using either short-term exposure or long-term exposure but not both due to double-counting issues

Table 12.10 RH : National Annual Monetized Health Benefits*
Estimates are incremental to the selected PM and ozone standards
(billions of 1990 \$, year = 2010)

ENDPOINT*	1.0 deciview improvement in 15 years (0.67 deciview target)		1.0 deciview improvement in 10 years (1.0 deciview target)	
	Incidence Reductions Low- to High-end Est.	Monetized Benefits Low- to High-end Est.	Incidence Reductions Low- High-end Est.	Monetized Benefits Low- to High-end Est.
*Mortality ^a	120 - 200	\$0.060-\$0.950	360 - 600	\$0.130 - \$2.900
*Chronic Bronchitis	2,600 - 4,400	\$660 - \$1,100	3,500 - 5,900	\$0.900 - \$1.500
Hospital Admissions:				
*all respiratory (all ages)	140 - 230	\$0.002 - \$0.003	250 - 420	\$0.003 - \$0.005
all resp. (ages 65+)	290 - 490	\$0.004 - \$0.006	420 - 700	\$0.005 - \$0.009
pneumonia (ages 65+)	110 - 180	\$0.002 - \$0.003	150 - 250	\$0.002 - \$0.004
COPD (ages 65+)	90 - 150	\$0.001 - \$0.002	130 - 220	\$0.002 - \$0.003
*congestive heart failure	80 - 130	\$0.001 - \$0.002	110 - 190	\$0.002 - \$0.003
*ischemic heart disease	80 - 140	\$0.002 - 0.003	130 - 210	\$0.002 - \$0.004
*Acute Bronchitis	310 - 510	\$0 - \$0	530 - 880	\$0 - \$0
*Lower Respiratory Symptoms	7,800 - 13,000	\$0.000 - \$0.000	14,000 - 23,000	\$0.000 - \$0.000
*Upper Respiratory Symptoms	2,400 - 4,000	\$0.000 - \$0.000	3,100 - 5,200	\$0.000 - \$0.000
shortness of breath	1,600 - 2,700	\$0.000 - \$0.000	4,000 - 6,600	\$0.000 - \$0.000
asthma attacks	11,000 - 17,800	\$0.001 - \$0.001	20,000 - 33,000	\$0.001 - \$0.001
*Work Loss Days	74,000 - 124,000	\$0.006 - \$0.010	140,000 - 230,000	\$0.011 - \$0.019
*Minor Restricted Activity Days (MRADs)	620,000 - 1,032,000	\$0.024 - \$0.040	1,150,000 - 1,912,400	\$0.044 - \$0.073
TOTAL MONETIZED BENEFITS	N/A	\$0.760 - \$2.100	N/A	\$1.100 - \$4.500

^a numbers may not completely agree due to rounding

^b only endpoints denoted with a * are aggregated into total benefits estimates

^c mortality estimates must be aggregated using either short-term exposure or long-term exposure but not both due to double-counting issues

Tables 12.4 and 12.5 present national annual health incidence reductions and the associated monetized benefits associated with partial attainment of the alternative PM_{2.5} standards. Based on these results, partial attainment of the selected PM_{2.5} would result in decreasing premature mortality within the range of 3,300 to 16,000 cases (depending on whether short-term exposure or long-term exposure mortality is included and on whether a threshold at 15 µg/m³ or effects down to background are assumed). The selected standard would also be expected to reduce the development of chronic bronchitis by approximately 45,000 to 75,000 cases and hospital admissions for all respiratory illnesses by approximately 3,600 to 6,000 cases. Total annual monetized health benefits estimates associated with the selected standard are expected to be approximately \$ 14.5 billion when the estimate is based on the low-end assumptions and \$96 billion when the estimate is based on the high-end assumptions. These estimates are incremental to partial attainment of the current PM and ozone NAAQS. Incremental from the current standard in the year 2010, population estimates associated with people living in predicted PM_{2.5} nonattainment counties are approximately: 23.6 million for the 16/65 standard; 45.5 million for the 15/65 standard; 52.0 million for the 15/50 standard.

Tables 12.6 and 12.7 present benefits results associated with the selected PM₁₀ standard. Based on these results, partial attainment of the selected PM₁₀ standard is expected to decrease premature mortality by approximately 350 cases, hospital admissions for all respiratory illness by approximately 200 cases and chronic bronchitis cases by approximately 7,000 cases. Total annual monetized health estimates associated with the selected standard are expected to be approximately \$3.4 billion to \$3.5 billion.

Tables 12.8 and 12.9 present national annual health incidence reductions and the associated monetized benefits associated with partial attainment of the alternative ozone standards. Note that ozone benefits include ancillary PM benefits for the high end estimate. Based on these results, partial attainment of the selected ozone standard is expected to decrease premature mortality by approximately 160-330 cases, hospital admissions due to all respiratory illnesses by approximately 300, and acute respiratory symptoms by approximately 30,000 cases. Total annual monetized benefits associated with the selected standard are expected to be approximately \$0.1 billion for the low-end estimate and \$2.1 billion for the high-end estimate. Incremental from the current standard in the year 2010, population estimates associated with people living in predicted ozone nonattainment areas are approximately: 30.6 mil-

lion people for the 0.08 5th max., 40.2 million people for the 0.08 4th max., and 62.2 million people for the 0.08 3rd max. standard.

Table 12.10 presents national annual health incidence reductions and monetized benefits estimates associated with the RH targets. Health benefits can be estimated for a RH target because the control strategies (described in chapter 8) implemented to reduce RH also reduce particulate concentrations. This commonality between the control strategies for the two different programs allows the benefits analysis to estimate health as well as visibility benefits attributable to the RH target. The RH benefits estimates are calculated incremental from partial attainment of both the selected PM and selected ozone standards. The method for estimating visibility changes is presented in chapter 8. As explained in chapter 8, the analytical baseline understates the visibility progress achieved by CAA-mandated controls and implementation of a new ozone standard over the period 2000 to 2010. Additionally, the RH benefits are affected by the inability to model full attainment of the selected PM_{2.5} standard as well as the degree to which some Class I area counties reach background air quality conditions. Given this analytical baseline, benefits are calculated using air quality changes incremental from partial attainment of the selected PM_{2.5} standard. Under a visibility target of 0.67 equivalent to a 1 deciview improvement in the haziest days over 15 years, premature mortality is expected to decrease by approximately 120–200 cases; the development of chronic bronchitis cases is expected to be reduced by 2,600–4,400 cases; and hospital admissions for all respiratory illnesses is expected to decrease by 140–230 cases. Total annual monetized health benefits estimates associated with the 0.67 visibility target is expected to be as much as \$0.8 to \$2.1 billion. Under a visibility target of 1.0 equivalent to a 1 deciview improvement in the haziest days over 10 years, premature mortality is expected to decrease by approximately 360–600 cases; the development of chronic bronchitis cases is expected to be reduced by 3,500–5,900 cases; and hospital admissions for all respiratory illnesses is expected to decrease by 250–420 cases. Total annual monetized health benefits estimates associated with the 1.0 deciview visibility target is estimated to be as much as \$1.1–4.5 billion.

The monetized health benefits estimates presented in this section are likely to be underestimates of the total health benefits associated with these standards due to a number of data and modeling limitations. See section 12.10 for a discussion of these limitations.

12.8 WELFARE: EFFECTS

12.8.1 Introduction

The term “welfare benefits” encompasses all benefits categories other than human health effects. This section presents the welfare benefits methodology and results associated with reductions in ambient PM and ozone. These results include the economic benefits associated with reductions in the yield of some ozone-sensitive important commercial crops and forests and reduction of nitrogen deposition in estuarine and coastal waters for alternative standards. Adequate data are currently available to assess economic benefits for the commodity crops studied in the National Crop Loss Assessment Network (NCLAN) project (discussed in section VII-D.2 of the U.S. EPA Staff Paper for Ozone, June 1996) and for fruits and vegetables grown in California. Data are also available to estimate potential reductions in yield of some important ozone-sensitive commercial forest species nationwide, and to calculate nitrogen deposition avoided in estuaries, visibility improvements, consumer cleaning cost savings, and enhanced worker productivity.

12.8.2 Welfare Benefits Methodology

A number of models are used to estimate the welfare benefits presented in this analysis. This section briefly describes the welfare benefits categories and the methods employed to estimate the economic benefits associated with them.

12.8.2.1 Commodity Crops

The economic value associated with varying levels of yield loss for ozone-sensitive commodity crops is analyzed using a revised and updated (Mathtech, 1994; Mathtech, 1995; EPA 1997a) Regional Model Farm (RMF) agricultural benefits model. The RMF is an agricultural benefits model for commodity crops that account for about 75 percent of all U.S. sales of agricultural crops (Mathtech, 1994). The results of the model are extrapolated to account for all commodity crops nationwide. A rough approximation of a national estimate can be calculated by proportionally scaling the monetized estimates to the entire market. It is recognized, however, that factors such as the sensitivity to ozone of crops not formally analyzed, regional air quality, and regional economics introduce considerable uncertainty to any approach that develops a national estimate. The RMF explicitly incorporates exposure-re-

sponse functions into microeconomic models of agricultural producer behavior. The model uses the theory of applied welfare economics to value changes in ambient ozone concentrations brought about by particular policy actions such as attaining ambient air quality standards.

The measure of benefits calculated by the model is the net change in consumers' and producers' surplus from baseline ozone concentrations to the ozone concentrations resulting from attainment of alternative standards. Using the baseline and post-control equilibriums, the model calculates the change in net consumers' and producers' surplus on a crop-by-crop basis. Dollar values are aggregated across crops for each standard. The total dollar value represents a measure of the change in social welfare associated with the policy scenario. Although the model calculates benefits under three alternative welfare measures (perfect competition, price supports, and modified agricultural policy), results presented here are based on the "perfect competition" measure to reflect recent changes in agricultural subsidy programs. Under the recently revised 1996 Farm Act, most eligible farmers have enrolled in the program to phase out government crop price supports for the RMF-relevant crops: wheat, corn, sorghum, and cotton.

For the purpose of this analysis, the six most economically significant crops are analyzed: corn, cotton, peanuts, sorghum, soybean, and winter wheat. The model employs biological exposure-response information derived from controlled experiments conducted by the National Crop Loss Assessment Network (NCLAN) (Lee et al., 1996). Four main areas of the RMF have been updated to reflect the 1996 Farm Act and USDA data projections to 2005 (the year farthest into the future for which projections are available). These four areas are: yield per acre, acres harvested, production costs, and model farms. Documentation outlining the 2005 update is provided in U. S. EPA, 1997a.

The benefits from the RMF commodity crops range from for partial attainment of the .08 ppm, 4th max. standard are \$11 million. See Table 12.15.

12.8.2.2 Fruit and Vegetable Crops

There are currently no national-level economic models that incorporate fruits and vegetables, although more comprehensive modeling efforts are underway. A regional model, the California Agricultural Resources Model (CARM), has been developed and used by the California Air Resources Board. This model is used in this analysis to calculate the benefits of reducing ambient ozone on sensitive crops grown in California (Abt, 1995a). Among these sensitive crops are the economically important fruits and vegetables endemic to California and other states with similar climate, such as Florida and Texas. The crops included in the CARM analysis are: almonds, apricots, avocados, cantaloupes, broccoli, citrus, grapes, plums, tomatoes, and dry beans. In 1990, California crops accounted for almost 50 percent of the U.S. fruit and vegetable production. Results of the model are extrapolated to include 100 percent of the crops. The results of the model are extrapolated to account for fruits and vegetables grown nationwide. A rough approximation of a national estimate can be calculated by proportionally scaling the monetized estimates to the entire market. It is recognized, however, that factors such as the sensitivity to ozone of crops not formally analyzed, regional air quality, and regional economics introduce considerable uncertainty to any approach that develops a national estimate.

The California Air Resources Model (CARM) is a nonlinear optimization model of California agricultural practices which assumes that producers maximize farm profit subject to land, water, and other agronomic constraints. The model maximizes total economic surplus and predicts producers' shifts in acreage planted to different crops due to changing market conditions or resources. The version of the CARM used for this analysis is calibrated to 1990 production and price data. Similar to RMF, the CARM production and price data will be updated using USDA projections to 2005 (Abt, 1997). Although this update is not completed yet, the CARM results have been extrapolated to reflect estimates for the year 2005.

The benefits from the CARM fruits and vegetables for partial attainment of the .08 ppm, 4th max. standard are \$23 million. See Table 12.15.

12.8.2.3 Commercial Forests

Any attempt to estimate economic benefits for commercial forests associated with attaining alternative ozone standards is constrained by a lack of exposure-response functions for the commercially important mature trees. Although exposure-response functions have been developed for seedlings for a number of important tree species, these seedling functions cannot be extrapolated to mature trees based on current knowledge. Recognizing this limitation, a study (Pye, 1988 and deSteiger & Pye, 1990) involving expert judgment about the effect of ozone levels on percent growth

change is used to develop estimates of ozone-related economic losses for commercial forest products.

An analysis by Mathtech in conjunction with the USDA Forest Service (Mathtech, 1997) of forestry sector benefits describes quantitatively the effect of ozone on tree growth and the demand and supply characteristics of the timber market. The analysis employs baseline and post control ozone data equivalent to, and consistent with, the data used for the RMF and CARM models. The estimates do not include possible non-market benefits such as aesthetic effects. Forest aesthetics is discussed qualitatively later in this chapter.

The economic value of yield changes for commercial forests was estimated using the 1993 timber assessment market model (TAMM). TAMM is a U.S. Forest Service (Adams and Haynes, 1996) spatial model of the solidwood and timber inventory elements of the U.S. forest products sector. The model provides projections of timber markets by geographic region and wood type through the year 2040. Nine regions covering the continental U.S. are included in the analysis. While the Pye et al. and deSteiger, Pye et al. studies present estimates of O₃ damage to forest growth rates for a variety of wood types by region, they present no damage estimates for western hardwoods. As a result, the forestry sector benefit estimates exclude the potential benefits of improved growth rates for western hardwoods. However, hardwoods account for only about 11 percent of total western growing stocks. TAMM simulates the effects of reduced O₃ concentrations on timber markets by changing the annual growth rates of commercial forest growing-stock inventories. The model uses applied welfare economics to value changes in ambient O₃ concentrations. Specifically, TAMM calculates benefits as the net change in consumer and producer surplus from baseline O₃ concentrations to the O₃ concentrations resulting from full or partial attainment of alternative standards.

Table 12.11 presents estimates of the annual benefits to the commercial forestry sector for two ozone scenarios incremental to the current ozone standard: the 0.08 ppm, 3rd max partial attainment and full attainment. These benefits are estimates of the annual payments that society would be willing to pay over the period 2010 through 2040 for higher growth rates in commercial forests.

Because of the long harvesting cycle of commercial forests and the cumulative effects of higher growth rates, the benefits to the future economy will be much larger than the estimates reported in Table 12.11. For example, the .08 ppm 3rd max standard under the full attainment scenario would generate about \$370 million in undiscounted economic surplus to the U.S. economy during the year 2040 and result in about \$3.69 billion additional forest inventories by 2040. The estimated annualized benefits for this scenario, \$65 million, are much lower because of smaller benefits in earlier years (i.e., the 2010 and 2020 decades) and because the higher benefits realized in later years are heavily discounted. Also, the estimates presented in Table 12.11 are slightly conservative based on the interpretation of the Pye 1988 report versus the deSteiger and Pye 1990 article. Another reason for describing the estimates as conservative is the uncertainty that exists about the relationship between carbon assimilation and how assimilated products affect overall tree growth. A complicating factor is the tree aging process, since "the relative amount of photosynthetic to non-photosynthetic tissue changes with age" (Fox, 1995).

**Table 12.11 Ozone: Estimated Annual Commercial Forestry Benefits
Incremental to the Current Ozone Standard**
(millions of 1990 dollars in 2010)

Scenario	Annual Benefits
8-hr, 3rd max, partial attainment	\$14
8-hr, 3rd max, full attainment	\$65

12.8.2.4 Nitrogen Denosition in Estuarine and Coastal Waters

The December 1996 RIA did not estimate the benefits of reducing the amount of air-borne nitrogen which is entering our nation's estuaries. Excessive amounts of nitrogen entering our estuaries are linked with the outbreak of large algal blooms.

The resulting large fish kills cause a decaying, odoriferous situation which can shut down local tourism. Partially in response to public comments which asked for some proof of the assumed size of these unquantified benefit categories, scientists from EPA and NOAA have developed a methodology to measure the potential benefits from the reduction of atmospheric nitrogen in the estuaries of the East Coast of the United States accrued from implementation of the PM and ozone NAAQS (US EPA, 1997c).

The benefits to surrounding communities of reduced nitrogen loadings resulting from various control strategies for atmospheric NO_x emissions were calculated for 12 East and Gulf Coast estuaries, and extrapolated to all 43 Eastern U.S. estuaries. See Table 12.12. The 12 Eastern estuaries represent approximately half of the estuarine watershed area in square miles along the East coast. Benefits are estimated using an average, locally-based cost for nitrogen removal from water pollution (US EPA, 1997c). The benefits to the 12 estuaries are estimated at \$ 112 million for partial attainment of the .08 ppm, 4th max. standard. The benefits for the Eastern U.S. are estimated at \$193 million for partial attainment of the .08 ppm, 4th max standard. Total Eastern U.S. projections are made by scaling results based on watershed area and annualized benefits computed over the period 2010 through 2040, discounted at a 7 percent annual rate NOAA surveys of nitrogen loadings. These benefits are probably below the actual benefits because they do not include: improved recreation, wildlife habitat, commercial fishing, and other public health benefits.

12.8.2.5 Visibility

Visibility effects are measured in terms of changes in deciview, a measure useful for comparing the effects of air quality on visibility across a range of geographic locations. This measure is directly related to two other common visibility measures: visual range (measured in km) and light extinction (measured in km). The deciview measure characterizes visibility in terms of perceptible changes in haziness independent of baseline conditions. The visibility improvement is modeled on a county-specific basis. Based on the deciview measure, two types of valuation estimates are applied to the expected visibility changes: residential visibility and recreational visibility.

Table 12.12: Benefits To Estuaries From Reduced Nitrogen Deposition Due To Alternative PM2.5 and 8Hr Ozone NAAQS*

ESTUARY	PM2.5 15/50		0.08 / 4th max		0.08 / 5th max	
	Reductions in Air N Load	Value (\$ million)	Reductions in Air N Load (thous. kg/yr)	Value (\$ million)	Reductions in Air N Load (thous. kg/yr)	Value (\$ million)
Albemarle/Pamlico Sound	240	18	120	9	80	6
Cape Cod Bay	100	14	40	6	40	6
Chesapeake Bay	1,220	60	480	23	390	19
Delaware Bay	190	26	120	17	110	15
Delaware Inland Bays	10	1	0	0	0	0
Gardiners Bay	0	0	0	0	0	0
Hudson River/Raritan Bay	180	25	140	19	120	17
Long Island Sound	180	42	130	30	110	26
Massachusetts Bay	80	11	40	6	40	6
Narragansett Bay	10	1	10	1	0	0
Sarasota Bay	10	1	0	0	0	0
Tampa Bay	0	0	10	2	10	2
TOTAL for the above 12	2,220	200	1,009	112	900	96
TOTAL for Eastern US	3,820	344	1,880	193	1,548	165

* Reductions and valuation incremental to current ozone and PM NAAQS and target the year 2010; ranges reflect partial attainment of alternative standards. Benefits valued at the average cost today of removing nitrogen from point- and non-point- water pollution controls. Numbers may not add up exactly due to rounding. Total Eastern US projections made by scaling results for the listed estuaries based on watershed area and NOAA surveys of nitrogen loadings.

The residential visibility valuation estimate is derived from the results of an extensive visibility study (McClelland et al., 1991). A household WTP value is derived by dividing the value reported in McClelland et al. by the corresponding hypothesized change in deciview, yielding an estimate of \$14 per unit change in deciview. This WTP value is applied to all households in any county estimated to experience a change in visibility.

Recreational visibility refers to visibility conditions in national parks (referred to as Class I areas). Chestnut (Chestnut, 1997a) has developed a methodology for estimating the value to the U.S. public of visibility improvements in Class I areas. Based on contingent valuation studies, Chestnut calculates a household WTP for visibility improvements, capturing both use and non-use recreational values, and attempts to account for geographic variations in WTP.

Chestnut divides the recreational areas of the U.S. into three regions: California, Southwest, and Southeast. The regions are developed to capture differences in

household WTP values based on proximity to recreational areas. That is, in-region respondents typically place higher value on visibility improvements at a local recreational area than out-of-region respondents. Chestnut reports both in-region WTP and out-of-region WTP for each of the three regions. Chestnut concludes that, for a given region, a substantial proportion of the WTP is attributable to one specific park within the region. This so called "indicator park" is the most well-known and frequently visited park within a particular region. The indicator parks for the three regions are Yosemite for California, the Grand Canyon for the Southwest, and Shenandoah for the Southeast. In accordance with the Chestnut methodology, this analysis calculates out-of-region and in-region benefits for a particular regions for a given change in Class I areas visibility.

In theory, summing benefits out-of-region and benefits in-region would yield the total monetary benefits associated with a given visibility improvement in a particular recreational region, which could then be summed across regions to estimate national benefits. However, as described earlier, this analysis also estimates benefits associated with residential visibility improvements. To reflect the uncertainties raised by the use of CV methodology, the low-end estimate does not include visibility improvements in non-indicator parks.

12.8.2.6 Consumer Cleaning Cost Savings

Welfare benefits also accrue from avoided air pollution damage, both aesthetic and structural, to architectural materials and to culturally important articles. At this time, data limitations preclude the ability to quantify benefits for all materials whose deterioration may be promoted and accelerated by air pollution exposure. However, this analysis addresses one small effect in this category, the soiling of households by particulate matter. Table I. 1 documents the function used to associate nationwide PM levels with household WTP to avoid the cleaning costs incurred for each additional $\mu\text{g}/\text{m}^3$ of PM.

Assumptions regarding the air quality indicator are necessary to evaluate the concentration-response function. For each alternative scenario, the function for household soiling damage, originally derived using total suspended particulates (TSP) as an indicator of PM, is evaluated using the indicator under consideration for that scenario. PM_{10} and $\text{PM}_{2.5}$ are both components of TSP. However, it is not clear which components of TSP cause household soiling damage. The Criteria Document cites some evidence that smaller particles may be primarily responsible, in which case these estimates are conservative.

12.8.2.7 Worker Productivity

Crocker and Horst (1981) and U.S. EPA present evidence regarding the inverse relationship between ozone exposure and productivity in exposed citrus workers. This analysis applies the worker productivity relationship (reported as income elasticity with respect to ozone) to workers engaged in strenuous outdoor labor in the U.S. (approximately one percent of the population). Baseline income for these workers is reported as \$73 per day. Table I.2 in Appendix I details the concentration response function.

12.8.3 National Welfare Benefits Results

Table 12.13 presents the welfare benefits associated with partial attainment of the alternative $\text{PM}_{2.5}$ standards. PM welfare benefits categories that are monetized in this analysis include: consumer cleaning cost savings, improved visibility and decreased nitrogen deposition. Based on the results presented in Table 12.13, total welfare benefits associated with the selected $\text{PM}_{2.5}$ standard range from \$4.3 to \$8.1 billion annually. These results are incremental to partial attainment of the current ozone and PM NAAQS.

Table 12.14 presents national annual welfare benefits estimates associated with the selected PM_{10} standard. Total annual monetized welfare benefits are estimated to be approximately \$5 billion.

The welfare benefits associated with partial attainment of the alternative ozone standards are presented in Table 12.15: Monetized ozone welfare benefits categories include increased yields of commodity crops and fruits and vegetables, increased yields in commercial forests, decreased nitrogen deposition, improved visibility, consumer cleaning cost savings, and increased worker productivity. Based on the results presented in Table 12.15, total welfare benefits associated with the selected ozone standard are expected to be approximately \$320 million annually. These results are incremental to partial attainment of the current ozone NAAQS.

Table 12.13 PM : National Annual Monetized Welfare Benefits^a
 Estimates are incremental to the current ozone (0.12 ppm, 1-hr.) and PM
 NAAQS (50 $\mu\text{g}/\text{m}^3$ annual; 150 $\mu\text{g}/\text{m}^3$ daily)
 (billions of 1990 \$; year = 2010)

CATEGORY		Partial Attainment Scenario		
		High-end Est.	Low- to High-End Est.	High-end Est.
	Annual $\text{PM}_{2.5}$ ($\mu\text{g}/\text{m}^3$)	16	15	15
	Daily $\text{PM}_{2.5}$ ($\mu\text{g}/\text{m}^3$)	65	65	50
Consumer Cleaning Cost Savings		\$0.29	\$0.37	\$0.40
Visibility		\$7.30	\$3.96 - \$7.80	\$8.40
Nitrogen Deposition		N/E	N/E	\$0.34
TOTAL MONETIZED BENEFITS		\$7.54	\$4.26 - \$8.10	\$9.10

N/E = not estimated

**Table 12.14 PM : Proposed PM_{10} Standard (50/150 $\mu\text{g}/\text{m}^3$) 99th Percentile
 National Annual Monetized Welfare Benefits^b**
 Estimates are incremental to the current ozone (0.12 ppm, 1-hr.)
 (billions of 1990 \$; year = 2010)

CATEGORY		Partial Attainment Scenario High-end Estimate
	Annual $\text{PM}_{2.5}$ ($\mu\text{g}/\text{m}^3$)	50
	Daily $\text{PM}_{2.5}$ ($\mu\text{g}/\text{m}^3$)	150
Consumer Cleaning Cost Savings		\$0.034
Visibility		\$1.62
TOTAL MONETIZED BENEFITS		\$1.6

^a numbers may not completely agree due to rounding

^b numbers may not completely agree due to rounding

Table 12.15 Ozone : National Annual Welfare Benefits Estimates*
 Estimates are incremental to the current ozone NAAQS (0.12 ppm, 1-hour)
 (billions of 1990 \$, year = 2010)

CATEGORY	Partial Attainment Scenario		
	0.08 5th max	0.08 4th max	0.08 3rd max
Commodity Crops	\$0.000	\$0.011	\$0.029
Fruits and Vegetables Crops	\$0.015	\$0.023	\$0.023
Commercial Forests	N/E	N/E	\$0.014
Nitrogen Deposition in Estuarine and Coastal Waters	\$0.165	\$0.193	\$0.301
Consumer Cleaning Cost Savings	\$0.002	\$0.003	\$0.004
Visibility	\$0.056	\$0.082	\$0.102
Worker Productivity	\$0.009	\$0.009	\$0.014
TOTAL MONETIZED BENEFITS	\$0.250	\$0.320	\$0.490

N/E = not estimated

Table 12.16 presents national annual welfare benefits associated with the regional haze targets. These estimates are calculated incremental from partial attainment of both the PM and ozone selected standards. Monetized welfare benefits associated with reducing RH include consumer cleaning cost savings and improved visibility. The method for estimating visibility changes is presented in chapter 8. The same low-end and high-end assumptions are used in the visibility calculations as are used in the ozone and PM NAAQS benefits analyses. As explained in chapter 8, the analytical baseline understates the visibility progress achieved by CAA mandated controls and implementation of a new ozone standard over the period 2000 to 2010. Additionally, the baseline visibility target may be understated due to the inability to model full attainment of the selected PM_{2.5}. Given this analytical baseline, benefits are calculated using air quality changes incremental from partial attainment of the selected PM_{2.5} standard. Under a visibility target of 0.67 equivalent to a 1 deciview improvement in the haziest days over 1 S years, economic benefits associated with consumer cleaning cost savings is estimated as \$23 million; increased residential visibility is estimated to yield approximately \$ 140 million; and increased visibility in Class I areas is estimated to yield approximately \$340–850 million annually. Based on these results, total annual welfare benefits associated with the 0.67 deciview visibility target range from approximately \$0.5 to \$1 billion. Under a visibility target of 1.0 equivalent to a 1 deciview improvement in the haziest days over 10 years, economic benefits associated with consumer cleaning cost savings is estimated as \$31 million; increased residential visibility is estimated to yield approximately \$200 million; and increased visibility in Class I areas is estimated to yield approximately \$370–920 million annually. Based on these results, total annual welfare benefits associated with the 1.0 deciview visibility target range from approximately \$0.6 to \$1.2 billion.

Table 12.16 RH : National Annual Monetized Welfare Benefits

Estimates are incremental to the selected ozone and PM NAAQS
(billions of 1990 \$; year = 2010)

CATEGORY	1.0 Deciview Improvement Over 15 Year (0.67 Deciview Target)	1.0 Deciview Improvement Over 10 Years (1.0 Deciview Target)
Consumer Cleaning Cost Savings	\$0.023	\$0.031
Visibility	\$0.480 - \$0.990	\$0.57 - \$1.13
TOTAL MONETIZED WELFARE BENEFITS	\$0.50 - \$1.01	\$0.60 - \$1.16

12.9 Summary of Health and Welfare Benefits

The purpose of this section is to summarize the health and welfare benefits discussions presented earlier in this chapter. Annual monetized benefits have been presented separately for health and welfare effects. It is now possible to sum these health and welfare benefits to provide a more complete depiction of the total benefits expected to result from the various alternative standards examined in this RIA. The national monetized health and welfare benefits associated with PM, ozone and RH are presented in Tables 12.17 through 12.20.

The monetized benefit results presented in this benefits chapter cover a plausible range of estimates, from a high end to a low end, reflecting some of the uncertainties in this estimation. A Monte Carlo uncertainty analysis of the monetized benefits of attaining the PM_{2.5} 15/65 standard, the PM₁₀ 50/150 standard (99th percentile), and the ozone .08, 4th max. standard are presented in Benefits TSD (USEPA 1997a).

The reduction of ambient ozone concentrations is achieved through the control of precursor emissions. These precursor emissions consist of volatile organic compounds (VOCs) and nitrogen oxides (NO_x). The cost analysis shows that many control measures employed in the a numbers may not completely agree due to rounding ozone analysis are successful at removing both types of precursor emissions. In addition to contributing to ozone formation, VOC and NO_x react with other air-borne pollutants to form particulates. The PM air quality model, consolidated regional deposition model (CRDM), is used to estimate a quantifiable relationship between the ozone precursor emissions and ambient PM concentrations (i.e., the source-receptor relationship). An analysis of the ozone-related VOC and NO_x emission reductions shows that particulate concentrations as estimated by the source-receptor matrix will decrease as a result of implementation of the ozone controls. These PM reductions are used to estimate ancillary PM benefits attributable to ozone control measures. The PM reductions attributable to implementation of the ozone control measures are then used in conjunction with all PM-related concentration-response functions to estimate total ancillary PM benefits. For example, all PM benefits categories listed as quantifiable in Table 12.1 are also applicable in the ozone benefits analysis because reductions of ozone precursor emissions will also reduce particulate concentrations.

The inclusion of ancillary PM benefits in the estimation of ozone benefits raises the issue of possible overlap between PM and ozone benefits estimation when using when using single-pollutant and co-pollutant models. A discussion of a possible overlap between PM and ozone mortality effects is presented here since mortality is the single largest contributor to total benefits for both PM and ozone reductions.

The PM-mortality relationship is currently more well established than the ozone-mortality relationship, and the magnitude of the PM effect on mortality appears to be significantly larger than that of ozone. To avoid falsely attributing the PM effects on mortality to ozone, therefore, inclusion of PM in the model was a criterion for inclusion of a study in the analysis of ozone and mortality. Most ozone-mortality studies met this criterion. It might be argued that the inclusion criteria for PM-mortality studies should mirror those of ozone-mortality studies, and that PM-mortality studies that did not include ozone in the concentration-response model should be excluded. The situation with PM-mortality studies, however, is not symmetrical to that of ozone-mortality studies. Because evidence of a significant association between ozone and premature mortality is quite recent, most PM-mortality studies have not included ozone in the concentration-response model. Excluding PM-mortality studies that did not include ozone would therefore substantially reduce the

database on the relationship between PM and mortality. Because it appears that the magnitude of the ozone effect on mortality is substantially smaller than that of the PM effect, and because PM and ozone are generally not highly correlated, the omission of ozone from a concentration-response model is likely to have only a very small effect on the estimated PM coefficient. Any potential double counting of benefits from adding the PM-related benefits estimated from models without ozone to the ozone-related benefits is therefore also likely to be quite small. Avoiding that small amount of possible double counting does not seem worth the substantial loss of information on the PM-mortality relationship that would result from restricting the analysis to only those studies with both PM and ozone in the model.

As shown in Table 12.17, total annual monetized health and welfare benefits associated with partial attainment of the selected PM_{2.5} standard range from a high-end estimate of \$104 billion to a low-end estimate of \$19 billion. Table 12.18 shows that the high-end estimate of total annual monetized health and welfare benefits associated with partial attainment of the selected PM₁₀ standard range from \$5.1 to \$5.2 billion. Table 12.19 shows that total annual monetized health and welfare benefits associated with partial attainment of the selected ozone standard range from a high-end estimate of \$2.1 billion to a low-end estimate of \$0.4 billion. Table 12.20 presents total annual health and welfare benefits of alternative regional haze targets.

Table 12.17 PM: Summary of National Annual Monetized Health and Welfare Benefits^a
 Estimates are incremental to the current ozone and PM NAAQS
 (billions of 1990 \$; year = 2010)

Category ^b	Annual PM _{2.5} (µg/m ³)	Partial Attainment Scenario		
		High-end Est.	Low- to High-end Est.	High-end Est.
		16	15	15
	Daily PM _{2.5} (µg/m ³)	65	65	50
Health Benefits		\$83	\$15 to \$96	\$99
Welfare Benefits		\$7.5	\$4.3 to \$8.1	\$9
TOTAL MONETIZED BENEFITS		\$90	\$19 to \$104	\$107

Table 12.18 PM: Selected PM₁₀ Standard (50/150 µg/m³-- 99th percentile) Summary of National Annual Monetized Health and Welfare Benefits^a
 Estimates are incremental to the current ozone and PM NAAQS
 (billions of 1990 \$; year = 2010)

Category	Annual PM ₁₀ (µg/m ³)	Partial Attainment Scenario High-end Est.
		50
		Daily PM ₁₀ (µg/m ³)
Health Benefits		\$3.4 to \$3.5
Welfare Benefits		\$1.6
TOTAL MONETIZED BENEFITS		\$5.1 to \$5.2

^a numbers may not completely agree due to rounding

Table 12.19 Ozone: Summary of National Annual Monetized Health and Welfare Benefits^a

Estimates are incremental to the current ozone and PM NAAQS
(billions of 1990 \$; year = 2010)

Category	Partial Attainment Scenario		
	0.08 5th max High-end Est.	0.08 4th max Low- to High-end Est.	0.08 3rd max High-end Est.
Health Benefits	\$1.4	\$0.06 to \$1.76	\$2.4
Welfare Benefits	\$0.25	\$0.32 to \$0.32	\$0.5
TOTAL MONETIZED BENEFITS	\$1.6	\$0.4 to \$2.1	\$2.9

Table 12.20 RH: Summary of National Annual Monetized Health and Welfare Benefits^a

Estimates are incremental to the selected ozone and PM NAAQS
(billions of 1990 \$; year = 2010)

Category	1.0 Deciview Goal Over 15 Years (0.67 Deciview Target)		1.0 Deciview Goal Over 10 Years (1.0 Deciview Target)	
	Low-end Est.	High-end Est.	Low-end Est.	High-end Est.
Health Benefits	\$0.8	\$2.1	\$1.1	\$4.5
Welfare Benefits	\$0.5	\$1.0	\$0.6	\$1.2
TOTAL MONETIZED BENEFITS	\$1.3	\$3.2	\$1.7	\$5.7

For a visibility target of 0.67 deciview (i.e., 1.0 deciview goal over 15 years), total annual monetized benefits are expected to range from \$1.3 billion to \$3.2 billion. For a visibility target of 1.0 deciview (i.e., 1.0 deciview goal over 10 years), total annual monetized benefits are expected to range between \$1.7 billion and \$5.7 billion. The \$1.3 billion to \$5.7 billion plausible benefits range presented in this analysis may be potentially overstated due to the inability to quantify all visibility improvements prior to implementation of the RH visibility targets. The benefits associated with the RH targets are directly linked to the eventual choices made by States on the reasonable progress targets for the period 2000 to 2010 of this RH analysis. Should the States submit appropriate State implementation plans (SIPs) with reasonable progress target levels set close to those that would be achieved by implementation of the NAAQS and other CAA requirements, then visibility improvements and benefits attributed to the RH program will be minimal and could be as low as zero.

The monetized benefits presented above are likely to be under-represented for a number of reasons. First, modeling limitations prevent the estimation of ancillary ozone benefits associated with implementing control strategies designed to reduce particulate concentrations. For example, low NO_x burners imposed on industrial combustion sources is a control measure selected in the PM cost analysis. In addition to contributing to PM formation, NO_x is also an ozone precursor. Therefore, the use of low NO_x burners to reduce particulate concentrations would also concurrently reduce ozone concentrations. To the extent that such controls are used in area that would be imposing them anyway to meet the ozone standard, they may provide additional ozone benefits beyond those included in this analysis. There are also reasons to think that the benefits presented here could be overstated. There are likely to be lags associated with the relationship between changes in air quality and changes in mortality (as measured by long-term studies) and on chronic bronchitis. EPA does not know the magnitude of this lag, but if it did, it would discount the benefits appropriately. EPA has not prepared such estimates here.

A second reason for the under-representation of monetized benefits is the inability to model achievement of RH targets. A discussion of the unquantified benefits as well as uncertainties associated with this analysis are presented in the next section.

Not presented in Table 12.17 are full attainment $PM_{2.5}$ benefits. Estimation of full attainment PM benefits is more uncertain than partial attainment estimation because the sources from which additional emissions will be reduced will not be identified until further monitoring and modeling are performed. The PM partial attainment analysis indicates that PM control strategies outside of a violating county are often selected to help the violating county attain the standard. This procedure often causes PM air quality to change across an entire region rather than only in the violating county. However, for benefits analysis purposes, it is not possible to predict PM air quality distribution changes in areas other than the small number of residual nonattainment counties. This procedure is likely to underestimate the benefits associated with full attainment because it does not account for possible air quality changes and the associated population outside of the few remaining residual nonattainment counties. This method of adjusting partial attainment PM air quality to a full attainment scenario will show only a small change between partial and full attainment of the alternative standards. In the residual nonattainment counties only, the air quality is adjusted using the procedure described in section 12.6. Because regionwide PM air quality changes cannot be estimated, full attainment visibility benefits are assumed equal to the partial attainment visibility benefits for this analysis. This is an underestimate of the full attainment visibility benefits expected from full attainment of the selected $PM_{2.5}$ standard. This procedure results in a high-end estimate of annual full attainment monetized benefits (health and welfare) of approximately \$110 billion and a low-end estimate of \$20 billion for the 15/65 alternative. These full attainment PM estimates are presented incremental from full attainment of the current ozone and PM NAAQS.

Full attainment ozone benefits are also not presented in the summary table. The ozone full attainment benefits estimation is limited for the same reason as the PM full attainment analysis. For the high-end estimate in the ozone partial attainment analysis, emission reductions achieved by ozone controls are processed by the source-receptor matrix to predict ancillary PM air quality by ozone controls are processed by the source-receptor matrix to predict ancillary PM air quality changes attributable to each ozone alternative. However, full attainment ozone air quality is estimated by using the air quality adjustment procedure as described in section 12.6. The ozone air quality rollback procedure reduces baseline ozone concentrations to the level specified by each alternative ozone standard. However, it is not possible to know how the PM air quality distributions will change given full attainment of the ozone alternatives. It is not possible to adjust PM air quality distributions in the same manner because, in this context, there is no PM standard against which the PM distributions can be evaluated. Given this limitation, the ancillary PM benefits are proportionally scaled from partial to full attainment using the ratio of ozone full attainment to partial attainment benefits. Using this procedure, high-end annual full attainment monetized ozone benefits (health and welfare) are estimated to be approximately \$8.5 billion and low-end benefits are estimated to be approximately \$1.5 billion for the 0.08 4th max. alternative. These full attainment ozone estimates are presented incremental from full attainment of the current ozone NAAQS.

12.10 ANALYTICAL UNCERTAINTIES, LIMITATIONS, AND POTENTIAL BIASES

12.10.1 Introduction

Given incomplete information, this national benefits analysis yields inexact results because associated with any estimate is the issue of uncertainty. Potentially important sources of uncertainty exist and many of these are summarized in Table 12.21. In most cases, there is no apparent bias associated with the uncertainty. For those cases for which the nature of the uncertainty suggests a direction of possible bias, this direction is noted in the table.

Table 12.21 Identified Sources of Uncertainty in Benefits Estimation

1. Post-Control Air Quality Estimation	
1.1	CRDM: The degree to which the CRDM reflects post-control PM air quality
1.2	Air Quality Rollback: The degree to which the air quality rollback procedures reflect future air quality distributions
2. Concentration-Response Relationships	
2.1	Mean Value of concentration-response functions
2.2	Mean population: How well the mean population ($M\beta$) approximates that value of β , that if used in all counties, would yield the same results as would be obtained if county-specific β s were used?
2.3	Future-year concentration-response functions: How similar will future-year concentration-response relationships compare to current concentration-response relationships?
2.4	Correct functional form of each concentration-response relationship
2.5	For crops, the application of exposure-response functions from the NCLAN open-top chambers studies extrapolated to 2010 ambient air exposure patterns
2.6	For some fruit and vegetable crops, the use of alternative non-NCLAN exposure-response functions
3. Baseline Incidence Rates	
3.1	Non-county-specific incidence rates: Some baseline incidence rates are not county-specific (e.g., those taken from the epidemiological studies) and may not accurately represent the actual county-specific rates
3.2	Future baseline incidence rates: How similar will future baseline incidence rates compare to current baseline incidence rates?
3.3	Population projections: How well will the population projections compare to actual populations in the year 2010?
4. Economic Valuation	
4.1	Willingness-to-Pay estimates: The true distribution associated with each WTP value is unknown
4.2	Future WTP estimates: How similar will future WTP estimates compare to current WTP estimates?
4.3	Valuation method: Does valuation based on mortality risk, or extensions to life better reflect WTP?
4.4	Discounting/Lags: Lags between exposure and incidence might affect benefits.
5. Aggregation of Monetized Benefits	
5.1	Incomplete information for all benefit categories: Monetized benefit estimation is limited to those health and welfare endpoints for which concentration-response functions and WTP values are estimated
5.2	Possible double counting: Given that the pollutants have similar effects there may be double counting some of the benefits categories

12.10.2 Projected Income Growth

This analysis does not attempt to adjust benefits estimates to reflect expected growth in real income. Economic theory argues, however, that WTP for most goods (such as environmental protection) will increase if real incomes increase. The degree to which WTP may increase for the specific health and welfare benefits provided by the PM, ozone, and RH rules cannot be estimated due to insufficient income elasticity information. Thus, all else equal, the benefit estimates presented in this analysis are likely to be understated.

12.10.3 Unquantifiable Benefits

In considering the monetized benefits estimates, the reader should be aware that many limitations for conducting these analyses are mentioned throughout this RIA. One significant limitation of both the health and welfare benefits analyses is the inability to quantify many PM and ozone-induced adverse effects. Tables 12.1 and 12.2 lists the categories of benefits that this analysis is able to quantify and those discussed only in a qualitative manner. In general, if it were possible to include the

unquantified benefits categories in the total monetized benefits, the benefits estimates presented in this RIA would increase.

The benefits of reductions in a number of ozone- and PM-induced health effects have not been quantified due to the unavailability of concentration-response and/or economic valuation data. These effects include: reduced pulmonary function, morphological changes, altered host defense mechanisms, cancer, other chronic respiratory diseases, infant mortality, airway responsiveness, increased susceptibility to respiratory infection, pulmonary inflammation, acute inflammation and respiratory cell damage, and premature aging of the lungs. Indirectly, SO_x emissions controls applied for the purpose of implementing the PM_{2.5} standard are expected to result in considerable reductions of mercury (approximately 16%). Mercury's toxic effects include human neurotoxicity; fish deaths and abnormalities; plant damage (e.g., senescence, reduced growth, decreased chlorophyll content, leaf injury, and root damage); and impaired reproduction, liver damage, kidney damage, and neurotoxicity in birds and other mammals.

In addition to the above non-monetized health benefits, there are a number of non-monetized welfare benefits of PM and ozone controls from reduced adverse effects on vegetation, forests, and other natural ecosystems. The CAA and other statutes, through requirements to protect natural and ecological systems, indicate that these are scarce and highly valued resources. In a recent attempt to estimate the "marginal" value (changes in quantity or quality) of ecosystem services, Costanza et al. (1997) state that policy decisions often give little weight to the value of ecosystem services because their value cannot be fully quantified or monetized in commercial market terms. Costanza et al. warn that "this neglect may ultimately compromise the sustainability of humans in the biosphere". Lack of comprehensive information, insufficient valuation tools, and significant uncertainties result in understated welfare benefits estimates in this RIA. However, a number of expert biologists, ecologists, and economists (Costanza, 1997) argue that the benefits of protecting natural resources are enormous and increasing as ecosystems become more stressed and scarce in the future. Just the value of the cultural services (i.e., aesthetics, artistic, educational, spiritual and scientific) may be considered infinite by some, albeit in the realm of moral considerations. Additionally, agricultural, forest and ecological scientists (Heck, 1997) believe that vegetation appears to be more sensitive to ozone than humans and consequently, that damage is occurring to vegetation and natural resources at concentrations below the selected ozone NAAQS. Experts also believe that the effect of ozone on plants is both cumulative and long-term. The specific non-monetized benefits from ozone reductions in ambient concentrations would accrue from: decreased foliar injury; averted growth reduction of trees in natural forests; maintained integrity of forest ecosystems (including habitat for native animal species); and the aesthetics and utility of urban ornamentals (e.g., grass, flowers, shrubs and trees³). Other welfare categories for which there is incomplete information to estimate the economic value of reduced adverse effects include: existence value of Class I areas (e.g., Grand Canyon National Park); materials damage; reduced sulfate deposition to aquatic and terrestrial ecosystems; and visibility impairment due to "brown clouds" (i.e., distinct brown layers of trapped air pollutants close to the ground).

Infant Mortality

A recent study in the U.S. has found an association between infant mortality and PM₁₀ (Woodruff et al., 1997). This conclusion is similar to conclusions in previous studies (Ministry of Public Health, 1954; Bobak et al., 1992; Knobel et al., 1995 and Penna et al., 1991). These last 3 studies were reviewed by the CASAC but not relied on by EPA in standard setting. The most recent study finds that high PM₁₀ exposure is associated with increases in total infant mortality. Evaluation by cause of death finds a higher association for respiratory mortality and sudden infant death syndrome for normal birthweight infants. Although the association between PM exposure and increased postneonatal mortality risk is important, this category could not be included in the quantified benefits analysis because the new study was not published at the time the benefits analysis was conducted.

Other Human Health Effects

Human exposure to PM and ozone is known to cause health effects such as: airway responsiveness, increased susceptibility to respiratory infection, acute inflammation and respiratory cell damage, premature aging of the lungs and chronic respiratory damage. An improvement in ambient PM and ozone air quality is expected to reduce the number of incidences within each effect category that the U.S. population would experience. Although these health effects are known to be PM or ozone-induced, concentration-response data is not available for quantifying the benefits as-

sociated with reducing these effects. The inability to quantify these effects leads to an underestimation of the monetized benefits presented in this analysis.

Mercury Emission Reductions

Emissions of mercury from human activity are thought to contribute between 40 to 75 percent of the current total annual input of mercury to the atmosphere. This RIA imposes a national SO_x strategy for the purpose of implementing the PM_{2.5} alternatives. From the 2010 baseline, the SO_x strategy is estimated to reduce 11 tons of mercury, which is approximately a 16 percent reduction.

Once emitted to the atmosphere, mercury can deposit to the earth in different ways and at different rates, depending on its physical and chemical form. The form of mercury emitted influences its atmospheric fate and transport, as do conditions specific to its site of release. The result is that mercury deposition is a local, regional, and global issue. Mercury can be deposited directly to water bodies or can be transported from land by run-off and enter many different types of water bodies. The water bodies contain microorganisms that have the metabolic capability to carry out chemical reactions which bind mercury to methyl groups, producing methylmercury. Methylmercury is the form of mercury to which humans and wildlife are generally exposed, usually from eating fish which have accumulated mercury in their muscle tissue.

Methylmercury is biologically concentrated or bioaccumulated. That is, an animal at a higher position in the foodweb may have mercury concentrations thousands of times higher than an animal at a lower position in the foodweb. The transfer of mercury in the foodweb to progressively higher concentrations in large fish is key to understanding how release of mercury to the atmosphere results in exposure to high concentrations of mercury in fish, and ultimately humans and wildlife which consume fish. Humans are most likely to be exposed to methylmercury through fish consumption, although exposure may occur through other routes as well. In addition, mercury is a known human toxicant which has been associated with occupational exposure and with exposure through consumption of contaminated food. The range of neurotoxic effects can vary from subtle decrements in motor skills and sensory ability to tremors, inability to walk, convulsions, and death. Neurotoxicity can also affect a developing embryo or fetus.

The environmental impacts of mercury on fish include death, reduced reproductive success, impaired growth, and developmental and behavioral abnormalities. Exposure to mercury can also cause adverse effects in plants, birds, and mammals. Effects of mercury on plants include plant senescence, growth inhibition, decreased chlorophyll contents leaf injury, root damage, and inhibited root growth and function. Reproductive effects are the primary concern for avian mercury poisoning and can include liver and kidney damage as well as neurobehavioral effects. Although clear causal links between mercury contamination and population declines in various wildlife species have not been established, mercury may be a contributing factor to population declines of the endangered Florida panther and the common loon.

Current levels of mercury in freshwater fish in the U.S. are such that advisories have been issued in 37 states warning against the consumption of certain amounts and species of fish that are contaminated with mercury. Seven states have statewide advisories. Such widespread contamination is a concern for several reasons including: potential health risk to people who continue to catch and eat fish from these waters; economic losses to tourism, commercial and recreational fisheries; health and economic impacts to people, including subsistence fishers, who can no longer eat fish from these waters.

Urban Ornamentals

Urban ornamentals represent an additional vegetation category likely to experience some degree of effects associated with exposure to ambient ozone levels and likely to impact large economic sectors. In the absence of adequate exposure-response functions and economic damage functions for the potential range of effects relevant to these types of vegetation, no direct quantitative economic benefits analysis has been conducted. Ornamentals used in the urban and suburban landscape include shrubs, trees, grasses, and flowers. The types of economic losses that could potentially result from effects that have been associated with ozone exposure include: 1) reduction in aesthetic services over the realized lifetime of a plant; 2) the loss of aesthetic services resulting from the premature death (or early replacement) of an injured plant; 3) the cost associated with removing the injured plant and replacing it with a new plant; 4) increased soil erosion; 5) increased energy costs from loss of shade in the urban environment; 6) reduced seedling survivability; and 7) any additional costs incurred over the lifetime of the injured plant to mitigate the effects of ozone-induced injury. It is estimated that more than \$20 billion (1990 dol-

lars) are spent annually on landscaping using ornamentals (Abt, 1995b), both by private property owners/tenants and by governmental units responsible for public areas, making this a potentially important welfare effects category. However, information and valuation methods are not available to allow for plausible estimates of the percentage of these expenditures that may be related to impacts associated with ozone exposure. While recognizing this limitation, an estimate of ozone-induced damage to ornamentals can be made based on data assessing retail expenditures on environmental horticulture at \$23 billion in 1991 (Abt, 1995b). If only half of a percent of public expenditures on ornamentals could be traced to ozone-induced damage avoided with a revised ozone standard, then benefits would amount to \$115 million.

Aesthetic Injury to Forests

Ozone is a regionally dispersed air pollutant that has conclusively been shown to cause discernible injury to forest trees (Fox, 1995). One of the welfare benefits expected to accrue as a result of reductions in ambient ozone concentrations in the United States is the economic value the public receives from reduced aesthetic injury to forests. There is sufficient scientific information available documenting that ambient ozone levels cause visible injury to foliage and impair the growth of some sensitive plant species. Ozone inhibits photosynthesis and interferes with nutrient uptake, causing a loss in vigor that affects the ability of trees to compete for resources and makes them more susceptible to a variety of stresses (U.S. EPA, 1996a, p. 5-251). Extended or repeated exposures may result in decline and eventual elimination of sensitive species. Ozone concentrations of 0.06 ppm or higher are capable of causing injury to forest ecosystems.

The most notable effects of ozone on forest aesthetics and ecosystem function have been documented in the San Bernardino Mountains in California. Visible ozone-related injury, but not necessarily ecosystem effects, have also been observed in the Sierra Nevada in California, the Appalachian Mountains from Georgia to Maine, the Blue Ridge Mountains in Virginia, the Great Smoky Mountains in North Carolina and Tennessee, and the Green Mountains in Vermont (U.S. EPA, 1996a, pp. 5-250 to 5-251). These are all locations where there is substantial recreation use and where scenic quality of the forests is an important characteristic of the resource. Economic valuation studies of lost aesthetic value of forests attributed to plant injuries caused by ozone are limited to two studies conducted in Southern California (Crocker, 1985; Peterson et al., 1987). Both included contingent valuation surveys that asked respondents what they would be willing to pay for reductions in (or preventions of increases in) visible ozone injuries to plants. Crocker found that individuals are willing to pay a few dollars more per day to gain access to recreation areas with only slight ozone injury instead of areas with moderate to severe injury. Peterson et al. estimated that a one-step change (on a 5 point scale) in visible ozone injury in the San Bernardino and Angeles National Forests would be valued at an aggregate amount of between \$27 million and \$144 million for all residents of Los Angeles, Orange, and San Bernardino counties. A reassessment of the survey design, in light of current standards for contingent valuation research, suggests that it is plausible that concerns for forest ecosystems and human health could have been embedded into these reported values. The extent of this possible bias is uncertain.

Present analytic tools and resources preclude EPA from quantifying the national benefits of improved forest aesthetics expected to occur from the selected ozone standard. This is due to limitations in our ability to quantify the relationship between ozone concentrations and visible injury, and limited quantitative information about the value to the public of specific changes in visible aesthetic quality of forests. However, there is sufficient supporting evidence in the physical sciences and economic literature to support the finding that the proposed changes to the ozone NAAQS can be expected to reduce injury to forests, and that reductions in these injuries will likely have a significant economic value to the public.

Nitrates in Drinking Water

Nitrates in drinking water are currently regulated by a maximum contaminant level (MCL) of 10 mg/L on the basis of the risk to infants of methemoglobinemia, a condition which adversely affects the blood's oxygen carrying capacity. In an analysis of pre-1991 data, Raucher, et al. (1993) found that approximately 2 million people were consuming public drinking water supplies which exceed the MCL. Supplementing these findings, the National Research Council concluded that 42 percent of the public drinking water users in the U.S. (approximately 105 million people) are either not exposed to nitrates or are exposed to concentrations below 1.3 mg/L (National Research Council, 1995).

In a recent epidemiological study by the National Cancer Institute, a statistically significant relationship between nitrates in drinking water and incidence of non-

Hodgkin's lymphoma were reported (Ward, et al., 1996). Though it is generally acknowledged that traditional water pollution sources such as agricultural runoff are mostly responsible for violations of the MCL, other more diffuse sources of nitrate to drinking water supplies, such as that from atmospheric deposition, may also become an important health concern should the cancer link to nitrates be found valid upon further study.

Brown Clouds

NOx emissions, especially gaseous NO₂ and NOx aerosols, can cause a brownish color to appear in the air (U.S. EPA, 1993). In higher elevation western cities where wintertime temperature inversions frequently trap air pollutants in atmospheric layers close to the ground, this can result in distinct brown layers. In Denver, this phenomenon has been named the "brown cloud." In the eastern U.S., a layered look is not as common, but the ubiquitous haze sometimes takes on a brownish hue. To date, economic valuation studies concerning visual air quality have focused primarily on the clarity of the air in terms of being able to see through it, and have not addressed the question of how the color of the haze might be related to aesthetic degradation. It may be reasonable to presume that brown haze is likely to be perceived as dirty air and is more likely to be associated with air pollution in people's minds. It has not, however, been established that the public would have a greater value for reducing brown haze than for a neutral colored haze. Results of economic valuation studies of visibility aesthetics conducted in Denver and in the eastern U.S. (McClelland et al., 1991) are not directly comparable because changes in visibility conditions are not defined in the same units of measure. However, the WTP estimates for improvements in visibility conditions presented in this assessment are based on estimates of changes in clarity of the air (measured as deciview) and do not take into account any change in color that may occur. It is possible that there may be some additional value for reductions in brownish color that may also occur when NOx emissions are reduced.

Other Unquantifiable Benefits Categories

There are other welfare benefits categories for which there is incomplete information to permit a quantitative assessment for this analysis. For some endpoints, gaps exist in the scientific literature or key analytical components and thus do not support an estimation of incidence. In other cases, there is insufficient economic information to allow estimation of the economic value of adverse effects. Potentially significant, but unquantified welfare benefits categories include: existence and user values related to the protection of Class I areas (e.g., Grand Canyon National Park), tree seedlings for more than 10 sensitive species (e.g., black cherry, aspen, ponderosa pine), non-commercial forests, ecosystems, materials damage, and reduced sulfate deposition to aquatic and terrestrial ecosystems. Although scientific and economic data are not available to allow quantification of the effect of ozone in these categories, the expectation is that, if quantified, each of these categories would lead to an increase in the monetized benefits presented in this RIA. For example, the National Acid Precipitation Assessment Program (NAPAP) reports that user values for visibility changes at recreation sites in the east and west are in the range of \$1 to \$10 per visitor per day. Similarly, estimates of the economic effects of acidic deposition damages on recreational fishing in the Adirondack region of New York range from \$1 million to \$13 million annually.

Potential Disbenefits

In this discussion of unquantified benefits, -a discussion of potential disbenefits must also be mentioned. Several of these disbenefit categories are related to nitrogen deposition while one category is related to the issue of ultraviolet light.

Passive Fertilization

Several disbenefit categories are related to nitrogen deposition. Nutrients deposited on crops from atmospheric sources are often referred to as passive fertilization. Nitrogen is a fundamental nutrient for primary production in both managed and unmanaged ecosystems. Most productive agricultural systems require external sources of nitrogen in order to satisfy nutrient requirements. Nitrogen uptake by crops varies, but typical requirements for wheat and corn are approximately 150 kg/ha/yr and 300 kg/ha/yr, respectively (NAPAP, 1990). These rates compare to estimated rates of passive nitrogen fertilization in the range of 0 to 5.5 kg/ha/yr (NAPAP, 1991). Approximately 75 percent (70 -80 percent) of nitrogen deposition is in the form of nitrates (and thus can be traced to NOx emissions) while most of the remainder is due to ammonia emissions (personal communication with Robin Dennis, NOAA Atmospheric Research Lab, 1997).

Elsewhere in this analysis, it is estimated that a 0.08 3rd max ozone standard would result in NO_x emissions reductions of approximately 0.3 million tons/yr for partial attainment or 1.4 million tons/yr for full attainment from a 2010 baseline. These reductions are roughly equivalent to 1–6 percent of 1990 emission levels (i.e., the approximate year of the NAPAP deposition estimates).

NO_x reductions resulting from a 0.08 3rd max ozone NAAQS could therefore, in theory, increase the nitrogen fertilization requirement for wheat from 0–0.03 percent for partial attainment and from 0–0.17 percent for full attainment. For corn, the increase would be from 0–0.01 percent for partial attainment and from 0–0.08 percent for full attainment. However, given the extremely small magnitude of these increases, it is highly unlikely that farmers could detect them and increase their fertilization application accordingly nor even control their nitrogen applications with this degree of precision.

Information on the effects of changes in passive nitrogen deposition on forest lands and other terrestrial ecosystems is very limited. The multiplicity of factors affecting forests, including other potential stressors such as ozone, and limiting factors such as moisture and other nutrients, confound assessments of marginal changes in any one stressor or nutrient in forest ecosystems. However, reductions in deposition of nitrogen in could have negative effects on forest and vegetation growth in ecosystems where nitrogen is a limiting factor (U.S. EPA, 1993).

However, there is evidence that forest ecosystems in some areas of the United States are nitrogen saturated (U.S. EPA, 1993). Once saturation is reached, adverse effects of additional nitrogen begin to occur such as soil acidification which can lead to leaching of nutrients needed for plant growth and mobilization of harmful elements such as aluminum. Increased soil acidification is also linked to higher amounts of acidic runoff to streams and lakes and leaching of harmful elements into aquatic ecosystems.

Ultraviolet Light

A reduction of tropospheric ozone to meet health and welfare-based standards is likely to increase the penetration of ultraviolet light, specifically W-B, to ground level. W-B is an issue of concern because depletion of the stratospheric ozone layer (i.e., ozone in the upper atmosphere) due to chlorofluorocarbons and other ozone-depleting chemicals is associated with increased skin cancer and cataract rates. EPA is not currently able to adequately quantify these effects for the purpose of valuing benefits for these standards. If EPA were able to do so it would attempt to quantify these effects.

Other EPA programs exist to address the risks posed by changes in W-B associated with changes in total column ozone. As presented in the Stratospheric Ozone RIA (U.S. EPA, 1992), stratospheric ozone levels are expected to significantly improve over the next century as the major ozone depleting substances are phased out globally. This expected improvement in stratospheric ozone levels is estimated to reduce the number of nonmelanoma skin cancers (NMSC's) by millions of cases in the U.S. by 2075.

12.11 REFERENCES

- Adams, D.M. and Haynes, R.W. (1966). The 1993 Timber Assessment Market Model: Structure, Projections and Policy Simulations. U.S. Department of Agriculture, Forest Service, Technical Report PNW-GTR-368; November.
- Abt Associates, Inc. (1995a), Ozone NAAQS Benefits Analysis: California Crops. Prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; July.
- Abt Associates, Inc. (1995b), Urban Ornamental Plants: Sensitivity to Ozone and Potential Economic Losses. Prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; July.
- Abt Associates, Inc. (1996a), A Particulate Matter Risk Assessment for Philadelphia and Los Angeles. Prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; July.
- Abt Associates, Inc. (1996b), Supplement to A Particulate Matter Risk Assessment for Philadelphia and Los Angeles. Prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; December.
- Abt Associates, Inc. (1997), Memorandum to Rosalina Rodriguez U.S. EPA, OAQPS on Changes to the Method for Estimating Benefits to California Agriculture from Ozone NAAQS Using the CARM Model; July.
- Bobak, M. And Leon, D.A. (1992), Air Pollution and Infant Mortality in the Czech Republic, 1986-1988. *Lancet*, 340: 1010-1014.

- Chesnut, L. (1995), Human Health Benefits from Sulfate Reductions Under Title IV of the 1990 Clean Air Act Amendments. Prepared by Hagler Bailly Consulting, Inc. for the U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Atmospheric Programs; Washington, D.C.
- Chesnut, L. (1997a), Methodology for Estimating Values for Changes in Visibility in National Parks. Prepared by Hagler Bailly Consulting, Inc. for the U.S. Environmental Protection Agency, Office of Air and Radiation; Washington, D.C.
- Chesnut, L. (1997b), Potential Effects of Ambient Changes on Values Related to Forest Aesthetics. Prepared by Hagler Bailly Consulting, Inc. for the U.S. Environmental Protection Agency, Office of Policy Planning and Evaluation and the Office of Air Quality Planning and Standards; April.
- Costanza, R.; d'Arge, R.; de Groot, R.; Farber, S.; Grasso, M.; Hannon, B.; Limburg, K.; Naeem, S.; O'Neill, R.V.; Paruelo, J.; Raskin, R.G.; Sutton, P.; and van den Belt, M. (1997), The Value of the World's Ecosystem Services and Natural Capital. *Nature*, Vol. 387: 253-259.
- Crocker, T.D. (1985), On the Value of the Condition of a Forest Stock. *Land Economics* 61(3):244-254.
- Crocker, T.D. and Horst, R.L., Jr. (1981) Hours of Work, Labor Productivity, and Environmental Conditions: A Case Study. *The Review of Economics and Statistics* 63 :361 -368.
- Dennis, R. (1997), Personal communication. NOAA Atmospheric Research Lab; Research Triangle Park, N.C.; June.
- DeSteiger, J.E.; Pye, J.M.; Love, C.S. (1990), Air Pollution Damage to U.S. Forests. *Journal of Forestry*, 88-8: 17-22.
- Fox, S. and Mickler, R.A. (1995), Impact of Air Pollutants on Southern Pine Forests. *Ecological Studies* 118; Springer-Verlag; New York.
- Haddix, A., S. M. Teutsch, P. A. Schaffer, and D. O. Dunet (1996), Prevention Effectiveness: A Guide to Decision Analysis and Economic Evaluation; January.
- Heck, W.W. and Cowling, E.B. (1997), The Need for a Long Term Cumulative Secondary Ozone Standard—An Ecological Perspective. *EM*, January 1997: 23-33.
- Johnson, T.; Capel, J.; Mozier, J.; McCoy, M. (1996), Estimation of Ozone Exposures Experienced by Outdoor Children in Nine Urban Areas Using a Probabilistic Version of NEM. Prepared by IT/Air Quality Services for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; August.
- Johnson, T. (1997), Sensitivity of Exposure Estimates to Air Quality Adjustment Procedure. Prepared by TRJ Environmental, Inc. and IT/Air Quality Services for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards; Research Triangle Park N.C.; June.
- Knobel, H.; Chen, C.; and Liang, K. (1995) Sudden Infant Death Syndrome in Relation to Weather and Optimetrically Measured Air Pollution in Taiwan. *Pediatrics* 96: 1106–1110.
- Lee, E.H.; Hogsett, W.E. (1996), Methodology for Calculating Inputs for Ozone Secondary Standard Benefits Analysis: Part II. Prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; March.
- Lutter, R. And Wolz, C. (1997), W-B Screening by Tropospheric Ozone: Implications for the National Ambient Air Quality Standard. *Environmental Science & Technology*, Vol. 31, No. 3:142-146.
- Madronich, E. (1997), memorandum to Reva Rubenstein, Office of Atmospheric Programs, Washington, DC.
- Mathtech, Inc. (1994), The Regional Model Farm (RMF): An Agricultural Sector Benefits Assessment Model, Version 3.0 for Personal Computers. Prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; September.
- Mathtech, Inc. (1995), Addendum to the Regional Model Farm (RMF) User's Guide, Version 3.0 for Personal Computers. Prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; June.
- Mathtech, Inc. (1997), Forestry Sector Benefits of Alternative Ozone Standards. Prepared for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; July.
- McClelland, G.; Schulze, W.D.; Irwin, J.; Schenk, D.; Waldman, D.; Stewart, T.; Deck, L.; Slovic, P.; Thayer, M. (1990), Valuing Visibility: A Field Test of the Contingent Valuation Method (Draft). Prepared for the U.S. Environmental Protection Agency, Office of Air and Radiation; Washington, D.C.; Cooperative Agreement #CR-812054.

McClelland, G., W.D. Schulze, D. Waldman, J. Irwin, D. Schenk, T. Stewart, L. Deck, and M. Thayer. (1991). Valuing Eastern Visibility: A Field Test of the Contingent Valuation Method (Draft). Cooperative Agreement #CR-815183-01-3, U.S. Environmental Protection Agency, Washington, D.C.

Ministry of Public Health (1954). Mortality and Morbidity During the London Fog of December 1952 on Public Health and Medical Subjects. Her Majesty's Stationary Office, London.

NAPAP (1990). Acidic Deposition: State of Science and Technology, Report 18: Response of Vegetation to Atmospheric Deposition and Air Pollution. National Acid Precipitation Assessment Program, Office of the Director; Washington, D.C.

NAPAP (1991). National Acid Precipitation Assessment Program 1990 integrated Assessment Report National Acid Precipitation Assessment Program, Office of the Director; Washington D.C.

National Research Council (1995). Nitrate and Nitrite in Drinking Water. Subcommittee on Nitrate and Nitrite in Drinking Water, National Academy Press; Washington, DC.

Penna, M.L.F. and Duchiae, M.P. (1991). Air Pollution and Infant Mortality from Pneumonia in the Rio de Janeiro Metropolitan Area. Bulletin of PAHO:47-54.

Peterson, D.C.; Rowe, R.D.; Schulze, W.D.; Russell, G.W.; Boyce, R.R.; Elliott, S.R.; Hurd, B. (1987). Improving Accuracy and Reducing Costs of Environmental Benefit Assessments: Valuation of Visual Forest Damages from Ozone. Prepared for the U.S. Environmental Protection Agency, Office of Air and Radiation; Washington, D.C.; Cooperative Agreement #CR812054-02.

Pope, C.A., III; Thun, M.J. ; Namboodiri, M.M. ; Dockery, D.W., Evans, J. S.; Speizer, F.E., and Heath, C.W., Jr. (1995). Particulate Air Pollution as a Predictor of Mortality in a Prospective Study of U.S. Adults. *Am. J. Respir. Crit. Care Med.* 151:669-674.

Pye, J.M.; deSteiguer, J.E.; Love, C. (1988). Expert Opinion Survey on the Impact of Air Pollutants on Forests of the USA. Proceedings of Air Pollution and Forest Decline; Interlaken, Switzerland; October.

Raucher, R. S.; Drago, J. A.; Trabka, E.; Dixon, A.; Patterson, A.; Lang, C.; Bird, L.; Ragland, S. (1993). An Evaluation of the Federal Drinking Water Regulatory Program under the Safe Drinking Water Act as Amended in 1986. Appendix A: Contaminant-Specific Summaries. Prepared for the American WaterWorks Association;

Richmond, H. (1997). Supplemental Ozone Exposure and Health Risk Analyses. EPA—memorandum to Karen Martin, Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; February.

U.S. Environmental Protection Agency, (1992). Regulatory Impact Analysis: Protection of Stratospheric Ozone. Vol. II, Part I. Stratospheric Protection Program. Washington, DC.

U.S. Environmental Protection Agency (1993). Air Quality Criteria for Oxides of Nitrogen. Volume II. Office of Research and Development; Washington, D.C.; EPA report no. EPA/600/8-91 /049bF.

U.S. Environmental Protection Agency (1996a). Air Quality Criteria for Ozone and Related Photochemical Oxidants. Office of Research and Development; Office of Health and Environmental Assessment; Research Triangle Park, N.C.; EPA report nos. EPA/600/P-93/004aF-cF.

U.S. Environmental Protection Agency (1996b). Air Quality Criteria for Particulate Matter. Office of Research and Development, Office of Health and Environmental Assessment; Research Triangle Park, N.C.; EPA report no. EPA/600/P-95/001cF; April.

U.S. Environmental Protection Agency (1996c). Review of National Ambient Air Quality Standards for Ozone: Assessment of Scientific and Technical Information. OAQPS Staff Paper. Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; EPA report no. EPA/452/R-96-007.

U.S. Environmental Protection Agency (1996d). Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper. Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; EPA report no. EPA/452/R-96-013.

U.S. Environmental Protection Agency (1997a). Benefits Technical Support Document for the Regulatory Impact Analysis for the PM and Ozone NAAQS, and Proposed Regional Haze Rule. Office of Air Quality Planning and Standards; Research Triangle Park, N.C.

U.S. Environmental Protection Agency, (1997b). The Benefits and Costs of the Clean Air Act, 1970 to 1990. Draft Report for the U.S. Congress. Office of Air and Radiation; Washington, D.C.

U.S. Environmental Protection Agency, (1997c). Benefits of Reducing Atmospheric Deposition of Nitrogen in Estuarine and Coastal Water; July.

Ward, M. H.; Mark, S. D.; Cantor, K.P.; Weisenburger, D.D.; Correa-Villasenor, A.; Zahm, S.H. (1996), Drinking Water Nitrate and the Risk of Non-Hodgkin's Lymphoma. *Epidemiology* 7:465-471; September.

Whitfield, R.G.; Biller, W.F.; JuskO, M.J.; Keisler, J.M. (1996), A Probabilistic Assessment of Health Risks Associated with Short-Term Exposure to Tropospheric Ozone. Prepared by Agronne National Laboratory for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; June.

Whitfield, R.G. (1997), Sensitivity of Risk Estimates to Air Quality Adjustment Procedure. Prepared by Agronne National Laboratory for the U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards; Research Triangle Park, N.C.; June.

Woodruff, T.J.; Grillo, J.M.; and Schoendorf, K.C. (1997), The Relationship Between Selected Causes of Postneonatal Infant Mortality and Particulate Air Pollution in the United States. *Environ. Health Perspectives*. June.

13.0 BENEFIT-COST COMPARISONS

13.1 Results in Brief

Estimated partial attainment (P/A) benefits of implementation of the particulate matter (PM) and ozone NAAQS greatly exceed estimated P/A costs. Estimated combined net P/A benefits (P/A benefits minus P/A costs) for the combined PM_{2.5} 15/65 and ozone 0.08 4th max alternatives range from approximately \$9.5 to \$96 billion.

Considered separately, estimated PIA benefits of alternative PM_{2.5} standards far outweigh estimated P/A costs. Estimated quantifiable net PIA benefits of the selected PM_{2.5} 15/65 standard range from \$10 to \$95 billion. Estimated quantifiable full-attainment (F/A) net benefits range from -\$17 to \$73 billion. Estimated quantifiable net P/A quantified and monetized benefits of the ozone 0.08 4th max standard range from -\$0.7 to \$1.0 billion. F/A benefit estimates are somewhat smaller than F/A cost estimates. Quantifiable net benefits for full attainment of the 0.08 4th max. ozone standard are estimated to range from -\$8.1 to \$1.1 billion.

13.2 Introduction

This Regulatory Impact Analysis provides cost, economic impact, and benefit estimates potentially useful for evaluating PM, ozone, and RH control alternatives. Benefit-cost analysis provides a systematic framework for assessing and comparing such alternatives. According to economic theory, the efficient alternative maximizes net benefits to society (i.e., social benefits minus social costs). However, both the Agency and the courts have defined the primary National Ambient Air Quality Standards (NAAQS) setting process as a fundamentally health-based decision that specifically is not to be based on cost or other economic considerations. This benefit-cost comparison for the PM and ozone NAAQS, therefore, is intended to generally inform the public about the potential costs and benefits that may result when revisions to the PM and ozone NAAQS are implemented by the States. The benefit-cost comparison for the RH rule, however, may be used to support the decision making process for this program.

13.3 Comparisons of Benefits to Costs

13.3.1 Separate PM and Ozone NAAQS

13.3.1.1 Results

Tables 13.1 and 13.2 present the estimated P/A benefits, costs, net benefits, and residual nonattainment area (RNA) results for alternative PM_{2.5} NAAQS and ozone NAAQS, respectively.

Full attainment (F/A) cost and benefit estimates of alternative PM_{2.5} and ozone NAAQS are presented in Chapters 9 and 12. Estimated F/A costs of the selected PM_{2.5} 15/65 standard equal \$36.7 billion, while estimated F/A benefits range from \$19.8 to \$109.7 billion. Estimated F/A costs of the ozone 0.08 4th max standard equal \$9.6 billion, while estimated F/A benefits range from \$1.5 to \$8.5 billion.

13.3.1.2 Key Results and Conclusions

Monetized net benefit estimates are positive and substantial for all three PM_{2.5} alternatives for the P/A scenario. For the selected PM_{2.5} 15/65 standard, estimated net annual P/A benefits range from \$10 to \$95 billion, depending whether the estimates are based on the low end and high end assumptions.

Monetized net benefit estimates are ambiguous for the three ozone standards assessed for the P/A scenario. For the selected ozone 0.08 4th max standard, estimated net annual P/A benefits range from -\$0.7 billion to \$1.0 billion, depending on whether

er the estimates are based on the low or the high end assumptions. Note that significant categories of nonmonetized benefits are omitted from these estimates.

Table 13.1 Comparison of Annual Benefits and Costs of PM Alternatives in 2010^{a,b} (1990\$)

PM _{2.5} Alternative (µg/m ³)	Annual Benefits of Partial Attainment ^c (billion \$) (A)	Annual Costs of Partial Attainment (billion \$) (B)	Net Benefits of Partial Attainment (billion \$) (A - B)	Number of Residual Nonattainment Counties
16/65 (high end estimate)	90	5.5	85	19
15/65 (low end estimate) (high end estimate)	19 - 104	8.6	10 - 95	30
15/50 (high end estimate)	108	9.4	98	41

- a All estimates are measured incremental to partial attainment of the current PM₁₀ standard (PM₁₀ 50/150, 1 expected exceedance per year).
- b The results for 16/65 and 15/50 are only for the high end assumptions range. The low end estimates were not calculated for these alternatives.
- c Partial attainment benefits based upon post-control air quality as defined in the control cost analysis.

Table 13.2 Comparison of Annual Benefits and Costs of Ozone Alternatives in 2010^{a,b} (1990\$)

Ozone Alternative (ppm)	Annual Benefits of Partial Attainment (billion \$) ^c	Annual Costs of Partial Attainment (billion \$) (B)	Net Benefits of Partial Attainment (billion \$) (A - B)	Number of Residual Nonattainment Areas
0.08 5th Max (high end estimate)	1.6	0.9	0.7	12
0.08 4th Max (low end estimate) (high end estimate)	0.4 - 2.1	1.1	0.7 - 1.0	17
0.08 3rd Max (high end estimate)	2.9	1.4	1.5	27

- a All estimates are measured incremental to partial attainment of the baseline current ozone standard (0.12ppm, 1 expected exceedance per year).
- b The results for .08, 5th and .08, 3rd max. are only for the high end assumptions. The low end estimates were not calculated for these alternatives.
- c Partial attainment benefits based upon post-control air quality estimates as defined in the control cost analysis.

13.3.2 Combined PM and Ozone NAAQS

Based on results from sensitivity studies performed for the sequential implementation of a PM and an ozone standard (see Appendix D), the sum of estimated P/A costs and benefits associated with separate PM and ozone standards, regardless

of sequence, is likely to exceed the P/A costs and benefits associated with coordinated implementation of both standards, but only by a small percentage. Thus the benefits and costs of coordinated implementation of a PM_{2.5} 15/65 and ozone 0.08 4th max standards can be estimated roughly by summing results from the separate standards-analyses.

13.3.3 Regional Haze Rule

13.3.3.1 Results

The estimated benefits and costs associated with achieving a .67 and 1 deciview visibility improvement, incremental to the application of controls to attain the PM_{2.5} 15/65 standard, are presented in Table 13.3.

13.3.3.2 Key Results and Conclusions

Net monetized benefit estimates are ambiguous for both RH alternatives assessed. Actual benefits and costs associated with the proposed RH rule will depend on the reasonable progress target levels included in State Implementation Plans (see Chapter 8).

Table 13-3 Comparison of Annual Monetized Benefits and Costs of RH Alternatives in 2010 (1990\$)

RH Alternative Incremental to PM _{2.5} 15/65	Annual Benefits (billion \$) (A)	Annual Costs (billion \$) (B)	Net Benefits (billion \$) (A - B)	Residual Noncompliant Class I Areas
1.0 Deciview Improvement Over 15 Year (0.67 Deciview Target)	1.3 - 3.2	2.1	(0.8) - 1.1	17
1.0 Deciview Improvement Over 10 Years (1.0 Deciview Target)	1.7 - 5.7	2.7	(1.0) - 3.0	28

d The benefits range results are associated with the RH targets and are directly linked to the eventual choices made by States on the reasonable progress targets for the period 2000 to 2010. Should the States submit approvable State implementation plans (SIPs) with reasonable progress target levels set close to those that would be achieved by implementation of the NAAQS and other CAA requirements, then visibility improvements and benefits attributed to the RH program will be minimal and could be as low as zero.

13.4 LIMITATIONS TO THE BENEFIT-COST COMPARISONS

As discussed throughout this document, there are significant analytical uncertainties associated with these benefit-cost assessments. Various emission inventory, air quality modeling, cost, health and welfare effect, and valuation uncertainties and limitations are discussed throughout this analysis. An effort has been made to account for some of these uncertainties through the estimation of a plausible range of monetized benefits as described in chapter 12. Additional limitations specific to the comparison of estimated benefits and costs for the various alternatives include the following:

Some identified benefit categories associated with PM and ozone reductions could not be quantified or monetized. Nonmonetized benefit categories include changes in pulmonary function, altered host defense mechanisms, and cancer. Thus, this chapter presents a comparison of estimated monetized benefits versus estimated total costs.

The uncertainty associated with the benefit estimates may be greater than the uncertainty associated with the P/A cost estimates. In particular, benefit estimates vary greatly depending on the mortality risk reduction effect and valuation measures employed.

Full-attainment cost estimates are speculative and should be compared with full-attainment benefit estimates with caution.

Comparisons of P/A costs and benefits across alternatives examined should be made with caution because of the existence of residual nonattainment (RNA). P/A

costs associated with more stringent standards may not increase at an increasing rate because the additional violating counties may have low-cost controls available to attain the more stringent standards. The number of RNA areas, however, increases with the stringency of the standards.

The cost and benefit estimates presented in this chapter do not account for market reactions to the implementation of these rules. These estimates represent the direct but not the true social benefits and costs (calculated after market adjustments to price and output changes, etc.) associated with alternative standards. Social costs are typically somewhat smaller than direct control costs while social benefits may be greater or less than direct benefits depending on the specific market adjustments and substitutions that occur.

13.5 SUMMARY

Despite numerous limitations and uncertainties, the analysis provided in this document provides a basis for believing that in the reference year 2010 benefits resulting from efforts to meet both new NAAQS are likely to exceed costs. Though uncertainties associated with estimates after the next decade trend toward lower costs, it is not clear today what those out-year costs will be. The history of compliance with the Clean Air Act indicates, however, that a commitment to continue progress today does not require rigid adherence to timelines that, in ten or more years, prove to be impractical.

PREPARED STATEMENT OF KENNETH A. COLBURN, DIRECTOR OF THE AIR RESOURCES DIVISION, NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES

Good day. My name is Ken Colburn. I am the air director for the State of New Hampshire. I appreciate the opportunity to share with this committee a northeastern State's perspective on the problem of regional haze.

Although this problem has not received the same degree of attention as acid rain and ozone pollution over the last several years, the Northeast States have an equally long history of concern about visibility impairment. In fact, in 1979 the eight northeast States adopted a resolution calling for Federal action to address the long range transport of visibility impairing pollutants. In part it reads:

Whereas the Northeastern States are particularly susceptible to the effects of pollution transport and have been experiencing significant increases in the acidity of precipitation and decreases in visibility;

The resolution calls on EPA to take several actions including, and again I quote:

Promulgate improved ambient air particulate standards which reflect the health and welfare effects of the respirable and corrosive fractions of the particles [and] . . . Ensure that environmental consequences beyond those that directly affect a national ambient air quality standard are factored into reviews, evaluations and decisions involving fossil fuel consumption and other contributors to secondary air pollutants and acid precipitation.

The full resolution is attached to my written comments.

That resolution, adopted almost 20 years ago recognized that the problems of regional haze, particulate pollution, ozone, and acid deposition are all connected. Moreover, it recognized that the interstate transport of pollutants, especially sulfur dioxide (SO₂) from large coal-fired power plants, lies at the heart of these problems in the Northeast. Unfortunately, two decades later, these sources continue to harm our public health, damage our natural environment, and impair our tourism-based economy.

Haze is typically perceived as a Western concern, but it is actually much worse in the Eastern United States. Visibility impairment 2–3 times worse than in the West is pervasive throughout the East. And while we do not have the concentration of Class I areas found in the West, we do have a large number of wilderness areas that are very important both as a recreational resource for our densely populated region and as a source of tourist revenue. All of our wilderness areas, whether they are designated Class I or not, are significantly impacted by haze and will benefit from regional efforts to improve visibility.

In my own State of New Hampshire, for example, tourism is our second largest industry after manufacturing. I am told that New Hampshire's White Mountain National Forest—which contains two of New England's six Class I airsheds—receives 7 million visitor days per year, an amount which exceeds that of Yellowstone and Yosemite National Parks combined. This is not surprising since about one-quarter of the U.S. population lives within one day's drive of the White Mountains. The 48

million tourists who visit New Hampshire each year spend over \$2.5 billion dollars in our State. Tourism directly supports 1 out of every 12 jobs in New Hampshire and contributes almost \$150 million annually to our State budget.

Surveys of hikers in the White Mountains indicate that people notice haze and are affected by it. They see it as a visible sign of unhealthy air, and they're right: the small particles that scatter light and cause haze are also the small particles that have been shown in numerous epidemiological studies to cause serious human health impacts. The bottom line is that visibility is a key measure used by the public to discern whether or not we are making progress in cleaning up the air.

That is why New Hampshire and other Northeast States generally support EPA's efforts to address the problem of regional haze. We agree that we should strive for steady, perceptible progress in reducing haze. And we agree with EPA that for these efforts to be successful, they must be broadly regional in scope and must include upwind States throughout the eastern part of the country, not just those with designated Class I areas. We also support EPA's use of the "deciview" metric. The Clean Air Act requires that visibility be protected, and the deciview is a visibility metric. Like ozone reduction, visibility improvement is a non-linear (exponential) effort. Unlike linear "parts-per-billion" metrics commonly applied to ozone, however, deciviews are appropriately logarithmic in nature.

We are concerned, however, that EPA may inappropriately impose the same control requirements on Western States as on Eastern States. Even though regional haze is a problem in both the East and the West, it's a very different problem in these two regions of the country. In the West, the causes of haze are complex and vary from one location to another. In the East, the causes of haze are well understood and are much the same from one place to the next. In fact, haze is a simpler problem in the East because it is dominated by the same sources and types of pollution that we are already dealing with from the standpoint of acid rain, fine particles, and ozone. To put it bluntly, we know how to cost-effectively reduce haze in the East.

The key, as I indicated before, is sulfates. Sulfates formed from sulfur dioxide (SO_2) emissions, primarily from coal-fired power plants, are typically responsible for more than half of the visibility impairment found in our part of the country. We are making an important dent in SO_2 emissions under the Acid Rain Program, but it is becoming clear to us in the Northeast that further reductions will be necessary even after the second phase of the program is implemented. The fact is that very significant quantities of SO_2 —10 to 15 million tons per year—will still be going into the atmosphere at that point, creating continued problems of acid rain, fine particulates, and regional haze throughout the East. The NO_x reductions sought in EPA's 22-State Transport SIP call, while essential for lowering ozone concentrations, will do relatively little for visibility in the East because nitrates are a comparatively small fraction of fine particulate matter in the East. In addition, it is not clear that the new $\text{PM}_{2.5}$ standard will help reduce visibility substantially, since it is likely to apply primarily to urban areas, and not to large sulfur emission sources located in cleaner areas upwind. The good news is that SO_2 emission reductions are one of the best buys in pollution control to be had right now; further substantial SO_2 cuts are not only available, they are quite cost-effective.

In this context, I want to say a couple of words about EPA's proposed regional haze rule. First, the rule represents a good step toward finally taking haze seriously. The fact is that a national goal of no man-made visibility impairment in Class I areas has been on the books for decades, and we have never really done much about it. Nevertheless, the progress targets EPA has proposed are quite modest for the Eastern U.S. If they are followed, it will take longer for many Eastern parts of the country to achieve the Clean Air Act's goal than the United States has existed as a Nation! Since we in the East can make greater visibility improvements more quickly by going after further SO_2 reductions, reduction requirements in the hazier East should reflect more rapid progress (e.g., 2–3 deciviews per decade) than in the clearer West (e.g., 1 deciview per decade).

Alternatively, EPA could implement a visibility improvement target of 10 percent per decade—measured in deciviews—over existing visibility conditions. This target would allow for more rapid improvement in the East, where our visibility impairment approaches 30 deciviews on the haziest days, while automatically providing a less aggressive target in the West, where baseline visibility conditions are considerably cleaner.

Second, while the Northeast States are generally supportive of the haze program, they are feeling the combined burden of multiple regulatory obligations very keenly at this time. Fortunately, there are a few things that Congress and EPA can do to help out. First, give States the flexibility to integrate our efforts on regional haze with our efforts on fine particles, acid rain, and ozone since all these programs tar-

get many of the same pollutants. Second, keep visibility improvement the measure of SIP success, but don't make SIP cycles unnecessarily rapid or burdensome; a 5-year cycle should be adequate. Third, give us the added resources and support we'll need to implement an effective regional haze program. Fourth, develop a Federal presumptive BART (Best Available Retrofit Technology) program at a national or at least OTAG-wide level. This would relieve States of the burden of individual BART assessments and would finally begin to address the problem of "grandfathered" old facilities which have been allowed to continue polluting at rates far in excess of technically feasible, cost-effective emissions control levels. Finally, provide strong Federal leadership where appropriate, as in the case of national control measures such as lower-sulfur fuels.

In closing, I'd like to amplify a bit on the need for Federal leadership. EPA's proposed haze rule puts a lot of emphasis on regional solutions. That's appropriate because haze is a regional problem. But the fact is that Federal leadership is sometimes needed to make regional solutions work. That's proven to be the case in the OTAG context with respect to the long-range transport of ozone and ozone precursors. EPA action has been necessary to ensure that the regional NO_x reductions we need to deal with ozone throughout the East will be realized—and, as we all know—that fight isn't over yet. The Federal Acid Rain program—which is currently doing more to reduce regional haze in the East than any other pollution control program—provides another case in point. In fact, this program may provide the best model for future efforts to address regional haze in the East. The fine particulate matter that makes up regional haze is sufficiently stable in the atmosphere to enable it to be transported over much greater distances than ozone and ozone precursors. In such circumstances, a strong Federal role to facilitate interstate cooperation—and if it becomes necessary, to make culpability assignments—is essential in ensuring that each State's sources do their part in reducing visibility impairment.

Thank you again for the opportunity to share these views. I look forward to answering your questions.

NESCAUM RESOLUTION ON PRODUCTION, TRANSPORT AND EFFECTS OF SECONDARY AIR POLLUTANTS

Whereas the long distance transport of sulfur oxides and the formation of secondary air pollutants have been demonstrated; and

Whereas tall stacks and other dispersion-enhancement techniques increase the effects of such secondary pollutants in areas downwind of their precursor emission sources; and

Whereas adverse health, welfare, economic, and environmental consequences of secondary pollutants have been documented; and

Whereas the Northeastern States are particularly susceptible to the effects of pollutant transport and have been experiencing significant increases in the acidity of precipitation and decreases in visibility; and

Whereas low-visibility, high-sulfate, and high-ozone events occur simultaneously within the same air masses; and

Whereas current projections for fossil fuel consumption point toward an imminent increase in the combustion of coal, one of the major contributors to secondary pollutants; and

Whereas there is a distinct movement by utilities and other fossil fuel consumers to seek relaxations of the existing standards for sulfur in fuels and for particulate emissions because of economic and supply factors;

Now, therefore, NESCAUM urges EPA to take the following actions:

1. Revise its estimates of anticipated fossil fuel consumption and of the concurrent emissions of sulfur oxides and nitrogen oxides.

2. Assess the effects of such emissions in the formation of acid precipitation and of the secondary pollutants; sulfates, nitrates, and photochemical oxidants.

3. Project the health and welfare effects which may be caused by these pollutants.

4. Promulgate improved ambient air particulate standards which reflect the health and welfare effects of the respirable and corrosive fractions of the particulates.

5. Thoroughly examine the effects of relaxations to standards for sulfur in fuels and particulate emissions, particularly on the eastern part of the country.

6. Foster regional consistency by developing short and long range programs calling for fuel quality sufficient to maintain air quality and to prevent economic and social disruptions and inequities.

7. Establish policy, guidance, and procedures to ensure that environmental consequences beyond those that directly affect a national ambient air quality standard

are considered in reviews, evaluations, and decisions involving fossil fuel consumption and other contributors to secondary air pollutants and acid precipitation.

PREPARED STATEMENT OF CHRISTINE L. SHAVER, CHIEF OF THE AIR RESOURCES
DIVISION, NATIONAL PARK SERVICE, DEPARTMENT OF THE INTERIOR

Mr. Chairman and members of the subcommittee, I appreciate the opportunity to appear before you today at this oversight hearing on proposed regulations under Section 169A of the Clean Air Act (CAA).

The National Park Service (NPS) manages 48 of the "Class I" areas that will be affected by the proposed regulation. Under the Clean Air Act, Class I areas are the larger national parks and wilderness areas that were established prior to 1978. As noted by the U.S. Environmental Protection Agency (EPA) in its proposed rule-making, over 10 years ago (November 1985), the Federal Land Manager (FLM) for the Department of the Interior (DOI), the Assistant Secretary for Fish and Wildlife and Parks, stated that all of these Class I areas experience visibility impairment in the form of regional haze virtually all the time, in varying degrees. (See attached Figure 1 for map of all mandatory Class I areas).

There were over 275 million recreational visits to units of the National Park System last year. To put this number of recreational visits in perspective, that is roughly one visit for each member of the U.S. population. The economic impact of park visitation is enormous—the total economic impacts associated with travel-related expenditures is estimated to be \$10–19 billion and between 144,000–276,000 jobs. These numbers only reflect direct and indirect expenditures and employment. They do not reflect the value people—including visitors and non-visitors—place on our national parks and the natural, scenic and cultural resources they contain. Surveys indicate that the ability to see—and see clearly—the spectacular scenery of our parks and wilderness areas is very important to the millions of people who visit these areas. Even people who do not visit our national parks and wilderness areas want these resources to be protected.

Although we have an affirmative responsibility under the Clean Air Act and our own organic legislation to protect the resources and values of these areas, we generally lack the regulatory authority to bring about emission reductions needed to carry out our responsibilities, particularly with respect to pollution sources located outside our boundaries.

Therefore, we applaud EPA's decision to develop regional haze regulations and commend the thoughtful way in which EPA has addressed this very complicated issue in the proposed rule. In general, we believe EPA's proposal provides a good foundation and direction for the development of emissions management programs that will be needed to unveil the spectacularly scenic resources that this nation has had the foresight and wisdom to encompass in our park and wilderness systems as part of our national legacy for present and future generations.

We look forward to working with EPA, as well as the States, Tribal governments, and all interested parties, in the development of reasonable, yet protective programs to make "reasonable progress" toward the Clean Air Act's national goal of remedying any existing, and preventing any future, man-made visibility impairment in Class I areas.

The Department of the Interior submitted formal comments on EPA's proposal in December.

VISIBILITY MONITORING EFFORTS

Since 1978, DOI has conducted visibility monitoring in most of the Class I areas we manage. Our current visibility monitoring program includes the monitoring of fine particulate matter in 36 NPS areas, and the monitoring of light extinction (a measure of visibility impairment) in 18 NPS areas.¹ (See attached Figures 2 and 3 for map of current monitoring sites and visibility conditions). All our monitoring is done in cooperation with the IMPROVE (Interagency Monitoring of Protected Visual Environments) program, and the data are publicly available and routinely reported. Current visibility research efforts include the development and application

¹ Fine particle monitoring consists of two weekly 24-hour samples, which provide: undifferentiated mass; specific elemental, ion (sulfate, nitrate and chloride), and organic and inorganic carbon concentrations; and atmospheric adsorption. Visibility monitoring comprises continuous measurement of impairment of either total atmospheric extinction or the fraction due to scattering.

of analytical methods to identify the airborne particles responsible for visibility impairment, and when possible, determine the source of the particles.

The current NPS program, in conjunction with the other IMPROVE sites, provides the estimates of “current” conditions in many locations necessary for implementation of EPA’s proposed rule. The data can also be used to assess trends over time, since visibility data have been collected at 30 IMPROVE sites for at least nine years. The IMPROVE particulate matter monitors separate the fine particles into their chemical species, including sulfates, nitrates, and organics, thus providing a useful existing database for developing regional haze improvement strategies. The IMPROVE data will also help States with the EPA’s Particulate Matter_{2.5} National Ambient Air Quality Standards.

The implementation of the proposed rule and the new National Ambient Air Quality standard for fine particulate matter will rely on the NPS visibility monitoring network that can monitor both fine particles and extinction in Class I areas.

IMPACT ON VISIBILITY

The Clean Air Act requires EPA to adopt regulations to ensure “reasonable progress” toward the national visibility goal of remedying any existing, and preventing any future, visibility impairment in Federal mandatory Class I areas. EPA’s proposal includes measurable targets and criteria for assessing the effectiveness of the visibility program, but allows States to propose alternative approaches.

First, we support the concept of having a reasonably consistent method for tracking progress toward the national visibility goal. This would not only provide a check on whether current and future emission management programs are having the expected effect on visibility, but also a benchmark that can be used to let the public know whether visibility is getting better or worse.

Based on a preliminary examination of data from 30 IMPROVE monitoring sites,² we predict that all these sites are meeting EPA’s proposed presumptive reasonable progress targets of no degradation for “clean” days (i.e., the best 20 percentile visibility conditions), and over 80 percent of the sites are meeting EPA’s proposed presumptive reasonable progress targets of measured improvement on the “dirty” days (i.e., the worst 20 percentile visibility conditions). This progress is both expected and reassuring, reflecting the progress that has been made nationally in reducing pollution. Far more substantial progress will be needed, however, to remedy the man-made visibility impairment experienced at heavily impacted Class I areas, like Shenandoah National Park and Great Smoky Mountains National Park.

If continuing progress can be assured over the long term from already existing and planned air pollution control programs, then the proposed regional haze regulations will have minimal independent impact. However, there may be areas where existing programs will have diminishing impacts on visibility conditions in the future.³ Given the value we place on our parks and the importance our visitors place on the ability to see the spectacular scenery, these areas will benefit from the kind of “insurance policy” that EPA’s proposal would create.

We have suggested some ways the proposed program could be improved. In order to reduce the administrative burden on States and Federal land managers, the NPS commented to EPA on the rule in support of a regional approach to defining current and “natural” conditions, establishing emission reduction objectives that will ensure reasonable progress toward the national visibility goal, and developing a relatively uniform approach for regularly tracking progress. The State-by-State approach could result in substantial duplication of effort and inconsistencies that might frustrate planning efforts. In particular, some of our Class I areas straddle State boundaries, and all of our Class I areas in the lower 48 United States are affected by interstate transport of pollution. Guidelines might also be helpful to promote consistency across regions.

To ensure that the rate of progress is “reasonable” and to increase our ability to carry out our stewardship responsibilities, we need to consider whether EPA’s suggested “no degradation” approach for the best days is adequate in Class I areas

²The method we used to analyze the data would be acceptable under EPA’s proposal; however, any number of methods would be acceptable (e.g., EPA allows use of a 1-to-9-year period for calculating “baseline”). We understand that others have reached different conclusions using alternative methods for calculating the baseline and trends. This discrepancy suggests the need for a more standardized approach.

³For example, in the West, health-based air quality standards have been met in most urban areas (outside of California, Phoenix and Salt Lake City), and further efforts to reduce pollution may not occur in spite of rapidly growing populations. Therefore, projections suggest a relatively flat progress line for the first part of the next century—2005–2035. Still, visibility impairment plagues our scenic western Class I areas.

where these 20 percent “cleanest” days are now substantially impaired. In addition, the suggested “reasonable progress” target for the most impaired days needs to be closely examined as it would allow 220–330 years to achieve the national visibility goal in those areas, such as Shenandoah and Great Smoky Mountains National Parks, where visibility is currently very degraded. We do not believe this is acceptable to our park visitors. Based on an examination of current trends, we find that the proposed criteria could allow for a slower rate of progress than is actually being achieved in many areas.

We support the use of the “deciview” as a useful metric for expressing and comparing degrees of visibility impairment in a relatively simple way. EPA’s recommended tracking of deciview changes over the long term is the best way to evaluate whether emission management strategies are working. However, one could argue that tracking emissions changes provides a useful supplemental measure for evaluating “reasonable progress”.

POTENTIAL IMPACTS ON NPS RESOURCE MANAGEMENT PROGRAMS

Development of Regional Haze Programs: We generally agree with EPA’s suggestion that regional haze programs be developed on a regional scale with participation from multiple governmental jurisdictions (State, Local, Tribal, as well as EPA and FLMs) and other interested parties. This type of process has been used to address a variety of air quality problems involving interstate transport of pollution (*e.g.*, the Grand Canyon Visibility Transport Commission (GCVTC),⁴ the Southern Appalachian Mountains Initiative (SAMI), and the Ozone Transport Assessment Group.)

These processes have substantial benefits, particularly if consensus can be achieved in a timely manner. Like hundreds of others, the NPS has devoted significant time and resources to, in particular, the GCVTC and SAMI. The suggested regional planning fora would clearly benefit from our participation, because we are the collector and keeper of most of the visibility data, and provide expertise nationally through our visibility research program and policy activities. Were several such stakeholder processes to be initiated, or were State-by-State consultations to intensify, NPS might need to direct more of its available staff and resources to meet these challenges.

Impact on NPS Fire Programs: EPA has proposed to require States to consider, at a minimum, several factors during the development of long-term strategies, including—“smoke management techniques for agricultural and forestry management purposes including such plans as currently exist for these purposes.” As a practical matter, wildland fires cannot be eliminated. While NPS suppresses fire to protect public safety and to prevent unacceptable impacts on property and resources, NPS also uses fire for ecological purposes (many ecosystems are fire-dependent), habitat protection and creation, and safety reasons (to reduce fuel loadings and prevent catastrophic wildfires).

We recognize that the implementation of regional haze programs may affect the Federal Government’s land management activities. With respect to the Department of the Interior, this includes a potential need (1) to develop and maintain a better inventory of fire emissions, (2) to increase visibility monitoring, (3) to prepare more detailed reports, (4) to conduct additional training requirements, and (5) to implement a more vigorous smoke management program or to consider alternatives to burning. The Department of the Interior has already committed to implementing the GCVTC recommendations regarding fire emissions and smoke management—not only within the Colorado Plateau, but nationally. We are also participating in EPA’s Wildland Fires Issues Group, which is developing a national policy on how best to improve the quality of wildland ecosystems and to reduce threats of catastrophic fires through increased use of planned or managed fire, while achieving national clean air goals. Among other things, this group is examining a variety of emission reduction techniques that land managers can use to reduce smoke impacts from managed fires to the maximum extent possible.

In implementing the visibility protection requirements of the Clean Air Act, we encourage EPA, regions, and States to include all fire users (Federal, State, or other publicly-owned or managed wildlands, Indian lands, and privately-owned agricultural and other lands) in the smoke management provisions of the long-term strategy.

⁴The implementation of the GCVTC recommendations is the focus of the recently established Western Regional Air Partnership, initiated and organized by the GCVTC in cooperation with the Western Governors’ Association and National Tribal Environmental Council.

THE GRAND CANYON VISIBILITY TRANSPORT COMMISSION RECOMMENDATIONS

DOI was actively involved in the GCVTC process, devoting significant time and resources to help forge the consensus that emerged. We support the “reasonable progress” objectives adopted by the GCVTC (“achieving continuous emissions reductions necessary to reduce existing impairment and attain steady improvement of visibility and managing emissions growth so as to prevent perceptible degradation of clean air days.”). We believe the “reasonable progress” targets and metrics proposed by EPA are consistent with the GCVTC recommendations.

Like the States, Tribes, and other stakeholders who devoted similar resources to the GCVTC process, we do not want those efforts to be diminished or dismissed. We believe that EPA has made it clear in its proposal that the States included in the GCVTC are welcome and encouraged to submit SIP revisions that incorporate actions consistent with the GCVTC recommendations.

Before deciding whether the GCVTC participants should be given carte blanche to proceed, however, it is important to remember that the recommendations—while comprehensive and far-reaching—are just that: recommendations. The GCVTC report specifically highlighted that some recommendations were presented as options, some as things to be studied or further fleshed out, and some as actions to be implemented.

We encourage EPA to embrace the GCVTC recommendations, but to provide some incentive for the States and Tribes to proceed expeditiously with ongoing efforts to turn the recommendations into enforceable actions. One approach EPA might take would be to incorporate into the EPA final rule an “action plan,” based on the GCVTC recommendations, that would hold the States and Tribes accountable for the activities and actions they agreed to pursue and for the “continuous emissions reductions” they committed to produce. This could take the form of an enforceable schedule, with specific milestones, work products, decision points, and expected “reasonable progress” outcomes.

This concludes my prepared testimony. I would be pleased to respond to any questions you might have.

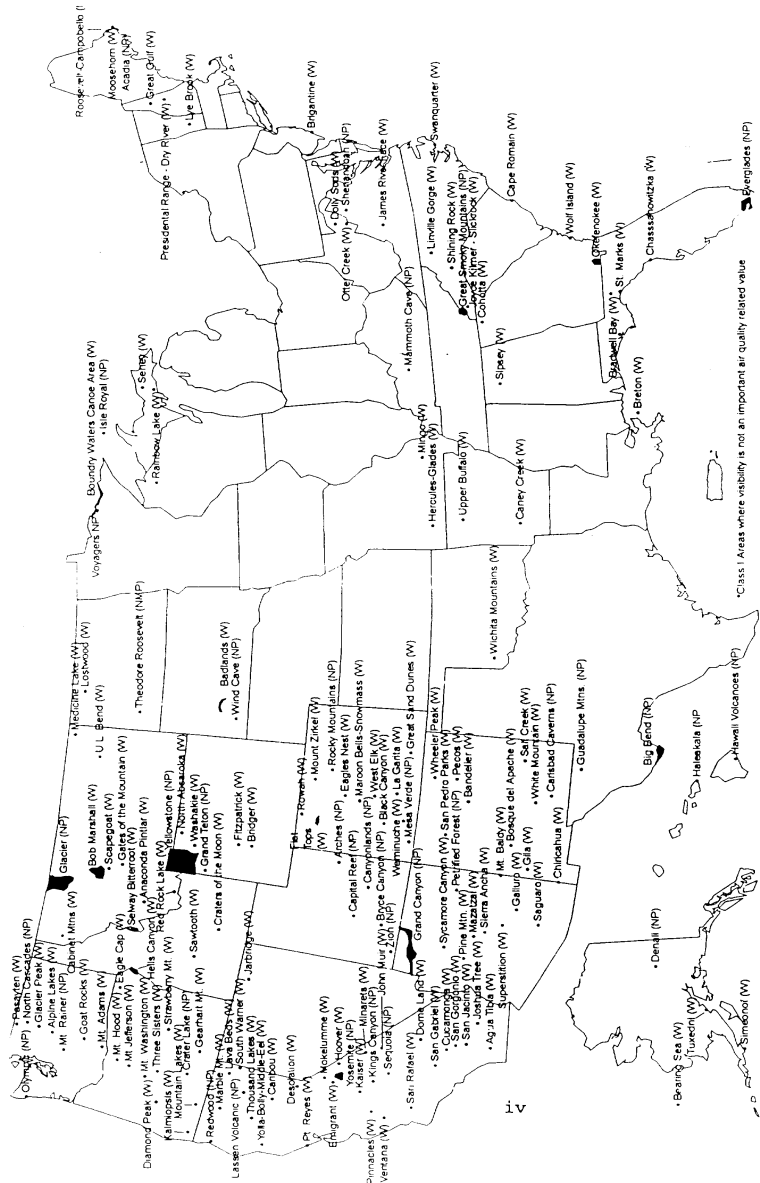
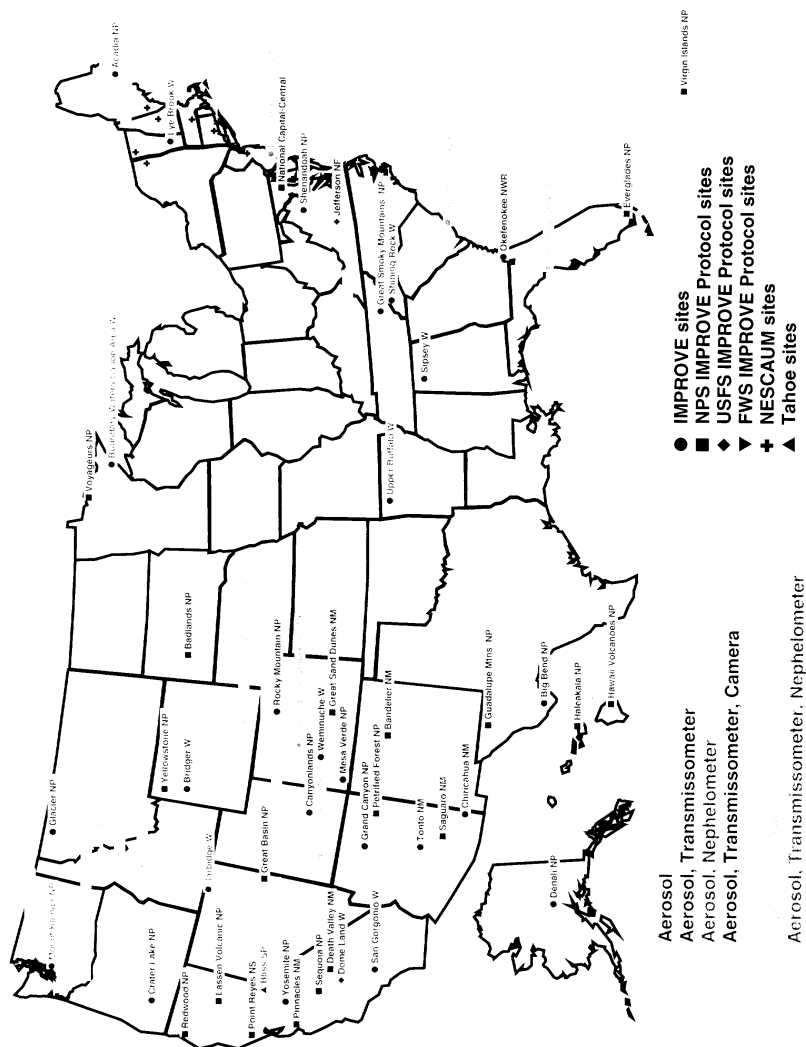


Figure 1 Map of Mandatory Federal Class I Areas



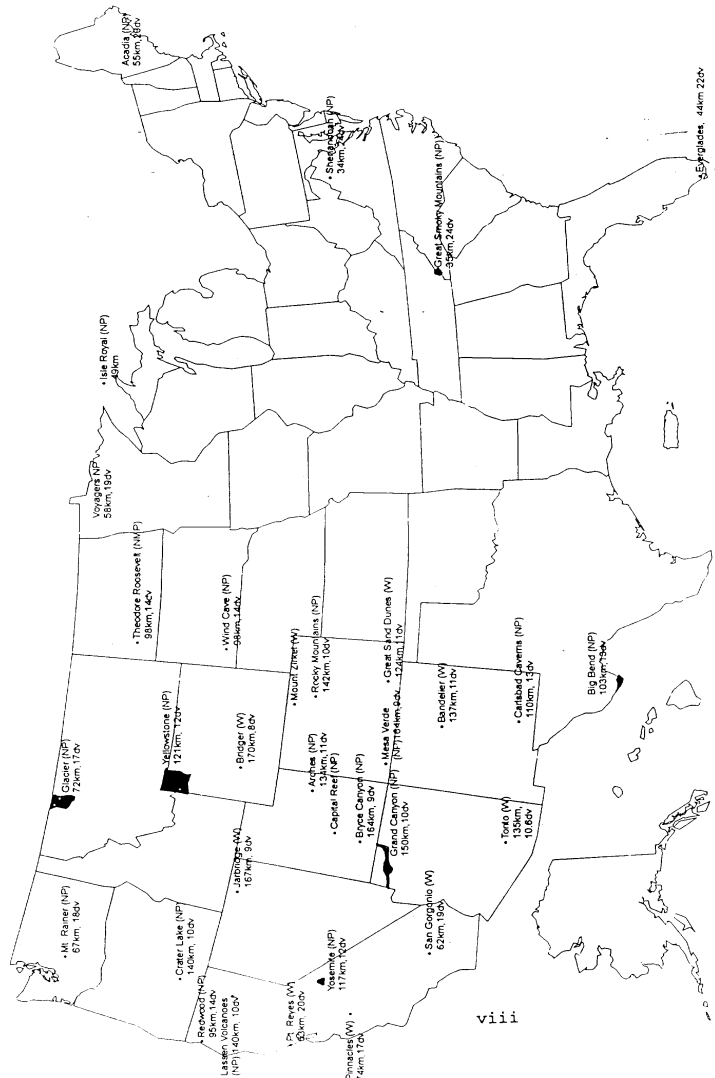


Figure 3 Average Visibility Conditions from Monitored Aerosol Data

- Average Standard Visual Range in kilometers. Haziness Index in Decidew
- Source: IMPROVE report, "Spatial and Temporal Patterns and Chemical Composition of Haze in the United States, February, 1993"

PREPARED STATEMENT OF LYNN M. TERRY, DEPUTY EXECUTIVE OFFICER, AIR
RESOURCES BOARD, CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

Thank you for the opportunity to provide testimony regarding the U.S. Environmental Protection Agency's (U.S. EPA's) proposal for new regional haze regulations to improve visibility in Class I national parks and wilderness areas.

California is home to some of the most beautiful scenery and vistas in the world. As a result, one-fifth of the areas affected by the proposed visibility regulations are in California, spanning the State from Redwoods National Park on the North Coast to Joshua Tree in the Southern Desert.

In California, the Air Resources Board (ARB) is charged with overseeing the State's implementation of the Federal Clean Air Act, as well as our own California Clean Air Act. ARB is committed to protecting and improving visibility in both our scenic wild areas and our urban landscapes, in concert with our efforts to meet health-based air quality standards.

While we support efforts to improve visibility, we strongly oppose the regulatory framework as outlined in U.S. EPA's December 1997 proposed regional haze regulation.

Visibility improvement programs must gain public support to succeed. To garner this support, the regulatory framework must be sensible, scientifically sound, and complement efforts to meet health-based standards. In our evaluation, the proposed regional haze regulation fails to meet these criteria.

Today, I would like to highlight some of our concerns and identify four key recommendations which need to be implemented in the final regulation to allow States to build successful visibility programs at the lowest cost.

First, the most critical issue—drop the deciview approach as the test for visibility progress and replace it with steady reductions in emissions of pollutants shown to contribute to regional haze.

As part of the Grand Canyon Visibility Transport Commission, California and 7 other Western States, 5 tribes, and 6 Federal entities wrestled with the question—what is reasonable progress? The Commission ultimately defined reasonable progress as “continuous emission reductions . . .,” parallel to the Clean Air Act's approach for progress towards the health-based air quality standards.

Although the proposed regulation purports to offer States the flexibility to choose an appropriate progress target, States must demonstrate to the satisfaction of U.S. EPA that even obvious alternatives are justified. California knows all too well how difficult and how expensive it can be to pursue U.S. EPA approval for alternatives to federally-prescribed approaches, no matter how innovative or effective those alternatives may be.

In California, regional haze, fine particulate matter, and ozone share some common components. So, our existing and planned air quality programs to address ozone pollution will also cut particulate levels and improve visibility throughout the State and beyond. California, and other States in similar situations, should be able to satisfy reasonable progress for haze by reducing emissions to meet the progress requirements for the health-based standards, until those standards are attained.

The deciview metric is too subjective to be the basis for holding States accountable for visibility improvement. The technical tools necessary for translating emissions into increments of visibility improvement are not available.

Congress created the Grand Canyon Visibility Transport Commission to advise U.S. EPA on strategies for improving visibility at national parks and wilderness areas on the Colorado Plateau. The Commission process resulted in the conclusion that emission reductions are the appropriate progress target for visibility. U.S. EPA should not ignore this conclusion.

Second, change the timing for planning and implementation of the regional haze program to parallel and complement the schedule for fine particles.

The timelines in the proposed regulation would preclude a thoughtful, efficient approach to visibility improvement. Most of the extensive technical work needed for fine particles is also critical to support visibility planning. The schedule should allow States to integrate these efforts to capitalize on the overlap between the sources of fine particles and haze.

Third, provide new funding to support State, local, and tribal efforts to meet Federal requirements for regional haze.

Visibility plans will be extremely resource-intensive, with monitoring, inventory, modeling, technology assessment, control measure development, public review, and Agency adoption and implementation. States, tribes and local agencies should not be asked to divert funds from existing programs focused on meeting health-based air quality standards to instead implement the regional haze program.

Finally, ensure that Federal agencies are full partners in visibility solutions.

National emission standards for sources under Federal control are key to meeting all of our air quality goals. While we are encouraged by the Federal Government's actions to require lower-emitting heavy-duty diesel engines in trucks, off-road equipment, and locomotives, a more proactive Federal approach is needed to make progress on cleaner engines for ships and aircraft.

We also need improved coordination between Federal land managers and air agencies to accommodate increased burning for public safety and forest health, without “smoking out” downwind communities. California intends to continue to improve the State's smoke management programs to address both visibility and public health concerns. Federal land managers must be a partner in that process.

CONCLUSION

U.S. EPA has an opportunity to create a sound framework that will support visibility improvement through the next century; but the structure must be rebuilt to

ensure common-sense implementation that is integrated with existing air quality programs. We appreciate this opportunity to share our recommendations to achieve that goal.

California will continue to implement the State's clean air plan for achieving health-based air quality standards and incorporate additional strategies to meet the new ozone and fine particulate standards. These efforts will improve visibility as well. We all want to restore and preserve the scenic vistas in our Nation's most beautiful places for future generations to enjoy.

PREPARED STATEMENT OF RANDOLPH WOOD, DIRECTOR, NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY

Mr. Chairman, members of the subcommittee on Clean Air, Wetlands, Private Property, and Nuclear Safety, I am Randolph Wood, Director of the Nebraska Department of Environmental Quality. In that position, I am responsible for the administration and enforcement of all of the environmental programs within the State of Nebraska.

I appreciate the opportunity to provide comments to this illustrious committee as you review EPA's activities and the proposal for regulations on "regional haze".

EPA's proposed regulations on "regional haze" have created as much consternation for us as any set of regulations in my memory. This consternation is not because we do not believe in the concept of protection of visibility in important places such as our Class I national parks and wilderness areas. It's not because we are insensitive or that we don't understand the technical basis for the "regional" approach, and it's not because we fail to grasp the nexus between sources of emission and the impact of those emissions. It's also not because we are not sympathetic with the responsibility of the Environmental Protection Agency in fulfilling their obligations, specifically those that are established by Congress as "non-discretionary". We, too, have obligations under State statutory provisions that we must meet.

As we have reviewed EPA's proposal over the past 8 months, we have identified a number of significant technical concerns within the proposal. But we have also come to the conclusion that it appears to us that EPA made a policy decision and then asked for technical justification for that policy decision.

We all understand the difficulty that one State has in dealing with an air quality problem if some portion of the cause of that problem originates in an "up-wind" State. A most recent example of the recognition of this issue is the ozone transport assessment group (OTAG) process in the Eastern States. While some will question the use of the specific results in the development of implementation plans, few would argue that this has not been the most technically sound and rigorous analysis of long-range and interstate transport of pollutants ever conducted. That process produced the most widely accepted cause and effect relationship that has been developed to date.

Contrast that to the technical analysis and cause and effect relationship upon which EPA is basing its proposal for the "regional haze" regulations. While I cannot and do not intend to argue the basis for all of the relationships developed within the technical documents used by EPA to support its proposal, Nebraska has serious concerns with the technical basis for this proposal as it applies to our State. I believe that I can provide a couple of examples to demonstrate that this technical analysis cannot and should not be used to impose a requirement for SIP development on Nebraska.

First, while I know that most of you may have some familiarity with Nebraska, it is important to provide some demographic details for you in order to provide a background for the following comments. Nebraska is and personifies the Midwest. In fact, some have described us as the transition between the Eastern States and the square States, i.e., those west of us. The land form of Nebraska could be described as a tilted table top that rises from the eastern border on the Missouri River with an elevation of approximately 1,000 feet above sea level to the western border that abuts Colorado and Wyoming at elevations of some 5,000 feet at the highest point. There is a significant series of rivers that flow eastward across Nebraska ultimately draining into the Missouri River. Nebraska covers approximately 77,000 square miles with a population of approximately 1.6 million people. Two-thirds of the population reside in the eastern one-third of the State. Nebraska is a leading agricultural production State with corn, soy bean, sorghum, and other crops of national significance along with cattle, swine, and poultry production of very significant levels. Nebraska has never been a "smokestack industry" State even though we have significant industrial activity spread throughout the State. Nebraska has 93 counties with Cherry County, the largest, at 5,961 sq. miles rivaling the area

of some Eastern States. These are important factors, not just as a geography lesson but because they help us analyze and critique EPA's technical analysis of Nebraska's impact on "regional haze".

Section 169A(b) requires EPA to adopt regulations to implement the visibility protection provisions for Federal Class I areas and specifically requires that "each applicable implementation plan for a State in which any area listed by the Administrator under subsection (a)(2) is located (or for a State the emissions from which may reasonably be anticipated to cause or contribute to any impairment of visibility in such area) to contain such emission limits, schedules of compliance and other measures as may be necessary to make reasonable progress towards meeting the national goal specified in subsection (a). . . ."

Quite clearly, it is incumbent upon EPA to conclude that there is a reasonable anticipation that emissions from a State cause or contribute to any impairment of visibility in a Class I area as a prerequisite for the determination that an implementation plan for that State is required. It is with the issue of "may reasonably be anticipated" that causes us great concern. As I noted previously, most people recognize that the technical basis for the OTAG conclusions was the most rigorous and most critically conducted ongoing peer review process of any air pollution cause and effect analysis conducted to date. That level of rigor creates confidence in the regulated community; it creates confidence in the regulatory community, and it creates confidence with the general public. While we do not argue even in the slightest that "regional haze" does not occur, we must argue very strongly that EPA's analysis as it relates to Nebraska and probably a number of other rural States is significantly deficient in its rigor. As such, it falls significantly short of what is necessary in order for EPA to reach a "may reasonably be anticipated" conclusion.

The following two examples demonstrate that EPA's technical analysis is insufficient to draw a conclusion that a SIP is required from Nebraska:

As I indicated earlier, much of Nebraska is rural agricultural country with a low population density. Along with the low population density the number of vehicle miles traveled in these rural counties is low as is the number of road miles. As a result, most of us who have been around the air pollution control scene for a number of years would not expect a large potential for air pollution emissions from travel related activities in these rural counties. For instance, Cherry County that I've already mentioned has an area of 5,961 square miles with a population of 6,307 persons (slightly more than 1 person per square mile) with 1,808 road miles. The neighboring county, Sheridan County, is slightly less than half that size at 2,543 sq. miles with a slightly larger population of 6,750, but with 1,504 road miles. These two counties can certainly not be described as bustling metropolises from which you would expect significant automobile and travel-related emissions. They are also not industrial complexes and in fact are not listed as having any point source emissions that affect visibility or create regional haze". Rather, they are primarily livestock ranching counties where the grass is the major product and the livestock are simply used to harvest that grass. However, Sheridan County is calculated in EPA's technical document as contributing 2.2 percent to the regional haze indicator in the badlands wilderness area and national park in South Dakota. At the same time, Campbell County, Wyoming, which is the largest single coal-producing area in the world with a potential to produce more than 300 million tons of coal a year is listed in this analysis as contributing only 3.21 percent of the regional haze parameter in the badlands wilderness area and national park. While Cherry County is listed as a 2.22 percent contributor, Sheridan County is listed as a 1.79 percent contributor. I would submit to the committee that this comparison alone provides ample reason for EPA to conclude that its technical analysis is flawed and therefore, that it should withdraw its proposed regulations until it can conduct a more justifiable analysis. EPA's contractor recognized that there were problems with some of their modeling results when they stated that "modeled primary PM_{2.5} concentrations range from as low as 1 microgram per cubic meter in much of the West to 13 to 107 micrograms per cubic meter in urban areas and even in non-urban States like Oklahoma. The latter modeled concentrations are definitely not in line with measurements. It appears that fugitive dust emissions may be overestimated by as much as an order of magnitude. Similar overestimates are also made for primary PM₁₀."

If States are to be required to prepare State Implementation Plans, the basis for that requirement should certainly be something better than an accuracy of "an order of magnitude". In trying to understand the basis for the Cherry County and Sheridan County contributions at the Badlands Wilderness Area and National Park, we were advised that the total road dust emissions for the State

of Nebraska were apportioned to the individual counties based upon the percentage of that county's area to the State area of 77,000 square miles. Thus, even though the Sheridan County population is only .398 percent of the population, because it has 7.75 percent of the land area in the State, the road dust emissions assigned to Cherry County was 7.75 percent of the State total, or about 19 times what the level would be if the travel emissions were apportioned on the basis of population.

Sheridan County suffers from the same kind of comparison. At 2,543 sq. miles it represents 3.19 percent of the total land area and its population of 6,750 represents .426 percent of the population, thus the road dust emissions for Sheridan County are calculated as 3.19 percent of the State total or about 8 times what would be calculated if the apportionment was based upon population. Quite clearly, this kind of analysis does not incorporate the kind of rigor that should be required in order to determine that Nebraska may reasonably be anticipated to contribute to visibility impairment in the badlands wilderness area or national park in South Dakota.

The second example that highlights the problem of an inadequate technical analysis involves two other counties in Nebraska and the projection that the emissions from these two counties cause an impairment in visibility in the Voyageurs National Park on the Canadian-United States border in Minnesota. Once again, the two counties implicated by the technical analysis are rural counties that are agricultural in nature. Cuming and Cedar Counties are located in the extreme northeast portion of Nebraska with the northern border of cedar county defined by the Missouri River. Keep in mind, that these two counties in north-eastern Nebraska are some 750 miles (1250 km) south/southwest of the Voyageur Wilderness Area in Minnesota. While Cherry and Sheridan Counties are primarily characterized as grazing land, Cedar and Cuming Counties would be characterized primarily as agricultural cropland with a significant grazing land component. Corn and other grains are the primary crops with beef and swine the primary non-crop agricultural products. As with Sheridan and Cherry Counties, Cuming and Cedar Counties are not bastions of industrial production. This is not a "smokestack industry" area; the emissions, whatever they might be, are ground level emissions associated with agricultural production and people activity. Cuming County is 575 square miles in size with a population of 10,117 while Cedar County has a population of 10,131 in 740 sq. miles. While we in Nebraska know Cuming and Cedar Counties as being industrious agricultural production areas, they are known to the EPA as those two Nebraska counties that are "reasonably anticipated" to cause impairment of visibility in the Voyageur Wilderness Area in Minnesota. EPA's modeling analysis indicates that Cuming County contributes .23 percent of the regional haze indicator in Voyageur National Park while Cedar County contributes .199 percent.

While someone might be able to convince me that this analysis is sufficient to provide a basis for EPA to require Nebraska to develop a SIP, at this point in time it simply defies all logic.

Having pointed to two examples in Nebraska that should certainly call into question the technical analysis on which EPA bases its proposed regulation, it is also of interest to look at the two Class I areas in these examples to ask a more basic question. That is, what do we know about the visibility impairment in these two areas and what do all of these numbers mean? With respect to the Badlands Wilderness Area National Park in South Dakota, we understand that the Environmental Protection Agency under a Federal implementation plan has gathered some data but has not provided an analysis of that data. In fact, we understand that a contractor is currently performing that analysis and expects to issue a report near the end of July. What that tells me is, we don't really know whether there is a visibility problem in that mandatory Class I area or not, but Nebraska under EPA's proposed regulation will be required to develop an implementation plan to address that impairment.

Our inquiries about visibility data gathering in the Voyageur National Park in order to characterize actual visibility there has been unrevealing. We are not aware of any data that has been gathered. In fact, the actual technical reports present the modeling data and EPA has used this to make its proposed decision. In attempting to compare the modeling data with actual monitoring data, we are advised that the source attribution tables in the report were not meant to correlate with real numbers monitored in the Class I areas. Recent improved data—in the 30 sites that exist in Class I areas in the country—does show that the modeled total PM data in the report is frequently several times higher than the monitoring data.

On the other hand, EPA's mathematical (not monitored) analysis calculates that there is a level of visibility-impairing pollution in the Badlands Wilderness Area National Park in South Dakota of 2.155 micrograms per cubic meter. The calculated value for the Voyageurs National Park in Minnesota is 1.642 micrograms per cubic meter. These calculations are based upon a theoretical mathematical model. While this model may well have been compared to actual data gathered through analytical sampling processes, I would certainly question the precision that is inferred by the calculation of an impact down to 1/1000th of a microgram per cubic meter.

Using the data presented, Cherry County, Nebraska is calculated to contribute .047 micrograms per cubic meter of visibility-impairing pollution in the badlands wilderness area. In the monitoring program protocol, this number would be rounded to zero. The corresponding calculation for the impact of Cuming County, Nebraska in the Voyageur wilderness area attributes .0033 micrograms per cubic meter to the total of 1.642 micrograms per cubic meter in Voyageurs National Park in Minnesota. This is certainly not a compelling case upon which to base a conclusion that the State of Nebraska reasonably attributes to visibility impairment in Voyageurs National Park.

Developing implementation plans is a process that is extremely resource intensive. With respect to visibility-based implementation plans under EPA's proposed regulations, this would be an even more resource intensive process given EPA's expectation that States would form regional commissions or regional groups to develop regional plans. Even the development of an in-State implementation plan is a decision that is not made lightly. We are currently trying to address requirements for PM_{2.5} and ozone as well as phase II of the acid rain program. All of these activities could well be thought of as surrogates to solve whatever visibility impairment problem that is caused by emissions from the State of Nebraska. We do not have unused resources waiting to be applied to the development of a visibility SIP called for in EPA's proposal. Additionally, we are not aware of any additional Federal resources that EPA is going to provide to us for the development of such a SIP. Therefore, resources that will have to be applied to the development of a visibility SIP will have to come off the top from something else that we are doing. I can not over-emphasize the point that decisions to require the development of SIP is one that should not be taken lightly.

As we have discussed our concerns with EPA, EPA has responded to us by saying that States could argue in the initial SIP submittal that their contribution was so small as to make further measures unreasonable. I would submit to you that if EPA can approve a "do nothing" strategy based upon a minimal impact contribution in a SIP demonstration, the same approach should and ought to be used to determine whether or not a State needs to submit a SIP revision at all. I am baffled by the rationale here that requires us to utilize scarce resources to develop an answer that says we don't have to do anything. This is analogous to EPA's saying "we find you guilty, but we will now parole you because there was no basis for the guilty verdict; but by the way, you still have to develop the SIP and you have to have a process of revising that SIP every three years".

A more rigorous and technically sound rational requirement for imposing these provisions on a State should be required.

Let me conclude by dispelling any notion that Nebraska is uncaring about the importance of visibility as an attribute with a value unto itself. The public unquestionably values the ability to enjoy and admire the beauty of our precious class I areas. We would not support a policy of neglect. In fact, we in Nebraska have beautiful scenes and vistas in our State that are as important to us even though they are not class I areas. We respect the concerns of South Dakota and Minnesota just as we know they respect ours.

Again, I appreciate the opportunity to be able to provide this testimony to you. I would be very pleased to answer any questions that you may have. Thank you.

CLEARING THE AIR ON "REGIONAL HAZE"

(By Tom Alley, Michigan State Representative)

Keeping the environment clean and protecting our natural resources is one of government's most important responsibilities.

But that doesn't mean that every proposed environmental regulation is a good idea. And we should be especially wary if it is coming out of the EPA bureaucracy in Washington, DC. After all, this is an Agency with a history of overestimating the benefits and underestimating the costs of its usual one-size-fits-all regulations.

On July 31, 1997, EPA issued a proposed regulation to address "regional haze." The purpose of the regulation is to improve visibility in 156 national parks and wilderness areas (referred to as "Class I" areas in the Clean Air Act) in 35 States plus the Virgin Islands. Regional haze impairs visibility and is caused by both natural sources and man-made air pollution. Long-range transport of fine particles to regional haze. Visibility varies among Class I areas, but is generally better in the west than in the east.

The goal of the proposed regulation is to achieve "natural background" levels of visibility in Class I areas (visibility that is not affected by man-made air pollution). The proposed regulation establishes a target—one "deciview" improvement per decade to be achieved in each Class I area until natural background visibility levels are reached. One deciview equates to an approximate 10 percent decrease in airborne particulate concentrations. Several decades of emission reductions will be required to reach natural background levels in Class I areas.

The proposed regulation requires all States to control fine particles, as does the New Ambient Air Quality Standard for tiny particles (known as NAAQS or the PM_{2.5} standard), which were designed to improve health conditions. Not only would the proposed regional haze regulations overlap NAAQS, but would be on a faster schedule (two years earlier) in some areas, affect more areas of the country, and require more drastic emission reductions to reach "background levels."

Under the regulation, distant sources may be subject to emission controls. Presently, it is uncertain how many miles away sources will be regulated, but it could be hundreds of miles from Class I areas. The exact distance will be based on analyses by the States and EPA.

According to EPA's calculations, the benefits of achieving the first one deciview improvement exceed its costs. However, two-thirds of the benefits come from assumed health improvements, even though the purpose of the rule is not to improve public health. EPA has not analyzed the costs and benefits of just attaining natural background visibility levels.

States will be charged with developing new plans (and revising them every three years) to implement the regional haze program at the same time many are faced with developing plans to implement the new standards for ozone and PM_{2.5}. This is on top of the rulemaking that will come from the recommendations of EPA's Ozone Transport Assessment Group.

A third of the States have questioned the need for a regional haze program because of Clean Air Act requirements, in particular the Clean Air Act Amendments of 1990, that will continue to improve air quality and visibility in many Class I areas without a new program. Forty-three of 44 States, along with business groups, have submitted comments on the regional haze program calling for significant changes to make the program flexible, less burdensome and scientifically sound.

While the EPA has met with a handful of Western States to hear their concerns, much more input is needed from the other States that could be severely affected.

It is very important that other States seek the opportunity to meet with the EPA this month.

This is an extremely important issue that will have broad environmental, social and economic ramifications. I strongly encourage all legislators and other interested parties to contact their Governors, or State departments of environmental quality, to determine your State's policy on regional haze as well as to obtain information on how you can have input into this process.

We all need to work diligently to make sure the final product is in the best interests of each of our States and our nation as a whole.

PREPARED STATEMENT OF DR. T. PETER RUANE, PRESIDENT AND CEO, AMERICAN
ROAD AND TRANSPORTATION BUILDERS ASSOCIATION

EXECUTIVE SUMMARY

Good morning, Mr. Chairman. I am T. Peter Ruane, President and CEO of the American Road and Transportation Builders Association (ARTBA). ARTBA represents 4,000 member organizations in the Nation's transportation construction industry, including construction contractors, professional engineering firms, heavy equipment manufacturers, and materials suppliers. Our member companies employ more than 500,000 people in the transportation construction industry in the United States. I am pleased to provide this statement addressing our concerns about the Environmental Protection Agency's July 3, 1997 proposed regional haze regulation.

ARTBA studies indicate that the regional haze regulation could have an adverse economic impact even greater than a July 18, 1997 EPA rule setting national air

quality standards for ozone and particulate matter. That rule, which gained headlines throughout the Nation, is widely projected to be the most expensive environmental regulation in history.

The proposed regional haze regulation, if adopted as proposed, would have a major detrimental impact on public health and the economy in terms of highway safety, loss of jobs in the transportation construction industry, and decreased mobility. Such impacts are expected to occur primarily because of interactions of the proposed regulation with existing air quality enforcement mechanisms contained in the 1990 Clean Air Act Amendments and the 1991 Intermodal Surface Transportation Efficiency Act.

Under existing law, States are required to develop State Implementation Plans (SIPs) delineating the actions they will undertake to bring all areas of the country into compliance with national air quality standards. Failure to achieve approval by EPA of SIPs by specified deadlines can result in the loss of Federal highway funding. In addition, Metropolitan Planning Organizations (MPOs) are prohibited from approving any transportation plan, program or project that does not conform to the applicable SIP and prohibits the Federal Government from supporting or approving any activity that does not conform to the SIP.

The proposed regional haze rule would substantially increase the difficulty States face in gaining SIP approval from EPA. Even where this can be accomplished, difficulties in demonstrating the conformity of transportation plans, programs and projects with approved SIPs would be increased greatly.

The bottom line for our industry is that the proposed regional haze rule, in conjunction with the highway funding sanction authorities and MPO approval requirements of the CAAA and ISTEA, poses a tremendous threat to the transportation construction industry throughout the Nation, endangering tens of thousands of jobs, creating major new constraints to mobility, and putting the safety of millions of highway users in greater jeopardy.

Having said that, I also would like to point out that EPA has ignored several aspects of its legal responsibilities under the Small Business Regulatory Enforcement Fairness Act (SBREFA) in issuing the proposed rule. EPA is attempting to avoid its responsibilities by arguing that the rule, if promulgated as proposed, would not have a significant impact on small companies. That is despite the fact that, according to EPA's own estimates, annual costs of the rule could reach \$2.7 billion annually, not including the impacts to the transportation construction industry that have been estimated by ARTBA to reach an additional \$15 billion per year.

In light of the huge economic impact the rule will have on the economy and the complete certainty that States would have no options available to them that do not heavily impact small entities, EPA's position is patently ridiculous. Instead of constituting an arguable position, it is a complete abdication of its statutory responsibilities under the Regulatory Flexibility Act and SBREFA.

INTRODUCTION

According to ARTBA's analyses, close to 90 percent of the counties in the United States are within a 250-mile radius of the 156 mandatory Federal Class I areas. Because the proposed rule has the potential of affecting so many areas of the country and because it includes an extremely ambitious schedule for compliance, it could have an economic impact greater than could the National Ambient Air Quality Standards for ozone and particulate matter that were promulgated on July 18, 1997. When one considers the fact that the ozone and PM NAAQS rules were projected to be the most expensive in history when implemented, and the fact that the proposed regional haze regulations are not intended to protect human health, the wisdom of this proposal immediately becomes suspect.

While we have a number of concerns about the proposed rule that are specific to the transportation construction industry, our primary concern is about the impacts the rule will have on public safety, transportation networks (public mobility), jobs and economic growth from increased applications of highway funding sanctions and the increased difficulty of Metropolitan Planning Organizations in demonstrating transportation conformity. Therefore, we will address that concern first, followed by an explanation of related concerns.

HIGHWAY FUNDING SANCTION AND TRANSPORTATION CONFORMITY IMPLICATIONS OF THE PROPOSED REGULATIONS

The 1991 Intermodal Surface Transportation Efficiency Act (ISTEA), combined with the Clean Air Act Amendments (CAAA) of 1990, injected major new environmental constraints into the transportation policy of the United States. Under the CAAA, States are required to develop State Implementation Plans (SIPs) delineat-

ing the actions they will undertake to bring all areas of the country into compliance with the National Ambient Air Quality Standards.

Failure to achieve approval by EPA of SIPs by specified deadlines can result in the loss of Federal highway funding, which today represents 55 percent of all public investment in highway improvements. Highway funding sanctions also can be applied by EPA for failure of States to comply with other requirements of the CAAA, such as those under Title V. In addition, the CAAA prohibits Metropolitan Planning Organizations (MPOs) from approving any transportation plan, program or project that does not conform to the applicable SIP and prohibits the Federal Government from supporting or approving any activity that does not conform to the SIP.

The proposed regional haze regulation, if promulgated in final form as proposed, would impose major new requirements on State and local governmental entities by establishing new presumptive reasonable progress targets, requirements for modified State Implementation Plans (SIP) and subsequent SIP revisions every three years thereafter, requirements for periodic demonstrations of reasonable progress by States, expansion of current monitoring networks, and the development of new strategies to reduce emissions of visibility impairing pollutants, particularly fine particles. Furthermore, in imposing these new requirements, EPA proposes to overlay an entirely new air quality metric, the "deciview," over all existing air quality metrics.

Each of these new requirements almost certainly will make it much more difficult for States to develop approvable SIPs by the specified dates. Even where this can be accomplished, the difficulty of demonstrating the conformity of transportation plans, programs and projects with approved SIPs will be increased dramatically. Thus, the proposed regional haze rule, in conjunction with the highway funding sanction authorities and MPO approval requirements of the CAAA and ISTEA, poses a tremendous threat to the transportation construction industry throughout the Nation, endangering tens of thousands of jobs, creating major new constraints to mobility, and putting the safety of millions of highway users in greater jeopardy.

THREATS TO TRANSPORTATION CONSTRUCTION INDUSTRY AND HIGHWAY SAFETY

EPA's regional haze regulation threatens not only the livelihoods of our member companies and their employees' jobs, but also the safety and physical conditions of our roads and bridges. The Federal Highway Administration, for example, reports that 12,000 highway fatalities each year are related to poor road and bridge conditions. Since the proposed rule is designed to protect and enhance visibility at national parks and wilderness areas, and not to protect human health, it is essential that EPA determine with clarity the number of additional lives that may be lost due to disinvestment in highway and bridge safety features resulting from promulgation of the proposed regulation and take such impacts into consideration in its decision making process, a consideration that is completely missing in the proposed rule and supporting Regulatory Impact Analysis.

The proposed rule would require States to submit visibility SIP revisions for regional haze within 12 months of issuance of the final regional haze rule, requires SIP revisions four years later, then every three years thereafter. Each such revision is to contain "such emission limits, schedules of compliance, and other measures as necessary" to carry out the regulations. Because of the immediacy and continuing nature of the rule, impacts on highway safety, the economy and jobs will be felt very quickly and continue into the indefinite future.

NEED FOR MORE IMPACT INFORMATION

Because of these facts, we believe that it is imperative for EPA to calculate and provide to the public information quantifying the potential impact on the transportation construction industry and the traveling public from highway funding sanctions that could result from the proposed regional haze regulations. This information should be provided on a geographical basis, disaggregated to the State and county levels. In addition, EPA should provide the results of a quantitative analysis of the impacts that their proposals will have on the ability of MPOs to approve transportation plans, programs and projects throughout the Nation.

We believe that these analyses are required by Executive Order 12866, which states that "in deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating." Unfortunately, all EPA offers in terms of EO 12866 compliance is the statement that "there are an unusually large number of limitations and uncertainties associated with the analyses and resulting cost impacts and benefit estimates." Without better information, it is impossible to evaluate intelligently the impacts of the proposals.

APPLICATION OF SBREFA

Closely related to EPA's neglect of its requirements under EO 12866 is the Agency's apparent complete delinquency regarding the requirements of Small Business Regulatory Enforcement Fairness Act (SBREFA). As an organization that was intensively involved with the creation and passage of SBREFA, we are extremely concerned about EPA's interpretation of the applicability of the provisions of that Act to this rulemaking.

Under SBREFA, the test of whether or not a Regulatory Flexibility Analysis must be performed is whether or not the rule will have a "significant economic impact on a substantial number of small entities." This test is not limited to small entities that are affected directly by the rule, but also small entities who are impacted by the rule. In addition, the Regulatory Flexibility Analysis requires a "description of the steps the Agency has taken to minimize the significant economic impact on small entities."

According to the July 31, 1997 Federal Register notice containing the proposed rule, EPA has determined that the rule, if promulgated as proposed, will not have a significant impact on a substantial number of small entities. That is despite the fact that, according to EPA's own estimates, annual costs of the rule could reach \$2,700,000,000 annually, apparently not including the impacts to the transportation construction industry mentioned above. We believe that such excluded costs could reach an additional \$15,000,000,000 per year and impact up to 22,000 jobs. (These costs were derived in an ARTBA study of the impacts of the recent ozone and PM NAAQS on the transportation construction industry, which we believe to be similar to the magnitude of potential impacts from the regional haze regulation.)

According to the Regulatory Flexibility Act summary accompanying the proposed rule, the rationale behind EPA's finding is that, under the proposed regional haze rule, States will bear the primary responsibility for establishing control requirements and so therefore any attempt to determine impacts on small entities would be speculative. In EPA's words, "(t)he regional haze rule being proposed today applies to States, not to small entities." In light of the huge economic impact the rule will have on the economy and the complete certainty that States would have no options available to them that do not heavily impact small entities, EPA's position is patently ridiculous. Instead of constituting an arguable position, it is a complete abdication of statutory responsibilities under the Regulatory Flexibility Act and SBREFA.

NATIONWIDE AIR QUALITY IS IMPROVING

In considering the concerns expressed in these comments, one should note that EPA's proposed regional haze rule is being promulgated at a time when emissions visibility-reducing pollutants nationwide are decreasing and that the resulting quality of the lower troposphere is improving. EPA's recently released 1996 Air Quality and Emissions Trends Report, for example, shows that nationwide air quality for all pollutants has been improving for at least the past decade.

Furthermore, it appears to be a consensus expectation that progress in reducing emissions and in consequent improvements in air quality will continue in the future, even in the absence of the proposed rule. This universal expectation is due to the control measures mandated by the CAAA, which will ensure further reductions of PM and PM precursors in the future without the proposed rules.

RECOMMENDATION

The American Road and Transportation Builders Association strongly recommends that EPA be required to defer its regional haze rulemaking process until it has (1) complied fully with the Regulatory Flexibility Act, the Small Business Regulatory Enforcement Fairness Act, and Executive Order 12866, including the small business consultation requirements of SBREFA, and (2) examined the human health aspects of its proposal relative to considerations of highway safety.

[From the Congressional Research Service, The Library of Congress]

REGIONAL HAZE: EPA'S PROPOSAL TO IMPROVE VISIBILITY IN NATIONAL PARKS AND WILDERNESS AREAS

SUMMARY

On July 31, 1997, the Environmental Protection Agency proposed a new regulatory program to reduce "regional haze." The proposed program would require the

States to develop and implement long-term strategies to attain a congressionally mandated goal of remedying the impairment of visibility in national parks and wilderness areas resulting from man-made air pollution.

Regional haze results from the presence of small particles, generally ranging in size from 0.1 to 1.0 micrometers in diameter, in the air. These particles absorb and scatter sunlight, with the effect of reducing contrasts, washing out colors, and making distant objects indistinct or invisible. Because of this pollution, the current visual range in the East is only about 20 miles, about one-fifth of the range one could expect in the absence of air pollution. In the West, visibility is better, ranging up to 90 miles, but even there it is only half to two-thirds of its natural range.

Contributors to the regional haze problem include sulfates from fossil-fueled power plants and smelters; nitrates and organic matter from the same sources, as well as from cars and trucks; elemental carbon from forest fires, prescribed burns, and diesel engines; and soil dust from unpaved roads, construction, and agriculture. Some of these are emitted directly to the atmosphere; other particles form in the atmosphere, as a result of reactions involving gaseous precursors. Whatever their source, the fine particles that cause regional haze tend to remain suspended for long periods of time and to travel long distances. Thus, addressing the problem will require planning on a regional basis, and will involve measures in all 50 States.

The proposed regulations would require the States to develop plans to improve visibility by one "deciview" (a measure of visibility) every 10 to 15 years. As a first step, the States would be required to review major stationary sources of pollution to identify those potentially subject to "Best Available Retrofit Technology" (BART), as required in Section 169A of the Clean Air Act.

The visibility program is currently a proposal, subject to public comment. EPA will review the comments it receives before promulgating a final regulation, an action expected in the spring of 1998. Thus far, at least five groups of issues have arisen during the comment period. They include: (1) the potential impacts on industry and other economic sectors (with special concern directed at impacts on the use of prescribed burning in the forestry and agricultural sectors); (2) the choice of methodology (i.e., "deciviews"), and more broadly whether improvement should be measured in terms of emission reductions or visibility improvement; (3) what constitutes reasonable further progress, as required in the Act—in particular whether a goal of one deciview improvement is sufficiently ambitious, or appropriate for all regions of the country; (4) whether EPA paid sufficient attention to the work of the Grand Canyon Visibility Transport Commission, which completed a five-year study of the visibility issue and made a series of recommendations in June 1996; and (5) issues related to the respective powers of Federal regulators and land managers and State governments.

INTRODUCTION

On July 31, 1997, the Environmental Protection Agency proposed a new regulatory program to improve visibility in the Nation's national parks and wilderness areas. This "regional haze" program uses the authority of section 169A of the Clean Air Act, first granted the Agency in 1977, and reinforced by Section 169B in the Act's 1990 amendments.

This report provides background concerning the regional haze program and the issues that have been raised concerning the proposed rule. The report is divided into five sections. Section I discusses the nature of the visibility problem and the sources of regional haze. Section II provides a brief history of legislative and regulatory attempts to address the problem. Section III discusses the proposed rule. Section IV places the rule in context, discussing how it relates to other EPA initiatives, including revision of the air quality standards for ozone and particulates and the acid rain program, and providing a brief discussion of benefits and costs. Section V discusses five sets of issues that have been raised since the rule was proposed.

A formal public comment period on the proposed rule ends December 5, 1997. EPA will review the comments received before promulgating a final regulation, an action expected in the spring of 1998. The rule would then be implemented over a multi-year period.

EPA faces significant choices in finalizing the regulations, with potential impacts on a variety of economic sectors and regions. States will have decisions to make, too, once the rule is final. As a result, the Congress is likely to retain an interest in the program and its implementation.

I. NATURE OF THE PROBLEM

Impairment of visibility due to air pollution occurs throughout the United States. According to the National Academy of Sciences,

. . . the average visual range in most of the western United States, including national parks and wilderness areas, is 100–150 km (about 60–100 miles), or about one-half to two-thirds of the natural visual range that would exist in the absence of air pollution. . . . In most of the East, including parklands, the average visual range is less than 30 km (about 20 miles), or about one-fifth of the natural visual range.¹

This reduction in visibility is caused by the presence of small particles, generally ranging in size from 0.1 to 1.0 micrometers in diameter, in the air. Such particles absorb and scatter sun light. In doing so, they reduce contrasts, wash out colors, and make distant objects indistinct or invisible. Especially in national parks and wilderness areas, but more generally in any area dependent on tourism, a reduction in visibility vitiates the experience sought by visitors and reduces the economic value of assets related to tourist services.²

Some of the particles that create this reduction in visibility are emitted directly to the atmosphere. Others form as a result of atmospheric reactions involving gaseous precursors. Whatever their source, they tend to remain suspended for long periods of time and travel long distances, creating a widespread problem known as regional haze.

The primary causes of regional haze are sulfates, organic matter, elemental carbon (soot), nitrates, and soil dust. As noted in the National Academy of Sciences report:

The major cause of reduced visibility in the East is sulfate particles, formed principally from sulfur dioxide (SO₂) emitted by coal combustion in electric utility boilers. In the West, the other four particle types play a relatively greater role than in the East. The causes and severity of visibility impairment vary over time and from one place to another, depending on meteorological conditions, sunlight, and the size and proximity of emission sources.³

Humidity also plays a role. Because moisture in the air can facilitate the formation of fine particles in atmospheric reactions, visibility in the East would generally be less than that in the arid West, even in the absence of air pollution. Estimates of the natural visual range in the East are on the order of 90–100 miles, versus 140–150 miles in the West. Because of pollution, however, the current visual range in the East is only one-fifth of the natural range, whereas in the West it is half to two-thirds what it would otherwise be.

II. EFFORTS TO ADDRESS THE PROBLEM

The Federal Government has had a long-standing interest in protecting national parks against a variety of perceived threats, including impaired visibility. The goal of Section 169A of the Clean Air Act, calling for the "prevention of any future, and the remedying of any existing, impairment of visibility" resulting from manmade air pollution in national parks and wilderness areas, is consistent with the purpose of the National Park Service Organic Act of 1916 which is: "To conserve the scenery and the natural and historic objects and wildlife therein, and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."⁴

Prevention of Significant Deterioration. Legislative developments that have led to the current attention to visibility and regional haze began with the Air Quality Act of 1967. In that Act, Congress inserted into one of the fundamental purposes of clean air legislation the phrase "to protect and enhance the quality of" the Nation's air resources. In 1972, this phrase was used by the Sierra Club in a lawsuit against EPA to argue that the Clean Air Act required EPA to disapprove any State Implementation Plan that permitted "significant deterioration" of air quality. The district court agreed, and rulings on appeal left the district court opinion intact.⁵ Thus, EPA had to review all State Implementation Plans (SIPs), disallow any that inadequately protected clean air areas, such as national parks, and promulgate regulations to prevent future significant deterioration of air quality in these areas. The resulting Pre-

¹ Committee on Haze in National Parks and Wilderness Areas, National Research Council, National Academy of Sciences, *Protecting Visibility in National Parks and Wilderness Areas* (Washington: National Academy Press, 1993), p. 1. hereafter cited as NAS Report.

² There may also be health benefits related to the reduction of fine particle pollution, but the proposed regulations are aimed primarily at improving welfare, not health.

³ NAS Report, p. 2.

⁴ 39 Stat. 535, Ch. 408, Act of August 25, 1916.

⁵ *Sierra Club v. Ruckelshaus*, 344 F. Supp. 253 (D.D.C. 1972), aff'd., 4 Environment Reporter (Cases) 1815, 2 Environmental Law Reporter 20656 (D.C. Cir. 1972), aff'd. by equally divided Court sub. nom. *Fri v. Sierra Club*, 412 U.S. 541 (1973).

vention of Significant Deterioration (PSD) regulations were promulgated in 1974, with amendments in 1975.⁶ The regulations focused on preventing further deterioration of air quality in pristine areas of the country by specifying how much increase in pollution levels would be permitted. PSD regulation applied only to new sources of air pollution and only to sulfur dioxide and particulates.

1977 Amendments to the Clean Air Act. These PSD regulations for clean air areas were codified, with some changes, as Part C of Title I in the 1977 Amendments to the Clean Air Act. The primary change was to single out for maximum protection national parks and other important national sites (P.L. 95–95). Later regulation by EPA added nitrogen oxides to the pollutants covered by the PSD program.⁷ Mandatory class I areas—those areas that receive the maximum amount of protection—include most national parks, national wilderness areas, and national memorial parks, currently 156 areas. In addition, the Congress added Section 169A to address visibility impairment caused by existing sources of pollution in any mandatory class I areas where visibility was an important value. Thus, PSD and Section 169A act in tandem, with PSD controlling new sources of impairment, and Section 169A controlling existing sources of impairment.

Implementation. Implementing these provisions protecting visibility has not been easy, particularly Section 169A respecting existing sources. First, EPA had to define what visibility was. In general, visibility impairment from human activities manifests itself in two ways: (1) plume blight, where a clearly identifiable plume of smoke emanates from one or more sources; and (2) regional haze, where a uniform reduction in visual range occurs, or a layered discoloration by hovering bands of air tinged brown, yellow, or red. Second, EPA had to promulgate regulations within 24 months of enactment to assure that State Implementation Plans (SIPs) required (1) reasonable progress toward meeting the national goal mentioned earlier, and (2) compliance with several very specific provisions, including Best Available Retrofit Technology (BART) requirements for existing sources.

EPA promulgated rules in 1980 to address visibility impairment that was “reasonably attributable” to a single source or small group of sources—i.e., plume blight.⁸ As with many air pollution regulations, these visibility regulations are implemented by States through SIPs. In general, the 36 States with mandatory class I areas were required to revise their SIPs to assure reasonable progress toward the national visibility goal. The major elements of the regulation were: (1) identifying existing sources causing visibility impairment and creating procedures for determining which existing stationary sources should be subject to BART requirements; (2) assessing potential adverse impacts from proposed new sources (or modified old sources) and recommending remedial actions via the New Source Review process and the PSD program; (3) developing a 10–15 year long-term strategy to make “reasonable progress” toward the visibility goal; and (4) conducting visibility monitoring in mandatory class I areas.

As noted, these regulations deal with plume blight only—regional haze reduction was explicitly delayed until some future date. This lack of aggressive implementation of Section 169A extended to the implementation of the 1980 regulations as well. After 35 of 36 States missed the September 1981 deadline for final visibility plans, the Environmental Defense Fund sued the EPA in 1982 to implement the plume blight regulations. The suit was settled in 1984 with the EPA developing a phased-in schedule for compliance with a December 1986 deadline for States to revise their SIPs to include controls on existing sources that hinder visibility goals.⁹ This sequential implementation of plume blight regulations actually extended through 1989. So far, the only BART installation to occur under the 1980 regulations has been the installation of sulfur dioxide scrubbers at the Navajo Generating Station in 1991.¹⁰

During the 1980s, EPA’s decision to delay regulating regional haze was subject to a variety of challenges, partly because of the relationship between regional haze and acid rain (both involve sulfur dioxide and nitrogen oxide emissions). In April, 1986, Vermont submitted a visibility plan to EPA focused on visibility problems at Lye Brook National Wilderness Area—the State’s only class I area. Arguing that out-of-state sources were responsible for impairing visibility (and thus impeding Vermont’s attempts to assure reasonable progress toward the national visibility goal), Vermont proposed a long-term strategy to combat the effects of regional haze.

⁶ 40 CFR 52.21.

⁷ 53 Federal Register 40656, October 17, 1988; 40 CFR Parts 51 and 52.

⁸ 45 Federal Register 80084, December 2, 1980, 40 CFR 51.300–51.307.

⁹ *Environmental Defense Fund v. Gearstick*, No. CO2–6850 (N.D. CA) (April 20, 1984). See 49 Federal Register 20647, May 16, 1984.

¹⁰ 56 Federal Register 50172, October 3, 1991; 40 CFR 52.

This strategy included a 48-State sulfate reduction plan and the disapproval of the SIPs of eight upwind States that were major contributors to visibility impairment at Lye Brook. In July, 1987, EPA decided to take "no action" on Vermont's regional haze proposal because EPA had yet to act under Section 169A.¹¹ Vermont sued. Although sympathetic to Vermont's argument, the Second Circuit Court ruled in June, 1988, that EPA's action was in accordance with Federal law.¹²

During this same time period, seven States sued EPA to compel issuance of regional haze regulations, under the citizen's suit provision of the Clean Air Act (Section 304). The District Court for Maine ruled in July, 1988 that it did not have jurisdiction in the matter, as EPA's 1980 rule represented a final action, and, therefore, was reviewable only in the D.C. Circuit Court within 60 days of the date of the rule.¹³ The States appealed the decision to the Circuit Court which affirmed the District Court decision.¹⁴ In affirming the District Court decision, the Circuit Court agreed that EPA had a mandate under Section 169A to control the "vexing problem of regional haze," but the Court concluded it did not have jurisdiction to compel EPA to move.

1990 Amendments. EPA's inaction during the 1980s prompted the Congress to act on visibility in the 1990 Amendments to the Clean Air Act. Those actions included a new title IV controlling precursors of acid rain and regional haze,¹⁵ and a new Section 169B. In some ways, Section 169B is a triggering mechanism to force EPA to move on Section 169A with respect to regional haze. Specifically, the 1990 Amendments required EPA to establish a Grand Canyon Visibility Transport Commission within 12 months of enactment (and other commissions upon its own discretion or petition from at least two States). Commissions are required to assess the scientific, technical, and other data available on visibility impairment from potential or projected emissions growth in their region. Based on those data, the commissions are to issue a report within 4 years to EPA recommending what measures, if any, should be taken to remedy such impairment. Within 18 months of receiving a Commission's report, EPA is to carry out its responsibilities under Section 169A, including criteria for measuring "reasonable progress" toward the national goal. Finally, States affected by any regulations promulgated under Section 169A are required to revise their SIPs within 12 months of such promulgation.

National Academy of Sciences Report. At the same time that Congress was considering revisions to the visibility provisions of the Clean Air Act, early in 1990, the National Research Council of the National Academy of Sciences established a Committee on Haze in National Parks and Wilderness Areas. The committee, consisting of 13 members, included experts in meteorology, atmospheric chemistry, air pollution monitoring and modeling, statistics, control technology, and environmental law and public policy, most of whom were drawn from academic institutions.

The committee examined patterns of visibility degradation and haze-forming pollutant concentrations in various parts of the United States resulting from natural and anthropogenic sources of gases and particles. It reviewed the scientific understanding of haze formation and visibility impairment, as well as chemical and physical measurement techniques. It evaluated methods for source identification and apportionment, discussed control techniques, and considered policy implications.

In January 1993, the committee issued a final report, which reached eight broad conclusions: (1) progress toward the national goal of reducing visibility impairment will require regional control programs that operate over large areas; (2) strategies should be adopted that consider many sources simultaneously on a regional basis; (3) simple models are available now and could be used as the basis for designing regional visibility programs; more complex models could be used to refine those programs over time; (4) policy and strategies may need to be different in the West than in the East; (5) improving visibility in class I areas (national parks and wilderness areas) will improve it outside those areas as well; (6) reducing emissions to improve visibility will help alleviate other air quality problems, and vice-versa; (7) achieving the national goal of improving visibility will require a substantial, long-term program; and (8) current scientific knowledge is adequate and control technologies are available for taking regulatory action to improve and protect visibility. At the same

¹¹ 52 Federal Register 26973, July 17, 1987.

¹² *Vermont v. Thomas*, 850 F.2d 99 (2d Cir. 1988).

¹³ *Maine v. Thomas*, 690 F. Supp. 106 (D. Me. 1988).

¹⁴ *Maine v. Thomas*, 874 F.2d 883 (1st Cir. 1989).

¹⁵ As noted by Section 401(a)(1): "the presence of acidic compounds and their precursors in the atmosphere and in deposition from the atmosphere represents a threat to natural resources, ecosystems, materials, visibility, and public health."

time, continued progress will require a greater commitment toward atmospheric research, monitoring, and emissions control R&D.¹⁶

Grand Canyon Visibility Transport Commission. As noted above, in Section 169B(f) of the Clean Air Act, the Congress specifically required EPA to establish a Visibility Transport Commission for the region affecting visibility in Grand Canyon National Park. In June 1996, this commission (consisting of the Governors of Arizona, California, Colorado, Nevada, New Mexico, Oregon, Utah, and Wyoming, and the leaders of five Indian tribes) approved a set of recommendations for improving Western vistas.¹⁷ There were 9 primary recommendations:¹⁸

- *Prevention.* To prevent and reduce air pollution, the commission recommended policies based on energy conservation, increased energy efficiency, and promotion of the use of renewable resources for energy production.

- *Clean Air Corridors.* The commission recommended careful tracking of emissions growth that may affect air quality in corridors of clean air that are sources of clear air at class I sites.

- *Stationary Sources.* The Commission's Baseline Forecast anticipated that current regulatory programs will reduce emissions of sulfur dioxide from stationary sources (power plants, smelters, and other industrial sources) 13 percent by the year 2000, although additional measures under consideration might reduce emissions 20–30 percent. In light of this uncertainty about the effects of current programs and the fact that emissions are being reduced in the short term without additional regulation, the Commission agreed to set regional targets for sulfur dioxide emissions in the year 2000. The ultimate targets would be in the range of 50–70 percent reduction by the year 2040, but "interim targets may also be needed to ensure steady and continuing emission reductions and to promote investment in pollution prevention."¹⁹ If the targets are exceeded, this would trigger a regulatory program, probably including a regional cap on emissions, with market-based trading.

- *Areas in and near Parks.* The commission concluded that it lacked sufficient data regarding the visibility impacts of emissions from some areas in and near parks. "Pending further studies of these areas, the Commission recommends that local, State, tribal, Federal and private parties cooperatively develop strategies, expand data collection, and improve modeling for reducing or preventing visibility impairment in areas within and adjacent to parks and wilderness areas."²⁰

- *Mobile Sources.* Recognizing that mobile source emissions are projected to decrease, the Commission recommended capping emissions at the lowest level achieved and endorsed the concept of a 49-State low emission vehicle.

- *Road Dust.* The commission remained uncertain of the possible role of road dust: "The Commission's technical assessment indicates that road dust is a large contributor to visibility impairment on the Colorado Plateau. As such, it requires urgent attention. However, due to considerable skepticism regarding the modeled contribution of road dust to visibility impairment, the Commission recommends further study . . . prior to taking remedial action."²¹

- *Mexican Emissions.* Mexican emissions, particularly sulfur dioxide, contribute significantly to visibility impairment on the Colorado Plateau. The Commission called for "continued binational collaboration" on this problem and better monitoring and emissions inventories.

- *Fire.* The Commission recommended programs to minimize emissions and visibility impacts from prescribed fire, as well as to educate the public. In particular, the recommendations included establishment of annual emission goals for all fire programs, implementing enhanced smoke management programs, and removing administrative barriers to the use of alternatives to burning.²²

- *Future Regional Coordinating Entity.* The Commission concluded that there was a continuing need for an entity like the Commission to oversee, promote, and support many of the recommendations in the final report. Such an entity has subsequently been established: the Western Regional Air Partnership (WRAP).

The Clean Air Act requires the EPA Administrator to take action under Section 169A within 18 months of receipt of a Commission report. This requirement was among the factors motivating proposal of the regional haze program at this time.

¹⁶ Summarized from NAS Report, pp. 6–11.

¹⁷ *Recommendations for Improving Western Vistas*, Report of the Grand Canyon Visibility Transport Commission to the United States Environmental Protection Agency, June 10, 1996. A ninth State, Idaho, was included in the region, but chose not to participate in the Commission.

¹⁸ The recommendations are summarized in *Ibid.*, pp. i–iii.

¹⁹ *Ibid.*, pp. 34–35.

²⁰ *Ibid.*, p. ii.

²¹ *Ibid.*

²² *Ibid.*, pp. 47–50.

III. THE PROPOSED RULE

The proposed rule appeared in the Federal Register on July 31, 1997.²³ Proposal began a public comment period that was originally scheduled to run until October 20. To solicit comments, the Agency also held a public hearing in Denver on September 18. At that hearing, numerous cementers requested extra time to submit comments. As a result, EPA extended the comment period 6 weeks, to December 5.

SIP Revisions. As proposed, the rule would require all 50 States to submit revised State Implementation Plans (SIPs) within 12 months of the rule's promulgation, with further revisions due 4 years after the initial revision and every 3 years thereafter. The SIP revision must contain a long-term strategy that demonstrates how measures implemented by the State will improve visibility in each class I area within the State and in class I areas outside the State that may be affected by the State's emissions. As described further below, the SIP must also identify facilities to be subjected to "best available retrofit technology."

Many States, particularly in the Midwest, do not have class I areas (i.e., the national parks and wilderness areas that the rule is designed to protect), but EPA has included all States under the scope of the rule because the fine particles that cause regional haze can travel hundreds of miles.

BART. The Clean Air Act requires the installation of best available retrofit technology (BART) on major stationary sources of pollution in existence on the date of enactment (1977), but not more than 15 years old as of that date. BART is less well-defined than other Clean Air Act terms, in part because it has only been used once in the 20 years since enactment (to impose controls on Arizona's Navajo Generating Station in 1991).

The statutory definition of BART stipulates numerous factors to be used in determining what BART is and to what sources it should be applied, including costs of compliance, energy and nonair quality environmental impacts, the degree of improvement in visibility which may reasonably be anticipated to result from the use of the technology, and such site-specific factors as the remaining useful life of the source and the nature of any pollution control equipment in use at the source.

As part of the SIP revision process, States would be required to identify existing stationary facilities that are potentially subject to the imposition of BART. Such facilities are defined in Section 169A of the Act and 40 CFR 51.301(e). Under the statute, they include stationary sources that were placed in operation between 1962 and 1977 and emit at least 250 tons per year of any air pollutant. There are 26 industrial categories listed in the Code of Federal Regulations as potentially subject to BART requirements, including electric utilities, smelters, petroleum refineries, and Graft pulp mills.

Regulations would not be imposed on these industries immediately. Rather, the regulations would give States 3 years after promulgation of the rule to "evaluate BART for applicable sources." The States would then have an additional 2 years to address BART requirements in their State Implementation Plans. EPA would take up to 6 months to determine whether a SIP is complete and an additional 12 months to approve or disapprove the plan, with BART to be implemented "no later than five years after plan approval"—the autumn of 2009, if all goes smoothly. EPA is also proposing, however, that States preparing SIPs for fine particulate matter (PM_{2.5}) need not submit the regional haze SIP revisions until the required date for submittal of the PM_{2.5} revisions. Because of the need to establish a monitoring network and collect 3 years of monitoring data before the States identify PM_{2.5} non-attainment areas and begin the development of SIPs, the BART implementation deadline could slip an additional 5 years in these States, to 2014.²⁴

Reasonable Further Progress. In addition to requiring the States to consider imposition of BART, the regulations would set "presumptive reasonable progress targets," requiring the States to prevent visibility degradation on the least impaired days and to improve visibility on the most impaired days.

The progress targets are expressed in terms of "deciviews." A deciview is to vision what a decibel is to sound. As defined in the proposal, it is an index of atmospheric haze "that expresses uniform changes in haziness in terms of common increments across the entire range of conditions, from pristine to extremely impaired environ-

²³ 362 Federal Register 41138, July 31, 1997. For an overview, see <http://ttnwww.rtpnc.epa.gov/naaqsfin/hazefs.htm>.

²⁴ For a discussion of the PM_{2.5} SIP deadlines, see *Air Quality: EPA's New Ozone and Particulate Matter Standards*, CRS Report 97-8 ENR July 29, 1997, p. 23-24 (note 54).

ments.” A one deciview change is “a small but noticeable change in haziness under most circumstances. . . .”²⁵

As proposed, the rule would require each State to develop a long-term strategy that addresses regional haze visibility for each class I area within the State and each class I area outside the State which may be affected by emissions from within the State. The areas outside the State are to be defined in consultation with the appropriate Federal land managers. The “long term” to be addressed by the strategy is defined as either 10 or 15 years (the Agency is seeking comments on the choice of time period). The strategy must provide for an improvement over the long term period of 1.0 deciview in the average visibility on the 20 percent most impaired days, and no degradation (i.e., less than a 0.1 deciview deterioration) in the average visibility on the 20 percent least impaired days.

These reasonable further progress targets are presumptive, rather than mandatory: under the proposed rule, States can, if they wish, propose alternate progress targets. If they do so, however, they must provide a justification for the alternate target addressing the statutory factors used in identifying BART (availability of technology, cost of compliance, etc.) and demonstrate the justification to the satisfaction of EPA.

Beginning 5 years after promulgation of the rule and continuing every 3 years thereafter, States must review their progress and revise their plan as appropriate.

Regional Cooperation. The proposed regulations presume a great deal of regional cooperation. Coordination with other States and Federal land managers is mentioned frequently in the proposed rule. In most cases, a State will not be able to determine on its own its contribution to regional haze, but must coordinate monitoring, modeling, and strategies with Federal land managers, other States, and EPA.

The rule also stipulates that measures to reduce emissions from sources contributing to regional haze “should be consistent with strategies developed in conjunction with other States through regional planning processes to address related air quality issues,” a reference to the regional planning necessary to combat ozone transport and to implement measures addressing EPA’s new ambient air quality standards for ozone and fine particulates.²⁶

IV. THE RULE IN CONTEXT

Related EPA Programs. While the Clean Air Act provides specific programs for protecting visibility in Sections 169A and 169B, other CAA programs to control air pollutants can reduce emissions that adversely affect visibility. Five of the most important are National Ambient Air Quality Standards, Prevention of Significant Deterioration, acid rain controls, New Source Performance Standards for stationary sources, and motor vehicle emission controls.

National ambient air quality standards (NAAQS) establish maximum levels of designated pollutants to protect health (primary NAAQS) and public welfare (secondary NAAQS). Pollutants for which NAAQS have been set are particulate matter (PM), sulfur oxides, nitrogen oxides, ozone, carbon monoxide and lead. The Act requires States to implement plans (State Implementation Plans, or SIPs) to meet primary, health-based NAAQS by federally enforceable deadlines; secondary standards do not include such deadlines. In these plans, States have wide latitude to determine which sources must reduce emissions—so long as the NAAQS is met. Visibility is explicitly included among the values to be protected by secondary NAAQS (§§ 109(b)(2) and 302(h)). EPA recently revised the particulate matter (PM) and ozone NAAQS, primarily to address adverse health effects; the net effect of the new primary standards for fine particulates (PM_{2.5}) and ozone will be to require further reductions in emissions of particulate matter and ozone precursors. Because these pollutants also affect visibility, EPA included an analysis of the impacts of the proposed regional haze rule in a combined regulatory impact statement (RIA) for the final PM and ozone NAAQS issued in July 1997. Moreover, in its discussion of the visibility rule, EPA emphasizes at several points its effort to coordinate the visibility requirements with the implementation of the fine particulate rule: “The planning schedule for the

²⁵ The quoted material is from Section I.F. of the preamble to the proposed regulation at p. 41145 of the July 31, 1997 Federal Register notice. The actual definition appearing on p. 41157 at 40 CFR 51.301(bb) uses similar language and goes on to provide a mathematical formula for calculating deciviews based on atmospheric light extinction coefficients. As the explanatory material notes, “the deciview is a means of expressing atmospheric light extinction, just as visual range is an expression of atmospheric light extinction. All three of these visibility metrics are mathematically related.”

²⁶ For an explanation of the ozone and fine particulate rules, see CRS Report 97–8, *Air Quality: EPA’s New Ozone and Particulate Matter Standards*.

long-term strategy has been developed to facilitate integration with State planning for the PM and Ozone NAAQS. Similarly, EPA intends to address specific visibility emissions control strategies in more detail in conjunction with the PM and Ozone NAAQS control strategies.”²⁷

Prevention of significant deterioration (PSD) (Part C, Subpart 1 of Title I of the Act) is a program to protect air quality where ambient concentrations of pollutants are better than required by NAAQS. The provision classifies areas as to the amount of degradation allowed. All international parks, national parks larger than 6,000 acres, and national memorial areas and wilderness areas larger than 5,000 acres are mandatory class I areas—those for which the least increment of pollution is allowed.²⁸ Most other areas are classified class II, which allows moderate degradation. Pollutants subject to PSD increments include PM, sulfur oxides, and nitrogen oxides—all of which affect visibility. Major new sources in PSD areas must undergo preconstruction review and must install “best available control technology” (BACT); State permitting agencies determine BACT on a case-by-case basis, taking into account energy, environmental, and economic impacts. More stringent controls can be required if modeling indicates that BACT is insufficient to avoid violating an allowable PSD increment or the NAAQS itself. Because visibility is such an important value in class I areas, the visibility sections of the CAA constitute a subpart under the PSD program.

Acid rain controls added to the CAA in 1990 (Title IV) protect natural resources, ecosystems, materials, visibility, and public health (§ 401(a)(1)) by reducing emissions of sulfur oxides and nitrogen oxides—reductions required even if NAAQS are being met. These reduction requirements fall primarily on utilities, mostly in the eastern portion of the country. The acid rain control program establishes a two-stage process to reduce emissions of sulfur oxides by 10 million tons and nitrogen oxides by 2 million tons from 1980 levels by the year 2000.

New source performance standards (§ 111) ensure adoption of best available control technologies (BACT) on all new sources regardless of location, even where primary NAAQS are being met; these standards apply to several pollutants contributing to regional haze, including particulate matter, sulfur oxides, and nitrogen oxides. The provision requires these new sources to install the best system of continuous emission reduction that has been adequately demonstrated. In making this assessment, the CAA requires EPA to take into account “the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements” (§ 111(a)(1)). Also, the provision explicitly permits EPA to “distinguish among classes, types, and sizes within categories of new sources for the purposes of establishing such standards” (§ 111(b)(2)). To take into account technological improvements in control technologies, the Act requires EPA to review and, if appropriate, update the standards of performance every 8 years, unless readily available information indicates such a review is unnecessary. The utility boiler NSPS for sulfur dioxide is currently under review and an updated utility boiler NSPS for nitrogen oxides has been proposed.²⁹

Motor vehicle emission control requirements and nonroad engine standards (Title II) regulate tailpipe emissions, including nitrogen oxides and volatile organic compounds that affect visibility; and also establish related controls, for example on gasoline volatility and emissions from fuel handling and auto refueling. These standards apply in all 50 States.

²⁷ EPA, *Regional Haze Regulations*, 62 Federal Register 41142, July 31, 1997. Also, “In light of EPA’s intent to foster coordinated planning and implementation of the regional haze requirements proposed and the new PM_{2.5} while still addressing the need to ensure reasonable progress in addressing visibility impairment, EPA is also proposing to allow States preparing nonattainment plans for fine particulate matter (PM_{2.5}) to submit their regional haze emissions control strategy SIP revisions by but not later than the required date for submittal of the State’s PM_{2.5} attainment control strategy SIP revisions” [Ibid., p. 41151]. Similarly, EPA foresees “ultimate integration of monitoring data from the new PM_{2.5} monitoring network and the visibility monitoring network. . . .” [Ibid., p. 41152].

²⁸ An “increment” is the “maximum allowable increase” over baseline concentrations. For PM and SO₂, these increments are set by law. For example, for a class I area, the maximum allowable increase in concentration of PM is 5 micrograms per cubic meter annual geometric mean, and 10 micrograms per cubic meter for the 24-hour maximum.

²⁹ 62 Federal Register, July 9, 1997, pp. 36948–36963.

All these air pollution control programs,³⁰ although imposed primarily for reasons other than the protection and improvement of visibility, nevertheless will definitely contribute to that goal by controlling pollutants that diminish visibility by causing regional haze.

The existence of these other programs that reduce emissions of pollutants impairing visibility means that visibility is likely to improve even while debate continues over the goals and requirements EPA is proposing for addressing regional haze. However, while visibility improvements may be marked in some areas, it is likely that emissions reductions required by these other programs will be insufficient to improve visibility significantly in numerous areas, especially in the West. Where visibility goals remain unmet, additional pollution control programs are likely to create tensions, as sources that successfully reduce emissions so as to comply with NAAQS implementation plans, acid rain controls, and/or new source performance standards may object to any further emission control requirements on the grounds that they chose the most cost-effective way to meet those prior requirements, and more controls would be costly and inefficient.

Costs. Because of the overlaps among control regimens affecting emissions of pollutants that cause regional haze and impair visibility and because the proposed rule would allow States to adjust targets to parallel ozone and PM NAAQS programs and would give broad discretion to States in determining control measures to meet visibility requirements, it is very difficult to isolate prospective costs of a regional haze control program. EPA's analysis³¹ is confined to the 141 class I areas located in 121 counties in the 48 contiguous States. EPA projects that, in order to meet a presumptive target of improving the most impaired days (average of 20 percent highest days) in 2010 by 1 deciview, 76 of 121 class I area counties would need reductions beyond those achieved by then to meet the PM_{2.5} NAAQS. If the goal were 2015, 58 mandated class I area counties would need additional controls. Virtually all the areas needing further controls would lie west of the Mississippi. Largely because of the acid rain control program, all 29 class I counties in the Northeast, Midwest, and Southeast would meet the 2015 target and only 1 Southeast county would not attain the 2010 target.

EPA estimates that regional haze controls would cost \$0 if the target does not go beyond the ozone and PM NAAQS implementation plans to a maximum of \$2.7 billion per year (in 1990 \$) for additional controls to meet the presumptive 2010 goal.³² This analysis shows, too, that even with additional controls some areas would still fall short of EPA's alternative 2010 or 2015 targets (28 counties for 2010 and 17 for 2015); these areas would be concentrated in the south central and west regions, particularly in Arizona and southern California.

Benefits. EPA estimates that the benefits of the proposed regional haze control program range from \$0 if the target does not go beyond the ozone and PM NAAQS implementation plans to a maximum of \$5.7 billion annually for the presumptive 2010 goal.³³ This \$5.7 billion benefit is not, however, all attributable to the value of visibility improvements per se: it is the sum of the upper range estimates for visibility (\$0.57–1.13 billion), incremental health benefits attributable to pollutant reductions beyond those being implemented for meeting NAAQS (\$1.1–4.5 billion), plus consumer cleaning cost savings of \$0.03 billion.³⁴

V. ISSUES

At least five sets of issues have been raised in the wake of EPA's proposal: (1) the potential impacts on industry and other economic sectors (with special concern for forestry and agriculture, where the use of prescribed burning is an important management tool); (2) the choice of methodology (i.e., "deciviews"), and more broadly whether improvement should be measured in terms of emission reductions or visibility improvement; (3) what constitutes reasonable further progress, as required in the Act—in particular whether a goal of one deciview improvement is sufficiently ambitious or appropriate for all regions of the country; (4) whether EPA paid sufficient attention to the work of the Grand Canyon Visibility Transport Commission; and (5) questions concerning Federal and State government relations, in particular

³⁰ For a list of major CAA requirements that EPA considered in modeling emissions related to the PM and ozone NAAQS, see EPA, *Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule*, July 16, 1997, Table 4.5, p. 4–20.

³¹ EPA, *Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule*, July 16, 1997, Chapter 8.

³² *Ibid.*

³³ *Ibid.*, Chapter 12.

³⁴ *Ibid.*, pp. 12–49 and 12–66.

the authority of each level of government vis-a-vis the other, as well as the relationships between Federal or State regulators and Federal land managers. This section reviews each of these issues in turn.

Concern over potential impacts. As previously noted, it is difficult to project specific private sector impacts of the proposed visibility rule, since States not only bear primary responsibility for establishing control requirements but also are given the option of adjusting the goal. Moreover, the proposal presumes that many requirements will develop through future regional agreements.³⁵ As a result, EPA's impact assessment takes a very broad-brush approach to estimating impacts and costs; however, some commentators on the rule have been more forthright in speculating on specific ones.

As a practical matter, the first impacts of requirements derived from visibility regulations will probably occur in the West. This is because the acid rain program in the East will be reducing sulfur oxide emissions substantially over the next 10 years, and they are the primary cause of visibility degradation east of the Mississippi. In the West, existing CAA requirements will not be reducing the pollutants degrading visibility as much, meaning that controls specifically designed to improve visibility can be expected to come into play there sooner than in the East.

Stationary Sources. The most immediate private sector impact could involve existing stationary sources potentially subject to "Best Available Retrofit Technology" (BART) requirements of the Act³⁶ (listed at 40 CFR 51.301(e)). As noted previously, this includes 26 source categories (e.g., electric utilities, smelters, petroleum refineries, and kraft pulp mills) which have the potential to emit 250 tons per year of any air pollutant and which began operating between 1962 and 1977.³⁷ EPA's proposal would require States to inventory sources potentially subject to BART within 1 year of promulgation of the rule, and then would give the States 3 years to complete evaluation of BART for applicable sources (i.e., probably by sometime in 2001). It would remain up to States to determine which, if any, candidate sources would actually have to install BART.

There has been some complaint that EPA's proposal overemphasizes BART controls relative to controls on other sources of pollutants impairing visibility.³⁸ The western Governors, as a group, prefer market-based approaches rather than BART for the control of stationary sources. The BART procedure is specified in Section 169A, however, and is the only specific regulatory tool mentioned in the section. As a result, EPA had little choice but to require the States to use it; to fault the Agency for doing so is to ignore the mandate that Congress imposed.

Even so, imposition of BART is to be left largely to the discretion of the States, who will implement the requirement through the SIP process. The proposed rule does not require the imposition of BART on all sources.

Forestry and Agriculture. Another area of impact that could be felt soon involves both the private and public sectors: prescribed burning. In agriculture, fire is used to remove stubble and grass; in forestry, it is used to control brush and to diminish fuel buildup. Smoke from prescribed burning and from wildfires contributes to visibility impairment, and the 1980 visibility regulations included a requirement that States consider smoke management techniques for agricultural and forestry burning in developing long-term strategies for visibility protection. With the new, proposed rule, concern has been expressed that the EPA regulations could hinder prescribed burning in forests, with the potential effect of increasing damages from wildfires. Conversely, if prescribed forest burning were not impeded, then other sources of pollutants impairing visibility would necessarily be subject to more stringent controls (including, perhaps, controls on agricultural burning) to compensate for the impairment of visibility resulting from forest burning.³⁹

³⁵ EPA's discussion of the proposed regulation notes that the application of visibility program to all States "should not be interpreted by the States to mean that they will necessarily have to adopt control strategies for regional haze immediately. Instead, it means that a State subject to the program first should participate in a regional air quality planning group. . . ." EPA, *Regional Haze Regulations*, 62 Federal Register 41145, July 31, 1997.

³⁶ See "Plan Revisions to Address Best Available Retrofit Technology (BART)" in EPA, *Regional Haze Regulations*, 62 Federal Register 41149, July 31, 1997.

³⁷ After 1977, these sources would have been subject to the new source review requirements of PSD.

³⁸ See, for example, the statement of Michael O. Leavitt, Governor of Utah, before the Subcommittee on Forests and Public Land Management, Committee on Energy and Natural Resources, U.S. Senate, October 28, 1997.

³⁹ Statement of Greg E. Walcher before the Subcommittee on Forests and Public Land Management, U.S. Senate, *Hearing: Impact of Regional Haze Rules on Federal Land Management*, Oct. 28, 1997.

EPA's position is that sound fire management of prescribed burning is possible, and the Agency is working jointly with States and the land management agencies in the Departments of Agriculture, Defense, and the Interior on a national policy for managing the impacts of prescribed fires. EPA anticipates issuing a *Wildland Fire/Air Quality Policy* in 1998. Overall, it remains uncertain what, if any, impacts the proposed regulation will have on prescribed burning, or on agriculture and forestry more generally, particularly since it will be the States, individually or regionally, that determine local control requirements.⁴⁰

Small Businesses. EPA has certified that the proposed rule will not have a significant impact on small businesses, because the States will be exercising "substantial intervening discretion in implementing the proposed rule."⁴¹ This finding does not mean there will be no small business impact, although impacts are speculative; rather, by claiming that only subsequent State implementation would affect small business, EPA seeks to avoid procedural requirements that would otherwise be imposed by the Small Business Regulatory Enforcement Fairness Act (SBREFA). Nonetheless, EPA has undertaken small business outreach efforts on the impacts of the PM and ozone NAAQS and the regional haze rule—efforts that largely parallel the SBREFA requirements.⁴²

Mobile Sources. The Grand Canyon Visibility Transport Commission report recommends additional attention to controlling mobile source emissions, particularly endorsing the concept of a 49-State low emission vehicle whose emissions would be substantially less than those allowed by current regulation. Mobile source emissions are directly regulated by Title II of the Clean Air Act, however, and are outside the purview of Section 169A. In addition, the 49-State car is a voluntary effort, the success of which is outside of EPA's control.

Unpaved Roads. The Commission also notes that models attribute significant impairment to visibility on the Colorado Plateau from road dust—a finding that suggests paving unpaved roads could be an effective control measure. However, many question the technical accuracy of this finding, and the Commission gives high priority to further research on the issue.

Mexican Sources. Finally, particularly in the Southwest, emissions from Mexican sources may significantly contribute to visibility impairment. The visibility regulation does not provide any mechanism for addressing this issue directly, but several U.S.-Mexican agreements provide for cooperation in solving environmental problems of the border region—including attainment and maintenance of primary and secondary NAAQS.⁴³ Such cooperation could lead to controls on major Mexican sources of sulfur oxides, particularly smelters and/or coal-fired power plants.

Choice of Methodology. A second set of issues raised in debate over the proposed rule concerns the methodology chosen by EPA to be the measure of progress in improving visibility. As explained earlier in this report, the rule sets a target of improving visibility by 1.0 deciview over either a 10- or 15-year period. EPA requested comments concerning both the choice of time period and the proposed use of deciviews as the means of measuring visibility improvement.

A deciview is a small but noticeable change in haziness, determined by use of a mathematical formula that uses logarithmic values of atmospheric light extinction coefficients. The term was coined by Marc Pitchford of the National Oceanic and Atmospheric Administration (NOAA) and William Maim of the National Park Service in a 1994 article that appeared in the journal *Atmospheric Environment*.⁴⁴ The idea behind the use of deciviews is that changes on the scale have a linear relationship to human perception: i.e., a change from 10 to 11 and a change from 30 to 31 are both small, perceptible changes to a human observer. The other available measures (such as light extinction or visual range) "do not express perception linearly. For example, a 5-mile change in visual range can in some cases be very significant, such

⁴⁰ A related issue is the extent to which prescribed burning can be controlled by the States if it occurs on Federal land. For a discussion of this issue, see p. 23 below.

⁴¹ EPA, *Regional Haze Regulations*, p. 86.

⁴² *Ibid.*

⁴³ Notably, the "Agreement between the United States of America and the United Mexican States on Cooperation for the Protection and Improvement of the Environment in the Border Area (La Paz Agreement)"; an annex to this agreement was used by EPA as the vehicle for implementing §815 of the CAA, "Establishment of Program to Monitor and Improve Air Quality in Regions along the Border between the United States and Mexico" (added by the 1990 Clean Air Act Amendments). See, EPA, *U.S.-Mexico Border XXI Program Framework Document* (October 1996 [EPA 160-R-96-003]), Appendix I.

⁴⁴ Marc L. Pitchford and William C. Malm, "Development and Applications of a Standard Visual Index," *Atmospheric Environment*, Vol. 28, No. 5, 1994, pp. 1049-1054.

as a change from 5 to 10 miles in an impaired environment, whereas it may be barely perceptible on a clearer day (such as from 95 to 100 miles)."⁴⁵

EPA argues that use of this measure as the way of defining reasonable progress makes sense "because of the importance that progress . . . be measured in terms of 'perceptible' changes in visibility, and due to the simplicity of its useful scale."⁴⁶ It also conforms closely to the recommendations of the National Academy of Sciences, whose Committee on Haze, writing before the appearance of Pitchford and Malm's article, concluded that existing measures of visibility, such as visual range, were not well-suited to measuring the "vague and qualitative" definition of visibility impairment in the Clean Air Act. The NAS Committee recommended that an index of visibility impairment be developed:

The ability to make quantitative connections between optical properties of the atmosphere and human judgments of visibility is still in the developmental stage because of the complexity of the physical and psychological phenomena. To quantify visibility impairment, an index must be developed that can incorporate the complexity of those phenomena; the index also must be understandable and useful to the general public and policy makers as well as to scientific researchers. Because impairment is based largely on human judgments of the visual environment, the human element must be incorporated in the development of such an index. In addition, the index must be based on properties of the physical environment that can be readily measured and monitored to enable enforcement of air quality standards.⁴⁷

Not everyone agrees that the deciview approach is the appropriate one, however. Gov. Michael Leavitt of Utah, testifying to a Senate subcommittee on behalf of the Western Governors' Association, argued that:

Visibility improvement or "reasonable progress" should not be based strictly on a visibility standard, a quantitative deciview measurement. Given the current state of the science and technical air quality management tools as well as the inherent nature of visibility management in the West, visibility measurement should be used as a tool but not a standard.⁴⁸

Instead, Leavitt and others would prefer to use emissions-based measures for determining progress. Such measures would be more in line with traditional air pollution control programs, and have the advantage of being more predictable for industry and other sectors subject to compliance.

What Constitutes "Reasonable Further Progress". Whether or not one agrees with the methodology used to measure progress, a related issue concerns the amount of progress that States should be asked to make. EPA has defined reasonable further progress, in all areas of the country, as a 1.0 deciview improvement in visibility every 10 to 15 years. Such a target implies that visibility will continue to be severely degraded for long periods of time in some parts of the West and particularly in the East. (For a map showing current levels of visibility in various regions of the United States, see Figure 1.)

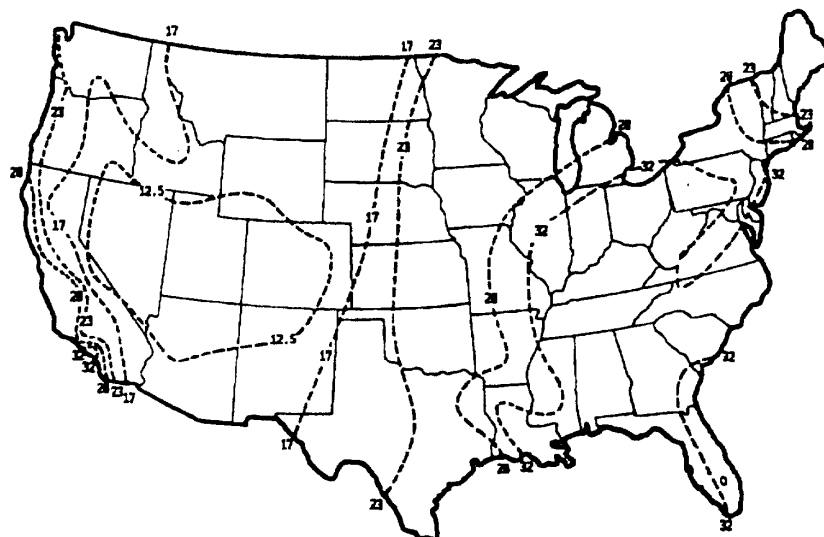
⁴⁵ Regional Haze Regulations, Preamble, 62 *Federal Register* 41145, July 31, 1997.

⁴⁶ *Ibid.*

⁴⁷ NAS Report, p. 354

⁴⁸ Statement of Michael O. Leavitt, Governor of Utah, before the Subcommittee on Forests and Public Land Management, Committee on Energy and Natural Resources, U.S. Senate, October 28, 1997 p. 5.

Figure 1. Median Summer Visibility for Suburban/Non-urban Areas: 1974-1976, Displayed Using the Deciview Scale



Note: Increases on the deciview scale correspond to greater impairment of visibility. Zero on the scale represents visibility in particle-free air, a condition that is not achievable in most cases, even in the absence of pollution. Under normal unpolluted conditions, median visibility would range from 4 to 5 deciviews in the West to about 8 to 9 in the East.

Source: Pitchford and Maim, "Development and Applications of a Standard Visual Index," *Atmospheric Environment*, Vol. 28, No. 5, 1994, p. 1053.

In testimony before a Senate subcommittee, Marcia Frientz of the National Parks and Conservation Association (NPCA), stated:

Currently, Eastern States face a 15 deciview impairment from non-natural haze. Even under the stricter one deciview per 10 years goal, it would take the region 150 years to remedy its severe haze pollution problem! NPCA does not believe this is reasonable progress, particularly when one considers that the man-made haze problem has been created over the last 50 years. For that reason, we recommend that a three deciview rate of improvement over 10 years be adopted for Eastern States.⁴⁹

An Associate Director of the National Park Service, speaking to the same subcommittee, was less direct in his recommendations, but painted an even more negative picture of the dimensions of the problem:

EPA's suggested "reasonable progress" target for the most impaired days needs to be closely examined as it would allow 220-330 years to achieve the national visibility goal in those areas, such as Shenandoah and Great Smoky Mountains National Parks, where visibility is currently very degraded. In addition, the proposed criteria allow for a slower rate of progress than is actually being achieved in many areas.⁵⁰

In portions of the West, the reverse problem may occur: here, air quality is still sufficiently good that obtaining a noticeable (i.e., 1.0 deciview) improvement would require substantial effort, and improvements of more than that amount may not be feasible. Anne Smith, who, as a consultant to the Grand Canyon Visibility Transport

⁴⁹ Statement of Marcia Frientz, National Parks and Conservation Association, before the Subcommittee on Forests and Public Land Management, Committee on Energy and Natural Resources, U.S. Senate, October 28, 1997, p. 3.

⁵⁰ Statement of Dr. Michael Soukup, Associate Director, Natural Resource Stewardship and Science, National Park Service, before the Subcommittee on Forests and Public Land Management, Committee on Energy and Natural Resources, U.S. Senate, October 28, 1997, p. 6.

Commission, developed the model that projected impacts of control measures on visibility at the Grand Canyon, has concluded that the "Maximum Management Alternative" on the Colorado Plateau "generates only 1 deciview of improvement in 50 years in terms of the annual average (from 9 deciviews in 1990 down to 8 deciviews in 2040). In terms of the 20 percent worst days, which is the focus of the proposed rules, this 'upper bound' generates approximately 1.5 to 2 deciviews of improvement."⁵¹

However, this conclusion does not take into account certain control possibilities, and may overstate the difficulty of achieving visibility improvement, particularly in the near term. The Maximum Management Alternative, defined as the "maximum visibility improvements possible regardless of the cost of the pollution controls used," did not include mobile source controls or measures that would require international cooperation.⁵² Further, the same analysis shows that, due to existing control requirements, visibility will improve until about 2010, by as much as one deciview.⁵³ As a result, EPA's target, at least for the first 10 to 15 year period, appears to be relatively easily attained both in the West and the East.

Nevertheless, Dr. Smith's larger point is well-taken: beyond 2010, visibility improvements in the West may be difficult to achieve. Because air quality is less degraded there, a less stringent target may be justified, particularly if the first 10 to 15-year period yields projected improvements. Opponents have characterized EPA's proposal as a "one-size-fits-all" Federal regulation. In most respects, given the flexibility EPA is allowing the States to develop their own goals, strategies, and regulatory programs, this criticism seems out of place; but in requiring the same rate of progress in all areas of the country, EPA is establishing a sort of "one-size fits all" target, which may be too lenient in some areas, while being difficult to maintain long term in others.

Setting different Federal standards for different parts of the country poses its own challenges, however. Typically, the Federal Government has imposed uniform Federal standards to protect health and to provide a level playing field for new major sources. Because States begin with different levels of pollution, the establishment of a uniform Federal standard (for example, a National Ambient Air Quality Standard) can have the effect of requiring more stringent measures in some States and local areas than in others.⁵⁴ In addition, the States have authority under most environmental statutes to set their own standards (as long as they are more stringent than the federal), and have done so under other parts of the Clean Air Act.

What is unique in the regional haze rule is that the standard is expressed in terms of progress, rather than as the ultimate goal. This choice seems mandated by the language of the Act itself, which requires "regulations to assure . . . reasonable progress toward meeting the national goal. . . ." Nevertheless, achieving sufficiently rapid progress in the East, while not setting impossible standards in the West, is a challenge that EPA faces in crafting the final regulations.

Grand Canyon Commission Recommendations. A number of interested parties, including many of the participants in the Grand Canyon Visibility Transport Commission process, have complained that EPA's proposal pays insufficient attention to the Commission's recommendations. The Commission assembled a diverse group of interested parties from eight States and spent 5 years analyzing the problem of visibility in the national parks and wilderness areas of the Colorado Plateau, including the Grand Canyon, Bryce Canyon, Zion and other areas. As noted earlier in this report, the Commission reached consensus on a set of nine recommendations that addressed a wide range of contributors to the haze problem, including mobile sources, road dust, stationary sources, international sources, and prescribed burning, and recommended a wide array of measures, including further research needs, to address the problem.⁵⁵

EPA's proposed rule discusses the work of the Commission in its preamble, but it does not strictly follow the Commission's recommendations for several reasons. First, the recommendations are useful in outlining future research needs (e.g., tracking emissions growth in clean air corridors, expanding data collection and improving modeling for areas in or near parks, and resolving uncertainties concerning the contribution of road dust to visibility impairment). The Commission report also

⁵¹ Statement of Dr. Anne E. Smith, Decision Focus Incorporated, before the Subcommittee on Forests and Public Land Management, Committee on Energy and Natural Resources, U.S. Senate, October 28, 1997, p. 3.

⁵² *Ibid.*

⁵³ *Ibid.*, p. 2.

⁵⁴ For a discussion of the setting of ambient air quality standards, see CRS Report 97-722, *Air Quality Standards: The Decisionmaking Process*.

⁵⁵ For a summary of the recommendations, see the discussion above, on pp. 6-8.

identifies areas that need additional attention, such as collaboration with Mexico on emissions inventories and monitoring. But many of its recommendations do not address the regulation or reduction of emissions. In this regard, they do not offer a regulatory blueprint.

Second, where the recommendations do address regulation, in many cases they recommend programs for which EPA has limited statutory authority. For example, the Commission endorsed "national strategies aimed at further reducing tailpipe emissions, including the so-called 49-State low emission vehicle."⁵⁶ EPA and the auto industry have promoted this concept as an alternative to State-by-State adoption of California emission standards, but implementation has stalled because EPA lacks statutory authority to strengthen auto emission standards until the year 2004. Similarly, the Commission recommended "policies based on energy conservation, increased energy efficiency and promotion of the use of renewable resources for energy production," including the adoption of emission fees to replace property or income taxes, and the adoption of stricter energy efficiency standards for motors, appliances, and lighting.⁵⁷ But the Clean Air Act gives EPA no authority to promulgate any such requirements.

Third, EPA's proposal is meant to address visibility problems in all areas of the country not just the eight States that participated in the Commission process. While there are many useful ideas in the Commission report, the visibility problem is substantially different, both in causes and in severity, in other parts of the country: recommendations intended to protect the Grand Canyon do not necessarily fit in the eastern or southern United States.

What EPA has proposed focuses on State planning, allowing the States flexibility to adopt whatever measures they conclude will make progress toward the national goal. It requires the States to measure that progress and revise their plans at 3-year intervals. And it allows the States to adopt alternative progress targets, where they can justify doing so, using criteria spelled out in the Act. This degree of flexibility is unusual in an EPA regulatory program. It appears to be consistent with the statutory authority provided in Section 169A.

Federal-State Issues. The proposed regional haze regulations have also called attention to certain perennial issues of federal-State relations under the Clean Air Act—in particular, the extent to which Federal entities can prevent or penalize actions by States, and vice versa. More specifically, three federal-State issues present themselves: (a) whether a Federal land manager can block State issuance of permits under the Prevention of Significant Deterioration (PSD) program; (b) whether the actions of Federal land managers (such as prescribed burns on Forest Service lands) are subject to State authority, and (c) what authority EPA has to enforce its visibility program requirements on States—in particular, whether sanctions under Sections 179 and 110(m) of the Clean Air Act apply to States that fail to submit or implement adequate State Implementation Plans.

Federal Land Managers and Permits. Can a Federal land manager (FLM)⁵⁸ block State issuance of emission permits because of the impact the emissions may have on visibility in class I areas? As a practical matter, it would seem not. It is true that the Clean Air Act gives the ELM an "affirmative responsibility" to protect visibility on Federal lands in class I areas.⁵⁹ It is also true, more concretely, that where the FLM shows "to the satisfaction of the State" that emissions from a proposed major emitting facility will adversely affect visibility on such lands, the Act instructs that "a permit shall not be issued."⁶⁰ Read literally, this directive could be deemed a Federal veto. Realistically, however, the unqualified discretion afforded the State to determine when a showing has been made "to [its] satisfaction" means that the State retains control over whether the permit is issued.

Elsewhere in the Clean Air Act, it is required that a State "consult in person with the appropriate [FLM]" before holding a hearing on proposed visibility-related SIP revisions.⁶¹ Plainly, this also falls short of an FLM veto authority over individual emission permits.

State Authority over Federal Land Managers. Turn now to the reverse situation. What authority do States have, through their SIPs as revised in accordance with the new visibility regulations, to regulate emissions on Federal lands? In particular, what authority do States have to regulate prescribed burning of National Forest

⁵⁶ Recommendations for Improving Western vistas, p. ii.

⁵⁷ *Ibid.*, p. 30.

⁵⁸ "Federal Land Manager" is defined as the Secretary of the department with authority over the Federal lands in question. CAA §302(i).

⁵⁹ CAA §165(d)(2)(B).

⁶⁰ CAA §165(d)(2)(C)(ii).

⁶¹ CAA §169A(d).

lands? Because the Clean Air Act (like most other Federal pollution laws) contains a broad waiver of Federal supremacy, States appear to have broad authority to regulate emissions on Federal lands—whether the regulation is contained in a SIP or not. Under the Act, Federal agencies “having jurisdiction over any property” or “engaged in any activity resulting . . . in the discharge of air pollutants” must comply with State air pollution rules to the same extent as any nongovernmental entity.⁶²

Sanctions. Finally, there is the issue of sanctions, long a sensitive one under the Clean Air Act. (Title I of the Clean Air Act provides both mandatory and discretionary authority for the EPA Administrator to impose sanctions on States that have not submitted adequate State Implementation Plans. Sanctions take two principal forms: (1) withholding Federal highway funds, and (2) 2:1 offsets—requiring permit applicants in nonattainment areas to assure offsetting emission reductions twice as great as the emissions to be released by a proposed facility. For a more thorough discussion of Clean Air Act sanctions, see Highway Fund Sanctions for Clean Air Act Violations, CRS Report 97–959 ENR.)

What sanctions can be imposed on States for failing to revise their SIPs to meet the visibility-related requirements of EPA’s regional haze regulation, when it is issued?⁶³ Reading closely the mandatory sanctions provision⁶⁴ and the discretionary sanctions provisions⁶⁵ in the Act, it would appear that the latter fits this situation more closely. If this interpretation is correct, then in the event of a State’s failure to make the SIP revision, EPA may, but does not have to, impose the highway sanctions and/or the 2:1 emissions offset sanctions (in nonattainment areas), and must, should the State’s failure continue, promulgate a Federal implementation plan revision.⁶⁶

But while CAA sanctions may be imposed for failure to submit an adequate SIP, they may not be imposed, following procedural compliance, for not achieving visibility goals. That is, where visibility-related SIP revisions are made by the State and approved by EPA, sanctions may not be imposed if the new SIP measures prove to be less effective than believed at the outset. As an initial matter, proposed 40 C.F.R. §51.306(d)(5) allows a State to adopt an “alternate reasonable progress target” if the original target can be shown to be unattainable due to such factors as availability of source control technology, costs of compliance with the original target, the remaining useful life of sources, etc. Only if the State cannot make the required showing, or simply refuses to try, would matters move to the next phase. In such event, the CAA calls for an EPA finding that the SIP is “substantially inadequate,” and an EPA deadline of no more than 18 months for the State’s submission of plan revisions.⁶⁷ If such SIP revisions are not timely submitted, the Act contemplates that 18 months after the determination of nonsubmission EPA must impose either the highway sanction or (in nonattainment areas) the 2:1 emissions offset sanction,⁶⁸ may also withhold air pollution program grants,⁶⁹ and must, should the non-submission continue, promulgate a Federal implementation plan revision.⁷⁰

CONCLUSION

The regional haze rule, on its own, appears unlikely to have much impact on air quality before the year 2010. It proposes relatively modest goals for visibility improvement. These goals appear likely to be met or surpassed in most sections of the country as a result of regulations already being implemented—notably the acid rain program and controls on mobile sources and non-road engines. In States required to implement programs to control fine particles—which EPA and other observers believe includes most of the States—implementation of the regional haze program will be delayed to coincide with PM control measures, which are unlikely to be determined before 2009.

However modest its immediate impact, the proposed rule is one of several regulations that point in the same direction. Along with the nonattainment provisions of the 1990 Clean Air Act, the revised air quality standards for ozone and particulates (promulgated in July), the acid rain program, the regional efforts to control ozone

⁶² CAA §118(a).

⁶³ Such SIP revisions are required by CAA §169B(2).

⁶⁴ CAA §179(a).

⁶⁵ CAA §110(m).

⁶⁶ CAA §110(c)(1).

⁶⁷ CAA §110(k)(5). See also CAA §110(a)(2)(H)(ii) (State-submitted SIP, to be approvable, must provide for revision of plan if substantially inadequate to comply with Act’s requirements).

⁶⁸ CAA §179(a). Some ambiguity exists as to whether CAA §110(m), rather than CAA §179(a) might govern in this circumstance. If section 110(m) controls, then EPA imposition of the highway and emission offset sanctions is discretionary, not mandatory.

⁶⁹ CAA §179(a).

⁷⁰ CAA §110(c)(1).

transport developed by the Ozone Transport Assessment Group and the Ozone Transport Commission, the threat of action to control interstate sources of air pollution under Section 126 of the Act, the implementation of revised New Source Performance Standards for stationary sources of pollution, and new standards for mobile sources that are now being implemented, these regulations will help move the nation toward noticeably cleaner air.⁷¹ In this respect, the haze regulations may function almost as “standby” regulations: in case the other measures being implemented do not improve visibility in national parks and wilderness areas, the tools of the regional haze program are available to do so.

At the same time, EPA faces significant choices in finalizing the haze regulations, which could substantially affect the reach and impact of the rule. For example, adoption of more stringent targets for visibility improvement, or standards that emphasize emission reductions from specific types of sources rather than the more general goal of visibility improvement, could make regional haze regulation more of a controlling factor on the regulatory agenda.

States will have decisions to make, too, once the rule is final. Successful implementation of the rule will require consultation and decision-making on a regional basis. In its proposal, EPA has placed significant emphasis on the regional consultations and decision-making required, but at present, the institutional structures necessary for regional decision-making are nonexistent. The regions themselves require definition.

As a result, Congress is likely to retain an interest in the regional haze program and its implementation. Congress can express this interest in a number of ways. It can review regulations and their implementation under both its general oversight authority and under the new congressional regulatory review process; it can use the appropriations process to shape implementation; and it periodically revisits issues by considering amendments to the authorizing legislation—in this case, the Clean Air Act, whose authorization expires in 1998. Whether the regional haze program will be considered in any of these congressional fore is likely to depend on the final form of the rule that EPA chooses to promulgate.



⁷¹For descriptions and discussion of these other programs, see CRS Issue Brief 97007, Clean Air Act Issues, and the Clean Air Act section of CRS Report 97-49 ENR, Summaries of Environmental Laws Administered by the Environmental Protection Agency.