S. HRG. 105–945

ACID DEPOSITION CONTROL ACT

HEARING

BEFORE THE

SUBCOMMITTEE ON
CLEAN AIR, WETLANDS, PRIVATE PROPERTY AND
NUCLEAR SAFETY

OF THE

COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

ONE HUNDRED FIFTH CONGRESS

SECOND SESSION

ON

S. 1097

A BILL TO REDUCE ACID DEPOSITION UNDER THE CLEAN AIR ACT

OCTOBER 6, 1998

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ACID DEPOSITION CONTROL ACT

TUESDAY, OCTOBER 6, 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 9:30 a.m. in room 406, Senate Dirksen Building, Hon. James M. Inhofe (chairman of the subcommittee) presiding.

Present: Senators Inhofe, Allard, Sessions, and Chafee [ex officio].

Senator INHOFE. The subcommittee will please come to order.

We have several simultaneous meetings taking place right now. I know I had one, the Readiness Committee, downstairs. I know that Representative Solomon has his committee meeting.

So, I'll forego my statement and go ahead and recognize you at this time to make any statement you want, then we'll go back to the regular order, in deference to your schedule. Is that all right?

Mr. SOLOMON. Senator, I would deeply appreciate that. I have to bang the gavel to send you Senators some vital legislation so we can get out of here in a few days.

Senator INHOFE. Well, I have to say that one of the only regrets I have about leaving the House is I left your companionship on a regular basis.

Mr. SOLOMON. We're very proud of having you over here representing my personal views, because you and I think a lot alike, Senator.

STATEMENT OF HON. JERRY SOLOMON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW YORK

Mr. SOLOMON. Senator, let me thank you again for the opportunity to speak on this subject here today. I also would like to thank my colleague, Senator Moynihan, who I understand has the flu and probably will not be able to be here today. He is vitally interested in this legislation as well, as is Senator D'Amato, who will be here, for their valuable work on an issue that is so very important to my particular district, but the entire northeast as well.

And that issue is the very real and necessary changes that need to be made to strengthen the Clean Air Act, to continue fighting acid rain and air pollution. The legislation before the committee today as introduced in this body by again, my good friends, Senator Moynihan and Senator D'Amato, will build on the Clean Air Act

and the provisions dealing with the pollution most responsible for acid rain.

And I was pleased to introduce this companion legislation in the House and to have the support of the entire New York delegation as well as all Democrats and Republicans from al of the New England States. That's how serious the issue is, Mr. Chairman.

Although we've made tremendous progress in cutting pollution through the original Clean Air Act, it hasn't been enough to reduce the pollution responsible for acid rain and excessive air contamination that we suffer in the northeast. The forest and the waterways of the Hudson Valley, including the Catskills and the Adirondacks where I live, as well as the Green Mountains of Vermont and New Hampshire and on into Maine, have literally become a dumping ground for this pollution and they will be destroyed if we don't do something about it.

In fact, in studies as early as 1984, 20 percent of the Adirondack lakes, and we have literally hundreds and hundreds of lakes throughout the Adirondacks, 20 percent of them were dead. That means no fish, entirely. And 55 percent were highly acidic and that means that they are going to suffer the same results.

These statistics will only get worse in the future. And as an outdoorsman myself and a lifelong hunter and fisherman, and a lifelong resident of this beautiful region, I witnessed with my own eyes, as have my children and now my grandchildren, the slow deterioration of the woods, the lakes and streams. It's truly heartbreaking, Mr. Chairman, to think that we in the Congress have not been able to produce legislation to reverse the pollution that continues its daily destruction.

And you know, Mr. Chairman, I am not one of these flaming environmentalists. I try to look at things from a practical point of view. And as a matter of fact, Mr. Chairman, you know that even thought I'm one of the northeasterners, I always vote with those west of the Mississippi and Oklahomans and those from western States on their special issues, because they do have different issues than we might have in the northeast and we all need to consider each other's.

I've got an extended written testimony that goes into specifics on the details, Mr. Chairman. But I do have to get back to my committee. Let me ask unanimous consent to submit that for the record and then urge the committee to pass this legislation.

It's time that we really all recognized that acid rain is a serious problem. There's only one way to do it, and that's to not make drastic changes but make changes that will allow us to begin to reverse that course. That will save those mountains.

Senator INHOFE. Without objection, your entire statement will be in the record. Let me ask you one question before you leave, and I know you do have to leave. You drafted your legislation prior to the EPA taking action a couple of weeks ago on the SIPs and NOx. Is the main difference between yours and the new rules that the EPA came out with subsequent to your drafting your legislation the regional aspect and the level of the cap?

Mr. SOLOMON. Yes. That's one of the primary differences. In other words, Mr. Chairman, again, we only want to go back to 1984. We don't want to make drastic changes. But if we could go

back to that level, it would reverse, in other words, the acid rain, it would make all the difference in the world.

And again, I'd be glad to submit specific answers for you in writing if you would like.

Senator INHOFE. That's fine.

Congressman Solomon, we're very happy to have you here. Your entire statement will be in the record, and you may go to your meeting.

Mr. SOLOMON. Thank you very much. I'd like to apologize to my good Senator and my great friend from New York, I've got to go bang the gavel to send you over some vital legislation, so that you can get out of here at a reasonable time, too.

Thank you very much, and thank you for the good job you're doing.

Senator INHOFE. Thank you, Congressman Solomon.

Senator D'Amato, we have foregone our opening statements, and if you're on a short time line, we'll let you go ahead and make your statement now if you'd like. If not, we'll make our statements for the record, and the choice is yours.

Senator D'AMATO. Mr. Chairman, I'm deeply appreciative of your holding this hearing. And indeed, inasmuch as Congressman Solomon has already finished and you've been so accommodating. Let me thank you for holding this hearing at this late date. We in the northeast and New York in particular that have this problem are tremendously concerned. And we really are looking for relief. So I'd be very pleased to pass up your generous offer and listen to the Chairman and my friend, Senator Sessions, make their remarks.

Senator INHOFE. All right, Senator D'Amato. You're probably aware, I understand that Senator Moynihan will not be able to be here. We will be putting his statement in. He's suffering from the flu right now.

Senator D'AMATO. Yes.

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

Senator INHOFE. Before we go any further, I'd like to point out that today is the twelfth hearing of our subcommittee this Congress. We've covered a broad range of issues. We actually had six hearings on the NAAQS issue, which is one that endured a year and a half, we had hearings on regional haze, mercury, wetlands, Nuclear Regulatory Commission and FEMA. In addition, we have marked up the FEMA bill and passed it into law, a very important amendment on the NAAQS standards, which was included in the highway bill.

Those who talk about a do-nothing Congress are ignoring one of the most important roles of Congress, and that is oversight. An important measure of the Congress is how it performs its oversight responsibilities. And I'm proud of the number of oversight hearings we have held on a variety of topics. We will continue to do that in future years.

In today's hearing, of course, Senator Moynihan is not going to be able to be here. We've already heard from Congressman Solomon. We will hear in a moment from Senator D'Amato.

This hearing follows by 2 weeks the recent rulemaking by the EPA to reduce nitrogen oxides in the eastern 22 States area through the OTAG process. That rulemaking places limits on NOx emissions by State. While the Clean Air Act does not authorize a trading program for NOx, I certainly support market based approaches, such as that which is contained in your bill.

I'd like to ask the witnesses to keep two points in mind today, and that is, the need to incorporate more market-based approaches into the Clean Air Act. For example, by broadening the cap and trade programs, in effect, this legislation, in light of the recent OTAG rule. In other words, Senator D'Amato, your legislation was drafted prior to the rule that came out 2 weeks ago. And we'd like to have your idea and your assessment as to how your legislation would compare to that.

We'll have a second group coming in right after, a second panel after we complete this. And I'd ask at this time, Senator Sessions, if you have any opening comments to make before we hear from Senator D'Amato.

Senator SESSIONS. Just briefly, Mr. Chairman.

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

Senator SESSIONS. You have really spent a lot of time and effort on these issues, and I appreciate that. The country has benefited from it. I have been with you on field hearings and many hearings here in Washington.

There are a number of successful programs that have already been implemented to control nitrogen oxide and sulfur dioxide. EPA emissions data indicates 1995 sulfur dioxide emissions were reduced almost 40 percent below their required level. Further reductions will occur in 2000 when phase two of the Acid Deposition title of the Clean Air Act is implemented.

I'm concerned, however, about additional restrictions future regulations will have on the utility industry. All of us utilize the power that comes from that industry. EPA proposed a one-size-fits-all OTAG implementation plan despite some scientific conclusions that regional reductions would have minimal impact on long range nonattainment areas. As Senator Robert Byrd said on the Floor the other day, we may be imposing very high costs in one area, yet little or virtually no benefit in another area.

The further reduction of nitrogen oxides and sulfur dioxide as proposed by this bill, while beneficial in many ways, in light of recent OTAG call for the upcoming implementation of their phase two acid rain program, it raises some questions for me. I'm concerned about over-burdening the States with additional regulations and believe it's important for the existing regulations to take effect so we can ascertain the impacts of those regulations before going forward with another initiative.

I would say this to Senator D'Amato, I am certainly, I respect him and his leadership in this body. And I know that he is determined to make sure that the health and safety and environmental conditions in his State and area are properly protected. I am certainly open to that, and look forward to considering this legislation.

We've got to be careful that what we do has a scientific basis and does in fact produce benefits in comparison to the cost that's imposed. And I would mention as an example of that, an article that I circulated to every member of this committee within weeks of my arriving here. I read it in Scientific American on the airplane coming up to my first visit to the U.S. Senate. It was in Scientific American in December 1996.

It talked about the unintended consequence of some of our actions, because it reduces the base particles in the air, which are the particles that neutralize acid. The conclusion was that even though we've made some very huge changes in what we've done, we may not have impacted the acidity problem as much as we thought, because we were reducing the neutralizing base at the same time we were reducing acid.

So I am open-minded about this. I look forward to working with you, and Mr. Chairman, thank you for conducting this hearing.

[The referenced article follows:]

ATMOSPHERIC DUST AND ACID RAIN

(by Lars O. Hedin and Gene E. Likens)

EMISSIONS OF ACIDIC AIR POLLUTANTS HAVE FALLEN DRAMATICALLY. WHY IS ACID RAIN STILL A PROBLEM? ATMOSPHERIC DUST MAY BE PART OF THE ANSWER.

For the past several decades, scientists have been studying acid rain and how it affects the environment. As the harmful consequences of acidic air pollutants became increasingly clear, governments in North America and Europe began to regulate emissions of these compounds. Countries in the European Union enacted a variety of laws to control the release of sulfur dioxide and nitrogen oxides; the Clean Air Act imposed similar regulations in the U.S. Policymakers expected these reductions to rejuvenate forests lakes and streams in many regions. In some respects, the issue seemed wrapped up.

But the problem of acid rain has not gone away. Why is the rain falling on parts of Europe and North America still acidic, despite tighter controls on pollution? And why do some natural ecosystems—in particular, forests—show levels of damage from acid rain "rearer than scientists originally predicted?

Recent findings suggest that acid rain is a much more complex phenomenon than previously though!. Results from several studies point to the unexpected but critical role of chemicals in the atmosphere known as bases, which can counteract the effects of acid rain by neutralizing acidic pollutants. We have found that all the attention given to acidic compounds in the atmosphere has obscured the fact that emissions of bases have also decreased. A number of factors seem to be diminishing the level of these atmospheric bases and in the process aggravating the ecological effects of acid rain. Ironically, among these factors are some of the very steps that governments have taken to improve air quality.

Acids and bases are measured by what is known as the phi scale: solutions with a pH of less than 7 are acidic; those with a pH greater than 7 are basic; those with a pH of 7 are neutral Common acids around the home include vinegar, orange juice and beer; ammonia, baking soda and antacid tablets are all bases. Most of the bases in the atmosphere can be found in airborne particles referred to as atmospheric dust. These dust particles are rich in minerals such as calcium carbonate and magnesium carbonate, which act as bases when they dissolve in water.

Atmospheric dust particles originate from a combination of sources. Fossil fuel combustion and industrial activities, such as cement manufacturing, mining operations and metal processing, generate particles that contain bases. Constructionsites, farms and traffic on unpaved roads also contribute. Sources such as forest fires and erosion caused by wind blowing over arid soils with little vegetation are considered natural yet can still be linked to human activity.

A Natural Antacid

In the air, dust particles can neutralize acid rain in a manner similar to the way antacids counteract excess acid in an upset stomach. In a sense, when an acid and a base combine, they cancel each other out, producing a more neutral substance.

Neutralization in the atmosphere lakes place as dust particles dissolve into acidic cloud-waler droplets or combine directly with acidic gases such as sulfur dioxide or nitrogen oxides. These reactions also generate so-called base cations—a term used to describe the positively charged atoms of elements such as calcium and magnesium that arise when mineral bases dissolve in water.

In addition to lowering the acidity of precipitation, atmospheric base cations also neutralize acid rain once they reach the ground—although the chemistry is a bit different than in the atmosphere. Small particles of clay and humus (decayed organic matter) in soil bear negative and thus attract positively charged cations, such as calcium and magnesium; as a result, soils contain a natural store of base cations attached to these particles. As acidic rainwater drains into the ground, the base cations give up their places to the positively charged hydrogen ions found in acids, which bind more tightly to the soil particles. Because these particles sequester hydrogen ions, the acidity of the water that flows through the soil stays low. In some soils the process becomes more complex: acid rain triggers the dissolution of toxic aluminum ions that also displace the base cations.

As long as the soil has an abundant supply of base cations, this buffering system, known as carton exchange, protects forests from the harmful effects of acid rain. But the natural reserves of base cations can become depleted if soils that are naturally poor in bases are exposed to acid rain over decades, as has been the case in regions of Europe and North America. In these areas, hydrogen ions and aluminum ions have displaced a large part of the available base cations in soils, allowing levels of aluminum to rise and leaving the soil highly acidic. Furthermore, such acidified soils can no longer protect downstream ecosystems from acid rain: waters that drain these forests carry both acids and aluminum into streams, lakes and rivers.

Dust particles may serve one other important role. Elements such as calcium and magnesium, as well as sodium and potassium—all of which can be found in mineral dust—are essential nutrients for most plants. Acid rain not only dislodges these elements from clay and humus particles, from which plants get most of their nutrients, it also washes them into rivers and streams, depleting the ecosystem of its store of minerals.

With the exception of early work in the 1950's by Hans Egner of Uppsala Agricultural University in Sweden and Eville Gorham of the Freshwater Biological Association laboratory in England, scientists have not paid much attention to the idea that the atmosphere can be a major source of base cations found in soils. Scientists have traditionally thought that the slow dissolution of minerals and rocks in deeper parts of the soil replenished base cations, in a natural process called chemical weathering.

But recent findings, including our own studies, are now revising the general view of how bases enter soils and how forests depend on atmospheric inputs of minerals and nutrients. In some forests the atmosphere actually appears to be the main source of base canons. These new results suggest that many forests are more sensitive to changes in atmospheric chemistry than scientists once believed.

Less Dust, More Damage

Efforts to reduce emissions of acidic air pollutants offered encouraging results at first: levels of atmospheric sulfur, for instance, have dropped dramatically over the past three decades in much of Europe and eastern North America. The two of us became concerned, however, that policymakers and scientists alike might be neglecting the role of atmospheric bases in their attempts to evaluate whether these reductions in sulfur compounds have benefited the environment. Considering the significance of basic chemicals to both forest growth and the prevention of acid rain, we decided to investigate whether levels of atmospheric dust have also changed over rime in response to lower emissions imposed by new regulations.

Regulations to limit emissions of dust were enacted because, as scientists have known for some time, microscopic particles suspended in the air can cause a range of health problems when inhaled; they also degrade visibility and contribute to a host of other environmental problems. Governments in North America and Europe have for over 90 years designated acceptable air-quality standards for particulate matter; these regulations were quite distinct from those focusing on acidic pollution. (Atmospheric dust from other sources appears to have dropped off as well: Gary J. Stensland and Donald F. Gatz of the Illinois State Water Survey have found that emissions of particles containing bases have fallen in response to less traffic on unpaved roads.)

Working together with European scientists, we began by evaluating the longest records of precipitation chemistry that can be found in eastern North America and western Europe. By measuring base cations dissolved in snow and rainwater we can keep track of the levels of mineral bases in the atmosphere and monitor the input of these base cations into forest ecosystems. Our findings were startling: we discov-

ered that atmospheric bases have declined at unexpectedly steep rates during the past 10 to 30 years. The longest existing North American record, collected at the Hubbard Brook Experimental Forest in New Hampshire, showed a 49 percent drop in atmospheric base cations since 1965.

On the other side of the Atlantic we found that the longest-running high quality European record, from the forested area of Sjoangen in southern Sweden, showed a 74 percent decrease in base cations since 1971. Our analyses of several other records confirmed with few exceptions that atmospheric bases have declined precipitously across extended areas of Europe and North America.

But have these cuts in atmospheric bases been strong enough to counteract—or even nullify—the environmental benefits of reductions in acidic emissions? Our research indicates that this indeed has been the case. We found that the decline in bases has often mirrored the downturn in atmospheric sulfur, at rates sharp enough to offset a large part of the drop in sulfur compounds. For example, we found that the decrease in base cations canceled out between 54 and 68 percent of the reductions in atmospheric sulfur in Sweden and up tO 100 percent at some locations in eastern North America. These trends mean that declines in bases have kept the atmosphere sensitive to acidic compounds despite reduced emissions of these chemicals. When we began this work, we certainly did not anticipate that reductions in one form of pollutants—dust particles—would be found to decrease the success of reductions of another pollutant, sulfur dioxide.

The numerous sources of dust particles and the often sketchy information on emissions of particulates make it difficult to determine why these sharp reductions in atmospheric bases have occurred. We do know that new and cleaner industrial techniques, developed in accordance with regulations on the release of particulate matter, have been an important factor. For example, improved combustion efficiency and the practice of scrubbing particles from smokestacks have curtailed particulate pollution associated with the burning of fossil fuels. Evaluating the contribution of more diffuse sources of dust—traffic, agricultural methods and wind erosion, for instance—has been more difficult. But our studies suggest that the decline in dust particles mainly reflects changes in human behavior as opposed to natural variations.

A Major Source of Nutrients

Scientists have watched for years as calcium, magnesium and potassium levels have dropped in forest soils around the world. For example, Leif Hallbacken and Carl Olof Tamm, both at Uppsala Agricultural University in Sweden, have documented losses of 56 tO 74 percent of the available cations in Norway spruce forests over the past 60 years. Other reports show similarly dramatic losses of base cations in England, Germany and the U.S. Several recent studies of ailing forests show that the precipitous loss of base cations can be a key factor in the phenomenon of forest decline. Ernst-Detlef Schulze and his colleagues at the University of Bayreuth have argued that depletion of magnesium in soils has played a significant role in the dwindling of spruce forests in the Fichtelgebirge of Germany. Although their evidence is less clear, researchers at Oak Ridge National Laboratory in Tennessee, led by Samuel B. McLaughlin, have found that the slowdown in growth of red spruce trees in the southern Appalachian Mountains correlates with lower availability of calcium in soils. Interestingly, small-scale experiments involving fertilization of some forests with base cations, particularly calcium and magnesium, have ameliorated damage—in the sugar maple forests of Quebec, for instance, and in Norway spruce and silver fir forests of Germany and France.

Reports such as these made us wonder whether certain soils are suffering not only because of continued exposure to acid rain but also because they do not receive enough base cations from the atmosphere. Scientists can now pinpoint the origin of base cations and trace their movements through forest ecosystems by looking at the natural isotopes of the element strontium (determined by evaluating the number of neutrons in the nucleus of a strontium atom), which can be used as a tracer for calcium. Strontium atoms that derive from the bedrock and those that come from the atmosphere tend to exist as different mixtures of isotopes. This technique has illustrated that atmospheric dust is in fact a critical source of mineral ions in many forest ecosystems.

Moreover, in certain regions, where soils tend to be damaged by acid rain or naturally low in base cations, most of the calcium appears to come from the atmosphere rather than the bedrock. For instance, we have determined that in unpolluted forests of Chile, the dominant tree species, the southern beech, feeds on calcium that originates almost exclusively in the atmosphere.

These observations suggest that many forests depend quite heavily on the atmosphere for a supply of mineral bases; the drops in atmospheric base cations have

therefore led to a slower replenishment of critical bases and nutrients in forest soils. Of course, natural levels of atmospheric dust have always varied, but across centuries or millennia. Studies conducted by Paul A. Mayewski and his coworkers at the University of New Hampshire on ice cores from Greenland indicate that the amounts of dust and calcium in the atmosphere have been strongly affected by climate variations over the past 20,000 years. In the coldest and driest global climates, high levels of calcium and dust prevailed, whereas wetter and warmer periods saw low concentrations. Analysis of modern trends, from around 700 A.D. to the present, suggests that current quantities of dust are relatively low compared with conditions during the past 20,000 years. One notable exception was the Dust Bowl, the extended drought of the mid-1930's in the western U.S.

Remaining Questions

As scientists have discovered the importance of bases in the atmosphere and, more recently, the link between emissions of atmospheric dust and nutrients in the soil, they have begun to paint a new picture of how forests respond to atmospheric pollution. This emerging view suggests that the effects of acid rain are more complex than expected and that the damage caused by the pollution is more serious than predicted. For instance, the widely quoted conclusion from the 1990 National Acid Precipitation Assessment Program (the most recent evaluation of the problem of acid rain by the U.S. government), that there was no clear evidence linking acid rain to forest damage, no longer seems tenable.

It is entirely feasible that continuing acid rain, in combination with limited supplies of base cations, could produce environmental conditions to which many plant species, particularly in sensitive ecosystems, have never been exposed in the course of Heir evolution. Consequently, predicting how they will respond over the next several decades will be extremely difficult. And effects may not be limited to plants. Jaap Graveland and his colleagues at the University of Groningen, have noted chat certain birds, such as the great tits of the Netherlands produce thinner, more fragile eggs in forests that have been heavily damaged by acid rain and have low stores of calcium in the soil.

What can we do about acid rain and atmospheric dust? Suggestions range from the improbable to the feasible. After the publication of one of our recent papers, a reader wrote proposing that forests might be saved by a hot-air balloon campaign to drop calcium-rich particles from the skies—a costly and impractical solution. Deliberate increases in the release of particulates are also unrealistic and would set back progress in air pollution control by decades. One reasonable suggestion, however, is to reduce emissions of acidic pollutants to levels that can be buffered by narural quantities of basic compounds in the armosphere; such a goal would mean continued reductions in sulfur dioxide and nitrogen oxides, perhaps even greater than those prescribed in the 1990 Amendments to the Clean Air Act in the U.S.

The ecological dilemma of atmospheric dust will very likely be widh us for some time: base cations take years to buildup in soils, and it may take decades or more for forests to recover Their depleted pools of nutrienrs, even if levels of acidic air pollution continue to fall. In the meantime, researchers and governments must develop careful strategies not only for monitoring the current health of forests but also for predicting Their stability in the next century and beyond. Simple solutions do not always work in complex ecosystems.

Senator INHOFE. Thank you, Senator Sessions.

I think also we have a concern about the layering and layering of these regulations. If everything you and I said at this table the last year and a half, and have gone over this, and this has a cumulative effect that makes us noncompetitive and makes us question the sound science. So I know we share those concerns.

Senator D'Amato, if you'd like to make your statement.

Senator D'AMATO. Mr. Chairman, I want to thank you and Senator Sessions, particularly yourself for holding this hearing as late as this in the session. I'm deeply appreciative of that. I want to express appreciation of the Senior Senator from New York, Senator Moynihan, who as you have indicated, will not be able to be with us. He does have a case of the flu and could not be here.

I'm going to ask that my full statement be placed in the record as if read in its entirety.

Senator INHOFE. Without objection.

Senator D'AMATO. A magnificent statement, it is a beautiful statement.

[Laughter.]

Senator INHOFE. Before we do that, I have a magnificent opening statement, too. So without objection, mine will be in there with yours.

[The prepared statement of Senators Inhofe follows:]

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

Before we begin today's hearing, I would like to point out that today is the twelfth hearing of our subcommittee this Congress. We have covered a broad range of issues:—a series of six hearings on the NAAQS standards, ozone and PM,—hearings on Regional Haze and Mercury,—a hearing on wetlands,—the first NRC hearing in 4 years, and—the first general FEMA hearing in 7 years.

In addition we marked up a FEMA Bill and passed into law a very important amendment on the NAAQS standards which was included in the Highway Bill. Those who talk about a do-nothing Congress are ignoring one of the most important roles of Congress, that of oversight. An important measure of a Congress is how it preforms its oversight responsibilities. I am proud of the number of oversight hearings we have held and the variety of topics. However, I will say for every hearing held there is probably another ten topics that deserve hearings. In the next Congress, it is my intention to increase the oversight responsibilities of this Subcommittee.

Today's hearing is on Senator Moynihan and Senator D'Amato's acid rain bill, S. 1097. The Bill calls for a new Cap and Trade program for nitrogen oxides and a lowering of the current Cap for sulfur dioxide, in order to reduce acid rain.

This hearing, follows by 2 weeks, the recent rulemaking by the EPA to reduce nitrogen oxides in the Eastern 22 State area through the OTAG process. That rulemaking places limits for NOx emissions by State. While the Clean Air Act does not authorize a trading program for NOx, I certainly support market-based approaches, like the one in S. 1097, for dealing with pollution. Three weeks ago I gave a Clean Air Reauthorization speech in which I called for more market-based approaches to be incorporated into the Act. I intend for reauthorization hearings to cover this topic next year.

I would like to ask today's witnesses to keep these two points in mind during your testimony.

1) The need to incorporate more market-based approaches into the Clean Air Act, for example by broadening the cap and trade programs, and

2) The effect of this legislation in light of the recent OTAG rule.

I do have concerns, however, in how the EPA is layering regulation upon regulation. Just in the last year we have had the new ozone standard, the Particulate Matter standard, and the Regional Haze rule; all addressing the same particles. Now we have the new SIP call for NOx. While it appears that they are trying to turn these particles into endangered species; the effect is they are turning jobs into endangered species; particularly coal miners. This next year, I will be asking the General Accounting Office to examine the cumulative impacts of all of these regulatory programs on the economy.

We have a very distinguished first panel today, the primary sponsors of the legislation. Senators Moynihan and D'Amato and Congressman Solomon, the lead sponsor for the House companion Bill. While I may not agree with everything in the legislation, we can certainly find common ground in their market-based approach to the problem.

STATEMENT OF HON. ALFONSE M. D'AMATO, A UNITED STATES SENATOR FROM THE STATE OF NEW YORK

Senator D'AMATO. It is filled with the kind of data and information that I think the former Attorney General of Alabama, who is a man of detail, will find interesting. And I think it's important.

But indeed, the essence of S. 1097, the Acid Deposition Control Act, which has been introduced by Senator Moynihan and myself, has been the product of a number of years worth of study. You know, people generally think of New York in the context of New

York City. It's understandable, because it's the Big Apple that gets written about.

When things aren't going well, we all hear about the crime, the infestation, the welfare rolls. When things go well, we hear about the renaissance. And we're pleased that people have been hearing about the renaissance, have been coming to the city, enjoying the great restaurants, the theaters, and of course, our hopefully world championship Yankees this year. They play this evening, they play Cleveland. I notice none of the members of the panel are from Ohio, so I can do a little braggadocio. We want to even the score. They knocked us out, as you know, last year.

Having said that, that is not an accurate picture. Even the great city of New York is not an accurate picture of what New York is about. It's about magnificent lakes and rivers and forests, forests that are among the greatest in this country. The Adirondack Range, 2,800 lakes, magnificent, magnificent.

It is about farming. It is about an agricultural community of tens of thousands of dairy farmers, vegetable farmers, apple farmers. We have the second largest apple crop in the United States of America. We're about fourth in dairy. I daresay, many people are not aware of that. We're a $4 billion industry in agriculture.

You see, we are not really understood by many. By many even within the State, forget about being out of the State. When do you ever hear about the great agriculture? When do you ever hear about the pristine lakes and rivers, etc., that are about our State? About the 6.7 million people who live west of the Hudson who encompass it and who create a major part of that.

Of course, Congressman Solomon represents a significant portion of that area covered by the Adirondacks. Significant, not all of it. But a significant portion.

So it is with this in mind that I place in front of you that we have been assaulted by airborne terrorism for far too long. We have complied with all the EPA requirements, and indeed, in terms of dealing with the waste, with the emissions, have made remarkable strides. We could close all of our power plants, all of our factories, and never be able to accomplish the attainment called for because of that airborne terrorism.

Now, I want to say to you in all fairness, gentlemen, if we were to eliminate every moving truck, car, every factory and still have airborne terrorism knocking out our lakes, and by the year 2040, it is estimated that of the 2,800 lakes, 43 will be so acidic that we can't use them.

And we know where it's coming from. We know that if you build giant smokestacks 600 and 700 and 800 feet into the air, you discharge your pollutants, so that the State or the place where the emissions are coming from never feel them. They enter the jet stream and carry to the northeast.

Now, it's pretty good to say, now, listen, I have to worry about the cost of this, and what will the cost be, if you're not the State or the people being bombarded. But if you're being bombarded and your lakes and your forests are being knocked out, that is not good enough.

I note that the Senator, and the Chairman indicated quite correctly that the public-private working together, the purchase by

those in non-attainment zones, etc., those work. They haven't provided that, the EPA, it doesn't relate to nitrogen oxide. However, in terms of the sulfur dioxide, where they once estimated it would cost $1,500 a ton, they're doing it for $150 a ton. It does work. It does not have to put businesses out.

But you can no longer, because the great Senator from West Virginia is worried that coal, dirty coal, will have a maybe less economic impact, maybe others will turn to natural gas, maybe it will not have the economic value to his region, you can't permit the bombardment of the northeast into these forest. It's just not right.

And I would suggest that if we had the reverse taking place, that any one of my colleagues and their States, they would have an absolute right and an obligation to say, come on, let's take a look at this, how do we deal with this. That's what we're talking about here.

So while it's easy to say what is the cost and should we take a look at it, let's take a look at the cost of not doing it. We've lost 500 of the 2,800 lakes already. They're lost. If we continue this, we're going to lose the majority of these lakes. It's not what we can or should be about.

So that's why we offered this legislation. And it is prudent legislation, it provides an opportunity over a period of time. But it does call for the kinds of reductions that people have a right to know that their Government does care about the quality of life.

And we didn't even get into the asthma, we didn't get into the health situation. And that is a problem, and it is a problem precipitated by that kind of flow.

Last but not least, I want to say that the measures offered by the EPA, I think they call it the SIP program, are not nearly adequate enough. You may have some questions here and think they are over-reaching. They are not. Let me say that they give us some relief during the summer, none during the winter. I cannot understand for the life of me why they would engage in that. Maybe in an attempt to minimize the cost.

But the fact is that what happens is during the winter, your snow, the accumulation of the snow will have this acid in it, and thereafter, when you have the spring thaw, it is a bombardment into those lakes. The acidity is incredible.

So it is not adequate, and Senator Moynihan's legislation and mine goes to that. We set up reductions, we set up standards, we set up timetables. We have done this with the help of some of the great scientists. We did not just pick numbers out, working with our State environmental people and others, to arrive at these figures, bringing about annual reductions.

I think it's prudent. I hope that staff will have an opportunity to look at it, to examine it, to see in detail what kinds of changes may or may not be suggested.

But that's the problem. We have this airborne terrorism. And again, we can never, never protect those lakes. If we were to shut down every moving vehicle in New York, close all of our factories, we would still have this same degradation of the quality of life.

And so that's the problem that I put forth to my colleagues. I would hope we would have an understanding. It's more than sim-

ply saying, what will the costs be. What's the cost if we don't? And how can we do this within reason?

We're not looking to hurt any region. Believe me, we're not. But I have to tell you, if we're not burning dirty coal, and if we had to put in scrubbers where we are burning coal, and we do have to reduce that. We've had to turn to natural gas. And how and why is it that we should allow the continuation of this? Because there are some who took advantage of the existing law, which does not, and which provided them with the opportunity of building the big stacks to avoid that kind of cost.

That cost is being borne by others. And the degradation to our quality of life continues. So it's real, it's a real problem, it's not imaginary. I wouldn't come here and tell you, and make this up because it sounds good. It is a real problem for us.

I thank the committee for their patience, for their understanding, and you, Mr. Chairman, in particular for your thoughtfulness, from the fact that you have held a dozen hearings to look and see where is the proper balance in terms of legislation and the impact that legislation will have to try to improve all of our qualities of life.

Senator INHOFE. Thank you, Senator D'Amato. And your observation is very accurate. I know most of my adult life, I've thought of New York as being New York City, until I had occasion to spend time up there. Everything you say is true, and you certain champion the cause of the potential harm that can be done to that area. I'm sure people are appreciative of it.

I think you've answered my question, when I asked the question that the EPA rules that came out after you had already drafted your legislation, you still feel are inadequate, is that correct?

Senator D'AMATO. Yes, absolutely. Again, as I mentioned to you, Mr. Chairman, there is no factory, I think it works for 4 months in the winter time, there's no controls whatsoever. The buildup, the deposition of the acidity is such that when you have the spring thaw, it is an actual shock to the lake, when you have the runoff, it's an incredible shock. So the aquatic life will be tremendously impacted.

I understand what they're trying to do, they're trying to do a balancing act. It doesn't work. So while we don't get the direct assault immediately, we get it during the spring, an acidic accumulation of all that that has been deposited in the snowbanks.

Senator INHOFE. The EPA, and I'm sure we'll hear it again today, has told us that the sulfur dioxide emissions have been reduced. Have you noticed that in terms of impact on New York?

Senator D'AMATO. Yes, there has been an overall drop in the level of emissions of sulfur dioxide. It's not having the anticipated effect in the State. For example, levels of acidity in our soil and water have not dropped. It was thought that the levels of acidity would drop with the enactment.

In order to see that, we think there has to be a much greater reduction. We have not had the impact. Because we have been bombarded over the years. So it does not have the kind of impact.

Senator INHOFE. Do you think enough time has gone by that you would be able to determine that impact?

Senator D'AMATO. Yes. We would.

Senator INHOFE. All right, Senator Sessions.

Senator SESSIONS. I would say this, I am familiar with the threat to the forests and the lakes of New York. It's a very real thing in the northeast, and in some other areas of the country. It's not something we ought to ignore. We need to establish good public policy that deals with it.

You have again confirmed your reputation as being an articulate advocate for views that you feel strongly about, Senator D'Amato, and we will certainly give those consideration.

Senator D'AMATO. I thank the General. I call you the General, because I have such respect for those who have been Attorney General, for the great job you did, Senator, and we're delighted to have that thoughtfulness.

Let me just, if I might, Mr. Chairman, and Senator Sessions, conclude. Think about this, it's not really fair or responsible to have people evading, and I say evading, the intent of the law by building a giant smokestack that brings its pollution, the worst kind, that would never be permitted in your State, in either of our States, to then take that and carry that stuff by way of the jet stream hundreds and hundreds of miles away and say, well, our environment is fine. Whether it's in Indiana or Illinois, and those are two of the States, and Ohio, States that contributed. I've nothing against Indiana, Illinois and Ohio. I hope they have great, wonderful environments and that their lakes aren't bombarded.

But I do have a problem with that kind of an attitude, that they save money because they build a huge stack. We have scrubbers, we have to burn natural gas. We understand that. That's the price you have to pay.

But there's something wrong, and we've got to change it. And so that's where we're coming from. This is something that will not go away. This is not something born of the days of political process, where there's an election. This is something that Senator Moynihan and I have been working on. And I am more determined than ever to attempt to do something.

And I would hope with the great leadership and the strength of this committee, that we could come to some kind of reasonable solution to begin to move us in the process of fairness. And that's what we're looking for, fairness. And I'm really deeply appreciative of my colleagues' sensitivity and your patience.

Thank you.

Senator INHOFE. Well, thank you very much, Senator D'Amato. You have presented a very strong case, and we appreciate your presence here this morning.

We would also like to say that due to his illness, Senator Moynihan is not going to be here, but we do have a statement which will be in the record in its entirety.

[The prepared statement of Senator Moynihan follows:]

STATEMENT OF HON. DANIEL PATRICK MOYNIHAN, U.S. SENATOR FROM THE STATE OF NEW YORK

Good morning, Mr. Chairman. Thank you for holding this hearing on acid deposition. I appreciate the opportunity to testify on two bills Senator D'Amato and I have introduced, S. 1097 and S. 2377, legislation to require additional reductions in utility sector emissions of sulfur dioxide (SO_2) and nitrogen oxides (NOx), and to reduce the sulfur content in gasoline, respectively.

We have come a long way in understanding the causes and effects of acid deposition and ways to control it. But we have a long way to go yet. We have learned,

for instance, that the SO_2 emissions reductions required under the Clean Air Act Amendments of 1990 ("1990 Amendments") are insufficient to prevent the continued acidification of many lakes and further damage to sensitive ecosystems. We also have learned that legislation containing regulatory flexibility and market incentives is preferable to the traditional "command and control" approach.

Perhaps most importantly, since the 1990 Amendments were enacted, we have learned that nitrogen oxides, which we largely ignored 8 years ago, are significant "precursors" of acid deposition. And we have learned that acid deposition does not cause environmental degradation just in remote, high-elevation forests and lakes in the Adirondacks and northern New England. Rather, it poses a continuing and significant threat to the environmental quality of lakes, streams, forests, bays, and estuaries in numerous regions of the country, and to the health of the people who reside in these regions.

And so Senator D'Amato and I have introduced two bills, each of which addresses different facets of the acid deposition problem: one targets stationary sources of SO_2 and NOx, the other targets mobile sources of NOx. The first, S. 1097, is modeled after and builds on the Environmental Protection Agency's (EPA) Sulfur Dioxide Allowance Program. The second, S. 2377, requires a reduction in gasoline sulfur using existing and readily available refinery technology. The cost of gasoline would rise under S. 2377—by a nickel a gallon at the retail level, at most. For a car driven 15,000 miles per year that achieves 15 miles per gallon, the cost of S. 2377 would be $50 annually. Keep in mind, however, that gasoline prices, adjusted for inflation, are cheaper now than they have been at any time since 1950 (the beginning point of our analysis). And the benefits to human health and the environment of reducing gasoline sulfur far outweigh this modest cost.

I think these are good bills—good for human health and the environment, good for New York and the United States—and I am optimistic that their essential features will be incorporated into legislation this Subcommittee and, eventually, the full Committee will report to reauthorize the Clean Air Act. Certainly, I welcome the scrutiny this hearing affords, and I look forward to working with other Committee Members on fashioning sound legislation to control acid deposition.

Background

Mr. Chairman, as far back as the 1960's, fisherman in the Adirondacks began to complain about more than "the big one that got away." Fish, once abundant in the pristine, remote Adirondack lakes, were not getting harder to catch. They were gone.

At first, pollution seemed an unlikely cause. The lakes are in a 6 million acre park protected by the New York State Constitution. And most of them are all but inaccessible, except to determined fishermen lured by their solitude and beauty, and by what was once an enormous bounty. But the lakes, it turned out, are accessible to something besides fishermen: the winds that blow in from coal country, Appalachia.

In time, pioneering scientists such as Cornell University's Carl Schofield, Eugene Likens, and Charles Driscoll established a strong inferential link between "acid" deposition—principally caused by burning coal upwind—and the diminished ability of lakes in the Adirondacks to sustain healthy fish populations. Water made acidic by atmospheric deposition was leaching inorganic aluminum from the granite bedrock surrounding the lakes, and the aluminum was poisoning the fish, primarily through their gills.

Acid rain. Now there is a powerful image. Not always so. There were days when dark plumes of smoke were a sign of prosperity. During the Depression, New York City's Jim Farley, who was Postmaster General, liked nothing more than to open a new Post Office and hire a WPA artist to paint murals on its walls depicting busy factories belching smoke from their chimneys. No longer.

By the early 1970's, environmentalists were alarmed. Environmentalism is nothing if not an ethic of responsibility. Our first responsibility is to the facts. Facts about cause and effect. Facts about costs and benefits. It is not knowledge that we should fear, but the lack of knowledge.

When I entered the Senate in 1977, there was much we needed to learn about acid rain. So I introduced the first Federal legislation to address our "knowledge deficit" about acid rain: the Acid Precipitation Act of 1979. My bill was enacted into law as Title VII of the Energy Security Act, which Congress passed in June 1980 (Public Law 96–264). Title VII established the National Acid Precipitation Assessment Program (NAPAP), an interagency program charged with assessing the causes and damages of acid deposition, and reporting its findings to Congress.

NAPAP created a network of long-term atmospheric deposition monitoring stations, permanent forest plots, and lake sampling regimes. These stations and sites, which comprise the infrastructure of the National Science Foundation's Long Term

Ecological Research (LTER) network, provide scientists with data sets now spanning decades across a variety of ecosystems. One of these sites, the Hubbard Brook Experimental Forest in New Hampshire, has been under continuous study for 35 years. The availability of long-term data is critical for the study of complicated ecosystems.

NAPAP spawned tremendous academic interest in the subject of acid deposition. Between 1970 and 1979, only two doctoral degrees were issued in the "field" of acid deposition—if it could be called such at the time. From 1980 through 1989, after NAPAP was established, 71 individuals earned doctoral degrees in the field. And between 1990 and 1995, another 35 scientists earned their Ph.D.s in the field.

More than 1,700 research papers describing the results of NAPAP-funded research were published in technical journals by October 1989, when debate on reauthorization of the Clean Air Act was under way. This is a good indicator of new findings. Authors must compete for limited space in these publications. Poor science and shopworn discoveries are usually rejected. As we began consideration of the 1990 Amendments, we could glean from the technical "state-of-science" reports that at least 800 lakes and 2,200 streams in the eastern United States had been made acidic by acid deposition; at least 200 additional streams, about 10 percent more, would become acidic over the next decade without additional legislation to control emissions.

In all, some $570 million was spent to underwrite the scientific research contained in the first NAPAP report to Congress. Except for space and weapons research, NAPAP had become the Federal Government's biggest scientific undertaking in history. It continues.

I was an original co-sponsor of the Clean Air Act Amendments of 1990, and I am proud of what we accomplished through that landmark legislation. Title IV of the 1990 Amendments established a "Sulfur Dioxide Allowance Program." Its creation represented a radical departure from the traditional "command and control" approach to environmental regulation common at the time. This program was the first national, statutorily mandated, market-based approach to pollution control. It has been tremendously successful.

The SO_2 Allowance Program is successful because of the flexibility it affords the affected utilities. The EPA allocated a number of allowances to each utility under the Program. Each allowance represents the limited authority of the utility to emit one ton of SO_2. EPA "capped" the number of allowances to ensure an overall reduction in emissions. Each utility may choose to reduce its own emissions, or to purchase unused allowances from another utility. Further, utilities may choose to "bank" their allowances, which may be used or sold at a later date. The allowances trade quite freely, as stocks do. In fact, members of my legislative staff recently purchased two such allowances, at a discounted price of $100, which they donated to the New York-based Adirondack Council. The Council, in turn, "retired" the two allowances, which is their right under the Program.

This past August, NAPAP issued another report. It states that we have made progress under the SO_2 Allowance Program toward our goal of protecting sensitive ecosystems from the scourge of acid rain since 1990. In 1995, the first year of the program, SO_2 emissions declined dramatically, to nearly 5 million tons below 1980 levels—a reduction which was 39 percent ahead of the Program's target. Large areas of the eastern United States saw up to a 25 percent decrease in sulfate concentration levels in the air and in the acidity levels of wet deposition. Between 1989 and 1995, monitoring stations at eastern sites showed dry deposition of sulfur dioxide and sulfates decreased by 35 and 26 percent, respectively. Concentrations of sulfates in lakes and streams have decreased in many areas, with evidence of some recovery from acidification in New England.

Resources For the Future (RFF) scientists and economists conducted an analysis to estimate the benefits from reduced risk of human health effects resulting from SO_2 emissions reductions required under Title IV of the 1990 Amendments. The RFF analysis estimates mortality benefits ranging from $1,075 to $15,020 per ton of reduction in SO_2 emissions. Even the lowest benefit exceeds the cost per ton of emissions reduction by more than a factor of ten. (The price of allowances reflects the control costs for SO_2 emissions reductions. The price of an allowance has dropped from an estimated $500 per ton when the 1990 Amendments were passed to about $100 per ton currently.)

The median value of benefits from reduced risk of human morbidity effects estimated in the RFF analysis is an additional $475 per ton of SO_2 emissions reduction. The RFF analysis is consistent with analyses conducted by EPA staff on the magnitude of health benefits.

Reductions in SO_2 emissions have provided substantial improvements in visibility, especially in the eastern United States. EPA estimates that reductions in SO_2 emis-

sions so far have resulted in a 20 percent reduction in regional haze in large areas of the eastern United States. Researchers have estimated monetary benefits to residential areas in 31 eastern states and to national parks in the southeastern states of $3.4 billion (1994 dollars) in 2010, or about $377 per ton of SO_2 reduction.

Perhaps the most pleasant development with regard to the SO_2 Allowance Program has been program compliance and cost. Because of the Program's flexibility, the compliance rate is 100 percent. The cost of compliance has been less than half of what was projected in 1990. Actual costs of compliance for 1995, for instance, are estimated at $726 million. The General Accounting Office (GAO) had estimated in 1994 that the costs of compliance for 1995 would be $1.2 billion. Estimates of total costs of Title IV compliance continue to be revised downward.

The market flexibility provided by allowance trading promotes innovation and competition in emissions reduction technologies. This flexibility has allowed reductions to be made at sites where they could be achieved in the most cost-effective manner. Studies conducted since 1990 have estimated that the cost savings due to emissions trading, compared to the cost of a traditional command-and-control approach, has been between $230 million and $600 million per year.

S. 1097: Addressing Stationary Sources of SO_2 and NOx

We can be proud of our accomplishments thus far. But we must look carefully at the scientific data before we conclude that our work is done in controlling SO_2 emissions. The data indicate that the 1990 Amendments did not go far enough to prevent continued damage from acid rain. For example, the August 1998 NAPAP Report contains an assessment of long-term data collected at monitoring sites in the Southern Appalachians which indicates that sulfate concentrations of surface waters have been increasing consistently for more than a decade. The majority of Adirondack lakes have not shown recovery from acidity levels, and the most sensitive Adirondack lakes continue to acidify.

So Senator D'Amato and I introduced S. 1097, the Acid Deposition Control Act of 1997. Our bill would require additional reductions in emissions of 50 percent for SO_2, and 70 percent for NOx, from the electric utility sector. It would also require the EPA to develop measurable indicators of ecosystem health to evaluate the effectiveness of the Agency's Acid Rain Program.

S. 1097 would require reductions in SO_2 emissions beyond those provided for in Phase II of the existing Program. In light of the impressive success and cost effectiveness of the SO_2 Allowance Program, our bill is designed to build onto it as seamlessly as possible. In effect, our bill establishes a "third phase" under the existing SO_2 Allowance Program. Under the proposed Phase III, total utility emissions of SO_2 would be reduced to just under 4.5 million tons per year—a 50 percent reduction.

The Importance of Nitrogen

We have learned a great deal about the science of acid rain in the years since the 1990 Amendments. Perhaps the most important insight we have gained from the last decade of scientific research is that the emission of nitrogen oxides (NOx) contributes significantly to acid deposition. We now know that nitrogen is quantitatively as—or, in some cases, more—important than sulfur as a cause of both chronic and episodic acidification.

Normally, terrestrial and aquatic plant growth is limited by the availability of nitrogen. Inputs of new nitrogen from atmospheric deposition (as opposed to nitrogen recycled within the ecosystem) have caused some forests to become "nitrogen saturated." Nitrogen saturation is accompanied by depletion of soil base cations (which are nutrients) such as calcium that buffer the soil from acidity. The soil chemistry changes, affecting forest health. And increases in soil acidity affect the pH of drainage water which empties into lakes and streams. Chronically high nitrate concentrations have been documented in lakes and streams in a variety of locations throughout the United States, including the San Bernardino and San Gabriel Mountains within the Los Angeles air basin, the Front Range of Colorado, the Allegheny Mountains of West Virginia, the Catskill Mountains of New York, and the Great Smoky Mountains of Tennessee.

We also have gained an improved understanding of the importance of episodic acidification. In 1990, the best science available at the time indicated that chronic acidification posed the greatest threat to sensitive ecosystems. We now know that episodic acidification—short-term drops in the pH of lakes and streams during periods of high water flow, such as storms and snow melt—can be extremely damaging to ecosystems, too. We now understand that nitrogen plays a more important role in these acidic episodes than does sulfur.

Episodic acidification is ubiquitous in our surface waters. Nearly all lakes and streams throughout the United States, Canada, and Europe experience increased acidification during high water flow events. Biological effects on fish in acidified lakes and streams are largely attributable to increased concentrations of dissolved aluminum. The aluminum is transported to drainage waters from soils which have been leached by excess nitrates. We know that much of the nitrates accumulate in the soil as a result of acid deposition.

Since 1990, we have become much more aware of the problem of eutrophication of bays and estuaries. Through a combination of monitoring, experimental research, and modeling, scientists better understand the effects of atmospheric deposition of nitrogen to these near-coastal waters. Excessive nitrogen loading causes eutrophication, which is the increase in the rate of supply of organic matter to an ecosystem. The consequences of eutrophication include massive die-offs of estuarine and marine plants and animals; loss of biological diversity; growth of nuisance algae potentially toxic to humans and marine animals, such as pfisteria; and damage to ecosystems which endangers the sustainability of local fisheries resources.

Atmospheric deposition is a significant source of nitrogen loading to coastal waters stretching from the Gulf Coast around and up the entire length of the eastern seaboard. For example, the Chesapeake Bay is believed to receive 27 percent of its nitrogen load directly from the atmosphere. For Tampa Bay, the figure is 28 percent. For the coastal waters of the Newport River in North Carolina, between 35 and 80 percent.

In 1997, the Ecological Society of America convened a workshop to consider atmospheric nitrogen deposition to coastal watersheds. The participants in the workshop included eminent scientists, coastal managers, and national policymakers. The workshop report concludes that atmospheric deposition of nitrogen must be included in policy and coastal management plans to address coastal eutrophication problems successfully.

EPA NOx SIP Call

Just 2 weeks ago, the EPA released its Final Rule to reduce the emissions of nitrogen oxides from the utility sector. The EPA plan, patterned after the highly successful "cap-and-trade" allowance program for SO_2 emissions, is designed to reduce levels of NOx emissions which contribute to ground-level ozone in urban areas. The Final Rule is likely to increase the air quality significantly in urban areas during the summer "ozone" season, and to protect urban populations from the deleterious health effects caused by exposure to ozone.

The EPA's Final Rule, however, is not designed to solve the problems caused by acid deposition. The EPA's NOx "cap-and-trade" allowance program outlined in the Final Rule is seasonal, regional, and voluntary. While the Final Rule is an appropriate way to address urban ozone levels, solving the problems of acid deposition will require a more comprehensive approach.

Nitrogen emissions contribute to acid deposition to forests, lakes, streams, and estuaries on a year-round basis. From an environmental (as opposed to health) standpoint, acid deposition may be more important during the winter months than during the summer. NOx emissions during the winter months contribute to stockpiles of acidified snow, which cause extremely acidic episodes in lakes and streams during the spring thaw. Many aquatic systems are most biologically sensitive at precisely this time, during the spring spawning season.

Recognizing the need for reductions in nitrogen emissions throughout the year, our bill—S. 1097—establishes a year-round cap-and-trade program for NOx emissions from the utility sector. Because of the particular health risks of urban ozone formation during the summer months, S. 1097 requires utilities to surrender two allowances for each ton of NOx emitted between the months of May through September. During the remainder of the year, only one allowance is required to produce one ton of NOx emissions. In this way, utilities are encouraged to make their most stringent emissions reductions during the summer months, when the collective risk to human health is higher.

The NOx cap-and-trade program proposed by EPA is a regional program because it has been envisioned as a response to a regional problem—the problem of urban ozone. The problem of acid deposition, however, is not limited to the Northeast. As I noted earlier in my testimony, eutrophication is adversely affecting the coastal waters throughout the eastern seaboard, including the Chesapeake Bay and Long Island Sound, and the Gulf of Mexico. Forests, streams, and rivers in the Southern Appalachians, the Front Range of Colorado, and the San Bernardino Mountains in California are also showing the effects of acidification and nitrogen saturation.

The best scientific data available indicate that emissions of NOx, like SO_2, are transported across state lines. A recent report released by Northeast States for Co-

ordinated Air Use Management (NESCAUM) concludes that several northeastern states will be unable to attain the health-based air quality standards set by EPA without reductions in the emissions levels transported to the Northeast from upwind states. Moreover, several urban centers in the western part of the country have already recorded numerous "exceedances" of permissible air pollution levels established by EPA. Consequently, a national emissions reduction program for NOx—as well as SO_2—is required.

S. 2377: Addressing Mobile Sources of NOx

It is worth noting that utility emissions are not the only significant source of NOx emissions. When we designed the SO_2 Allowance Program in 1990, our task was simplified by the fact that over 85 percent of SO_2 emissions originated in fossil fuel-fired electric utilities. Emissions from utilities account for just under 30 percent of total NOx emissions, roughly speaking. The share from utilities is certainly large enough that any serious program to reduce NOx emissions must address the utility sector. But another major source of NOx emissions, the transportation sector, must be addressed as well.

Earlier this year, I introduced S. 2377, the Clean Gasoline Act of 1998. This bill establishes a national, year-round cap on the sulfur content of gasoline sold in the United States. The bill would extend the so-called California gasoline sulfur standard nationwide. The benefits of reducing gasoline sulfur would be dramatic and virtually immediate.

The transportation sector accounts for nearly half of national NOx emissions. A large portion of these emissions are in the form of tailpipe exhaust from our national vehicle fleet. In recent years, advances in vehicle technology have produced Low Emission Vehicles (LEVs)—vehicles designed to reduce vehicle emissions by 90 percent. These vehicles were first sold in New York last fall, beginning with the 1998 model year. Unfortunately, New York will not see the full air quality benefits these vehicles are capable of providing because New Yorkers do not have access to the higher quality, lower sulfur gasoline these vehicles have been designed to use.

Low Emission Vehicles were first marketed in California, where their use has contributed to significant improvements in local air quality. One reason for the success of these vehicles in California is that California adopted a maximum level for gasoline sulfur content, beginning in June 1996. In California, gasoline sulfur levels average about 30 parts per million (ppm). The national average, outside of California, is more than ten times greater—about 330 parts per million.

The presence of sulfur in gasoline increases vehicle emissions because sulfur poisons the catalytic converter used in the vehicle's emissions control system. Sulfur is a pollutant only: its presence (or absence) does not effect engine performance. In the 1970's, we fought to remove lead from gasoline to make possible the introduction of catalytic converters. Until recently, we did not appreciate that sulfur is a catalyst poison, too. The problem is not limited to LEVs, although these vehicles are especially sensitive to gasoline sulfur. All vehicles in the national fleet with catalytic converters—virtually all vehicles—produce higher levels of emissions because of the high levels of sulfur in the gasoline they burn.

A recent study by the State and Territorial Air Pollution Program Administrators and the Association of Local Air Pollution Control Officials (STAPPA-ALAPCO) found that reducing gasoline sulfur levels to 40 parts per million, the California standard, would bring an air quality benefit equivalent to removing nearly 54 million vehicles from our national fleet. New York City alone would have a benefit equal to removing 3 million vehicles from its streets.

As I mentioned earlier, I am proud of what we accomplished in enacting the Clean Air Act Amendments of 1990. The SO_2 Allowance Program established by that legislation has achieved extraordinary benefits at program compliance costs less than half of initial projections. The efficacy of the approach is proven. The current science indicates, however, that we did not go far enough in 1990 in setting our emissions reduction targets. The bills I have introduced, S. 1097 and S. 2377, endeavor to buildupon our accomplishments thus far, and to begin the work which remains to be done.

ACID PRECIPITATION AND SCIENTIFIC FALLOUT

(By Senator Daniel Patrick Moynihan)

In the 1960's, fishermen in the Adirondacks began to complain about more than the big ones that got away. Fish, once abundant, were not just getting harder to catch. They were gone.

At first, pollution seemed an unlikely cause. After all, the lakes lie in a park protected by the New York State Constitution from most disturbances at the hand of man. Most are all but inaccessible, except to fishermen—and the winds that blow in from coal country, Appalachia.

It didn't take pioneering scientists (including Cornell University's Eugene Likens, Carl Schofield , and Charles Driscoll) long to establish a strong inferential link between increasing deposition of acid sulfates in rainfall, primarily from burning coal, and the absence or deformity of fish in lakes with clear water and low pH.

This was precisely the phenomenon of acid rain first observed by Robert Angus Smith in Manchester, England, in 1852. More recently, acid rain had been of concern in Scandinavia. Acids lofted into the atmosphere from tall smokestacks in the industrial basin of the Ruhr River were falling on watersheds that were, in many places, little more than bare rock. Closer to the source, acid rain was blamed for Waldsterben, the death of Germany's prized Black Forest.

Imagery and Science

Acid rain. Now there is a powerful image. By 1982, popular magazines, including Time, Sports Illustrated, and National Geographic, warned that acid rain was the most serious environmental threat of the decade. One year later, major Senate bills to reduce sulfur dioxide emissions to the atmosphere were being debated in the 97th Congress. Acid rain was blamed for everything from poisoning cisterns to the death of trees on mountain tops.

In Senate hearings as early as 1976 it was clear that acid rain was a prime suspect. But neither the extent of the damage nor a quantitative, causal link between controlling emissions of sulfur dioxide and the resulting environmental benefits had been established with any confidence. And so the question arose, what would happen to fish or forests if we reduced emissions of sulfur dioxide by half? Or ninety percent? Or not at all? If we thought that a powerful image was all we needed, we were wrong. Science is more complicated.

In June 1980, Congress passed the Energy Security Act, Public Law 96–264. Title VII consisted of a bill I introduced in 1979, the Acid Precipitation Act of 1980. It created the National Acid Precipitation Assessment Program (NAPAP)—an interagency research program to develop the scientific basis for a Federal policy regarding acid rain.

A decade later, in Hilton Head, South Carolina, scientists worldwide gathered to discuss the results. What they learned is that, in many areas of the Northeast, what was going to happen had happened. We could glean from the technical "state-of-science" reports that at least 800 lakes and 2,200 streams in the eastern United States had been made acidic by acid rain; at least 200, about 10 percent more, would become acidic over the next decade without additional legislation.

And, as had been expected, small sulfur-dioxide particles in the atmosphere caused a haze that reduced visibility in the eastern United States. Sulfur dioxide had contributed to forest "decline" in some high elevation forests, and corrosion of stone and metal structures had accelerated, but we know less about these problems, at least quantitatively.

NAPAP also made projections, based on scientific principles coded into computer models, about what would happen if we did one thing or another about sulfur dioxide controls. One of the options studied was similar to what was proposed in Senate bill S. 1630, the Clean Air Act Amendments of 1990. Figure I was prepared from NAPAP data by Larry Cupitt, an Environmental Protection Agency Congressional Fellow detailed to my staff during debate on the bill. It shows the projected emissions of sulfur dioxide with no new legislation, compared to the 10-million ton reduction in emissions specified in S. 1630.

Without enactment of any Federal law to control acid rain, replacement of old, inefficient generating facilities with new, efficient ones would reduce sulfur-dioxide emissions to approximately the same level as under S. 1630 by 2030. S. 1630 would reduce the projected 890 million tons of sulfur-dioxide emissions from 1990 to 2030 by only 240 million tons.

When all was said and done, we enacted acid rain controls to reduce sulfur-dioxide emissions by 10 million tons below 1985 levels. This is expected to have some beneficial effects. Additional acidification of lakes and streams will largely cease, and many of the acidified waters will recover. It will be a noticeable, but not overwhelming, effect.

Visibility will increase, and acidification of soil and deterioration of materials will be reduced, all by an unknown amount. The legislation may reduce the incidence of respiratory disease, but we are less sure about that. In any case, we estimated that such benefits would cost between $2.7 and $4 billion per year. Paul Portney

of Resources for the Future suggested later that the number might prove closer to $5 billion.

These were our results. But a CBS 60 Minutes program in December 1990 concluded that, after spending $570 million on NAPAP, the program was all but ignored in the debate over the Clean Air Act Amendments of 1990. Articles in The Washington Post and The New York Times echoed this assessment, as did Science. And, sad to say, so did some of my Senate colleagues who supported the original bill. I hope to moderate, if not to dispel, this perception.

What NAPAP Found

NAPAP discovered much that was new about the phenomenon of acid rain. More than 1,700 research papers describing the results of NAPAP-funded research were published in technical journals by October 1989. This is a good indicator of new findings. Authors must compete for limited space in these publications. Poor science and shopworn discoveries are usually rejected. But were the new findings relevant? An Oversight Review Board, led by Milton Russell of The University of Tennessee and Oak Ridge National Laboratory, concluded that NAPAP's scientific findings will be of "extraordinary value" to the United States and other countries making decisions about acid deposition. Did NAPAP really contribute nothing to the debate? Consider this quote from a letter submitted as testimony to the Senate Environment and Public Works Committee in June 1981, by a group of eminent environmental scientists:

> Scientific information is necessary but not sufficient to determine policy. Environmental policymakers receive information on the extent of known and anticipated damages caused by certain practices, together with information on possible remedies. They then decide whether to alleviate some or all of the damages by comparing the societal consequences of changing the practices responsible for them. Policy makers who are convinced that the identified damage to lakes, streams, materials, and visibility are unacceptable will advocate a policy to reduce them. Policy makers who believe the identified damages are too small to justify action may require additional evidence or greater certainty regarding causes and remedies, however.

I would say that NAPAP provided just such "additional evidence" and "greater certainty," at least with respect to the problems noted by fishermen. NAPAP research told us how many acid lakes and streams we had. It told us how many more would become acidic if we did nothing. It told us how many would recover if we did something. The rest, as the scientists pointed out, was up to policymakers. Russell and his colleagues on the Oversight Review Board subsequently summed it up:

> [NAPAP] demonstrated that the Nation does not confront an acid deposition problem of a size or of an urgency that puts substantial resources at major near-term risk or that threaten human health, at least in a major way. In doing so, NAPAP established the scientific range of policy decisions that our society could take with substantial confidence, while denying such support to other decisions at either extreme of action or inaction.

The NAPAP results appeared to justify our hesitancy to undertake draconian measures to reduce sulfur-dioxide emissions in the early 1980's.

During 1989, the Bush administration became determined to see a bill enacted that would reduce sulfur-dioxide emissions 10 million tons per year below 1980 levels. The question has been posed whether this decision was informed by NAPAP research. In fact, much of the critical NAPAP data on surface waters were presented to EPA Administrator Lee Thomas in briefings during the summer of 1987. The most important data from the National Surface Water Survey, the NAPAP project that estimated the number of acidic lakes and streams, were published in scientific journals in 1988 and 1989. Given this, what is the basis for the arguments that NAPAP was money wasted?

I believe that this perception arises from several problems. These can, and in my opinion should, be rectified as NAPAP continues. First, scientific findings were not assimilated into a form suitable for use by Congress and the public. This inadequacy of interpretation and communication was duly noted by the NAPAP Oversight Review Board. The board observed that scientists are not always eager to take time away from their research to explain complex, quantitative issues to a non-technical, and perhaps hostile, audience. They must be persuaded, and assisted, to do so in the future.

More important, the effort to disseminate NAPAP's findings became mired in a quest to arrive at a consensus on the meaning of the data. Such a quest can be complicated by differing norms for reaching consensus in the two types of science identified by political scientist Mark Rushefsky. In "normal science," results are incremen-

tally added to a "paradigm," a widely accepted framework for interpreting new data. But in the newer practice of "regulatory science," research is brought to bear, wholesale, to answer a specified (often complex) question as well as possible within a limited time. Jay Messer, a former environmental engineering professor on my staff in the 102d Congress, thinks that consensus on what constitutes acceptability of new results in normal science may be easier to reach simply because regulatory science sometimes hasn't sufficient time to generate its own paradigm.

If true, then in regulatory science dissenting views, biases acknowledged, are valuable. In NAPAP, scientists from agencies with biases (I might say appropriate ones about producing energy or protecting the environment) spent months, years, trying to reach consensus on how best to interpret their results. At best, there was the high opportunity cost of delaying any scientific input to the debate. Worse, good scientists not persuaded to the majority view became alienated. They withdrew. The resulting consensus often was a lowest common denominator. We learn in elementary school mathematics that simplification comes at a cost.

NAPAP Redux

Four things can be done to improve NAPAP as it enters its second decade. They are offered in order of increasing difficulty.

First, we should recognize dissenting and concurring opinions in regulatory science. The value of a multi-agency assessment group is that the viewpoints of agencies with different interests can shed different lights on the same facts. Provided the supporting analyses and underlying data stand up to the level of technical scrutiny expected of publication in scientific journals, these differences are too valuable to be disregarded.

Second, we should devote particular attention to developing communication skills needed to inform decisionmakers. This is not eliminating jargon and complicated equations. Scientists must be able to enter into a colloquy with decisionmakers that defines the scientific questions to be answered. Both must establish the timeframe in which the answers will be needed and how the answers might be used to make decisions. Results of research in progress, reported in a format readily accessible to nonscientists, can be of use in signaling mid-course corrections.

Third, Congress should involve scientists more directly in the decisions we make. During the months of debate on the Clean Air Act Amendments of 1990, we heard from industry, government agencies, and environmental organizations—everyone but the professional scientists carrying out $570 million worth of acid rain research. For the most part, professional congressional staff, which includes some of the brightest graduates of the nation's best universities, could not access this information directly.

Staff members work tirelessly on behalf of environmental legislation. But their education in matters of science is seldom sufficient to critically evaluate research in progress. We might do well to integrate a larger number of scientists with research experience into the staff of the Environment and Public Works Committee of the U.S. Senate. I have remarked that it would be easier for a diabolist to enter a nunnery, but I hope I exaggerate.

Fourth, and perhaps most important, we must correct the virtual disregard of economics in NAPAP. How do we calculate the value of increased visibility in the Smoky Mountains? What is it worth? We cannot yet say it is worth 50 cents, but the minute you ask yourself the question you already know more about the subject. Try to put a number on anything, and you have learned about it.

I offered amendments to S. 1690 that I hope will henceforth characterize the environmental program of the Federal Government. Environmentalism is nothing if not an ethic of responsibility, and our first responsibility is to the facts—facts about costs and facts about benefits. It is not knowledge that we should fear but the lack of knowledge.

This is not a new concept in government. The analytical foundations of cost/benefit analysis as a discrete discipline date back to an 1844 article by J. Dupuit entitled ? On the Measurement of the Utility of Public Works. ? These methods were applied systematically to dams and reservoir projects following passage of the Flood Control Act of 1936, but their application to matters of environmental protection is a relatively new endeavor. We have some experience in quantifying costs but little in quantifying benefits.

These are complex things. Acid-rain controls will mean there are going to be coal miners who lose their jobs. This will occur at a point in life when getting another job, finding another occupation, is difficult. We also will create jobs—people who make scrubbers and commodity traders who deal in emissions allowances. More fishermen may return to some of the Adirondack lakes, and more tourists to the Blue Ridge Parkway to enjoy the view. We must not be frightened of the complexity,

but we must be sure that there will be long-term measurements. We must know what happened.

We have always known a lot about this country, and we know how to learn more. One of the greatest problems facing countries that practiced central economic planning is that they now have no data. They (and we) believed that they were succeeding because they listened to their leaders instead of listening to the facts. We were largely able to avoid this problem because data were available from the Bureau of the Census, the Bureau of Labor Statistics, and the Department of Commerce. But before NAPAP, we had precious little data on what it means to change the atmosphere.

NAPAP has given us 10 years of data. Ten years from now, we will have 20 years of data, and 30 years from now we will have 40 years of data, and we will know something about what happens when we intervene in the natural environment. We will know some of the costs and some of the benefits.

There were days when dark plumes of smoke coming out of factory chimneys were signs of prosperity. There was nothing Jim Farley liked to do better in the 1930's than to put up a new Post Office and hire an artist to paint on its walls prosperity returning. Black columns of smoke reaching up to the sky—strong colors for what we hoped would be a strong economy.

Times change, but NAPAP is an opportunity to go someplace that we are not now. A place where we will know what we have done and, possibly, to adjust to the consequences of what we have learned.

Thank you very much, Senator D'Amato.

We will now ask our second panel of witnesses to come to the table. Our second panel consists of Mr. Brian McLean, Director, Acid Rain Division, Office of Air Radiation in the Environmental Protection Agency; Mr. Edward "Skip" Kropp, Deputy Director, Office of Air Quality, West Virginia Department of Environmental Protection; Mr. Bernard Melewski, Counsel and Legislative Director, the Adirondack Council; and Mr. William F. Tyndall, Vice President, Environmental Services, Cinergy Corporation.

With that, I will ask Mr. McLean to begin his testimony. And I would like at this time to ask if Senator Sessions would be good enough to chair the meeting for a few moments. Simultaneous to this, I have another committee meeting where we have Secretary Bill Cohen down there. I'm due to ask some questions, and I'll be right back as soon as he gives his answers, which I'm sure will be adequate.

Senator SESSIONS [assuming the Chair]. Thank you.

I know you'll ask some tough ones over there, Mr. Chairman. I know you're deeply concerned about the state of our Nation's defense.

Our panel today, and I'll run through this and then give you an opportunity to give your remarks in this order. Mr. Brian McLean, Director of Acid Rain Division, Office of Environmental Protection Agency; Mr. Skip Kropp, who's the Deputy Director of West Virginia Department of Environmental Protection; Mr. Melewski, Adirondack Council; and Mr. Tyndall.

Mr. McLean, we'd be delighted to hear from you.

STATEMENT OF BRIAN J. MC LEAN, DIRECTOR, ACID RAIN DIVISION, U.S. ENVIRONMENTAL PROTECTION AGENCY

Mr. MCLEAN. Thank you, Mr. Chairman.

I'm very pleased to be here today to have the opportunity to testify on S. 1097, the Acid Deposition Control Act. I will focus on the impacts of acid deposition and its precursor emissions, the progress of current efforts to reduce these emissions, and our reactions to the bill.

In 1980, driven in particular by Senator Moynihan's interest in acid rain, Congress passed the Acid Precipitation Act, which established the National Acid Precipitation Assessment Program to study the causes and effects of acid rain and other pollutants. NAPAP concluded that acid deposition and its precursor emissions, sulfur dioxide and nitrogen oxides, acidify lakes and streams, impact high elevation forests, damage materials, impair visibility and impact human health.

NAPAP also documented the long-range transport of pollution, making apparent the need for a broad, regional approach to address this broad, regional problem.

The wealth of information developed under NAPAP provided the underpinning for Title IV of the Clean Air Act amendments of 1990. In creating Title IV and establishing the Acid Rain program, Congress moved environmental protection in a new direction, away from traditional command and control regulation. First, Congress focused on reducing the emissions that cause acid rain, rather than relying on regionally variable deposition standards and State by State implementation plans.

Second, Congress translated its 10 million ton SO_2 reduction goal into a nationwide cap on emissions and allowed the industry 20 years to achieve that goal. Third, Congress provided EPA with a new tool to achieve the reduction, an innovative, market-based allowance trading system. The cap and trade approach allowed industry unprecedented flexibility in how to achieve the needed emission reductions. In return for this flexibility, sources were to provide a full accounting of their emissions through continuous monitoring and reporting, and would be subject to severe consequences if they failed to hold enough allowances to cover their emissions.

The objective here was for sources to find the most cost-effective means for limiting emissions and to be responsible then for achieving those reductions. In 1995, the first year of compliance under the acid rain program, SO_2 emissions declined dramatically, by over 3 million tons that 1 year.

Over the first 3 years of the program, emissions from phase one units have been 30 percent below their allowable levels, and sulfate deposition has been reduced by as much as 25 percent. Further emissions reductions will be required beginning in the year 2000 to achieve the full 10 million ton reduction goal.

Cost savings have exceeded expectations. In 1990, EPA projected the cost of full compliance with trading of $4 billion per year. In 1994, the General Accounting Office projected the cost to be less than $2 billion per year. And the most recent estimate published this year is approximately $1 billion per year.

Senator SESSIONS. Can I interrupt you? Is that based on estimates, or what you estimate the actual cost to have been that year?

Mr. MCLEAN. No, this is projected to be the full cost by the year 2010, when the full reduction is in place. So it's the maximum annualized cost.

Control of nitrogen oxides from coal-fired utility boilers under the acid rain program began in 1996. Emissions from phase one utility units declined by 35 percent. By the year 2000, NOx from utility boilers will be reduced by a total of 2 million tons per year.

However, without further reduction in rates, NOx emissions would be expected to begin rising. Because there is no cap on emissions for NOx.

Most of what we currently know about acid rain impacts was published in NAPAP's assessment report, released in August this year. I'll mention a few points here from that report.

Sulfur deposition has declined, and so have sulfate concentrations in some surface waters. Surface water nitrate levels, however, have not changed significantly, which is consistent with the lack of change in nitrate deposition.

Lakes in New England have begun to show some recovery. But Adirondack lakes in New York have exhibited either no trend or further acidification. Other sensitive watersheds in the southeastern U.S., such as Virginia trout streams, appear to be so saturated with sulfur that they may get worse before there are signs of recovery.

Through improved modeling, we have confirmed that the number of acidic lakes would be increasing substantially if it were not for the emission reductions that are taking place under the 1990 amendments. But we also have projected that additional reductions in both sulfur dioxide and nitrogen oxides may be necessary to fully protect the most sensitive systems.

We also have a better understanding now of the broader effects associated with nitrogen deposition on coastal waters. We believe that reducing NOx year-round would increase protection of coastal ecosystems along our east and Gulf coast. We believe that reducing SO_2 and NOx year-round would reduce the number of acidic lakes and streams in various sensitive regions of the country.

We also believe that reducing ambient sulfates and nitrates year-round would reduce risks to human health and improve visibility throughout the United States.

Let me turn now to S. 1097. In general, S. 1097 builds on those elements of the Clear Air Act that are working well. The bill relies on the successful market-based mechanism introduced in the 1990 amendments, and applies it to both NOx and SO_2. The bill reduces and caps emissions of NOx. The NOx emissions cap in the recent SIP Call is broadened under this bill to cover the entire year in the 48 contiguous States, making the bill consistent with our latest understandings coming from ecological research.

The bill further reduces SO_2 emissions in a way that tries to minimize the disruption to the existing acid rain program.

While the direction of the bill is generally consistent with EPA's views, the timing of some of the provisions may need to be further considered. For example, the timing of the SO_2 cap reductions should be examined for its potential impact on the allowance market that has now been created. We should also consider these reductions in the context of the fine particle standard review that we're going through, as well as our efforts to reduce regional haze.

I would like to conclude by noting that the electric power industry and EPA continue to discuss current and upcoming air pollution control decisions and how they might best be coordinated to achieve the multiple environmental goals at the lowest possible cost. EPA recognizes the appropriateness of engaging in long-term integrated planning and the need to explore the use of market-

based approaches, such as that demonstrated under the acid rain program, which the regulated community generally regards as working well.

We understand that this subcommittee is planning to hold hearings in the next Congress regarding the Clean Air Act reauthorization. And we believe bills such as S. 1097, which address regional, multi-State air pollution issues in ways that could improve and strengthen the Act ought to be considered in those discussions.

Thank you for the opportunity to appear, and I'd be glad to answer questions.

Senator SESSIONS. Thank you very much.

Mr. Kropp?

STATEMENT OF EDWARD KROPP, ASSISTANT CHIEF, WEST VIRGINIA OFFICE OF AIR QUALITY

Mr. KROPP. Good morning. My name is Edward Kropp and I'm an Assistant Chief of the West Virginia Office of Air Quality. I appreciate the opportunity to appear before you this morning.

One of the important aspects of S. 1097, the Acid Deposition Control Act, is the continued effort to regulate emissions of nitrogen oxides, which has already been the subject of regulation in the 1990 Clear Air Act amendments, and in addition, is an ozone precursor.

West Virginia is concerned about the imposition of additional stringent controls on nitrogen oxide emissions from sources in West Virginia which appear to be based on politics and rhetoric rather than environmental science. Indeed, on September 24, 1998, EPA announced a final rule which would require 22 States and the District of Columbia to drastically reduce emissions of nitrogen oxide in an effort to mitigate the long-range transport of ozone into the northeast.

West Virginia believes that neither the EPA NOx reduction rule, known as the Ozone Transport Assessment Group, or OTAG, SIP Call, nor any additional nitrogen oxide controls which might be imposed under S. 1097, can be economically justified when compared to the relatively insignificant environmental benefits which might result.

EPA sponsored OTAG, which was a stakeholder process, taking place between approximately May 1995 and June 1997. The OTAG process included scientific modeling to test a hypothesis that long-range, on the order of 600 or so miles, transport of ozone was occurring from the midwest and southeast to the northeast, exacerbating non-attainment of the 1-hour ozone standard in the northeast.

A key conclusion of the OTAG process was that emission reductions yield the greatest benefit locally, and that benefits decrease as distance from the controlled source increases. Further, OTAG concluded that regional nitrogen oxide reductions produce regional ozone reduction benefits.

Finally, OTAG modeling data indicates that literally shutting down all man-made sources of nitrogen oxide sources in the midwest will not result in the northeast attaining the old 1-hour ozone standard.

In November 1997, EPA proposed its OTAG SIP Call to reduce nitrogen oxide and requested comments on the proposed rule. West Virginia and 12 other States, all subject to the SIP Call, time and again submitted comments to EPA without ever receiving a formal response to our comments.

Moreover, West Virginia and five other States jointly submitted an alternative to the proposed EPA rule on June 25, 1998. The alternative proposal focused on attaining the new 8-hour standard, rather than mitigating transport, to solve the northeast attainment problems with the old 1-hour standard. Seven other States submitted alternate proposals which focused on attainment of the new standard as well.

Regrettably, EPA has continued to ignore the efforts of all 13 States to collaborate with EPA to attain the 8-hour standard, instead focusing on EPA's effort to reduce nitrogen oxide emissions primarily from midwest and southeast power plants.

In addition to proposing power plant nitrogen emission reductions of 85 percent and overall State nitrogen oxide emission reductions of as much as 51 percent from 1990 levels in the case of West Virginia, EPA counts the new nitrogen oxide reduction rule as being flexible, because it allows sources in the midwest and southeast to trade emissions between sources in order to distribute the emission reduction burden.

West Virginia believes that such flexibility must be tied to air quality science. And in the case of the EPA rules, submits that EPA has once again ignored science in order to level economic playing fields. That is, controlling midwest nitrogen oxide power plants to raise the cost of electricity to levels more nearly equal to those in the northeast.

West Virginia has on numerous occasions attempted to provide EPA with input regarding the nitrogen oxide rule. And our position remains both unchanged and scientifically supported. West Virginia believes that power plant nitrogen oxide reductions of 65 percent from 1990 levels will result in attainment of the new 8-hour standard in most, if not all, of West Virginia.

In addition, power plant reductions in excess of 65 percent may be necessary to ameliorate any ozone transport from West Virginia occurring in the 150 to 200 mile range which OTAG concluded was likely to occur. The EPA OTAG SIP Call will result in the expenditure in West Virginia alone of approximately $1 billion in excess of the cost of 65 percent reductions, while providing virtually no discernible concomitant benefit in the northeast.

West Virginia urges that EPA be required to reconsider its ill-conceived, one-size-fits-all OTAG SIP Call to reduce nitrogen oxide emissions and that any further midwest and southeast power plant nitrogen emission reductions which might be required as a result of S. 1097 be deleted from the Act.

Thank you for your attention.

Senator SESSIONS. Thank you, Mr. Kropp.

First, let me say I'm glad to be joined by the Chairman of our full Committee, Senator Chafee. If you have any remarks you'd like to make at this time, we'd be glad to hear them.

Senator CHAFEE. Thank you very much, Senator Sessions. I wanted to come by the meeting of the subcommittee and hear these

witnesses. This is important, and I appreciate your conducting the hearing, and I look forward to hearing the balance of the witnesses. Thank you very much.

Senator SESSIONS. Thank you.

All right, Mr. Melewski.

STATEMENT OF BERNARD MELEWSKI, COUNSEL AND LEGISLATIVE DIRECTOR, ADIRONDACK COUNCIL

Mr. MELEWSKI. Thank you, Senator.

I want to thank you for the opportunity to be here. My name is Bernard Melewski. I'm the Counsel and Legislative Director for the Adirondack Council, which is a not-for-profit organization located in New York State, that focuses on enhancing and protecting New York's Adirondack Park, which is a 6 million acre park, which is the largest in the lower 48 States, approximately 6 million acres.

We've had a long involvement in the acid rain issue. We were instrumental in New York State's acid deposition act in 1984, the first in the Nation. And the inclusion of an innovative trading proposal in that law which was later adopted in 1990 by Congress. We are very much involved in the Clean Air Act amendments as well.

Shortly after the Clean Air Act amendments were put into place, we were interested to see an EPA administrator announce simultaneous with the release of the regulations implementing the law that the regulations now put an end to acid rain in the Adirondacks. Certainly that was the intent of Congress, but we believe that Congress wisely commissioned two reports in later years to take an assessment of the Act and how it was performing.

Those reports are now both in. The first came in 1996 from EPA, and it reported that the benefits, the environmental benefits from the Clean Air Act amendments perhaps were not going to be as substantial as envisioned. And to the stunning of many New Yorkers, also revealed for the first time that much of the lakes of the Adirondack Park may be lost, and that a substantial portion of our streams will be chronically acidified in the next 30 years.

Just this past summer, NAPAP reported with a more comprehensive study, and I think the significant thing about the NAPAP report is not just that it confirmed EPA's earlier findings, but that it illustrated that it's not just an Adirondack problem. NAPAP's report extensively documents in peer-reviewed scientific review that the highlands of the United States, whether it's New England, the central Appalachians, the Smoky Mountains, the Rocky Mountains, the mountains of California, are all suffering similar problems from acid rain. They also document that the estuaries, the coastal estuaries, whether it be the bays of Rhode Island, of Long Island Sound, Chesapeake Bay, of Tampa Bay, are all too suffering from airborne deposition of nitrogen.

Other studies have also been released but were not peer reviewed yet by NAPAP. Environment Canada called for extensive new reductions, both in their country and in here to address Canada's problem. Trout Unlimited this summer released a study of Virginia's trout streams which indicates without further cuts in sulfur in particular, we may see a loss of 35 percent of the trout streams of Virginia, which they extrapolated in the southern Appa-

lachians to thousands of miles of trout streams throughout the east coast.

And our publication, which I hope to provide to the committee, on acid rain, also documents this phenomenon around the country and the basic findings in the NAPAP report.

I think both reports come to two conclusions. One is that the mechanism that Congress put in place, the cap and trade program, is working extremely well. The second conclusion of both reports, I feel, is that the goals of Congress to protect sensitive environmental areas, have not yet been met.

That's why we very much favor S. 1097, the Acid Deposition Control Act. Because I think it does three things, in short. One, it capitalizes on the success of the sulfur program by creating a third phase to achieve an additional 50 percent cut from sulfur. Second, it creates a parallel NOx program capitalizing on the market mechanism that clearly is working very well.

And I do want to mention that we have preferred the proposal, the NOx program, in this bill to the trading and SIP Call proposal from EPA for some time. Because we feel that this proposal is yearround, it addresses a national problem, it addresses problems other than the immediate problems that OTAG was focusing on. And we believe that it also has some advantages of having statutory authority. There is a report out of the Congressional Budget Office that basically came to some similar conclusions. I'm sure you have access to that.

Third, the bill provides a continuation of the research monitoring that has led us to the scientific certainty that we have now that we need to address the problem. I think it's quite clear that Congress wisely set up a reporting mechanism. Those reports are now in. We have now some scientific certainty as to what's going on out there, and the time is now for a mid-course correction. We urge you to support this bill.

Thank you.

Senator SESSIONS. Thank you very much.

Mr. TYNDALL.

STATEMENT OF WILLIAM F. TYNDALL, VICE PRESIDENT, ENVIRONMENTAL SERVICE, CINERGY CORPORATION

Mr. TYNDALL. Thank you, Mr. Chairman.

My name is William Tyndall, and I'm a vice President of Environmental Services for Cinergy Corporation. I should add that up until about 7 weeks ago, I was a counsel on the House side for Mr. Dingell and was working on these issues. I'm not sure which I enjoy more. They seem a lot harder from this side.

Senator SESSIONS. I can vouch for that, Mr. Tyndall.

Mr. TYNDALL. As one of the first utilities to endorse an acid rain title as part of the 1990 Clean Air Act amendments, Cinergy retains a keen interest in any further consideration of legislation on this subject. To summarize our views, we are committed to addressing the environmental consequences of emissions from our power plants. But we believe it's premature to adopt any new acid rain legislation, certainly acid rain legislation standing alone, until the existing acid rain provisions of the Clean Air Act are fully implemented, and more importantly, until EPA's recent initiatives on

NOx transport, the new national ambient air quality standards and regional haze, are understood if not implemented.

Senator Sessions, when I was listening to you, I jotted down the things that I sit here in my new job trying to manage. They include a new 8-hour standard, a new $PM_{2.5}$ standard, a new NOx SIP Call, possible mercury controls, possible CO_2 controls, and acid rain. I would say, although EPA talks about the need to coordinate these things, at this moment in time, each of these regulatory initiatives is proceeding singly on different time scales, different timeframes and we are madly trying to figure out if and how you comply and what the best strategy is, as we also move forward into a deregulated environment.

Senator SESSIONS. Just based on your experience with the House and this initiative, have you ever seen this many new regulatory initiatives coming on the scene at one time?

Mr. TYNDALL. No, but in self-interest, I should say probably it is what got me hired.

[Laughter.]

Senator SESSIONS. You've become an important person, I've no doubt.

Mr. TYNDALL. Cinergy Corporation and its subsidiaries own and operate fossil-fired and hydroelectric generating facilities in Indiana, Kentucky and Ohio. Cinergy is one of the Nation's largest coal-burning utilities. We are confident that coal will continue to be an important fuel source for electrical generation in the future.

Because of this, Cinergy accepts its obligation to assure that all of its use of this fuel meets current environmental standards as well as future environmental standards.

EPA has already talked to the committee about how much progress has been made under the existing both Clean Air Act and specifically the Acid Rain program. This is not to say that everything is done. But as the committee considers S. 1097, it is necessary to bear in mind not only the environmental progress we have made, but what additional reductions we can expect in the future. Under the Acid Rain program phase two, there are an estimated 4.6 million tons of sulfur dioxide emissions and an additional 1.6 million tons of nitrogen oxide emissions that will be removed from the air.

Second, EPA has adopted in the last few years, as I've stated, a number of new emission initiatives that will lead to emission reductions by utilities and nearly every other business. For instance, EPA has recently finalized its NOx SIP Call rule for 22 eastern States and the District of Columbia. Under the rule, utility nitrogen oxide emissions will fall by over 1 million tons. The estimated capital cost to utilities in the 22 State region is over $14 billion.

Cinergy estimates its capital costs to comply with this rule alone are approximately $500 million to $600 million, which by the way based on the figures from EPA is more than the entire States of New York and New Jersey will spend to comply with a SIP Call. I'm sorry Senator D'Amato isn't here to hear that.

Beyond the NOx SIP Call, last year EPA tightened the national ambient air quality standard for ozone, created a new national ambient air standard for fine particles and proposed new regional haze regulations. In doing so, it set in motion a myriad of State

and local planning activities that will result in further reductions in air pollutants beyond those called for by the Clean Air Act amendments of 1990. Of course, further reductions of these pollutants will directly affect acid deposition.

I should also point out that as a result of Senator Inhofe's amendment to the Transportation Bill enacted last spring, Congress has established implementation milestones for the new ozone and fine particle standard. For the new PM standard, the Inhofe amendment extended the implementation schedule to allow States to site, install and operate a new monitoring network. Senator Inhofe's amendment received the support of EPA, the States, and Members of Congress from both sides of the aisle, because of the universal recognition that States could not design effective fine particle implementation programs without the data from the new monitoring network.

In conference, the House and Senate agreed to tie the timing of the regional haze program to the timing of the fine particle standard implementation. In doing so, Congress recognized that the compounds blamed for regional haze, such as SO_2, are also the precursors to fine particles, thus moving ahead on regional haze would defeat the point of the Inhofe amendment, to allow States to build their implementation strategies, using the data generated by the new monitoring program.

I bring all this up, because the committee should apply the same logic to S. 1097 as it considers this measure. Since the pollutants at issue are the same, any new acid rain program should be coordinated with the implementation of the new particle standard.

In conclusion, as a result of the Clean Air Act, we've made tremendous progress in reducing emissions of pollutants associated with acid rain. We can expect further progress through implementation of the rest of the acid rain program. Whether these reductions standing alone will eliminate acidification of the Nation's lakes and streams may be in dispute.

But it is no longer the relevant question. EPA has set in motion many new programs that will result in further reductions in the relevant pollutants. This committee should not act on this bill or any similar legislation until we have a full understanding of the reductions that these initiatives will trigger.

More importantly, any legislation on this topic must be coordinated with the Inhofe amendment to ensure that further reductions are based on sound science and coordinated with implementation of the new air quality standards.

Before I conclude, I would also like to agree completely with the statements made by West Virginia, in that 13 States put proposals before EPA, including the three States that we operate, that Cinergy operates in. There was never a formal response, there was never any attempt to see whether the differences between Senator Chafee's State and other States could be bridged, without getting into a situation where we may have States suing directly to set this aside, we may have States fighting EPA over what is going to be in their SIPs.

And we may very well end up with a lot of regional skirmishing instead of reaching some agreement that accommodates both sides, so we can move forward.

I think there are solutions that could have satisfied both sides. They probably deal more with the timing than the stringency. But we never got a chance to explore those, and I think that's a lost opportunity.

I'll conclude with that. Thank you very much.

Senator SESSIONS. Thank you very much, Mr. Tyndall.

We're glad to be joined by Senator Wayne Allard. Senator Allard, do you have any comments?

Senator ALLARD. Not right now. I wanted to listen to the testimony here. I'm not particularly excited about looking at a reallocation that might impact my State on this issue. Because we do have coal-generated electricity in the State, although it's clean coal. And I want to approach this particular piece of legislation very cautiously, so I understand how this might impact the State of Colorado.

Senator SESSIONS. Mr. Chairman, I'd be glad to recognize you for any questions you may have.

Chairman CHAFEE. Well, aren't you nice, Senator.

Why don't you go ahead. I came in on the latter part, and I will have some questions. But you go ahead, and I'll pick up when you're through.

Senator SESSIONS. Mr. Kropp and Mr. Tyndall have both said, Mr. McLean, that they went to some considerable effort, being representatives of their States, to submit some proposals to EPA. And they were not, in their opinion, adequately responded to or respected, and no dialog ensued.

To me, I think EPA at a minimum ought to engage very seriously these departments of environmental management or private sector experts, and really attempt to confront and grapple with the science of this problem. Do you think that's a valid criticism and would you comment on that?

Mr. MCLEAN. I think the suggestion is a good one. And I think over the last 3 years, EPA has tried several times to engage the industry in a dialog on particularly integrating various regulatory requirements that we saw approaching.

In 1995, we met with the utility industry and States and other interests and said, would it be helpful if we tried to sit down and evaluate all the different requirements that we saw coming up over the next several years, revisions to the NAAQS, mercury requirements, regional haze requirements, even climate requirements. And said, would it be good if we tried to evaluate these and come up with a more comprehensive approach that would lay out a strategy for 10 to 15 years, so that we wouldn't have this layer upon layer of requirement that was referred to earlier.

We got general support from the industry that we should approach this. And a few months later, we held our first meeting. And we were attacked by the same people who had said we should approach this issue.

Senator SESSIONS. Attacked in terms of, they disagreed with your proposals? Or attacked for having the hearing?

Mr. MCLEAN. Well, attacked about the process. They said this is an extra regulatory process. We told them this is what we would do, and then they turned around and disagreed with the approach.

Senator SESSIONS. Well, do you see anything wrong with fundamentally an informal meeting as you develop or receive information from a multitude of sources, when you've got 12 or 13 States who wish to share that with you, just to sit down and enter into dialog with them?

Mr. MCLEAN. Well, we did. In fact, Cinergy came to us earlier this year, relative to the SIP Call, and had some suggestions about a way that we might find a middle ground approach. And we did sit down and talk to them about that approach. And shortly thereafter, they formed a larger group and they backed away from the proposal and put forth a proposal that did little beyond the current Act.

So we interpreted that as a moving away from a position where we might find common ground.

Senator SESSIONS. Well, let me ask Mr. Tyndall. How would you respond to that?

Mr. TYNDALL. I think it would also be appropriate to ask West Virginia. But Cinergy worked very hard in the last year to put together a coalition of utilities and try and put something constructive on the table. Eventually an alternative was put forward by 13 States of the 22 States that were subject to the SIP call. And it basically was a two-step approach. One was an emissions reduction of 65 percent, and EPA ended up with approximately 85 percent. But that was a first step.

And the second step was further reductions as necessary to meet the new 8-hour standard, which isn't supposed to be implemented until 2005, although in appearances before the committee I staffed, EPA regularly talked about a 2010 or 2012 implementation date when they were on the selling side of the new air quality standard.

But they went with an 85 percent due in 2003, both because of the——

Senator SESSIONS. An 85 percent reduction?

Mr. TYNDALL. Due by 2003, because in their view it's necessary for both the 1-hour and the 8-hour, that the 8-hour, if you're not supposed to be in compliance with the 8-hour standard in 2005, it makes little sense to us why you would structure the decision that way.

So it was a two-step reduction generally supported by 13 States and if you look through EPA's 1,600 pages that they put out the week before last, you will not find a direct discussion of that. So even in the formal rulemaking, I must say, I can't guarantee in the whole 1,600 pages, I looked pretty carefully, I couldn't find it, other people have looked pretty carefully, they couldn't find it.

Instead, what you find is some references to commentors. The States were reduced to being commentors. And they were treated no differently than anybody else in the public. Essentially what there is, is a brief discussion of the modeling that shows that the lower reductions may be just as effective as the higher reductions and especially when there's a guarantee that there would be a second step to see if more reductions are necessary.

Then EPA said, well, we're not going to deal with that modeling. Instead, we'll do our own, which they put out at the same time as the new rule without any input from anybody.

I had to deal with the press a lot on the date this rule came out. What I said time and time again is, there's a lost opportunity here. We have a regional war going on. We could have tried to come up with something that resolved it. EPA essentially stoked the fires.

Senator SESSIONS. Mr. Kropp, how would you comment on that?

Mr. KROPP. On March 9, which was the comment date for the November 1997 EPA SIP Call rule, the State of West Virginia and nine other States submitted a letter to EPA Administrator Browner and President Clinton. And in that letter, we committed to having an alternative proposal done by August 1, 1998 to the OTAG SIP Call.

EPA's response was to open the comment period not to August 1, but to June 25. So we redoubled our efforts, and we had a meeting in May in North Carolina with representatives——

Senator SESSIONS. You mean they'd already set the August 1 date, or is that a date you requested?

Mr. KROPP. That was the date we requested. And then the publication came out on, saying that the close of the comment period was June 25.

In early May 1998, ten of us, different State representatives, met with EPA in North Carolina. During that meeting, we raised the issue of our perception problem. The perception was that we had all submitted comments by the March 9 deadline, and none of us had gotten any response to any of our comments. And yet, EPA had proposed supplemental rules after receiving our comments. In the supplemental rules, they did not incorporate the bulk of our comments.

We did submit, six States wound up being in the Southeast-Midwest Governors Ozone Coalition. We submitted the alternative proposal by the end of the comment date on June 25. And I, like Mr. Tyndall, confess that I have not read word for word the 1,600 pages of rules. But I do not find, nor has West Virginia, nor to my knowledge any other State, received any kind of a formal response even acknowledging the existence of the Governors Ozone Coalition.

And I believe, as well, that it's a lost opportunity. The Governors Ozone Coalition proposal supported a two phase reduction which would begin with 65 percent reduction for utilities by the year 2004, followed by whatever it took. And if that was 85 percent, fine, if it was 95 percent, fine. But we believe that the science still needs to be defined in order to decide what emission reductions will be necessary to attain the 8-hour standard.

Senator SESSIONS. Thank you very much.

Mr. Chairman?

Senator INHOFE [resuming the Chair]. Thank you, Senator Sessions.

Again, I apologize, we have two committee meetings simultaneous right now. One's an Armed Services Committee, so I was going back and forth. But I'm here for the duration now.

Mr. Tyndall, it's nice to have you here in your new position. People say there's no such thing as bipartisanship, and yet your old boss and I worked together for 12 years. You performed great services for him and then for us. And I appreciate that very much.

In the event that questions have already been asked, I would like to ask one question, then go on to the Chairman. Mr. Kropp, you

took part in the midwestern Governors conference this summer, I believe, didn't you?

Mr. KROPP. Which conference?

Senator INHOFE. In the midwestern Governors counterproposal that they came up with to the EPA's recommendation on their SIP Call?

Mr. KROPP. Yes.

Senator INHOFE. And in that, I believe you stated in your testimony that shutting down all man-made sources of NOx emissions in the midwest will not result in the northeast attaining the old 1-hour ozone standard. Is that accurate?

Mr. KROPP. That's correct, and that's based on OTAG modeling, not modeling that our Governors coalition did.

Senator INHOFE. All right. Mr. Melewski, he has pointed out that even if the midwest eliminates all emissions, the northeast will still not comply with the ozone standard. Mr. Tyndall points out that only 29 percent of NOx emissions come from utilities, while 49 percent come from the transportation sector.

It would seem to me that the northeast is trying to blame everybody else for their problems. Would you respond to that statement in terms of the transportation, the NOx emissions coming from utilities, while the 49 percent come from the transportation sector?

Mr. MELEWSKI. Senator, I'm sorry you missed our testimony.

Senator INHOFE. If you answered in your testimony, then don't respond any more. That's fine. I'll get it from the record. I do apologize.

Mr. MELEWSKI. Well, the short answer, sir, is that the two reports to Congress which Congress commissioned in 1990 support our contention that a cap and trade program on NOx is both desirable and very effective to address not only the acid rain problem, but also the ozone problem.

Senator INHOFE. All right, sir, thank you very much.

The CHAIRMAN.

Chairman CHAFEE. Thank you very much, Mr. Chairman.

I didn't hear all the testimony, but I heard some of it. Mr. Kropp, we've got a problem here from the northeast point of view. And I can understand the approach that you have here. As the Chairman mentioned, you indicated that if you just shut down everything, all coal burning out in your section, it would have relatively insignificant environmental benefits.

What is the answer? Is it the mobile sources that the Chairman was mentioning?

Mr. KROPP. Senator, my understanding from the OTAG modeling data was that the previously thought hypothesis of long-range transport on the order of 600 miles or so has been proven wrong, and that in fact, in the case of West Virginia, we believe that our emissions absolutely are impacting Western Pennsylvania, and we intend to do something about that. But we believe that local solutions are the answer on the order of 150 to 200 miles from those local problems.

Chairman CHAFEE. Well, let's take New England as an entity, since it's geographically not that large. I'll give you a bit of incidental information. Did you know Maine is as big as the rest of New England put together?

Mr. KROPP. I did not know that.

Chairman CHAFEE. Well, chalk that up as a bit of trivia.

[Laughter.]

Chairman CHAFEE. But taking New England as a whole, you're saying the solution is local. In other words, our problem as you see it is generated by our own power plants?

Mr. KROPP. I think it's an oversimplification to say that the problem is power plants only. In the case of ozone, there are two precursors, nitrogen oxide emissions and organic compounds. There is a vast inventory of both, more than enough being emitted all over the northeastern part of the United States to go around.

We believe, for example, in West Virginia, that we had some ozone non-attainment areas with the old 1-hour standard. In our case, we implemented very, very severe and stringent VOC reduction requirements and our ozone levels dropped. We are now in attainment with the old 1-hour standard.

We haven't had to designate yet and won't be required until June or July 1999 to designate non-attainment areas under the new 8-hour standard.

Chairman CHAFEE. Mr. Tyndall, I want to welcome you here. It was interesting what you said on page 6, and I wonder if Mr. McLean would agree with this. You say the SO_2 emissions are currently the lowest in the United States in the past 50 years. Mr. Tyndall, do you stand by that?

Mr. TYNDALL. It's in my written testimony? I completely stand by it.

[Laughter.]

Chairman CHAFEE. I'd ask you to review page 6 of your testimony.

[Laughter.]

Mr. TYNDALL. Senator Chafee, I do recall that. And I do stand by it.

Chairman CHAFEE. Start on the second paragraph, SO_2 emissions in the United States are the lowest in 50 years as a result of these existing programs.

Now, I might say, your not being absolutely conversant with every part of your testimony is not grounds for chastisement. I think most of us have that similar experience.

Mr. TYNDALL. I was actually responding more, in the House we swear everybody in, at least in the Oversight Investigations Committee. So when you're asked a question like that, you have to make very sure it really was in your testimony.

But I certainly stand by the statement that's in there.

Chairman CHAFEE. So you feel since you weren't sworn here, you can be a little more casual?

[Laughter.]

Mr. TYNDALL. I would refer to my earlier statement.

Chairman CHAFEE. Mr. Melewski, what do you say? You've spent a lot of time studying this, and representing the incredible park that you do, and the council that deals with the park. I think it is always interesting to us to realize the size of that park. It is, as you point out, twice the size of Yellowstone.

Mr. MELEWSKI. Yes. You could put Yellowstone and Yosemite combined inside the Adirondack Park.

Chairman CHAFEE. Well, that's incredible. And indeed, protected by the constitution of the State of New York.

Mr. MELEWSKI. Yes. Actually, that has been unique to the world, that the State constitution, since 1895, makes all public lands inside the park, which is both public and private, forever wild, it's in Article 14 of our constitution.

Chairman CHAFEE. Now, you heard the testimony of Mr. Kropp and others here, that you've got a particular problem, and we're aware of your problem, having Senator Moynihan serving in this committee for so many years. I think he's served in this committee ever since he came here.

But you heard the others say that if they shut down ever SO_2 emission in West Virginia, it wouldn't make a bit of difference in the east, minimal. What do you say to that?

Mr. MELEWSKI. Well, I would refer you to the two reports that Congress commissioned. I think they take exception to that conclusion. I also take exception to the notion that we——

Chairman CHAFEE. I guess I said SO_2. I guess it's the NOx emissions. Go ahead.

Mr. MELEWSKI. I also take exception to the notion that further delay is warranted. While I did not elaborate in my oral testimony, my full testimony indicates that the reports to Congress did not come here without some considerable struggle and the threat of litigation. And they were much delayed.

The delayed reports now indicate that we have a very small timeframe in which to literally save the Adirondack Park and to make any kind of substantial progress on cleaning up our coastal estuaries. Perhaps there will be other impacts across the east coast.

Our observation is that the scientific evidence is fairly well conclusive that further cuts are necessary, and that the sources to New York State, for example, are dramatically outside the State, especially with regard to sulfate, which is in excess of 90 percent of the total loading in the States, comes from outside our borders.

Chairman CHAFEE. Do you think it may well be that problems that are manifesting themselves now are just as a result of years and years of accumulation and you passed over the threshold where now the dangers and the damage coming from the accumulations that have been there and caused there year after year after year, so even though circumstances haven't changed, and if you go along with Mr. Tyndall's sworn testimony that the emissions have been reduced, nonetheless, any emissions now put you over the border? Do you think that's the case?

Mr. MELEWSKI. Well, Senator, you must have read the NAPAP report as well. That's exactly their conclusion, that we are at a saturation point, not only in the Adirondacks, but also in the southern pine forests of the United States, and even in the highlands of Colorado. That is the most dramatic aspect of the NAPAP report, that we are near saturation. Certainly we're past saturation in the Adirondacks, but we're near saturation throughout a good portion of the east coast and highland areas in California and Colorado as well.

So I agree with you completely that we need to dramatically drop loading, just to get back, as Senator D'Amato has mentioned, to a 1984 level in the Adirondacks, basically.

Chairman CHAFEE. Well, thank you. Thank you, Mr. Chairman.

This is a knotty problem. This is a problem that is of great concern to the section of the country I come from, and I appreciate the effort you went to to put together this panel, and thank all the members of the panel for taking the trouble to be with us.

Senator INHOFE. Thank you, Senator Chafee.

Senator ALLARD.

Senator ALLARD. Thank you, Mr. Chairman. I want to followup on my further comment. I apologize for missing your earlier testimony, but it couldn't be avoided.

In the legislation, we have taken and we're allocating the NOx from 22 States over to all 48, the lower? Is that what we're doing? Mr. McLean, would you explain how that would impact the other 26 States that we have out there? Has there been some study to make an evaluation on those other 26 States?

Mr. MCLEAN. We haven't done an analysis of this particular bill. But what the bill does is it expands geographically and throughout the year the NOx reduction that would be done in the east for the SIP Call. What it results in the 23 jurisdictions of the SIP Call is about the same reduction that the SIP Call called for. But it calls for a slightly lower reduction in the winter and a reduction throughout the 48 States.

Senator ALLARD. With that, though, there is this allocation of shares based on NOx emissions, is that right, from the plants, which is actually under the allowance program? So then you bring in more States into the allowance program, is that correct?

Mr. MCLEAN. Right.

Senator ALLARD. And so when you do that, what does that do to the other, what happens to the dynamics of all this, when you bring in all these 26 States, or 25 or whatever we're talking about?

Mr. MCLEAN. Well, the first thing that we consider when someone makes a proposal for trading, we look at the geographic area of the trading, the level of control. And we evaluate it through economic models as to what is likely to happen in terms of shifting of emissions. Our first concern is environmentally, is it going to produce a shift in emissions that would be detrimental. Or is it going to result in minimal shifts in emissions, and actually just obtain the economic benefits of having the trading.

And when we looked at Title IV, when that was being proposed for sulfur, and when we looked at the SIP Call, where we looked at a 23 State jurisdiction, we did that kind of examination to assure ourselves that the result would not be any major shift in emissions away from areas where we thought the control would be most important.

We would want to do the same thing with this bill to see that if we enlarged the geographic area and enlarged throughout the year, made the reductions throughout the year, that in fact the reductions would be what would be desirable. I think the goal of the bill was to get slightly more reductions in the summer time, where we have an ozone problem, as well as to get some reductions in the

winter time to deal with the acid rain issue and eutrophication issues.

Senator ALLARD. See, I'm particularly concerned, because I come from a higher altitude State. We have a little different dynamics, because we tend to have less complete combustion. And so I would like to see some information as to how it's going to have an impact on these 26 other States. Do you plan on doing some work on that?

Mr. MCLEAN. Well, we got a request from Senator Moynihan's office to look at the bill, and we will try to do that. We've been a little backlogged this year, but we're going to try to get to that analysis.

Senator ALLARD. Yes. I don't know if there's any plan to push this thing through in the last minute of this session. If there is, I'd be concerned about that. But I guess what I would like to know is, if you could do that evaluation. Because I'd be interested in what is happening in the other 25, 23 States through the allowance program in nitrous oxide emissions, if it's allocated through that, and see how these other States are impacted.

I realize this is an issue that is faced pretty much in the midwest to New England States. But we also, with this bill, it also brings in another 25 to 26 States. And in our focusing on those States, I hope we don't lose sight of the total picture, which I'm trying to accomplish here. So if you could get us a report on that, I would appreciate it.

Mr. MCLEAN. OK.

Senator ALLARD. Maybe the committee would like to have that report, Mr. Chairman, in which case we could have him send it to the committee, too.

Senator INHOFE. That would be a good idea. I think we can respond to your question about something being passed through in this last week. It would be most unlikely. It's not going to happen.

[Laughter.]

Senator INHOFE. In my opening testimony, which I didn't get the whole part out, I talked about the layering of regulation after regulation of the PM of ozone, regional haze, the SIP Call and all the rest. What I didn't read in my statement, but it's in my written statement, is that next year I will be asking the General Accounting Office to examine the cumulative impacts of all these regulatory programs on the economy.

Now, Mr. Tyndall, I would like to ask you, has your company done any work in this direction to see what is the cumulative effect of all these regulations?

Mr. TYNDALL. Well, I guess the answer is yes and no. We have done in EEI, Edison Electric Institute, has done some work in looking at the cumulative impact. I don't think anybody has completed an analysis so that we know what each of these things are going to do.

The timing is, because of your efforts, the timing of regional haze and the fine particulate standard are now joined together. But there still is the question of the 8-hour ozone standard. There is also mercury, CO_2, acid rain, and how they fit together, they are each independently set up under the Act to the extent there's legal authority for what EPA is doing. And that's part of the problem when EPA brings everybody into a room and says, well, let's work

voluntarily on trying to rationalize all these. There are several different statutory deadlines involved that EPA can't move unilaterally.

So it becomes very difficult to try and put them all together. It's very important, and probably the most important thing from our point of view, that Congress should look at as it considers reauthorization.

Unfortunately, we're making business decisions today about implementing all of these, and trying to make guesses. The reality is that the legislative cycle is going to be well behind our business decisions.

Senator INHOFE. Well, while we do have some things locked in, so that it's easier to analyze the costs of particulate matter, ozone, regional haze, and I hate to say it, but I think your guess is probably as good or better than our guess would be on the rest of these things. But any information you have, if you would share with GAO to help them come up with something.

I think it's very significant. I think certainly those of us on this committee who are here today and the majority of the committee are going to be more concerned about cost benefit analyses and things that we have not been as concerned as we should have been before.

Mr. McLean, in your testimony you seemed to suggest that in some areas it may get worse before it gets better, but it ultimately is going to get better, if I read that correctly. Are we on the road to recovery for acid rain? And is the current program working?

Mr. MCLEAN. Well, what I tried to characterize there, it is complex. There are areas where we're clearly seeing benefits as a result of the 1990 amendments and the reductions that are occurring. And we expect to see some continued benefits from that.

At the same time, over the last 8 years, we have continued to evaluate the situation using our latest understanding of the science and the models and bring them to bear on this issue, and find that with the full implementation of the Act, there will probably still be some areas where we are not achieving the full goals that we set out to achieve. And I do think that one of them clearly is in the Adirondacks, which is one that we've pointed out in reports that we've done and NAPAP has done. And it looks like throughout the mid-Atlantic region there will be some areas that do not fully recover with the current program.

Senator INHOFE. You heard in the first panel, when we talked to the representatives who were here, representing the State of New York, that they came out with their recommendations, and with this bill, prior to the changes that the EPA had come out with. Do you agree with their response that we need to go ahead with these restrictions or these regulations? Or with the bill, as opposed to going with the new rules that they're proposing?

Mr. MCLEAN. Well, what we did want to talk about is perhaps more next year, when you get into the reauthorization hearings, is to talk about these issues and how they can be better integrated into the Act.

Senator INHOFE. But for right now, you think the new rules that you have put out there would be adequate?

Mr. MCLEAN. I think the new rules we've put out will be adequate for the summer ozone problem in the east, reducing the transport of summer ozone in the east. They do not address the winter acid deposition.

Senator INHOFE. That Senator D'Amato talked about. Any other comments about that?

Mr. TYNDALL. On the question of, EPA's NOx SIP Call is a summer requirement. But when you look at what power plants will do to comply with that, some of the things they will do, fuel switching, new burner technology, are things that you basically will do year-round. So it's not clear that because it's a seasonal standard that it will only be implemented on a seasonal basis by power plants.

Senator INHOFE. Thank you.

Senator SESSIONS.

Senator SESSIONS. Thank you, Mr. Chairman.

Mr. Kropp, you raised the 150–200 mile range in which you really get some impact from containing NOx emissions or SO_2 emissions, how strongly do you feel about it? How big a disagreement do we have here? Is this a close question? Our people from New York say no doubt that, I suppose those in Alabama, are causing their acid rain. Are they correct? And what can we say with certainty about that?

Mr. KROPP. Senator, I'm not sure that we can say anything with certainty. However, the OTAG process came out with a number of significant conclusions and recommendations.

Senator SESSIONS. This is a process that included EPA and environmental groups?

Mr. KROPP. Yes. It was a stakeholder process. And my understanding was it was funded for the most part by EPA. And that process used computer models to predict the impact of various control scenarios. And if one accepts the validity of those computer models, then I think what the results were, and what the OTAG process concluded, was that the extremely long-range transport hypothesized simply is not occurring to any great extent.

The results that we've looked at indicate that the imposition of the, for example, the OTAG Sip Call on sources in the midwest, may result in an ozone improvement on an episode day in the north to northeast of something——

Senator SESSIONS. An ozone improvement?

Mr. KROPP. An ozone improvement, yes, on the order of a few parts per billion. There are some scientists who say that on a 120 part per billion standard, which the old standard was, models can't even detect that, it's within the noise. So you have to accept the premise that those models work.

If you do, it seems to say that controlling only power plants in the midwest is not going to accomplish the attainment of the old standard in the northeast.

Senator SESSIONS. Now, that's what Senator Byrd said. I was in the chair and heard his speech. He said it will have an infinitesimal and virtually no benefit. His challenge is, should we have these heavy burdens if they're not going to produce any benefits.

Mr. McLean, I believe you'd like to comment on that.

Mr. MCLEAN. Yes. I think to try to understand this issue, people try to draw boundaries, 150, 200, 600. It's like saying you have an

impact up to that point, and then the next mile, you have no impact.

These are a gradually reducing impacts over distance. You have a dispersion of pollutants, you have a reaction of pollutants. You have changing wind directions.

So when people, depending on your point of view, you can either try to bring that line in and say it has a short impact, or you're going to try to stretch that line out and say it has a long impact. The fact is, it's a gradually declining impact.

But we have thousands of sources and dozens of States that are impacting dozens of non-attainment areas throughout the eastern United States. So, you don't look at one power plant, look at one non-attainment area and say, does this have a significant impact.

Senator SESSIONS. What about these models, though? Don't they take that into account?

Mr. MCLEAN. The models take all of that into account. And it's very difficult to characterize the result of a model with a single sentence, you know, it's 150 miles. What the model shows you is the picture of all the sources over time having impacts on all the non-attainment areas, and giving you a sense of the degree of impact it has on all the different areas.

I think it was interesting this morning that we heard Senator D'Amato say that if I shut down all the industry in New York, it wouldn't solve my problem. Yet West Virginia is saying, if we shut down all the industry in West Virginia, it wouldn't solve New York's problem.

Well, the truth is, we don't want to shut down anyone's industry. What we want to do is control industries in a cost-effective way, to bring about a reduction and a solution to these problems. We believe we're going to need to reduce emissions in both New York and West Virginia if we're going to be solving this issue. You can't cordon off one State from another.

Senator SESSIONS. Has there been any research on worldwide transport of these pollutants, for example, we know what kind of problem there is in China if you're there. To what extent are some of our problems coming from international sources, where we happen to have much less stringent pollution laws? Anybody want to comment on that?

Mr. MELEWSKI. I can comment that, in the late 1980's and 1990, the Clean Air Act amendments were adopted in consideration of bilateral agreements with Canada, who also engaged in a program to reduce their emissions substantially. Because they were having an impact on New England and western New York in particular.

They have followed through on that program, and that's one reason why we find it so significant now that Environment Canada is calling on their government to pursue a renewal of the bilateral agreement with much lower targets.

So yes, there is cross boundary pollution issues with regard to acid rain in Canada and the United States.

Senator SESSIONS. Mr. Melewski, with regard to the northeast, are you familiar with the December 1996 Scientific American article and/or the study that went behind it, dealing with the question that with regard to dust particles and other particulate matter, that they are in fact natural antacids, much as an antacid helps

your stomach? And they note that in addition to the lowering of acidity, precipitation, atmospheric base casseins also neutralize acid rain, once they reach the ground.

And they go on and have some charts in this article that say, parallel decreases, parallel decreases in acidic sulfur pollutions and the base casseins that neutralize them cancel out much of the expected benefits from reducing pollutants. And they cite a Swedish study and a northeast United States study. And they go on to note that other studies have shown that levels of the base casein calcium have decreased in the trees of a New Hampshire forest over the past several decades. Such decreases in essential nutrients weakens the forest further.

The authors say, when we began this work, we certainly did not anticipate that reduction in one form of pollution, dust particles, would be found to decrease the success of reductions of another pollutant, sulfur dioxide. Are you familiar with that? I guess that's one reason we've got on parallel track, PM ozone, OTAG, haze, NOx, sulfur dioxide, all these things going. And is anybody thinking about how it's going to come out in the end?

Mr. MELEWSKI. I am familiar, not with the article, but with the issue. It is a fascinating dynamic. It's explored much more extensively again in the NAPAP report, which was delivered in August to Congress. But it raises, the implications are quite profound for our forestry industry. The depletion of mineral resources, retarding growth, exposing forests to more insect infestation, basically weakening our forest industry from Maine to Alabama, I think is a very serious consideration.

One of the things that NAPAP pointed out is that approximately 59 percent of the southern pine area is now to a saturation level which this type of leachate of basic minerals may affect long-term viability of the forests. So it's a much bigger dynamic than the particulates being removed and affecting the total chemistry. But the impacts for us are quite severe. It appears to us that the most predictable and viable resolution is simply to minimize the total loading of sulfur and nitrogen, which is what the bill seeks to accomplish.

Senator SESSIONS. Well, that's what the article pointed out, we have been doing those things and we haven't received some of the benefits we expected to receive from it because of the countervailing scientific events.

Mr. Chairman, I thank you.

Senator INHOFE. Senator Sessions, do you have more questions to ask? First of all, let me apologize for having to go back and forth, but I'm in the Senate Armed Services Committee and I've got to go on down there. We will be keeping the record open when we adjourn this meeting for 7 days. There will be questions that will be submitted, because we have a lot of staff people here who will be submitting for their members.

So we'll hopefully be looking forward to your responding to those questions. And I appreciate your attendance here very much.

But let me, if you don't mind, go ahead and go back to the Armed Services Committee meeting, and you go ahead and complete the Chair in this meeting.

Senator SESSIONS. Very good.

Senator INHOFE. Thank you, Senator Sessions.

Senator SESSIONS [assuming the Chair]. Mr. Melewski, installation of the expensive SO_2 NOx and mercury control technologies could lead utilities to decide to continue the use of coal indefinitely. In addition, SO_2 scrubbers, which would be required to achieve a 50 percent reduction in SO_2 actually increase CO_2 emissions.

What implications do these facts have on the current concerns about CO_2 that we've been dealing with?

Mr. MELEWSKI. Well, I can't speak directly to the CO_2 issue, I have no expertise in that area. I can say that the benefits of the bill's structure is that they take advantage of the marketing mechanism that has now been demonstrated to be quite effective. There is maximum flexibility for the utilities to come in compliance. There's maximum opportunity to use pollution allowances in an openly traded market mechanism.

And the expense can be mitigated through sound business planning. That's the basis for the trading mechanism. I think it's been very successful so far. The costs are much lower than what was projected. And the impact on every utility and its own business decisions, whether to fuel switch or to add scrubbers or to discontinue the unit I think are going to be very dynamic and this is a perfect mechanism. They are going to be especially dynamic as States deregulate their utility industry, as New York is doing.

Senator SESSIONS. Anyone else?

Mr. TYNDALL. I would add that to provide an advantage to business planning, you have some certainty. When there are seven things coming at you, you have no certainty. To the extent this bill were to schedule every one of these things, setting aside what the stringency levels would be, that may begin to give you some certainty. But since this is the bite for acid rain, and there are five more major things coming at you, you don't have the certainty.

Senator SESSIONS. Well, Mr. Tyndall, you've been on both sides of the table now.

Mr. TYNDALL. Seven weeks on this side of the table.

Senator SESSIONS. Well, is it possible to have a more comprehensive bill and a more comprehensive set of regulations that could give more predictability and certainty to business as they go about investing?

Mr. TYNDALL. It's theoretically possible for Congress to resolve a number of these issues. The dynamic that has developed that I saw when I worked with the staff here on these issues and that members who have worked on this have run into is that EPA has been pretty much taking positions on one side of the spectrum. And States that are benefited by that don't see any reason to even begin to move legislation, because it will only diminish where they are right now.

So we haven't gotten to a situation where there are compromises.

But any one of these issues and certainly, you add to the political troubles when you add the issues. But any one of these issues is a candidate to be resolved here versus administrative action, since the administrative action in most cases is tenuous at best in terms of its relationship to the Clean Air Act. And hasn't been done in a manner that gets you a compromise so that we're not all sitting here, with Senator D'Amato calling Ohio airborne terrorists and us

telling him to put some controls on the taxi drivers and leave the voters of Ohio alone.

That's not going to be a productive way to go.

Mr. MCLEAN. Senator, with all due respect to Mr. Tyndall, dynamics change. And I think that the atmosphere while he was staffing and the atmosphere now, there are several dynamics that have occurred in that 7 weeks. One of them is that the NAPAP report has been delivered. The second is that EPA has proposed its own ozone regulations.

I think he's being a little disingenuous that the acid rain legislation that is before us for discussion today will not have a positive impact and a predictable impact in coming into compliance with many of the other regulatory efforts that EPA has deservedly advanced. So I think that quite the contrary, the perspective that the legislature is a mire and won't be able to resolve these problems I think is shortsighted. I think that Congress, by taking another look at this particular program, may open up avenues to resolve some other conflicts.

Mr. TYNDALL. But the question would be, would, if we pass this and there were the SO_2 reductions in this bill, would that be all utilities or any other business would have to do to comply with the fine particulate standard that's coming 4 years from now or 5 years from now.

Senator SESSIONS. What do you think, from the commercial side? What are the most difficult challenges? We have particulate matter, ozone, regional haze. We've got NOx and SO_2 and those kinds of things. What are the ones that are most challenging, briefly, you think are going to be most difficult to meet or most costly to meet?

Mr. TYNDALL. I think that we view the NOx, the SO_2 reductions that may be required as part of the fine particle standard, mercury to be all very difficult issues that we face. Then the CO_2, I am told this dwarfs the costs associated with the others. I know the basic U.S. strategy for complying involves utility sector not making reductions, really, but buying 85 percent or some incredibly high percentage of our reduction credits from overseas.

Senator SESSIONS. I really am very troubled by that.

Mr. Kropp, do you have any comment on that?

Mr. KROPP. I guess in terms of the complexity, Senator, West Virginia, while not being the smallest State geographically, has a population of only about 1.8 million. Unfortunately, in our agency, we have about six of us that have to worry about ozone and regional haze and PM fine and large particulates and the odor complaints and all the other aspects that we deal with.

I believe that it would be much easier for a small agency like ours to deal with a comprehensive bill, instead of having differently timed deadlines and different regulatory initiatives to deal with all in a row. We are stretching our resources.

Senator SESSIONS. Mr. McLean, are we "ad hoc"-ing here, and if we see a problem we jump on it, and we look back later and we've really created a mosaic of rules and regulations that could be simplified?

Mr. MCLEAN. Well, it certainly, going back to what Bill said theoretically, you could bring these things together. I think you have to look at the Clean Air Act, for instance, just on the air qual-

ity side, over a 30 year history of raising issues, defining issues, asking for action to be taken on issues. It's a learning process. We didn't know 30 years ago all these issues. We've learned about them as time has gone on.

There is a feeling that as we define an issue that we should take action to address the issue. But I also think it's worthwhile taking stock periodically of all the things we have on the plate and seeing whether we can't do it in a more efficient manner. We have tried to do that. The Act is somewhat difficult in places, because it has these specific mandates throughout it. We do try to coordinate those mandates as best we can.

And as I said, back a few years ago, we saw these things coming, standard changes, mercury, regional haze. Perhaps additional acid rain concerns, climate concerns. And we said, maybe we can find a way to coordinate these. And we tried.

But it's very difficult. The industry is not of one mind. There isn't one person out there who represents all the industry that's affected either. So when you try to sit down, you have different interests. And different years, different months of that year you're going to get a different reaction.

It's a very difficult task to try to bring everybody together. But one of the options we were not considering was delaying everything. We said, we have to reach some compromise. Some things we might be able to delay. Some things——

Senator SESSIONS. But standards are coming on board every year that are tougher than the year before. We didn't pass a single law, isn't that correct?

Mr. MCLEAN. Well, the standards are supposed to be reviewed every 5 years, and we haven't changed the ozone standard for almost 20 years. So it's not like the agency has been throwing new standards at people for ozone.

Senator SESSIONS. No, not you, but I mean the standards are tougher in a lot of these areas each year.

Mr. MCLEAN. It goes where the science leads you. As studies are done, health studies are done and ecological studies are done, we need to take that new information into account. The statute says every 5 years review the information and decide whether this leads you to change the standard. We didn't change the ozone standard for almost 20 years, and we did this time, because of the work that's been done over the last 20 years.

So I think that when you look at all of them, it looks like a lot. If you look at one of these at a time, there are long gaps between action on an individual issue. It's a very complex issue.

Senator SESSIONS. Well, I've been here 2 years, and I'm seeing a lot of new ones coming up.

Mr. MCLEAN. These are all, a lot of them are set in the 1990 amendments as actions to be taken by the agency. Some of these have actually been delayed considerably. The ozone SIP Call really is a result of a failure to act in 1994. We gave the States extra time and evaluated the issue together with them over 2 years. The SIP Call is a result of a failure to actually solve the problem 4 years ago.

Senator SESSIONS. Briefly, I'll ask you this. How do you evaluate the progress, some general progress, I understand, in acid rain in

the forests and lakes of the northeast? How do you evaluate that? I see Adirondacks are level, they didn't show any progress, basically. But other areas have. How would you evaluate that?

And then second, the legislation that's being proposed would cost as we understand it four times what EPA's proposals are. Do you feel like your proposals will continue to show progress, if your standards are adhered to?

Mr. MCLEAN. Well, first on the progress. I think we have and are making progress and will continue to make some progress on acid rain, with reductions in both sulfur and nitrogen.

Senator SESSIONS. Based on current standards?

Mr. MCLEAN. Based on current standards. And I think Mr. Melewski would agree with me. I think his concern and our concern that we share is that based on the work we've done, we can project this probably will not be enough.

Senator SESSIONS. How would you say it would not be enough if you have a steady improvement?

Mr. MCLEAN. Because the improvement will end. We know the reduction that's being called for, we have achieved over half of that reduction in sulfur already. So we can see the effects of that. Just as we did in 1990, we modeled the future. I mean, in 1990, it was based, the decision to take 10 million tons out of the air was based on our best scientific assessment of what would happen if we were to take 10 million tons out of the air. And it was a scientific judgment and a political judgment about what was acceptable.

We analyzed 8 to 12 million tons and picked 10. It wasn't a guarantee that it was going to solve every problem. But it was an understanding that it would go a long way toward solving the problems. And it will go a long way in several areas. But it appears that it won't go far enough in terms of solving all the problems we have out there.

We look at S. 1097 as not a bill that's going to pass this week. But we look at it as a constructive proposal to deal in the long term with these issues and lay out a long term strategy. The reductions called for in that bill—although the impositions will be early in some cases because of the trading and banking program—full effects won't occur for another 10 to 15 years. So it's not a precipitous kind of approach, and it is something that should be considered when there are deliberations on the whole Clean Air Act.

Senator SESSIONS. And how do you deal with the argument that vehicles and other sources of pollution are significant? One thing, as an economist, we know that there's no free lunch, that everything has a cost. In economic terms, I consider it the absolute equivalent of a tax to require a private industry to spend $500 million. It's no different economically than taxing that corporation $500 million and having EPA spend $500 million to reduce pollution.

So I guess I'm asking, are we making the right assessments of cost on our private sector? And with regard to other areas, there's not s many voters in utility areas, because the ratepayers don't recognize that these costs on utilities get passed on to them in rates. They don't feel it like we would if we passed a tax in this Congress. They'd know it, they wouldn't like it.

So we by subterfuge a lot of times put this cost on them by mandates and say, we didn't raise your taxes. But we've raised their cost to live, because they have to have electricity and gasoline.

With regard to that, I think we ought to ask ourselves, which is the most cost beneficial to the public, automobiles or other areas, or is it utilities? Do you have any comments on that?

Mr. MCLEAN. Yes. I agree with you that whatever we do when we impose costs, they affect the economy. Our goal is to try to keep those costs to a minimum.

We do believe that those costs are there, not just like a tax, but they are there to provide some benefit.

Senator SESSIONS. Well, taxes have benefits, too. We might tax $500 million and use it for health care and save more lives than on ozone.

Mr. MCLEAN. Well, the tax itself doesn't, but the use of the tax does. So I'm saying that the use of the money, it's supposed to be for a benefit. So far the cost benefit analyses we've done of the Clean Air Act shows tremendous benefits far exceeding the costs.

As to what people pay, I think it was interesting, we got a letter a few months ago from a citizen in Ohio. The State of Ohio asks the electric companies to include on their billing statements the cost of meeting acid rain requirements, so that individual citizens could see the impact of this requirement on their electric bill.

This citizen complained that his bill had gone up from $70 to $80 a month and this was a tremendous cost, and that the cost of the acid rain control was 18 cents of that $10 increase. I think that it showed that that 18 cents, we probably wouldn't disagree with. We think that the cost was probably in that range. We don't believe that is a significant cost, given that in the State of Ohio, the health benefits alone from the SO_2 reduction would be $3 billion a year. So there'd be tremendous health benefits from the reduction of sulfur in the State of Ohio and surrounding States that we think would be worth that cost.

And that's the kind of thing that we try to weigh.

Senator SESSIONS. I think we need to be right up front with these costs, and compare that to the benefit. I think that's a healthy way to do it.

But what about the cost of utilities versus automobiles and things of that nature?

Mr. MCLEAN. That's also a concern.

Senator SESSIONS. What would get you the best bang for your buck in terms of clean air?

Mr. MCLEAN. Exactly. And some of the direction we get from Congress itself and the statute as to which areas to control and how far to control them, and in other cases, the decision is left up to the agency through the regulatory process to determine what seems to be the most cost-effective way to go about solving the problem.

When we look at the NOx issue, for instance, that we've been addressing, about a third of the emissions come from utilities. About a third of them come from automobiles. About a third of them come from heavy duty vehicles and other industrial sources. They're spread throughout the economy.

When it comes to reducing them, we look at what will the cost be of taking a ton out of the air from each of these different sectors. We look at the automobile sector, where the NOx control levels on new cars are over 90 percent now. They've been ratcheted down over the past 30 years. The cost is in the thousands of dollars per ton.

We look at some of the small industries and businesses. We find that the cost of control for some of the smaller sources may be in the thousands of dollars per ton, because the costs tend to go up as your size goes down, in terms of cost effectiveness.

When we look at large utility boilers and some large industrial boilers, we found in this particular NOx SIP Call that the average cost would be about $1,500 a ton. Yet they were the lowest cost of all the major sectors that we could find to reduce nitrogen oxide.

Senator SESSIONS. Does Mr. Tyndall agree with that? That sounds like the ball's in your court.

Mr. TYNDALL. No, he was talking about the large, nonutility industrial boilers.

Mr. MCLEAN. And utility boilers.

Mr. TYNDALL. But on this issue in general, another way of saying it is that there's no free lunch, there's no low-hanging fruit, either.

Senator SESSIONS. In other words, the easy progress has already been made?

Mr. TYNDALL. Having served with Mr. Dingell, I'm completely aware of what the reductions have been from the automobile sector, in terms of the tailpipe emission standards. And I'd be the last to say that there's not any problem with what they've done.

But you know, you have a third of the emissions, the NOx emissions for instance, coming from automobiles and other transportation and off-road engines, including things like weed whackers and stuff, which have tremendous emissions.

Senator SESSIONS. Those things have a lot, weed whackers and lawn mowers really do contribute?

Mr. TYNDALL. Yes, they have big emissions. An hour on a lawn mower is like 400 miles on a new car.

Mr. MCLEAN. That shows you the progress that's been made in the automotive sector. That wasn't true 30 years ago. The car would have been far heavier.

Mr. KROPP. Senator, may I respond to that?

Senator SESSIONS. Yes.

Mr. KROPP. One of the problems that we see with that kind of an analysis, and we've tried to offer EPA comments, is that cost per ton removed may or may not be the proper metric. In the case of ozone, for example, we have suggested, and the EPA rule suggests, that a ton of NOx removed from a source in Ohio has the same impact as a ton of NOx removed from a source 50 miles from a non-attainment area. We don't believe that's the case.

So perhaps the proper metric is, what is the cost per part per billion of ozone in the atmosphere reduced. That takes into account the transport phenomena, and that is not being taken into account in the OTAG SIP Call.

Mr. TYNDALL. To emphasize that, because that is a key problem here, you take a source very close to where the nonattainment area is, there's complete consensus that those reductions are going to

impact that area regularly. They aren't going to just impact it when the 4-hours of the year when the wind is at the absolute worst for transport. They're going to impact every day. And those impacts are basically going to be one ton removed equals one ton removed from the atmosphere.

You go to one of our power plants 250 miles away or whatever, you know, the transport is either nil or it's one one-hundredth, or it's one-tenth, whatever we end up fighting about. In other words, the ratepayers are going to remove ten tons to get one ton of reduction at the local area concerned about after the transport. And again, that's only going to happen for the 4 hours, I mean, the OTAG process, this multiState process was modeling the four worst 1-hour episodes.

So you're looking at 4 hours and making these decisions. And that ton reduced locally is helping air quality every single hour of every single day.

EPA, when it looked at this issue, it essentially said, well, we're going to presume that everybody influences somebody, and therefore, we're justified in making these across the board. They're pretty far from the statute, and they may get into trouble on that in court.

But the cost effectiveness, which they then throw in your face, is really unfair. Because you've got to look at what the ratepayers are doing is reducing ten tons for the one ton or the one pound, whatever it ends up being, of transport that occurs.

Senator SESSIONS. Well, American business is incredibly sophisticated, and it is prepared, and the reason it remains competitive in the world, in my opinion, is because you're able to fine tune everything. I think Government's got to get better at that.

Would you respond to that, Mr. McLean, that we ought to, that if we want to deal with areas that are not in attainment, primarily, it would seem to me to be appropriate that we would put more stress on the industries and utilities who are right there daily, polluting, rather than those who have only incidental impact?

Mr. MCLEAN. I think to understand the transport SIP Call, it was not designed to achieve attainment in each non-attainment area. We consider ozone to have two major elements to it. There's the transported component and there's the local component. They tend to merge at certain points.

But we have been focusing on the local component for 30 years. We have been asking States and localities to reduce emission sources in local areas to attain their standard.

And when we got to 1994, the comment we got from a lot of people was the same comment we got from Senator D'Amato this morning: if I shut down all my industry to attain this standard in my State, I can't do it. There was a recognition that transport was a component of the problem. It wasn't the whole problem, but it wasn't a zero part of the problem. It was a portion of the problem.

So we embarked on the whole OTAG process to try to understand the significance of that component and then to take action to deal with that component. That's what the SIP Call does. You can go ahead and——

Senator SESSIONS. I understand that, but if you've got a plant that blows out over the Atlantic 90 percent of the year, and one

part of the year it blows in the non-attainment zone, you're just not going to get as much health benefit as if you deal with the plant that's right there, seems to me.

Mr. MCLEAN. Right. And the local areas are free and encouraged to deal with the plants that they feel have the most significant impact on the problem. But those local areas were getting transported air pollution. They could not control the transported air pollution which came in from different States on different days from different directions.

Now, we don't have the capability to dispatch pollution control the way we dispatch electricity. We don't sit there and say, on July 7, I'm going to control this plant in northern Ohio and on July 8, I'm going to control the plant in southern Ohio. We're not that sophisticated to move our dispatch around with the wind flows and the weather. So we've adopted an approach which reduces overall background because that air blows somewhere. And it may blow in a curvilinear path and end up in another non-attainment area. So because it didn't hit Pittsburgh yesterday doesn't mean that it's not going to hit Erie, Pennsylvania or Philadelphia on another day.

So we look at this more as a comprehensive set of sources, collective set of sources that are causing a collective problem. And by tracking one individual source, we have not solved this problem in 30 years. So we felt that——

Senator SESSIONS. We've made remarkable progress.

Mr. MCLEAN. We've made progress, but we've run up against a wall, where we were focusing only on one way of going about solving it. And we decided that it was appropriate to bring down the background, so that the local areas could take the additional steps needed to bring the areas into attainment. So this transport SIP Call is bringing down background levels so people can have a chance at finishing the job and solving their local nonattainment problems.

Senator SESSIONS. Well, there we have it, I think, bringing down the background. And I hope that we can take time and, as the science comes in over the years, determine whether or not that's an effective way to make our air more healthy.

Any of you have any final comments? I'm sure you may have something at this point you feel you need to say.

Mr. MELEWSKI. I actually want to go back to your question earlier to Mr. McLean about if we're seeing some progress in the reductions from sulfur, why continue to examine the problem. I think it also goes to Senator Chafee's question about the saturation issue. What we're seeing as a result of the 1990 amendments in the Adirondacks, per se, is that the time line has been stretched for the loss of our lakes. Instead of losing them in 10 years, we're going to lose them in 40 years. It's still an unacceptable resolution for us.

Senator SESSIONS. But I thought the lakes were actually getting cleaner or healthier in areas of New England.

Mr. MELEWSKI. Yes, in many ways it's a dynamic of the buffering capacity of lakes and the soils around them. Which also goes to Senator Chafee's question about the saturation of the soils. If you can illustrate it as a sponge and you're applying water at a certain rate, if you slow that rate, you may fill up the sponge, but you won't exceed the sponge's capacity.

And in many areas outside of the Adirondacks, we're well past that point, in many areas outside the Adirondacks, from Maine down the east coast, soils are saturated with acidic components. If we continue the rate in which we're going to deposit nitrogen and sulfur dioxide, even with the new amendments, we will fill up that sponge, if I can use that analogy. And you're going to start seeing the same kinds of problems, loss of trout fisheries, loss of lakes, severe loss of the spruce and other tree species that you're seeing in a very dynamic and aggressive way in the Adirondacks now.

Senator SESSIONS. Thank you, that's an insight that we should consider. Do you have any comment about that sponge theory, Mr. Kropp?

Mr. KROPP. Senator, I don't have a comment about the sponge theory. But I guess I would like to respond to one of the comments that Mr. McLean made, indicating that the OTAG SIP Call occurred because of failures in SIPS in 1994. And I simply want to point out that my understanding is that West Virginia has never had a SIP Call as a result of ozone. West Virginia had ozone non-attainment areas. We dealt with them locally. We don't have ozone non-attainment areas any more. We may have some under the new standard.

We put controls on our sources when we had non-attainment problems to deal with the 1-hour ozone standard. The failures in 1994, my understanding, are the result of many of the northeast States to default on absolute requirements under the Clean Air Act to have, for example, enhanced inspection and maintenance programs for vehicles by 1994. Those States do not have those programs today. And the idea that we need the OTAG SIP Call to deal with transport, rather than dealing with the local problems and the local mandates of the Clean Air Act, is something that West Virginia thinks needs to be resolved first.

Senator SESSIONS. Well, I think that's some of the issues we've been dealing with, and I appreciate your sharing that.

Seeing there are no further questions, I want to thank all of you for your testimony. It's been extraordinarily interesting and insightful and beneficial to me. And should there be additional questions, I'm sure members of the committee may submit those to you in writing.

No other questions. We are in adjournment.

[Whereupon, at 11:40 a.m., the subcommittee was adjourned, to reconvene at the call of the Chair.]

[Text of S. 1097 and statements submitted for the record follow:]

STATEMENT OF HON. JERRY SOLOMON, U.S. REPRESENTATIVE FROM THE STATE OF NEW YORK

Mr. Chairman, I want to thank you for the opportunity to speak today. also would like to thank my colleagues, Senator Moynihan and Senator D'Amato for their valuable work on an issue that is very important to my district as well as much of the northeast and in fact the entire country. That issue is the very real and necessary changes that need to be made to strengthen the Clean Air Act to continue fighting acid rain and air pollution.

The legislation before the committee today, as introduced in this body by my good friends Senator Moynihan and Senator D'Amato, will build on the Clean Air Act and the provisions dealing with the pollutants most responsible for acid rain. I was pleased to introduce this companion legislation in the House and to have the support of many in the New York delegation.

Although we've made tremendous progress in cutting pollution through the original clean air act, it hasn't been enough to reduce the pollution responsible for acid rain and excessive air contamination we suffer from in New York.

The forests and waterways of the Hudson Valley and the Adirondacks have become a dumping ground for this pollution and will be destroyed if we don't do something to stop it. In fact, in studies as early as 1984, 19 percent of the Adirondack lakes were dead and 55 percent were highly acidic. This statistic will only get worse in the future. As an outdoorsman and lifelong resident of this beautiful region, I'm not going to stand by and watch our area and many others like it be destroyed.

This legislation, entitled the Acid Deposition Control Act of 1997, focuses on further reductions in the emissions of nitrogen oxide (NOx) and sulfur dioxide (SO_2), the two primary components of acid rain. Sulfur dioxide emissions have been declining under the emissions cap currently in place, but not fast enough for environmentally sensitive areas like the Adirondack mountains, the Hudson River Valley as well as much of the eastern seaboard. This bill would cut the amount of SO_2 emitted in half in 2003 so dirty power plants won't be able to continue business-as-usual and get around pollution restrictions.

But even more important, this proposal finally takes on dangerous nitrogen oxide emissions. The Clean Air Act, as it stands, virtually ignores nitrogen oxide which in many ways is the most dangerous pollutant because of its devastating contribution to acid rain and ozone pollution which can cause significant health risks for people suffering from respiratory problems, like asthma.

This bill creates a market-based "cap and trade. system for NOx emissions similar to that already in place under the clean air act of 1990 that regulates SO_2. Under such a trading system, states are given pollution allowances directly related to the percent of power the utilities in their state produce. The state then divides up these allowances to each utility in whatever manner they choose.

The system provides incentives for utilities to produce less' pollution than allotted because they can sell extra allowances to other utilities. However, if a utility exceeds its emission allowances, even after buying additional credits, they will be subject to serious financial penalty.

Another important provision dealing with NOx emissions seeks to cut these emissions at the most dangerous point of the year for many elderly and children afflicted with respiratory problems. The bill cuts in half the NOx allowance during the summer months of May, June, July, August and September when the heat and sunshine combine with NOx and other pollutants to create hazardous ozone pollution.

I am pleased with the support this legislation has already received from many environmental organizations and industry groups. We need to continue working with all members in the House and Senate that are serious about reducing pollution in this country. I urge the committee to pass this legislation and become committed to this cause. It's time for all of us to get together to fight against acid rain for the health of our citizens and the health of our vital natural resources!

STATEMENT OF HON. ALFONSE M. D'AMATO, U.S. SENATOR FROM THE STATE OF NEW YORK

Good morning. I appreciate this opportunity to present my testimony to the Clean Air Subcommittee regarding S. 1097, the Acid Deposition Control Act. This measure, introduced by Senator Moynihan and myself, and combined with companion legislation in the House sponsored by Congressman Gerald Solomon will help protect the sensitive ecological regions of our nation, including the Adirondack Mountains of New York, from the scourge of acid rain.

Mr. Chairman, I have likened the assault on our lakes, our rivers and our forests by acid rain as a form of "airborne terrorism." For decades, power plant smokestacks—hundreds of feet high—have been spewing pollutants into the air where they are carried via the jet-stream to our state. Once over New York and other Northeastern states, they fall to earth, poisoning our environment. These pollutants have had a devastating effect. In fact, right now in the Adirondacks—New York's 6 million acre state park—500 of the areas 2,800 lakes and ponds are too acidic to support life. Further, according to the EPA, if nothing else is done to reduce acid rain by the year 2040, 43' of the Adirondacks water-bodies will be acidic. That's just plain wrong. The steps we have taken to combat acid rain have been important, but, they have not been enough. We can do more and we must do more.

When Congress passed the 1990 Clean Air Act Amendments, we thought we had tackled the pollution problem that sulfur dioxide was causing. Today, nearly a decade later, it is abundantly clear that the steps taken under the Clean Air Act to reduce sulfur dioxide emissions are insufficient to protect regions such as the Adi-

rondacks from acid rain. Scientists now tell us that, along with sulfur dioxide, nitrogen oxides (NOx) play an important role in the acid rain problem. EPA's own reports -? released only under the threat of litigation—clearly show that additional steps are needed, and this is the purpose of the legislation sponsored by Senator Moynihan and myself and Congressman Solomon in the House.

Critics of our bill will point out that the EPA recently issued a State Implementation Plan—or SIP call—for 22 states. This SIP call will reduce emissions of nitrogen oxides or NOx, from large stationary sources (power plants) by over 75 percent in the summer months, but, less than 40 percent annually. While a step in the right direction, I do not believe that the EPA's actions will be sufficient to end the acid rain problem in the Northeast. In fact, I believe that additional measures will be required.

Our bill includes provisions to reduce annual nationwide NOx emissions by 70' from 1990 levels and not the 40' average annual reduction under the SIP call. Unlike the SIP call, our bill provides EPA with a clear legislative authority to establish a NOx "cap-and-trade" program patterned after the successful sulfur dioxide cap-and-trade program that was created under the Clean Air Act. Our bill also would require 50' more reductions of sulfur dioxide emissions annually beyond those called-for in the 1990 Clean Air Act.

Critics of this bill are going to say that it costs too much. I disagree. When the Clean Air Act was enacted, it was expected that an allowance to emit a single ton of sulfur dioxide would cost over $1,500 on the open market. Today, that allowance costs between $150 and $200. It is a clear example that, given the chance, business and industry will devise the most cost? effective means to meet pollution reduction goals. It also demonstrates that additional reductions of sulfur dioxide are both achievable and cost effective.

In addition, EPA's SIP call is aimed at reducing NOx emissions during the summer to reduce ozone. Our bill requires emission reductions all year round, with special emphasis on the summer months. However, one important fact is our bill does not ignore the critical winter months. What many people forget is acid deposition, falling as snow, accumulates over the winter in the snow-pack. When warm weather comes, and the snow melts, the accumulated acid in the snow is released into water bodies in a single shock-load during Spring runoff. Such a massive influx has a harmful effect on the development of fish and other aquatic life.

Finally, I want to make it clear that the acid rain problem is not limited to New York; this is not just a bill to cut down on acid rain in our state alone. We believe that a number of states will benefit from our bill. For example:

1) An organization of New England States and the Eastern Provinces of Canada has issued a resolution calling for action to decrease the impact of acid rain in their region with detailed steps to reduce their own emissions. Their recommendations are nearly identical to those called-for in our bill.

2) The same emissions that cause acid rain in the Adirondacks are causing nutrient-loading in the Chesapeake Bay and Long Island Sound. This process depletes oxygen from the water, killing fish and other aquatic life.

3) According to the National Acid Precipitation Assessment Program (NAPAP) report released this summer, acid deposition is damaging forest lands around the Nation including the Colorado Rockies and from the southern Appalachians to the tip of Maine.

4) The national sportsmen's group, Trout Unlimited, recently released a study of Virginia's trout streams indicating the need to reduce the levels of acid deposition by 70' to prevent the acidification of half of Virginia's trout streams.

In conclusion, Mr. Chairman, the EPA's initiative in issuing the SIP call to combat ozone is the right thing to do. However, the EPA's measure is clearly not enough to protect the nation's sensitive water-bodies and forests from acid rain. To fully combat the effects of acid rain—this "airborne terrorism" -? we need this legislation to make the significant cuts in the pollutants that cause acid rain. Those of us in states that are being subjected to this onslaught are saying enough. We have no more tolerance for this assault on our health and the environment.

Thank you, Mr. Chairman, for holding this hearing today.

STATEMENT OF BRIAN J. MCLEAN, DIRECTOR, ACID RAIN DIVISION, ENVIRONMENTAL PROTECTION AGENCY

Mr. Chairman and members of the subcommittee, I am pleased to have the opportunity to testify on S. 1097, the "Acid Deposition Control Act." My testimony will focus on several major themes pertaining to the impacts of acid deposition and its precursor emissions sulfur dioxide (SO_2) and nitrogen oxides (NOx), the progress

and cost-effectiveness of current efforts to reduce these emissions, and our reactions to the provisions in S. 1097. This hearing provides an opportunity to examine where we are, what we have learned since the 1990 Clean Air Act Amendments, and how successful mechanisms such as those in the current Acid Rain Program may be used in future efforts to address air pollution.

Background

In 1980, driven in particular by Senator Moynihan's interest in acid rain, Congress passed the Acid Precipitation Act. In that Act, Congress mandated a 10-year scientific, technological and economic study to examine the relationships among fossil fuel combustion, acids and other pollutants formed by emissions, and the effects on the environment and human health. The National Acid Precipitation Assessment Program (NAPAP) was established to coordinate and administer the study. NAPAP drew several significant conclusions. First, NAPAP concluded that the effects of acid deposition and its precursor emissions SO_2 and NOx are broad. They include acidification of lakes and streams, damage to certain high elevation forests, depletion of essential forest soil nutrients, damage to materials, particularly those of historical and cultural significance, and visibility impairment and human health effects associated with ambient sulfates and nitrates. Second, the source-receptor research performed in the 1980's recognized and documented long? range transport of air pollution and revolutionized clean air policy regarding regional air pollution issues. It became apparent that a broad regional approach would be needed to address a broad regional air pollution problem. Third, the emissions inventories developed under NAPAP revealed critical information regarding the source of acid rain forming emissions. Two-thirds of the SO_2 emissions and one-third of the NOx came from electric power generation. The wealth of data and analyses developed under NAPAP provided the underpinning for Title IV (Acid Deposition Control) of the Clean Air Act Amendments of 1990. At that time, Congress also reauthorized NAPAP to periodically report to Congress on the costs, benefits and effectiveness of Title IV.

Innovative "Cap and Trade" Design to Reduce SO_2

In creating Title IV and establishing the Acid Rain Program, Congress drove environmental protection in a new direction, away from traditional command and control regulation. First, to address the problem of acid rain, Congress focused on reducing the SO_2 and NOx emissions that cause acid deposition rather than relying on regionally variable deposition standards and state-by-state implementation plans. Second, Congress translated its 10 million ton SO_2 reduction goal into a nationwide cap on emissions from electric generating sources and allowed the industry 20 years to achieve it. Third, Congress provided EPA with a new tool to achieve this reduction—an innovative market-based allowance trading program, where one allowance is a limited authorization to emit one ton of SO_2, allowances are allocated to sources based on performance standards, and they can be freely traded.

This "cap and trade" approach allowed industry unprecedented flexibility in how to achieve the needed emission reductions. They could install pollution control equipment such as "scrubbers", switch fuel, conserve energy, rely more on renewables, trade SO_2 allowances, or any combination of these. In return for this flexibility, sources were to provide a full accounting of their emissions through continuous monitoring and reporting, and there would be severe consequences for failing to hold sufficient allowances to cover one's emissions. The objective was for sources to find the most cost-effective means for limiting SO_2 emissions and to be responsible for achieving those emissions reductions. There would be no government second guessing and lengthy permit reviews.

Progress of the Acid Rain Program—Significant Reductions at Low Costs

In 1995, the first year of compliance under the Acid Rain Program, SO_2 emissions declined dramatically—by over 3 million tons—resulting in a nearly 5 million ton SO_2 reduction from electric power generation from 1980 levels. Over the first 3 years of the program, emissions from Phase I units emissions were more than 30 percent below their allowable levels and sulfate deposition has been reduced by as much as 25 percent. Of particular importance is that the most significant emissions reductions occurred in the highest emitting states and regions of the country. Phase II will begin in 2000 and further emissions reductions will be required to achieve the total 10 million ton reduction in SO_2 under the Program.

Cost savings have exceeded expectations. In 1990, EPA projected the cost of full implementation of the SO_2 emissions reduction with trading at $4 billion per year. In 1994, GAO projected the cost to be less than $2 billion per year. The most recent estimate of annualized cost of compliance published this year by Resources for the Future is approximately $1 billion per year.

Control of NOx from coal-fired utility boilers under the Acid Rain Program began in 1996. For Phase I utility units, the average NOx emission rate declined by 42 percent (from 0.69 lb/mmBtu to 0.40 lb/mmBtu). These same units exhibited about a 35 percent reduction in tons of NOx (approximately 400,000 tons between 1990 and 1997). However, NOx emissions in 1997 increased slightly from 1996, because of greater electricity production. In 2000, NOx from electric utility boilers will be further reduced to a total reduction of over 2 million tons per year. However, without further requirements to reduce emission rates, such as those in the Agency's final ozone transport rule ("NOx SIP Call"), NOx emissions would be expected to rise with increased utilization.

The success of the cap and trade approach is being adapted for other programs. In 1996, the Ozone Transport Commission (OTC), composed of 12 northeastern states and the District of Columbia, asked EPA to help develop and administer an emissions trading program, modeled after the SO_2 program, to control summer NOx emissions in the OTC region. More recently, the cap and trade approach was included as an option for states in the NOx SIP Call. When implemented, that rule will achieve significant, cost-effective summertime NOx emissions reductions in 22 states and the District of Columbia.

Environmental Trends, Modeling and Continued Concerns for Natural Resources

Environmental data are beginning to reflect improvements accompanying the downward emissions trend, but fundamental concerns regarding recovery persist. The nation's deposition monitoring networks have shown significant reductions in sulfate concentrations measured in both wet and dry forms. Results from an analysis of long-term surface water monitoring data have confirmed that acid sensitive lakes have experienced significant declines in sulfate concentrations in response to declining sulfate deposition. Surface water nitrate levels, however, have not shown significant upward or downward trends which is also consistent with trends in nitrate concentration levels in deposition.

Acid neutralizing capacity (ANC) is a measure of alkalinity or buffering ability and is most often used as a primary indicator of surface water response, or recovery. Lakes in New England have begun to show some recovery while Adirondack lakes in New York have exhibited either no trend or further acidification (decrease in ANC). Other sensitive watersheds in the southeastern U. S. (e.g., Virginia trout streams) appear to be so saturated with sulfur that they may get worse before there are signs of recovery.

In August of this year, NAPAP reported that some forest soils are beginning to "leach" sulfates or nitrates or both due to decades of exposure to high sulfur and nitrogen deposition loads. High elevation lakes in the western U. S. are also vulnerable to sulfur and nitrogen loadings. In 1995, the EPA sent to Congress its Acid Deposition Standard Feasibility Study. This study drew several conclusions: 1) The number of acidic waters would be expected to increase substantially without the SO_2 and NOx emissions reductions required by the 1990 Amendments. 2) The study projected that although there is uncertainty and regional variability regarding a specific "protective threshold" the direction and magnitude of the modeled results indicate that additional reductions in both sulfur dioxide and nitrogen oxide emissions may be necessary to fully protect sensitive resources. 3) This study, as well as numerous other research studies in the peer reviewed literature, identifies nitrogen as a major contributor to both short? term (episodic) and long-term (chronic) acidification.

Recent evidence also points to atmospheric nitrogen deposition as a significant contributor to total nitrogen loading to coastal waters along the East and Gulf coasts and nutrient loading in large river basins. Excessive nitrogen levels have been found in all East and Gulf coast estuaries including for example the Narragansett Bay, Long Island Sound, the Chesapeake Bay, Albemarle and Pamlico Bays, Tampa Bay, Galveston Bay and the "hypoxia zone" along the Gulf coast. Recent analyses of estuaries along the East and Gulf coasts have estimated the nitrogen contribution from atmospheric sources to range from 10 to 45 percent. Excessive nitrogen or nutrient over-enrichment is associated with adverse ecological effects such as eutrophication and extreme anoxic (low oxygen) conditions in some locations. These conditions have important implications for the biological communities.

MULTIPLE EFFECTS ASSOCIATED WITH SULFUR DIOXIDE AND NITROGEN OXIDES EMISSION

Reducing SO_2 and NOx provides multiple environmental and human health benefits

- Reduced number of acidic lakes and streams in various sensitive regions of the country (e.g., Northeastern, Mid-Atlantic, Southern Blue Ridge, Upper Midwest and

high elevation Western regions) and more sensitive ecosystems will be capable of sustaining diverse aquatic life. In particular, annual reduction of NOx emissions ensures greater ecosystem protection (i.e., against acidification, eutrophication), particularly during spring when highly sensitive biological aquatic life stages (i.e., spawning) are most susceptible to acidic pulses from snowmelt and heavy rainfall.

- Increased protection of coastal ecosystems and estuarine aquatic life due to a reduction in nitrogen deposition onto coastal waters and their larger watersheds.
- Reduced leaching of essential soil nutrients, addressing the "saturation" of certain forested watersheds due to many years of high sulfur and nitrogen deposition, to a state in which recovery can occur.
- Increased protection of sensitive structural materials, particularly objects of cultural and historical significance. The effects of dry acidic compounds and their reactions are now understood to cause the most deleterious loss of structural integrity.
- Reduced ambient sulfates and nitrates with consequent reduced risks to human health.
- Reduced ground-level ozone concentrations with consequent reduced risks to human health.
- Reduced ambient sulfates and nitrates with consequent improvements in reducing haze that impairs scenic visibility.

Comments on S. 1097

In general, S. 1097 builds on those elements of the Clean Air Act that are working well.

- The Bill relies on the successful market-based mechanism introduced in the 1990 Amendments and applies it to both NOx and SO_2 Trading allowances provides flexibility to sources and competition across compliance options, and the emissions cap ensures that the pollution reduction goals are met and maintained into the future. Contrary to early concerns over trading and the potential for "hot spots," SO_2 trading has not led to significant geographical emissions shifting from one state to another.
- The Bill reduces and caps emissions of NOx. It builds upon the existing NOx reduction requirements under the acid rain program and the recent ozone transport rule. The level of summertime NOx emission reductions is similar to that under EPA's recent SIP Call; however, the NOx emissions cap is broadened to cover the entire year and the 48 contiguous states. By requiring the retirement of two allowances for every ton of NOx during the five summer months, the Bill ensures greater reductions in the summer when the health impacts of ozone are of primary concern. By requiring NOx reductions year-round, the Bill is consistent with the latest research on ecological protection during biologically sensitive times of the year.
- The Bill further reduces SO_2 emissions from the utility sector by requiring two SO_2 emissions allowances to be surrendered for each ton of SO_2 emitted, thereby cutting the current cap in half. EPA prefers an approach which minimizes disruption to implementation of the current SO_2 allowance system under the Acid Rain Program.
- The Bill emphasizes measurement of emissions by requiring the industrial sector to install continuous emissions monitoring systems. Continuous monitoring generated by this requirement would improve the accuracy in emissions inventories for that sector, however EPA would need to analyze the associated costs. The Bill does not require emissions reductions from that sector.
- The Bill places significant emphasis on monitoring and assessment by requiring EPA to report to Congress periodically on environmental progress and to take further regulatory action if reductions are insufficient to achieve environmental objectives. This emphasis on assessment and evaluation is consistent with the Agency's current plans to maintain the capabilities to monitor progress and assess recovery. The requirement to periodically report to Congress and take action as needed, although potentially resource intensive, provides an ongoing mechanism to respond to new scientific research. The Bill also recognizes, as does the Agency, areas of needed research particularly to address uncertainties associated with nitrogen deposition on sensitive watersheds and coastal waters.

In addition, the Bill places importance on addressing mercury. Recent information on mercury emissions warrants further attention. Electric power plants, and specifically coal-fired powerplants are the largest source category of mercury emissions in the U.S., accounting for fully one-third of all man made mercury emissions in this country, and they are uncontrolled. EPA is currently working to obtain further data on mercury emissions from electric utility sources and additional information on cost-effective control technologies.

Overall, while the direction of the Bill is consistent with EPA's views, the timing of the provisions in the Bill may not be consistent with that of EPA. For example, the reduction of the SO_2 allowance cap in the Bill is to occur in 2003. This timeframe may be disruptive to the allowance market and industry planning for compliance, leading to higher compliance costs. Additionally, since such a reduction could affect achievement of the broader range of human health as well as ecological benefits, the timing of such reductions should be considered in the context of the National Ambient Air Quality Standard (NAAQS) review for particulates and the efforts to address regional haze. The Agency anticipates completion of national particulate monitoring networks by 2000, completion of another 5-year scientific review of the NAAQS by 2002, nonattainment designations completed between 2002 to 2005 and implementation plans due between 2005 and 2008. However, it is certainly conceivable that a broad emission reduction approach using market-based mechanisms could be utilized to achieve cost-effective reductions. Another timing issue is the Bill's phasing in of NOx emissions reduction in 2000 and 2003. Since the Bill was first introduced in 1997, the Agency has proposed and finalized NOx emissions reductions under the NOx SIP Call and resolved litigation allowing NOx reductions under the Acid Rain Program to proceed on schedule by the year 2000. Therefore, the Bill's first phase of NOx emission reductions may no longer be necessary. Furthermore, analysis of costs and benefits would be necessary to better understand the impacts of the Bill before the Administration can take a position.

Integrating Pollution Control Strategies

The electric utility industry and EPA continue to discuss current and upcoming air pollution control decisions and how they might best be coordinated to achieve environmental goals at the lowest possible cost. The EPA recognizes the appropriateness of engaging in long? term integrated planning and the need to explore the use of market-based approaches such as that being used for the Acid Rain Program. The regulated community has also acknowledged that the mechanism employed by the Acid Rain Program works well. Congress has been kept informed through periodic congressional hearings in 1993,1994 and 1996, as well as with reports by the General Accounting Office in 1994 and 1996, on the progress and costs of the Acid Rain Program. The pressing policy question is how to best respond to continued and evolving concerns for the multiple health and environmental effects of SO_2 NOx, mercury and other pollutants resulting from combustion of fossil fuels. It is our understanding that this Subcommittee is planning on holding hearings in the next Congress regarding Clean Air Act reauthorization. Should the Committee hold such hearings, we believe that bills, such as S. 1097, which address regional, multi-state air pollution issues ought to be considered in those discussions.

Thank you for the opportunity to appear here today to discuss S. 1097 and our experiences implementing acid deposition control under the Clean Air Act. I would be happy to respond to any questions you may have.

RESPONSES OF BRIAN MCLEAN TO ADDITIONAL QUESTIONS FROM SENATOR MOYNIHAN

Question 1. This bill calls for an allowance reduction for SO_2 beginning in 2003. When would the full effect of this reduction be seen?

Response. Most likely, emissions levels would decline gradually with the full additional 50 percent reduction in SO_2 occurring sometime between 2010 and 2015 due to allowances "banked" by sources that over-controlled prior to 2003.

Question 2. In your testimony, you noted that S. 1097 would impact the existing SO_2 market. With adequate lead time, could these impacts on the market be mitigated?

Response. Yes, the impact on the SO_2 market could be reduced by providing industry with an advance indication of the future allowance availability level. Sending an early signal would enable sources to plan ahead for their future compliance strategy and permit allowance prices to adjust to this new information.

Question 3. What costs are incurred by States in implementing the existing SO_2 Allowance Program?

Response. Since the Allowance Program is federally implemented, States have spent very few resources implementing the Program. EPA has provided adequate resources to the States through section 105 Grants to cover establishment of the permitting programs and emission monitoring systems.

Question 4. What have overall program costs of the acid rain program been, and how do these costs compare to the costs projected in 1990?

Response. There have been several cost estimates of the SO_2 trading program since 1990. Following is a description of how these estimates have changed over time. All of these estimates have been converted to 1990 dollars (based on a GDP deflator) for easy comparison. In addition, unless noted otherwise, all of these estimates represent scenarios of full and efficient emissions trading. Finally, all of these estimates are for annualized cost of the program in the year that the 8.95 million ton cap on SO_2 is projected to be achieved (i.e., either 2009 or 2010).

EPA Study: In 1990, EPA estimated the cost of complying with the SO_2 emissions reduction through a market trading approach at approximately $4.6 billion per year by 2010. EPA's 1990 study also included a lower cost estimate ($1.4 billion in 1990$) based on assumptions of low energy use. However, this number was deemed so improbable that it was not used in Congressional testimony, press releases, or the public debate.

In 1994, the cost was re-evaluated by the General Accounting Office and estimated to be $ 1.9 billion by 2009 (see General Accounting Of rice, "Allowance Trading Offers an Opportunity to Reduce Emissions at Less Cost", 1994, page 74, Table I.1). GAO also estimated that if there was only trading within companies instead of between companies, costs for 2009 would equal $2.8 billion in 2009.

Most recently, researchers at Resources for the Future conducted two studies using two different methodologies to project the costs of the SO_2 trading program. A 1997 study used an engineering cost model developed by Argonne National Laboratory to project a point estimate of annualized costs in 2010 of $0.8 billion (see, Burtraw et. al., "Costs and Benefits of Reducing Air Pollutants Related to Acid Rain", Contemporary Economic Policy, Vol. XVI, October 1998.) A 1998 study used an econometric model to project a "best estimate" of annualized compliance costs for 2010 of $0.87 billion per year (see Carlson et. al., "Sulfur Dioxide Control by Electric Utilities: What are the Gains from Trade?", RFF Discussion Paper 98–44, July 1998.).

There are several reasons that estimates of the total costs of Title IV have been revised downward. First, railroad deregulation has opened up Western coals to the mid-Western electric utility market and has led to a collapse of the premium paid for low sulfur coal. The flexible structure of Title IV allowed these cost savings to be realized. Second, some of the cost savings associated with more recent analyses can be linked to reductions in scrubber costs by almost 50 percent since 1989. There is also evidence that competition between different compliance options and the integration of the allowance and fuels markets may have a downward impact on compliance costs.

Question 5. What collateral benefits would the additional SO_2 and NOx reductions called for in S. 1097 have on human health? On regional visibility?

Response. Human health and visibility benefits of additional SO_2 and NOx reductions called for in S. 1097 would be substantial, particularly since these emission reductions are expected to result in significant reductions of fine inhalable particulates (see EPA, 1997 Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule) EPA has not yet estimated benefits of the bill explicitly, however. Based on EPA's Acid Deposition Standard Feasibility Study Report to Congress, 1995, additional SO_2 and NOx reductions would also provide further benefits to ecosystems e.g., lakes and streams suffering from acidification, coastal ecosystems affected by eutrophication, forests, as well as monuments and structures which can weaken and degrade in the presence of acidic deposition.

Question 6. Does S. 1097 adequately deal with industrial boilers? In what ways could this aspect of the bill be strengthened ?

Response. The bill includes a provision to monitor emissions of industrial boilers with a capacity of 100 mmBtu/hour or greater. Monitoring will provide needed information about the magnitude of emissions from this source category. In general, EPA believes that it is already cost effective and feasible to monitor and control NOx emissions from industrial boilers with a heat capacity of 250 mmBtu/hr. EPA's recent NOx SIP call calculated State-wide summertime NOx emissions budgets which assumed a 60 percent reduction in emissions from industrial boilers with a heat capacity of 250 mmBtu/hour or greater. States may control this source category as part of their NOx budget strategy.

Question 7. If enacted, would S. 1097 add costs to utilities in the East beyond the costs these utilities are likely to incur under the recently released NOx SIP Call Final Rule?

Response. EPA has not analyzed costs of the bill thoroughly, however, in general, this bill would result in NOx controls on utilities in the East to be used for 12 months rather than 5 months under the SIP call. Extending the NOx control period

to 12 months might raise costs by between 10—30 percent in the East. A very rough calculation estimates that costs for annual NOx controls nationwide would be about double the costs estimated for controlling similar sources at levels specified by the recent SIP call, which covered summertime emissions (May through September) for 22 Eastern States. (Total SIP call costs were estimated at $1.7 billion, $1.4 for utility NOx controls.)

Nationwide total annual costs of the additional SO_2 reductions in the Moynihan bill may be around $2.6 billion dollars, based on EPA's Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule, page 6–30, costs for National PM2. 5 Strategy (EPA, 1997). Costs for the additional SO_2 reductions in the East have not been calculated separately. Monitoring of mercury emissions would also result in additional costs for utilities.

Question 8. What are the primary conclusions of the Scientific American article, "Atmospheric Dust and Acid Rain," (December 1996) mentioned during the hearing?

Response. Lars O. Hedin and Gene E. Likens, authors of "Atmospheric Dust and Acid Rain" (Scientific American. Dec., 1996), examined the phenomenon of continued environmental problems associated with acid rain despite reduced emissions of acid rain precursors. They point out that the problem is much more complex than previously thought, particularly the role that dust particles (e.g. base cations such as calcium, magnesium, etc.) play in neutralizing acidic pollutants. Sources of dust particles include industrial emissions, agricultural processes, construction, traffic on unpaved roads, forest fires, and erosion of and soils from wind. Dust particles deliver nutrients to forest soils providing some level of protection from acid rain. According to Hedin and Likens, the atmosphere is a much more important source of particles for soils than was previously thought.

Since 1965, atmospheric dust has dropped substantially. Although these particles can help forest soils resist the affects of acid rain, they are also known to cause adverse human health effects, degrade visibility and cause other environmental problems. Recognizing that any deliberate increases in these particulates would set back progress in air pollution control by decades, Hedin and Likens suggest "reducing emissions of acidic pollutants to levels that can be buffered by natural quantities of basic compounds in the atmosphere." EPA has continued to reduce sulfur dioxide and nitrogen oxides through the Acid Rain Program. The authors suggested path would require continued and perhaps even greater reductions in sulfur dioxide and nitrogen oxides beyond those prescribed in the 1990 Clean Air Act Amendments.

RESPONSES OF BRIAN MCLEAN TO ADDITIONAL QUESTIONS FROM SENATOR SESSIONS

Question 1. What standards for mobile and stationary sources have states in the North East imposed to meet state and Federal air emissions limits?

Response. The attached list which was put together by the State and Territorial Air Pollution Program Administrators (STAPPA) and Association of Local Air Pollution Control Of finials (ALAPCO) has been used by the states of the Northeast and the rest of the country in developing their strategies for achieving the 1-hour ozone standard. The states in the Northeast have regulated many of the sources listed on these tables with different states using different size cutoffs depending on the severity of their ozone problem. In 1994, 12 of the Northeast states located in the Ozone Transport Region adopted a NOx budget program to control NOx emissions from large combustion sources to be implemented in phases, the final phase in 2003 resulting in reduction levels similar to those in the NOx transport SIP call for such sources. In addition, the states are moving forward as necessary to adopt additional local measures to address their local contribution to their ozone problem.

With respect to controls on mobile sources, as you may know, states to a large extent are preempted by the Clean Air Act from establishing emission standards on new vehicles and engines. Because of the nature of vehicles, these emission requirements are set nationally by EPA. Northeast states, however, have taken actions within their authority to control mobile source emissions. Many nonattainment areas in the Northeast have opted to join the reformulated gasoline program to get the benefits of that cleaner burning fuel. Also, some Northeast states have improved their vehicle emission inspection programs and other states are moving ahead with similar enhancements. Finally, as a result of Northeast state action to consider adoption of California's Low Emission Vehicle (LEV) program, EPA was able to get agreement from auto companies to participate in the National Low Emission Vehicle (NLEV) program. This program will result in the sale of new cars meeting more stringent tailpipe standards in the Northeast states beginning with the 1999 model year and the rest of the country in 2001 .

Question 2. What standards has California imposed for mobile and stationary sources to meet state and Federal air emissions limits?

Response. The STAPPA/ALAPCO list is a good indicator of the types of industries and rules that have been imposed by California to achieve the 1-hour ozone standard. Generally, California has regulated much smaller sources than the other states.

The Clean Air Act allows California, because of its severe air pollution problems, to establish its own motor vehicle and fuels control programs. Other states are preempted from such actions, although the law does permit other states the option of adopting programs identical to California's. California is often a leader in adopting more stringent mobile source controls, such as the second phase of their Low Emission Vehicle (LEV2) program just recently adopted by the California Air Resources Board.

Question 3. Which would be most effective in improving air quality for the North East, adopting local standards similar to those in effect in California or reducing background levels?

Response. A combination of reducing background (transported) levels of ozone and placing local controls on ozone precursor emissions will likely be needed to bring the North East into attainment of the ozone NAAQS. Under the Clean Air Act, each state is required to identify and implement all control measures necessary to bring its areas into attainment with the National Ambient Air Quality Standard (NAAQS) for ozone by its appropriate attainment date. In addition each state's plan must prohibit emissions from its state which contribute significantly to nonattainment in, or interfere with the maintenance by, any other state with respect to the national ambient air quality standards. Many areas in the Eastern U.S. including the North East have imposed substantial controls locally to address ozone. However, the interstate contributions to these ozone problems have not previously been addressed. It is the emissions that contribute to the interstate transport of ozone and its precursors that EPA addressed with its ozone transport rule.

The emission reductions required under EPA's ozone transport rule will reduce the upwind contributions to ozone nonattainment and will be achieved much more cost effectively than local control measures. These reductions alone will not be sufficient to meet the 1-hour ozone standard, and may not be sufficient to meet the revised 8-fur ozone standard, in all areas of the East so individual states will still be adopting additional local controls as necessary to meet these standards by their appropriate attainment date.

RESPONSES BY BRIAN MCLEAN TO ADDITIONAL QUESTIONS FROM SENATOR CHAFEE

Question 1. Mr. Tyndall and Mr. Kropp indicated that comments from States and industry regarding EPA's SIP Call were largely disregarded. Please describe the comments that EPA received from States and industry representatives during the comment period on the proposed SIP Call and explain the manner and substance of EPA's response to these comments.

Response. Summary of Major Comments from the States and Industry on Proposed NOx SIP Call Rule

Eleven Governors (from CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI and VT) sent a letter to the President expressing their strong support for EPA's efforts to reduce NOx emissions in the eastern U.S. and their position that the rule is technically and legally sound.

Environmental commissioners from six states in conjunction with executives from more than a dozen industry commenters or groups representing industry (including PSE&G, Niagara Mohawk, Consolidated Edison, Florida Power & Light, PECO, United Illuminating, US Generating Company) wrote to Administrator Browner characterizing the rule as "extremely important, both in the interests of protecting public health and in the economic interests of a wide range of businesses across the affected states".

Six Governors representing Alabama, Michigan, Ohio, Tennessee, Virginia, and West Virginia submitted an alternative to EPA's proposed ozone transport rule which included a two phased approach to utility emissions and delayed implementation of controls until 2007

Other states such as Illinois, Indiana, and Kentucky also favored some form of a 2-phase approach.

Two states, North Carolina and South Carolina, commented that they should not be included in the ozone transport rule.

A number of industry commenters including the Alliance for Constructive Air Policy supported a similar approach to the 6 Governors proposal.

A number of industry commenters such as the Utility Air regulatory Group (UARG) and Midwest Ozone Group objected to the ozone transport rule. In the end, UARG's main concerns were associated with the timing for installation of control equipment and the potential impact on electricity supplies.

Many of these same states and industry commenters raised concerns about the ability of the electric utility industry to meet the compliance schedule of the ozone transport rule without power "brown outs" or outages.

While generally supportive of the overall rule, other industry commenters including the Tennessee Valley Authority, Commonwealth Edison, Ohio Edison, Pennsylvania Power, Cleveland Electric Illuminating, and Toledo Edison preferred an allocation approach for energy sources which was output-based as opposed to EPA's input-based allocation approach.

EPA'S RESPONSE TO STATE AND INDUSTRY ISSUES AND CONCERNS RAISED BY SENATOR INHOFE

1. EPA's Rule Is Consistent With Results from State-Run Analyses

EPA has been working with the States since 1995 to develop on a solid scientific understanding of the ozone transport problem in the Eastern U.S. through the Ozone Transport Assessment Group (OTAG) and EPA's proposed rule was consistent with all of the recommendations of OTAG in their final report.

2. EPA Conducted Additional, New Analyses Specific to State and Industry Requests and Concerns

In response to state and industry concerns EPA performed several new, additional analyses including:

Extensive additional modeling and cost analyses on a range of alternative control levels including the level proposed by the Governors. Two of the alternatives even assumed lesser levels of control for the Midwest and Southeast than in the Northeast. These analyses showed that no other alternative level delivered equal or better air quality benefits at equivalent or lower costs. Analysis of the impact on electricity supplies as a result of the level of control assumed on utilities used in establishing the states budgets and the timing of those reductions. The analysis showed that full compliance was possible by May 1, 2003 without disruptions in the energy supply. Additional analysis of the cost and impact of controlling non-utility stationary sources of NOx to address concerns about the equitable distribution of the reductions and the potential impacts on small businesses.

The results of these new analyses were given full consideration in the final decisions on the transport rule and were all made available to the public.

3. EPA Changed the Rule In Response to State and Industry Concerns

Response. EPA made a number of significant changes to the rule based on the more than 700 comments received during the nearly 8-month public comment period:

To address concerns on the timing of implementing controls submitted by the six Midwest/Southeast Governors (MI, OH, TN, VA, WV, AL) as well as those from KY, IN, IL, MO, NC, SC, WI and other states and industry, EPA extended the deadline for compliance with the requirements from September 2002 to May 2003.

In response to concerns about facilities' ability to comply by the required date and the potential effects of the rule on the availability of electricity, the final rule created a pool of emission credits for each state. The final rule provides emission credits for sources that achieve their emission reductions earlier than required, and/or demonstrate they cannot meet the compliance date. This pool of credits encourages early compliance, but also provides significant flexibility by allowing these credits to be sold to sources that might not otherwise meet the deadline. This will ease any lingering concerns about the ability of utilities (or other sources) to meet the deadlines of the rule and the availability of electricity to their customers.

To address concerns about the impact of the proposed rule on small businesses expressed by IL, MI, MO, NC, NY and PA, EPA exempted over 90 percent of the smaller industrial sources thereby reducing state NOx budgets. The number of industrial sources covered under the rule dropped from 13,000 to 1,200; however, associated emission reductions were reduced by only about 50 percent.

To accommodate the state concerns, EPA made the final rule more flexible by allowing states to include all stationary NOx sources in emission trading programs provided the additional sources meet certain requirements in the ozone transport rule particularly the monitoring of emission requirements.

EPA's proposed rule asked for comments on a wide range of options for incorporating emissions "banking" into the program, including an option that would have prohibited banking. In response to comments, EPA's final rule provides sources the opportunity to bank allowances once the program begins.

As requested in many state proposals, the final rule lessened the control on large industrial boilers to 60 percent (from 70 percent in the proposed rule) and exempted many other non-electricity generating sources categories.

Support for NOx SIP Call

Following promulgation of the ozone transport rule, a number of affected states and the District of Columbia communicated their support for as well as plans to meet the NOx SIP Call rule during in national and regional meetings to discuss implementation of the rule. These include Connecticut, Delaware, District of Columbia, Illinois, Kentucky, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Rhode Island, and Tennessee. This roster of supporting states included some, like Tennessee, which initially opposed the ozone transport rule.

STATEMENT OF EDWARD KROPP, WEST VIRGINIA DIVISION OF ENVIRONMENTAL PROTECTION,

Good morning. My name is Edward Kropp and I am an Assistant Chief of the West Virginia Office of Air Quality. I appreciate the opportunity to appear before you this morning.

One of the important aspects of S. 1097, the Acid Deposition Control Act, is the continued effort to regulate emissions of nitrogen oxides (NOx), which has already been the subject of regulation in the 1990 Clean Air Act Amendments and, in addition, is an ozone precursor. West Virginia is concerned about the imposition of additional stringent controls on NOx emissions from sources in West Virginia which appear to be based upon politics and rhetoric rather than environmental science. Indeed, on September 24, 1998, EPA announced a final rule which would require 22 states and the District of Columbia to drastically reduce emissions of NOx in an effort to mitigate the long-range transport of ozone into the Northeast. West Virginia believes that neither the EPA NOx reduction rule, known as the Ozone Transport Assessment Group (OTAG) SIP Call, nor any additional NOx controls which might be imposed under S. 1097 can be economically justified when compared to the relatively insignificant environmental benefits which might result.

EPA sponsored OTAG, which was a stakeholder process taking place between approximately May 1995 and June 1997. The OTAG process included scientific modeling to test a hypothesis that long range (on the order of 600 or so miles) transport of ozone was occurring from the Midwest and Southeast to the Northeast, exacerbating non-attainment of the 1-hour ozone standard in the Northeast. A key conclusion of the OTAG process was that emission reductions yield the greatest benefit locally and that benefits decrease as distance from the controlled source increases. Further, OTAG concluded that regional NOx reductions produce regional ozone reduction benefits. Finally, OTAG modeling data (copy attached) indicates that literally shutting down all man-made sources of NOx emissions in the Midwest will not result in the Northeast attaining the old 1-hour ozone standard.

In November 1997, EPA proposed its OTAG SIP Call to reduce NOx, and requested comments on the proposed rule. West Virginia and 12 other states, all subject to the SIP Call, time and again submitted comments to EPA without ever receiving a formal response to our comments. Moreover, West Virginia and five other states jointly submitted an alternative (copy attached) to the proposed EPA rule on June 25, 1998. The alternative proposal focused on attaining the new 8-hour standard rather than mitigating transport to solve the Northeast attainment problems with the old 1-hour standard. Seven other states submitted alternate proposals which focused on attainment of the new standard as well.

Regrettably, EPA has continued to ignore the efforts of all 13 states to collaborate with EPA to attain the 8-hour standard, instead focusing on EPA's effort to reduce NOx emissions primarily from Midwest and Southeast power plants. In addition to proposing power plant NOx emission reductions of 85 percent and overall state NOx emission reductions of as much as 51 percent from 1990 levels in the case of West Virginia, EPA touts the new NOx reduction rule as being flexible because it allows sources in the Midwest and Southeast to trade emissions between sources in order to distribute the emission reduction burden. West Virginia believes that such "flexibility" must be tied to air quality science and, in the case of the EPA rule, submits that EPA has once again ignored science in order to level economic playing fields,

i.e., controlling Midwest NOx power plants to raise the cost of electricity to levels more nearly equal to those in the Northeast.

West Virginia has, on numerous occasions, attempted to provide EPA with input regarding the NOx rule and our position remains both unchanged and scientifically supported. West Virginia believes that power plant NOx reductions of 65 percent from 1990 levels will result in attainment of the new 8-hour standard in most, if not all, of West Virginia. In addition, power plant reductions in excess of 65 percent may be necessary to ameliorate any ozone transport from West Virginia occurring in the 150–200 mile range which OTAG concluded was likely to occur. The EPA OTAG SIP Call will result in the expenditure, in West Virginia alone, of approximately $1 billion in excess of the cost of 65 percent reductions while providing virtually no discernible concomitant environmental benefit in the Northeast.

West Virginia urges that EPA be required to reconsider its ill-conceived one-size-fits-all OTAG SIP Call to reduce NOx emissions and that any further Midwest and Southeast power plant NOx emission reductions which might be required as a result of S. 1097 be deleted from the ct. Thank you for your attention.

STATEMENT OF BERNARD MELEWSKI, ADIRONDACK COUNCIL

Good Morning. My name is Bernard Melewski. I am the counsel and legislative director of the Adirondack Council. I would like to thank the chairman, and the members of the committee for the opportunity to be here with you this morning and to provide testimony on Senate Bill 1097, the Acid Deposition Control Act.

I would like to begin with a brief explanation of what is the Adirondack Park, the role of the Adirondack Council in New York, and why we are particularly interested in the topic of acid rain and in this legislation.

The Adirondack Park is the largest park of any kind in the contiguous United States. It is nearly three times the size of Yellowstone National Park and covers one fifth of the State of New York making it equal in size to the State of Vermont. The Adirondack Park is roughly six-million acres of public and private land containing the largest assemblage of Old Growth forest east of the Mississippi River. The Adirondacks include the headwaters of five major drainage basins. Lake Champlain and the Hudson, St. Lawrence, Mohawk and Black rivers all draw water from the Adirondack Park. Within the Park are More than 2,800 lakes and ponds, and more than 1,500 miles of rivers fed by an estimated 30,000 miles of brooks and streams. The Park contains 46 mountain peaks more than 4,000 feet tall. Forty-five percent of the Park is publicly owned Forest Preserve protected as "Forever Wild" by the New York State Constitution since 1895. One million acres of these public lands are classified as Wilderness.

The Adirondack Council was founded in 1975, it is a private, not-for-profit organization dedicated to enhancing the natural and human communities of the Park through research, education, advocacy and legal action.

The Council receives moral and financial support from its more than 18,000 members and from private foundations. The Council's national and regional member organizations include the Natural Resources Defense Council, The Wilderness Society, National Audubon Society, National Parks and Conservation Association, Citizens Campaign for the Environment and the Association for the Protection of the Adirondacks.

Our interest in the problem of acid rain is long held. We were active contributors to the dialog on acid rain in New York State in the early years of the 1980's, and helped craft the first acid rain law in the country which was adopted in 1984. The New York law identified both sulfur dioxide and nitrogen oxide as precursors to acid rain, sought limits on total emissions from utilities sited within the state and even proposed an innovative trading mechanism that Congress would adopt nationwide in the Clean Air Act Amendments of 1990.

The Adirondack Council was also an active participant in the national debate that led to the adoption of the acid rain program in the clean air act amendments 8 years ago. Our publication, "Beside the Stilled Waters," which was produced and distributed in cooperation with our member organizations, brought the problem of acid rain to the attention of the Nation and to Congress.

We are here today because acid rain remains a continuing national tragedy. We ask that you now finish the job that was begun 8 years ago.

We remember well that day when a deputy administrator for the Environmental Protection Agency grandly pronounced in a press release that the new regulations implementing the new Clean Air Act Amendments would mean "the end to acid rain in the Adirondacks."

Certainly that was the intention of the Senate and the House. But wisely, Congress ordered a series of reports that would advise you of the success or failures of the goals of the acid rain program.

And the acid rain program as adopted was not without controversy. Congress adopted an innovative "cap and trade" program, modeled after the New York legislation, which would abandon the so-called "command and control" approach to regulation, in favor of a free wheeling pollution allowance trading program that would provide utilities with the flexibility to make compliance strategies part of their long-term business planning. The Adirondack Council, among others raised concern that the cap on total emissions might not be low enough to protect sensitive areas. Others debated both the need for and the cost of the program.

The wisdom of requiring these reports at that time is now apparent.

The first report was due in 1993, from the Environmental Protection Agency (ordered under sec. 404, Title IV appendix B of the 1990 CAAA) and was entitled the Acid Deposition Standard Feasibility Study Report to Congress. The report, dated October, 1995, was finally released in 1996 under the threat of litigation from the Adirondack Council and the State of New York. The report concluded that the pollution reductions accompanying the 1990 Clean Air Act Amendments would not be sufficient to allow recovery of certain sensitive ecosystems and that some would continue to get worse. The report was particularly compelling for New Yorkers because it revealed that despite the reductions expected from the 1990 Amendments the loss of near fifty percent of its lakes and acidification of most streams in the Adirondack Park could be expected.

The second of two reports to Congress, the report of the National Acid Precipitation Assessment Program (NAPAP) was submitted to Congress as you left for the August recess (ordered under Sec. 901J of the 1990 CAAA). It was due in 1996 and it too was released under pressure from Senators Moynihan and D'Amato and the threat of litigation from the State of New York. In short summary, it confirms and substantially elaborates upon the findings of the earlier report to Congress submitted in 1996 from the EPA.

The NAPAP report also confirms that acid rain is not just an Adirondack problem.

The damage that sulfur and nitrogen pollution causes is far from a regional issue. It is an issue of national, even international importance. Excess nitrogen in waters and in soils—"nitrogen saturation"—can be found in the North East and in West Virginia's Allegheny Mountains, Tennessee's Great Smoky Mountains, Colorado's Front Range of the Rockies and even as far west as the San Bernardino and San Gabriel Mountains. High levels of nitrogen deposition are causing nitrate to leach into stream water from these watersheds. This nitrate leaching acidifies streams and strips base cations from soils. In snow covered areas the flush of nitric acid stored in the snowpack is the leading cause of "acid pulses" which are responsible for fish kills during spring thaws.

NAPAP found that high elevation areas in the Northeast and the Appalachians are bathed in acidic cloud water for extended periods of time. Sulfuric acid from sulfur dioxide emissions is the significant cause of the widespread spruce die back in these areas. The mechanism for the die back is the leaching of calcium from the spruce needles by the acidic fog which makes the trees susceptible to frost and winter injury.

The coastal estuaries of the entire east coast suffer from airborne inputs of nitrogen that can make up nearly 40 percent of the total nitrogen loaded into their systems. From the Long Island Sound to the Chesapeake Bay to Tampa Bay in Florida, nitrogen-based pollution is overloading the water with nutrients. This causes "eutrophication,"an overabundance of algae. These blooms are associated with fin fish kills, shellfish kills and human illness. When algae dies and decays, it depletes the water of precious oxygen needed by all aquatic animals. This condition is known as hypoxia.

Perhaps even more alarming was NAPAP's finding that areas of North America that are not seeing damage now are likely to in the future due to an effect known as soil acidification. Over the long term, acidic deposition is slowly leaching away key soil nutrients like calcium and magnesium (known as base cations) that are essential for plant growth. This nutrient depletion is occurring in high and mid elevation forests in New England, New York and the Southern Appalachians. Fifty 9 percent of the commercial pine forest soil in all of the South East has low enough reserves of these chemicals to warrant concern.

Acid deposition, whether from sulfur or from nitrogen based pollution, not only leads to base depletion, but also the release of toxic compounds from soils to living things. For example, the release of Aluminum from soils rapidly accelerates when pH drops below 5. The release of aluminum interferes with plant biochemistry. It is also the leading cause of fish mortality in affected lakes. In other words, it is not

the acidity directly, but the aluminum toxicity that is responsible for the damage. This effect is very wide-spread. Studies conducted in the Shenendoah National Park show that fish species richness, population density, condition, age distribution, size and survival rate were all reduced in streams no longer able to neutralize acidity. A study of streams in the Adirondacks, Catskills and Northern Appalachians in Pennsylvania showed that episodic acidification "acid pulses" had long term adverse effects on fish populations including significant fish mortality. Lake acidification, whether from sulfur or nitrogen is also implicated in the increase in mercury concentrations found in fish. Acidity leads to greater conversion of mercury from its less toxic elemental form to methyl mercury, which is much more toxic. Fish consumption warnings due to mercury contamination are common in many states and are on the rise.

All of this disturbing information has been exhaustively peer reviewed and verified by the May 1998 National Acid Precipitation Assessment Program Biennial Report to Congress.

Other studies have found similar results:

Environment Canada, in its 1997 report "Toward a National Acid Rain Strategy", said that reducing sulfur emissions significantly beyond the current Clean Air Act requirements in both countries would be needed for all of eastern Canada to be protected from acid rain. In southern Canada an area the size of France and Britain combined receives harmful levels of acid deposition. As many as 95,000 lakes in the region will remain damaged.

A study recently released by Trout Unlimited that was conducted by the University of Virginia. The study found that without deep additional deposition reductions up to 35 percent of Virginia trout streams would become "chronically acidic" and would no longer support trout populations. The study further estimated that thousands of trout stream miles in the Southern Appalachians may be lost to acidification.

We believe that a fair reading of the two reports to Congress lead to two very clear conclusions:

First, that the mechanism of a national cap in emissions coupled with the pollution allowance trading program has been an outstanding success. All facilities are in compliance and there is every reason to believe that the target cap will be reached. The Administrative and implementation costs of the program are less than a traditional regulatory approach. Furthermore, the actual cost of the program is substantially less than projected at the time of adoption.

Second, that despite the success of the regulatory scheme, the overall cap in emissions is too high to accomplish one of the primary goals of Congress, which was to protect sensitive resource areas from the harmful effects of acid rain.

Senate bill 1097, is the best proposal we have seen to address the shortcomings of the acid rain program without doing harm to the positive accomplishments of the current program.

The proposed Acid Deposition Control Act would essentially accomplish three things:

First, it would build on the successful sulfur dioxide cap-and-trade program by creating a third phase of reductions further along the current time line. All of the advantages of the current program are preserved. It is predictable, flexible, and cost-effective. The legislation would reduce sulfur-dioxide emissions by an additional 50 percent.

Second, it would create a new cap-and-trade program for nitrogen-oxide emissions from utility smokestacks that mirrors the successful program already in place for sulfur. The role of nitrogen deposition both in high elevation waters and forests and in our coastal estuaries is much better understood and accepted by the scientific community. The proposed cap and trade program would reduce nitrogen emissions from utilities nationwide by approximately 70 percent of 1990 levels, resulting in a substantial and beneficial cut that is also reasonably achievable. Similar in structure to the existing sulfur program, the cuts would be phased in by two stages.

We fully expect that utility executives will audibly grumble about the stringency of the proposal and its cost. But we fully expect that the additional reductions can be accomplished within the costs that were projected when Title IV was passed.

It is also important to address the subject of the new air regulations issued just a week ago by the USEPA.

It is a fair question to ask whether the nitrogen program proposed in Acid Deposition Act is necessary in light of the adoption of these new Federal regulations. We think the answer is quite definitely yes. USEPA has proposed a twenty-two state voluntary utility cap and trade program for nitrogen emissions as the preferred response for state compliance with its new ozone program.

The EPA ozone proposal, which is only summer seasonal, will not address in any significant way, the acid rain problem. The issue is the total loading of nitrogen to sensitive areas. For high elevation areas the main concern stems from the buildup of nitrogen in the snow pack and the subsequent "acidic pulse" to aquatic systems in the spring of the year. Year-round controls will be necessary to address the nitrogen problem. Furthermore, only nationwide reductions will address the problems outside of the twenty-two state region covered by EPA's plan.

The proposed Acid Deposition Control Act, will be a more effective and efficient way to accomplish both the public health goals of the ozone rules and the atmospheric loading of nitrogen to our sensitive ecological resources.

Not only would the nitrogen program of the legislation under discussion today accomplish the same goals of the USEPA regulations, but will insure uniformity and an expanded market which will be more efficient and cost effective. The legislation will also level the competitive playing field for the utility industry. The Congressional Budget Office (Factors Affecting the Relative Success of EPA's Nox Cap-and-trade Program, June 1998), identified similar benefits to providing additional statutory authority in a report on the proposed rules this summer.

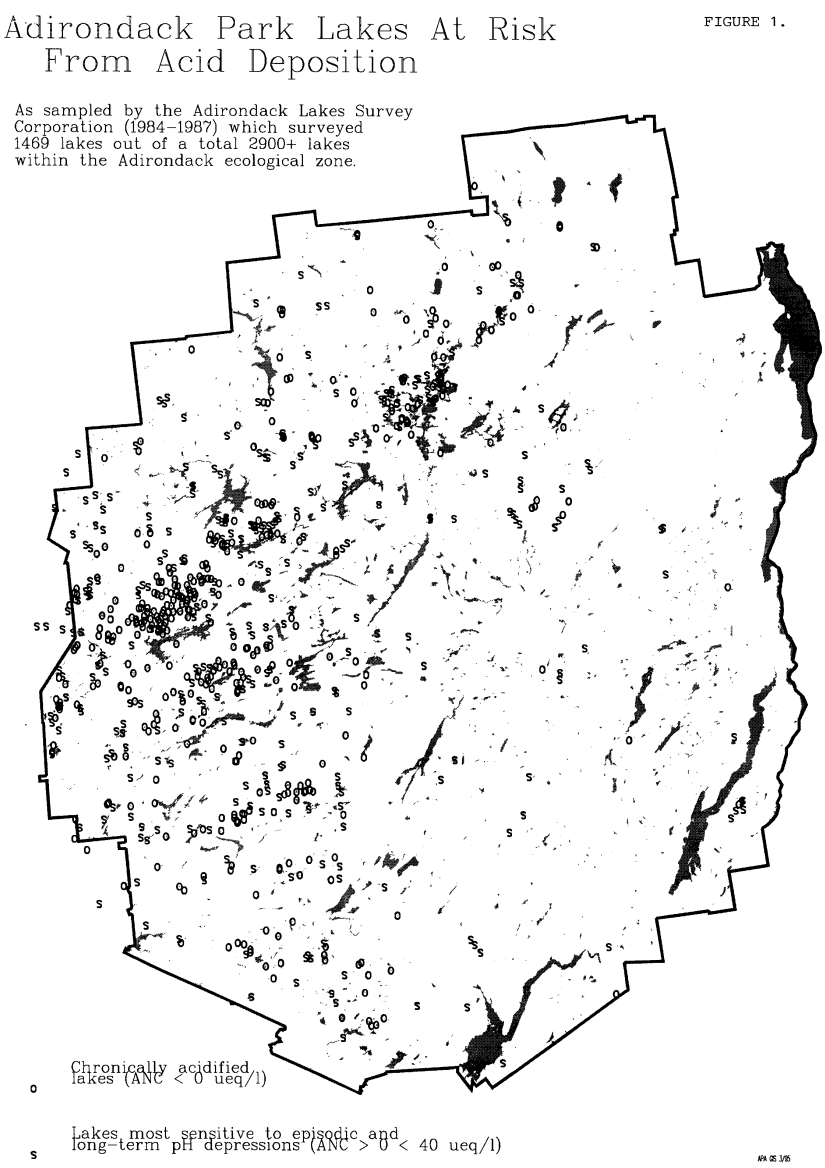
Third, the Acid Deposition Control Act would provide additional resources to the monitoring and research networks that on a shoe-string budget have provided the nation's research scientists with invaluable data on the actual state of affairs on the ground and in the air. The level of scientific certainty and confidence on acid rain has improved substantially since 1990 because we now have the ability know what goes up the stack coupled with an accurate monitoring of our air and water resources. The Acid Deposition Control Act would continue to improve our monitoring and therefor our ability to assess the success of these programs.

As advocates for the preservation of the wild character of one of the nation's greatest parks, imagine our dismay in reading the reports from USEPA and NAPAP on the future of the Adirondacks.It is small wonder then that more than 150,000 New Yorkers have signed petitions urging more action on acid rain in the past year, collected by the Citizens Campaign for the Environment, our member organization.

The need for additional action on acid rain is not just a New York perspective. In May of this year the Conference of New England Governors and Eastern Canadian Premiers recommended additional reductions in utility emissions of SO_2 and NOx nearly identical to those called for in S. 1097. The problems these pollutants bring are felt from the Chesapeake to Tampa Bay, and in the Rockies, Sierra Nevada and Appalachian Mountains. The Acid Deposition Control Act will improve the environment and public health to the benefit of virtually every American.

Mr. Chairman, the scientific uncertainty that existed in the early 1990's has been removed. The basis for strong action could not be better articulated than in the significant findings of these reports which we believe wholly support the actions and elements of S. 1097. We urge the Committee to move this bill to the floor for consideration by the full Senate at the earliest opportunity. Thank you again.

FIGURE 1.



RESPONSES BY BERNARD MELEWSKI TO ADDITIONAL QUESTIONS FROM SENATOR MOYNIHAN

Question 1. What human health effects result from acidification of aquatic systems in New England?

Response. There is extensive literature regarding large negative human health effects from the pollutants that cause acid rain in their airborne forms: sulfate aerosols and ozone. However your question is directed at human health effects related only to the acidification of aquatic systems. Acidified water bodies generally have higher levels of Mercury in them than non-acidified waters. This is due to higher

levels of mercury deposition and the leaching of mercury from watersheds by acidity. Also, the acidity may speed the process that changes inorganic mercury to its more toxic organic form. The Mercury Study: a Framework for Action conducted by Northeast States for Coordinated Air Use Management (NESCAUM) and others noted that 39 of the lower 48 states had fish consumption advisories for mercury. Mercury is a toxic heavy metal associated with damaging effects on the neurological development of mammals and birds. The study noted that available science indicates that the adverse health effects associated with exposure to mercury may not be reversible. Many of the combustion sources that emit acid rain precursors also emit mercury.A study conducted by H. Simonin, et. al. titled, "Mercury in Yellow Perch from Adirondack Drainage Lakes" found that the pH of the lake in which perch lived was the best predictor of the amount of mercury in the lake's fish. In other words, fish from acidified lakes have more mercury (and are more dangerous to eat) in them than fish from healthy lakes.

National Acid Precipitation Assessment Program (NAPAP) study State of Science and Technology report #23: Indirect Health Effects Associated with Acidic Precipitation discussed lead exposure. Acidic surface water used as drinking water can leach lead out of the fittings and solder that make up normal household plumbing systems. The report found that this added lead exposure could cause young children and pregnant women to be at increased risk of the adverse health effects associated with lead exposure.

Question 2. Are there economic impacts due to acid deposition in the Northeast? If the economic impacts are difficult to quantify, please discuss the effects qualitatively.

Response. The 1998 NAPAP report discussed a wide variety of negative impacts caused by acid deposition. In many cases, the actual economic cost of these impacts can be difficult to quantify. Where economic analysis would be possible in some cases, little research has been done.'It is nonetheless safe to say that there are very significant economic impacts of acid deposition.

It is worth noting that NAPAP/98 found that the costs of implementing the existing acid rain program were far outweighed by the benefits to human health alone. A brief list of the negative effects of acid rain and its precursor chemicals would include damage to commercial farms and forests, recreational fisheries, visibility, and cultural and material resources. NAPAP found that roughly 900,000 properties of historic value were at risk for damage by acid deposition, not including as many as 30 million grave markers. Structures made out of limestone and marble are particularly sensitive to erosion caused by acid deposition.

The negative economic effects of this damage to the tourism, agriculture and forestry industries are potentially quite large.

STATEMENT OF WILLIAM F. TYNDALL, VICE PRESIDENT, ENVIRONMENTAL SERVICES, CINERGY CORP.

Mr. Chairman and members of the Committee, my name is William F. Tyndall. I am Vice President of Environmental Services for Cinergy Corp. I am pleased to be here today to present testimony on behalf of Cinergy on a subject that this company probably knows too much about—acid rain legislation and sulfur dioxide (SO_2) controls. As of one of the very first utilities to embrace the concept of strict SO_2 controls as part of the 1990 Clean Air Act Amendments—which this committee was instrumental in getting enacted—Cinergy is in a unique position to comment on S. 1097. To summarize our views, while we are committed to addressing the environmental consequences of our generating stations, we believe it is premature to adopt any new reduction programs until the existing Acid Rain provisions of the Clean Air Act Amendments of 1990 and the new regulatory requirements spawned by EPA's recent decisions on the National Ambient Air Quality Standards (NAAQS) and the rule relating to transport of nitrogen oxides (NOx) are given a chance to work.

Cinergy Corp. and its operating utility subsidiaries (Cinergy) own and operate fossil fired and hydroelectric generating facilities in Indiana, Kentucky and Ohio. Cinergy was created in 1994 through the merger of The Cincinnati Gas & Electric Company and PSI Energy, Inc. The Cinergy companies serve over 1.4 million customers with natural gas, electricity, or both in those three states.

The Power of Coal

Cinergy is one of the nation's largest coal-burning utilities. There are those in the environmental community and in government that see coal as a four letter word. They would have us abandon this valuable natural and economic resource. Coal is an important fuel source for electric generation, accounting for 57 percent of all

power produced in the United States. Coal will continue to be a large part of our national energy strategy. Cinergy knows that coal can be used in an environmentally responsible fashion. In its operations, Cinergy accepts this obligation for ensuring protection of the environment. However, by endorsing the 1990 Clean Air Act Amendments, PSI Energy, Inc., a Cinergy subsidiary, helped signal a then new way of thinking—that command-and-control environmentalism was doomed to a future of market-based solutions that actually provide incentives for companies to reduce their emissions.

Cinergy's View

Cinergy remains committed to promoting cost-effective and innovative ways to attain cleaner air. This is particularly important as the industry moves toward competitive marketplaces that will add even more pressure to keep customer costs as low as possible. Cinergy believes it is paramount that industry, government, the environmental community and other parties work together to find common sense solutions to environmental concerns. We believe that success in business and environmental excellence can and must go hand in hand. As an example of its commitment to the environment, on the first day of business as a merged company, Cinergy's Board of Directors adopted an Environmental Pledge to govern corporate actions.

Cinergy Steps Forward

In September 1997, Cinergy was the first Midwestern utility to voluntarily commit to additional reductions of nitrogen oxides (NOx) to support attainment of the existing clean air standards and to address the issue of NOx transport. At that time we also stated our support for market based solutions and for emissions trading. We also announced a voluntary demonstration project for the first application of Selective Non-Catalytic Reduction technology (SNCR) on Midwestern fuel at our Miami Fort Station near Cincinnati, Ohio. We realized that future emissions reductions were going to heavily depend upon technologies that were new and largely unproven on boilers of the size and configuration that we operate, or that use our fuel types. This demonstration began in June of this year and has so far been successful in reducing NOx emissions by 30 percent.

The Clean Air Act Is Working

There has been tremendous success in cleaning the nation's air. The work accomplished under the original Clean Air Act and its subsequent amendments has been a major contribution to this improvement. Lest we forget how far we have come in this effort, consider the following facts as presented in EPA's "Summary of National Emissions Trends, 1900–1996": [1]

- Total SO_2 emissions for 1995 and 1996 were lower than in 1940 (18,552,000 and 19,113,000 vs.19,952,000 tons respectively)
- Total VOC emissions for 1995 and 1996 were less than in 1950 (20,586,000 and 19,086,000 vs. 20,936,000 tons respectively)
- Total NOx emissions for 1995 and 1996 were less than in 1980 (23,935,000 and 23,393,000 vs. 24,875,000 tons respectively)

In addition, I am pleased to confirm that the Greater Cincinnati Area, Cinergy's headquarters city, has met the requirements to apply for re-designation to attainment status for ozone. This success has come through cooperation between industry, government, and the people of our area. It is Cinergy's request that the Senate continue to encourage the EPA, industry and all other parties to work cooperatively and in the spirit of compromise to address pollution concerns and solve these concerns in a cost effective fashion. In this way, environmental benefits do not have to come at the expense of the economy.

This is not to say that everything is done. As the committee considers S. 1097, it is necessary to keep in mind not only where environmental programs have been, but also where they are going. We know we will get large additional reductions from utilities beginning in the next few years. Many of these programs post-date the introduction of S. 1097. Still other provisions are premature because the benefits of these further reductions are not yet realized. It is imperative that Congress understand the full impacts of all these adopted and pending measures before it legislates further.

In my remaining remarks, I will describe several of the current regulatory programs that have been, or soon will be, enacted that greatly impact utility operations. Congress established the Acid Rain Program in Title IV of the Clean Air Act Amendments (CAAA) of 1990. Its goal was to reduce acidification of lakes and streams, damage to trees, structural and architectural materials, and improve visi-

[1] Summary of National Emissions Trends, 1900–1996

bility by reducing SO_2 and NOx emissions. The amendments placed a cap on SO_2 emissions at a level 10 million tons per year below 1980 levels. In addition, NOx emissions were to be reduced 2 million tons below 1980 levels.[2] This program has already produced substantial reductions in SO_2 and NOx. In the first year alone, SO_2 emissions fell by about 5.6 million tons. NOx emissions are expected to fall 400,000 tons per year by 1999. In the year 2000, the second phase of the Title IV program takes effect, and an additional 4.6 million tons of SO_2 reductions and 1.6 million tons of NOx reductions will occur.[3]

Sulfur Dioxide

Since 1990, Cinergy has reduced its emissions of SO_2 per kWh of electricity by 42 percent and emissions of NOx per kWh by 27 percent. Cinergy further projects that it will further reduce its emissions per kWh by a total of 50 percent for SO_2 and 34 percent for NOx when the second phase of Title IV takes effect in the year 2000. To achieve these results, Cinergy has made and will continue to make significant expenditures to reduce these acid rain precursors.[4]

- Title IV NOx Phase I & II capital expenditures of about $100 million.
- Title IV SO_2 Phase I capital expenditures of about $333 million.
- Title IV additional O&M SO_2 expenditures of about $90 million for 1995 and 1996 including allowance purchases.

In addition during the construction of the W. H. Zimmer Station, Cinergy and its partners spent $350 million for environmental control equipment including precipitators, scrubbers, and low NOx burners. This station began commercial operation in 1991 and was recognized by EPA Region V for excellence in SO_2 control.

SO_2 emissions in the United States are the lowest in over 50 years as a result of these existing programs. Nationally, NOx emissions have remained fairly constant between 1980 and 1996, even with the tremendous increase in vehicular traffic, fuel combustion and other source activity. The second phase of SO_2 and NOx reductions under Title IV will begin in a little over 1 year. Additional near term reductions are expected with the new NOx SIP Call, the new NAAQS for $PM_{2.5}$, and potentially under the proposed rules for Regional Haze. It will take time for the full effect of these new efforts to be fully seen in the environment.

However, the environment is already seeing the benefits of these reductions. The first year's reductions made under Phase One of the CAAA's Title IV alone produced measurable differences in acid deposition. The U.S. Geological Survey found that when 1995 data was compared with that of 1983 through 1994, there was a 10 percent to 25 percent drop in wet deposition of sulfate concentration and acidity particularly at some sites in the Midwest, the Northeast, and Mid-Atlantic Regions. In addition, SO_2 concentrations have fallen 37 percent between 1986 and 1995 at ambient monitoring sites.[5]

NOx SIP Call

EPA has recently finalized its NOx SIP Call rule. This rule establishes limits on summer NOx emissions, and places a cap on utility NOx emissions during the summer ozone season in 22 eastern states and the District of Columbia. This utility cap is based on an extremely low mass emissions rate of 0.15 lb NOx/mmBtu of heat input. Overall, the rule is expected to reduce NOx emissions during the ozone season in all sectors from 4.2 million tons to 3 million tons per season, or a decrease of 28 percent. Utility NOx will fall from 1.5 million to 0.5 million tons per season for a 64 percent decrease. The estimated capital cost to utilities in the 22 state region is over $14 billion. Cinergy estimates its potential capital cost between now and 2003 to be between $500 and $600 million. Clearly utilities are bearing the brunt of these reductions.

The rule requires the affected jurisdictions to modify their State Implementation Plans (SIPs) to incorporate the requirements of this rule and submit the revised plans by September 30, 1999. Many of the requirements of S. 1097 are contained in the final NOx SIP Call. These provisions include, but are not limited to:

- A NOx allowance program for the 22 states and District of Columbia affected by the rule.
- State by state NOx allowance allocations, and a suggested an allowance distribution scheme within the states.
- An allowance banking and tracking system and a NOx allowance transfer system(model trading rule) for the states to adopt at their discretion.

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[2] Source www.epa.gov/acidrain/noxts3.html
[3] Source www.epa.gov/acidrain/overview.html
[4] Cinergy internal estimates.
[5] EPA Brochure on National Air Quality: Status and Trends, 1996.

- A recommendation for states to establish "new source set-asides" for new sources.
- A proposed Federal Implementation Plan (PIP) in the event a state fails to submit an acceptable plan containing the requirements established in the SIP Rule.

NOx and volatile organic compounds (VOCs) are the two precursors that form ground level ozone. The most effective approach to resolving ozone concerns is a mixture of NOx and VOC controls. The appropriate mix of these controls varies by region. In the Greater Cincinnati area for example, it has been shown that VOC controls are more effective for attaining the existing 1 hour ozone standard. The Ozone Transport Assessment Group (OTAG) showed that the impacts of air pollutants carried by air currents decrease exponentially with distance from the source of release. In addition, power plants currently produce only 29 percent of all NOx emissions. The transportation sector produces 49 percent, with the balance of 22 percent being produced by all other industrial and fuel combustion sources. In addition, power plants produce negligible amounts of VOCs. Individual conditions are very site specific. Therefore Cinergy believes that a local and sub-regional approach to controlling ground level ozone is most effective, as opposed to the one size fits all approach embodied in the NOx SIP Call.[6]

Last summer, EPA revised the NAAQS for ozone, created the new $PM_{2.5}$ health standard, and proposed regional haze regulations. In doing so, it set in motion a process that will likely result in further reductions in many pollutant precursors, including SO_2 and NOx beyond those called for by Title IV and the NOx SIP Rule. Scientific research has shown that small aerosol particles generated from a wide variety of sources are significant contributors to both visibility impairment and the level of fine particulates in our air. An important portion of these particles is believed to be caused by emissions of SO_2 and NOx. Fine particulate emissions come not only from utilities but other industries and the transportation sources as well. In fact, many of these are in close proximity to urban areas. Ongoing research and monitoring efforts are designed to quantify the magnitude and source of these emissions. These particulate reductions will not only result in additional health benefits, but also will reduce acid deposition.

I should point out that as a result of the Senator Inhofe's Amendment to the transportation bill enacted last spring, Congress established a schedule for implementing the new $PM_{2.5}$ standard. Senator Inhofe's Amendment was based on the consensus view that there should be no implementation of the new standard until the necessary monitoring data was collected regarding the amount and composition of the fine particulate matter in the air. Without this data, States can not make informed decisions regarding the amount or location of emissions reductions needed to meet the new $PM_{2.5}$ standard.

In conference, the conferees extended the implementation schedule to include EPA's proposed regional haze program. In effect, Congress realized that the compounds blamed for regional haze—such as sulfur dioxide—are also the pollutants of concern for the fine particulate matter problem. Moving ahead on regional haze without the fine particulate matter monitoring program would clearly be imprudent.

The same logic should apply to S. 1097. The new fine particulate matter standard, the regional haze program and the acid rain program all target sulfur dioxide. It makes no sense to implement them on separate time tables. It also makes no sense to force States to make arbitrary and untargeted cuts without the technical information that everyone—including EPA—agrees the States should have to make effective reduction strategies. It also allows individual or groups of States to balance technical and economic criteria and maintain state primacy of their duties without Federal preemption. In short, the SO_2 program as envisioned by this bill would conflict with Senator Inhofe's Amendment as ultimately included in the highway legislation.

Mercury

Late last year, EPA released the "Mercury Study Report to Congress". This report was required by section 112(n)(1)(B) of the 1990 CAAA. It is the most comprehensive study of mercury in the environment to date. While EPA pointed out areas where they think additional data is needed, and they did reach several important conclusions. EPA estimates U.S. anthropogenic mercury emissions from all sources to be about 187 tons per year. This estimate mirrors that of the Electric Power Research Institute. Utilities comprise only about one third of total emissions. In addition, total global emissions of mercury from all sources are estimated to be 5,500 tons per year, making U.S. sources only about 3 percent of the world's total. Be-

[6] The Chesapeake Bay and the Control of NOx Emissions: A Policy Analysis, August 1998, Discussion Paper 98–46, Resources for the Future, Alan Krupnick.

cause of the global nature of mercury transport, it is not clear that reductions in domestic mercury emissions will produce demonstrable reductions in exposure.

Despite the close agreement in the estimates of mercury emissions, EPA has since announced a Mercury Information Collection Request (ICR) that currently proposes to require utilities to provide specific data on coal characteristics from each generating station. Cinergy anticipates that this ICR will not appreciably improve the currently available data. EPA is also considering lowering the threshold reporting limits for mercury under the Toxic Release Inventory program.[7]

In the same report, EPA describes its review of available control methods for mercury. EPA states, "Although a number of mercury control technologies are being evaluated for utility boilers, most are still in the research stages, making it cliff cult to predict final cost effectiveness as well as the time to scale-up and commercialize the technologies. Because the chemical species of mercury emitted from boilers varies from plant to plant, there is no single technology that removes all forms of mercury." The report goes on to state that although estimates have wide variability and costs will be in the billions of dollars per year, more research is needed before technologies can be applied.[8]

EPA concludes that the average citizen is not at risk from mercury exposure. Only a small subset of the population is potentially impacted. The latest research indicates that the reference dose EPA uses to access risk is perhaps a factor of five too high. EPA's reference dose is based on short term, but high intensity exposures associated with a mercury poisoning incident in Iraq. Several studies from the Seychelle Islands and other locations which focus on low level exposures from fish consumption indicate that EPA's current reference dose is too conservative, even considering an appropriate safety factor.[9] For this reason there is disagreement between different Federal agencies such as the Food and Drug Administration and the Agency for Toxic Substances and Disease Registry as to what this limit should be. The White House Office of Science and Technology Policy will launch an effort to resolve this conflict starting with a workshop next month. We encourage the EPA to work to resolve these differences by adopting a reference dose that considers the new scientific data and is also in line with that of the FDA and ATSDR, so that an appropriate exposure standard that is protective of public health can be agreed upon. Therefore there should be no regulatory action on mercury emissions until the Federal Government sets final exposure limits.

Conclusion

In summary, I would like to repeat that our country is benefiting from tremendous improvements in our air quality. This has come from the hard work of industry, government, the environmental community and other stakeholders.We know the implementation of the Clean Air Act to date has already brought additional emission reductions in SO_2, NOx, and particulate matter. The benefits of these reductions are already being seen in the environment. Because of current initiatives under the existing law and ongoing regulatory actions, Cinergy sees no reason for Congress to pursue additional emission reductions at this time. As a proponent of competition in electric markets, Cinergy believes that many technological advances will be made in the coming years to make producing electricity even cleaner and more efficient. . The arbitrary addition of costly pollution control equipment at this time could actually impede such technological innovation by utilities and others. Once the implementation of the various pending environmental laws and regulations is complete, Congress should fully evaluate their effectiveness before imposing additional requirements.[10]

I would like to thank this distinguished committee for the opportunity to appear before you.

RESPONSES BY WILLIAM TYNDALL TO ADDITIONAL QUESTIONS FROM SENATOR SESSIONS

Question 1. What standard for mobile sources have the states in the Northeast imposed to meet state and federal air emissions limits?

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[7] Mercury Study Report To Congress Volume I: Executive Summary, December 1997.
[8] Mercury Study Report To Congress Volume I: Executive Summary, December 1997.
[9] Effects of Prenatal and Postnatal Methylmercury Exposure from Fish Consumption on Neurodevelopment, Davidson, Philip W., et al. Journal of the American Medical Association, August 26, 1998, p. 701.
[10] National Acid Precipitation Assessment Program Biennial Report to Congress: An Integrated Assessment, National Science and Technology Council, Committee on environment and Natural Resources, May 1998, pages 23–24.

Response. Title II of the Clean Air Act provides for EPA to set national "tail pipe" emissions standards for mobile sources. These national standards preempt State tail pipe standards, except in California, which is allowed to set more stringent standards. The Clean Air Act, however, does allow States to "opt in" to the more stringent California standards. Recently automobile manufacturers have offered to produce for sale in the Northeast (and elsewhere) automobiles meeting emissions standards equivalent to the California standards. States in the Northeast have either accepted this program or have formally opted in to the California mobile source program.

The Northeast States have made less progress in adopting the enhanced inspection and maintenance programs called for by section 182(f) of the Clean Air Act. These programs are designed to ensure that cars continue to meet tail pipe standards once they are in operation and are viewed as a potent and cost effective tool in the fight against ozone. In June 1998, Congressman Henry Waxman requested the General Accounting Office to determine the status of the enhanced Inspection and Maintenance Plans of states required to adopt such programs (including the Northeast). A copy of the GAO report (GAO/RCED–98–175) is attached to this response. For your convenience, the GAO "Results in Brief" is repeated below.

"Two of the 23 states had begun testing vehicles by the January 1, 99S deadline that EPA set for implementing enhanced inspection and maintenance programs, and 12 had begun testing vehicles as of April 1998. A number of factors have contributed to delays in implementing programs. Opposition to EPA's enhanced inspection and maintenance regulation—including the reluctance of some state legislatures to provide the legislative authority and funding needed to implement these programs—cause most of the 23 states to delay implementation. In addition, the states had difficulty in obtaining new testing equipment and software support from vendors.

The delays in implementing enhanced inspection and maintenance programs have jeopardized the states' ability to meet the deadline for attaining the national ozone standard. EPA has allowed the states to claim credit for future reductions in emissions of volatile organic compounds from their enhanced inspection and maintenance programs, provided they demonstrated that they will achieve the required reductions as soon as practical after November 1996. If states cannot demonstrate that reductions in volatile organic compounds can be obtained from the mandatory enhanced inspection and maintenance programs, they may have to look to other mobile sources as well as stationary sources to meet their goals for reducing these emissions. However, achieving further reductions from other sources will be costly and take longer than achieving the reductions from enhanced inspection and maintenance programs."

Question 2. What standards has California imposed for mobile sources to meet state and Federal emissions standards?

Response. California has more extensive regulations on mobile sources than any other state as a result of the substantial role that the transportation sector plays in contributing to violations of the national ambient air quality standards, especially in Southern California. As discussed, California is the only state in the Nation allowed to adopt their own mobile source standards.

California has continued to evaluate the benefits of additional mobile controls and strengthen tailpipe and fuel standards. Attached is a summary of transportation emission controls strategy measures included in the 1994, and updated in the 1997 California South Coast Air Quality Management Plan. To our knowledge these are the most current rules being implemented in California. The first two pages are a list of the South Coast mobile control strategies. Note that rules M1-M16 are California Air Resources Board (CARB) level controls, and the South Coast has simply added three additional controls (MON–09, MON–10, and MOF–07) to the controls prescribed in the California 1994 SIP for on-road and off-road vehicles. The next two pages are a description of the CARB level control M1-M–16, with implementation dates and reduction estimates. The final two pages contain a table taken from the South Coast 1997 AQMP which describes the Transportation Improvements and Transportation Technology Measures in more detail.

In November of this year, CARB approved tighter emissions standards for light duty trucks and passenger cars. These new standards extend California's strict low-emission vehicle standards (LEV-II) to light-duty trucks, mini-vans, and sport-utility vehicles. These new standards will cut NOx emissions 75 percent from current levels beginning with model year 2004. These standards also increase the life expectancy for tailpipe emissions control equipment from 100,000 miles to 120,000 miles. The new LEV-II also establishes for the first time a market-based system for automakers to help them reach a mandated 10 percent market share for zero-emission vehicles by 2003.

Question 3. Which would be most effective in improving air quality for the North East, adopting local standards similar to those in effect in California or reducing background levels?

Response. Over the past few years, substantial progress has been made in understanding the complex relationship between NOx and VOC emissions from local and remote sources to high levels of ozone in the Northeast.

While the focus of the Ozone Transport Assessment Group (OTAG) study was not on examining local impacts, sufficient modeling was conducted for the group to develop the following conclusions:

"Based on OTAG modeling, the Regional and Urban Scale Modeling and Air Quality Analysis Workgroups have drawn several conclusions regarding the benefits to be derived from NOx and VOC controls for all source sectors and regarding ozone transport. Regional NOx reductions are effective in producing ozone benefits: the more NOx reduced, the greater the benefit. Ozone benefits are greatest where emission reductions are made and diminish with distance. Elevated and low level NOx reductions are both effective. VOC controls are effective in reducing ozone locally and are most advantageous to urban nonattainment areas. . . ." (Emphasis added.)'

The final OTAG results clearly demonstrate that local emission reductions in the Northeast -whether from the transportation sector or from local stationary sources—are more effective in lowering ozone concentrations than emissions reductions from States upwind of the Ozone Transport Region.

During the ozone transport SIP Call comment period, many states and organizations outside the Northeast developed additional information that provided auxiliary analyses to quantify the impact of controls on distant sources versus additional local controls in the Northeast. One such example of the distinction between local versus distant source impacts is found in Figure 9 (attached) from the Alliance for Constructive Air Policy SIP Call comments. This figure shows that emissions from local elevated (utility and other tall smokestack sources) and low level (near ground level) sources comprised a majority, 45 percent and 17 percent respectively, of ozone contributions above the 1-hour standard in the metropolitan New York area. And "utility" emissions from all the distant upwind states combined only contribute 10 percent of the ozone associated with 1 hour ozone exceedances.

A similar study was conducted by the Midwest Ozone Group that also examines the benefits of local controls in the Northeast versus controls in distant upwind state. The baseline ozone concentration is significantly lowered by imposing a 0.151b/mmbtu rate only on NOx sources located entirely within the Inner Zone and the Northeast Ozone Transport Region (NEOTR). Imposing controls on sources located outside the Inner Zone of the NEOTR at increasing levels of stringency results in little or no additional air quality improvement. An additional 30 percent reduction in emissions of low level VOC and NOx from sources located entirely within the Inner Zone of the NEOTR also show significant air quality improvement. This and other studies demonstrate that the most effective way to meet the ozone standard will be to focus on additional local emission reductions.

"'Ozone Transport Assessment Group, Final Recommendation on Major Modeling/Air Quality Conclusions, Approved by the Policy Group, June 3, 1997."

Responses by William Tyndall to Additional Questions from Senator Moynihan

Question 1. In your testimony, you stated that it is premature to adopt the provisions contained in S. 1097 until the Clean Air Act Amendments of 1990, the 1995 National Ambient Air Quality Standards (NAAQS) and the recent NOx State Implementation Plan (SIP) Call have been fully implemented. How would you reconcile your position with the evidence provided by the recent National Acid Precipitation Assessment Program (NAPAP) report to Congress which indicates that the reductions of SO_2 and NOx emissions required by existing programs will not be sufficient to prevent further damages from acid deposition?

Response. NAPAP did not and could not assess the impact of any recent reductions in SO_2 and NOx levels due to continued implementation of Title IV of the Clean Air Act, let alone the reductions that will occur due to the NOx SIP call and implementation of the new National Ambient Air Quality Standards for fine particles and ozone.

For the most recent NAPAP Study (1996)', only the Phase I SO_2 controls were in place. Reductions from Phase II SO_2, Phase I NOx, and Phase II NOx were not in place and could not be measured. In fact, NAPAP's report acknowledges this:

"NAPAP recognizes with the passage of the 1990 Clean Air Act Amendments that a complete assessment of Title IV in 1996 would be premature because emissions

reductions did not occur until 1995. Further more, due to scientific uncertainties, weather variability, and the inherent slow response times of many ecosystems, a quantification of human and ecosystem responses to any changes in emissions could not be made with reasonable confidence in 1996. Hence, a limited assessment was planned for 1996, with the goal of a more comprehensive assessment in 2000.

Qualitatively, Title IV has been effective in reducing acid deposition. However the geographical distribution and the quantitative measure of the changes in total deposition resulting from emissions reductions require a longer monitoring record and further analysis. 2

At this time, we know that the substantial reductions brought by Phase I of the SO_2 program have improved sulfur concentrations in wet and dry deposition. Concentrations of sulfate in lake and stream waters have decreased in many areas. There is also evidence of recovery from acidification in New England. Although sulfate concentrations in many Adirondack Lakes have remained fairly constant, this does not signify a need to impose reductions in SO_2 emissions beyond what is required under Phase II of the Acid Rain program.

National Acid Precipitation Assessment Program Biennial Report to Congress: An Integrated Assessment pg. 96. 2 Ibid., at pg. 94

As noted, the 1996 NAPAP study was conducted after only 1 year of Phase I Acid Rain program SO_2 emissions reductions. Phase I of the program, however, includes only the largest, highest emitting sources in the country and allocated allowances based on a 2.5 lb/mmbtu emission rate. Moreover, in the years 1995 and 1996, Congress allocated an extra 3.5 million allowances as compliance extensions for sources installing scrubber technology, resulting in 3.5 millions tons of SO_2 emissions beyond what would other wise have been allowed in Phase I of the program.3 Thus, the majority of SO_2 emissions reductions resulting from the acid Rain program are anticipated to occur in Phase II, which begins in 2000, includes all coal- and oil-fired electricity generating units (except for very small units), and is based on a substantially more stringent emissions rate (1.2 lb/mmBtu) that was the basis for the Phase I limits.

Furthermore, current scientific research suggests that nitrogen oxides may be as important as SO_2 in causing acidification. EPA's recent NOx SIP Call, which will be implemented in 2003, can be expected therefore to result in significant additional benefits for the Adirondack Lakes. Again, however, further NAPAP assessments will be necessary to determine the impact of these reductions on acidification.

Finally, the Title IV acid rain program and the NOx SIP call will not be the last source of SO_2 and NOx reductions. In 1997, EPA promulgated a new fine particulate standard and a new ozone standard. According to EPA's regulatory impact analysis, these new standards will require reductions in SO_2 and NOx reductions below the levels required under the existing acid rain program. At a minimum, Congress should have a substantial understanding of the impact of these additional reductions on the acidification of the Adirondack Lakes before it considers additional acid rain legislation.

Question 2. Please comment on the cost effectiveness of the Acid Rain programs established under Title IV.

Response. The cost effectiveness of Title IV has been good as a result of the successful use of market mechanisms. The average compliance costs as quoted by EPA, EPRI, and other sources have been lower than predicted for Phase I and have ranged between $70 and $180 per ton. Phase II compliance costs are expected to be between $200 and $400 per ton.

While there were initial cost estimates that were significantly higher, they did not reflect the benefits of a fully implemented cap and trade program. In addition, when implementing the SO_2 reductions of Phase I of the Title IV, there was a dramatic unforeseen drop in the price of low sulfur coal from the Powder River Basin (PRB). This gave many utilities the unexpected option of using lower sulfur fuel. In many cases, use of PRB coal replaced the need for scrubbers. These dynamics fueled a vigorous market, and encouraged over-compliance with Phase I emission limits by some utilities in the early years of the program. As a result, the environment benefited from greater early reductions than envisioned by the CAA Amendments. However, Cinergy does not expect these same conditions to be present for NOx reductions under the SIP Call, or future SO_2 reductions beyond Phase II of Title IV, thus increasing utility compliance costs.

3 See 42 U.S.C. § 765 Id.(a)(2), (d).

Question 3. In your testimony before the subcommittee, you noted that as a result of the NOx SIP Call, many utilities would adopt approaches to emission reductions which would in fact produce emissions reductions on a year-round basis (e.g. fuel switching).

a. To what extent does Cinergy intend to adopt approaches to emission reduction which will result in year-round reductions?

Response. Cinergy will consider a combination of techniques to reduce NOx emissions, including fuel switching and co-firing, add-on controls, improvements in controls and burner operations and purchasing allowances. Fuel switching and improvements in burner technology are permanent changes to units which will therefore operate year round. In addition, any new generation that Cinergy builds will probably consist of natural gas fired combustion turbines. At this time, Cinergy has not completed its compliance planning and cannot provide any specific prediction of its reliance on these types of compliance strategies.

b. To your knowledge, which utilities have indicated they are likely to adopt approaches to emissions reduction which will result in year-round emissions?

Response. Cinergy expects that other Mid-West utilities will consider using the same mix of techniques to comply with the SIP Call. However, at this time, Cinergy is unaware of any utility that has made any final decisions regarding its compliance strategy.

c. What are the marginal costs per ton of NOx emission reduction under the NOx SIP Call? What would the marginal costs per ton be under S. 1097?

Response. S. 1097 is an annual reduction program while the NOx SIP Call is a 5-month seasonal program. The marginal costs per ton of the two programs are not directly comparable. Under the NOx SIP Call, the cost of a capital addition on a specific unit is spread over all the reductions during the 5-month season. For S. 1097 that same capital cost for a specific unit would be spread over a greater number of tons reduced during the entire year. As more fully set forth in response to question 4, S. 1097 also results in a less restrictive average emissions rate. As a result the capital costs, operation and maintenance costs, and thus the total average costs per ton, would be lower when calculated on an equivalent basis.

Question 4. As you noted in your testimony, some approaches to emission reduction (e.g., fuel switching) could result in year-round emission reductions. Please compare the capital costs required to meet the seasonal requirements of the NOx SIP Call to the capital costs required to meet the year-round emissions reduction provisions of S. 1097.

Response. S. 1097 would establish a NOx "cap and trade" program that would require additional NOx controls in all 48 contiguous states and would operate on an annual basis. The recently approved NOx SIP Call only applies to 22 Eastern States and the District of Columbia, and would be in effect only during the ozone season. S. 1097 would require more facilities to install additional NOx controls. When comparing the two programs, consider the following:

S. 1097 calls for 5,400,000 NOx allowances to be issued between 2000 and 2003. Assuming that in 1996 electric utilities emitted 6,663,000 tons, this would be an immediate reduction of about 19 percent in the total ton budget. This does not consider that total generation will increase due to economic growth.

S. 1097 would also require that emission allowances be surrendered at a 2:1 rate during the ozone season. In 1997, Cinergy emitted 44 percent of its NOx emissions during the 5 month ozone season. Assuming this were true for all utilities, requiring this 2:1 offset would result in an additional reduction of 30.6 percent. Thus without considering increased generation due to economic growth, total emissions would be reduced by 43.8 percent for the years 2000–2002 under S. 1097.

S. 1097 would reduce the amount of available allowances after 2002 to 3,000,000 per year. This is an additional reduction of 44.4 percent. The cumulative reduction from 1997 levels, excluding economic growth effects would then be about 70 percent.

The SIP Call is an effective 85 percent reduction from 1990 levels, which is a greater reduction in emissions rate than S. 1097. However, because S. 1097 is applied to all 48 states, and it is an annual program, it would result in more total emissions reduced.

Considering the effects only on the utilities operating in the areas subject to the SIP Call, S. 1097 would allow utilities to operate at a higher average emissions rate, and thus would result in lower capital costs. However, because S. 1097 is an annual program, it is to be expected that utilities would consider somewhat more capital intensive investments in the interest of reducing total operation and maintenance costs.

Question 5. On page 8 of your written testimony, you state that local or sub-regional controls are most effective in controlling ozone. Would local or sub-regional controls also address the damages of acid deposition included in the recent NAPAP report?

Response. It is generally believed that long-range transport of SO_2 and other sulfates is a contributor to acid deposition. However, local emissions of SO_2, NOx and

other acid aerosols are also of significant concern because of their consistent and unadulterated impact. As a result, local or subregional controls can play an important role in reducing acidification. As noted above, based on available data, it is premature to require additional long-range or local controls to address acidification since the impact of existing control requirements has yet to be fully assessed.

Question 6. Your written testimony indicates that Congress should wait until all of the relevant scientific evidence is available before moving to enact further reductions on SO_2 and NOx. Please identify areas of scientific research on NOx emissions, SO_2 emissions, and regional transport of these emissions that have not been adequately addressed by OTAG, EPA, NESCAUM, or NAPAP studies and reports.

Response. As noted, we are unaware of any study that has considered the problem of acidification in light of the reductions of pollutants expected as a result of full implementation of the acid rain program, the recent NOx SIP Call, and the reductions inherent in EPA's decisions to strengthen the ozone and particulate matter standards. Each of these initiatives will provide real benefits to the environment, including areas of concern in New York. Before there can be an informed decision regarding the need for further reductions to address acid rain, the reductions in SO_2 and NOx emissions that these initiatives will bring need to be quantified and modeled so that a scientifically sound assessment can be made of the status of the lakes in the Adirondacks after these reductions are achieved.

SOUTH COAST AQMP CONTROL STRATEGIES

Short- and Intermediate-term Mobile Source Control Measures

1997 AQMP Number	Control Measure Title
On-Road Mobile Source Control Measures	
M1	Accelerated Retirement of Light-Duty Vehicles
M4	Heavy-Duty Diesel Vehicles; Early Introduction of low NOx Engines
M5	Heavy-Duty Diesel Vehicles; Additional NOx Reductions in California
M6	Heavy-Duty Diesel Vehicles; 2.0 g/bhp-hr NOx Standard-National
M7	Accelerated Retirement of Heavy-Duty Vehicles
MON-09	In-Use Vehicle Emission Mitigation
MON-10	Emissions Reduction Credit for Truck Stop Electrification
Off-Road Mobile Source Control Measures	
M11	Industrial Equipment; Gas & LPG - California
M12	Industrial Equipment - Gas & LPG - National
M13	Marine Vessels; National and International Standards
M14	Locomotives; Nationwide Standards, New and Rebuilt
M16	Pleasure Craft; Nationwide Emission Standards
MOF-07	Credits for the Replacement of Existing Pleasure Craft Engines with New Lower Polluting Engines
Transportation Improvements	
TCM-01	Transportation Improvements

Advanced Transportation Technology Measures	
ATT-01	Telecommunications
ATT-02	Advanced Shuttle Transit
ATT-03	Zero-Emission Vehicles/Infrastructure
ATT-04	Alternative Fuel Vehicles/Infrastructure
ATT-05	Intelligent Vehicle Highway Systems (IVHS)

From the California Air Resources Board 1994 Ozone State Implementation Plan

TABLE 1

EMISSION REDUCTIONS FROM **ON-ROAD** "M" MEASURES IN THE SOUTH COAST IN 2010 (TPD)

Control Measure	Adoption Date	Implementation Date	ROG	NOx	Implementing Agency
M1: Accelerated retirement of LDVs	1997	1997-2010	14	10	ARB/ Districts
M2: Improved control technology for LDVs	2000	2004-2005	10	13	ARB
M3: Accelerated ULEV standards for MDVs	1995	1998-2004	*	*	ARB
M4: Early introduction of 2.0 g/bhp-hr NOx engines in HDDV fleets through incentives	--	1997-2002	0	1	ARB/ Districts
M5: Additional reductions equivalent to a California-only 2.0 g/bhp-hr NOx standard for HDDVs	1997	2002	1	6	ARB
M6: National 2.0 g/bhp-hr NOx standard for HDDVs	1997	2004	6	45	U.S. EPA
M7: Accelerated retirement of HDVs	1997	1997-2010	1	10	ARB/ Districts
M8: Lower emission standards in California for HDGVs	1995	2004	*	*	ARB

* Control measure adopted, so emission reductions now in EMFAC7G baseline.

TABLE 2

EMISSION REDUCTIONS FROM **OFF-ROAD** "M" MEASURES IN THE SOUTH COAST IN 2010 (TPD)

Control Measure	Adoption Date	Implementation Date	ROG	NOx	Implementing Agency
M9: California 2.5 g/bhp-hr NOx standard for off-road diesel equipment	2001	2005	1	20	ARB
M10: National 2.5 g/bhp-hr NOx standard for off-road diesel equipment	2001	2005	3	26	U.S. EPA
M11: Three-way catalyst for gasoline & LPG industrial equipment in California	1997	2000-2004	15	8	ARB
M12: Three-way catalyst for gasoline & LPG industrial equipment Nationwide	1997	2000-2004	17	10	U.S. EPA
M13: National and international standards for marine vessels	1997	1998-2001	0	15	U.S. EPA (With IMO)
M14: National standards for new and rebuilt locomotives	1997	2000-2010	0	19	U.S. EPA
M15: National emission standards for aircraft	1999	2000	3	5	U.S. EPA
M16: National emission standards for pleasure craft	1996	1998	21	0	U.S. EPA

TABLE 2

Implementation Actions and Agencies

MEASURE		IMPLEMENTATION ACTION(S)	IMPLEMENTING AGENCY
TCM-01 Transportation Improvements	HOV Lanes	Through RTIP, program and implement HOV projects (& pricing alternatives), park & ride lots/intermodal facilities.	SCAG, CTCs, Caltrans
	Transit/Systems Management	Through RTIP, program and implement transit improvements, Urban Freeway System Management Improvements, smart corridors TSM programs, railroad consolidation programs, CMP-based demand management strategies, vanpool programs, telecommunications facilities, demonstration programs, and bicycle and pedestrian facilities.	SCAG, CTCs, Caltrans, Transit Operators, Local Governments
	Information Services	Through RTIP, program and implement marketing information services for employers and activity centers to encourage shared rides and transit use, and transit pass centers.	SCAG
ATT-01 Telecommunications		Increase usage of telecommunications products and services in daily business, educational and personal activities. Targets 6.8% decrease from 1990 levels in 2010 H-W trip equivalents.	SCAG/SCAQMD/ Partnership/Local Gov'ts/Subregions
ATT-02 Advanced Shuttle Transit		Introduction of technology-enhanced "smart" vehicles to provide consumers a choice between automobiles and "smart shuttles." In combination with "traditional transit," targets a 10% mode split.	SCAG/SCAQMD/ Partnership/Local Gov'ts/Subregions
ATT-03 Zero-Emission Vehicles/Infrastructure		Enhance market penetration of zero-emission vehicles and aggressive deployment of infrastructure. Facilitate State ZEV mandate and market-enhanced levels of vehicle sales.	SCAG/SCAQMD/ Partnership/Local Gov'ts/Subregions
ATT-04 Alternative Fuel Vehicles/Infrastructure		Enhance market penetration of alternative fuel vehicles along with aggressive deployment of refueling infrastructure. Facilitate state program actions and market-enhanced levels of vehicle sales.	SCAG/SCAQMD/ Partnership/Local Gov'ts/Subregions

ATT-05 Intelligent Transportation Systems	Apply Advanced Traffic Management and Advanced Traveler Information Systems to reduce fuel usage and emissions, improve travel time and safety, and support transit-user information and patronage. Facilitate 5% improvement in roadway vehicle capacity.	SCAG/SCAQMD/ Partnership/Local Gov'ts/Subregions
FSS-02 Market Based Transportation Pricing	Further Study. Implement pricing policies to reduce congestion and emissions from vehicles.	State and/or Local Agencies

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GENERAL ACCOUNTING OFFICE REPORT TO CONGRESS

AIR POLLUTION: DELAYS IN MOTOR VEHICLE INSPECTION PROGRAMS JEOPARDIZE ATTAINMENT OF THE OZONE STANDARD

REPORT (GAO/RCED–98–175) TO THE RANKING MINORITY MEMBER, COMMITTEE ON GOVERNMENT REFORM AND OVERSIGHT, HOUSE OF REPRESENTATIVES—JUNE 1998

THE HONORABLE HENRY A. WAXMAN,
Ranking Minority Member,
Committee on Government Reform and Oversight,
House of Representatives.

DEAR MR. WAXMAN: Although the United States has significantly improved its air quality since the 1970's, air pollution problems, such as ozone and carbon monoxide, continue to threaten the health of millions of Americans.[1] Motor vehicles are responsible for up to half of the emissions of volatile organic compounds (VOC) that affect ozone levels and up to 90 percent of the carbon monoxide emissions found in urban areas.[2] Title I of the Clean Air Act Amendments of 1990 (P.L. 101–549, Nov. 15, 1990) requires the states with the most serious ozone and carbon monoxide problems—23 states have been identified—to implement enhanced inspection and maintenance (I&M) programs to reduce the emissions from motor vehicles.[3] Under the amendments, these states were required to have their programs implemented by November 1992. However, in November 1992, despite this requirement, the Environmental Protection Agency (EPA) issued a regulation that postponed the required implementation date until January 1995. I&M programs test vehicles' emissions to ensure that the vehicles are adequately maintained and working properly. If the vehicles pass these tests, they are assumed not to be emitting excessive amounts of VOCs and carbon monoxide.

Because of concerns about the implementation of the enhanced I&M programs, you asked us to determine the status of the states' programs. Specifically, we examined (1) the progress made by the 23 states that are required to implement enhanced I&M programs, including the difficulties that the states have encountered, and (2) the impact that delays in implementing enhanced I&M programs may have on the states' ability to comply with the national air quality standard for ozone. In order to address these issues, we used a mail survey to obtain information from the 23 states. (App. I presents the survey we used.) We also met with officials from EPA's program and regional offices, as well as with officials from two states, to discuss the implementation of the enhanced I&M programs.

Two of the 23 states had begun testing vehicles by the January 1995 deadline that EPA set for implementing enhanced inspection and maintenance programs, and 12 had begun testing vehicles as of April 1998. A number of factors have contributed to delays in implementing programs. Opposition to EPA's enhanced inspection and maintenance regulation—including the reluctance of some state legislatures to provide the legislative authority and funding needed to implement these programs—

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[1] The health effects of exposure to ozone and carbon monoxide include eye, nose, and throat irritation, as well as bronchitis, emphysema, and other serious lung diseases.

[2] Volatile organic compounds are a major contributor to the formation of ground-level ozone (urban smog). Ozone is formed by sunlight and high temperature acting on volatile organic compounds and nitrogen oxide.

[3] Twenty-two states and the District of Columbia are required to implement enhanced I&M programs. Hereafter, we refer to the District as one of the 23 states.

caused most of the 23 states to delay implementation. In addition, the states had difficulty in obtaining new testing equipment and software support from vendors.

The delays in implementing enhanced inspection and maintenance programs have jeopardized the states' ability to meet the deadlines for attaining the national ozone standard. EPA has allowed the states to claim credit for future reductions in emissions of volatile organic compounds from their enhanced inspection and maintenance programs, provided they demonstrate that they will achieve the required reductions as soon as practical after November 1996. If states cannot demonstrate that reductions in volatile organic compounds can be obtained from the mandatory enhanced inspection and maintenance programs, they may have to look to other mobile sources as well as stationary sources to meet their goals for reducing these emissions. However, achieving further reductions from other sources will be costly and take longer than achieving the reductions from enhanced inspection and maintenance programs.

EPA determined that 23 states needed enhanced I&M programs in order to meet national air quality standards. Figure 1 shows the 23 states that are required to implement enhanced I&M programs.

Because the ozone levels in many areas exceeded the national ozone standard, the Congress recognized that reducing ozone levels would be a long-term effort for some states and established interim goals and milestones in title I of the Clean Air Act Amendments of 1990. Areas that exceeded the national ozone standard were classified as "nonattainment areas," and according to the severity of their ozone problems, states were given future dates ranging from 3 to 20 years to attain the ozone standard. Title I required most ozone nonattainment areas to develop plans for EPA's approval that showed which control measures they would need to achieve a 15-percent reduction in VOC emissions by November 1996. Furthermore, the states with serious to extreme nonattainment areas were required to prepare plans showing how they would achieve additional VOC reductions beyond 1996.

Enhanced I&M programs are designed to measure the pollution that vehicles release when they are operated under simulated driving conditions. EPA issued an enhanced I&M regulation in November 1992 that required the states to meet or exceed a stated performance standard based on a model program that included IM–240 testing equipment.[4] Although the amendments required the states to implement their enhanced I&M programs by November 1992, EPA's regulation postponed the required start date to January 1995 and required full implementation of the program by January 1996. Appendix II describes the statutory and regulatory requirements for the enhanced I&M program.

In August 1996, EPA recognized that the states' delays in implementing their enhanced I&M programs would prevent many of them from achieving the 15-percent reduction in VOC emissions. Subsequently, in February 1997, EPA issued guidance to allow the states that revised their enhanced I&M programs under the September 1995 revised enhanced I&M regulation or the National Highway System Designation Act of 1995 (P.L. 104–59, Nov. 28, 1995) to have more flexibility in developing and implementing their programs. In order for the states to operate under the relaxed requirement, they had to demonstrate that their 15-percent reduction in VOC emissions would be achieved as soon as possible after November 1996, but no later than November 1999. The guidance allowed states to resubmit their VOC reduction plans to show that they would achieve the required reductions from the implementation of their enhanced I&M programs by November 1999. According to EPA, the states that had not implemented their enhanced I&M programs as of November 1997 may be unable to demonstrate how they will achieve required VOC reductions.

MANY STATES HAVE NOT IMPLEMENTED ENHANCED I&M PROGRAMS

None of the 23 states met the November 1992 statutory date for implementing their enhanced I&M programs, and only 2 had begun testing vehicles by EPA's January 1995 deadline for starting their programs. In total, 12 states had begun testing vehicles under enhanced I&M programs by April 1998. A number of factors account for the delays in implementing enhanced I&M programs, including opposition to the stringent requirements of EPA's enhanced I&M regulation, the reluctance of some state legislatures to provide authority and funding for the programs, and difficulties in obtaining test equipment and software support.

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[4] IM–240 is computer-controlled equipment that simulates actual driving conditions and measures vehicles' tailpipe emissions for 4 minutes—240 seconds—on a dynamometer—a treadmill-like device.

The 12 states that are testing vehicles account for 43 percent of the 52 million vehicles subject to the enhanced I&M testing.[5] Furthermore, several of the other 11 states are scheduled to start testing vehicles within the next few months.[6] For example, California and Georgia, which have 9.4 million vehicles that will be subject to enhanced I&M testing, are scheduled to start testing in June 1998 and July 1998, respectively. Appendix III shows the implementation and approval status and the number of vehicles subject to enhanced I&M testing for each of the 23 states.

STATES HAVE ENCOUNTERED DIFFICULTIES IN IMPLEMENTING PROGRAMS

According to EPA, states opposed EPA's enhanced I&M regulation because the regulation did not allow them enough flexibility in designing and implementing their programs. The 1992 regulation required all enhanced I&M programs to meet or exceed a performance standard based on a model program that used computer-controlled test equipment and centralized "test-only" inspection centers. Some states believed that centralized programs resulted in fewer inspection centers, often making the testing programs less convenient for vehicle owners and potentially resulting in longer delays than previous I&M programs. Furthermore, the states believed that consumers would be inconvenienced by the 1992 enhanced I&M regulation because of the test-only feature of the model program, which required the owner of any vehicle that failed the inspection to go elsewhere to have repairs made and to return to the same inspection center for retesting. While the 1992 enhanced I&M regulation permitted the states to implement decentralized programs that allowed inspection centers to test and then repair vehicles, EPA determined that these programs were less effective in identifying and repairing vehicles with excessive emissions.

Because of the opposition to the stringency of the 1992 regulation, EPA issued a revised enhanced I&M regulation in September 1995, and the Congress enacted the National Highway System Designation Act of 1995, which gave the states more flexibility to develop and implement their programs. For example, the revised regulation allowed the states to implement less stringent enhanced I&M programs if they could demonstrate emission reductions from other sources. The regulation also allowed the states more leeway in inspecting and repairing failed vehicles. Eight of the 23 states took advantage of the flexibility allowed by the revised regulation by implementing less stringent enhanced programs. Additionally, the National Highway System Designation Act of 1995—which prohibited EPA from requiring the states to have centralized IM–240 enhanced I&M programs—allowed the states to revise their programs to include decentralized testing and provided an 18-month interim approval period for them to demonstrate that their revised programs could achieve the needed emissions reductions.[7] Eight of the 23 states have implemented or plan to implement the more flexible enhanced I&M programs under the act.

Even though the revised enhanced I&M regulation and the National Highway System Designation Act of 1995 allowed more flexibility, nine states indicated in response to our survey that difficulties in obtaining legislative authority delayed the implementation of their enhanced I&M programs. For example, Massachusetts had planned to start inspecting vehicles under an enhanced I&M program in July 1997. However, as of November 1997, the date to which Massachusetts had committed to begin program operations, the state legislature had not enacted the needed legal authority for an enhanced I&M program, and vehicle testing had not begun. In December 1997, EPA notified Massachusetts that its enhanced I&M program was disapproved. Currently, Massachusetts is planning to begin testing vehicles in May 1999. Similarly, the Maryland legislature attempted to make the enhanced I&M program voluntary instead of mandatory, as required by the Clean Air Act Amendments of 1990, and this attempt delayed the implementation of the state's program. However, the Governor's veto of this legislation paved the way for Maryland to start testing vehicles under its enhanced I&M program in the fall of 1997.

In response to our survey, 13 states indicated that they have experienced problems with obtaining needed testing equipment or software support from vendors, which have delayed the implementation of their programs. These problems were especially apparent in late 1997 and early 1998, when several states were scheduled to start testing vehicles. According to EPA officials, only a limited number of vendors supply the testing equipment and the computer software needed for enhanced I&M inspection centers. With the high demand for the equipment in recent months,

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[5] EPA's Nov. 1992 technical support document for the 1992 enhanced I&M regulation estimated that 56 million vehicles would be subject to enhanced I&M testing.

[6] While some of these states are testing vehicles under an I&M program, their testing does not meet all of the requirements to qualify as testing under an enhanced I&M program.

[7] An "interim approval" is a time-limited approval action created by the enhanced I&M provisions of the National Highway System Designation Act of 1995.

vendors have been unable to fill all orders. For example, Georgia had planned to have 300 inspection centers operating under an enhanced I&M program by July 1997. However, because of the vendor's problem with delivering the equipment and providing software support, Georgia now plans to start testing vehicles in July 1998—a year later than originally planned.

Overall, our survey of the 23 states identified a number of factors that delayed the states' efforts to implement enhanced I&M programs. These included opposition to the stringent requirements of EPA's initial program, difficulties in obtaining testing equipment, delays by EPA in issuing the initial regulation, difficulties in obtaining authority from state legislatures, and difficulties in certifying inspection centers and technicians. Figure 2 shows the factors cited by states as reasons for their delays.

PUBLIC ACCEPTANCE OF ENHANCED I&M PROGRAMS IS IMPORTANT

The states recognize the importance of informing the public about the reasons for enhanced I&M programs. In fact, 14 states said that it was very or extremely important to educate the public about their enhanced I&M programs. Furthermore, seven said that they tried to educate the general public to a great or very great extent about the frequency of testing, the costs of tests, testing locations, and other pertinent information about the program. Seven states also said that they tried to educate the general public to a great or very great extent about the reasons for implementing enhanced I&M programs.

For example, in implementing an enhanced I&M program, Georgia contracted with an advertising agency to develop and disseminate information through television and radio spots and distributed printed materials through community groups and organizations. A recent survey of the effectiveness of Georgia's public information campaign for its I&M program showed that consumers believe that cars are the largest contributing factor to air pollution. The study also showed that 88 percent of Georgia's consumers were aware of the current I&M program, and 76 percent believed that the program was doing a good job.

In contrast, Maine initially tried to implement an enhanced I&M program in 1994 with little or no public relations efforts. After very strong public opposition to the program, the Governor canceled it. According to EPA, the opposition to the program was caused, in part, by the perception that the enhanced I&M program was being implemented as an alternative to imposing control measures on certain stationary sources. As of April 1998, Maine's enhanced I&M program had been disapproved because the state's revised plan for it did not meet all of EPA's requirements. Even though some states have been more successful than others in overcoming public opposition and other obstacles to implementing their enhanced I&M programs, EPA has made only a limited effort to identify the practices these successful states have used and to share them with other states that are in the early stages of developing and implementing their programs.

DELAYS IN IMPLEMENTING ENHANCED I&M PROGRAMS HAVE SLOWED EFFORTS TO REDUCE OZONE LEVELS

Because of delays in implementing enhanced I&M programs, 19 of the 23 states are in jeopardy of not meeting deadlines for attaining the national ozone standard.[8] The 19 states are relying on the enhanced I&M programs to reduce VOC emissions. In August 1996, EPA recognized that the states could not achieve a significant portion of their 15-percent VOC reductions by November 1996 because of delays in implementing enhanced I&M programs. It therefore examined other available control measures for reducing VOC emissions. EPA required the states to demonstrate in their VOC reduction plans that enhanced I&M programs were the most practical way for them to achieve the 15-percent reduction in VOC emissions. EPA then allowed the states to revise their enhanced I&M programs to claim credit for the emissions reductions that are based on the future implementation of their programs, provided they demonstrated that the required VOC reductions would be achieved as soon as possible after November 1996 but no later than November 1999. EPA also allowed the states to resubmit their VOC reduction plans to show that they would achieve the required VOC reductions from implementing their enhanced I&M programs by November 1999. EPA encouraged the states to customize their revised

[8] Four states do not have to meet deadlines for attaining the national ozone standard. Colorado, Nevada, and Washington are required to implement enhanced I&M programs to reduce carbon monoxide emissions to help them attain the national carbon monoxide standard, and Vermont is required to have an enhanced I&M program because of VOC emissions that are transported from other states.

VOC reduction plans to include other control measures that would be the most practical for their areas to implement in achieving the required reduction in VOC emissions.

Even with the relaxed requirement, 11 of the 19 states are at risk of not meeting the required VOC reductions specified under title I of the Clean Air Act Amendments of 1990 because they had not started testing vehicles as of April 1998. According to EPA, the states that had not implemented their enhanced I&M programs as of November 1997 may be unable to demonstrate how they will achieve required VOC reductions, and are at risk of having their VOC reduction plans disapproved because of the anticipated shortfall in VOC reductions. For example:

—EPA's conditional interim approval[9] of New Jersey's enhanced I&M program, which accounts for 26 percent of the state's planned reductions in VOC emissions, required the program to begin by November 15, 1997, in order for all vehicles to be tested by November 1999 and for the state to receive full credit for the VOC reductions from the program. New Jersey officials advised EPA that they would not select a contractor to operate the program until April 1998. In December 1997, EPA notified New Jersey that its 15-percent reduction plan was disapproved because the state failed to meet the required November 1997 start date for its enhanced I&M program. According to a New Jersey official, it is unclear how the state will make up the shortfall in VOC reductions caused by its failure to implement an enhanced I&M program.

—The District of Columbia is required to reduce VOC emissions by 133 tons per day to attain the ozone standard by November 1999. Even though the District is relying heavily upon its enhanced I&M program to provide 48 percent of the overall VOC reductions, it does not plan to start inspecting vehicles under an enhanced I&M program until April 1999. While control measures are available to the District for reducing VOC emissions from other mobile and stationary sources, many of these measures have already been implemented, and, according to EPA officials, imposing further controls on these sources will not produce the reductions that the District is expecting to achieve with an enhanced I&M program.

Many of the states that are required to implement enhanced I&M programs must achieve the required VOC reductions by November 1999 but still do not have final approval for their VOC reduction plans. Table 1 shows the approval status of the states' VOC reduction plans as of April 1998.

Approval Status of the States' VOC Reduction Plans

As of April 1998

State	Testing vehicles	Approval status of VOC reduction plans	
		15-percent reduction plan	Post-1996 reduction plan
California	No	Approved[1]	Approved
Connecticut	Yes	Proposed conditional approval[2]	Submitted—complete
Delaware	Yes	Conditional approval	Submitted—complete
District of Columbia	No	Submitted—complete	Submitted—complete
Georgia	No	Proposed conditional interim approval	Submitted—complete
Illinois	No	Approved	Submitted—complete
Indiana	Yes	Approved	Submitted—complete
Louisiana	No	Approved	Submitted—complete
Maine	No	Submitted—complete	Not required
Maryland	Yes	Conditional approval	Submitted—complete
Massachusetts	No	Proposed conditional interim approval	Proposed conditional interim approval
New Hampshire	No	Proposed approval	Submitted—complete
New Jersey	No	Disapproved	Disapproved
New York	No	Submitted—complete	Submitted—complete
Pennsylvania	Yes	Conditional interim approval	Not submitted
Rhode Island	No	Limited disapproval	Submitted—no action
Texas	Yes	Approved—Beaumont/Port Arthur Proposed conditional interim approval--Dallas/Ft. Worth, El Paso, and Houston.	Proposed disapproved
Virginia	Yes	Conditional approval	Submitted—complete

[9] A "conditional interim approval" is a formal action taken on an enhanced I&M program plan submitted under the National Highway System Designation Act of 1995 that meets most but not all requirements for enhanced I&M programs.

Approval Status of the States' VOC Reduction Plans—Continued

As of April 1998

State	Testing vehicles	Approval status of VOC reduction plans	
		15-percent reduction plan	Post-1996 reduction plan
Wisconsin	Yes	Approved	Submitted—complete

[1] All but one of California's nine nonattainment areas that are required to submit 15-percent VOC reduction plans have had their plans approved. The ninth nonattainment area—Mojave Desert—has submitted a plan, but EPA has not yet acted on it.

[2] A ''conditional approval'' is a formal approval action taken on an enhanced I&M program plan that meets most but not all relevant requirements for enhanced I&M programs. A state must make a commitment to correct the deficiencies within 12 months of the conditional approval action.

Source: GAO's analysis of information provided by EPA and the states.

Even though most of the states are planning to have their enhanced I&M programs account for a significant amount of the required reductions in VOC emissions, EPA and the states will not know how much of the needed VOC reductions will be met by enhanced I&M programs until each program is fully approved and operational. Thus, further delays by the states in implementing enhanced I&M programs jeopardize their efforts to achieve the required VOC reductions.

While the states can use mobile and stationary sources in conjunction with the mandated enhanced I&M programs to attain the ozone standard these sources, especially stationary sources, have already made significant reductions in their VOC emissions, and, according to EPA, further reductions from them will be costly and take some time to achieve. In 1992, EPA estimated that the cost to reduce VOC emissions with an enhanced I&M program was $879 per ton compared with $5,000 per ton from stationary sources. According to EPA officials, with the less stringent requirements of many of the current programs, the cost per ton of VOC reductions from the enhanced I&M programs is probably higher, but not as high as further reductions from other mobile sources or stationary sources. However, EPA is not aware of any data that show current costs.

CONCLUSIONS

While enhanced I&M programs are an integral part of the effort to significantly reduce emissions from motor vehicles, states' efforts to implement their programs have been slow and troubled by numerous delays. Recognizing that states have encountered a variety of challenges in implementing enhanced I&M programs, we believe that EPA could expand its efforts at helping some of the states that are experiencing the most significant problems by sharing the best practices, such as public relations campaigns, adopted by the states with approved and/or operating programs.

Furthermore, because of delays in implementing enhanced I&M programs, states have not realized the reductions in VOC emissions that they were statutorily required to achieve by 1996, nor are they likely to achieve additional reductions that EPA is now requiring by November 1999 to enable them to attain the national ozone standard. Therefore, states will have to look to other mobile sources as well as stationary sources to meet their goals for reducing VOC emissions. However, obtaining the required reductions from other sources will be difficult because many of them, especially stationary sources, have already made major reductions in their VOC emissions, and any further reductions may be costly and take some time to achieve.

RECOMMENDATION

In view of the pivotal role that enhanced I&M programs play in reducing VOC emissions and the delays experienced to date in implementing these programs, as well as the possibility of future delays, we recommend that the Administrator of EPA compile information on the more successful practices, such as public relations campaigns, used by the states that have implemented their enhanced I&M programs and share the information with those states that are in the early stages of developing and implementing their programs.

AGENCY COMMENTS

We provided copies of a draft of this report to EPA for review and comment. In commenting for the agency, the Director of the Office of Mobile Sources agreed with the information presented and suggested a few editorial changes to clarify points but did not comment on the recommendation. We included EPA's comments as appropriate.

SCOPE AND METHODOLOGY

We gathered data on the enhanced I&M programs in the 23 states required to implement the programs under the Clean Air Act Amendments of 1990. Data were obtained through the use of a survey mailed to the environmental offices in each of the 23 states. The survey was pretested by officials from the states of Georgia, Maryland, and Washington, and subsequently mailed in late January 1998. Completed surveys were returned by all 23 states. A copy of the survey is in appendix I.[10] In addition to our analyses of the data gathered from the survey, we asked EPA to update the data for some questions.

We also reviewed notices in the Federal Register that provided information on the status of the states' enhanced I&M programs as well as other pertinent documentation. Additionally, we visited EPA's regional offices in Boston, Massachusetts; Philadelphia, Pennsylvania; and Atlanta, Georgia to obtain background information on issues concerning the enhanced I&M programs. We also visited EPA's Office of Mobile Sources in Ann Arbor, Michigan, and the Office of Air Quality Planning and Standards in Durham, North Carolina, and interviewed officials about the enhanced I&M program as well as issues concerning attaining the ozone standard. We met with officials in Massachusetts and Georgia to discuss the implementation of their enhanced I&M programs. We measured progress in terms of the states with operating programs that were testing vehicles as of April 1998. We did not use EPA's approval status to measure progress because a state's approval status is subject to change.

We performed our work from July 1997 through May 1998 in accordance with generally accepted government auditing standards.

As arranged with your office, unless you announce its contents earlier, we plan no further distribution of this report until 15 days from the date of this letter. At that time, we will send copies to the appropriate congressional committees; the Administrator of the Environmental Protection Agency; and the Director of the Office of Management and Budget. We will also make copies available to others on request.

Please call me at (202) 512–6111 if you or your staff have any questions. Major contributors to this report are listed in appendix IV.

Sincerely yours,

PETER F. GUERRERO DIRECTOR, *Environmental Protection Issues,*
General Accounting Office.

CHANGES IN REQUIREMENTS FOR THE ENHANCED INSPECTION AND MAINTENANCE PROGRAM

This appendix describes the statutory and regulatory changes leading to the Environmental Protection Agency's (EPA) current requirements for enhanced inspection and maintenance (I&M) programs.

THE CLEAN AIR ACT AMENDMENTS OF 1990

Title I of the Clean Air Act Amendments of 1990 (P.L. 101–549—Nov. 15, 1990) required the 23 states with the most serious ozone and carbon monoxide problems to implement enhanced I&M programs. Specifically, the states with serious, severe, or extreme ozone nonattainment areas with 1980 urban populations of 200,000 or more; serious and certain moderate carbon monoxide nonattainment areas with urban populations of 200,000 or more; and areas with a population of 100,000 or more in the Ozone Transport Region, regardless of their attainment status; were required to implement enhanced I&M programs.[11] The enhanced I&M programs were required to have centralized inspection centers and perform annual inspections unless the state demonstrated to EPA that a decentralized or biennial program would be equally effective. Title I also required EPA to issue regulations for the enhanced

[10] Because much of the data are not reported in an aggregated format, and many of the questions asked for information unique to a particular state, data are not reported in the survey presented in app. I.

[11] The Ozone Transport Region includes 12 states in the northeastern United States that have significant ozone nonattainment problems because much of the ozone originates in other states and is transported to these states by the eastern air flow patterns. These states are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and the Consolidated Metropolitan Statistical Area that includes the District of Columbia.

I&M program by November 15, 1991, and the states to implement their enhanced I&M programs by November 15, 1992.

Title I divided all of the ozone nonattainment areas into five categories—marginal, moderate, serious, severe, and extreme—and set timeframes for each category to reach attainment. The attainment dates ranged from 3 years (marginal) to 20 years (extreme) after the act was enacted. Title I also required the states to demonstrate how they would reduce volatile organic compounds (VOC) emissions—one of the major pollutants that contribute to the formation of ozone. The states with moderate to extreme ozone nonattainment areas were required to prepare implementation plans by November 1993 that showed how they would reduce VOC emissions by 15 percent within 6 years after enactment. The states with serious to extreme nonattainment areas also had to prepare plans showing how they would achieve additional VOC reductions. The plans to reduce VOC emissions after 1996 were due by November 1994 and were to show how the states planned to achieve 3-percent VOC reductions annually until the nonattainment areas reach attainment.

ENHANCED INSPECTION AND MAINTENANCE PROGRAM REGULATION

EPA issued its regulation for the enhanced I&M program on November 5, 1992. The regulation required the states with areas switching from test-and-repair to test-only requirements to implement programs that would begin testing 30 percent of all vehicles that were subject to enhanced I&M in the nonattainment areas in January 1, 1995, and all areas to begin testing all vehicles by January 1, 1996. The regulation also required the states to meet or exceed a performance standard that was based on a model program for an annual, centralized enhanced I&M program that included IM–240 test equipment, or an equivalent test protocol approved by EPA, and covered all 1968 and later model cars and light-duty trucks. The states that elected to implement decentralized programs or a program consisting of centralized and decentralized inspection facilities were to have their emission reduction credits discounted by approximately 50 percent for the decentralized portion of their programs, unless they could demonstrate that their programs were as effective as a centralized program. The regulation also included the requirement under the Clean Air Act Amendments of 1990 that a minimum expenditure of $450 for emission-related repairs was required for vehicles to qualify for a waiver of further repairs. According to EPA, a typical urban area adopting the model program established by the regulation would, by 2000, reduce the levels of air pollutants more than they would have reduced them without an enhanced I&M program: for carbon monoxide, the additional reduction would be 31 percent, for VOCs, 28 percent, and for nitrogen oxides, 9 percent.

ENHANCED INSPECTION AND MAINTENANCE FLEXIBILITY REGULATION

In response to strong public opposition to its initial enhanced I&M regulation, EPA issued a regulation known as the Inspection/Maintenance Flexibility Amendments on September 18, 1995. This regulation created a less stringent enhanced I&M program by allowing certain states more flexibility in implementing their programs. Specifically, the revised regulation allowed the states that can meet the requirements of the Clean Air Act Amendments of 1990 for VOC reductions and attainment without an enhanced I&M program as effective as the one adopted by EPA in the 1992 regulation to meet a less stringent low enhanced performance standard. The new standard, referred to as the low enhanced standard, did not include the IM–240 test as part of its model program. The regulation also modified other requirements of the 1992 regulation, such as extending the implementation of the minimum expenditure of $450 until January 1998.

NATIONAL HIGHWAY SYSTEM DESIGNATION ACT OF 1995

The National Highway System Designation Act of 1995 (P. L. 104–59, Nov. 28, 1995) also responded to public opposition to the 1992 enhanced I&M regulations. Specifically, the act prohibited EPA from requiring a centralized, IM–240 enhanced I&M program and stopped EPA's use of the 50-percent discount rate for decentralized or hybrid programs. Additionally, the act allowed states to submit, within 120 days after enactment, revisions to their enhanced I&M programs by proposing interim enhanced I&M programs. The act required EPA to approve enhanced I&M programs on an interim basis if the proposed credits for each element of the program reflected good-faith estimates and the revised programs complied with the Clean Air Act Amendments of 1990. The act further provided an 18-month period for the states to demonstrate that the credits they had proposed were appropriate, with no opportunity to extend the 18-month period.

ENHANCED INSPECTION AND MAINTENANCE OZONE TRANSPORT REGION FLEXIBILITY AMENDMENTS REGULATION

On July 25, 1996, EPA issued the Inspection and Maintenance Ozone Transport Region Flexibility Amendments regulation. The regulation created a special low-enhanced standard for areas within the Ozone Transport Region that would be exempt from I&M requirements if they were not located in the region. These areas included attainment areas, marginal ozone nonattainment areas, and certain moderate nonattainment areas with populations under 200,000 within the 12-state Ozone Transport Region. Emission reduction goals in these areas were lower than those required for low enhanced I&M and basic I&M programs. The regulation provided flexibility to certain Ozone Transport Region states to implement a broader range of I&M programs than allowed under earlier regulations. Elements of the program include performing annual tests of 1968 and newer vehicles, checking on-board computer equipment for 1996 and newer vehicles, conducting remote sensing tests of 1968 through 1995 model year vehicles, and visual inspection of various control components on 1968 and newer vehicles.

States' Progress in Performing Mandatory Enhanced Inspection and Maintenance Testing

As of April 1998

State	Approval status of enhanced I&M programs	Actual/planned testing start date	Number of vehicles (in millions)
Testing vehicles as of April 1998[1]			
Colorado	Approved	January 1995	1.69
Connecticut	Conditional approval	January 1998	1.20
Delaware	Conditional approval	October 1995	0.30
Indiana	Approved	January 1997	0.56
Maryland	Conditional approval	October 1997	2.40
Nevada	Approved	January 1995	0.75
Pennsylvania	Conditional interim approval	October 1997	6.00
Texas	Conditional interim approval	July 1996	4.30
Washington	Approved	June 1993	2.20
Wisconsin	Approved	December 1995	1.10
Vermont	Status pending	January 1997	0.50
Virginia	Conditional Interim Approval	February 1998	1.30
Subtotal			22.30
Not testing[2]			
California	Interim approval	June 1998	7.00
District of Columbia	Status pending	April 1999	0.24
Georgia	Disapproved	July 1998	2.40
Illinois	Approved	December 1998	2.50
Louisiana	Disapproved	Unknown[3]	0.27
Maine	Disapproved	Unknown[3]	1.20
Massachusetts	Disapproved	May 1999	4.20
New Hampshire	Disapproved	January 1999	1.00
New Jersey	Disapproved	October 1998	5.00
New York	Interim approval	November 1998	5.50
Rhode Island	Disapproved	Unknown[3]	0.70
Subtotal			30.01
Total			52.31

[1]These states had begun testing vehicles under an enhanced I&M program.
[2]While some of these states are testing vehicles under an I&M program, their testing does not meet all of the requirements to qualify as testing under an enhanced I&M program.
[3] The state has not submitted a revised enhanced I&M program plan that show a planned start date.
Source: GAO's analysis of information provided by EPA and the 23 states.

TESTIMONY OF RICHARD H. LEFEBVRE, CHAIRMAN, NYS ADIRONDACK PARK AGENCY

The Adirondack Park Agency applauds the efforts of Senators D'Amato and Moynihan in sponsoring the Acid Deposition Control Act (S. 1097) to address the reduction of acid precipitation and to remediate its effects to the environment of the Adirondack Park and other areas of the nation. On November 14, 1997, the Agency formally endorsed the proposed legislation, and a copy of the resolution is attached.

The Adirondack Park is important to the surrounding region, New York State, and the Nation. An area of six million acres, with over 2.6 million acres of "forever wild" Adirondack Forest Preserve, the Adirondack Park is larger than the State of Massachusetts and contains 20 percent of New York's land area. It has public lands larger than Yellowstone National Park within its boundary. The Park contains over 500,000 acres of old-growth forest, and much of the balance of the "Forest Preserve" is functionally nearing old-growth status because of more than a century of protection afforded State lands in the Park by Article 14 of the State Constitution. It is the largest formally designated wilderness area east of the Mississippi River.

Ecologically, the Adirondack Region is a landscape dominated by large expanses of forest clearly visible from space in a sea of fragmented forest throughout the eastern United States. It forms the headwaters of five major river systems and has 30,000 miles of free flowing rivers, brooks, streams and pristine riparian habitat. Its mountains are interspersed with over 3,000 ponds and lakes, from tiny kettlehole bogs to major waterbodies like Lake George and Lake Champlain. The lakes, forests, rivers, wetlands and even sand plains support an array of natural communities and species, many of which are among the best examples of their kind in the Nation.

The Park is also a human community with 130,000 permanent residents in 130 different settlements, including the "Tri-Lakes" communities of Tupper Lake, Saranac Lake and Lake Placid at its heart. It is within a day's drive of 90 million people in the northeastern United States and southeastern Canada. The Park economy depends on tourism, forestry, public services and a wide variety of small-scale enterprises, all of which bear a strong relation to the quality of the natural setting the Park provides.

New York State has a strong tradition for stewardship of the Adirondack Park. For over 100 years, the State has provided protection for the "forever wild" lands of the Park in Article 14 of its Constitution.

For over 25 years, the State has addressed the environmental protection of the private lands of the Park with the Adirondack Park Land Use and Development Plan, contained in the Adirondack Park Agency Act, adopted in 1971. The Act created this agency to develop and administer State land and private land plans for the Park. This forward-thinking effort is recognized as an innovative framework for sustainable development, designed for partnership with local governments and the settlements in the Park as well as for the protection of the open spaces and the Park's working forest.

For over 20 years, the Agency has administered New York's Freshwater Wetlands Act providing additional protections beyond the Adirondack Park Agency Act to the wetlands of the Park. Representing over 14 percent of the landscape, these critical hydrologic linkages between aquatic and terrestrial habitats continue to be the subject of analysis and concern by the Agency and its governmental, academic and not-for-profit partners in watershed characterization and protection efforts.

For over 20 years, the Agency has administered New York's Wild Scenic and Recreational Rivers System Act, addressing over 1,200 miles of State-designated rivers within the Park for environmental protection and public enjoyment.

These concerted efforts by the State of New York, to provide for the continued stewardship of the natural resources of the Adirondack Park, have been threatened for the last several decades by long-range transport of air pollutants, loosely described as "acid rain." The solution to these threats to the Park and its natural and human communities lies beyond the reach of State policy with the Federal Clean Air Act. Much progress has been made, but the Adirondack Park Agency notes a substantial body of research that defines additional issues to be addressed if the Park ecology is to survive intact in the 21st Century.

Nearly half of the Park's more than 3,000 lakes and ponds are critically sensitive to atmospheric deposition of sulfates and nitrates, especially those sources of human activities upwind of the Adirondack Mountains. Thousands of miles of streams and rivers in the Adirondacks experience acidic conditions during the spring snowmelt period, adversely affecting aquatic life in these waters.

The existing mechanisms under the 1990 Clean Air Act Amendments are inadequate to protect the sensitive forest, stream and lake resources of the Adirondack Park and other areas of the country similarly affected. Since 1990, a series of federally funded study reports have consistently shown that the scientific evidence calls for further reductions in both sulfur and nitrogen emissions beyond those required by the 1990 CAAA.

The Adirondack Park Agency is a whole-hearted supporter of this bill because it contains the appropriate elements:

Reduction of sulfur dioxide emissions;

Limits on nitrogen oxide emissions, through a "cap and trade" program; A report on environmental indicators for each of the sensitive regional ecosystems, including the Adirondack Mountains;

Identification of ecological endpoints;

A tracking network to report on the health and chemistry of lakes and streams of the Adirondacks.

This agency finds that several impressive reports have been generated by various Federal offices including the Environmental Protection Agency (EPA) in the last several years that are technical, scientifically based and credible. These provide the evidence to support the actions/elements of S. 1097. The first is the 1995 EPA Report to Congress which finds and concludes that:

Scientific analysis indicates that nitrogen as well as sulfur deposition are important contributors to chronic and episodic acidification of surface waters. Further reductions in nitrogen as well as sulfur deposition may be necessary in order to realize protection of target-sensitive systems. Model projections indicate that if the time to nitrogen saturation in the Adirondacks is 100 years or less, maintaining the proportion of chronically acidic target surface waters in the Adirondacks in the year 2040 near proportions observed in 1984 may require reducing anthropogenic sulfur and nitrogen deposition by 40 to 50 percent or more below levels achieved by the CAAA (Executive Summary, page xvi). Environmental monitoring of deposition, ecological indicators, and ecological endpoints provides a parallel and complementary strategy to modeling in order to assess ecological resource issues (Executive Summary, page xix). It is reasonable to conclude that the natural resources most sensitive to acidic deposition are aquatic systems and high-elevation red spruce forests. Protection of sensitive aquatic resources should particularly focus on lakes and streams where watersheds are smaller, have shallow acidic soils with rapid, shallow subsurface flows, and are at higher elevations (page 24). Adirondack, Pocono and Catskill Mountains and mid-Appalachian Region apparently are now at continuing risk from acidification effects (page 24). The Adirondack subregion, including Adirondack State Park, has the highest number and percentage of acidic lakes (14 percent) found for any National Surface Water Survey (NSWS) subregion, except Florida (page 32). The proportion of chronically acidic (ANC < 0 μeq/l) Adirondack target lakes is projected to increase by about 50 percent in 2015 and may double by 2040, relative to 1984 proportions (page 47).

This report recognizes that there is merit and importance to understanding the inherent ecological processes of sensitive regions and monitoring the health and changes of those ecosystems. Developing resource-specific goals would provide a guide to assessing whether existing programs are effectively protecting the environment (page 119).

The Adirondack Park Agency prepared a map showing the extent and distribution of lakes at risk from acid deposition including chronically acidified lakes, and the lakes sensitive to springmelt acidification.

The most recently released Federal report on acid rain (1998) is the National Acid Precipitation Assessment Program's "Biennial Report to Congress: An Integrated Assessment." It concludes:

It is too early to determine whether changes in aquatic ecosystems have resulted from Title IV emission reductions. But over the last 15 years, lakes and streams throughout many areas of the United States have experienced decreases in surface concentrations in response to decreased emissions and deposition of sulfur. For example, there is evidence of recovery from acidification in New England lakes. In contrast, the majority of Adirondack lakes have remained fairly constant while the sensitive Adirondack lakes have continued to acidify. In 1995, EPA reported to Congress that additional reductions in sulfur and nitrogen deposition would be required to fully recover sensitive Adirondack lakes (page 4). Sulfur and nitrogen deposition have caused adverse impacts on certain highly sensitive forest ecosystems in the United States. High-elevation spruce-fir forests in the eastern United States are the most sensitive. Forest ecosystems in the East, South, and West are not currently known to be adversely impacted by sulfur and nitrogen deposition. However, ii deposition levels are not reduced in areas where they are presently high, adverse effects may develop in more forests due to chronic, multiple-decade exposure (page 4).

The gradual leaching of soil nutrients from sustained inputs of acid deposition could eventually impede forest nutrition and growth in several areas (page 4). Nitrogen deposition can significantly degrade forest ecosystems, especially in areas where nitrogen levels are already high and soil has reached or is approaching saturation (pages 4–5).

Canadian studies provide further support for these conclusions (1997 The Acidifying Emissions Task Group).

In conclusion, S. 1097 is critical to protect the natural and economic resources of the Adirondack Park and related regions suffering the effects of acidic deposition.

STATE OF NEW YORK, EXECUTIVE DEPARTMENT, ADIRONDACK PARK AGENCY

RESOLUTION ADOPTED BY THE ADIRONDACK PARK AGENCY IN SUPPORT OF CONGRESSIONAL ACID RAIN BILL

WHEREAS, the six-million-acre Adirondack Park is abundant in natural resources and open space unique to New York and the United States. The Park contains a unique mixture of privately and publicly owned lakes, rivers and mountains. and the New York State Forest Preserve lands comprising over 40 percent of the Park are mandated by the New York State Constitution to be forever kept as wild forest lands;" and

WHEREAS, more than 1?0,000 New Yorkers live or work in the Adirondack Park; and

WHEREAS, the Park is within a day's drive of 70 million people, and over nine million people from the United States, Canada. and elsewhere visit the Park annually to delight in its unique character, fostering tourism as a major pillar of its economy; and

WHEREAS, nearly half of the Park's more than 3,000 lakes and ponds are critically sensitive to the atmospheric deposition of sulfates and nitrates. including those sources of human activities upwind of the Adirondacks; and thousands of miles of streams and rivers in the Adirondacks experience acidic conditions during the spring snow melt period. adversely affecting aquatic life in these watershed; and

WHEREAS, in the 1990 Amendments of the Clean Air Act, Congress directed the U S Environmental Protection Agency to describe a program to protect critically sensitive aquatic and terrestrial resources in the Adirondacks and other areas similarly affected; and

WHEREAS, EPA's 1995 Final Acid Deposition Standard Feasibility Report to Congress concludes that the Adirondack Park is the area most severely impacted by acid deposition and predicts that 43 percent of its lakes and ponds will become critically acidified by 2040 unless Congress mandates additional sulfate and nitrate reductions over and above that mandated by the present Clean Air Act; and

WHEREAS, in response to the findings of this report, Senators Daniel P. Moynihan and Alphonse D'Amato and Congressman Gerald B. Solomon have drafted bills designed to require action to reduce acid deposition under the Clean Air Act and, by the establishment of a NOR allowance system in regions contributing to acid deposition in the Adirondacks, to provide for additional reductions in emissions of nitrogen oxides; and

WHEREAS, the proposed bill calls for a report, with one of its the goals to identify as an objective "to increase the proportion of waterbodies with an acid neutralizing capacity greater than zero from the proportion identified in surveys begun in 1984;" and,

WHEREAS, the report will also identify scientifically credible environmental indicators sufficient to protect sensitive ecosystems of the Adirondack Mountains and other sensitive receptor areas; and,

WHEREAS, the proposed legislation also calls for the establishment of a competitive grant program to fund research on the effects of nitrogen deposition on sensitive watersheds and coastal estuaries in the Eastern United and calls for a report on the health and chemistry ot lakes and streams of the Adirondacks; and

WHEREAS, the Adirondack Park Agency recognizes the initiatives of the New York State Department of Environmental Conservation to preserve and enhance the air quality of the Adirondack Park and notes that this resolution is consistent herewith and in support thereof, and

WHEREAS, the existing mechanisms under the 1990 Clean Air Act Amendments appear inadequate to protect the sensitive aquatic resources of the Adirondack Parl;. that keN scientific knowledge is lacking on some aspects of the role of nitrogen in Adirondack ecosystems. and that further scientific investigation and analysis is necessary in order to accurately assess and predict outcomes from various emission scenarios; and

WHEREAS, in order to fully support broader public understanding of the proposed legislation, the Adirondack Park Agency intends to continue its public discussion on the benefits and consequences of the legislation; furthermore, because of its staff's scientific expertise and the ability to contribute information and analysis, the Agency will request of EPA to be involved in the implementation of the technical aspects of the legislation.

NOW, THEREFORE, BE IT RESOLVED, that the Adirondack Park Agency respectfully requests that this legislation be supported by all Members of Congress.

Resolution adopted unanimously:

STATEMENT OF NEW YORK ATTORNEY GENERAL DENNIS C. VACCO

In the three decades since the birth of the environmental movement and the creation of EPA, this nation has made amazing progress in improving our natural environment. The days of Love Canal and burning urban rivers are largely a thing of the past. Our children can now swim in lakes and rivers that our parents would not allow us near.

However, acid rain is nowhere to be found on this list of environmental successes While our environment has improved in almost every other way, acid rain continues to cause more and more damage to our environment. My state of New York bears much of the brunt of this environmental scourge, which is killing our lakes' ponds and streams, particularly in the Adirondack Mountain region. That is why I support the Acid Deposition Control Act, which contains significant and effective provisions necessary to fight acid rain.

In contrast to polluted air which may blow in and out of an air basin, acid rain stays—it stays in the soil, where it damages trees, crops and other vegetation, and it stays in our lakes and ponds, where it kills flash and other animal life.

In New York State, we feel strongly that we cannot fiddle while Rome burns. It is rime to enact the Acid Deposition Control Act.

Since I took office in 1995, I have made combating acid rain my top environmental priority. In the past 3 years, my office has filed three lawsuits against SPA, seeking to force it to take steps to address acid rain. In 1996, I took EPA to court over its decision to exempt portions of four midwestern states from the Clean Air Actors requirements for control of nitrogen oxides. In 1997, I sued EPA over its failure to comply with a Congressional mandate to define the nature and numerical value of an acid deposition standard that would be protective of the resources threatened by acid rain The Attorneys General of New Hampshire and Connecticut have joined me in the prosecution of that action.

Then, earlier this year, joined by seven other northeastern states, I sued EPA over its failure to take timely action on petitions filed by New York and the other northeastern states, seeking reductions of NOx emissions from utilities under Section 126 of the Act.

The Problem of Acid Rain

The toll of acid rain on New York's natural resources is, tragically, all too clear. At least 20 percent of the lakes in the 6 million acre-Adirondack Park—which is nearly three times of size of Yellowstone National Park—are now identified by EPA as chronically acidic.

These are not just the cold statistics of a government report. In fact, they can be attested to by sportsmen who have found many of their favorite destinations are devoid of fish.

Without further emission reductions, the situation will just get worse. A 1995 EPA report concludes that the number of lifeless lakes is likely to double by the year 2040 unless controls beyond those currently anticipated by the Clean Air Act, are put into place.[1] recent study by the National Acid Precipitation Assessment Program (NAPAP) confirms that the emission reductions under EPA's acid rain program are not stemming the further deterioration of the Adirondacks.[2]

Although our concern is primarily with New York's resources, acid rain is not a problem only for the Northeast. The NAPAP study informs us that continued deterioration is taking place nationwide: in Californian San Bernardino and San Gabriel Fountains, in Colorado's Rockies, in the Allegheny Mountains of West Virginia and the Great Smokies of Tennessee[3] The Report singles out the pine forests in Southern California's San Bernardino mountains and alpine meadows in Colorado's Front Range as natural resources particularly threatened by continuing acid rain.[4] The

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[1] According to EPA's Acid Deposition Feasibility Study, Report Confess (the "Report to Congress"), the percentage of lanes in the Adirondacks that will be chronically acidic (i.e. corresponding to a pH of 5.28, a level at which many species of fish can no longer survive) by the year 2040 may exceed 40 percent. Id at xv.

[2] NAPAP Biennial Report to Congress: An Integrated Assessment ("NAPAP Report") at 50–51.

[3] Id. at 49

[4] "In the alpine areas of Colorado, about half of the nitrogen is deposited in snowpack and that is released with the spring thaw. This large release of nitrogen leaches through the soil,

nitrogen in acid rain also contributes to the eutrophication of Long Island Sound and Chesapeake Bay.

Acid rain also has a direct effect on public health. EPA has identified nitrate and sulfate particulates as among the primary constituents of fine particulate matter which are responsible for tens of thousands of premature deaths nationwide. In addition, acidified rainwater may leach lead and other heavy metals out of the soil and water supply pipes, raising the very real possibility of elevated lead levels in drinking water supplies.

The seasonal nature of the acid rain problem

Acidification can take one of two forms: acute or chronic. Most of EPA's work to date has focused on chronic acidification which occurs when the acid precipitation exceeds the neutralizing capacity of a body of water. But, perhaps more important for water bodies fed by snowmelt, in the Rockies, the Adirondack and elsewhere, is the episodic acidification which results from spring snowmelt.

EPA's report to Congress tells us that "pulses of highly acidic water flushing into and through soils, streams, and lakes often expose soil and aquatic biota to short-term, acutely toxic, lethal chemical conditions."[5] EPA has determined that event of episodic acidification are particularly significant because, coming in the springtime when fish are spawning, they can cause complete spawning failures.[6] EPA has determined that approximately 70 percent of the Adirondack lakes can be affected by the worst annual episode.[7]

While the acidity of many of the lakes may return to relatively normal levels after the snow melt ends, the damage to the life in the lake has been done, for that reason at least.

The inadequacy of the current regulatory regime

Acid rain was supposed to be solved by the 1990 amendments to the Clean Air Act. It included two key elements for addressing acid rain and related problems: the acid rain reduction program of Title IV and the Title I controls on nitrogen oxides as a precursor to ozone.

EPA and NAPAP both recognize that the Title IV reduction requirements are insufficient to protect the Adirondacks and other resources threatened by acid rain EPA has estimated "that between 40–50 percent reductions of NOx in the Eastern United States beyond those already required in the Clean Air Act may be necessary simply to keep the number of acidified lakes in the Adirondacks in New York at 1984 levels. "Without additional reductions, the number of acidic lakes in the Adirondacks are projected to increase by almost To percent by 2040.[8]

Not only are the anticipated controls insufficient, but JAPAN projects that NOx emissions will begin to increase in less than 2 years.[9] Nor will EPA's recent SIP call rulemaking sufficiently address acid rain. Any action which focuses only on summertime emissions, like the SIP call, will do little to prevent acid deposition, which in largely a wintertime problem for many parts of this country.

In fact, there is a danger that the SIP call may even be counterproductive in reducing acid rain, because it could nullify the Title IV acid rain controls. Those requirements anticipate year round reductions in NOx emissions.

However, because the Title IV emission requirements are measured on a year-round average, a utility which complies with the stricter requirements of the SIP call in the summertime can meet the Title IV requirements simply by averaging the summertime emission reductions over the rest of the year, thereby allowing emission controls to be turned off in the winter.

EPA recognizes that a year round emission reduction program is needed. In a report issued in August 1997, EPA explained clearly char Wintertime Box emissions reductions are especially important to lessening the incidence and severity of acidic

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removes base cations from the soil, and degrades the quality of streams and lakes." Id. at 62. With regard to the San Bernardino Mountains, the NAPAP Study reports: "Pine forests in the San Bernardino Mountains of Southern California receiving high levels of nitrogen saturation (25 kg/ha/yr) are already nitrogen saturated, while those receiving moderate levels (6–16 kg/ha/yr) show evidence of approaching saturation. Exposure to high levels of sulfur, nitrogen, and ozone, along with drought stress, weakens the trees and leads to premature mortality." Id.

[5] Report to Congress at 9. (emphasis supplied)

[6] Id. at 9–10.

[7] Id. at 14.

[8] 61 Fed. Reg. 671–1, 67115 December 19, 1996).

[9] NAPAP Report at 14.

episodes in certain areas. Continuous year-round NOx controls appear to be the most beneficial for decreasing acid deposition damage to natural resorces." [10]

Yet, EPA has taken no steps to ensure that the SIP call does not nullify the year round emissions reduction requirements of Title IV. A review of the 1990 amendments clearly shows Congress anticipated subsequent legislation may be necessary.

While Congress could have provided EPA with the express authority to require additional NOx reductions, it chose instead to require that EPA simply describe the necessary acid deposition standards, leaving Congress, not the agency, with the choice of whether to enact them.

The EPA and NAPAP reports were intended to provide Congress with the information necessary to enact any further reductions which may be needed.

AN explained above, the results of those reports are now in and the conclusion is unambiguous; protection of the resources threatened by acid rain requires year round emission reductions beyond those anticipated by the Clean Air Act.

Requirements of Effective Acid Rain Legislation

That is why I strongly endorse the Acid Deposition Control Act. It may finally put an end to the damage being caused by acid rain to our environment.

It includes the following elements which I believe are essential in any effective acid rain legislation:

It provides for year-round emission reductions. As explained above, there can no longer be any doubt that much of the worst damage caused by acid rain occurs in the winter and spring, when snowmelt and heavy spring storms send an "acutely toxic, lethal" shock to the lakes, ponds and streams most affected by acid rain. It should be emphasized that the additional cost of operating seasonal controls, as anticipated by the SIP call, on a year round basis is relatively minor.

It will reduce acid rain in a cost-effective manner. In order to meet the SIP call, utilities will have to incur the cost of installing new pieces of control equipment. In order to obtain year-round, rather than seasonal reductions, utilities will simply have to incur the additional cost of operating these controls the other 7 months of the year It has been estimated that state-of-the-art NOx emission controls are twice an cost-effective (measured by cost per ton of NOx removed) when they are operated year-round. [11] Furthermore, the development of an emissions credit trading program further serves to reduce the cost of emissions across an industry.

It requires reductions of emissions rather than creating an administrative process that may lead to the development of further emission limitations. The experience of the past 8 years has demonstrated the need to provide firm direction to EPA. EPA has a poor record of complying with Congressional mandates to identify potential acid rain reduction programs. For example, EPA's response to the requirement that it describe the nature and numerical value of an acid deposition standard was to perform yet another acid rain study, even though NAPAP had already performed $500 million worth of studies. [12] EPA did not even try to comply with another Congressional mandate, that it report to Congress on using the secondary standard provisions of the Act to address welfare effects, such as acid rain. [13]

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[10] Nitrogen Oxides: Impacts on Public Health and the Environment, EPA 452/R–97–002 (August 1997), p. 27.

[11] In a 1995 report prepared for EPA entitled Estimated Effects of Alternative NOx Cap and Trading Schemes in the Northeast Ozone Transport Region, ICF Kaiser estimates that the annual cost-effectiveness of selective catalytic reduction (SCR) is $1,000 to $1,500 per ton, as opposed to its seasonal cost-effectiveness of $2,OOO to $3,000 per ton. Id. at 29. A more detailed analysis, which includes calculations of the annual and seasonal cost-effectiveness of several control strategies, is contained in NESCAUM and MARAMA, Status Report on NOx Control technologies and Cost Effectiveness for Utility Boilers (June 1998), at 77–120. The NESCAUM and MARAMA report concludes all control strategies studied are significantly more cost-effective when operated annually, with SCR and coal reburning technologies being at least twice as cost-effective when operated year round. Id. at 114–16.

[12] See Statement of Dr. James R. Mahoney, Director, National Acid Precipitation Assessment Project (NAPAP), at hearings before the Senate Committee on Energy and Natural Resources, January 24 and 25, 1990, Senate Hearing 101–826, at pg. 115.

[13] Section 817 of P.L. 101–549, required that EPA and the National Academy of Sciences undertake a study on the role of secondary standards in protecting welfare and the environment. Among other things, this study is supposed to "determine ambient concentrations of each [criteria] pollutant which would be adequate to protect welfare ant the environment from such [welfare] effects." EPA was required to take public comment on a draft of the report of the study and provide a final report to Congress no later than November 15, 1993. In response to a recent FOIA request served by the New York Attorney Generals office, EPA has confirmed that it has not even commenced this study, even though nearly 5 years have passed since the deadline for completion of the study. As a result, New York sent EPA, on July 27, 1998, a notice of intent to sue under Section 304 of the Act.

It provides EPA with the explicit authority to require further emission reductions. If shown to be necessary, both EPA and NAPAP, as well as numerous academic institutions, will continue to monitor the resources affected by acid rain. If these research efforts show the need for more emission reductions, this legislation provides EPA with the clear authority to enact new emission reduction requirements, without the need for more legislation.

Time is of the essence, you must act before more natural resources are destroyed.

Summary of STAPPA/ALAPCO Recommendations

STAPPA/ALAPCO
Recommendations for Stationary and Area Sources

SOURCE CATEGORY	STAPPA/ALAPCO RECOMMENDATION
Utility Boilers	Require T-fired and wall-fired coal units to meet levels of 0.15 lb/MMBtu or below, and oil and gas units to meet levels of 0.05 lb/MMBtu (one-hour averaging period). Adopt emission rates based on energy output (e.g., lb/megawatt-hr produced), rather than heat input (e.g., lb/MMBtu). Consider, among other options, emissions averaging among units to lower control costs and provide added flexibility.
Industrial and Commercial Boilers	Set limits for boilers larger than 100 MMBtu/hr at levels of 0.15 lb/MMBtu or below for coal and 0.05 lb/MMBtu for oil and gas. Mid-sized boilers between 50-100 MMBtu/hr can achieve limits of 0.10 lb/MMBtu for gas, 0.12 lb/MMBtu for distillate oil and 0.30 lb/MMBtu for residual oil. Consider setting limits for mid-sized boilers burning coal at 0.38 lb/MMBtu and requiring smaller boilers less than 50 MMBtu/hr to make annual "tune-ups" to minimize excess air.
Process Heaters	Consider requiring limits of 0.036 lb/MMBtu for gas and 0.05 lb/MMBtu for other liquid fuels. Set limits, at a minimum, similar to those for mid-sized industrial boilers — 0.10, 0.12 and 0.30 lb/MMBtu for gas, distillate oil and residual oil-fired units, respectively.
Gas Turbines	Regulate turbines burning natural gas at levels of 25-42 ppm and as low as 9-15 ppm. Regulate turbines burning distillate oil at 65 ppm or below, and as low as 25-42 ppm.
Reciprocating Internal Combustion Engines	Set limits for rich-burn gas-fired engines between 0.4-0.8 g/bhp-hr, for lean-burn engines as low as 0.5-0.6 g/bhp-hr and for diesel engines at 0.5-1.1 g/bhp-hr.
Kraft Pulp Mills	Regulate industrial boilers (see recommendation above for Industrial and Commercial Boilers), recovery boilers (consider SNCR) and lime kilns (see recommendation below for Cement Kilns).
Cement Kilns	Require combustion controls and post-combustion controls (SNCR) to achieve reductions of up to 70 percent on certain processes.

STAPPA/ALAPCO Recommendations for Stationary and Area Sources—*continued*

SOURCE CATEGORY	STAPPA/ALAPCO RECOMMENDATION
Iron and Steel Mills	Require reductions from reheat furnaces using low NO_x burners and FGR (to achieve reductions of 50 percent or more), from annealing furnaces using SCR and low NO_x burners (to achieve reductions of 95 percent or more) and from galvanizing furnaces using low NO_x burners and FGR (to achieve reductions of 75 percent or more).
Glass Furnaces	Require combustion modifications, process changes and post-combustion controls (SNCR). RACT limits of 5.3-5.5 lbs NO_x/ton of glass removed have been adopted, as well as limits as low as 4.0 lb NO_x/ton of glass removed. Require sources to coordinate installation of controls with routine furnace rebuilds to lower costs.
Nitric and Adipic Acid Plants	Consider a standard of 2.0 lbs NO_x/ton of nitric acid produced, representing approximately 95-percent control. Even lower standards are achievable using SCR. The nation's four adipic acid plants are already regulated at over 80-percent efficiency.
Municipal Waste Combustors	Set limits of 180 ppmv based on a 24-hr average for large, existing MWCs emitting more than 250 tons/day, pursuant to EPA's upcoming regulations. Consider more stringent limits (e.g., 30-50 ppmv) or shorter averaging periods (e.g., 8-hr average).
Medical Waste Incinerators	Require controls similar to those for municipal waste combustors.
Ammonia Plants	Set controls based on those for process heaters and industrial boilers.
Organic Chemical Plants	Require controls on industrial boilers and process heaters for these sources.
Petroleum Refineries	Regulate refinery boilers and process heaters in a comparable manner to other industries. Regulate fluid catalytic cracking units by controlling CO boilers (e.g., SNCR). Require SNCR or low NO_x burners on tail gas incinerators to achieve limits of 50 ppm or lower.
Residential Space and Water Heaters	Set limit on new sources of 0.09 lb/MMBtu of heat output and consider incentives to replace older space and water heaters.
Open Burning	Restrict open burning on days when ozone exceedances are expected or reduce the amount of refuse burned by recycling municipal waste or mulching agricultural and landscaping waste.

SOURCE CATEGORY	STAPPA/ALAPCO RECOMMENDATION
Motor Vehicle Inspection and Maintenance	Consider implementation of IM240 in areas not required to adopt such a program, in that IM240 tests for NO_x and requires repairs accordingly. Also consider augmenting the program by expanding geographic coverage, increasing model year and vehicle class coverage and pre-1981 stringency rate, conducting inspections annually and/or setting tighter cutpoints.
Reformulated Gasoline and Diesel Fuel	Consider opting into the federal program or utilizing Section 211(c)(4) authority to adopt a state program, including the California RFG program or one focused on fuel properties (e.g., reducing sulfur content of fuel). Consider adopting reformulated diesel fuel requirements, including the California reformulated diesel program, to achieve additional reductions from diesel engines.
California Low-Emission Vehicles	Consider adopting the California LEV program.
Clean-Fuel Fleets	Consider adopting a CFFV program, if one is not already required. Where a CFFV program is required, increase its reduction potential by purchasing more CFFVs than called for in any year, purchasing vehicles that meet stricter emission standards than those required, or purchasing vehicles in advance, before requirements take effect. Areas may also encourage non-covered fleets to participate and/or require the purchase of ILEVs where fleet requirements from the Energy Policy Act are applicable.
Nonroad Vehicles and Engines	In addition to EPA's regulations on 50-hp and above nonroad diesel engines, explore scrappage programs, among others, for near-term reductions and to increase turnover of these sources, particularly for construction equipment.
Transportation Control Measures	Evaluate the potential effectiveness of TCMs based upon the particular needs and circumstances of a given area, emphasizing pricing strategies, such as parking management, traffic flow improvements and road pricing.
Employee Commute Options	In areas not already required to implement an ECO program, evaluate the potential emission reductions to be achieved by implementing such a program and consider its implementation to achieve additional reductions and stabilize mobile source emissions.
Accelerated Vehicle Retirement	Consider implementing an accelerated vehicle retirement, or "scrappage," program in conjunction with an I/M program.

Observations from the Hubbard Brook Experimental Forest on the Environmental Effects of Changes in Sulfur Dioxide Emissions

In 1972 scientists from the Hubbard Brook Ecosystem Study reported that rainfall and snowfall in the northeastern United States had become increasingly acidic. In response to this discovery, Congress passed the Clean Air Act of 1970 and its subsequent amendments of 1990. The 1990 Amendments called for a 50 percent reduction of sulfur dioxide emissions below 1980 levels by the year 2010. Minor cuts in emissions of nitrogen oxides were also included.

The following observations from the Hubbard Brook Ecosystem Study (HBES) are relevant to the recent 1998 National Acid Precipitation Assessment Program biennial report to Congress and subsequent news stories. This information draws from research conducted as part of the HBES by Drs. Gene E. Likens, Charles T. Driscoll, F. Herbert Bormann and Mr. Donald C. Buso. The HBES is conducted at the USDA Forest Service Hubbard Brook Experimental Forest, West Thornton, New Hamp-

shire. Initiated in 1963, it is the longest running ecosystem study of its kind, and the site where acid rain was first documented in North America.

Progress Since the Clean Air Act: Headed in the Right Direction?

The combustion of fossil fuel to produce energy generates sulfur dioxide (SO_2) and nitrogen oxides (NOx) as by-products. Once emitted into the atmosphere, they mix with water to form sulfuric and nitric acid and are transported by prevailing winds to the northeastern U.S. where they fall to the ground in rain and snow. It has been well documented that acidity at Hubbard Brook is largely associated with human-produced emissions, rather than natural acidification processes.

After the passage of the 1970 Clean Air Act and the 1990 Clean Air Act Amendments (CAAA), electric utilities nationwide cut SO_2 emissions 31 percent from 17.2 million tons in 1980 to 11.9 million tons in 1995. Long-term measurements as part of the HBES show a roughly 45 percent decrease in sulfate in rain and snow since 1963.

Likewise, stream water chemistry has shown some improvement. Sulfate in stream water at Hubbard Brook has decreased approximately 30 percent since 1963. This decrease is consistent with declines in SO_2 emissions and sulfate in precipitation. The amount of toxic aluminum leached by acid rain from soils to stream water has also declined.

These important gains in rain, snow and stream water chemistry indicate that reductions in SO_2 emissions have been important to the control of acid rain and the potential reversal of its effects. Nevertheless, continued acid inputs and marked changes in soil chemistry have hindered the rate and magnitude of ecosystem recovery. This suggests important lessons for policymakers.

Recent Research Shows Recovery Impeded—New Link to Forest Health

Despite reductions in SO_2 emissions, there has been little improvement in acid levels in rain, snow and stream water at Hubbard Brook. Scientists predict that, with current pollution control measures, the acid-base status of stream water will not return to pre-industrial revolution levels in the foreseeable future. Reasons for this arrested recovery include the failure of the 1990 CAAA to address NOX emissions fully, as well as the recently identified changes in soil chemistry resulting from acid rain.

The policy debate of the 1980's focused almost exclusively on SO_2. This emphasis on sulfur obscured the role of other elements in acid rain and in the acid-base balance of soils and surface waters. Data show that NOX emissions contribute significantly and increasingly to acid rain. Scientists estimate that nitrogen may now constitute 25–50 percent of acid in precipitation. It is reasonable to suggest that further recovery from acid rain may require cutting NOX emissions beyond the 2 million tons called for in the 1990 CAAA.

Recent Hubbard Brook research reported in the journal Science links atmospheric dust, acid rain and forest health. Scientists found that the amount of calcium in the soil has declined by more that 50 percent since 1950. Acid rain has stripped away plant nutrients such as calcium and magnesium from soil particles. These essential nutrients, called base cations, are then leached out to streams and rivers and lost from the ecosystem. Years of leaching has depleted the antacid-like elements from the soil. With a diminished ability to neutralize acid, many forests are now more sensitive to continued inputs of acid rain and snow. Further, this loss of essential plant nutrients may prove limiting to biomass accumulation in forests. Overall, the depletion of base cations appears to retard the recovery of forests in response to decreases in SO_2 emissions.

Public Policy Implications

The progress made in rain, snow and stream water chemistry verify the value of the SO_2 emissions reductions called for in the 1990 CAAA. Yet, continued acidity of precipitation and surface waters at Hubbard Brook, and new links to long-term forest health, demonstrate that the acid rain problem has not been solved. Furthermore, the environmental effects of acid rain appear to be more subtle and insidious than first expected.

Leaching of base cations from the soils of the Hubbard Brook Experimental Forest by acid rain over the past 50 years has reduced their neutralizing capacity. As a result, the reductions mandated by the 1990 CAAA are necessary but not sufficient to protect sensitive forest and aquatic ecosystems in the northeastern United States from continued inputs of acid rain. The policy implication of this research may likely be that current SO_2 and NOX emission limits are not adequate to achieve the level of ecosystem recovery envisioned by the 1990 CAAA. It is clear that continued long-

term monitoring of acid rain and the health of forest and stream ecosystems is critical to assessing past legislation and directing future policy.

STATEMENT OF THE NEW ENGLAND COUNCIL

The New England Council would like to take the opportunity of this hearing on acid rain to restate its position on the important issue of ozone transport and the recent ruling by the EPA. In particular we believe this is important since nitrogen oxide is a primary component of smog and acid rain. The business community of our six state region, after several years of advocacy, is extremely gratified that EPA has set a course of action that will improve the air quality and economic competitiveness of the Northeast. The Council feels that EPA has put forth a solution that is equitable and cost-effective for all of the 22 states that make up the Northeast.

Since the time of the Clean Air Act of 1970, New England states and industries have struggled with the problems associated with ozone transport. Despite gradual mandatory and voluntary emission reductions over the years, the New England region was still unable to meet federally mandated air quality standards for public health due to the pollution that was crossing over its boarders from other regions. Other difficulties have included a chilling effect on industrial locations and expansions and the threat of monetary penalties.

The New England Council views this action as EPA's first effort to protect public health in downwind states from the smog that originates in upwind areas. Not only does it recognize that it is the coal burning utilities and industries in the Midwest and South that generate a degree of our background pollution, but importantly, it holds these areas responsible for its clean up. It is worth mentioning that this plan will also significantly improve the air quality around these large emission sources, enhancing air quality for citizens in these regions.

The opponents of this proposal claim that electricity reliability and the overall economy of the Midwest and South are at risk. New England utility companies have proven that conservation initiatives can be incorporated into management and operations to the benefit of its surroundings and bottom line. With very careful planning New England utilities were able to retool most of its power plants with the necessary controls during regularly scheduled maintenance checks to avoid interruptions. Similarly EPA's plan allows for the most economical reductions to be found utilizing the emissions "cap and trade" program.

The Northeast States for Coordinated Air Use Management (NESCAUM) estimated in a recent study that it would cost the economy of the Northeast up to $4 Billion if EPA's proposal did not go through as originally written. Again, the New England Council is pleased that EPA has finalized this plan. We feel that there is still much to do to be sure that the technical aspects are understood and that the implementation of the rule has no unintended consequences.

The New England Council is a broad-based business organization that represents the interests of the New England economy. Its mission is to promote Federal policies and legislation that improve the business climate of the region. It has offices in Boston and Washington, D. C.

STATEMENT OF THE OZONE ATTAINMENT COALITION

Audubon Society of New Hampshire
Connecticut Fund for the Environment
KeySpan Energy Company
Natural Resources Defense Council
PACE Energy Project
Public Service Electric & Gas
U.S. Generating Company
Central Maine Power Company
Consolidated Edison
Merck & Company
Northeast Utilities
PECO Energy Company
The United Illuminating Company
October 13, 1998

The Ozone Attainment Coalition has been an active participant throughout the Ozone Transport Assessment Group (OTAG) process and in EPA's regulatory development of the recently adopted NOx SIP Call regulations affecting 22 eastern states. The Coalition believes that EPA's action will result in cost-effective NOx re-

ductions and provides each of the affected states with sufficient flexibility to meet its NOx budget requirements.

The Ozone Attainment Coalition is composed of 13 organizations, including eight electric generating companies, and national, northeast-regional, and state-based environmental advocacy groups. The Coalition supports the adoption of effective regulatory programs that are designed to achieve timely implementation of cost-effective ozone precursor emission reductions in the eastern United States, as a means substantially to reduce regional ozone transport.

The Coalition is concerned that comments made during the October 6, 1998 hearing on S. 1097, the Acid Deposition Control Act, before the Senate Committee on Environment and Public Works Subcommittee on Clean Air, Wetlands, Private Property and Nuclear Safety regarding the impacts associated with EPA's NOx SIP Call regulations represented only one perspective, a perspective that the Coalition believes is inaccurate.

Enclosed for your review are two Coalition reports: "A Comparison of EPA's Proposed NOx SIP Call and an Alternate NOx Reduction Proposal," and "Comparison of Projected Cost Impacts of Implementing NOx Controls Needed to Reduce Ozone Transport in the Eastern U.S.," submitted to the EPA docket during the NOx SIP Call comment period. The first of these reports found that the Midwestern/Southeast Governors alternative proposal would deliver less than a 10 percent electric utility NOx reduction benefit, as compared to EPA's proposed 65 percent reduction. The second report found a surprising degree of agreement among six electric utility cost assessments, including those proposed on behalf of Midwest electric utility companies.

I hope that these reports will be of assistance in assessing the projected impacts associated with EPA's NOx SIP Call regulation. Please contact me should you have any questions regarding these reports or if additional related information would be of further assistance to you.

NESCAUM, NORTHEAST STATES FOR COORDINATED AIR USE MANAGEMENT

OZONE TRANSPORT IN THE EASTERN UNITED STATES—OCTOBER 1998

ONCE SOMETHING IS SEEN, IT CANNOT BE MADE TO BE UNSEEN

Bertolt Brecht, The Life of Galileo

The U.S. Environmental Protection Agency is in the process of implementing a regional strategy ("NOx SIP call") in 22 eastern states to reduce oxides of nitrogen (NOx), an important pollutant responsible for ozone (smog) formation. Both supporters and detractors of EPA's NOx SIP call cite work by the Ozone Transport Assessment Group (OTAG) in support for their positions, but their respective arguments sometimes omit reference to a large body of information on ozone transport appearing in the peer-reviewed scientific literature.[1] While OTAG was an important process that informed many state and Federal policymakers, it did not break new ground in the scientific understanding of the regional ozone problem.

The purpose of this paper is to present a brief synopsis of the scientific literature developed over the past 30 years that is relevant to the issue of ozone transport in the eastern United States.[2] Numerous studies that have passed scientific peer review appear in well-regarded journals specializing in the atmospheric sciences. A review of this literature finds that ozone transport has been recognized by scientific researchers decades before the creation of OTAG. While not all policymakers and industry stakeholders seem to recognize (or perhaps understand) this body of literature, it provides a strong, consistent, and independent supporting basis for EPA's

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[1] See, e.g., K. Jones & J. Bucher, "Will Reducing Transported Ozone Improve Regulatory Compliance?," Envtl. Mgr., pp. 11–16 (July 1998). The article asserts EPA's NOx SIP call has little scientific merit, citing statements from "OTAG scientists" but with no citations to the peer-reviewed scientific literature. While the author of the present paper holds a Ph.D. in chemical physics and participated in OTAG, he does not consider himself an "OTAG scientist" nor is he aware of any formal group of such persons. OTAG was a consensus-building effort among state and Federal policymakers and scientists, industry stakeholders and public interest groups, but was not a scientific research effort in any traditional sense.

[2] In the spirit of full disclosure, the author freely admits that he supports EPA's NOx SIP call and has argued for regional NOx strategies even prior to the formation of OTAG. See P.J. Miller, "Cutting Through the Smog: The 1990 Clean Air Act Amendments and a New Direction Toward Reducing Ozone Pollution," Stanford Envtl. Law Journal, Vol. 12 pp. 124–163(1993).

NOx SIP call that was not subject to the political and stakeholder positioning of the OTAG process.

The transport of ozone in power plant plumes has been known since at least the 1970's. Measurements of individual power plant plumes have documented high ozone levels transported within power plant plumes in Maryland [Davis, et al., 1974], from Wisconsin into Michigan [Miller, et al., 1978], from Tennessee into Indiana [Gillani, Kohli & Wilson, 1981], from Missouri toward Chicago [Gillani & Wilson, 1980; White, et al., 1983], and across southern Alabama and Mississippi [Ridley, et al., 1998]. These studies show that NOx in power plant plumes produces ozone approaching or exceeding health standards, and the ozone can travel long distances into neighboring states. Two of the power plant studies also found that individual power plant plumes can produce ozone on a regional scale comparable to the amount of ozone generated in an urban plume [White, et al., 1983; Ridley, et al. 1998]. The two studies also demonstrate that power plant plumes and urban plumes both contribute to downwind ozone transport.

Within the Ohio River Valley, where the concentration of large coal-fired power plants is greatest, there is a large and persistent area of high ozone during the summer months relative to air in other parts of the country [Husar, 1996]. In this region, winds intermingle ozone pollution from different power plant plumes (as well as other pollution sources). Because of this mixing, a large "reservoir" of ozone is formed across much of the east-central United States. People living in southern Indiana, southern Ohio, northern Kentucky and much of West Virginia can breathe elevated ozone over a more prolonged period of time than people living in Chicago or Boston.

In addition to public health impacts, natural resources are affected by transported smog. Scientists are raising concerns that prolonged ozone exposure can increase the death rates of trees in forests of the Appalachian region [Heck & Cowling, 1997; Wills, et al., 1997]. This will alter the long-term tree composition of eastern forests, thereby affecting the forests' value as timber and recreational resources. National parks in the East, once thought to be pristine, are especially vulnerable to transported pollution from sources far upwind. For example, beginning on the night of July 12, 1997 just prior to a severe ozone episode in the Northeast, an ozone monitor in Shenandoah National Park, VA recorded a rolling 8 hour average ozone concentration above the Federal 8-hour standard that lasted for 28 consecutive hours [Source: USEPA AIRS data base].

The large ozone reservoir in the Ohio River Valley returns each summer with little abatement. Researchers at Harvard University have found no significant downward trend in regional ozone levels from 1980 to 1995 [Five, et al., 1998]. This is due in large part to the lack of NOx reductions from power plants. While urban NOx levels have decreased (as have urban ozone levels in a few large metropolitan areas) due to pollution controls on automobiles, regional ozone and NOx levels have not significantly changed. In fact, between 1987 and 1996, NOx emissions from power plants rose by 3 percent [EPA, 1998]. Because regional ozone is more sensitive to NOx emissions than VOCs (volatile organic compounds), the lack of significant NOx reductions from power plants is impeding progress toward reducing regional ozone levels.

The demonstrated existence of regional ozone transport in the Midwest and Ohio River Valley calls for a regional strategy to reduce power plant pollution. Regional transport, however, is not limited only to these areas. A regional NOx control strategy is even more imperative in light of clear evidence that large amounts of ozone and its precursors are transported out of the Ohio River Valley and into the Northeast.

The movement of ozone from the Ohio River Valley into the Northeast was seen as early as 1979. During early August 1979, scientists tracked a mass of ozone leaving Ohio, crossing Pennsylvania and southern New York, and entering into the Northeast Corridor [Clarke and Ching, 1983]. When this mass of air from the Ohio River Valley entered into the Northeast Corridor, it contained about 99 parts per billion (ppb) of ozone and had the potential of generating an additional 35 ppb without the addition of any new emissions from within the Northeast. Therefore, despite even the most stringent possible controls within the Northeast, the amount of background ozone seen entering the Northeast can cause exceedances of air quality standards.

As the persistent ozone reservoir re-establishes itself every summer in the Ohio River Valley, large amounts of ozone continue to be transported into the Northeast from the west. During the summer of 1995, the North American Research Strategy for Tropospheric Ozone-Northeast (NARSTO-NE) conducted aircraft measurements of ozone in air masses along the western edge of the Northeast Corridor. During overnight hours, scientists measured ozone levels above Shenandoah, VA, Gettys-

burg, PA, Poughkeepsie, NY and other locations in excess of 100 ppb [Lurmann, et al., 1997; Zhang, et al., 1998; Ryan, et al., 1998]. During this time of night, the ozone could not have been formed locally (no sunlight is present to initiate the formation of ozone), so it must have been transported during the pre-dawn hours. Wind direction measurements during the highest ozone days (e.g., July 14, 1995) indicated the air flow was out of the west [Blumenthal, et al., 1997], therefore the ozone traveled into the Northeast from points to the west, i.e., the Ohio River Valley.

Consistent with these field studies are evaluations of air mass histories associated with the highest ozone levels observed in southern New England. In a recent study, university researchers found that the highest ozone levels observed at a site in rural Massachusetts are associated with air masses arriving from the west, i.e., source regions in the Midwest [Moody, et al., 1998]. Based on an analysis of air masses arriving in Massachusetts, the researchers concluded:

Anthropogenic pollutants (combustion-derived products) were highest under [southwest] flow conditions, which were generally warm, moist, and relatively cloudy. This is indicative of warm sector transport. The highest O3 concentrations did not occur under these conditions, which had a low O3 production efficiency. Instead, the highest average summer O3 occurred under [west] flow. . . which delivered well-aged air masses with high O3 production efficiency. This implies an important contribution of adverted pollutants from Midwest source regions[.] [Ibid.]

Ozone trapped aloft and transported during overnight hours has been quantitatively shown to contribute significantly to ground-level ozone concentrations experienced later in downwind regions as the aloft ozone is mixed back down to the ground [McElroy & Smith, 1993; Berkowitz, et al., 1998; Zhang, et al. 1998]. The field observations of high ozone concentrations mixing down to the ground during later daylight hours demonstrate that reducing aloft ozone is more than of theoretical importance.

With transported ozone pollution levels in excess of 100 ppb during pre-dawn hours, the Northeast is already over 80 percent on the way to a 1-hour ozone exceedance before the sun rises. The Northeast is in the predicament of achieving the 1-hour 120 ppb and the 8-hour 80 ppb Federal ozone standards in situations where 100 ppb of the ozone is beyond its control. The high levels of transported ozone virtually guarantee that the Northeast will not achieve air quality goals without regional NOx reductions.

The extent of regional ozone transport into the Northeast from the Midwest is also seen in modeling by the Ozone Transport Assessment Group (OTAG). OTAG modeling predicts significant decreases in ozone above 120 ppb in major metropolitan areas of the Northeast due to reductions in emissions from source regions in the Midwest (Table 1).

Table 1. Percent reduction in ozone exposure above 120 ppb predicted for downwind receptor areas by OTAG modeling for the July 1995 ozone episode. Reductions are due to "turning off" all anthropogenic NOx and VOC emissions in the respective source regions. The ozone exposures were calculated by OTAG in units of concentration (parts per million) times time (hours) times area (square kilometers), or ppm-hrs-km^2.

Percent Reduction in Ozone Exposure above 120 ppb In Northeast Metropolitan Areas

	New England area	New York City area	Philadelphia area	Baltimore-Washington DC area
Source region of emissions.				
Parts of IN, MI, OH	−7 percent	−11 percent	−15 percent	−12 percent
Parts of IL, IN, KY, MO	−4	−5	−11	−11
Parts of IN, KY, OH, WV	−12	−16	−41	−43

The July 1995 modeling data used to derive the percentage reductions of Table I can be found at the OTAG Northeast Modeling and Analysis Center (NEMAC) web address: http://sage.mcnc.org/OTAGDC/aqm/uamv/jul95.

When interpreting the modeling work of OTAG, one must be careful to place the results in the context of what is known about the physical world. Computer modeling can be interpreted to support almost any view if the interpretation is not constrained by real-world observations. A case in point is the OTAG modeling result for July 16, 1991 that is often cited as evidence for the lack of ozone and precursor transport. The OTAG Modeling Report (Draft 1.1, February 12, 1997, p. 47) states:

Unfortunately, model performance based on surface measurements in the upper Midwest is poorest on July 16 and 17 [1991 OTAG episode]. This poor performance

is also seen aloft on these 2 days. Simulated ozone concentrations are about 30 to 60 ppb lower than the observations.

Because long-distance ozone transport occurs aloft, not at ground level, a model that poorly represents aloft ozone is virtually guaranteed to underestimate ozone transport. This is not to say that models should not have a role in developing regional solutions to the ozone problem, but that model interpretations should be bounded by real-world observations so that the greatest confidence will be given to modeling results which best comport with field measurements.

A compelling need emerges for regional NOx reductions when the modeling results are put in the context of the real-world measurements of ozone transport. Power plants are responsible for about 50 percent of the NOx emissions in the Ohio River Valley, and represent the single largest pool of available low-cost reductions in the eastern United States. Even with the most stringent emission controls applied in the Northeast, ozone levels in excess of 100 ppb seen entering the region from the west will prevent the people of the Northeast from breathing clean air.

References

Berkowitz, C.M., J.D. Fast, S.R. Springston, R.J. Larsen, C.W. Spicer, P.V. Doskey, J.M. Hubbe, & R. Plastridge 1998. Formation Mechanisms and Chemical Characteristics of Elevated Photochemical Layers over the Northeast United States, J. Geophys. Res., Vol. 103, pp. 10,631–47.

Blumenthal, D.L., et al. 1997. Transport and Mixing Phenomena Related to Ozone Exceedances in the Northeast U.S., Sonoma Technology Report STI–996133–1710-WD1.1, February.

Clarke, J.F. & J.K.S. Ching 1983. Aircraft Observations of Regional Transport of Ozone in the Northeastern United States, Atmos. Envt., Vol. 17, pp. 1703–12.

Davis, D.D., G. Smith & G. Klauber 1974. Trace Gas Analysis of Power Plant Plumes Via Aircraft Measurement: O3, NOx, and SO_2 Chemistry, Science, Vol. 186, pp. 733–36.

EPA 1998. National Air Quality and Emissions Trends Report, 1996, EPA 454/R–97–013, p. 17, January.

Fiore, A.M., D.J. Jacob, J.A. Logan, & J.H. Yin 1998. Long-Term Trends in Ground Level Ozone over the Contiguous United States, 1980–1995. J. Geophys. Res., Vol. 103, pp. 1471–80.

Gillani, N.V., S. Kohli, & W.E. Wilson 1981. Gas-to-particle conversion of sulfur in power plant plumes-I. Parametrization of the conversion rate for dry, moderately polluted ambient conditions, Atmos. Envt., Vol. 15, pp. 2293–2313.

Gillani, N.V. & W.E. Wilson 1980. Formation and transport of ozone and aerosols in power plant plumes, Annals N.Y. Acad. Sciences, Vol. 338, pp. 276–296.

Heck, W.W. & E.B. Cowling 1997. The need for long term cumulative secondary ozone standard -An ecological perspective, Envt. Mgr., pp. 23–32, January.

Husar, R.B. 1996. Spatial Pattern of daily maximum ozone over the OTAG region, Web address: http://capita.wustl.edu/OTAG/Reports/otagspat/otagspat.html.

Lurmann, F.W., et al. 1997. Evaluation of the UAM-V Model Performance in the Northeast Region for OTAG Episodes, Sonoma Technology Report STI–996133–1716-WD2.1, March.

McElroy, J.L. & T.B. Smith 1993. Creation and Fate of Ozone Layers Aloft in Southern California, Atmos. Envt., Vol. 27A, pp. 1917–1929.

Miller, D.F., A.J. Alkezweeny, J.M. Hales, & R.N. Lee 1978. Ozone Formation Related to Power Plant Emissions, Science, Vol. 202, pp. 1186–88.

Moody, J.L., J.W. Munger, A.H. Goldstein, D.J. Jacob, & S.C. Wofsy 1998. Harvard Forest Regional-Scale Air Mass Composition by Patterns in Atmospheric Transport History (PATH) J. Geophys. Res., Vol. 103, pp. 13, 181–94.

Ridley, B.A., J.G. Walega, J.-F. Lamarque, F.E. Grahek, M. Trainer, G. Hubler, X. Lin, & F.C. Fehsenfeld 1998. Measurements of Reactive Nitrogen and Ozone to 5-km Altitude in June 1990 over the Southeastern United States, J. Geophys. Res., Vol. 103, pp. 8369–88.

Ryan, W.F, B.G. Doddridge, R.R. Dickerson, R.M. Morales, K.A. Hallock, P.T. Roberts, D.L. Blumenthal, J.A. Anderson, & K.L. Civerolo 1998. Pollutant Transport During a Regional O3 Episode in the Mid-Atlantic States, J. Air & Waste Manage. Assoc., Vol. 48, pp. 786–797.

White, W.H., D.E. Patterson & W.E. Wilson, Jr. 1983. Urban Exports to the Nonurban Troposphere: Results from Project MISIT, J. Geophys. Res., Vol. 88, pp. 10, 745–52.

Wills, K., O. Loucks, P. Kalisz, A. Fritsch, A. Rees, & W. Davidson 1997. Patterns of Forest Health: A Report on Citizen Monitoring in the Eastern Mountains 1994–97. The Lucy Braum Association, September.

Zhang, J., S.T. Rao & S.M. Daggupaty 1998. Meteorological Processes and Ozone Exceedances in the Northeastern United States during the 12–16 July 1995 Episode, J. Applied Meteorology, Vol. 37, pp. 776–789.

NESCAUM NORTHEAST STATES FOR COORDINATED AIR USE MANAGEMENT,
October 9, 1998.

HON. DANIEL PATRICK MOYNIHAN,
U.S. Senate
Washington, DC 20510

DEAR SENATOR MOYNIHAN: The Northeast States for Coordinated Air Use Management (NESCAUM) is writing to commend your efforts to address the continuing problem of acid rain in the eastern United States. As you are well aware, acidic deposition from emissions of sulfur dioxide (SO_2) and nitrogen oxides (NOx) are of special concern to our region. The Conference of New England Governors and Eastern Canadian Premiers recently passed an acid rain action plan that seeks to go beyond the provisions contained in Title IV of the 1990 Clean Air Act Amendments. While Title IV has been a great success in achieving significant SO_2 reductions at far lower costs than industry projections, there is a growing consensus that Title IV controls are not sufficient to protect sensitive ecological areas. Of particular concern is the inadequacy of Title IV NOx controls. We commend S. 1097's provision to require year round NOx controls. By building upon the seasonal control requirements recently promulgated by the U.S. EPA, S. 1097 will achieve significant and extremely cost effective environmental improvement.

At the recent October 6, 1998 hearing on S. 1097, two witnesses devoted substantial time to criticizing the smog transport rule recently finalized by EPA. (Testimony of Edward Kropp, Assistant Chief of the West Virginia Of floe of Air Quality, West Virginia Division of Environmental Protection; Testimony of William F. Tyndall, Vice President, Environmental Services, Cinergy Corp.) Because the testimony challenging EPA's smog plan strayed from the expected focus of the subcommittee hearing, we are concerned that the subcommittee received an unbalanced view of the EPA's smog plan. To remedy this imbalance, we would like to provide you with the Northeast states' understanding of ozone transport and cost-effective NOx control options.

Long-Range Ozone Transport is Well Documented

The independent scientific community has long recognized the formation and transport of ozone smog. In 1973, shortly after passage of the first Clean Air Act, scientists assessing New York State's ozone problem concluded, "local urban photochemical generation of ozone is not the dominant mechanism of ozone production. . .the high urban concentrations are principally the result of transport and mixing of ozone rich air into the city from the surrounding air mass." (see Coffey & Stasiuk Envtl Sci & Tech 1975). In 1976 the Organization for Economic Cooperation and Development (OECD) and the U.S. EPA sponsored an international conference on ozone transport. The published Summary Review for the Conference offers the following conclusions:

- elevated oxidant/03 concentrations can originate from upwind sources as far away as 1000 kilometers (km) or more; and
- regional (multistate) controls programs are needed, rather than on a state-by-state basis. (see Altshuller, JAPCA 1978) Given that over 20 years have passed between these conclusions and EPA action, arguments that EPA has acted rashly should be afforded little merit.

In 1991, the National Research Council reviewed hundreds of empirical studies supporting and challenging ozone transport. The resulting report "Rethinking the Ozone Problem in Urban and Regional Air Pollution," confirms the presence of multi-day ozone transport episodes in eastern United States.

Generally, those seeking to dismiss or diminish the magnitude of ozone transport rely solely on computer modeling devoid of reference to the real world. Certainly, predictive models are necessary when seeking to evaluate and compare the effects of future scenarios. However, skepticism is appropriate when confronted with assertions based entirely upon predictive models to assess transport episodes that occurred in the past. We know ozone transport exists because we see it. Ozone levels in excess of 0.10 parts per million (ppm) have been observed entering the Northeast Corridor during field studies as early as 1979. The magnitude of transported ozone makes it extremely difficult, if not impossible, to achieve the ozone public health standards of 0.12 ppm (1-hour average) and 0.08 ppm (8-hour average) in the Northeast.

Additional evidence of long-range transport is provided by measured violations of the ozone standard at remote sites in the eastern U.S. Field measurements at Acadia National Park in Maine, Shenandoah National Park in Virginia and Great Smoky Mountains National Park on the North Carolina/Tennessee border have all recorded substantially elevated ozone levels during the night or early morning hours when local ozone production is not possible due to the absence of sunlight. There is no logical explanation for these violations other than long range ozone transport.

At the October 6, 1998 Senate subcommittee hearing, Edward Kropp, West Virginia Division of Environmental Protection, cited an ozone transport limit of 150–200 miles. This assertion is not supported by actual field measurements of ozone transport in the eastern United States. While the absolute distance ozone travels varies among pollution episodes, Mr. Kropp's assertion underestimates measured ozone transport by at least a factor of three. We are attaching two NESCAUM documents providing an overview of the peer-reviewed scientific literature on ozone transport, as well as information developed by the Ozone Transport Assessment Group. The numerous studies of ozone transport in the eastern United States that have undergone peer review by the scientific community embody a more objective view of ozone transport than was provided in testimony previously submitted to the Senate subcommittee.

Transport Rule Can Be Met With Highly Cost-Effective Measures

Controlling NOx emissions from large power plants is the most cost-effective strategy remaining in the eastern United States. Often times, states and EPA will adopt technology forcing regulations requiring the development of new pollution control approaches and greatly complicating cost-estimation. The transport rule however, is not a technology forcing regulation. In fact, the technologies to meet the emission limits contained in the rule have been in use domestically and abroad for many years. To assess utility compliance costs, NESCAUM conducted a study relying upon the real-world cost and operating experience from actual installations of advanced NOx control systems at 14 U.S. facilities involving 52 coal, gas and oil fired boilers. The results, which summarize over 40 boiler years of actual experience with advanced controls, indicate that most coal power plants can achieve a reduction of up to 90 percent (or a 0.15 lb/mmBtu NOx emission rate) at a cost of $790-$1,200/ton. Even greater reductions are technologically feasible and cost effective. NESCAUM estimates that a 0.07 lb/mmBtu NOx emission rate can be achieved at some coal power plants in a cost range of $1,890-$3,350/ton. With a regional trading system, NESCAUM believes that the average compliance costs for the electric power industry will be substantially less than the $ 1,700/ton figure predicted by EPA. ("Status Report on NOx Control Technologies and Cost Effectiveness for Utility Boilers," June 1998 (attached)).

Transport Rule is a Responsible & Equitable Step Toward Clean Air

The EPA transport rule does not seek to control all the ozone-forming NOx emissions that undermine regional air quality. Instead, EPA focuses only on what it deems are the most "highly cost effective" controls (those estimated to cost less than $2,000/ton), leaving many other reasonably cost effective measures untapped. Far from a "one size fits all" strategy, the Transport rule presents a responsible first step that we in the Northeast and other regions must build upon in order to achieve clean air. Believing that additional pollution reduction measures beyond the smog transport rule must be implemented in the Northeast, the NESCAUM states held a workshop on September 16, 1998 in New York City to receive public comment and recommendations on future control strategies. All testifying agreed that additional local measures are needed in the Northeast. Several Northeast industry representatives asserted the concern that additional measures are likely to be far more costly per ton than the measures required by the transport rule. This recognition underscores the importance of achieving NOx reductions from all cheaply controlled sources both in-region and upwind. A recent analysis by NESCAUM determined that without the EPA regional NOx rule, it will cost the Northeast States $1.4 to $3.9 billion annually for local measures to offset transported ozone. While the Northeast will still likely incur many of these costs, diminishing upwind transport will allow these relatively more expensive local controls to make progress toward meeting health standards, rather than simply compensating for upwind pollution. ("The Costs of Ozone Transport: Achieving Clean Air in the East," July 1998 (attached).

Conclusion

We are confident that the wealth of information on the science of ozone transport provides an objective, independent basis for EPA's smog transport rule. Moreover, controlling large coal-fired power plants is a proven and extremely cost effective

means of reducing local and regional air pollution. It is unfortunate that some are so accustomed to their inequitable position that they will oppose cost-effective solutions in favor of the continued ability to harm their neighbors' health and economies. As the drafters of the Clean Air Act well understood, the perverse incentives created by interstate pollution transport necessitate Federal intervention. At long last, EPA has employed the authority granted by Congress to protect states from pollution beyond their control. Your efforts to reduce NOx emissions on an annual basis will go a great deal farther in protecting the air we breathe and the natural world we live in.

Sincerely,

JASON S. GRUMET, *Executive Director,*
NESCAUM.

TECHNICAL SUPPORT DOCUMENT FOR ALTERNATIVE PROPOSAL BY THE SOUTHEAST/MIDWEST GOVERNORS' OZONE COALITION

EXECUTIVE SUMMARY

In a letter to President Clinton, dated March 9, 199S, the Governors of several southeast and midwest States committed to the preparation of a plan to achieve compliance with the nation's ozone ambient air quality standard in an effective and common sense manner. These Governors, having organized themselves as the Southwest/Midwest Governor's Ozone Coalition ["Coalition"], now offer a proposal that will:

- Fully accomplish the purposes of USEPA's ozone transport proposal without imposing overly prescriptive Federal solutions to problems that affected States are fully prepared to address;
- Equitably distribute the reductions where needed most;
- Be more consistent with the available science on regional transport;
- Alleviate any significant contribution of our States beyond our borders;
- Be more consistent with the requirements of the Clean Air Act and the flexibility and the goals articulated in your directive to USEPA in July, 1997;
- Assure that electricity supplies in the eastern United States will not be disrupted as initial steps are taken to clean the emissions of power plant and large industrial boilers; and
- Reflect our commitment to take whatever other steps that science and good public policy point us toward in the next 3 years to assure that clean air goals are met.

The Coalition calls for States to assess the reductions that will assure that the 8-hour [1] ozone ambient air quality standard will be achieved by the fall of 2009, well in advance of the deadlines set forth in the Federal Clean Air Act. To accomplish this objective, the Coalition proposes to complete attainment plans which identify reductions of both nitrogen oxides (NOx) and volatile organic compounds (VOCs) as may be needed to achieve compliance with the ozone standard. Modeling and other analytical work necessary to make this determination would be completed by 2001, legally enforceable control requirements would be adopted by 2003, and emission reduction controls would be implemented by sources prior to the start of the ozone season in 2007.

Even in advance of completing the modeling work necessary to determine the emission reductions appropriate to achieve the 8-hour standard, the Coalition calls for electric utility generating units to substantially reduce their emission of nitrogen oxides. Most Coalition States will require the system wide reduction of NOx emissions from electric utility generating units to at least 65 percent or .25 lb/MMBtu, whichever is less stringent, (from 1990 levels). These reductions will be in place by April, 2004, unless a demonstration is made to the State that an additional year is necessary to avoid any demonstrated energy disruption.

To assure early progress in achieving the Coalition's emissions reduction goal, most Coalition States will require the reduction of NOx emissions by 55 percent (from 1990 levels) or .35 lb/MMBtu, whichever is less stringent, by April 2002. An additional year to achieve this reduction would be allowed to avoid any demonstrated energy disruption.

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[1] The States of Michigan, Ohio and West Virginia have joined as Plaintiffs in the consolidated case styled American Trucking Associations. Inc. et. al. v. EPA Docket No. 97–1441, pending in the United States Court of Appeals for the District of Columbia.

The Coalition also calls for large non-utility sources of NOx requiring that other large (greater than 250 MMBtu) be subject to Reasonably Available Control Technology (RACT) by April 2003.

SOUTHEAST/MIDWEST GOVERNORS OZONE COALITION OZONE ATTAINMENT PLAN

1.0 Introduction

By letter dated March 9, 1998, the Governors of several midwestern and southern States advised President Clinton of their great concern over the November 7, 1997 proposal by the United States Environmental Protection Agency (EPA) to address the transport of ozone in the eastern United States.

While the initial deadline for the submittal of the alternative to EPA's November 7, 1997 SIP call proposal was August 1, 1998, the reopening of the comment period on the proposed SIP call and the publication of the Supplemental Notice of Proposed Rulemaking (SNPR) has allowed the opportunity to submit the proposal as part of the formal comments on the SNPR.

The Coalition States have cooperated in an initiative known as the Southeast/Midwest Governors Ozone Coalition committed to the development and implementation of a plan that will address the contribution of Coalition States to the attainment of the National Ambient Air Quality Standard ["NAAQS"] for ozone within the Coalition States, as well as characterizing the resultant benefits in the nonattainment area of the Northeast Ozone Transport Region through the implementation of control strategies which optimize the cost of compliance per unit of ozone improvement.

The Coalition has organized itself into a Governors Committee, to address policy and other non-technical issues, and a Technical Committee, to address substantive issues involved in formulating the alternative proposal. Each Coalition State is represented on each committee and each Coalition State has one vote on matters which come before it for a vote.

The Governors Committee first met on April 6, 1998 and again June 16, 1998. The Technical Committee met on April 14 and 15, April 29 and 30, May 13 and 14, June 4, and on June 16 with the Governors Committee, with numerous conference calls being conducted between meetings. The Technical Committee developed the following eight work elements to provide an appropriate basis for the development of a scientifically sound alternative proposal to the EPA SIP Call:

1. Make Use of On-Going UAM-V Modeling—At least two groups, LADCO and a joint venture among Ohio, Kentucky and West Virginia, are conducting modeling germane to the development of its proposal.
2. Review Existing UAM-V Modeling—A significant amount of UAM-V modeling has been completed since the OTAG process concluded. Some of this modeling may be post-processed to determine sub-regional impact estimates.
3. Utilization of On-Going and Existing CAMx Modeling—A great deal of modeling using the CAMx model has been and is being conducted.
4. Cost per Ton NOx Removed Analysis—The cost of various control scenario costs was also evaluated by the Coalition.
5. Phase I NOx Reductions—One of the perspectives examined in developing the alternative proposal was to seek input from regulated sources as to the level of NOx reductions that might be appropriate even in advance of performing refined modeling.
6. Liaison with EPA—A communication link with EPA on the Coalitions initiative was established.
7. Additional 8-hour NAAQS Modeling—The Coalition recognized that sound air quality management demands that an air analysis of NOx controls based on attainment of the 8-hour standard be performed.
8. Cost per ppb Ozone Improvement Analysis—The OTAG process concluded that, while any NOx reduction will result in ozone reduction downwind of the course, the amount of reduction decreases significantly with distance from the source. Accordingly, the Coalition believes that an analysis of ozone reductions based on the cost per ppb of ozone reduction in downwind areas is a logical and resource-conservative means to deal with the concept of NOx transport.

Lead responsibility for the eight work elements was undertaken by: Task, Description, Lead, Responsibility.

1. Utilization on On-Going UAM-V Modeling—Illinois
2. Utilization of Existing UAM-x Modeling—Kentucky
3. Utilization of CAMx Modeling—Michigan
4. Cost per Ton NOx Removed Analysis—Ohio
5. Voluntary Early NOx Reductions—Virginia
6. Liaison with EPA—West Virginia

7. Additional 8-hour NAAQS Modeling—Virginia
8. Cost per ppb Ozone Improvement Analysis—South Carolina

2.0 Statements of Purpose

The Southeast/Midwest Governors Ozone Coalition has as its purpose to develop an alternative proposal to U.S. EPA's proposal for NOx transport. The following statements of purpose guided the Coalition in this effort:

1. To develop a control strategy that leads to attainment of the NAAQS for ozone throughout the multi-state area and the areas immediately downwind.
2. To develop a control strategy to provide for attainment of the 1-hour standard as soon as practicable and achieve the 8-hour standard within Clean Air Act deadlines, provided that the 8-hour standard survives its ongoing legal challenge.)
3. To determine control strategies which optimize cost of compliance per unit of ozone improvement.
4. To utilize good scientific principles and techniques to accurately characterize the amount of emission reductions, total cost, and expected air quality benefit related to the Coalition's recommended control strategy.

3.0 Proposed Attainment Plan

3.1 Overview

This plan describes the Coalition approach for developing quantitative estimates of the levels of ozone precursor reductions that are likely to be needed in the Southeast and Midwest States (i.e., the Coalition States) in order to reach attainment of the Federal 1-hr and 8-hr ozone NAAQS. More specifically, the plan describes the use of state-of-science regional photochemical dispersion models to identify emissions control strategies over the eastern U.S. that will cost-effectively abate those sources or source categories responsible for ozone exceedances where they occur in the ten Coalition States; the approach is also applicable across a broader geographic area, but would need commitments from other States.

3.2 Goal

The overarching Coalition goal consists of two inter-related components as follows:

A. Develop and implement those anthropogenic VOC and/or NOx emissions reductions that are estimated to be required for attainment of the 1-hr and 8-hr ozone NAAQS within the Coalition States; and

B. Develop and compare estimates of the cost-effectiveness of emissions in ameliorating violations of the 1-hr and 8-hr ozone NAAQS, assuming full and timely compliance with Clean Air Act (CAA) requirements in the affected nonattainment areas.

In striving to achieve this goal, particular attention must be placed on identifying and selecting the most cost-effective controls possible and in complying fully with the Clean Air Act Amendment requirements. Here, cost-effectiveness is specifically defined in terms of $/ppb ozone reduced under ozone exceedance conditions.

In summary, the Coalition is committed to implement controls in the Coalition States (and identify goals in neighboring States) to achieve attainment of the 1-hour violating counties in the Coalition addition, the Coalition is committed to the use of a comparative analysis of the most cost-effective control measures needed to achieve attainment of the 1-hour and 8-hour ozone NAAQS.

3.3 Regulatory Time Frame and Proposal Schedule

Attainment of the 1-hour ozone NAAQS is already overdue for many ozone nonattainment areas. As the CAA attainment deadline is missed, the nonattainment areas classification is typically "bumped up" to include new mandatory control provisions and the next attainment date. The most distant nonattainment areas in the eastern U.S. and 8-hour ozone NAAQS in and neighboring States. In attainment date for is 2007; thus the proposed approach needs to achieve attainment of the 1-hour ozone NAAQS by the year 2007.

The schedule for implementation of the 8-hour ozone NAAQS is likely to involve designation of 8-hour nonattainment areas by the year 2000, submission of an 8-hour ozone SIP control plan is due 3 years later by 2003; and attainment 10 years after designation (2010) with the possibility of a 2-year extension (2012). Thus, any 8-hour attainment plan needs to result in attainment of the 8-hour ozone NAAQS no later than 2010–12. Given that attainment is based on measured ozone concentrations during the latest three consecutive years, then all controls needed for attainment of the 8-hour ozone NAAQS need to be in place prior to the 2008 ozone season to minimize (no more than three per year) the occurrence of exceedances of the 8-hour ozone NAAQS during 2008–2010.

The Coalition believes that attainment can be achieved by the end of the 2009 ozone season, at least 1 year in advance of the Clean Air Act requirement as pro-

posed by EPA. However, implementation of controls can require from 1–3 years (e.g., implementation of stationary control measures or introduction of reformulated gasoline) or more (e.g., introduction new alternative fueled vehicles require many years of fleet turnover before the emission benefits are realized). Furthermore, once the most cost-effective control measures have been identified, then 1–2 years of review, public comment, and refinement are needed prior to regulation adoption. Thus, we estimate that all of the technical analysis to identify the most cost-effective control measures for achieving attainment of the 8-hour ozone NAAQS needs to be completed approximately 5 years before their spring implementation, e.g., by July, 2001.

Further, the Coalition proposes that certain States provide SIP's to implement Phase I reductions by April of 2000 as well. The timeframe is based on giving regulated sources until April of 2002 to begin to implement Phase I reductions (see Section 5) and to implement 8-hour attainment strategy controls by April of 2007.

3.4 Key Issues

Several key technical issues will need to be addressed in the course of developing the technical analysis necessary to determine an 8-hour control strategy. These include the following:

3.4.1. Continue Diagnostic Evaluation of OTAG Models: Further analysis of the UAM-V/CAMx base case model performance, particularly at sub-regional and urban-scales, is needed with particular focus on the models ability to reproduce ozone exceedances, precursor species, and species ratios.

3.4.2. Continue QA on OTAG Data Bases: Further quality assurance should be performed on the OTAG emissions inventories and aerometric data sets, particularly those being used in post-OTAG analyses.

3.4.3. Assess the Suitability of the OTAG Episode for 8-hr Modeling in the Southwest/Midwest Nonattainment Areas. The rationale for selecting the 4 OTAG episodes did not necessarily ensure that the conditions ultimately chosen are the best periods for 1-hr and 8-hr ozone attainment modeling in areas such as Louisville, Cincinnati, Pittsburgh, Atlanta, and so on. Consideration will need to be given to whether additional episodes need to be examined as well.

3.4.4. Assess Whether Attainment of the 8-hr Standard Implies Attainment of the 1-hr Standard. The greater stringency of the new 8-hr standard suggests that if it is met by States within the Coalition region, then the 1-hr standard will likely be met as well. While the OTAG modeling and other stakeholder modeling has shown that there is strong similarity in the responses of peak 1-hr and 8-hr ozone concentrations to precursor controls, some investigation is warranted into whether attainment of the 8-hr: standard necessarily means that the 1-hr will be met or approached as well. Particular attention should be given to whether there are situations where emissions controls for attainment of the 8-hr standard might, in fact, exacerbate attempts to achieve the 1-hr standard in certain areas.

3.4.5. Provide Adequate Time and Resources for the Subregional Modeling Analyses: It will take considerable time and resource requirements to carefully design subregional control scenarios to cost-effectively mitigate local ozone exceedance problems and avoid new exceedances while at the same time contributing, were appropriate, to an amelioration of the ozone exceedances in the most severe areas. Beginning with the SIPs developed in the early 1970's, there has never been adequate time and resources given to addressing this fundamental question. If appropriate time and resources are again not provided, the same incrementalism that has been the hallmark of the SIP processes for nearly two decades may be expected to continue.

3.5 Technical Approach

The Coalition urges that the implementation of this plan be pursued in accordance with the following schedule:

- 04/01/00 Coalition States will submit legally enforceable Phase I emission reduction requirements
- 07/31/01 Completion of modeling and analysis for attainment of 8-hour NAAQS
- 04/01/02 Implementation of Phase I utility NOx reductions of at least the lesser of 55 percent or .35 lb/MMBtu from the 1990 level, subject to a 1 year energy disruption exemption
- 07/31/03 Submit ozone NAAQS attainment SIPs
- 04/01/04 Implementation of Phase I utility NOx reductions of at least the lesser of 65 percent or .25 lb/MMBtu from the 1990 level, subject to a 1 year energy disruption exemption

- 04/01/09 Implementation of Phase II controls
- 09/30/09 Attain ozone NAAQS

3.5.1. Definition of the Analysis Improvements of Current Databases

Completion of this task will result in available data and databases, data gaps and uncertainties, additional data needs, and definition of the analysis to be performed subsequently. The following activities will be considered in individual States or cooperating State assessment efforts:

- Develop a prioritized list of key nonattainment areas in the Coalition States region for which modeling analyses are to be targeted;
- Assess the suitability of current OTAG models and data bases for addressing 1-fur and 8-hr1 ozone attainment issues in these key areas. Develop new modeling episode(s) if necessary; diagnose poor model performance and rectify performance problems where necessary;
- Improve the OTAG emissions inventories where feasible, consistent with the scope of the refined subregional modeling;
- Review and synthesize pertinent past studies to help guide the analysis;
- Identify and integrate the new improved post-OTAG modeling databases into the analysis. These databases include both OTAG spin-off data bases and new higher quality data bases that are beginning to come available.

OTAG spin-off data bases that are now complete or expected to be complete for use in this analysis include at a minimum:

1. The LADCO/IEPA refined 4 km modeling data bases for 1991 LMOS episodes;
2. The Tri-Sta data bases; and
3. The Missouri Electric Utility Environmental Committee (MEUEC) refined 4 km data base.
4. The Coordinating Research Council (CRC) NARSTO July 1995 CAMx and MAQSIP modeling data bases based on new high resolution emissions modeling and high resolution MM5 meteorological modeling;
5. The CRC LMOS June/July 1991 CAMx and MAQSIP modeling data bases based on new high resolution emissions modeling and high resolution MM5 meteorological modeling;
6. NYSDEC/SUNY 3 month 1995 seasonal UAM-V modeling data base;
7. EPA's MODELS3 data bases; and

- Identify models to be used in the analysis.
- Identify sources and uncertainties in economic data needed to perform cost-effectiveness analysis;
- Identify data gaps and shortfalls and what additional information needs to be obtained to perform a technically justified and comprehensive analysis; and Evaluation of Phase I emission controls to determine their benefits for achieving attainment of the 1-hour and 8-hour NAAQS in the Midwest/Southeast nonattainment areas and level of reductions of ozone transport. Evaluate whether Phase I emissions reductions will result in ozone disbenefits.

3.5.2. Data base Development and Model Performance Evaluation

The second task is to develop the data bases and tools needed to perform the refined modeling and cost-effectiveness analysis to determine the optimal control measures for achieving attainment of the 1-hour and 8-hour ozone NAAQS in the nonattainment areas in the Coalition States. Specific elements to be performed include the following:

- Acquisition of data bases and data to develop high quality refined modeling data bases. Acquisition or generation of missing data to fill data gaps and reduce uncertainties;
- Development of base case emissions and meteorological data bases (as necessary as defined in the first task);
- Performance of base case photochemical model simulations and comprehensive model performance evaluation. Model performance evaluation will be much more detailed than performed for OTAG and will (as well as many other consider the following elements):
- Ability of the model to reproduce ozone exceedances in the key nonattainment areas;
- Ability of the model to reproduce ozone precursors and key indicators to determine whether model is reproducing the chemical regimes that produced the ozone exceedances; and
- Establish 2007 CAA Baseline 1-hr and 2010 CAA Baseline 8-hr ozone conditions throughout the OTAG domain for pertinent modeling episodes; and.

- Conduct Roll-Out modeling (see Imhoff and Gautney, 1998 or Morris et al., 1998b) from each problem area to assess the extent of the geographical regions whose emissions influence 1-hr and 8-hr ozone concentrations in the problem areas.

3.5.3. Identify Optimal Control Strategies for Coalition States, Nonattainment Areas

EPA's SIP call is based on a massive reduction in NOx emissions throughout a 22-State area. EPA's justification is that such a large emission reduction will produce widespread ozone benefits. While it is not difficult to provide examples to contradict EPA's position nor is it difficult to show that their approach is counter to the Clean Air Act, the Coalition has chosen not to focus on the technical shortcomings of the SIP call. Instead, the Coalition has attempted to craft alternative proposals that are reasonable, cost effective and more universally supported. One of the tools employed by the Coalition to achieve this objective is the CAMx model.

Regional models such as CAMx are beneficial in assessing transport. However, because of their relatively large grid size, they typically are not used to project "attainment". Unfortunately, since EPA has frequently supported the SIP call on the basis of projected attainment as indicated by the UAM-V model, we were forced to review model results with a view toward attainment. Doing so in no way infers that the Coalition believes that regional modeling can be substituted for subregional modeling when conducting attainment demonstrations. That would have serious consequences because, among other things, NOx disbenefits would be underestimated.

The CAMx runs conducted for the Coalition allow several general conclusions to be made:

- The contribution of low level and elevated sources to ozone formation from the Coalition States is comparable.
- The largest fraction of the ozone in a receptor area is due to emissions from within that receptor area and from adjacent States.
- In some cases, the level of transport from non-SIP call States (a.k.a., the coarse grid States) is greater than that from the SIP call States. This is most evident for the receptor areas in the Midwest.
- Levels of ozone from biogenics, initial conditions and boundary conditions are sometimes as high or higher than from transport.

For the 1-hour standard, at the majority of the receptors, most of the ozone (usually 60 percent or more) is due to emissions in the receptor State and adjacent States. This effect is most pronounced in the OTR States. For the 8-hour) standard, local and adjacent State contributions are also most significant, but less so than for the 1-hour standard.

An examination of the CAMx results performed by Alpine Geophysics for the application of the SIP call and several alternatives to it demonstrates that the SIP call will not result in attainment particularly in the Northeast. Moreover, application of NOx controls in the midwest and southeast will have little or no impact on the northeast beyond the benefits that would result from applying the SIP call only to the Inner Zone of the Northeast Ozone Transport Region.

In the CAMx analyses contained in the enclosed graphics, impacts on the Northern, Central and Southern corridors are examined for each of the following 5 control strategies.

1. Base—Clean Air Act Base (Year 2007 CAAA controls, Title IV, etc.)
2. SIP/Inner—SIP call controls in the inner zone of the OTR; Phase II MOU controls in the outer zone of the OTR; Year 2007 CAAA controls, Title IV, etc., base elsewhere;
3. 55 percent MU—SIP call controls in the inner zone of the OTR; Phase II MOU controls in the outer zone of the OTR; 55 percent /0.35 lb/hr NOx on electric utility boilers >250 MMBtu in IL, IN, KY, MI, OH, TN, VA, WV, WI, the fine grid portion of MO, and in the outer zone of the OTR; Year 2007 CAAA controls, Title IV, etc., base elsewhere; and
4. 65 percent/MW—SIP call controls in the inner zone of the OTR; Phase II MOU controls in the outer zone of the OTR; 65 percent/0.25 lb/hr NOx on electric utility boilers > 250 to in IL, IN, KY, MI, OH, TN, VA, WV, WI and the fine grid portion of MO; Year 2007 CAAA controls, Title IV, etc., base elsewhere;
5. SIP/Call—SIP call controls applied over the full OTAG domain for the 1991 and 1995 OTAG episodes.

From the CAMx results it is apparent that in the development strategies the following conclusions are applicable:

- The SIP call reductions exceed what is necessary for most areas to address transport implications and will be counter productive in some areas.

- The SIP call will not result in attainment of either standard in many areas. CAMx results can be used to identify areas where detailed subregional modeling should be conducted as envisioned by OTAG.
- CAMx has quantified ozone contributions from each State. This information, coupled with control cost data, can be used to estimate benefits on a dollar per ppb basis. Attainment demonstrations must be based on more detailed subregional modeling as called for by OTAG.
- Contribution from individual States vary significantly, verifying that EPA's one-size-fits-all approach is inappropriate.
- Additional local controls will be necessary to comply with the new 8-hour standard in many areas.
- The model may result in underestimation of the benefits of VOC controls, overestimation of the benefits of NOx controls, is due to SIP call and underestimation of NOx disbenefits. This the high proportion of biogenic VOCs in EPA's inventory. This high level of biogenic emissions dominates the anthropogenic VOC emissions over most of the region.

Identification of the optimal VOC and NOx control measures needed to attain the 8-hour ozone NAAQS in nonattainment areas of the Coalition States will involve the following activities.

- Develop candidate subregional emissions control programs for each problem area based on results of previous modeling analyses (e.g., pertinent OTAG and post-OTAG studies). Estimate control requirements for 8-hr attainment in each Southeast/Midwest Coalition State problem areas separately;
- Integrate findings from above problem area analyses into one or more composite subregional strategies aimed a providing for 8-hr attainment in multiple Southeast/Midwest problem areas. Included as part of this analysis would be identifying and mitigating the potential for ozone disbenefits to occur in an area as the result of a proposed control measure;
- Repeat preceding two steps if necessary to reach a matrix of subregional VOC and/or NOx emissions controls throughout the Coalition States that achieves the 8-hr standards in the problem areas; and
- Integrate cost data into the alternative VOC and/or NOx ozone attainment emission control strategies to identify a matrix of optimal most cost-effective VOC/NOx emissions control strategies that achieve attainment of the 8-hour ozone NAAQS in the Midwest/Southeast nonattainment areas.

3.5.4 Comparative Analysis of the Cost-Effectiveness of Local Versus More Distant Control Measures for Reducing Ozone Exceedances

In the development of control strategies, cost effectiveness should consider the cost as well as the effectiveness of the control; i.e. the downwind benefit that a control has on ozone concentrations. Recognizing that not all NOx is created equal, control strategies should not seek to reduce cost-effectively NOx, but rather to reduce cost-effectively ozone. Any control strategy should determine the most cost-effective controls available to produce a demonstrated downwind impact. Ultimate control strategies should not utilize cost/ton of the controls as the primary consideration in determining cost effectiveness. Rather, cost-effectiveness should be calculated in terms of a cost per ppb of ozone removed.

The Cost/Benefit Analysis of OTAG Modeling Results was presented at the June 3, 1997 OTAG Policy Group Meeting. This document is not only part of the formal record for OTAG but is part of the NOx SIP Call Comments as well. To date this is the only known comparable analysis that has been publicly presented which takes into consideration cost per unit of ozone removed. While the analysis did not provide an absolute finding of cost-effectiveness, it did provide a relative comparison of cost-effectiveness across regional areas.

This analysis normalized cost-effectiveness considering all four OTAG episodes for the three identified 1-hour nonattainment areas and assumed comparable controls across OTAG Zones I-V. This analysis showed that NOx reductions from sources internal to Zones I, III, and V containing the current 1-hour nonattainment areas were more cost-effective on a per unit ozone removed basis than sources internal to Zones II and IV.

For example, utility controls applied in the Northeast Corridor (Zone III), the Lake Michigan Area (Zone I), and Georgia (Zone V), were shown to be 24 times more cost-effective at reducing ozone in the Baltimore/Washington area, 22 times more cost effective at reducing ozone in the Lake Michigan area, and 11 times more cost-effective at reducing ozone in the Atlanta area, respectively, than utility controls applied in Zone IV. Similarly, utility controls applied in the Lake Michigan area and Georgia would be 54 and 150 times respectively more cost-effective than controls in Zone II.

This analysis identified comparable costs between Zone II reductions and those in the Southern Corridor of the Northeast nonattainment area (Zone III). An important factor in this comparison was the exclusion of the costs associated with the OTC NOx-MOU in the Zone III area. This and other assumptions, such as using the costs associated across an entire Zone rather than limiting costs to a specific receptor area, as well as a uniform cost of controls across all Zones, contributed to this conclusion.

A state-by-state demonstration of the cost-effectiveness of any reductions necessary to achieve attainment of the 1-hour standard is needed. A reduction of "x" tons of NOx in State A may have no impact on attainment in State B. However, an identical reduction of "x" tons in State B may have a marked effect on ozone in State B. Uniformity in control is not uniformity in effect. Less stringent controls in some areas may actually be more cost effective in terms of cost/ppb of ozone reduced (or dollars/percent ozone reduction) than the most stringent controls elsewhere. The only way to determine this is to examine the full range of controls and calculate the costs and downwind ozone benefits of each set of controls. Models have been developed which will provide least cost options for reducing ozone concentrations and studies utilizing such models are ongoing. States need sufficient time to perform such an analysis and to evaluate appropriate actions.

3.5.5. Review, Refinement, and Public Outreach

Public outreach regarding the control plan development will be critical to receiving comment from the regulated community, public and governmental entities. Accordingly, the Coalition will assure that a mechanism is provided for full, regular, and meaningful public participation in the Coalition States modeling and analysis program; and that refined final control plans be based on public comments.

3.5.6. Rules and Implementation

The final task of the initiative will involve the Coalition States making rules for the control measures and for affected sources to implement the control technologies. It will therefore be critical for States to develop and promulgate rules for the control measures in the Coalition States and affected sources to implement control measures to achieve necessary emissions reductions prior to the ozone season in 2007.

4.0 Phase I Reductions

4.1. Reduction Levels

An integral part of the overall strategy for emission reductions is the commitment by States to Phase I emission reductions. Such reductions will be targeted for implementation during the ozone seasons in 2002 and 2004.

It is anticipated that implementation of Phase I reductions will result in emission reductions that will vary on a state-by-state basis as companies elect to over-control some units and under-control others to achieve a company wide average. To determine the level of Phase I reductions, the geographic scope, and the resultant improvement in air quality, the following actions were undertaken:

1. Use of On-Going UAM-V Modeling—At least two groups, LADCO and a joint venture among Ohio, Kentucky and West Virginia, conducted modeling which the Technical Committee felt is germane to the development of its proposal.

2. Review Existing UAM-V Modeling—A significant amount of UAM-V modeling has been completed since the OTAG process concluded. Some of this modeling was post-processed to determine sub-regional impact estimates. A significant effort was necessary to coordinate and analyze the necessary post-processing. A summary of the studies conducted in the first two work elements regarding UAM-V modeling is appended to this Technical Support Document as Appendix 1.

3. Utilization of On-Going and Existing CAMx Modeling—A great deal of modeling using the CAMx model has been and is being conducted. Analysis of existing results, including post-processing of the model output, was helpful in developing the alternative proposal.

4. Cost per Ton NOx Removed Analysis—Another piece of the ozone management puzzle which the Technical Committee explored is the cost of various control scenarios.

5. Initial Early NOx Reductions—One of the perspectives examined in developing the alternative proposal was to determine what regulated sources could achieve in NOx reductions in advance of refined analyses being performed.

Upon completion of the work elements and following review of the results and recommendations by the Technical Committee, the Governors Committee met and adopted the following Phase I emission recommendation:

- All Coalition States other than Alabama and South Carolina will require a reduction of NOx emissions form electric utilities within our States equivalent to at

least the lesser of a system wide emission rate of .25 lbs/MMBtu or a 65 percent level of reduction (from 1990 levels). These reductions will be in place by April of 2004, unless a demonstration is made that an additional year is necessary to avoid disruption of the energy supply in our States.

- To assure early progress in reducing emissions, these same tes will also require at least the lesser of a system wide emission rate of .35 lb/MMBtu or a 55 percent level of reduction (from 1990 levels). These reductions would be in place by April of 2002, unless a demonstration is made that an additional year is necessary to avoid disruption of the energy supply in our States. We will also require reductions from other large (greater than 250 MMBtu heat input) non-utility sources of NOx by April of 2003. These State reductions will be coordinated with USEPA's ongoing Industrial Combustion Coordinated Rulemaking. The control level for these non-utility sources will be based upon Reasonably Available Control Technology (RACT). State regulations requiring these reductions will be in place within 18 months of the final rulemaking by USEPA.
- While we commit to limit the emissions of NOx from these sources in Phase I, we approach of a mandatory States. The Clean Air do not agree with USEPA's proposed emission cap, or budget, for our Act provides the States with the authority and responsibility for making this choice. While some of our States may choose to implement a cap, many may not.

4.2. Air Quality Impacts

The Coalition anticipates that substantial air quality benefits will result even from its Phase I reductions with additional reductions as necessary to achieve the 8-hour' standard within the Coalition States. CAMx modeling runs performed by Alpine Geophysics allow a side-by-side comparison to be made between EPA's SIP Call and a 65 percent/.25 control strategy similar to that recommended by the Coalition.

The figures that follow make such a comparison first with respect to the 1991 episode and then the 1995 episode. The 65 percent/.25 control strategy (on the right in each case) that is being compared against the SIP Call (on the left in each case) contains the following controls:

07SIP2a controls in the inner zone of the OTR; Phase II MOU controls in the outer zone of the OTR; 65 percent/0.25 lb/hr NOx on electric utility boilers >250 MMBtu in IL, IN, KY, MI, OH, TN, VA, WV, WI, and the fine grid portion of MO; 07EPA1a base elsewhere.

The Coalition takes no position at this time as to the merit of any particular control strategy in Northeast Ozone Transport Regions and offers these graphics to illustrate the air quality benefits of its proposed Phase I reductions in a geographic area that closely proximates the scope of its proposal.

Phase II analyses will be used to address all remaining hour areas projected to exceed the ozone NAAQS and the 8-hour ozone NAAQS within the Coalition States.

5.0 Trading

The Coalition favors providing for an appropriate trading program. The alternative plan does not require an overall emissions cap, but does allow States the flexibility to establish such caps at their discretion.

6.0 Conclusion

The Southeast/Midwest Governors Ozone Coalition is pleased to have the opportunity to advance its proposed alternative to EPA's proposed NOx SIP call. This proposal is offered in the belief that it offers an answer to the ozone dilemma facing the Nation that is not only equitable and cost effective, but which for the first time assures that there is the strongest possible commitment to attain and maintain the national ambient air quality standard for ozone.

No one should minimize the extraordinary effort that will need to be undertaken to perform the assessment of air quality to determine the types of controls that will need to be put in place to achieve the 8-hour national ambient air quality standard for ozone. This proposal provides for an appropriate opportunity to allow this assessment to be conducted to assure that the ultimate control strategy selected will indeed comply with the standard and do so on a cost-effective basis.

In the meantime, the proposal brings about significant reductions of NOx principally through controls on electric utility boilers. Phase II controls, however, will likely require the imposition of controls on many other sources, including other point sources as well as area and mobile sources.

The Coalition is committed to taking the actions set forth in this proposal to assure that all Americans are afforded the opportunity to live and work in an environment free of air quality concerns related to ozone.

REFERENCES

Cass, G.R., and G.J. McRae, 1981. "Minimizing the Cost of Air Pollution Control", Environmental Science and Technology, Vol.15, No.–7.

EPA, 1996. "Guidance on Use of Modeled Results to Demonstrate Attainment of the Ozone NAAQS,'. EPA–454/B–95–007, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

EPA, 1997. "Calculation of Budget Components: Technical Support Document" prepared by the Office of Air and Radiation, U.S. Environmental Protection Agency, Research Triangle Park, NC.

Imhoff, R.E., and L.L. Gautney, 1998. "Regional Photochemical Model Estimation of the Scale of Ozone Transport in the Eastern U.S.", 10th Conference on Applications of Air Pollution Meteorology with the Air and Waste Management Association, American Meteorological Society, 11–16 January, Phoenix, AZ.

Koerber, M, 1998. "OTAG Modeling Results", proceedings of the 10th Joint Conference on the Applications of Air Pollution Meteorology, 11–16 January, 1998, Phoenix, AZ.

Lurmann, F. and N. Kumar, 1997. "Evaluation of the UAM-V Model Performance in OTAG Simulations: Summary of Performance Against Surface Observations", Final report prepared by Sonoma Technology, Inc., Prepared for the U.S. Environmental Protection Agency and the Ozone Transport Assessment Group, Research Triangle Park, NC.

MOG, 1996. "Ozone Attainment: Proceeding in the Right Direction?', prepared by the Midwest Ozone Group.

Morris, R.E., 1996a, "Review of Recent Ozone Measurement and Modeling Studies in the Eastern United States", Draft Final Report, prepared for the Ozone Transport Assessment Group, prepared by ENVIRON International Corp., Novato, CA.

Morris, R.E., 1996b, "Preliminary UAMx Ozone Source Apportionment Modeling Using the OTAG July 1991 B2 Base Case Data Base," prepared by ENVIRON International Corp., Novato, CA.

Morris, R.E. 1997. "Review of NESCAUM Report on Long-Range Transport of Ozone and its Precursors in the Eastern U.S.",

prepared for the Midwest Ozone Group, prepared by ENVIRON International Corp., Novato, CA.

Morris, R.E., 1998a. "Review and Critique of the November 7, 1997 EPA Ozone Transport SIP call and Assessment of the Contribution of Emissions from Missouri on Nonattainment Using the July 1995 OTAG Data base, prepared for the Missouri Electric Utility Environmental Committee, prepared by ENVIRON International Corporation, Novato, CA.

Morris, R.R., E. Tai, G. Wilson, and D. Weiss, 1998b. "Use of Advanced Ozone Source Apportionment Techniques to Estimate Area of Influence (AOI) Contributions to Elevated Ozone Concentrations", presented at 91st Annual Meeting and Exhibition of the Air and Waste Management Association, San Diego, California June 14–18, 1998.

National Academy of Sciences. 1991. Rethinkinq the Ozone Problem in Urban and Reqional Air Pollution, National Academy Press, Washington, DC.

OTAG, 1996. "Modeling Protocol", Version 3.0, prepared by the Ozone Transport Assessment Group, 29 February.

OTAG, 1997a. "Modeling Report", Draft Version 1.1, prepared by the Ozone Transport Assessment Group, 12 February.

OTAG, 1997b "Ozone Transport Assessment Group Executive Report, 1997", prepared by the Ozone Transport Assessment Group.

Tesche, T.W., et al,. 1998a. 'iReview of the EPA Ozone Transport SIP Call and Recent Post-OTAG Modeling and Analysis Studies", prepared for the States of Ohio, West Virginia, and Kentucky, prepared by Alpine Geophysics, LLC, Covington, KY and ENVIRON International, Novato, CA.

Tesche, T.W., et al., 1998b. "Assessment of the Reliability of the OTAG Modeling System, proceedings of the 10th Joint Conference on the Applications of Air Pollution MeteoroloqY,–11–16 January, 1998, Phoenix, AZ.

Tesche, T.W., et al., 1998c. "Tri-State Regional Ozone Modeling Study: Results of the Sub-Regional Modeling of the EPA Section 110 SIP call", prepared for the Greater Cincinnati Chamber of Commerce, prepared by Alpine Geophysics, LLC, Covington, KY.

Tesche, T.W., et al., 1998h, "Analysis of the Effects of VOC and NOx Emissions Reductions in the Eastern United States on Peak 1-hr and 8-hr Ozone Concentrations" prepared for the Midwest Ozone Group, prepared by Alpine Geophysics, LLC, Covington, KY.

Yarwood, G., R.E. Morris, C. Emery, and G. Wilson, 1998b. "Recent Advances in Regional Photochemical Grid Modeling and Application using the OTAG Modeling Data bases, presented at 91st Annual Meeting and Exhibition of the Air and Waste Management Association, San Diego, California June 14–18, 1998.

APPENDIX 1 SUMMARY OF UAM-V MODELING PROJECTS

SUMMARY

Significant regional and subregional modeling efforts were undertaken by States and other stakeholders, both during and after the OTAG effort, using the UAM-V model. Additionally, important work by the Lake Michigan Air Directors Consortium (LADCO) was nearing completion while this report was being compiled. This work is critical in developing control strategies that appropriately address NOx reduction disbenefits noted below. The UAM-V model was the model of choice for the OTAG evaluations of transport into the serious 1 hour ozone nonattainment areas. Most efforts were designed to evaluate the impact of various levels of controls as well as the effectiveness of different control strategies. The large volume of additional modeling data provided additional insight into the degree and range of transport in ways not originally considered in the OTAG process. The results of these analyses indicate that there is not a modeling basis for the requested level of control contained in the OTAG SIP call notice nor a basis for extending those controls beyond the serious nonattainment areas.

- Local Controls Most Effective: Most of the ozone reduction benefits of the EPA's SIP Call control strategy in a nonattainment area are due to controls in or immediately downwind of the nonattainment area.
- Ozone Improvements Occur Predominantly in Non-Problem Areas: Most of the ozone reductions due to the EPA's SIP Call control plan occur in attainment or near-attainment areas, reducing ozone concentrations to levels well below the NAAQS.
- Diminishing Effectiveness of Point Source NOx Control: There is very little difference in the reductions in ozone concentrations due to the Run A control strategy (55 percent controls on major NOx point sources) versus the Run I control strategy (85 percent control on major NOx point sources); the extra reductions in emissions from major NOx point sources from 55 percent to 85 percent is not cost-effective or justified based on the ozone air quality benefits.
- Controls on Nearest States Outside the OTR Yield Little Ozone Benefit in the North East: The high modeled 1-hr average ozone concentrations occurring in the northeast are not influenced appreciably by sources in the States of KY, OH, and WV. Results from modeling with two episodes (91, 95) reveals little (i.e., 2–6 ppb) or no ozone reduction in the Northeast Corridor. Also, Virginia UAM-V modeling results show that point source emissions from VA have little impact on the northeast.
- Regional NOx Reductions Cause Isolated, Local Ozone Disbenefits: OTAG modeling indicated NOx reduction disbenefits that generated some controversy. Subsequent modeling confirms that significant NOx reduction disbenefits do occur, as a result at EPA's SIP call, particularly around Lake Michigan and near certain urban areas including Baltimore (MD)-Washington (DC); Cincinnati, OH; Louisville, KY; and Pittsburgh, PA.

BACKGROUND

On 8 July 1998 the OTAG Policy Group forwarded to EPA recommendations approved by 31 States and the District of Columbia. The most significant OTAG findings were:

- Modeling/Air Quality Conclusions: Regional NOx reductions are effective in producing ozone benefits; the more NOx reduced, the greater the benefit. Ozone benefits are greatest where emissions reductions are made and diminish with distance.
- Elevated and low-level NOx reductions are both effective. VOC controls are effective in reducing ozone locally and are most advantageous to urban nonattainment areas.
- Additional Modeling and Air Quality Analysis: ". . . States must have the opportunity to conduct additional local and subregional modeling and air quality analyses, as well as develop and propose appropriate levels and timing of controls". ". . . priority should be given to the serious and severe nonattainment areas of Atlanta, Lake Michigan and the northeast, relative to transport". "OTAG recommends EPA evaluate States, timely submittal of comments and subregional modeling regarding the proposed statewide budgets prior to EPA's finalizing the SIP calls within 12 months of their proposal".

- Utility NOx Control: ". . . the range of utility NOx controls in the fine grid fall between Clean Air Act controls and the less stringent of 85-percent reduction from the 1990 rate (lb/MMBtu) or 0.15 lb/MMBtu in order to mitigate ozone transport and assist States in complying with the existing 120 ppb ozone standard".
- Vehicle Emission Inspection and Maintenance Controls: "The OTAG States recommend that, where required by the Clean Air Act, appropriate and effective vehicle emission and inspection and maintenance (I/M) programs be implemented., ". . . States [should] consider the option of enhanced I/M programs in all urbanized areas in the fine grid with a population greater than 500,000."

In response to the OTAG recommendation for additional regional and subregional modeling, many stakeholder groups performed additional UAM-V analyses. This combined work element summarizes the work completed both during and after OTAG.

ANALYSIS

This work element was undertaken to evaluate all available UAM-V modeling analyses which were performed during or after the OTAG process. The following are summaries of the approaches, assumptions and conclusions from UAM-V model efforts and ancillary studies performed outside of OTAG which have been completed since the beginning of the OTAG process.

MODELING STUDIES CONCURRENT WITH OTAG

OEPA State Specific UAM-V/CAMx Modeling

The Ohio EPA and the Midwest Ozone Group (MOG) jointly commissioned a study to perform state-specific ozone control simulations using the UAM-V model and the July 1991 and July 1995 OTAG modeling episodes. The objective of this modeling was to test an underlying OTAG hypothesis, namely that emissions from Midwestern States have an impact on ozone concentrations in States farther to the east, including in the Northeast Corridor. The UAMV model was exercised to examine the impact of emissions reductions in several States (Kentucky, Illinois, Pennsylvania, and the northeastern U.S.). The July 1991 and July 1995 OTAG episodes were used in conjunction with the 2007 Baseline OTAG Baselc emissions inventory to model a total of eight (8) scenarios based on the OTAG Round 2 Controls. Runs 11 and 8 defined with 2007 CEMla applied everywhere in OTAG domain except where OTAG Round 2 controls were applied:

The OEPA/MOG study concluded that:

- OTAG Round 2 controls in Kentucky produce 2–16 ppb ozone reductions throughout large portions of northern Kentucky and southern Illinois, Indiana, and Ohio for both the July 1991 and July 1995 OTAG episodes. Reductions above 2 ppb to not extend beyond Pittsburgh; localized ozone disbenefits on the order of 2–9 ppb are predicted in the Louisville nonattainment area.
- OTAG Round 2 controls in Illinois produce 2–14 ppb ozone reductions throughout large portions of Illinois, Indiana, Michigan, western Kentucky and Ohio during the 1995 episode and Ohio and Pennsylvania during the 1991 episode. For the 1991 episode, reductions of 2 ppb or greater extend to New York City; localized ozone disbene-fits of 2 −23 ppb are modeled in the Cincinnati-Hamilton nonattainment area.
- OTAG Round 2 controls in Pennsylvania produce 2–10 ppb ozone reductions throughout large portions of Pennsylvania and Maryland, southern New York State and western Connecticut during the 1995 episode; localized ozone disbenefits of 1 ppb are modeled in the Pittsburgh-Beaver Valley nonattainment area.
- OTAG Round 2 controls in the Northeast U.S. produce a broad region of ozone reductions in the 2–22 ppb range throughout virtually the entire coastal northeast corridor during the 1991 episode; localized ozone disbenefits of 2–19 ppb in a few metropolitan areas and over the Atlantic Ocean.

MOG Superregional Stakeholder Modeling

The Midwest Ozone Group (MOG) and other business and trade organizations commissioned a Superregional ozone modeling study to respond to the OTAG initiative. The Stakeholder Superregional Modeling Study evolved, had three main objectives:

The project analyzed several key ozone and NOx model evaluation statistics and graphical displays for the SAQM and UAM-V regional model simulations of the 13–21 July 1991 OTAG episode.

This analysis focused on model inter-comparisons at the 12 km grid scale since this is the most highly resolved scale used in OTAG.

MOG Subregional UAM-V Modeling

MOG also sponsored a subregional UAM-V ozone modeling study (Tesche and McNally 1996g) to corroborate the OTAG modeling results and to emphasize the need for subregional modeling as part of OTAG itself (Table 4–4). The following UAM-V simulations were performed with the 13–21 July 1991 OTAG episode using the 07D2/Base B1 modeling inputs:

- Run 1: 60 percent NOx control from elevated sources in the nonattainment areas;
- Run 2: 30 percent VOC and NOx control from elevated sources in the nonattainment areas;
- Run 3: 60 percent NOx control from elevated sources in the nonattainment areas and surrounding 100 km areas;
- Run 5: 30 percent VOC and NOx control from ground level sources in the nonattainment areas; and
- Run 6: 30 percent VOC and NOx control from ground level sources in the nonattainment areas and surrounding 100 km areas.

Key findings from the MOG subregional UAM-V emissions reduction simulations for the 13–21 July 2007 OTAG episode included:

Maximum Ozone Increases

- 60 percent elevated source NOx control in nonattainment areas and nonattainment areas plus 100 km increases ozone concentrations on average by 25 ppb and 37 ppb, respectively;
- 30 percent ground level VOC and NOx control in nonattainment areas and nonattainment areas plus 100 km increases ozone concentrations on average by 16 ppb and 15 ppb, respectively; 60 percent elevated source NOx control throughout the OTAG domain increases ozone concentrations on average by 26 ppb.

Maximum Ozone Decreases

- 60 percent elevated source NOx control in nonattainment areas and nonattainment areas plus 100 km decreases ozone concentrations on average by −18 ppb and −24 ppb, respectively;
- 30 percent ground level VOC and NOx control in nonattainment areas and nonattainment areas plus 100 km decreases ozone concentrations on average by −13 ppb and −14 ppb respectively;
- 60 percent elevated source NOx control throughout the OTAG domain decreases ozone concentrations on average by −27 ppb.

Grid Total Differences

- 60 percent elevated source NOx control in nonattainment areas increases grid total ozone concentrations on average by 5,970 ppb while reductions in the nonattainment areas plus 100 km decreases grid total ozone by −19,020 ppb;
- 30 percent ground level VOC and NOx control in nonattainment areas increases grid total ozone concentrations on average by 9,816 ppb while reductions in the nonattainment areas plus 100 km decreases grid total ozone by −2,959 pub;
- 60 percent elevated source NOx control throughout the OTAG domain decreases grid total ozone concentrations on average by 77,468 ppb.

Reduction in Episode-Average Exceedance Grid Cells

- 60 percent elevated source NOx control (in nonattainment areas and nonattainment areas plus 100 km) reduces the average number of exceedance grid cells from 202 to values of 169 and 146, respectively (−16 percent and −28 percent, respectively).
- 30 percent ground level VOC and NOx control (in nonattainment areas and nonattainment areas plus 100 km) reduces the average number of exceedance grid cells from 202 to values of 165 and 156, respectively (−18 percent and −23 percent, respectively).

The "Ozone Free, States Modeling

This report examines if there was any significant impact on ozone non-attainment problems in the upper Midwest or eastern U.S. at the result of the application of emissions controls in Iowa, Minnesota, Nebraska, North Dakota and South Dakota. The impact of controls from these northwest OTAG States were to be compared to emissions controls applied locally to ozone nonattainment areas and near the OTAG 12 ozone problem areas as a means for quantifying relative control effectiveness.

Twelve (12) future year emissions control scenario simulations were performed with the UAM-V model using the 10–18 July 1995 OTAG modeling episode. The objective of these runs was to estimate the ground level ozone impacts from man-made VOC and NOx emissions from the western tier of States in the OTAG domain, i.e.,

the so-called Northwest OTAG States. Of particular interest was the establishment of data allowing a comparison of the impact of controls in the northwest OTAG States and control applied locally in the 12 OTAG "ozone problem areas". The scenarios included a progression of zero anthropogenic controls in the northwest OTAG States, a series of controls in the 12 OTAG defined "ozone problem areas", and 5C controls on a state-by-state and combined basis. 5C controls were defined consistent with the OTAG sensitivity runs, with a 30 percent VOC reduction, 30 percent low level NOx reduction and 60 percent elevated NOx reduction referenced against year 2007 Base 1c projected emissions. The UAM-V modeling was performed in accordance with OTAG's "Maverick Modeling,' guidelines stipulated by the Regional and Urban-Scale Modeling Workgroup co-chairs (Messrs. Koerber and Tikvart) in their 4 February 1997 memorandum governing stakeholder modeling. The principal conclusions drawn from the study included:

- When 5C controls are applied to each of the five States individually, the maximum difference on a region in the OTAG domain above 100 ppb in the 2007 base year was 1.0 ppb for the simulation with controls applied to Iowa;
- When 5C controls were applied to North and South Dakota the maximum impact on any grid cell above 100 ppb was 0.1 ppb;
- When 5C controls were applied to Minnesota the maximum impact on any grid cell above 100 ppb was 0.4 ppb;
- When 5C controls were applied to Nebraska the maximum impact on any grid cell above 100 ppb was 0.1 pub;
- When 5C controls were applied to the five States simultaneously, the maximum impact on any grid cell above 100 ppb was 1.0 ppb;
- When 5C controls were applied to the 12 OTAG ozone nonattainment Problem areas" the maximum impact on any grid cell above 100 ppb was 43.8 ppb;
- At a threshold of 2 pub, the maximum difference of any emission control scenario on a region estimated to be above 100 ppb in the 2007 base year was 2.8 ppb for a simulation zeroing out all five States' anthropogenic emissions;
- When a simulation zeroing out anthropogenic emissions in the 12 OTAG ozone nonattainment areas was applied, the maximum impact on any grid cell above 100 ppb was a 141 ppb reduction in ground-level ozone; and
- When the 5C controls were applied to the five States simultaneously, the maximum impact on any grid cell above 80 ppb was less than a 2 ppb in regions outside of the five northwest States. A maximum local impact from application of 5C controls in the northwest States of 9 ppb was observed in isolated grid cells north of the Twin Cities and isolated grid cells near the eastern border of Iowa when an 80 ppb threshold was applied.

EPRI CEM-Enhanced UAM-V Modeling Study

A recent study by Enviroplan for the Midwest Ozone Group (MOG) indicated that the OTAG emissions inventory overstated utility NOx emissions based upon continuous emissions monitoring (CEM)data by 34 percent over the 1995 episode. In response, an EPRI-sponsored study was performed (Emigh et al., 1997) to develop a CEM-enhanced inventory using the OTAG inventory as the starting point and to perform baseline and sensitivity UAM-V simulations using these CEM-enhanced emissions (Table 4–6). The CEM-enhanced emissions were grown to the year 2007 using OTAG methodology, controlled using the OTAG 5C controls and UAM-V baseline and sensitivity simulations carried out. The major findings of this study were as follows:

- The CEM facility data were correlated with OTAG utility data for 737 facilities. The OTAG data were replaced with CEM data where the correlation could be made. The remaining utility temporal files were modified on a state-by-state basis to be consistent with the CEM temporal files;
- The CEM utility data were consistently less than the corresponding OTAG utility emissions data on a day-to-day basis. The CEM utility data were from 3.8 percent to 30.2 percent less than the corresponding OTAG data. The CEM emissions estimates were approximately 13.4 percent less than the OTAG emissions estimates for the period of the ozone episode;
- The variation between the CEM and the OTAG utility emission data were the most pronounced on a state-by-state basis. The CEM data are significantly less than the OTAG data in the transport States;
- The UAM-V baseline simulation indicates little impact of using the CEM-enhanced emissions on the domain ozone maximum.

However, there are significant differences in specific areas located within the domain. The largest positive difference during the 1995 OTAG episode was 130 ppb on 11 July and the largest negative difference was 97 ppb on 15 July. Large dif-

ferences, much larger than the regional differences, exceeded 50 ppb on several days during the 1995 episode;

In general, the CEM-enhanced emissions produced less ozone in the Ohio River valley and more ozone in the southern portion of the domain; and

The UAM-V sensitivity simulation using 5C controls applied to the OTAG Subregions 5, 6 and 9 shows that controls placed on the CEM emissions have relatively more impact than controls placed on the Baselc inventory.

POST-OTAG MODELING STUDIES

Pittsburgh-Beaver Valley Attainment Demonstration Study

The Pittsburgh Ozone Modeling Study was aimed at characterizing the processes whereby ozone is formed in and downwind of the seven-county Pittsburgh-Beaver Valley nonattainment area during high ozone episodes and to identify strategies for its control. Three major activities were carried out: (a) application of photochemical models to three recent ozone episodes, (b) evaluation of three emission control strategies developed by the Stakeholder's, and (c) additional modeling refinements and control strategy simulations for the Pennsylvania DEP in support of their efforts to develop an attainment demonstration for the region.

Modeling Methodology

While the models used in the Pittsburgh study were generally consistent with EPA (1991) guidance, in several instances, notably in the preparation of the meteorological fields, emissions inputs, and boundary conditions to the guideline UAM-IV urban model, more technically advanced models were used. These included the Emissions Modeling System (EMS–95) (AG, 1995) and the PSU Mesoscale Meteorological Model (MM5), and three state-of-science nested regional-scale photochemical models—UAM-V, SAQM, and CAMx.

These regional models were used to develop and intercompare estimates of ozone and ozone precursor boundary conditions to the UAM-IV for the base case and 1996 future year urban-scale ozone simulations.

The modeling episodes were drawn from the most recent five (5) year historical record (1991 through 1995) with primary emphasis given to the existence of significant ozone exceedances at numerous monitoring stations during the episode and the availability of supplemental ground-level and aloft aerometric data. The episodes selected were 31 July–2 August 1995, 13–15 July 1995 (the OTAG episode), and 17–19 June 1995. The various meteorological and photochemical models were set up, exercised, and evaluated for the three episodes following an approved protocol (Tesche et al., 1996d). An evaluation of the MM5 meteorological model for these episodes was reported by (Tesche and McNally, 1996h) and the emissions inputs were developed using the EMS–95 model as described by Loomis et al., (1996).

Control Strategy Evaluation

Future year (1996) emissions inventories for each episode were developed using EPA/OTAG growth and control methodologies and region-specific information (Loomis et al., 1996). Baseline UAM-IV simulations were then performed for all three episodes using the interim Stakeholder modeling files. Since base case performance for episode 3 was marginal, the emissions control scenarios developed by the Stakeholders were examined only with episodes 1 and 2. Results of these future year baseline and strategy simulations are summarized as follows:

- All strategies produce ozone benefits and some disbenefits (i.e., positive residuals);
- The "1999 Equivalent Measures" strategy for episode 1 produced the largest average and grid total ozone reductions across the JAM—IV domain;
- The "1999 Strategy" for episode 1 produces the largest ozone disbenefits and ozone-benefits, using the maximum residuals as the measure of change;
- The "1999 Strategy" results for episodes 1 and 2 are similar in the average and grid total residuals but under episode 2 conditions there are no ozone disbenefits (i.e., the maximum residuals are negative).
- The final flexible attainment demonstration for the Pittsburgh-Beaver Valley area, using EPA's "weight of evidence approaches, indicated that it is likely that the emissions controls represented in the 1996 attainment year emissions inventory will be sufficient to lead to attainment of the 1-hr ozone NAAQS within the Pittsburgh-Beaver Valley ozone nonattainment area without recourse to relying on significant upwind VOC and/or NOx controls.

Cincinnati-Hamilton Interim Attainment Demonstration Study

This study presents the results of a photochemical modeling study carried out for the States of Kentucky and Ohio to examine the levels of VOC and/or NOx emis-

sions controls that might be needed in the Cincinnati-Hamilton region to bring the area into attainment with the Federal 1-hr ozone standard by 1999. Nested UAM-V model simulations were made using the 12–14 July 1995 OTAG episode to develop estimates of model performance for the base year. The emissions inventory was then projected to the year 1999 using OTAG-derived emissions growth and control estimates. Based on the 1999 baseline UAM-V model simulation which shows the region to attain the 1-hr standard, a generic emissions reduction scenario was modeled to assess the need for further precursor controls in the region.

For the interim modeling analyses, one OTAG episode, 12–14 July 1999, was modeled. The UAM-V was set up and applied over a nested 36/12/4 km grid and tested the model's performance against measured ground-level ozone concentrations during this historical period. Having demonstrated model performance that does not reveal obvious performance problems or difficulties, the 1995 emissions inventory was then "grown" to 1999 using the EMS–95 Emissions Modeling System and the OTAG growth and control files to create a 1999 baseline inventory. A subsequent UAM-V simulation on the 36/12/4 km grid provided an estimate of the levels of peak ozone that are expected in the region in the attainment year. This year 1999 baseline inventory did not assume any additional emissions controls in the region beyond those already "on the books".

To examine the sensitivity of 1999 ozone levels in the region to emissions controls, one emissions reduction scenario was modeled: a 30 percent reduction in all anthropogenic VOC and NOx emissions across the 4 km domain. The implications of emissions controls upwind of the Cincinnati-Hamilton region were further examined with the results of recent UAM-V simulations for the July 1995 and 1991 episode in which SIP level controls (i.e., 07SIP2a) implemented individually in the States of Kentucky and Tennessee while the rest of the region was kept at year 2007 baseline (i.e., 07EPA1a) conditions. The results of these model calculations, presented in Subsection 5.10 under the Tri-State Study, suggest that an enlargement of the 4 km grid region currently proposed for the Cincinnati-Hamilton SIP demonstration may be appropriate.

The main findings of this analyses are as follows:

Future Year (1999) Baseline Results. UAM-V modeling with an interim future year (1999) emissions inventory revealed that the maximum ozone concentration on the 4 km grid on 14 July was 140 ppb northeast of Louisville, upwind of the seven-county Cincinnati-Hamilton ozone nonattainment area. The peak prediction in the nonattainment area was 131.8 ppb in extreme southwestern Boone County (Florence, Kentucky). Once the EPA "weight of evidence, analyses (EPA, 1996) are performed for Cincinnati, this episode will likely pass the attainment demonstration test without the need for significant further controls. The ozone exceedances modeled northeast of Louisville appear to be the result of emissions from Louisville and upwind Kentucky and Tennessee sources and not the Cincinnati-Hamilton nonattainment area.

- Effects of a 30 percent VOC and NOx Emissions Reduction Scenario: A future year 30 percent VOC and NOx emissions control inventory was modeled by reducing all anthropogenic emissions source categories in the 1999 baseline inventory by 30 percent. There was virtually no change in the maximum 4 km regionwide impact northeast of Louisville. The 30 percent VOC and NOx control scenario reduced the number of exceedance grid cells from 135 to 75. In addition, the peak concentrations in the nonattainment area were reduced to well below the standard (i.e., the peak prediction on 14 July 1999 was reduced to 120.8 ppb).

The results also showed that implementation of the 30 percent controls in the Cincinnati-Hamilton region are expected to lower peak ozone concentrations on the 14th by 2–6 ppb in several subregions. However, ozone increases are also modeled in several areas ranging from 2 to 10 ppb. Thus, this result suggest that developing an optimal control strategy for the region may not be a simple task since the issue of ozone benefits and disbenefits must be carefully examined and considered.

- *Role of Upwind States on Attainment Efforts in Cincinnati:* Analysis of existing CAMx and UAM-V simulations for the full OTAG episodes indicates the existence of subregional plumes of ozone and its precursors extending up the Ohio river through Cincinnati. Examination of recent UAM-V modeling of the effects of SIP Call controls on sources in Kentucky and Tennessee indicates that sources in both States have a direct impact on ozone levels in the Cincinnati-Hamilton nonattainment region. Furthermore, reductions in emissions in Kentucky are predicted to lead to both ozone disbenefits (i.e., 2–6 ppb ozone increases) and benefits (2–10 pub) in Cincinnati-Hamilton nonattainment area for both the 1991 and 1995 episodes. These results support the idea that attainment demonstration modeling in Cincinnati must take account the incoming transport of ozone and precursors from

upwind areas as well as account for the downwind transport of ozone past the region.

Tri-State Subregional Modeling and Analysis Study Tri-State Objectives

The three States of Ohio, Kentucky, and West Virginia are sponsoring a regional photochemical modeling and analysis study aimed at: (a) demonstrating attainment of the 1-hr ozone NAAQS in the Cincinnati-Hamilton moderate interstate nonattainment area, (b) evaluating the validity of the photochemical modeling used as the basis for the EPA SIP call, (c) estimating the impact of NOx emissions from Kentucky, West Virginia and Ohio sources on adjacent States and within Kentucky, Ohio, and West Virginia, including the impacts of emissions on the 1-hr and 8-hr ozone standards; and (d) assessing the impacts of emissions from Kentucky, Ohio, and West Virginia on Pennsylvania.

For the Tri-State study, pertinent OTAG and regional modeling data sets were used dozen UAM-V simulations to elucidate the emissions, aerometric. to conduct nearly two potential impacts of emissions from sources in one or more States in the Midwest on peak 1-her and 8-hr ozone levels in the same or neighboring States as well as in more distant, downwind States. The model runs were analyzed to assess the reasonableness of the NOx controls set forth in the SIP call and whether and to what extent lesser levels of controls will also achieve the desired ozone reductions in key receptor regions within and downwind of the Midwest States.

UAM-V Modeling Methodology

The Tri-State subregional modeling study consisted of the matrix of twenty-two (22) UAM-V model simulations. The July 1991 and July 1995 OTAG meteorological episodes were used and the base year emissions were scaled using OTAG growth and control factors to the forecast year of 2007. A 2007 base year inventory (i.e., 07EPA1a) and a year 2007 (i.e., 07SIP2a) inventory reflecting the state-by-state emissions controls set forth in the EPA SIP call. With these two inventories, a range of emissions reduction scenarios (from less to more stringent) were constructed using the EMS–95 emissions modeling system. The control levels ranged from the year 2007 baseline (i.e., the "EPA1a" inventory) involving Clean Air Act required controls plus Title IV and other reductions to the most stringent case, i.e., year 2007 SIP Call controls reflected in the "SIP2a" inventory. An intermediate level of controls, referred to as the "Cinergy package", were also examined. The various SIP Call and Cinergy package controls were applied selectively to particular States of interest in order to quantify the impact of their emissions on local and more distant 1-hr and 8-hr ozone levels.

The Tri-State UAM-V modeling was performed on the standard 36/12 Km OTAG grid and the simulation results were post-processed to develop estimates of the 1-hr and 8-hr ozone impacts in all States within the 36/12 Km OTAG region. These estimates were quantified in a number of ways including: (a) of the number of hours throughout the episode that grid cells within each State exceed specific concentration levels (e.g., 100 ppb, 124 ppb, 140 ppb) for both base case model runs and emissions control scenario runs, and (b) through the use of the so-called OTAG "objective measures,. The principal graphical and statistical results of the 22 UAM-V modeling runs, summarized below, were archived on CD-ROMs.

Year 2007 Base Case and SIP Call Results

Figures 5–10.1 and 5–10.2 present highlights of Runs 1 and 2, the so-called Clean Air Act Baseline. The figures contain daily maximum 1-hr and 8-hr ozone tile plots for the year 2007 baseline conditions (i.e., 07EPA1a) for two high ozone days during each episode. These are 14 July from the 1995 OTAG Episode and 19 July from the 1991 OTAG Episode. (The UAM-V results presented here are drawn from the 12 Km OTAG "fine grid" domain). Analysis of the full set of daily maximum ozone tile plots for these 2007 base case runs revealed the following:

Run 1: 2007 EPA1a Base case (1995). Significant areas of ozone exceedances are predicted in the Lower Lake Michigan, Atlanta, Richmond, Baltimore-Washington, Birmingham, and Louisville areas as well as across a broad portion of the Northeast Corridor. The maximum 1-hr ozone concentration modeled during the 2007 baseline was 211 ppb on 15 July in Atlanta. The number of daily maximum grid cells exceeding 124 ppb ranged from 36 to 400, with the highest number of exceedances occurring on 15 July. (Most of these cells were over the Atlantic Ocean however). The maximum modeled 8-hr ozone concentration was 177 ppb on 15 July in Atlanta. The number of daily maximum grid cells exceeding 124 ppb ranged from 14 to 265, with the highest number of 8-hr exceedances occurring on 14 July. (Most of these cells were over Lake Michigan)

Run 2: 2007 EPA1a Base case (1991). For the 1991 meteorological episode, significant areas of ozone exceedances are predicted in the Lower Lake Michigan, Atlanta,

Cincinnati, and Baltimore-Washington areas as well as across a broad portion of the Northeast Corridor. The maximum 1-hr ozone concentration modeled during the 2007 baseline was 171 ppb on 19 July near Boston. The number of daily maximum grid cells exceeding 124 ppb ranged from 15 to 383, with the highest number of exceedances occurring on 21 July. (Most of these cells were over the Atlantic Ocean). The maximum modeled 8-hr ozone concentration was 153 ppb on 21 July near Cape Cod. The number of daily maximum grid cells exceeding 124 ppb ranged from O to 246, with the highest number of 8-hr exceedances occurring on 21 July. (Most of these cells were over the Atlantic Ocean).

Figures 5–10.3 and 5–10.4 present daily maximum 1-hr and 8-hr ozone tile plots for Runs 3 and 4. These runs correspond to year 2007 conditions assuming fu77 implementation of the EM SIP Ca77 (i.e., 07SIP2a). The same two high ozone days are depicted. Analysis of the full set of daily maximum ozone tile plots for the Run 3 and 4 SIP Call simulations revealed the following:

Run 3: 2007 SIP Call (1995). Significant areas of ozone exceedances are still predicted in the Lower Lake Michigan, Atlanta, Richmond, Baltimore-Washington, Birmingham, Louisville, and in broad portions of the Northeast Corridor although the magnitude of the peak ozone concentrations and the spatial distribution of the high ozone levels is diminished somewhat from the 07EPA1a base case (Run 1). The maximum 1-hr ozone concentration was 181 ppb on 15 July in Atlanta. This represents a 30 ppb decrease from the Run 1 peak.

The number of daily maximum grid cells exceeding 124 ppb ranged from 18 to 207, nearly a 50 percent reduction from Run 1.

The highest number of exceedances (on 15 July) again were located the Atlantic Ocean. The maximum modeled 8-hr ozone concentration was 162 ppb on 10 July in Atlanta. The number of daily maximum grid cells exceeding 124 ppb ranged from 0 to 120, with the highest number of 8-hr exceedances occurring on 14 July. (Most of these cells were over Lake Michigan)

Run 4: 2007 SIP Call (1991). For the SIP Call run with the 1991 meteorology, ozone exceedances are predicted in the Lower Lake Michigan, New York, Cincinnati, Baltimore-Washington and Boston. The maximum 1-hr ozone concentration modeled during the 2007 baseline was 158 ppb on 18 July near Cincinnati. The number of daily maximum grid cells exceeding 124 ppb ranged from 5 to 108, with the highest number of exceedances occurring on 20 July. (Most of these cells were over Lake Michigan or the Atlantic Ocean). The maximum modeled 8-hr ozone concentration was 139 ppb on 18 July near Cincinnati. The number of daily maximum grid cells exceeding 124 ppb ranged from 0 to 41, with the highest number of 8-hr exceedances occurring on 21 July over Long Island.

It is thus apparent that the modeled effects of the EPA SIP Call significantly reduce ozone levels across the eastern U.S. but do not even come close to attainment of the 1-hr standard in the key problem areas: Lower Lake Michigan and the Northeast Corridor.

Run 5: SIP Call Controls in KY, OH, and WV (1995). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in northern Kentucky, southern Ohio and through large portions of western West Virginia in the high ozone areas (> 100 ppb). In addition, broad regions of −2 to −10 ppb ozone reductions are modeled over Lake Erie and the southern portion of the Northeast Corridor.

The daily maximum ozone residual plots (not shown) indicate broad regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of Kentucky, southern Ohio, West Virginia, Virginia and Pennsylvania on individual days. Localized ozone disbenefits of 2 to 14 ppb are modeled on certain days in Cincinnati, Pittsburgh, Cleveland, Louisville, and at other locations along the Ohio River. The maximum daily ozone increase and decrease during the episode were 25 ppb (Paducah, 11 July) and −47 ppb (West Virginia, 15 July). Ozone disbenefits were modeled as far east as northern New Jersey and ozone reductions as large as 2 to 6 ppb were modeled in the Northeast on 14 July. The episode total grid cell hours > 124 ppb were reduced from 3200 to 2804 in Run 5 (−12.4 percent).

Run 6: SIP Call Controls in KY, OH, and WV (1991). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in northern Kentucky, southern Indiana, central Ohio and south-central Pennsylvania in the high ozone areas (> 100 ppb). Broad regions of −2 to −10 ppb ozone reductions are modeled over the southern portion of the Northeast Corridor. Ozone disbenefits of 6 to 10 ppb are simulated in the Cincinnati region.

The daily maximum ozone residuals indicate broad regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of Kentucky, southern Indiana, southwestern Missouri, Ohio, West Virginia, northern Virginia and Penn-

sylvania on individual days. Localized ozone disbenefits of 2 to 30 ppb are modeled on several days in Louisville, Cincinnati, Cleveland, and Pittsburgh.

The maximum daily ozone increase and decrease during the episode were 33 ppb (Pittsburgh, 16 July) and −35 ppb , 17 July). Very extensive zone disbenefits were in Pittsburgh on 16 July and ozone reductions in −6 ppb range are modeled as far as NH and VT on some days. The episode total grid cell hours > 124 ppb were reduced from 2129 to 1832 in Run 6 (−14.0 percent).

Run 7: SIP Call Controls in KY and OH (1995). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in northern Kentucky, southern Indiana, southern Ohio, over Lake Erie, and in western West Virginia. A few isolated locations of −2 to −10 ppb ozone reductions are modeled over the southern portion of the Northeast Corridor. Ozone disbenefits of 6 ppb are simulated near Bowling Green.

The daily maximum ozone residuals indicate broad regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of Kentucky, southern Indiana, Ohio, West Virginia, northern Virginia and Pennsylvania on individual days. Localized ozone disbenefits of 2 to 20 ppb are modeled on several days in areas such as Louisville, Cincinnati, Cleveland, and in various "hot spots" in western Kentucky. The maximum daily ozone increase and decrease during the episode were 25 ppb (southwestern KY, 11 July) and −37 ppb (near Huntington, KY, 15 July). Isolated spots of ozone disbenefits appear in Ohio and ozone reductions in the −2 to −6 ppb range are modeled no farther east than New Jersey. The episode total grid cell hours > 124 ppb were reduced from 3200 to 2980 in Run 7 (−6.9 percent).

Run 8: Cinergy Controls in KY, OH, and WV (1995). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in central to northern Kentucky, southern Indiana, southern Ohio, over Lake Erie, and in major portions of western West Virginia. A few isolated locations of −2 to −10 ppb ozone reductions are modeled over the southern portion of the Northeast Corridor and in Atlanta. Ozone disbenefits of 2–4 ppb are simulated near Bowling Green and Memphis.

The daily maximum ozone residuals of ozone reduction in the range of −2 to −14 ppb or more throughout much of Kentucky, Ohio, West Virginia, northern Virginia and Pennsylvania on individual days. Localized ozone disbenefits of 2 to 20 ppb are modeled on several days in areas such as southern Kentucky, Louisville, Cincinnati, Cleveland, Pittsburgh, and even into New Jersey. The maximum daily ozone increase and decrease during the episode were 31 ppb (Paducah, KY, 12 July) and −34 ppb (western WV, 15 July). Isolated spots of ozone disbenefits appear in Ohio and several of the other in the −2 to −6 ppb range are modeled as far as Rhode Island. The episode reduced from 3200 to 2862 in Run 8 (−10.6 percent).

Run 9: Cinergy Controls in KY, OH, and WV ('91). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in western Kentucky, southern Indiana, central Ohio, central Pennsylvania, and along the Ohio River in West Virginia. A broad region of −2 to −10 ppb ozone reductions are modeled over the southern portion of the Northeast Corridor. Ozone disbenefits as high as 31 ppb are simulated near Cincinnati.

The daily maximum ozone residuals indicate broad regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of Kentucky, Ohio, southern Indiana, West Virginia, northern Virginia and Pennsylvania on individual days. Localized ozone disbenefits of 2 to 30 ppb are modeled on several days in areas such as Paducah, Louisville, Cincinnati, Cleveland, and Pittsburgh. The regions surrounding Pittsburgh and Cincinnati are very significant areas of ozone disbenefits on the 16th. The maximum daily ozone increase and decrease during the episode were 32 ppb (Pittsburgh, 16 July) and −28 ppb (Paducah, 17 July). Isolated spots of ozone disbenefits appear in Ohio and other Midwestern States; ozone reductions in the −2 to −6 ppb range are modeled as far as VT and NH. The episode total grid cell hours > 124 ppb were reduced from 2129 to 1907 in Run 9 (−10.4 percent).

Run 10: SIP Call Controls in KY (1995). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in western Kentucky, southern Indiana, and in Ohio and West Virginia along the Ohio River. An isolated region of −2 to −10 ppb ozone reductions is modeled in Atlanta. Ozone disbenefits as high as 6 ppb are simulated near Bowling Green, KY.

The daily maximum ozone residuals indicate modest regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of Kentucky, southern Indiana and Ohio, West Virginia, the western Carolinas, and northern Georgia. Very little impact in Pennsylvania is modeled on individual days. Localized ozone disbenefits of 2 to 20 ppb are modeled on several days in areas including western Kentucky, Louisville, and Maysville, KY. The maximum daily ozone increase and decrease during the episode were 25 ppb (near Bowling Green, 11 July) and −36 ppb (west-central KY, 15 July). Isolated spots of ozone disbenefits appear in south-

western Indiana and southern Illinois. Ozone reductions in the −2 to −6 ppb range are not modeled past eastern Pennsylvania. The episode total grid cell hours > 124 ppb were reduced from 3200 to 3051 in Run 10 (−4.7 percent).

Run 11: SIP Call Controls in OH (1995). The episode composite results indicate ozone reductions of −2 to −10 ppb or more in western West Virginia and eastern Ohio, over Lake Erie, and in western Ohio. A few isolated locations of −2 to −6 ppb ozone reductions are modeled in Maryland. Ozone disbenefits of 2–3 ppb are simulated near Cincinnati.

The daily maximum ozone residuals indicate broad regions of ozone reduction in the range of −2 ppb to −10 ppb or more throughout much of Ohio, West Virginia, and western Pennsylvania on individual days. Localized ozone disbenefits of 2 to 10 ppb are modeled on several days in areas such as Cincinnati, Cleveland, and in a few other locations in WV and Ohio. The maximum daily ozone increase and decrease during the episode were 15 ppb (Cincinnati, 12 July) and −19 ppb (near Parkersburg, WV 15 July). Isolated spots of ozone disbenefits appear in Ohio and ozone reductions in the −2 to −6 ppb range are modeled no farther east than New Jersey. The episode total grid cell hours > 124 ppb were reduced from 3200 to 3122 in Run 11 (−2.4 percent).

Run 12: SIP Call Controls in WV (1995). The episode composite—results indicate ozone reductions of −2 to −14 ppb or more in western WV; smaller reductions are simulated in southwestern PA. Modest (6–8 pub) ozone disbenefits are simulated in western WV.

The daily maximum ozone residuals indicate modest regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of West Virginia and Pennsylvania and portions of Maryland and Virginia. Regions of ozone disbenefits of 2 to 20 ppb are modeled on several days in areas including central WV, Pittsburgh, and Newark. The maximum daily ozone increase and decrease during the episode were 21 ppb (Pittsburgh, 12 July) and −41 ppb (west-central WV, 15 July). Isolated spots of ozone disbenefits appear throughout West Virginia and Pennsylvania. Ozone reductions in the −2 to −6 ppb barely extend to Connecticut and Massachusetts on 2 days. The episode total grid cell hours > 124 ppb were reduced from 3200 to 3008 in Run 12 (−6.0 percent).

Run 13: SIP Call Controls in TN (95). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in various parts of Tennessee, western Kentucky, eastern Missouri, and northern Alabama. Smaller reductions are simulated in southern Indiana and Mississippi, Alabama, and Georgia. Small ozone disbenefits (2–4 ppb) are simulated in eastern Arkansas.

The daily maximum ozone residuals indicate broad regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of Tennessee and Kentucky, northern Mississippi, Alabama, and Georgia, and along the Ohio River valley upstream to Ashland, Kentucky. Only on 2 days are regions of ozone disbenefits of 2 to 10 ppb are modeled. These occur in extreme western and eastern Tennessee. The maximum daily ozone increase and decrease during the episode were 12 ppb (northwestern Tennessee, 12 July) and −39 ppb (Paducah, 13 July). Unlike the other runs, there are very few regions of modeled ozone disbenefits in this scenario. Ozone reductions in the −2 to −6 ppb are confined to the Midwest and southeast States. There is no impact in the Northeast Corridor. The episode total grid cell hours > 124 ppb were reduced from 3200 to 2930 in Run 13 (−8.4 percent).

Run 14: SIP Call Controls in IN (1995). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in northern Kentucky, southern Indiana, southern Ohio, and in the Gary, IN region adjacent to Lake Michigan. Two localized regions of 2 to 10 ppb ozone increases are modeled near Gary and Louisville.

The daily maximum ozone residuals indicate modest regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of Kentucky, Indiana, Ohio, West Virginia, the western Carolinas, and eastern TN. Only little impact in Pennsylvania is modeled on individual days. Localized ozone disbenefits of 2 to 30 ppb are modeled on several days in areas including the Lower Lake Michigan area, Louisville, Cincinnati, and Indianapolis.

The maximum daily ozone increase and decrease during the episode were 44 ppb (Louisville, 12 July) and −38 ppb (Maysville, Kentucky, 15 July). Isolated spots of ozone disbenefits appear in throughout Indiana and Kentucky.

However, a broad ozone disbenefit plume of 2 to 10 ppb extends eastward from Gary, Indiana on several days of the 1995 episode. Ozone reductions in the −2 to −6 ppb range are not modeled east of Pittsburgh. The episode total grid cell hours > 124 ppb were reduced from 3200 to 3036 in Run 14 (−5.1 percent).

Run 15: Cinergy Controls in KY (1995). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in western Kentucky, southern Indiana, and in Ohio and West Virginia along the Ohio River. An isolated region of −2 to

−10 ppb ozone reductions is modeled over Lake Erie and in Atlanta. Ozone disbenefits as high as 6 ppb are simulated near Bowling Green and Memphis.

The daily maximum ozone residuals indicate modest regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of Kentucky, southern Indiana and Ohio, West Virginia, the western Carolinas, and northern Georgia. Essentially no impact is modeled in Pennsylvania or eastward on individual days. Localized ozone disbenefits of 2 to 30 ppb are modeled on several days in areas including southwestern Kentucky, Louisville, Maysville and Ashland, Kentucky. The maximum daily ozone increase and decrease during the episode were 31 ppb (Owensboro, Kentucky, 12 July) and −28 ppb (west-central Kentucky, 15 July). A few isolated spots of ozone disbenefits appear in southwestern Indiana and southern Illinois. The episode total grid cell hours > 124 ppb were reduced from 3200 to 3076 in Run 15 (−3.9 percent).

Run 16: Cinergy Controls in OH (1995). The episode composite results indicate ozone reductions of −2 to −10 ppb or more in western wv and eastern Ohio, over Lake Erie, and in western Ohio. A few grid cells of −2 to −6 ppb ozone reductions are modeled in Maryland and southwestern PA. Ozone disbenefits of 2–3 ppb are simulated near Cincinnati.

The daily maximum ozone residuals indicate broad regions of ozone reduction in the range of −2 ppb to −10 ppb or more throughout much of Ohio, West Virginia, and western Pennsylvania on individual days. Localized ozone disbenefits of 2 to 10 ppb are modeled on several days in areas such as Cincinnati, Cleveland, and in a few other locations in West Virginia and Ohio. The maximum daily ozone increase and decrease during the episode were 12 ppb (Cincinnati, 12 July) and −15 ppb (near Parkersburg, West Virginia 15 July). Isolated spots of ozone disbenefits appear in Ohio and ozone reductions in the −2 to −6 ppb range are modeled no farther east Pennsylvania. The episode total grid cell hours > 124 ppb were reduced from 3200 to 3139 in Run 16 (−1.9 percent).

Run 17: Cinergy Controls in West Virginia (1995). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in western West Virginia; smaller reductions of order −2 to −10 ppb are simulated in southwestern Pennsylvania. Modest (4–5 ppb) ozone disbenefits are simulated in western West Virginia.

The daily maximum ozone residuals indicate modest regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of West Virginia and Pennsylvania and portions of Maryland and Virginia. Regions of ozone disbenefits of 2 to 20 ppb are modeled on several days in areas including central West Virginia, Pittsburgh, and Newark. The maximum daily ozone increase and decrease during the episode were 22 ppb (Pittsburgh, 12 July) and 30 ppb (west-central West Virginia, 15 July). Isolated spots of ozone disbenefits appear throughout West Virginia and Pennsylvania. A major ozone disbenefit plume is simulated downwind of Pittsburgh on several days. Ozone reductions in the −2 to −6 ppb barely extend to New York on 1 day. The episode total grid cell hours > 124 ppb were reduced from 3200 to 3045 in Run 17 (−4.8 percent).

Run 18: SIP Call Controls in KY (1991). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in western Kentucky, southern Indiana and Illinois, and in central Ohio. Ozone disbenefits of 10 ppb are simulated near Cincinnati.

The daily maximum ozone residuals indicate modest regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout portions of western Kentucky and lower reductions in southern Indiana, Ohio, and West Virginia. Ozone reductions of −2 to −6 ppb were modeled in western Pennsylvania on a few days. Localized ozone disbenefits of 2 to 15 ppb are modeled on several days in Cincinnati or along the Ohio River valley. The maximum daily ozone increase and decrease during the episode were 18 ppb (Cincinnati, 19 July) and −35 ppb (Paducah, Kentucky, 17 July). Isolated spots of ozone disbenefits appear in southwestern Indiana and southern Illinois. Ozone reductions in the −2 to −6 ppb range are not modeled past central Pennsylvania. The episode total grid cell hours > 124 ppb were reduced from 2129 to 2088 in Run 18 (−1.9 percent).

Run 19: SIP Call Controls in OH (1991). The episode composite results indicate ozone reductions of −2 to −10 ppb or more in central Ohio and western PA. A few isolated locations of −2 to −6 ppb ozone reductions are modeled in WV, Maryland, and New Jersey. Ozone disbenefits of as much as 34 ppb are simulated near Cincinnati.

The daily maximum ozone residuals indicate broad regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of Ohio, southern Indiana, West Virginia, and western Pennsylvania on individual days. Localized ozone disbenefits of 2 to 30 ppb are modeled on all days in Cincinnati and Cleveland and

in several other locations in Ohio. The maximum daily ozone increase and decrease during the episode were 34 ppb (Cincinnati, 19 July) and −17 ppb (near Columbus, 18 July). Ozone reductions in the −2 to −6 ppb range extend on 1 day to New Jersey. The episode total grid cell hours > 124 pub were reduced from 2129 to 2062 in Run 19 (−3.1 percent).

Run 20: SIP Call Controls in WV (1991). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in western WV and southwestern PA; smaller reductions are simulated in the Delaware, Maryland, and Virginia region. Essentially no ozone disbenefits are simulated.

The daily maximum ozone residuals indicate modest regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of southern Ohio, northern Kentucky, West Virginia and Pennsylvania and portions of Maryland and Virginia. The principal regions of ozone disbenefits (2 to 30 ppb) is modeled on several days in Pittsburgh. The maximum daily ozone increase and decrease during the episode were 34 ppb (Pittsburgh, 16 July) and −23 ppb (Washington, PA, 17 July). Modeled ozone disbenefits occur within a broad plume encompassing the Pittsburgh-Beaver Valley nonattainment area. . Ozone reductions in the −2 to −6 ppb extend to CT and MA on a few days. The episode total grid cell hours > 124 ppb were reduced from 2129 to 1937 in Run 20 (−9.0 percent).

Run 21: SIP Call Controls in TN (1991). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in western Tennessee, north-central Kentucky, and eastern Arkansas.

The daily maximum ozone residuals indicate broad regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of Tennessee and Kentucky, northern MS, AL, and GA, along the Ohio River valley upstream to Ashland, KY, and through broad swaths of Ohio. Ozone disbenefits appear to be located principally in extreme northeastern and southwestern Tennessee. The maximum daily ozone increase and decrease during the episode were 12 ppb (northeastern TN, 16 July) and −28 ppb (northwestern TN, 18 July). There are very few regions of modeled ozone disbenefits in this scenario. There is no impact in the Northeast Corridor. The episode total grid cell hours > 124 ppb were reduced from 2129 to 2069 in Run 21 (−2.8 percent).

Run 22: SIP Call Controls in IN (1991). The episode composite results indicate ozone reductions of −2 to −14 ppb or more in southern Indiana and in south-central Ohio. Localized regions of 2 to 10 ppb ozone increases are modeled over the lake and in Cincinnati and Louisville.

The daily maximum ozone residuals indicate modest regions of ozone reduction in the range of −2 ppb to −14 ppb or more throughout much of southern Illinois, Indiana, Ohio, and north-western Pennsylvania. Localized ozone disbenefits of 2 to 40 ppb are modeled on several days in areas including the Lower Lake Michigan area, Louisville, Cincinnati, and Indianapolis. The maximum daily ozone increase and decrease during the episode were 45 ppb (Louisville, 18 July) and −17 ppb (Cincinnati, 20 July). Isolated spots of ozone disbenefits appear in throughout Indiana. However, a broad ozone disbenefit plume of 2 to 10 ppb emanates from Gary, IN on several days of the 1991 episode. The episode total grid cell hours > 124 ppb were reduced from 2129 to 2100 in Run 22 (−1.4 percent).

The total number of grid cell hours in each State in the OTAG 12 km domain for which predicted maximum 1-hr and 8-hr ozone concentrations exceed arbitrary cutoff levels were developed (Tesche et al., 1998b). For the 1-hr ozone results, these levels are 100 pub, 124 ppb, and 140 pub, respectively. 1-hr and 8-hr tables were compiled to help determine the total number of grid cell hours in a particular State where ozone levels are predicted to decrease over the episode relative to the 2007 EPA1a baseline simulation. Joint analysis of these grid cell hours tables and the daily maximum ozone difference plots (contained on the CD-ROM archives) reveals that in many cases, the absolute concentrations of ozone contributed in one State by another far upwind is well below a few ppb, even though the total concentration in the receptor State from all local and upwind sources is above 124 ppb.

Tri-State Subregional Modeling Results

The results of the Tri-State subregional UAM-V modeling (Table 5–10.2) in which SIP level controls and Cinergy controls were placed on the States of Ohio, Kentucky, West Virginia, Indiana and Tennessee suggest that:

Effects of the SIP Call

- SIP Call controls are effective in reducing the OTAG domainwide peak ozone concentrations from 211 ppb (695) and 171 ppb (1991) to 181 ppb (30 ppb reduction) and 158 ppb (13 ppb reduction), respectively. The number of daily maximum grid cells > 124 ppb in the 2007 Base case were reduced by factors of 2 to 4 for the two

OTAG episodes. Despite these significant regionwide ozone reductions, exceedances are still modeled in the Lower Lake Michigan, Atlanta, Northeast Corridor, Baltimore-Washington, Cincinnati, Birmingham, Raleigh, and Louisville nonattainment areas.

Impacts on the Northeast

- The high modeled 1-hr average ozone concentrations occurring in the northeast are not influenced appreciably by sources in the States of Kentucky, Ohio, and West Virginia. Results from modeling with both episodes reveals little (i.e., 2–6 ppb) or no ozone reduction in the Northeast Corridor. More specifically:
- Impacts from Ohio, Kentucky, and West Virginia may be as much as 2–6 ppb in the Northeast Corridor on one or a few days, but the impact areas are very small;
- Impacts from Ohio in the 2–6 ppb range extend no farther east than New Jersey; Impacts from Kentucky in the 2–6 ppb range extend no farther east than central to eastern Pennsylvania: Impacts from West Virginia in the 2–6 ppb range extend into the Northeast Corridor (Connecticut, Massachusetts) on one or a few days.
- Impacts from Indiana in the 2–6 ppb range are not modeled much beyond Pittsburgh; and
- There are no modeled impacts from Tennessee in the Northeast Corridor.

Effects of Individual State Controls

- SIP controls in Kentucky increase/decrease maximum ozone concentrations by 25 ppb/–36 ppb for the 1995 episode and by 18 ppb/–35 ppb for the 1991 episode. The net reduction in grid cell exceedance hours for the two episodes is −4.7 percent and −1.9 percent;
- SIP controls in Ohio increase/decrease maximum ozone concentrations by 15 ppb/–19 ppb for the 1995 episode and by 34 ppb/–17 ppb for the 1991 episode. The net reduction in grid cell exceedance hours for the two episodes is −2.4 percent and −3.1 percent;
- SIP controls in West Virginia increase/decrease maximum ozone concentrations by 21 ppb/–41 ppb for the 1995 episode and by 34 ppb/–23 ppb for the 1991 episode. The net reduction in grid cell exceedance hours for the two episodes is −6.0 percent and 9.0 percent;
- SIP controls in Tennessee increase/decrease maximum ozone concentrations by 12 ppb/–39 ppb for the 1995 episode and by 12 ppb/–28 ppb for the 1991 episode. The net reduction in grid cell exceedance hours for the two episodes is −8.4 percent and −2.8 percent;
- SIP controls in Indiana increase/decrease maximum ozone concentrations by 44 ppb/–38 ppb for the 1995 episode and by 45 ppb/–17 ppb for the 1991 episode. The net reduction in grid cell exceedance hours for the two episodes is −5.1 percent and −1.4 percent. A broad disbenefit plume (2–10 pub) is modeled downwind of Gary, Indiana on several days of the 1995 episode; The greatest number of grid-cell hours of ozone reduction occurs for SIP controls on West Virginia (32.9 percent for 1995 and 31.0 percent for 1991 episodes).
- The greatest number of grid-cell hours for ozone increases occurs for SIP controls on Indiana (79.2 percent, 695 episode) and Tennessee (75.3 percent, 1991 episode).

Differences Between SIP Call and Cinergy Controls

Comparing the SIP Call and Cinergy controls on the aggregate States of Kentucky, Ohio, and West Virginia:

- For the 1995 episode, the Cinergy package produced larger peak ozone increases (31 ppb vs. 25 pub) and smaller peak ozone reductions (−34 ppb vs. −47 ppb) than the SIP Call and lowered the episode total grid cell hours > 124 ppb by a smaller percentage (−10.6 percent versus −12.4 percent).
- For the 1991 episode the Cinergy package produced equivalent peak ozone increases (32 ppb vs. 33 ppb) and smaller peak ozone reductions (−28 ppb vs. −35 ppb) than the SIP Call and again lowered the episode total grid cell hours > 124 ppb by a smaller percentage (−10.4 percent versus −14.0 percent).
- Comparing the SIP Call and Cinergy controls on Kentucky sources for the 695 episode, the Cinergy package produced larger peak ozone increases (31 ppb vs. 25 ppb) and smaller peak ozone decreases (−28 ppb vs. −36 ppb) and a smaller reduction in grid cell exceedance hours (−3.9 percent versus −4.7 percent). Comparing the SIP Call and Cinergy controls on Ohio sources for the 695 episode, the Cinergy package produced nearly equal peak ozone increases (12 ppb vs. 15 ppb) and smaller peak ozone decreases (−15 ppb vs. −19 ppb) and a smaller reduction in grid cell exceedance hours (−1.9 percent versus −2.4 percent).

- Comparing the SIP Call and Cinergy controls on West Virginia sources for the 695 episode, the Cinergy package produced essentially equivalent peak ozone increases (21 ppb vs. 22 ppb) and larger peak ozone decreases (−41 ppb vs. −30 ppb) and a greater reduction in grid cell exceedance hours (−6.0 percent versus −4.8 percent).
- The effectiveness of the Cinergy package relative to the SIP Call appears to depend upon the State in which the controls are applied. Across the three State region of KY, OH, and WV and for controls individually in the States of Kentucky and Ohio, the SIP Call controls appear to provide greater ozone benefits, lower ozone disbenefits and a larger reduction in the total number of grid cells > 124 ppb. In contrast, Cinergy level controls in the WV appear to produce greater reductions in the peak ozone concentration and a greater reduction in the number of grid cells > 124 ppb. These results corroborate the overall necessity for focused analyses of subregional control strategy effectiveness. A simplistic, regionwide control strategy (e.g., an eastern States SIP Call) may not be most effective in individual OTAG subregions.

TVA Scale of Ozone Transport Study

The Tennessee Valley Authority (TVA) carried out a number of UAM-V modeling and analysis activities during and subsequent to the OTAG process. While many of the results were presented in public meetings during the OTAG process, no formal documentation was developed until the recent paper by Imhoff and Gautney (1998) summarizing a portion of the TVA analysis. Their work is briefly summarized here.

Two unique applications of the UAM-V photochemical model were performed by TVA using primarily the July 1995 OTAG episode:

- Rollout Modeling: The rollout modeling assessment requires a number of UAM-V runs. In the rollout methodology, particular control strategy of interest' (e.g., the OTAG 5c controls) is first applied to the problem area itself, say the Northeast Corridor. Subsequently, controls are applied in successive UAM-V runs in which the geographical region over which the controls are imposed is increased in size in a stepwise fashion, either in circles of expanding radii or in tiers of grid cells added onto the original problem area. The effects of controls in each of the larger areas is compared back to the effects of controls on the original problem area. Applied in this manner, the rollout methodology allows one to determine quantitatively the distance beyond which additional controls cease being effective in improving ozone in the original problem area.
- Reactive Tracer Modeling: The reactive tracer UAM-V simulations were aimed at examining the rate at which ozone is removed from the atmosphere. Anthropogenic NOx and VOC emissions and biogenic NOx emissions are turned off 48 hours and 24 hours before a time of interest in the model simulation. The biogenic VOCs emissions are retained in the model simulation to give the NOx remaining in the system an opportunity to form ozone and to preserve on of the important ozone removal mechanisms. The concentrations in this run is then compared with the base case to estimate the amount of ozone formed due to emissions in the previous 24 hours. In other words, the results allow one to estimate the decay rate of ozone in the atmosphere due to natural removal, dilution, and conversion processes.

Among the pertinent TVA findings reported by Imhoff and Gautney (1998) are:

- Both the rollout and reactive tracer modeling indicate that meaningful ozone reductions at high concentration locations (e.g., the Northeast Corridor) are difficult to achieve by controlling sources far away from the problem areas;
- Different regions of the eastern U.S. have very different characteristic scales of ozone transport, with Atlanta having the shortest and Lake Michigan the longest;
- Defining the Area of Influence (AOI) as the distance at which 75 percent of the overall effects of OTAG 5c controls are achieved, TVA found:
- Controls within the Atlanta region are sufficient to reducing peak ozone concentrations to 120 ppb (AOI = 0);
- Controls must extent additional 195 km beyond the Lower Lake Michigan region in order to aid in reducing concentrations to below 120 ppb (AOI = 195 km) and
- Controls must extend an additional 40 km beyond the Northeast corridor to achieve the 75 percent reduction potential available for 5c controls. To achieve 90 to 95 percent of the possible effectiveness of reducing cells below 120 ppb using the 5c controls would obviously require controls over a larger area—with the attendant costs.

By the time controls have been extended beyond 96 km from the Northeast Corridor, their efficiency is less than one-half that of controls within the corridor itself; and

Simulated ozone concentrations do not depend significantly on the amount of ozone that has been resident in the model for more than 48 hours, but is strongly dependent on the anthropogenic emissions that have occurred within the preceding 48 hours. This UAM-V findings refute the popular conceptual notion of a cause and effect relationship between transport of localized high ozone from far upwind and nonattainment in the NE.

The TVA analysis concludes that a strategy of regional NOx controls for controlling high ozone concentrations is not specifically focused at the locations in need, and is inefficient, impractical.

CONCLUSIONS

The analysis of the UAM-V air quality modeling addressing the proposed SIP Call plan reveals the following:

- Local Controls Most Effective: Most of the ozone reduction benefits of the SIP Call control strategy in a nonattainment area are due to controls in or immediately downwind of the nonattainment area.
- Ozone Improvements Predominantly in Non-Problem Areas: Most of the ozone reductions due to the SIP Call control plan occur in attainment or near-attainment areas, reducing ozone concentrations to levels well below the NAAQS.
- SIP Call Does Not Produce Desired Result in Regions of Greatest Need: The SIP Call control scenario produces much smaller reductions in ozone concentrations in the most serious ozone nonattainment areas (Northeast Corridor and Lake Michigan) because ozone in these areas is mainly due to area and mobile sources. What reductions that do occur are mainly due to local emissions reductions.
- Diminishing Effectiveness of Point Source NOx Control: There is very little difference in the reductions in ozone concentrations due to the Run A control strategy (55 percent controls on major NOx point sources) versus the Run I control strategy (85 percent control on major NOx point sources); the extra reductions in emissions from major NOx point sources from 55 percent to 85 percent is not cost-effective or justified based on the ozone air quality benefits.
- NOx-Focused Plan Accelerates Ozone Formation Rates: The SIP Call NOx-focused control plan increases the rate of atmospheric ozone formation; States whose emissions are not affected by the SIP Call control strategy have higher contributions to nonattainment after implementation of the SIP Call controls.
- Regional NOx Reductions Cause Isolated, Local Ozone Disbenefits: OTAG modeling indicated NOx disbenefits that generated some controversy. Subesequent modeling confirms that significant NOx disbenefits do occur , particularly around Lake Michigan and near certain urban areas including Baltimore (Maryland)-Washington (DC); Cincinnati, Ohio; Louisville, Kentucky; and Pittsburgh, Pennsylvania.

A very large number of photochemical model simulations have been performed to develop refined estimates of whether and to what extent precursor emissions from sources in the Midwestern U.S. actually contribute to the modeled high ozone concentrations in the Northeast Corridor. These simulations, employing the UAM-V and CAMx regional models and OTAG data sets, have examined specific controls on individual facilities, individual States and/or specific aggregations of States. As such, they constitute much more focused analyses than the generic "zero-out" runs performed by OTAG and used by EPA to justify the SIP Call. Overall these refined model simulations reveal a consistent picture. The expected effect of significant ozone precursor emissions in the Midwest:

- Has at most a -2 to -6 ppb reduction on modeled afternoon ozone concentrations in the Northeast Corridor under severe ozone episode conditions;
- Tends not to produce significant ozone reductions at the same time or location in the Northeast where the peak ozone concentrations are modeled or measured; and
- Produces far greater increases in peak ozone concentrations in local Midwestern attainment and nonattainment areas than decreases in ozone levels in the Northeast Corridor.

Results from the Tri-State study evaluate the geographical extent and magnitude of expected ozone benefits in the Northeast Corridor from controls in the Midwest. These results very clearly reveal that in those instances where ozone benefits are modeled in the Northeast Corridor, the concentration reductions are very low (-2 to -6 ppb), tend not to occur in the most heavily populated areas, and do not occur in the areas of highest modeled ozone.

The tables below (Tesche, T.W., et al, 1998a) summarizes the UAM-V modeling results from the Tri-State study with respect to the extent of modeled ozone disbenefits occurring in the Midwest, particularly in Kentucky and southern Ohio. These results very clearly reveal that one of the negative consequences of the SIP

Call or Cinergy level control scenarios is the generation of significant ozone increases, particularly in the Cincinnati and Louisville nonattainment areas. Ozone increases on the order of 20 to 45 ppb are predicted in Cincinnati and Louisville under severe ozone episode conditions.

Table 1. Summary of Ozone Impacts in the Northeast Corridor Resulting from Application of the SIP Call Emissions Controls.

RunNo.	Run Description	Summary of UAM-V Ozone Impacts in the Northeast Corridor Based on the Tri-State Modeling Analysis
1	2007EPA1a Basecase ('95)	Significant areas of ozone exceedances are predicted in the Northeast Corridor.
2	2007EPA1a Basecase ('91)	Significant areas of ozone exceedances are predicted across a broad portion of the Northeast Corridor. The maximum 1-hr ozone concentration modeled during the 2007 baseline was 171 ppb on 19 July near Boston. The maximum modeled 8-hr ozone concentration was 153 ppb on 21 July near Cape Cod.
3	2007 SIP Call Base-case ('95)	Significant areas of ozone exceedances are still predicted in broad portions of the Northeast Corridor. The magnitude of the peak ozone concentrations and the spatial distribution of the high ozone levels is diminished somewhat from the 07EPA1a Basecase (Run 1).
4	2007 SIP Call Base-case ('91)	Ozone exceedances are predicted in the Baltimore-Washington and Boston.
5	SIP Call Controls in KY, OH, and WV ('95)	Ozone reductions in the -2 to -6 ppb range were modeled in the Northeast on 14 July.
6	SIP Call Controls in KY, OH, and WV ('91)	Ozone reductions in the -2 to -6 ppb range modeled as far as NH and VT on some days.
7	SIP Call Controls in KY and OH ('95)	Ozone reductions in the -2 to -6 ppb range were modeled no farther east than New Jersey.
8	Cinergy Controls in KY, OH, and WV ('95)	Ozone reductions in the -2 to -6 ppb range were modeled as far as Rhode Island.
9	Cinergy Controls in KY, OH, and WV ('91)	Ozone reductions in the -2 to -6 ppb range are modeled as far as VT and NH.
10	SIP Call Controls in KY ('95)	Ozone reductions in the -2 to -6 ppb range are not modeled past eastern Pennsylvania (i.e., no impact in the Northeast Corridor).
11	SIP Call Controls in OH ('95)	Ozone reductions in the -2 to -6 ppb range are modeled no farther east than New Jersey.
12	SIP Call Controls in WV ('95)	Ozone reductions in the -2 to -6 ppb range barely extend to CT and MA on two days.
13	SIP Call Controls in TN ('95)	No impact in the Northeast Corridor.
14	SIP Call Controls in IN ('95)	Ozone reductions in the -2 to -6 ppb range are not modeled east of Pittsburgh (i.e., no impact in the Northeast Corridor).
15	Cinergy Controls in KY ('95)	No impact in the Northeast Corridor.
16	Cinergy Controls in OH ('95)	Ozone reductions in the -2 to -6 ppb range are modeled no farther east than Pennsylvania (i.e., no impact in the Northeast Corridor).
17	Cinergy Controls in WV ('95)	Ozone reductions in the -2 to -6 ppb range barely extend to New York on one day.
18	SIP Call Controls in	Ozone reductions in the -2 to -6 ppb range are

	KY ('91)	not modeled past central Pennsylvania (i.e., no impact in the Northeast Corridor).
19	SIP Call Controls in OH ('91)	Ozone reductions in the -2 to -6 ppb range extend on one day to New Jersey.
20	SIP Call Controls in WV ('91)	Ozone reductions in the -2 to -6 ppb range extend to CT and MA on a few days.
21	SIP Call Controls in TN ('91)	No impact in the Northeast Corridor.
22	SIP Call Controls in IN ('91)	Ozone reduction in the 2- to -6 ppb range do not extend beyond north-central Pennsylvania (i.e., no impact in the Northeast Corridor).

Table 2. Summary of Ozone Disbenefits in the Tri-State Region Resulting from Application of SIP Call Emissions Controls.

RunNo.	Run Description	Summary of UAM-V Ozone Disbenefits In the Midwest Based on the Tri-State Modeling Analysis
1	2007EPA1a Basecase ('95)	Significant areas of ozone exceedances are predicted in the Louisville area.
2	2007EPA1a Basecase ('91)	Significant areas of ozone exceedances are predicted in the Cincinnati area.
3	2007 SIP Call Base-case ('95)	Significant areas of ozone exceedances are still predicted in the Louisville area.
4	2007 SIP Call Base-case ('91)	Ozone exceedances are predicted in the Cincinnati area. The maximum 1-hr ozone concentration modeled during the 2007 baseline was 158 ppb on 18 July near Cincinnati. The maximum modeled 8-hr ozone concentration was 139 ppb on 18 July near Cincinnati.
5	SIP Call Controls in KY, OH, and WV ('95)	Localized ozone disbenefits of 2 to 14 ppb are modeled on certain days in Cincinnati, Louisville, and at other locations along the Ohio River. The maximum daily ozone increase during the episode was 25 ppb (Paducah, 11 July).
6	SIP Call Controls in KY, OH, and WV ('91)	Localized ozone disbenefits of 2 to 30 ppb are modeled on several days in Louisville and Cincinnati.
7	SIP Call Controls in KY and OH ('95)	Localized ozone disbenefits of 2 to 20 ppb are modeled on several days in areas such as Louisville, Cincinnati, and in various "hot spots" in western Kentucky. The maximum daily ozone increase during the episode was 25 ppb (southwestern KY, 11 July). Isolated spots of ozone disbenefits appear in various areas in Ohio.
8	Cinergy Controls in KY, OH, and WV ('95)	Localized ozone disbenefits of 2 to 20 ppb are modeled on several days in areas such as southern Kentucky, Louisville, and Cincinnati. The maximum daily ozone increase during the episode was 31 ppb (Paducah, KY, 12 July). Isolated spots of ozone disbenefits appear in Ohio and several of the other Midwestern states.
9	Cinergy Controls in	Localized ozone disbenefits of 2 to 30 ppb are modeled on several days in areas such as Paducah, Louisville, and

	KY, OH, and WV ('91)	Cincinnati. The region surrounding Cincinnati is a very significant area of ozone disbenefits on the 16th. Isolated spots of ozone disbenefits appear in Ohio and other Midwestern states.
10	SIP Call Controls in KY ('95)	Localized ozone disbenefits of 2 to 20 ppb are modeled on several days in areas including western Kentucky, Louisville, and Maysville, KY. The maximum daily ozone increase during the episode was 25 ppb (near Bowling Green, 11 July).
11	SIP Call Controls in OH ('95)	Localized ozone disbenefits of 2 to 10 ppb are modeled on several days in Cincinnati and in other locations in Ohio. The maximum daily ozone increase during the episode was 15 ppb (Cincinnati, 12 July). Isolated spots of ozone disbenefits appear in Ohio.
12	SIP Call Controls in WV ('95)	No significant disbenefits in Tri-State region.
13	SIP Call Controls in TN ('95)	Only on two days are regions of ozone disbenefits of 2 to 10 ppb are modeled. These occur in extreme western and eastern TN. The maximum daily ozone increase and decrease during the episode were 12 ppb (northwestern TN, 12 July).
14	SIP Call Controls in IN ('95)	Localized ozone disbenefits of 2 to 30 ppb are modeled on several days in areas including Louisville, Cincinnati, and Indianapolis. The maximum daily ozone increase during the episode was 44 ppb (Louisville, 12 July). A broad ozone disbenefit plume of 2 to 10 ppb extends eastward from Gary, IN on several days of the 1995 episode.
15	Cinergy Controls in KY ('95)	Localized ozone disbenefits of 2 to 30 ppb are modeled on several days in areas including southwestern Kentucky, Louisville, Maysville, and Ashland, KY. The maximum daily ozone increase during the episode was 31 ppb (Owensboro, KY, 12 July). A few isolated spots of ozone disbenefits appear in southwestern Indiana and southern Illinois.
16	Cinergy Controls in OH ('95)	Localized ozone disbenefits of 2 to 10 ppb are modeled on several days in Cincinnati and in a few other locations in WV and Ohio. The maximum daily ozone increase during the episode was 12 ppb (Cincinnati, 12 July). Isolated spots of ozone disbenefits appear in Ohio.
17	Cinergy Controls in WV ('95)	No significant disbenefits in Tri-State region.
18	SIP Call Controls in KY ('91)	Localized ozone disbenefits of 2 to 15 ppb are modeled on several days in Cincinnati or along the Ohio River valley. The maximum daily ozone increase during the episode was 18 ppb (Cincinnati, 19 July). Isolated spots of ozone disbenefits appear in southwestern Indiana and southern Illinois.
19	SIP Call Controls in OH ('91)	Localized ozone disbenefits of 2 to 30 ppb are modeled on all days in Cincinnati and in several other locations in Ohio. The maximum daily ozone increase during the episode was 34 ppb (Cincinnati, 19 July).
20	SIP Call Controls in WV ('91)	No significant disbenefits in Tri-State region.
21	SIP Call Controls in	Ozone disbenefits appear to be located principally in extreme northeastern and southwestern Tennessee. The

	TN ('91)	maximum daily ozone increase during the episode was 12 ppb (northeastern TN, 16 July).
22	SIP Call Controls in IN ('91)	Localized ozone disbenefits of 2 to 40 ppb are modeled on several days in Louisville, Cincinnati, and Indianapolis. The maximum daily ozone increase during the episode was 45 ppb (Louisville, 18 July). Isolated spots of ozone disbenefits appear in throughout Indiana. A broad ozone disbenefit plume of 2 to 10 ppb emanates from Gary, IN on several days of the 1991 episode.

II

105TH CONGRESS
1ST SESSION

S. 1097

To reduce acid deposition under the Clean Air Act, and for other purposes.

IN THE SENATE OF THE UNITED STATES

JULY 31, 1997

Mr. MOYNIHAN (for himself and Mr. D'AMATO) introduced the following bill; which was read twice and referred to the Committee on Environment and Public Works

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A BILL

To reduce acid deposition under the Clean Air Act, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION. 1. SHORT TITLE.

This Act may be cited as the "Acid Deposition Control Act".

SEC. 2. FINDINGS AND PURPOSES.

(a) FINDINGS.—Congress finds that—

(1) reductions of atmospheric nitrogen oxide and sulfur dioxide from utility plants, in addition to the reductions required under the Clean Air Act (42

U.S.C. 7401 et seq.), are needed to reduce acid deposition and its serious adverse effects on public health, natural resources, building structures, sensitive ecosystems, and visibility;

(2) nitrogen oxide and sulfur dioxide contribute to the development of fine particulates, suspected of causing human mortality and morbidity to a significant extent;

(3) regional nitrogen oxide reductions of 50 percent in the Eastern United States, in addition to the reductions required under the Clean Air Act, may be necessary to protect sensitive watersheds from the effects of nitrogen deposition;

(4) without reductions in nitrogen oxide and sulfur dioxide, the number of acidic lakes in the Adirondacks in the State of New York is expected to increase by up to 40 percent by 2040; and

(5) nitrogen oxide is highly mobile and can lead to ozone formation hundreds of miles from the emitting source.

(b) PURPOSES.—The purposes of this Act are—

(1) to recognize the current scientific understanding that emissions of nitrogen oxide and sulfur dioxide, and the acid deposition resulting from emis-

sions of nitrogen oxide and sulfur dioxide, present a substantial human health and environmental risk;

(2) to require reductions in nitrogen oxide and sulfur dioxide emissions;

(3) to support the efforts of the Ozone Transport Assessment Group to reduce ozone pollution;

(4) to reduce utility emissions of nitrogen oxide by 70 percent from 1990 levels; and

(5) to reduce utility emissions of sulfur dioxide by 50 percent after the implementation of phase II sulfur dioxide requirements under section 405 of the Clean Air Act (42 U.S.C. 7651d).

SEC. 3. DEFINITIONS.

In this Act:

(1) ADMINISTRATOR.—The term "Administrator" means the Administrator of the Environmental Protection Agency.

(2) AFFECTED FACILITY.—The term "affected facility" means a facility with 1 or more combustion units that serve at least 1 electricity generator with a capacity equal to or greater than 25 megawatts.

(3) NO_x ALLOWANCE.—The term "NO_x allowance" means a limited authorization to emit, in accordance with this Act—

(A) 1 ton of nitrogen oxide during each of the months of October, November, December, January, February, March, and April of any year; and

(B) ½ ton of nitrogen oxide during each of the months of May, June, July, August, and September of any year.

(4) MMBTU.—The term "mmBtu" means 1 million British thermal units.

(5) PROGRAM.—The term "Program" means the Nitrogen Oxide Allowance Program established under section 4.

(6) STATE.—The term "State" means the 48 contiguous States and the District of Columbia.

SEC. 4. NITROGEN OXIDE ALLOWANCE PROGRAM.

(a) IN GENERAL.—

(1) ESTABLISHMENT.—Not later than 18 months after the date of enactment of this Act, the Administrator shall establish a program to be known as the "Nitrogen Oxide Allowance Program".

(2) SCOPE.—The Program shall be conducted in the 48 contiguous States and the District of Columbia.

(3) NO_x ALLOWANCES.—The Administrator shall allocate under paragraph (4)—

(A) for each of calendar years 2000 through 2002, 5,400,000 NO_x allowances; and

(B) for calendar year 2003 and each calendar year thereafter, 3,000,000 NO_x allowances.

(4) ALLOCATION.—

(A) DEFINITION OF TOTAL ELECTRIC POWER.—For purposes of this paragraph, the term "total electric power" means all electric power generated by utility and nonutility generators for distribution, including electricity generated from solar wind, hydro power, nuclear power, and the combustion of fossil fuel.

(B) ALLOCATION OF ALLOWANCES.—The Administrator shall allocate annual NO_x allowances to each of the States in proportion to the State's share of the total electric power generated in the 48 contiguous States and the District of Columbia.

(C) PUBLICATION.—The Administrator shall publish in the Federal Register a list of each State's NO_x allowance allocation—

(i) by December 1, 1998, for calendar years 2000 and 2002;

(ii) by December 1, 2000, for calendar years 2003 through 2010; and

(iii) by December 1 of each calendar year after 2000, for the calendar year 5 years previous.

(5) INTRASTATE DISTRIBUTION.—

(A) IN GENERAL.—A State may submit a report to the Administrator detailing the distribution of NO_x allowances of the State to affected facilities in the State—

(i) not later than September 30, 1999, for calendar years 2000 through 2002;

(ii) not later than September 30, 2001, for calendar years 2003 through 2010; and

(iii) not later than September 30 of each calendar year after 2011, for the calendar year 5 years previous.

(B) ACTION BY THE ADMINISTRATOR.—If a State submits a report under subparagraph (A) not later than September 30 of the calendar year specified in subparagraph (A), the Administrator shall distribute the NO_x allowances to

affected facilities in the State as detailed in the report.

(C) LATE SUBMISSION OF REPORT.—A report submitted by a State after September 30 of the specified year shall have no force or effect.

(D) DISTRIBUTION IN ABSENCE OF A REPORT.—

(i) IN GENERAL.—Subject to subsection (e), if a State does not submit a report under subparagraph (A) not later than September 30 of the calendar year specified in subparagraph (A), the Administrator shall, not later than November 30 of that calendar year, distribute the NO_x allowances for the calendar years specified in subparagraph (A) to each affected facility in the State in proportion to the affected facility's share of the total net electric power generated in the State.

(ii) DETERMINATION OF FACILITY'S SHARE.—In determining an affected facility's share of total net electric power generated in a State, the Administrator shall

consider the net electric power generated by the facility and the State to be—

(I) for calendar years 2000 through 2002, the average annual amount of net electric power generated, by the facility and the State, respectively, in calendar years 1995 through 1997;

(II) for calendar years 2003 through 2010, the average annual amount of net electric power generated, by the facility and the State, respectively, in calendar years 1997 through 1999; and

(III) for calendar year 2011 and each calendar year thereafter, the amount of net electric power generated, by the facility and the State, respectively, in the calendar year 5 years previous to the year for which the determination is made.

(E) JUDICIAL REVIEW.—A distribution of NO_x allowances by the Administrator under subparagraph (D) shall not be subject to judicial review.

(b) NO_x ALLOWANCE TRANSFER SYSTEM.—

(1) IN GENERAL.—Not later than 18 months after the date of enactment of this Act, the Administrator shall promulgate NO_x allowance system regulations under which a NO_x allowance allocated under this Act may be transferred among affected facilities and any other person.

(2) ESTABLISHMENT.—The regulations shall establish the NO_x allowance system under this section, including requirements for the allocation, transfer, and use of NO_x allowances under this Act.

(3) USE OF NO_x ALLOWANCES.—The regulations shall—

(A) prohibit the use (but not the transfer in accordance with paragraph (5)) of any NO_x allowance before the calendar year for which the NO_x allowance is allocated; and

(B) provide that the unused NO_x allowances shall be carried forward and added to NO_x allowances allocated for subsequent years.

(4) CERTIFICATION OF TRANSFER.—A transfer of a NO_x allowance shall not be effective until a written certification of the transfer, signed by a responsible official of the person making the transfer, is received and recorded by the Administrator.

(c) NO_x ALLOWANCE TRACKING SYSTEM.—Not later than 18 months after the date of enactment of this Act, the Administrator shall promulgate regulations for issuing, recording, and tracking the use and transfer of NO_x allowances that shall specify all necessary procedures and requirements for an orderly and competitive functioning of the NO_x allowance system.

(d) PERMIT REQUIREMENTS.—A NO_x allowance allocation or transfer shall, on recordation by the Administrator, be considered to be a part of each affected facility's operating permit requirements, without the requirement for any further permit review and revision.

(e) NEW SOURCE RESERVE.—

(1) IN GENERAL.—For a State for which the Administrator distributes NO_x allowances under subsection (a)(5)(D), the Administrator shall place 10 percent of the total annual NO_x allowances of the State in a new source reserve to be distributed by the Administrator—

(A) for calendar years 2000 through 2003, to sources that commence operation after 1995;

(B) for calendar years 2004 through 2009, to sources that commence operation after 1997; and

(C) for calendar year 2010 and each calendar year thereafter, to sources that commence operation after the calendar year that is 5 years previous to the year for which the distribution is made.

(2) SHARE.—For a State for which the Administrator distributes NO_x allowances under subsection (a)(5)(D), the Administrator shall distribute to each new source a number of NO_x allowances sufficient to allow emissions by the source at a rate equal to the lesser of the new source performance standard or the permitted level for the full nameplate capacity of the source, adjusted pro rata for the number of months of the year during which the source operates.

(3) UNUSED NO_x ALLOWANCES.—

(A) IN GENERAL.—During the period of calendar years 2000 through 2005, the Administrator shall conduct auctions at which a NO_x allowance remaining in the new source reserve that has not been distributed under paragraph (2) shall be offered for sale.

(B) OPEN AUCTIONS.—An auction under subparagraph (A) shall be open to any person.

(C) CONDUCT OF AUCTION.—

(i) METHOD OF BIDDING.—A person wishing to bid for a NO_x allowance at an auction under subparagraph (A) shall submit (by a date set by the Administrator) to the Administrator (on a sealed bid schedule provided by the Administrator) an offer to purchase a specified number of NO_x allowances at a specified price.

(ii) SALE BASED ON BID PRICE.—A NO_x allowance auctioned under subparagraph (A) shall be sold on the basis of bid price, starting with the highest priced bid and continuing until all NO_x allowances for sale at the auction have been sold.

(iii) NO MINIMUM PRICE.—A minimum price shall not be set for the purchase of a NO_x allowance auctioned under subparagraph (A).

(iv) REGULATIONS.—The Administrator, in consultation with the Secretary of the Treasury, shall promulgate regulations to carry out this paragraph.

(D) USE OF NO_x ALLOWANCES.—A NO_x allowance purchased at an auction under subparagraph (A) may be used for any purpose

and at any time after the auction that is permitted for use of a NO_x allowance under this Act.

(E) PROCEEDS OF AUCTION.—The proceeds from an auction under this paragraph shall be distributed to the owner of an affected source in proportion to the number of allowances that the owner would have received but for this subsection.

(f) NATURE OF NO_x ALLOWANCES.—

(1) NOT A PROPERTY RIGHT.—A NO_x allowance shall not be considered to be a property right.

(2) LIMITATION OF NO_x ALLOWANCES.—Notwithstanding any other provision of law, the Administrator may terminate or limit a NO_x allowance.

(g) PROHIBITIONS.—

(1) IN GENERAL.—After January 1, 2000, it shall be unlawful—

(i) for the owner or operator of an affected facility to operate the affected facility in such a manner that the affected facility emits nitrogen oxides in excess of the amount permitted by the quantity of NO_x allowances held by the designated representative of the affected facility; or

(ii) for any person to hold, use, or transfer a NO_x allowance allocated under this Act, except as provided under this Act.

(2) OTHER EMISSION LIMITATIONS.—Section 407 of the Clean Air Act (42 U.S.C. 7651f) is repealed.

(3) TIME OF USE.—A NO_x allowance may not be used before the calendar year for which the NO_x allowance is allocated.

(4) PERMITTING, MONITORING, AND ENFORCEMENT.—Nothing in this section affects—

(A) the permitting, monitoring, and enforcement obligations of the Administrator under the Clean Air Act (42 U.S.C. 7401 et seq.); or

(B) the requirements and liabilities of an affected facility under the Clean Air Act (42 U.S.C. 7401 et seq.).

(h) SAVINGS PROVISIONS.—Nothing in this section—

(1) affects the application of, or compliance with, the Clean Air Act (42 U.S.C. 7401 et seq.) for an affected facility, including the provisions related to applicable national ambient air quality standards and State implementation plans;

(2) requires a change in, affects, or limits any State law regulating electric utility rates or charges, including prudency review under State law;

(3) affects the application of the Federal Power Act (16 U.S.C. 791a et seq.) or the authority of the Federal Energy Regulatory Commission under that Act; or

(4) interferes with or impairs any program for competitive bidding for power supply in a State in which the Program is established.

SEC. 5. INDUSTRIAL SOURCE MONITORING.

Section 412(a) of the Clean Air Act (42 U.S.C. 7651k(a)) is amended in the first sentence by inserting ", or of any industrial facility with a capacity of 100 or more mmBtu's per hour," after "The owner and operator of any source subject to this title".

SEC. 6. EXCESS EMISSIONS PENALTY.

(a) IN GENERAL.—

(1) LIABILITY.—The owner or operator of an affected facility that emits nitrogen oxides in any calendar year in excess of the NO_x allowances the owner or operator holds for use for the facility for that year shall be liable for the payment of an excess emissions penalty.

(2) CALCULATION.—The excess emissions penalty shall be calculated by multiplying $6,000 by the quantity that is equal to—

(A) the quantity of NO_x allowances that would authorize the nitrogen oxides emitted by the facility for the calendar year; minus

(B) the quantity of NO_x allowances that the owner or operator holds for use for the facility for that year.

(3) OVERLAPPING PENALTIES.—A penalty under this section shall not diminish the liability of the owner or operator of an affected facility for any fine, penalty, or assessment against the owner or operator for the same violation under any other provision of law.

(b) EXCESS EMISSIONS OFFSET.—

(1) IN GENERAL.—The owner or operator of an affected facility that emits nitrogen oxide during a calendar year in excess of the NO_x allowances held for the facility for the calendar year shall offset in the following calendar year a quantity of NO_x allowances equal to the number of NO_x allowances that would authorize the excess nitrogen oxides emitted.

(2) PROPOSED PLAN.—Not later than 60 days after the end of the year in which excess emissions

occur, the owner or operator of an affected facility shall submit to the Administrator and the State in which the affected facility is located a proposed plan to achieve the offset required under paragraph (1).

(3) CONDITION OF PERMIT.—On approval of the proposed plan by the Administrator, as submitted, modified, or conditioned by the Administrator, the plan shall be considered a condition of the operating permit for the affected facility without further review or revision of the permit.

(c) PENALTY ADJUSTMENT.—The Administrator shall annually adjust the penalty specified in subsection (a) to reflect changes in the Consumer Price Index for all urban consumers published by the Bureau of Labor Statistics.

SEC. 7. SULFUR DIOXIDE ALLOWANCE PROGRAM REVISIONS.

Section 402(3) of the Clean Air Act (as added by section 401 of Public Law 101–549 (104 Stat. 2584)) (42 U.S.C. 7651a(3)) is amended by inserting before the period at the end the following: "for allowances allocated for calendar years 1995 through 2002, and ½ ton of sulfur dioxide for allowances allocated for calendar year 2003 and each calendar year thereafter.".

SEC. 8. REGIONAL ECOSYSTEMS.

(a) REPORT.—

(1) IN GENERAL.—Not later than December 31, 2002, the Administrator shall submit to Congress a report identifying objectives for scientifically credible environmental indicators, as determined by the Administrator, that are sufficient to protect sensitive ecosystems of the Adirondack Mountains, Mid-Appalachian Mountains, and Southern Blue Ridge Mountains and water bodies of the Great Lakes, Lake Champlain, Long Island Sound, and the Chesapeake Bay.

(2) ACID NEUTRALIZING CAPACITY.—The report under paragraph (1) shall—

(A) include acid neutralizing capacity as an indicator; and

(B) identify as an objective under paragraph (1) the objective to increase the proportion of water bodies in sensitive receptor areas with an acid neutralizing capacity greater than zero from the proportion identified in surveys begun in 1984.

(3) UPDATED REPORT.—Not later than December 31, 2006, the Administrator shall submit to Congress a report updating the report under paragraph (1) and assessing the status and trends of

various environmental indicators for the regional ecosystems referred to in paragraph (1).

(4) REPORTS UNDER THE NATIONAL ACID PRECIPITATION ASSESSMENT PROGRAM.—The reports under this subsection shall satisfy the report requirements set forth in section 103(j)(3)(E) of the Clean Air Act (42 U.S.C. 7403(j)(3)(E)) for the years 2002 and 2006.

(b) REGULATIONS.—

(1) DETERMINATION.—Not later than December 31, 2006, the Administrator shall determine whether emissions reductions under section 4 are sufficient to ensure achievement of the objectives identified in subsection (a)(1).

(2) PROMULGATION.—If the Administrator determines under paragraph (1) that emissions reductions under section 4 are not sufficient to ensure achievement of the objectives identified in subsection (a)(1), the Administrator shall promulgate, not later than 2 years after making the finding, such regulations, including modification of nitrogen oxide and sulfur dioxide allowance allocations or any such measure, as the Administrator determines are necessary to protect the sensitive ecosystems described in subsection (a)(1).

SEC. 9. GENERAL COMPLIANCE WITH OTHER PROVISIONS.

Except as expressly provided in this Act, compliance with this Act shall not exempt or exclude the owner or operator of an affected facility from compliance with any other law.

SEC. 10. MERCURY EMISSION STUDY AND CONTROL.

(a) STUDY AND REPORT.—The Administrator shall—

(1) study the practicality of monitoring mercury emissions from all combustion units that have a capacity equal to or greater than 250 mmBtu's per hour; and

(2) not later than 2 years after the date of enactment of this Act, submit to Congress a report on the results of the study.

(b) REGULATIONS CONCERNING MONITORING.—Not later than 1 year after the date of submission of the report under subsection (a), the Administrator shall promulgate regulations requiring the reporting of mercury emissions from units that have a capacity equal to or greater than 250 mmBtu's per hour.

(c) EMISSION CONTROLS.—

(1) IN GENERAL.—Not later than 1 year after the commencement of monitoring activities under subsection (b), the Administrator shall promulgate

regulations controlling electric utility and industrial source emissions of mercury.

(2) FACTORS.—The regulations shall take into account technological feasibility, cost, and the projected levels of mercury emissions that will result from implementation of this Act.

SEC. 11. DEPOSITION RESEARCH BY THE ENVIRONMENTAL PROTECTION AGENCY.

(a) IN GENERAL.—The Administrator shall establish a competitive grant program to fund research related to the effects of nitrogen deposition on sensitive watersheds and coastal estuaries in the Eastern United States.

(b) CHEMISTRY OF LAKES AND STREAMS.—Not later than September 30, 1999, and September 30, 2006, the Administrator shall submit to the Committee on Environment and Public Works of the Senate and the Committee on Resources of the House of Representatives a report on the health and chemistry of lakes and streams of the Adirondacks that were subjects of the report transmitted under section 404 of Public Law 101–549 (commonly known as the "Clean Air Act Amendments of 1990") (104 Stat. 2632).

(c) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated—

(1) to carry out subsection (a), $1,000,000 for each of fiscal years 1998 through 2003; and

(2) to carry out subsection (b), $1,000,000 for each of fiscal years 1998, 1999, 2005, and 2006.

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