S. HRG. 110–1090

THE STATE OF MERCURY REGULATION, SCIENCE AND TECHNOLOGY

HEARING

BEFORE THE

SUBCOMMITTEE ON CLEAN AIR AND NUCLEAR SAFETY

OF THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

MAY 16, 2007

Printed for the use of the Committee on Environment and Public Works

Available via the World Wide Web: http://www.access.gpo.gov/congress.senate

U.S. GOVERNMENT PRINTING OFFICE
61–965 PDF WASHINGTON : 2011

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ONE HUNDRED TENTH CONGRESS
FIRST SESSION

BARBARA BOXER, California, *Chairman*

MAX BAUCUS, Montana	JAMES M. INHOFE, Oklahoma
JOSEPH I. LIEBERMAN, Connecticut	JOHN W. WARNER, Virginia
THOMAS R. CARPER, Delaware	GEORGE V. VOINOVICH, Ohio
HILLARY RODHAM CLINTON, New York	JOHNNY ISAKSON, Georgia
FRANK R. LAUTENBERG, New Jersey	DAVID VITTER, Louisiana
BENJAMIN L. CARDIN, Maryland	LARRY E. CRAIG, Idaho
BERNARD SANDERS, Vermont	LAMAR ALEXANDER, Tennessee
AMY KLOBUCHAR, Minnesota	CRAIG THOMAS, Wyoming
SHELDON WHITEHOUSE, Rhode Island	CHRISTOPHER S. BOND, Missouri

BETTINA POIRIER, *Majority Staff Director and Chief Counsel*
ANDREW WHEELER, *Minority Staff Director*

SUBCOMMITTEE ON CLEAN AIR AND NUCLEAR SAFETY

THOMAS R. CARPER, Delaware, *Chairman*

JOSEPH I. LIEBERMAN, Connecticut	GEORGE V. VOINOVICH, Ohio
HILLARY RODHAM CLINTON, New York	JOHNNY ISAKSON, Georgia
BERNARD SANDERS, Vermont	LAMAR ALEXANDER, Tennessee
BARBARA BOXER, California *(ex officio)*	JAMES M. INHOFE, Oklahoma *(ex officio)*

C O N T E N T S

THE STATE OF MERCURY REGULATION, SCIENCE AND TECHNOLOGY

WEDNESDAY, MAY 16, 2007

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

The subcommittee met, pursuant to notice, at 10:03 a.m. in room 406, Dirksen Senate Office Building, the Hon. Thomas Carper (chairman of the subcommittee) presiding.

Present: Senators Carper, Inhofe, Voinovich. Also, Senator Collins.

Senator CARPER. The subcommittee will come to order. Welcome, everyone.

We are looking forward to the testimony and the opportunity to have an exchange with our witnesses. We are also looking forward to four votes that start at 10:30 a.m. There are a lot of committee hearings and markups going on right now that are figuring out what are they going to do. What we are going to do is go ahead and Senators will make their opening statements. We will be joined by Senator Collins and she will make a statement.

My hope is we will have a chance for the second panel to at least make opening statements. While they are wrapping it up, we will run off and vote four times, and then come back and try to finish it up before supper time. No, hopefully a lot sooner than that.

This is a hearing on the state of mercury regulation, science and technology. Before we begin, just a couple of procedural matters to lay to bed. I am going to give a brief opening statement and then turn it over to Senator Inhofe for his statement and others who come along.

Senator Collins is, I think, offering an amendment on the Floor right now. Once she gets here, we will recognize her to offer some of her views.

I am going to hold off because one of our Floor managers for the Water Resources Development bill is Senator Inhofe, along with Senator Boxer. He needs to get back over to the Floor, so Senator Inhofe, why don't you just go ahead and say whatever is on your mind, and then I will take it from there.

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

Senator INHOFE. All right. Well, thank you, Mr. Chairman. I am sorry that I can't stay. Barbara Boxer and I are managing the

WRDA bill on the Floor, which is probably the biggest non-defense bill of the year, so it is a very significant one.

I thank you for holding this subcommittee hearing on mercury perspectives, science and technology. I have to say, it is such a pleasure for me to be sitting in here in a hearing that is not on global warming. So I thank you very much. This is a first in—what?—3 months now.

Anyway, there is a lot of work to be done. For instance, there are still some areas that are out of compliance with particulate matter standards and serious non-attainment with ozone standards. I recommend this subcommittee examine what can be done to bring these highly polluted areas into compliance with existing laws.

But we can't let the failures of these few counties distract us from the enormous progress that we have made in cleaning up pollution in this country. Since 1970, we have had tremendous economic growth and tripled our energy use and vehicle miles traveled. Despite this, instead of tripling our pollution or doubling or even holding it constant, we have cut our pollution levels by more than half. That is really amazing. When you tell people that, they don't believe it. We have tripled the mileage, and yet we have cut the pollution in half.

So some things are working, Mr. Chairman. This gets to the heart of my greatest concern over the mercury debate. Few understand it, and some have preyed upon the lack of understanding. We are literally scaring ourselves to death over mercury. A few years ago when the EPA and the FDA issued the Joint Advisory on Mercury, environmentalists turned up their alarmist rhetoric and tuna consumption plummeted, and people became afraid to eat fish because they believed that it is all bad for them. Let's be clear. We all know that all seafood has some level of mercury. It always has and always will. It is an element pervasive in the environment and bioaccumulative.

The question is not whether mercury causes birth defects or even kills in high doses. It does in high doses. The question is whether it is harmful to the extreme in low quantities. According to the biggest and best designed and longest running study ever done, the answer is no.

I just hope that we don't resort to scare tactics, as we so often do in this committee. Even back in the years when I was the Chairman of this committee, we would hear people saying the world is always coming to an end, and so we are all going to die. But let's try to be reasonable, try to look at this, and approach this in such a way.

I would ask with that, Mr. Chairman, that my entire statement be placed into the record.

Senator CARPER. Without objection.

[The prepared statement of Senator Inhofe follows:]

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

Thank you, Mr. Chairman, for holding this subcommittee hearing on mercury perspectives, science and technology. I must say it is a pleasure to attend a hearing on something other than global warming. The issue of clean air is an important one, and is an issue this Committee should be focused on.

There is much work to be done. For instance, there are still some areas that are out of compliance with particulate matter standards and in serious nonattainment with ozone standards. I recommend this Subcommittee examine what can be done to bring these highly polluted areas into compliance with existing law.

But we cannot let the failures of these few counties distract us from the enormous progress we have made in cleaning up pollution in this country. Since 1970, we have had tremendous economic growth, and tripled our energy use and vehicle miles traveled. Despite this, instead of tripling our pollution or doubling or even holding it constant, we have cut our pollution levels by more than half. This is a success story that—hard as it is to believe—few people even realize is true.

This gets to the heart of my greatest concern over the mercury debate. Few understand it, and some have preyed upon that lack of understanding. We are literally scaring ourselves to death over mercury. A few years ago, when EPA and the FDA issued a joint advisory on mercury and environmentalists turned up their alarmist rhetoric, tuna consumption plummeted. People became afraid to eat fish because they believed it was bad for them.

Let's be clear: all seafood has some level of mercury—always has and always will. It is an element, pervasive in the environment and bioaccumulative. The question is not whether mercury causes birth defects and even kills in high doses—it does. The question is whether it's harmful in extremely low quantities. According to the biggest, best designed and longest running study ever done, the answer is a resounding "NO."

What most people do not realize is that the dose makes the poison. Fish is brain food. A diet rich in omega-3 fatty acids reduces colon and lung cancers and numerous other ailments, and aids brain development in the womb. The Seychelles Islands study found that, even though their seafood-rich diet meant they consumed more mercury than Americans, eating the seafood was beneficial. Let me repeat: by discouraging people from eating fish, we are literally scaring them to death.

That isn't to say we shouldn't make progress in bringing down mercury levels. We should and we are. But we need to put the issue in perspective.

Like other pollutants, mercury levels have also come down dramatically. Numerous industries that used to emit high levels of mercury, such as the municipal waste incinerators, have been controlled. The power sector industry is merely the latest industry to be regulated. And the regulations are significant—the Clean Air Mercury Rule will reduce powerplant mercury emissions by 70 percent. And because the rule acts in coordination with the Clean Air Implementation Rule—which reduces SO_2, NOx, and particulate matter—it can be done for $2 billion.

While there are many promising technologies on the horizon, some of which we will hear about today, no technology exists for which vendors will guarantee 90 percent mercury reductions, and some of these technologies are not appropriate for plants that are already controlled. According to the Energy Information Administration, setting a 90 percent reduction mandate on mercury over three years would cost up to $358 billion. That's right—cutting 70 percent will cost $2 billion, but incrementally increasing that amount to beyond what the technologies can reliably do would cost up to $358 billion.

Mr. Chairman, we all agree that reducing pollution levels in this country is important and that more can be done. But we cannot let political preferences let us lose sight of the fact that diverting enormous economic resources to this comparatively smaller problem away from the important mission of bringing ozone and soot levels into compliance with existing law is wrong-headed. And we cannot lose sight of the fact that this scaremongering is doing more harm to the health of our citizens than the very small incremental reductions that tightening the mercury standard further would achieve.

Thank you.

STATEMENT OF HON. THOMAS CARPER, U.S. SENATOR FROM THE STATE OF DELAWARE

Senator CARPER. Thank you, Senator Inhofe.

Welcome, Senator Voinovich.

Two years ago, the Bush administration finalized, as you may recall, the Clean Air Mercury Rule. Remember that the rule requires reductions in mercury really in two phases. The first phase starts in the year 2010. It requires a 22 percent reduction of mercury emissions from powerplants by then. These reductions will be achieved as a side effect of the clean air interstate rule, meaning

no specific actions will be required to attain this rule, which I believe is weak.

When it was finalized, opponents of the Clean Air Mercury Rule argued that the technology to limit mercury emissions does not exist and that stricter limits would cause utilities to switch from coal to natural gas. To put it simply, though, these critics have been proved wrong. The EPA was wrong, I believe, not to act more aggressively to limit the emissions of a pollutant that has serious health effects on children and pregnant women, some of the most vulnerable members of our society.

Today, we know that the technology to control mercury does exist. We know that companies burning a variety of coal types are moving forward with plans to install this technology to comply with the more stringent State requirements that have been adopted. Instead of pretending that we can't do more, we need to look at the reality of this issue. That is what we plan to do today.

The reality is that mercury is a potent neurotoxin that affects the brain, the heart, and our immune system. Developing fetuses, children, and pregnant women are especially at risk. Even low level exposure to mercury can cause learning disabilities, developmental delays, lower IQ, and problems with attention and with memory.

Today, we are going to hear from States that have taken action to protect their citizens from mercury pollution. These States are requiring their pipelines to reduce their emissions by at least 90 percent.

We are also going to hear testimony on the growing scientific evidence of mercury hotspots and the health effects of mercury.

Last, we will hear testimony on the reality of mercury control technology. It is affordable. It is available. It is reliable.

It is an understatement to say that the Clean Air Mercury Rule is too weak. That is why I have introduced, along with a number of our colleagues, some on this committee and some not, legislation requiring every coal-fired plant in our country to reduce their mercury emissions by 90 percent no later than the year 2015.

When EPA introduced the Clean Air Mercury Rule, they did get at least one thing right. EPA coupled the Mercury Rule with the nitrogen oxide and the sulfur dioxide requirements of the clean air interstate rule. When dealing with air pollution from powerplants, it makes sense to address all the pollutants at the same time, whether it is ozone-forming nitrogen oxide or asthma-causing sulfur dioxide, toxic mercury emissions or global warming caused by carbon dioxide, they all come out of the same smokestack. By addressing all four pollutants as a system, powerplants will have the flexibility and the regulatory certainty needed to plan for the most cost-effective control strategy.

With that said, I am pleased to yield to my compadre here, Senator Voinovich. I am delighted that we have some witnesses from your State, from Ohio, and I am anxious to hear from them, and now from you.

STATEMENT OF HON. GEORGE VOINOVICH, U.S. SENATOR FROM THE STATE OF OHIO

Senator VOINOVICH. Thanks very much.

As we are all well aware, we worked very, very hard in this committee during the last Congress to come up with a bipartisan multi-emissions bill which would reduce powerplant emissions of mercury, nitrogen oxide, and sulfur dioxide. Despite our valiant efforts, in the end there didn't seem to be a path forward. We couldn't get it done.

Mr. Chairman, I commend you for holding this hearing to continue our debate on this very important subject. I would like to thank Guy Pipitone, senior vice president of Operations, Strategy and Development at First Energy, from my home State, for being here today to discuss technology options to address mercury emissions.

The harmful health effects of mercury, especially to fetuses and pregnant women, are well established. There is no one arguing about that. It is harmful. However, what often gets overlooked in these debates is the fact that mercury pollution is a global issue because it can travel hundreds and thousands of miles before depositing in land and water. Most of the mercury disposition in our Nation that comes from manmade sources is coming from overseas. According to the Environmental Protection Agency, Asia is responsible for 53 percent of mercury emissions worldwide, and that U.S. powerplants contribute only about 1 percent of the mercury in the oceans, which is what we are talking about today.

In fact, according to the U.S. EPA, U.S. emissions of mercury were reduced by nearly half from 1990 to 1999. While we have made great progress in reducing these emissions, they have often been offset by increases in emissions from Asia, particularly China, and it is not going to get any better when you consider the fact that China is going to be building a new coal-fired plant every week for the next couple of years.

Still, by finalizing both the clean air interstate rule and Clean Air Mercury Rule in 2005, the United States became the first nation in the world to regulate mercury emissions from existing coal-fired powerplants, the first in the world. The clean air interstate rule is designed to leverage reduction in emission requirements for other pollutants such as sulfur dioxides and nitrogen oxides to control mercury emissions, as Senator Carper emphasized, but we did NOx, SOx, and mercury.

The Clean Air Mercury Rule will complement the other rule by establishing a cap and trade program for cutting overall powerplant mercury emissions from the current level of 48 tons annually to 38 tons in 2010, 15 tons is 2018, for a total reduction of 70 percent. This is modeled after the Nation's most successful clean air program, the Acid Rain Program. Utilities able to reduce emissions more than required can sell excess emission allowances to facilities for which achieving reductions is less cost effective or technologically too difficult.

These rules were developed through one of the most extensive rulemakings ever conducted for clean air regulations, culminating in nearly 15 years in the making, and reflect the most detailed scientific record ever established in developing this type of pollution reduction program.

However, several of my colleagues have expressed support for a maximum achievable control technology standard called the MACT

standard to reduce mercury emissions from every powerplant by 90 percent within 3 years. Proponents of this approach generally claim that each powerplant should be able to reduce mercury emissions by at least 90 percent, even though this level of reduction is not currently achievable and no control technology vendor will guarantee the performance of mercury removal technologies at this or any other specific level in the future.

A MACT standard would have a devastating impact on our Nation because coal plants unable to attain it would be shut down. This would result in fuel switching from coal, which is our most abundant and least costly energy source, to natural gas. I know all about that. In my State, 85 percent of our energy comes from coal, and natural gas costs have increased 300 percent, having a terrible impact on our economy.

Increased reliance on natural gas for electricity generation will further increase prices, seriously impacting the ability of businesses to compete in the global marketplace, and the families that pay their utility bills. By the way, Mr. Chairman, we always forget about the families and their utility bills: 300 percent since 2000 in my town, and Cleveland is known for the most poverty. It is having a very, very negative effect, but we never even consider them when we start talking about some of the things that we do here.

Well, EPA estimates the cost of its cap and trade rule at about $2 billion. The Independent Energy Information Administration has projected costs as high as $358 billion for a 90 percent MACT standard. The public's return for such a regulation is an average increase in national electricity prices of about 20 percent—more in States like mine that rely primarily on coal for electricity—and an additional reduction in U.S. mercury disposition of just 2 percent, and an almost immeasurable decline in people's exposure to mercury.

The question we face on this committee is whether we should do something reasonable to improve our understanding of the issues surrounding mercury emissions and attempt to reduce—I am having a tough time this morning, because I was on the radio since 6 o'clock this morning; we had two early morning radio people on and I did a lot of talking—atmospheric concentrations of mercury emissions without harming our economy, or rush into short-sighted policy that will cap mercury at unreasonable levels, shut down our economy, and cut thousands of jobs, and move manufacturing overseas to countries that do not have these environmental standards.

I will never forget, Mr. Chairman, Jim Jeffords 4 or 5 years ago. We were debating with each other, and I said, "You know, Jim, what this is going to do it is going to eliminate jobs in my State. Jim, they are not going to Vermont. They are not going to Vermont. Those jobs are going overseas."

So what we have to do is something that you and I talked about a long time ago, is somehow get our environment, get our energy, and get our economy in the same room and figure out how we work together, and make people realize that we have a symbiotic relationship. The more we work together and figure this out, the better off everyone is going to be, and we will make some real headway on environmental issues, and on energy challenges, and we will also have some movement forward in terms of our economy.

Thank you.

[The prepared statement of Senator Voinovich follows:]

STATEMENT OF HON. GEORGE V. VOINOVICH, U.S. SENATOR FROM THE STATE OF OHIO

Thank you Mr. Chairman. As you are well aware, we have worked hard on this Committee during the last Congress to come up with a bipartisan multi-emissions bill, which would reduce powerplant emissions of mercury, nitrogen oxides, and sulfur dioxide. Despite our valiant efforts, in the end, there did not seem to be a path forward.

Mr. Chairman, I commend you for holding this hearing to continue our debate on this very important issue. And, I would like to thank Guy Pipitone, Senior Vice President of Operations, Strategy and Development at First Energy—from my home state—for being here to discuss technology options to address mercury emissions. The harmful health effects of mercury, especially to fetuses and pregnant women, are well established.

However, what often gets overlooked in these debates is the fact that mercury pollution is a global issue because it can travel hundreds and thousands of miles before depositing in land and water. Most of the mercury deposition in our nation that comes from manmade sources is coming from overseas.

According to the Environmental Protection Agency, Asia is responsible for 53 percent of mercury emissions worldwide, and that U.S. powerplants contribute only about 1 percent of the mercury in the oceans, which is what we are talking about today. In fact, according to EPA, U.S. emissions of mercury were reduced by nearly half, from 1990 to 1999. While we have made great progress in reducing these emissions, they have been offset by increases in emissions from Asia, particularly China.

Still, by finalizing both the Clean Air Interstate Rule and Clean Air Mercury Rule in 2005, the United States became the first nation in the world to regulate mercury emissions from existing coal-fired powerplants. The first in the world!

The Clean Air Interstate Rule is designed to leverage reduction in emission requirements for other pollutants, such as sulfur dioxides and nitrogen oxides, to control mercury emissions. The Clean Air Mercury Rule will complement the other rule by establishing a "cap-and-trade" program for cutting overall powerplant mercury emissions from the current level of 48 tons annually, to 38 tons in 2010 and 15 tons in 2018, for a total reduction of 70 percent.

This is modeled after the nation's most successful clean air program—the Acid Rain Program. Utilities able to reduce emissions more than required can sell excess emission allowances to facilities for which achieving reductions is less cost-effective or technologically too difficult.

These rules were developed through one of the most extensive rulemakings ever conducted for clean air regulations, culminating in nearly 15 years in the making and reflect the most detailed scientific record ever established in developing this type of pollution reduction program.

However, several of my colleagues have expressed support for a Maximum Achievable Control Technology standard—called a MACT standard—to reduce mercury emissions from every powerplant by 90 percent within three years. Proponents of this approach generally claim that each powerplant should be able to reduce mercury emissions by at least 90 percent, even though this level of reduction is not currently achievable and no control technology vendor will or can guarantee the performance of mercury removal technologies at this or any other specific level in the future.

A MACT standard would have a devastating impact on our nation because coal plants unable to attain it would be shutdown. This would result in fuel switching away from coal, which is our most abundant and least costly energy source, to natural gas.

Increased reliance on natural gas for electricity generation will further increase prices, seriously impacting the ability of businesses to compete in the global marketplace and of families to pay their utility bills.

While EPA estimates the cost of its cap-and-trade rule at about $2 billion, the independent Energy Information Administration has projected costs as high as $358 billion for a 90-percent MACT standard. The public's return for such a regulation is an average increase in national electricity prices of 20 percent—more in states like mine that rely primarily on coal for electricity—an additional reduction in U.S. mercury deposition of just 2 percent, and an almost immeasurable decline in people's exposure to mercury.

The question we face on this Committee is whether we should do something reasonable to improve our understanding of the issues surrounding mercury emissions

and attempt to reduce atmospheric concentrations of mercury emissions without harming our economy—or rush into a short-sighted policy that will cap mercury at unreasonable levels, shut down our economy, cut thousands of jobs (particularly in manufacturing states like Ohio), and move manufacturing overseas to countries that do not have environmental standards?

We need to work with both business and environmental groups to find a bipartisan solution that makes a common sense in dealing with mercury emissions with an emphasis on sound science, and development of mercury control and clean coal technologies—a responsible approach that harmonizes our energy, environment, and economic needs.

Mr. Chairman, thank you once again for holding this important hearing, and I look forward to hearing the testimony from our witnesses.

Senator CARPER. Thank you, Senator Voinovich.

Pretty good timing, Senator Collins. I will give you time to grab a seat and have a drink of water if you want. My hope is that we have literally in this room today, starting with our first panelist, Senator Collins, followed by our other two panels, some of the folks who can help us answer those questions. Is it possible to reduce the emissions of mercury? Is it possible to do so in a way that doesn't push our economy into a tailspin? Is it possible to do so in a way that doesn't disadvantage consumers of electricity? Does it do so in a way that doesn't push production of electricity from coal to natural gas, and further spike natural gas prices?

I really look forward to this hearing, because I think we are going to find the answers to those questions. I think they may surprise us, I hope pleasantly so.

We are delighted, Senator Collins, that you have joined us. I understand you rushed over from the Floor, and you are good to come. We appreciate very much your testimony and your willingness to work with us as a cosponsor of our legislation that addresses sulfur dioxide, nitrogen oxide, mercury, and CO_2. Please take as much time as you wish. Welcome and thank you for coming.

STATEMENT OF HON. SUSAN COLLINS, U.S. SENATOR FROM THE STATE OF MAINE

Senator COLLINS. Thank you, Mr. Chairman.

I did run over from the Floor, but I so appreciate your invitation to speak today in support of the comprehensive National Mercury Monitoring Act of 2007. I have the great pleasure to work with both Chairman Carper and the Ranking Minority member, Senator Voinovich, on the Homeland Security Committee. It is a great honor to appear before both of you today.

Let me begin by thanking Chairman Carper for his leadership in introducing the Clean Air Planning Act. This legislation would reduce mercury emissions at powerplants by 90 percent by 2015. It would also address the pollutants that cause smog, acid rain, and climate change. I am very pleased to join the chairman as an original cosponsor of this important bill.

There are also two other members of the subcommittee, Senators Lieberman and Clinton, who I have worked very closely with and who joined me earlier this year in introducing the Mercury Monitoring Act. This bill would establish mercury monitoring sites across the Nation in order to measure mercury levels in the air, rain, lakes, streams, as well as in plants and animals.

Our bill would authorize $18 million in fiscal year 2008, and additional funding through 2013, for the EPA, the U.S. Geological

Survey, the U.S. Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration, NOAA, to perform scientific mercury measures. These agencies would measure long-term changes in mercury levels in the air and watersheds, including mercury levels in plants and animals at multiple monitoring sites in different ecosystems across the country.

The Act would also create an advisory committee to advise the administrator of the EPA in choosing where these sites should be across the country. Now, I don't think that I need to tell anyone on this committee that in the wrong form, mercury is an acutely dangerous neurotoxin that can cause serious developmental harm, especially to children and pregnant women.

In fact, recent studies indicate that at least 6 percent of women of childbearing age in this country carry enough accumulated mercury in their bodies to pose the risk of adverse health effects to their children should they become pregnant. I think that is very alarming, Mr. Chairman, and it is one reason that I feel so strongly that we need to know more about how mercury is accumulating in our environment, as well as its consequences.

Tragically, EPA scientists have found that some 630,000 infants were born in the United States in a 12-month period from 1999 to 2000 with blood mercury levels higher than what is considered safe. To see just how toxic mercury is, one does not have to look any further than my home State of Maine. It always concerns me that every single freshwater lake, river and stream in the State of Maine is subject to a mercury advisory warning that pregnant women and young children should limit their consumption of fish caught in these waters.

Of course, Maine is a State that prides itself on clean air and clean water and a beautiful environment, and yet there are warnings on all of our freshwater lakes, streams, and rivers about mercury. This advisory is especially difficult for indigenous peoples like those of the Penobscot Indian Nation, for whom sustenance fishing is historically an important part of their culture.

Mercury is dangerous not only to people, but also to wildlife. The Biodiversity Research Institute in Gorham, ME has found mercury concentrations in loon eggs in Maine that were dangerously high, nearly four times higher than those found in Alaska. EPA issued its Clean Air Mercury Rule in 2005 in order to help address this problem. But unfortunately, this rule really did not do the job. I don't believe that it was based on sound science.

Senator Lieberman and I met with EPA Administrator Johnson in 2005 in order to express our concerns over this rule. At that time, Mr. Johnson presented to us a number of charts depicting mercury problems across the United States, and in particular in the Northeast. I later found out in consulting with scientists that these charts were seriously flawed. They were based on computer measurements that were not peer-reviewed and that had not been verified with actual measurements.

The extent of the flaws in the EPA data became apparent earlier this year with the publication of several new studies. These studies by individuals at the Biodiversity Research Institute in Gorham, ME, as well as researchers at Syracuse University, demonstrate the existence of mercury hotspots in the northeastern United

States, and attribute much of the cause of these hotspots where mercury is concentrated to emissions from powerplants.

The studies conflict markedly with EPA's computer modeling data, which were used to justify the EPA mercury rule. For example, the study showed that mercury deposition is five times higher than previously estimated near a coal plant in southern New Hampshire. What I think these studies demonstrate, Mr. Chairman, is the need for real world mercury measurements, not just computer models.

Mr. Chairman, I know that we are under a time constraint this morning because of the votes that are coming up. Let me just close by saying that the EPA inspector general also issued a report a year ago saying that monitoring was needed to assess the impact of EPA's Clean Air Mercury Rule on these potential hotspots. That is exactly what this legislation would do.

Now, I know that some of our colleagues have different opinions on the EPA's mercury rule, and I certainly respect those opinions. But certainly, we all ought to be able to agree that the EPA ought to be basing its actions on the very best scientific measurements possible, and that is the purpose of the bill, the bipartisan bill that I have introduced.

It would provide those scientific measurements across the United States, help us identify the hotspots, help us identify the causes. So I would ask unanimous consent that my entire statement be put in the record, but I thank you very much for the opportunity to be here today to testify about something that I feel very strongly about.

Thank you, Mr. Chairman, and thank you, Senator Voinovich.

[The prepared statement of Senator Collins follows:]

STATEMENT OF HON. SUSAN M. COLLINS, U.S. SENATOR FROM THE STATE OF MAINE

Chairman Carper, Ranking Member Voinovich, and Members of the Committee, I appreciate the opportunity to speak in support of the Comprehensive National Mercury Monitoring Act of 2007.

Let me begin by thanking Chairman Carper for his leadership in introducing the Clean Air Planning Act. This legislation would reduce mercury emissions at powerplants by 90 percent by 2015. It would also address the pollutants that cause smog, acid rain, and climate change. I was pleased to join Senator Carper earlier this year as an original cosponsor of this important legislation.

I also want to thank two distinguished members of this subcommittee, Senators Lieberman and Clinton, who joined me earlier this year in introducing the Mercury Monitoring Act. This legislation would establish mercury monitoring sites across the nation in order to measure mercury levels in the air, rain, soil, lakes and streams, as well as in plants and animals.

Our legislation would authorize $18 million in fiscal year 2008, and additional funding through 2013, for the Environmental Protection Agency, United States Geological Survey, United States Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration to perform scientific mercury measurements. These agencies would measure long-term changes in mercury levels in the air and watersheds, including mercury levels in plants and animals, at multiple monitoring sites in different ecosystems across the country. The Act would create a "Mercury Monitoring Advisory Committee" to advise the Administrator of the EPA in choosing the monitoring sites.

I do not think I need to tell anyone on this Committee that, in the wrong form, mercury is an acutely dangerous toxin that can cause serious neurodevelopmental harm, especially to children and pregnant women. In fact, recent studies indicate that at least 6 percent of women of childbearing age in the United States carry enough accumulated mercury in their bodies to pose the risk of adverse health effects to their children, should they become pregnant. Tragically, scientists at the Environmental Protection Agency found that some 630,000 infants were born in the

United States in a 12-month period from 1999 to 2000 with blood mercury levels higher than what is considered safe.

To see just how toxic mercury is, one does not have to look any farther than my home state of Maine. Every freshwater lake, river, and stream in my state is subject to a mercury advisory warning pregnant women and young children to limit consumption of fish caught in these waters. This advisory is especially difficult for indigenous peoples, like those of the Penobscot Indian Nation, for whom subsistence fishing is an historically important part of their culture.

Mercury is dangerous not only to people, but also to wildlife. The Biodiversity Research Institute in Gorham, Maine, found that mercury concentrations in loon eggs in Maine were dangerously high, nearly four times higher than those found in Alaska.

EPA issued the Clean Air Mercury Rule in 2005 in order to help address our nation's mercury problem. Unfortunately, this rule did not go far enough. I believe it was not based on sound science.

Senator Lieberman and I met with EPA Administrator Johnson in 2005 in order to express our concerns over this rule. At that time, Mr. Johnson presented a number of charts depicting the mercury problem across the United States, and in particular, in the Northeast. As I later found out, these charts were seriously flawed. They were based on computer measurements that were not peer-reviewed and that were not verified with actual measurements.

The extent of the flaws in the EPA data became apparent earlier this year with the publication of several new studies. These studies, by David Evers and Wing Goodale of the Biodiversity Research Institute in Gorham, Maine, as well as researchers at Syracuse University, demonstrate the existence of mercury hotspots in the northeastern United States and attribute much of the cause of the hotspots to emissions from powerplants.

These studies conflict markedly with EPA's computer modeling data which were used to justify the EPA mercury rule. For example, the studies showed that mercury deposition is five times higher than previously estimated near a coal plant in southern New Hampshire. These studies demonstrate the need for real-world mercury measurements—not just computer models.

The EPA Inspector General issued a report exactly one year ago yesterday titled "Monitoring Needed to Assess Impact of EPA's Clean Air Mercury Rule on Potential Hotspots." This report noted that, "without field data from an improved monitoring network, EPA's ability to advance mercury science will be limited and 'utility-attributable' hotspots that pose health risks may occur and go undetected." The report recommended that EPA develop and implement a mercury monitoring plan.

I realize that some of my colleagues have a different opinion on EPA's mercury rule, and I respect their opinion. I hope, however, we can all agree that any EPA rule should be based on the best scientific measurements possible. I believe the Comprehensive National Mercury Monitoring Act would provide the scientific measurements we need in order to more accurately assess the extent of the mercury problem in this country, and to provide better information on how to address this serious problem.

I thank Chairman Carper, Ranking Member Voinovich, and the members of this Subcommittee for providing this opportunity for me to appear before you today.

Senator CARPER. Senator Collins, thank you very much. Without objection, your full statement will appear in the record. We are very grateful. We know this has been a hectic morning for you and we are grateful that you were able to work us into your schedule, and we look forward to working with you on this issue, as I have with others in the past.

Senator COLLINS. Thank you.

Senator CARPER. My family and I are going on a vacation in August, and among the places we are considering is Acadia National Park in Maine. Now that I know we can't eat the fish that we catch there, I am sure we have to revisit this.

Senator COLLINS. I would encourage you to come anyway. You are not of childbearing age anymore.

[Laughter.]

Senator CARPER. You never know these days. Remember what we used to say to Strom Thurmond.

[Laughter.]

Senator CARPER. All right. Again, thank you.

Senator COLLINS. Thank you.

Senator CARPER. Thank you so much.

We are going to try to do as best we can with this next set. Senate votes are now likely to start about 10 minutes later at 10:40 a.m. This may just work, the answer to a prayer.

I am going to ask our witnesses to come on up and have a seat at the table. The first panel is comprised of State witnesses representing the States of Illinois, New Jersey and Texas. We appreciate their willingness to appear before us today. I ask each of you to take maybe 5 minutes for your statements. I understand that Ms. Jackson from New Jersey cannot be here. Talk about hotspots.

Who is here from New Jersey? Come on up and join us and maybe you will be willing to answer some questions. I understand your name is Alyssa Wolfe, and you are a counselor to the Commissioner for the Department of Environmental Protection. I understand there is a forest fire or something that was created by a fire that an aircraft dropped. So New Jersey knows first hand about hotspots today, but we are grateful, and there is a spot for you to sit right here.

I spent most of the morning pronouncing Mr. Schanbacher's name. I think I have it right. Let's see here. Ms. Wolfe is here to respond to questions. She will not be giving the statement on behalf of the Commissioner. So we are going to just ask you to go ahead and lead us off. We are grateful that you are here, all the way from Texas, Austin, and know a thing or two about these issues. We appreciate your being here on behalf of your State.

We look forward to Mr. Scott, who has come to us all the way from Illinois. I believe he is a fighting Illini. We have a couple of Buckeyes up here, and we always welcome our friends from Illinois. I am interested to hear what you are doing there in your State to address mercury, and especially how you got the utilities to buy into this. That will be an interesting discussion, I am sure.

Mr. Schanbacher, you are on. Thanks.

STATEMENT OF DAVID SCHANBACHER, CHIEF ENGINEER, TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Mr. SCHANBACHER. Thank you very much.

I am David Schanbacher, the chief engineer of the Texas Commission on Environmental Quality. Thank you, Chairman Carper and Ranking Member Voinovich for asking me to speak to you this morning.

I have been working on environmental issues for over 15 years, and the transport and fate of mercury is one of the most complicated air pollutions that I have ever studied. We know a lot about the health effects of mercury thanks to extensive studies conducted outside of the United States. These studies looked at the children of women whose diet is comprised largely of fish. Fish consumption is the primary source of human mercury exposure.

These studies determined the mercury level in the mother's blood associated with the development of subtle neurological effects in their children. The EPA set a reference dose 10 times lower than the levels at which these subtle health effects were seen. Although

the EPA reference dose is very conservative and health effects are not expected, we like to maintain a large margin of safety for our citizens.

Thanks to extensive sampling by the Centers for Disease Control, we also have a very good idea of the U.S. population's exposure to mercury. Our review of the 2000–2001 CDC data indicates that only 2.5 percent of women of childbearing age have blood mercury levels greater than the EPA reference dose, and none of these women have blood mercury levels where any adverse effects are to be expected.

We also have a Texas study with similar results. The Texas Department of State Health Services looked specifically at a group of people who live near and consume fish from Caddo Lake, which has a fish consumption advisory for mercury. They found that the blood mercury levels did increase with increasing fish consumption, but these levels were all well below those expected to cause adverse effects.

At TCEQ, we look closely at all new information to make sure we are working with the best possible science. For example, a recent Texas study looked at mercury emissions and autism. This study reported an association between proximity to mercury emissions and special education rates. However, it could not establish that mercury causes autism, and in fact two recent case control studies indicated no causal relationship between mercury and autism.

The amount of mercury in fish is determined by many different factors and varies regionally. Especially important is the chemistry of the water body where mercury is deposited. Factors such as pH, sulfate, and oxygen influence the rate at which divalent mercury is converted into methylmercury, the form that accumulates in fish. Whether or not a water body has a fish consumption advisory is more dependent on lake chemistry than proximity to a mercury emissions source.

One major concern we have regarding a national standard for mercury control is the regional difference in the coal-types used in U.S. powerplants. Bituminous coal is used primarily in eastern States, while western States rely more on sub-bituminous coal and lignite. The coal type affects the amount and form of mercury released and the form of mercury is very important in determining deposition rates and the subsequent bio-accumulation of methylmercury in fish.

Now, divalent or reactive mercury is the form that is most likely to deposit locally and that is most easily converted to methylmercury in the water body. Fortunately, divalent mercury is also the easiest to remove from powerplant emissions. Plants that burn bituminous coal emit primarily divalent mercury. This means that mercury is most easily controlled at plants in the eastern United States.

Sub-bituminous coal and lignite, on the other hand, emit primarily elemental mercury, which is much more difficult to control because it is not water soluble and passes through most control devices.

However, elemental mercury is not deposited locally, but rather enters the global mercury pool where it is stable and can remain in the atmosphere from 6 months to 2 years.

We believe that the EPA's Clean Air Mercury Rule contains several important features that should be retained. It regulates powerplant mercury emissions based on the type of coal burned and as such the form of mercury emitted. Phase one of the mercury rule is set at levels that will likely force plants to control the more important divalent mercury. The cap and trade program creates a financial incentive for plants to remove more mercury than required. By deferring the removal of less important elemental mercury until 2018, industry has time to develop cost effective and safe mercury control technology.

I also have some concerns with requiring mercury emissions reductions on a more stringent schedule. Additional testing of the control technology is required to determine long-term reductions and the potential effects on unit performance. Activated carbon may change fly ash properties and may render it unusable in concrete, resulting in large volumes of ash to be landfilled, rather than reused. Many mercury-specific controls are designed to convert elemental mercury, which does not deposit locally, into divalent mercury which does. Control requirements that outpace technology could ironically increase local mercury deposition.

The EPA fish tissue modeling shows very little, if any, benefit from phase two, because phase two addresses elemental mercury, which does not deposit locally. Finally, mercury control requirements that outpace technology could adversely impact the Nation's supply of affordable and reliable electricity, and cause a shift away from one of our most abundant domestic energy sources.

Thank you very much.

[The prepared statement of Mr. Schanbacher follows:]

STATEMENT OF DAVID C. SCHANBACHER, P.E., CHIEF ENGINEER, TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Mercury is toxic to the nervous system and potentially associated with cardiovascular disease; however, blood mercury levels in the United States are below levels shown to cause adverse health effects. The U.S. EPA has developed a Reference Dose based on subtle neurological effects seen in children whose mothers consume higher than average amounts of fish. This level of 0.3 mg methylmercury/kg whole fish is 10 times lower than the levels at which effects were actually seen. The Reference Dose is set to protect against adverse effects from daily exposure in sensitive groups. Our review of the 2000-2001 National Health and Nutrition Examination Survey indicates that only 2.5 percent of women of child-bearing age had blood mercury levels greater than the Reference Dose. None of these women had blood mercury levels above doses where adverse effects were seen. Although these values are conservative and health effects are not expected to occur, we would like to maintain conservative levels of mercury in the blood of our citizens. As such, we advise people to limit their consumption of fish that exceed conservative screening values. The Texas Department of State Health Services looked specifically at a group of people who live near and consume fish from Caddo Lake, which has a fish-consumption advisory for mercury. They found that blood mercury levels did increase with increasing fish consumption, but these levels were all well below levels expected to cause adverse effects. All women of child-bearing age in this study had blood mercury levels below the EPA Reference Dose.

A recent study in Texas raised concerns about the association of mercury and autism. This study reported an association between mercury emissions and special education rates; however, it cannot establish that mercury causes autism. In fact, two recent case-control studies indicate no causal relationship between mercury and autism.

Fish consumption is the primary source of methylmercury exposure for humans; however, the amount of mercury in fish is determined by many different factors and varies regionally. These factors include the pH, dissolved organic carbon, sulfate, and oxygen content of the water body where divalent mercury is deposited. These factors influence the rate at which bacteria convert divalent mercury into methylmercury, which is the form that accumulates in fish.

Regional differences also exist in the types of coal used to fuel powerplants in the United States. The type of coal burned also affects the amount and form of mercury released. The form of mercury released is very important in determining deposition rates and subsequent bioaccumulation of methylmercury in fish. Bituminous coal is primarily used in the eastern United States, while western states rely more on sub-bituminous coal and lignite, especially in Texas. Bituminous coal, when burned, emits primarily divalent, or reactive, mercury. Sub-bituminous coal and lignite, on the other hand, emit primarily elemental mercury.

Divalent mercury settles out readily from the atmosphere through wet and dry deposition and as such, is subject to local deposition. Elemental mercury, the primary form of mercury emitted from sub-bituminous coal and lignite, is not deposited locally, but rather enters the global pool of mercury, where it is stable and can remain in the atmosphere between six months and two years.

The United States Environmental Protection Agency Clean Air Mercury Rule (CAMR) appropriately regulates mercury emissions from powerplants based on the type of coal burned and as such, the form of mercury emitted. The Phase I CAMR rule relies on co-benefits of the Clean Air Interstate Rule or CAIR. CAIR controls to reduce nitrogen oxide (NOx) and sulfur dioxide (SO_2), such as scrubbers, are also very effective in controlling divalent mercury, the form of mercury primarily emitted from bituminous coal and subject to local deposition. Texas electric generating units are subject to some of the most stringent requirements in the nation for NOx and SO_2.

EPA's Phase II CAMR controls will rely on mercury-specific control technologies that address control of elemental mercury. Mercury-specific technologies are in various stages of development. Additional testing is required to determine long-term reductions, potential effects on unit performance, and fly ash contamination for the types of coal burned in Texas. Current research has shown that abatement devices do not work equally as well for all boilers. Elemental mercury, specifically from lignite and sub-bituminous coal, can be especially difficult to control, because elemental mercury is not very water-soluble and passes through most abatement devices. Mercury efficiency removal rates for lignite have been recorded anywhere from 0 to 75 percent depending on the control technology. Lack of full-scale and long-term testing data for all mercury-specific control devices, particularly for lignite-fired boilers, is an important concern for Texas. For example, substantial data for activated carbon in municipal solid waste combustors exists, but these systems, with typically lower flue gas temperatures, are not as complex as utility boilers. Results from activated carbon injection from utility boilers vary, even on systems with similar design. With regard to fly ash contamination, standard sorbents may change the properties of the fly ash and may render it unusable in concrete, potentially resulting in large volumes of ash to be landfilled rather than put into beneficial reuse. Although mercury controls will be available for use on some scale prior to 2018, EPA and Texas do not believe they can be installed and operated on a national scale prior to that date. The potential availability and reliability of these controls provides justification for CAMR Phase II to begin in 2018 and Texas agrees. It is somewhat ironic that most of the mercury-specific controls are designed to convert elemental mercury, which is not subject to local deposition, into divalent mercury, which is. Lastly, EPA modeling of mercury fish tissue concentrations as a result of both CAIR and CAMR controls shows very little, if any, impact of CAMR Phase II over the CAIR controls. This result is expected since CAMR Phase II addresses elemental mercury which is not subject to local deposition.

There are three main interconnected networks or power grids that comprise the electric power system in the continental United States: the Eastern Interconnect, the Western Interconnect, and the Texas Interconnect. The Texas Interconnect is not connected with the other networks, except through certain direct current interconnection facilities. Limited portions of Texas do fall into the other two interconnects, however the Electric Reliability Council of Texas (ERCOT) manages the flow of electric power in the Texas Interconnect to approximately 20 million Texas customers—representing 85 percent of the state's electric load and 75 percent of the Texas land area. As the independent system operator for the region, ERCOT schedules power on an electric grid that connects 38,000 miles of transmission lines and more than 500 generation units. In August 2005, ERCOT recorded a new system

peak demand of 60,274 megawatts (MW) surpassing the previous record of 60,095 MW set in 2003. With Texas' continued growth, reliable power is essential.

Texas currently has 17 coal-fired electric generating utilities (EGUs) that have 36 boilers that are covered by the Clean Air Mercury Rule (CAMR). Of the 36 boilers, 15 are lignite (8200 megawatt electrical (MWe)); 20 are subbituminous (8102 MWe); and one uses bituminous coal (600 MWe). In 2003, 39 percent of the power in Texas was generated by coal (49 percent natural gas, 9 percent nuclear and 1.2 percent renewable). Texas committed to participating in the CAMR cap-and-trade program by adopting the federal rule by reference in July 2006. For CAMR Phase I beginning in 2010 through 2017, the EPA is relying on reductions as a "co-benefit" of NOx and SO_2 controls from the Clean Air Interstate Rule (CAIR) to assist EGUs in meeting the Phase I requirements of CAMR budgets. CAMR Phase II begins in 2018 and additional controls may be necessary for EGUs to meet their mercury allowance caps.

SFR-085
September 2006

Mercury in Texas: Background, Federal Rules, Control Technologies, and Fiscal Implications

Implementation of Section 2, HB 2481 (79th Legislature)—A Report to the Texas Legislature

printed on recycled paper

Chief Engineer's Office

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Mercury in Texas: Background, Federal Rules, Control Technologies, and Fiscal Implications

Implementation of Section 2, HB 2481 (79th Legislature)—A Report to the Texas Legislature

Prepared by
the Chief Engineer's Office

SFR-085
September 2006

This report is published as required
under Section 2 of HB 2481, 79th Regular Session, Texas Legislature.

Published and distributed
by the
Texas Commission on Environmental Quality
PO Box 13087
Austin TX 78711-3087

Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

ACI	Activated Carbon Injection
BMDL	Benchmark Dose Lower Confidence Limit
BTU	British Thermal Unit
CAIR	Clean Air Interstate Rule
CAMR	Clean Air Mercury Rule
CEMS	Continuous Emissions Monitoring System
CFR	Code of Federal Regulations
CMAQ	Community Multi-Scale Air Quality modeling system
DOC	Dissolved Organic Carbon
DOE	United States Department of Energy
DSHS	Texas Department of State Health Services
EERC	Energy and Environmental Research Center
EGU	Electric Generating Unit
EIA	United States Energy Information Administration
EPRI	Electric Power Research Institute
EPA	United States Environmental Protection Agency
ESP	Electrostatic Precipitator
GWh	Gigawatt Hour
Hg	Mercury
Hg^{2+} or Hg^{II}	Oxidized Mercury
Hg^{O}	Elemental Mercury
Hg_p	Particulate Mercury
HUC	Hydrologic Unit Code
ICR	Information Collection Request
IPM	Integrated Planning Model
IQ	Intelligence Quotient
kWhr	KiloWatt-Hour
lb	Pound
MerCAP	Mercury Capture by Adsorption Process
µg	Microgram
$\mu g/m^2$	Micrograms per Square Meter
mg/kg	Milligrams per Kilogram
µM	Micro-Molar
MMacf	Million Actual Cubic Feet
MW	Megawatt
MWe	Megawatt Electrical
MWh	Megawatt Hour
NHANES	National Health and Nutrition Examination Survey
NRC	National Research Council
NO_x	Nitrogen Oxides
NETL	National Energy Technology Lab

NSPS	New Source Performance Standards
OIG	EPA's Office of Inspector General
PCB	Polychlorinated Biphenyls
PEESP	Plasma Enhanced ESP
PRB	Powder River Basin, a subbituminous coal
RfD	Reference Dose
RIA	Regulatory Impact Analysis
SCDS	Seychelles Child Development Study
SCR	Selective Catalytic Reduction
SO_2	Sulfur Dioxide
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TPY	Tons Per Year
TRI	Toxic Release Inventory
U.S.	United States of America
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

Executive Summary

House Bill 2481, adopted by the Texas Legislature in 2005 (79th Legislative Session), instructs the TCEQ to:

- study the availability of mercury control technology;
- examine the timeline for implementing the reductions required under the federal Clean Air Mercury Rule (CAMR);
- examine the cost of additional controls both to the plant owners and consumers;
- examine the fiscal impact on the state of higher levels of mercury emissions between 2005 and 2018; and
- consider the impact of trading on local communities.

To address these directives, TCEQ staff reviewed the current scientific and technical literature and developed the detailed responses contained in this report. For this study, the agency used existing resources since no additional funds were appropriated.

Mercury emissions, deposition, exposure, and toxicity are complex issues. Much research has been conducted and more is being carried out. These issues remain controversial. No absolute consistency exists between studies. This report attempts to integrate the most pertinent scientific results for Texas.

Mercury Overview

Mercury is an element emitted globally from both natural and man-made sources. As an element, mercury cannot be created or destroyed. There are three primary forms of mercury found in the environment: (1) elemental (quicksilver); (2) divalent (oxidized or "reactive" mercury); and (3) organic (methylmercury). Elemental mercury is stable and can remain in the atmosphere between six months and two years, during which time it can be globally distributed. In the atmosphere, elemental mercury can be converted to the divalent form that can attach to solid particles ("particle-bound" mercury, subject to dry and wet deposition) or aqueous droplets (subject to wet deposition) and can be deposited on the ground and the surface of water bodies. Once divalent mercury enters a water body, it can undergo chemical conversion to methylmercury, which is retained in fish tissue and is the only form of mercury that accumulates in aquatic food webs. Fish consumption is the primary source of methylmercury exposure in humans.

Human activity since the Industrial Revolution has increased the amount of mercury present globally in the atmosphere. About half of global mercury emissions are natural—from oceans, erosion, vegetation, vegetation burning, and volcanoes—while slightly less than half of mercury emissions are the result of man-made sources. About three percent of total global mercury

emissions originate from man-made sources in the U.S., with approximately one percent of the global total from U.S. power plants. Asia contributes about half of the global emissions of mercury from man-made sources, while the U.S. contributes about six percent of emissions from man-made sources.

Availability of Controls

Texas electric generating units (EGUs) are currently regulated for nitrogen oxides (NO_x) and sulfur dioxide (SO_2) under state and federal regulations and will be further regulated under the Clean Air Interstate Rule (CAIR). CAIR controls, such as scrubbers, have the additional benefit of reducing divalent mercury. While CAIR is expected to provide sufficient mercury control to meet CAMR Phase I limits, additional mercury-specific technologies will be needed to attain CAMR Phase II limits. The choice of mercury-specific controls will vary for each boiler and is dependent upon fuel type, furnace type, and existing controls. Mercury-specific control technologies are in various stages of development, with injection of activated carbon as a mercury sorbent having been most extensively tested with the most extensive data to date. Although testing for EGUs has been short-term and limited, data show 30 to 60 percent reductions for Gulf Coast lignite. Test results for Powder River Basin coal in Texas have not been announced; however, studies in other states have indicated reductions up to 80 percent with brominated carbon additives. Additional testing is required to determine long-term reductions, potential effects on unit performance, and fly-ash contamination for all types of coal burned in Texas. Standard sorbents change the properties of fly ash and may render it unusable in concrete. Processes such as Toxecon, which separate the bulk of the fly ash from the sorbent, or halogenated sorbents, which are injected at lower amounts, are being developed to address this issue.

Implementation Timeline

On March 15, 2005, the United States Environmental Protection Agency (EPA) finalized the CAMR to permanently cap and reduce mercury emissions from new and existing coal-fired EGUs nationwide in two phases. Texas has been given an annual mercury budget of 4.656 tons for Phase I (2010–17) and 1.838 tons for Phase II (2018 and thereafter).

The EPA provided states with two compliance options: (1) meet the state's emission budget by requiring new and existing coal-fired EGUs to participate in an EPA-administered cap-and-trade system that caps emissions in two stages; or (2) meet an individual state emissions budget through measures of the state's choosing. In 2005, the 79th Texas Legislature passed House Bill 2481 in its regular session, which requires Texas to adopt the CAMR by reference and participate in the cap-and-trade program. CAMR requires Texas to prepare and submit a state plan pursuant to Federal Clean Air Act section 111(d) by no later than November 17, 2006.

Cost of Controls

Costs of complying with the CAMR in Texas include costs of installing mercury monitors; costs of complying with Phase I, which EPA has asserted are negligible due to "co-benefits" of the

CAIR; and costs of complying with Phase II using mercury-specific controls or purchasing allowances.

For a coal-fired unit to install a mercury continuous emissions monitoring system (CEMS), the EPA estimates capital costs to range from $95,000 to $135,000 per EGU, with annual operating and maintenance costs of $45,000 to $65,000. For sorbent trap monitors, another monitoring option, the EPA estimates the capital cost to be $18,000 per EGU, with annual operating, maintenance, and laboratory costs of $65,000 to $125,000. Based on these estimates, total monitoring costs in Texas could range from about $650,000 to $4.9 million for installation, depending on the type of monitor selected, with corresponding annual operation and maintenance costs of $1.6 to $4.5 million.

Under the cap-and-trade program, sources have the choice of controlling emissions or purchasing additional allowances to meet their obligations. Costs may vary substantially depending on whether a source chooses to control emissions or to purchase allowances for compliance. Under the CAMR, EPA is relying on mercury "co-benefit" reductions from CAIR to assist sources in meeting the CAMR Phase I budgets. Based on fiscal information provided by the EPA for the CAIR, EPA estimates that only three additional scrubbers will be installed in Texas to control SO_2 emissions during CAIR Phase II. EPA estimates SO_2 control costs to range from $400 to $800 per ton to achieve 30 to 40 percent mercury removal efficiency in subbituminous coal-fired units. No corresponding estimate for lignite-fired units is available.

The EPA performed extensive computer modeling using the Integrated Planning Model (IPM) to forecast outcomes of mercury control and trading. The IPM predicts that with currently available controls and no improvements made over time in performance, a pound of mercury allowances would cost roughly $23,200 ($1,500 per ounce) in 2010 (expressed in 1999 dollars), $30,100 per pound ($1,900 per ounce) in 2015, and $39,000 per pound ($2,400 per ounce) in 2020. With the assumption that efficiencies in capturing mercury improve over time, the cost estimates dropped considerably: $11,800 per pound ($700 per ounce) in 2010, $15,300 per pound ($1,000 per ounce) in 2015, and $19,900 per pound ($1,200 ounce) in 2020. Based on EPA estimates of mercury-control costs in 2020, Texas sources could face costs ranging from $112 million to $220 million, using either control technologies or allowance purchases, to move from compliance with the CAMR Phase I cap (4.656 tons) to compliance with the CAMR Phase II cap (1.838 tons).

The EPA forecasts that retail electricity prices are likely to fall from 2000 to 2020, whether or not the CAMR is implemented, due to projected decreases in energy prices, fuel switching, and other responses. Whether or not these predictions hold true, the model predicts prices will drop less under the CAMR than in its absence. A typical household using 1,000 kilowatt hours (kWh) of electricity per month would see an overall decrease of $1.70 in its monthly electric bill with the CAMR, as opposed to an overall decrease of $2.50 without CAMR. Therefore, the net increase in electricity costs due to CAMR is forecast to be about 80¢ per month for the typical household in Texas. For comparison, a preliminary Department of Energy report estimated

increases in electricity costs of 86¢ to $2.37 per month for electricity generated with subbituminous coal, and $2.57 to $3.92 per month for electricity generated with lignite coal.

Fiscal Impacts

Fiscal concerns regarding potential increased mercury emissions include health impacts on children, and impacts on the recreational and economic value of fishing. Fuel-switching to limit mercury emissions could impact the coal mining industry in Texas.

As discussed previously, divalent mercury is the primary form associated with deposition and bioaccumulation. While the CAMR will reduce overall mercury emissions, it primarily targets removal of elemental mercury. As a result, early introduction of the CAMR would have only negligible effects on deposition and bioaccumulation that are linked to health and recreation.

The EPA acknowledges, "There is limited evidence linking IQ and methylmercury exposure." Nonetheless, using IQ as a surrogate for neurobehavioral performance, the EPA estimated an average loss of 0.052 to 0.063 IQ points in children in Texas exposed prenatally to mercury from all sources in 2001. Average IQ is 100 points, and the CAMR is estimated in 2020 to reduce IQ loss by 0.0003 to 0.0004 points on average for prenatally exposed children in Texas, above estimated reductions in IQ losses achieved by CAIR alone of 0.0045 to 0.0067 point. The resulting total lost wages per child are estimated to range from $454 to $557. In Texas, EPA estimates that implementation of the CAIR alone will increase income by no more than $35 to $54 per child, relative to the 2001 base-case estimate. The CAMR is projected to contribute further, but only marginally: by no more than $3 per child. If complete elimination of utility-attributable mercury emissions were required, net earnings losses would not fall to zero, but would still range from roughly $427 to $514 due to other sources of mercury.

Impact of Trading on Local Communities

To assess the potential effects of the CAMR, including its trading provisions, the EPA modeled utility-attributable mercury deposition and fish-tissue methylmercury concentrations for a 2001 base year prior to CAMR-related emission reductions, and for a 2020 future year approximately corresponding to the implementation of CAMR Phase II. Because of additional benefits from reduced mercury emissions from the CAIR, the EPA addressed the effects of CAIR as well as the CAMR in the analysis. The EPA's analysis predicts that after implementation of the cap-and-trade programs of the CAIR and the CAMR, neither utility-attributable mercury deposition nor utility-attributable methylmercury concentrations in fish tissue will increase relative to the base-case levels, either nationally or in Texas. The modeling also showed no utility-attributable mercury "hot spots" from the implementation of the CAMR, where a mercury hot spot is a body of water having utility-attributable mercury concentrations in fish tissue at or above the federal fish tissue criterion of 0.3 mg/kg.

The modeling results show relatively large decreases in utility-attributable mercury deposition between the 2001 base case and the 2020 CAIR case, yet the differences between deposition for the 2020 CAIR and the 2020 CAIR plus CAMR cases are much smaller. This outcome is

attributable to the type of controls implemented in response to CAIR and CAMR. CAIR controls will be highly effective in reducing emissions of divalent mercury, which settles readily through wet and dry deposition. CAMR controls will primarily reduce elemental mercury, which is not readily deposited and enters the global pool of mercury. Because Texas EGUs primarily emit elemental mercury, CAMR controls will not appreciably reduce deposition in the state. Even removing all mercury emissions from power plants in the state would reduce mercury deposition very little compared to CAMR controls.

Chapter 1
Mercury Background

Introduction

Mercury is an element emitted globally from both natural and man-made sources, circulated and deposited by various processes at widely varying rates, and subject to complex chemical transformations. As an element, mercury cannot be created or destroyed. However, human activity since the Industrial Revolution has increased the amount of mercury present globally in the environment.

Forms of Mercury

Three primary forms of mercury are found in the environment: (1) elemental (quicksilver); (2) divalent (oxidized or "reactive" mercury); and (3) organic (methylmercury) (Tchounwou 2003). Mercury continually cycles among these three forms in the environment. Although the detailed processes of this complex cycle remain largely unknown, mercury cycling begins with the release of elemental mercury vapor into the atmosphere from natural sources, such as erosion and volcanic eruptions, and with the release of various forms of mercury from human activities, such as gold mining and burning of fossil fuels.

Elemental mercury is stable and can remain in the atmosphere between six months and two years, during which time it can be globally distributed (Clarkson 2002, Watras 1994). In the atmosphere, elemental mercury can be converted to the divalent form that can attach to solid particles ("particle-bound" mercury, subject to dry and wet deposition) or aqueous droplets (subject to wet deposition) and can be deposited on the ground and surface of water bodies. Once divalent mercury enters a water body, it can undergo chemical conversion to methylmercury. Both divalent and methylmercury can exist in the water column or in the sediment due to particle settling (Watras 1994). However, methylmercury is retained in fish tissue and is the only form of mercury that accumulates in aquatic food webs (Kidd 1995). Fish consumption is the primary source of methylmercury exposure in humans.

Methylation of mercury appears to be dependent upon several factors, including pH, dissolved organic carbon (DOC), sulfate, and oxygen. In freshwater lakes, one of the primary factors affecting fish methylmercury levels is pH. Lakes with lower pH, or more acidic water, contain fish with higher methylmercury content. One possible explanation of this phenomenon is enhanced uptake of divalent mercury by methylating bacteria at lower pH (Kelly 2003). Water column acidity may also remove DOC, which normally inhibits methylation rates. It is possible that divalent mercury may form complexes with the organic carbon, making it unavailable for methylation by bacteria (Barkay 1997). Conversely, a recent study indicates that the organic content of sediment is directly correlated with methylation rates in estuarine sediments. Importantly, this study found that estuarine environments with no direct mercury sources had sediment methylmercury concentrations equivalent to those of polluted marine environments (Lambertsson 2006). However, other differences may exist between freshwater and marine environments. In addition to pH, the sulfate concentration in the water body can influence the

methylation rate of mercury in sediment. Increased sulfate has been found to enhance methylation of mercury in sediment, porewater, and wetland experiments (Jeremiason 2006). Finally, oxygen plays an important role in mercury methylation. Because sulfate-reducing bacteria are anaerobic, increased oxygen inhibits their ability to methylate mercury (DeLaune 2004). Therefore, poor oxygen conditions, which can exist when algae or other organisms thrive on the surface of a water body, actually support mercury methylation. The applicability of these biogeochemical properties in East Texas water bodies is discussed by Twidwell (2000).

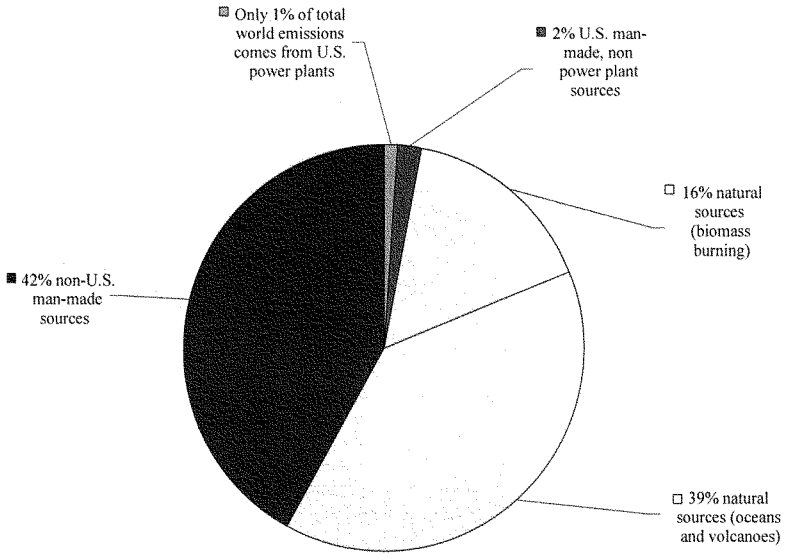
Global and United States Distribution of Mercury Emissions

Figure 1-1 shows the percentage of global mercury emissions from natural and man-made sources, based on 1995 data (Pacyna 2003). Based on these data, over half of global mercury emissions are naturally occurring from oceans, biomass burning, and volcanoes, while slightly less than half of mercury emissions are the result of man-made sources. Some portion of naturally-occurring emissions is actually re-emitted mercury. Re-emitted mercury is transferred to the atmosphere from biologic and geologic processes drawing on a pool of mercury that was deposited to the earth's surface following initial emissions from man-made or natural activities (EPA 1997).

Recent research indicates that emissions of elemental mercury from vegetation in the United States may be substantial. Mercury can be taken up through the leaves of plants and from the soil and then re-emitted through transpiration (Lin 2006). Researchers have concluded that in the United States overall, re-emitted mercury from vegetation may be comparable to mercury emitted from man-made sources during the summer. Vegetative emissions of mercury decrease greatly in winter (Lin et. al 2006).

As Figure 1-1 shows, only about three percent of total global mercury emissions originate from man-made sources in the United States, with approximately one percent of the global total from United States power plants.

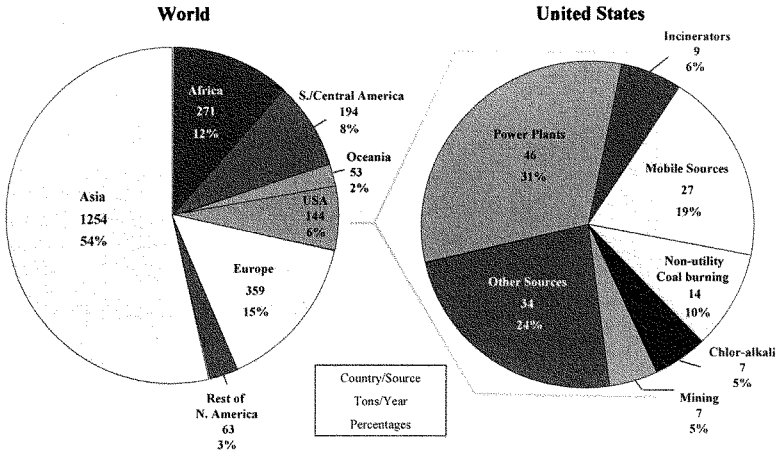
Figure 1-1. Global Emissions of Mercury



Source: Pacyna 2003

Figure 1-2 depicts annual emissions of mercury from man-made sources only, apportioned to the world's continents that emit the largest amounts of mercury. Emissions shown for power plants are for 1999, while emissions for other source types are for 1998 (Seigneur 2006). Values are shown in tons per year as well as in percentages of total man-made emissions. Based on these data, Asia contributes about half of the global emissions of mercury from man-made sources, while the United States contributes about six percent of emissions from man-made sources.

Figure 1-2. Man-Made Emissions of Mercury

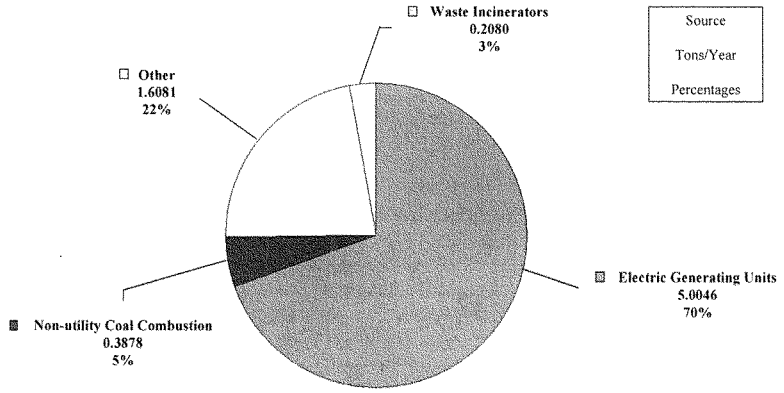


Adapted from Seigneur 2006

Figure 1-2 also shows the distribution of annual mercury emissions from man-made sources in the United States only, in tons per year and as percentages, and for the same years noted above (Seigneur 2006). This pie chart shows that power plants accounted for approximately 31 percent of mercury emissions from man-made sources in the United States in 1999.

Figure 1-3 shows a similar pie chart for Texas mercury emissions for 2003, although mercury emissions from mobile sources were not available in the examined databases. Emissions from power plants are for Clean Air Mercury Rule (CAMR)-applicable electric generating units (EGUs) (see Chapter 2 for a discussion of CAMR). The pie chart shows that EGUs accounted for about 70 percent of the mercury emissions in Texas in 2003, excluding mobile sources (TCEQ 2006).

Figure 1-3. Man-Made Emissions of Mercury in Texas



Source: TCEQ 2006

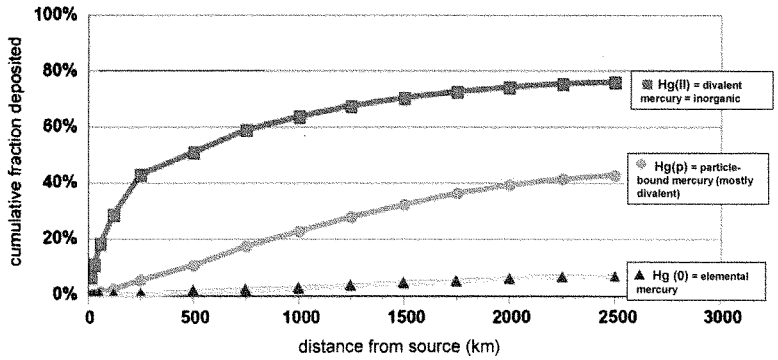
Within the past 100 years, human activities have increased the amount of mercury sustained in the global atmosphere. Estimates from atmospheric sampling over the Atlantic Ocean in 1977, 1978, 1980 and 1990 indicated a yearly increase of approximately one percent in elemental mercury, the form of mercury that serves as an indicator for the global mercury pool. Estimates were slightly higher for the Northern Hemisphere than for the Southern Hemisphere, indicating the possibility of greater emissions from man-made sources of elemental mercury in the Northern Hemisphere (Slemr 1992).

Mercury Deposition

When emitted from natural or man-made sources, the various chemical forms of mercury deposit to the ground or bodies of water at much different rates. Thus, the downwind distances from sources at which cumulative amounts are deposited vary considerably. Figure 1-4 depicts deposition versus downwind distance. The cumulative amount of deposition is plotted against downwind distance from the emitting source for elemental, divalent, and particle-bound mercury (Cohen 2005). This plot is based on modeling of a hypothetical electric generating unit with a stack height of 250 meters; thus, the plot shows only an example of relative distances of deposition for the types of mercury emitted. As an example, for divalent mercury, which deposits fairly readily, the plot shows that about twenty percent of the emissions would be deposited at a distance of about 50 kilometers. Deposition distances for particle-bound and elemental mercury would be much greater, though, due to lower deposition rates for these forms of mercury. In the example provided in Figure 1-4, twenty percent of particle-bound mercury would be deposited at about 800 kilometers downwind, while twenty percent of elemental mercury would be deposited

at a distance considerably greater than 3,000 kilometers downwind of the source. Because elemental mercury settles out at great distances from the source, controlling this form is important to reduce the global mercury pool. In contrast, divalent mercury settles out relatively close to the source, thus controlling this form will help reduce the potential for local impacts from sources.

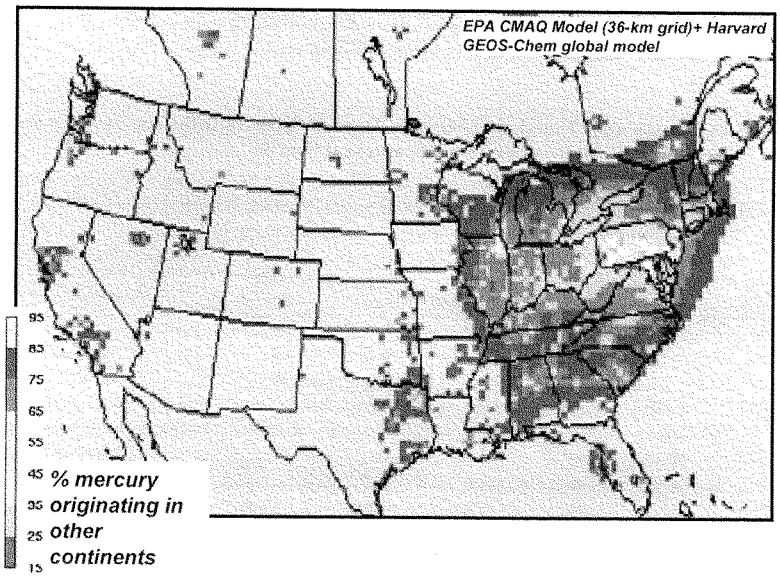
Figure 1-4. Cumulative Fraction of Mercury Deposited Out to Different Distance Ranges From a Hypothetical Source



Source: Cohen 2005

Based on the global mercury emissions balance shown in Figure 1-1 and discussed previously, it should be expected that a large percentage of mercury deposition in the United States would originate from emissions outside of the country. Figure 1-5 shows the estimated amount of mercury deposition across the United States from non-United States natural and man-made sources of emissions, based on modeling for 2001 performed by the United States Environmental Protection Agency (EPA) (Levin 2006). As the map in Figure 1-5 shows, the model predicts the percentage contribution to mercury deposition from non-United States sources to be over 85 percent over much of the United States. Another study indicates that most of the mercury deposition affecting the United States from non-United States sources originates from Asia (Seigneur 2004). The map in Figure 1-5 shows that the percentage contribution to deposition from non-United States sources decreases from west to east since mercury emissions from United States sources are generally higher in the east than in the west, and because precipitation is relatively high in the east, enhancing wet deposition of mercury.

Figure 1-5. Estimate of U.S. Mercury Deposition Originating from Non-U.S. Sources



Source: Levin 2006

Characterization of Mercury from Combustion of Coal

Based on 2003 emissions data, which show about five tons of mercury from Texas coal-fired power plants, about 67 percent of mercury from these plants was emitted as elemental mercury, 32 percent was emitted as the divalent form, and one percent was emitted as particle-bound mercury (Santschi 2005). These percentages can vary considerably on a source-specific basis, depending on such factors as fuel type and control equipment (Cohen 2005).

Generally, there are four "ranks" of coal ranging in geological age from the oldest anthracites to bituminous, subbituminous (including Powder River Basin coal), and the youngest, various lignites. Potential heat capacity and other characteristics vary substantially both within and across coal ranks, with older, higher rank coals generally capable of producing more heat per unit mass than younger, lower rank coals. Variation among coals extends to mercury and other inorganic compounds, such as chlorine, that may affect mercury control efficiency (EPA 2002).
In Texas, one of the primary fuel sources for power plants is Gulf Coast lignite. Although the average mercury content of lignite, as shown in Table 1-1, is comparable to bituminous coal (EPA 2005), the low calorific value or average heating value of lignite gives it the highest potential for mercury emissions (USGS 2001). That is, to generate the same amount of energy,

more lignite must be burned, resulting in the potential for increased mercury release. Due to the relatively low boiling point of mercury (357°C), when lignite is burned, 90 percent or more of the mercury exists in the elemental vapor phase and escapes with the flue gases (Menounou 2003). In addition, Table 1-1 indicates that lignite contains significantly lower concentrations of chloride on average compared to bituminous coal (EPA 2005). In the presence of chloride, elemental mercury is oxidized to divalent mercury and forms an inorganic salt known as mercuric chloride. Mercuric chloride is less volatile than elemental mercury and is significantly more water-soluble (Sliger 2000). Therefore, due to the low chloride content of lignite, very little mercury salt formation occurs, and the mercury that does escape is composed primarily of elemental vapor rather than more easily removable divalent mercury salts.

Subbituminous Powder River Basin (PRB) coal is also widely used in Texas. On average, the mercury content of PRB coal is lower than bituminous coal and lignite (Table 1-1). However, the table also indicates that the average chloride content is even lower than that for lignite (EPA 2005). Therefore, the elemental form of mercury dominates emissions from power plants burning PRB coal as well.

Table 1-1. General Characteristics of Coal Burned in U.S. Power Plants

Coal Type	Average Mercury Content (ppb)	Average Chlorine Content (ppb)	Average Higher Heating Value (BTU/lb)
Bituminous	0.113	1,033	13,203
Subbituminous	0.071	158	12,005
Lignite	0.107	188	10,028

Adapted from EPA 2005.

References

Barkay T, Killman M, Turner R. Effects of Dissolved Organic Carbon and Salinity on Bioavailability of Mercury. Appl Environ Microbiol 63 (11): 4267-4271 (1997).

Clarkson TW. The Three Modern Faces of Mercury. Environ Health Perspect 110 (1): 11-23 (2002).

Cohen, Mark, Ph.D. Atmospheric Fate and Transport of Mercury: Where does the mercury in mercury deposition come from? Presentation at the MARAMA Mercury Workshop. NOAA Air Resources Laboratory (2005).

DeLaune RD, Jugsujinda A, Devai I, Patrick, WH, Jr. Relationship of Sediment Redox Conditions to Methyl Mercury in Surface Sediment of Louisiana Lakes. J Environ Sci Health A Tox Hazard Subst Environ Eng 39 (8): 1925-1933 (2004).

Jeremiason JD, Engstrom DR, Swain EB, Nater EA, Johnson BM, Almendinger JE, Monson BA, Kolka RK. Sulfate Addition Increases Methylmercury Production in an Experimental Wetland. Environ Sci Technol 40 (12): 3800-3806 (2006).

Kelly CA, Rudd JWM, Holoka MH. Effect of pH on Mercury Uptake by an Aquatic Bacterium: Implications for Hg Cycling. Environ Sci Technol 37 (13): 2941-2946 (2003).

Kidd K, Hesslein R, Fudge R and Hallard K. The Influence of Trophic Level as Measured by Delta-N-15 on Mercury Concentrations in Fresh-water Organisms. Water Air Soil Pollut 80 (1-4):1011-1015 (1995).

Lambertsson L, Nilsson M. Organic Material: The Primary Control on Mercury Methylation and Ambient Methyl Mercury Concentrations in Estuarine Sediments. Environ Sci Technol 40 (6): 1822-1829 (2006).

Levin, Leonard, Ph.D. Mercury, State of the Science and Technology presentation given at the Texas Commission on Environmental Quality. Electric Power Research Institute (2006).

Lin C, Lindberg S, Ho T, and Jang C. Development of a Processor in BEIS3 for Estimating Vegetative Mercury Emission in the Continental United States. Atmos Environ 39: 7529–7540 (2005).

Lin C. Email communication of July 28, 2006. Lamar University (2006).

Pacyna JM, Pacyna EG, Steenhuisen F, and Wilson S. Mapping 1995 Global Anthropogenic Emissions of Mercury. Atmos Environ 37 (Supp. 1): S109-S117 (2003).

Santschi, Peter H, Laboratory for Oceanographic and Environmental Research, Department of Marine Sciences and Oceanography, Texas A&M University. Mercury Emissions and Texas Coal-fired Power Plants. Prepared for the Texas Clean Coal Technology Foundation 12 (2005).

Seigneur C, Vijayaraghavan K, Lohman K, Karamchandani P, Scott C. Global Source Attribution for Mercury Deposition in the United States. Environ Sci Technol 38 (2): 555-569 (2004).

Seigneur, Christian, Ph.D. Emissions data provided via email communication of May 20, 2006. Atmospheric and Environmental Research, Inc. (2006).

Slemr F, Langer E. Increase in Global Atmospheric Concentrations of Mercury Inferred from Measurements over the Atlantic Ocean. Nature 355: 434-437 (1992).

Sliger RN, Kramlich JC, Marinov NM. Towards the Development of a Chemical Kinetic Model for the Homogeneous Oxidation of Mercury by Chlorine Species. Fuel Process Technol 65-66: 423-438 (2000).

Texas Commission on Environmental Quality (TCEQ), Industrial Emissions Assessment Section. Annual Routine Mercury Emissions Reported to the TCEQ from Industrial Point Sources for Calendar Year 2003 (2006).

Tchounwou PB, Ayensu WK, Ninashvili N, Sutton D. Environmental Exposure to Mercury and its Toxicopathologic Implications for Public Health. Environ Toxicol 18 (3): 149-175 (2003).

Twidwell S. Bioaccumulation of Mercury in Selected East Texas Water Bodies. TCEQ Surface Water Quality Monitoring Team, Laboratory and Mobile Monitoring Section, and Monitoring Operations Division (2000).

United States Environmental Protection Agency (EPA). Mercury Study Report to Congress, Volume II. EPA-452/R-97-004b, Office of Air Quality Planning and Standards and Office of Research and Development (1997).

United States Environmental Protection Agency (EPA). Control of Mercury Emissions From Coal-Fired Electric Utility Boilers: Interim Report, including errata, EPA-600/R-01-109, National Risk Management Research Laboratory (2002).

United States Environmental Protection Agency (EPA).Control of Mercury Emissions from Coal-Fired Electric Utility Boilers: An Update. Office of Research and Development (2005).

United States Geological Survey(USGS). Mercury in US Coal-Abundance, Distribution, and Modes of Occurrence. USGS Fact Sheet FS-095-01 (2001).

Watras CJ, Huckabee JW, ed. Mercury Pollution Integration and Synthesis. CRC Press, Inc. (1994).

Chapter 2
Clean Air Mercury Rule (CAMR)

Clean Air Mercury Rule (CAMR) Overview

On March 15, 2005, EPA finalized the Clean Air Mercury Rule (CAMR). The final rule was published in the *Federal Register* on May 18, 2005. EPA's goal for CAMR is to permanently cap and reduce mercury emissions from new (commencing operation on or after January 1, 2001) and existing (commencing operation before January 1, 2001) coal-fired electric generating units (EGU) nationwide in two phases. EPA provided states with two compliance options: 1) meet the state's emission budget by requiring new and existing coal-fired EGUs to participate in an EPA-administered cap-and-trade system that caps emissions in two stages; or 2) meet an individual state emissions budget through measures of the state's choosing. Per EPA, the CAMR rule makes the United States the first country in the world to regulate mercury emissions from utilities. When fully implemented, these rules will reduce EGU emissions of mercury from 48 tons a year to 15 tons nationwide, a reduction of nearly 70 percent (EPA 2005).

In 2005, the 79th Texas Legislature passed House Bill 2481 in its Regular Session, which requires Texas to adopt the CAMR rule by reference. Therefore, Texas is statutorily required to participate in the EPA-administered cap-and-trade program, and the Texas Commission on Environmental Quality (TCEQ) adopted CAMR [40 Code of Federal Regulations (CFR) Part 60, Subchapter HHHH] by reference in 30 Texas Administrative Code (TAC) Chapter 101, Subchapter H, Division 8. The CAMR program is designed after the Acid Rain or Title IV program in the Federal Clean Air Act. In addition to being subject to the caps, CAMR requires any EGU for which construction commenced after January 30, 2004, to comply with the mercury new source performance standards (NSPS) in 40 CFR Part 60.45(a) (Texas Legislature 2005).

CAMR applies to any stationary, coal-fired boiler or stationary, coal-fired combustion turbine meeting the applicability requirements under 40 CFR Part 60.4104. The referenced applicability requirements under 40 CFR Part 60.4104 apply to stationary, coal-fired boilers or combustion turbines serving at any time, since the start-up of the unit's combustion chamber, a generator with a nameplate capacity of more than 25 megawatt electrical (MWe) producing electricity for sale. CAMR also applies to co-generation units serving at any time a generator with nameplate capacity of more than 25 MWe and supplying in any calendar year more than one-third of the unit's potential electric output capacity or 219,000 megawatt hours (MWh), whichever is greater, to any utility power distribution system for sale. Integrated gasification combined cycle units are also subject to the final rule (EPA 2005).

As part of the regulatory mechanism for controlling mercury, CAMR requires Texas to prepare and submit a state plan pursuant to Federal Clean Air Act section 111(d) by no later than November 17, 2006. Regulations in 40 CFR Part 60 contain requirements that establish a State Implementation Plan-like procedure under which each state submits to EPA a plan that establishes standards of performance for existing sources of certain air pollutants and that provides for the implementation and enforcement of those standards. The cap-and-trade program

is a standard of performance for the control of mercury emissions from existing sources. The CAMR state plan is the mechanism by which the standard of performance for existing sources is applied to existing EGUs (TCEQ 2006a).

As stated previously, CAMR will be implemented in two phases. Phase I of the CAMR program, years 2010 - 2017, will take advantage of the co-benefit of the Federal Clean Air Interstate Rule (CAIR). EPA has concluded that mercury reductions achieved as a co-benefit of controlling sulfur dioxide (SO_2) and nitrogen oxides (NO_x) under CAIR should dictate the appropriate cap level for mercury. EPA has also stated that requiring SO_2 and NO_x controls beyond those needed to meet the requirements of CAIR solely for the purposes of further reducing mercury emissions by 2010 is not reasonable because the incremental cost effectiveness of such a requirement would be extraordinarily high. Therefore, additional Phase I mercury reductions will not be required beyond the co-benefit of CAIR (EPA 2005).

The 2003 emissions inventory for CAMR EGUs in Texas is 5.0046 tons per year (TCEQ 2006b). Under the Federal CAMR rule, Texas has been given an annual mercury budget of 4.656 tons for Phase I (2010-2017) and 1.838 tons for Phase II (2018 - and thereafter). Therefore, there will be a decrease of 0.3486 tons per year based on the 2003 reported emissions inventory and the CAMR allocations for 2010. According to EPA's predictions, CAMR compliance in Texas will result in a mercury reduction of seven percent or 0.4 tons annually by 2010 and a total of 63 percent or 3.2 tons annually by 2018. These reductions are based on EPA's 1999 mercury emissions for Texas. However, because Texas will be participating in the EPA administered cap-and-trade program for CAMR, reductions could be higher if EGUs elect to over control beyond their CAMR allocations or the reductions could be less if EGUs choose to purchase CAMR allowances to stay in compliance. Regardless of the number of new coal-fired EGUs in Texas, the state's budget from EPA will not change (EPA 2005). However, EGUs within the state could purchase mercury credits annually from other states participating in the CAMR trading program.

Phase II of the CAMR program, 2018 and thereafter, will require new and existing coal-fired EGUs to use mercury-specific air pollution control technologies. Phase II reductions are based on the combined co-benefit from CAIR reductions and mercury-specific controls. Table 2-1 outlines the mercury caps under CAMR for Phase I and Phase II (EPA 2005).

Table 2-1. Mercury Caps under CAMR

	National Annual Mercury Cap	Texas Annual Mercury Cap
Phase I - 2010-2017	38 tons per year	4.656* tons per year
Phase II - 2018 and thereafter	15 tons per year	1.838 tons per year

*Texas's CAMR cap was lowered from 4.657 tons per year to 4.656 tons per year on April 28, 2006 by EPA (EPA 2006a)

Control Strategy
EPA requires states to submit a CAMR state plan that will show the state's legal authority to adopt emission standards and compliance schedules necessary for attainment and maintenance of the state's relevant annual mercury budget, and require owners or operators of EGUs in Texas to meet monitoring, recordkeeping and reporting requirements.

Title V permit revisions are required to reflect EGU participation in CAMR. The mercury update to the Title V permit must be submitted by June 1, 2007.

Compliance with CAMR is determined by EGUs maintaining an adequate mercury allowance to cover the previous year's emissions. If EPA determines that an EGU exceeded its mercury allowance requirements in EPA's cap-and-trade program, the EGU will be required to surrender allowances sufficient to offset the excess emissions. The EGU must also surrender allowances to EPA from the next control period equal to three times the excess emissions (EPA 2005).

Cap-and-Trade
Cap-and-trade programs, such as CAMR for EGUs, are market-based mechanisms for reducing pollution from a group of sources at lower cost than if sources were regulated individually. The CAMR cap-and-trade program first sets an overall mercury cap, or maximum amount of emissions per compliance period, that will achieve the desired environmental effects. Authorizations to emit in the form of emission allowances are allocated to states, and the total number of allowances cannot exceed the nationwide cap. Individual control requirements are not specified. Sources are required to completely and accurately measure and report all emissions and then surrender allowances equal to total emissions at the end of the compliance period.

Cap-and-trade provides sources, such as EGUs, flexibility in compliance by either choosing to control emissions through technology or through purchase of additional allowances to meet compliance obligations (EPA 2006b).

Monitoring and Reporting
CAMR requires monitoring of total vapor phase mercury concentrations from coal-fired EGUs through either a mercury continuous emission monitoring system (Performance Specification 12A) or a mercury sorbent trap monitoring system (40 CFR Part 75, Appendix K). In addition to the mercury concentrations, CAMR also requires monitoring of heat input, stack gas flow rate, and stack gas moisture (if moisture correction is necessary). Low mass emitters (less than or equal to 29 pounds mercury/year) have the option of using periodic mercury stack testing in lieu of the continuous mercury concentration monitoring systems. Low mass emitters between nine pounds mercury/year and 29 pounds mercury/year must test twice per year, while low mass emitters with nine pounds mercury/year or less must test once per year (EPA 2005).

Compliance Plan and Schedule
Owners or operators of a coal-fired EGU CAMR unit that commences commercial operation before July 1, 2008, must be in compliance with the monitoring requirements by January 1,

2009. Owners or operators of a unit that commences commercial operation on or after July 1, 2008, must comply with the monitoring requirements by the later of the following dates: January 1, 2009, or 90 unit operating days or 180 calendar days, whichever occurs first, after the date the unit commences commercial operation (EPA 2005).

Clean Air Mercury Rule (CAMR) Activity Time Line

March 15, 2005 – CAMR finalized by EPA.

May 18, 2005 – CAMR published in the *Federal Register.*

August 4, 2005 - D.C. Circuit Court of Appeals Refuses to Stay Mercury Rule - EPA opposed the stay sought by environmental groups, arguing that if it were granted, mercury would be unregulated and implementation of the cap-and-trade program for the toxic pollutant would not be possible. The fourteen states that sued EPA on the rule did not join in the request for the stay.

October 21, 2005 – In two separate actions, EPA granted requests from petitioners to reconsider certain aspects of its March 15, 2005, CAMR.

The first action addressed four petitions. EPA agreed to reconsider and accept comments on the following aspects of the final rule:

- method used to apportion the national caps to individual states;
- definition of "designated pollutant;"
- EPA's subcategorization for new subbituminous coal-fired units subject to NSPS;
- statistical analysis used for the NSPS;
- highest annual average mercury content used to derive the NSPS;
- definition of covered units as including municipal waste combustors; and
- definition of covered units as including some industrial boilers.

The second action addressed other petitions for reconsideration, with EPA agreeing to reconsider and accept comments on the following aspects of the final rule:

- legal issues underlying EPA's determination that the regulation of electric utility steam generating units under Section 112 of the Federal Clean Air Act was neither necessary nor appropriate, and removing certain utility units from the list of source categories; and
- the methodology used to assess the amount of utility-attributable mercury levels in fish tissue and the public health implications of those levels.

March 1, 2006 - The TCEQ staff requested the Commissioners' approval to publish for public comment the proposed CAIR SIP and CAMR State Plan, with the associated rules.

March 17 - April 17, 2006 - Comment period for CAIR and CAMR, with a public hearing held on April 11th at the TCEQ headquarters in Austin, April 12th at the TCEQ Regional Office in Fort Worth and April 13th at the TCEQ Regional Office in Houston.

June 9, 2006 – EPA took final action on petitions to reconsider two actions regarding mercury air pollution. EPA reaffirmed the determination it had made in the final Section 112(n) Revision Rule to remove certain utility units from the list of §112(c) source categories, and reaffirmed its decision that regulation of these units under §112 is neither necessary nor appropriate. EPA also granted requests from petitioners to reconsider certain aspects of its March 15, 2005, Clean Air Mercury Rule (CAMR) in two separate actions. Based on these requests, EPA is making the following changes to CAMR: adjusting the heat input values for a single unit in Alaska that will cause a decrease of 0.001 ton per year of mercury allowances for Texas in 2010-2017; increasing the NSPS limit for subbituminous coal-, lignite- and coal refuse-fired units and decreasing the limit for bituminous coal; amending the regulatory language to clarify that CAMR does not apply to municipal waste combustors; and correcting technical aspects to clarify the final rule. Additional rule changes are expected during the summer of 2006 from EPA.

July 12, 2006 – The Commission adopted the CAMR State Plan and associated rules.

October 31, 2006 – CAMR allocations due to EPA.

November 17, 2006 – CAMR State Plan is due to EPA.

January 1, 2009 – CAMR monitoring must be in place to continuously monitor mercury emissions.

January 1, 2010 – Phase I of CAMR begins.

January 1, 2018 – Phase II of CAMR begins.

References

Texas Commission on Environmental Quality (TCEQ), Texas State Plan for the Control of Designated Facilities and Pollutants, Plan for Control of Mercury Emissions from Coal-fired Electric Steam Generating Units, Clean Air Mercury Rule (2006a).

Texas Commission on Environmental Quality (TCEQ), Industrial Emissions Assessment Section. Annual Routine Mercury Emissions Reported to the TCEQ from Industrial Point Sources for Calendar Year 2003 (2006b).

Texas Legislature Act of June 18, 2005, 79th Legislature, Regular Session, House Bill 2481, §2 (codified at Tex. Health & Safety Code §382.0173, concerning Adoption of Rules Regarding Certain SIP Requirements and Standards of Performance for Certain Sources (2005).

United States Environmental Protection Agency (EPA). Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units; Final Rule, *Federal Register* (2005).

United States Environmental Protection Agency (EPA). Revision of December 2000 Clean Air Action Section 112(n) Finding Regarding Electric Utility Steam Generating Units; and Standards of Performance for New and Existing Electric Utility Steam Generating Units: Reconsideration, *Federal Register* (2006a).

United States Environmental Protection Agency (EPA). Clean Air Markets - Allowance Trading. <http://www.epa.gov/airmarkets/trading/basics/index.html> (2006b).

Chapter 3
Assessment of the CAMR Trading Program on Local Communities

Introduction

In addition to requiring the commission to adopt the Clean Air Interstate Rule (CAIR) and the Clean Air Mercury Rule (CAMR), HB 2481 provides that the commission shall "consider the impact of trading on local communities." The commission has interpreted this directive to mean an assessment of the potential for mercury emissions trading under CAMR to result in local, "utility-attributable" increases of methylmercury in fish caused by future increases in mercury deposition. Such an increase related to trading might occur if the downwind effect of any increase in mercury emissions at an electric generating unit (EGU) were to outweigh the effects of emission decreases from other sources, either nearby or distant. If a utility-attributable increase in fish tissue methylmercury concentration exceeds EPA's fish tissue criterion of 0.3 mg/kg, such an increase is considered by EPA to be a "utility hot spot" (EPA 2005a).

This section assesses the potential for CAMR to result in utility-attributable local increases of mercury deposition and methylmercury in fish, as well as utility-attributable hot spots, based on a review of technical work conducted primarily by EPA in developing CAMR.

EPA's Technical Approach and Results

To assess the potential effects of CAMR, including the CAMR trading provisions, EPA conducted modeling to estimate utility-attributable mercury deposition and fish tissue methylmercury concentrations for a base year (2001) prior to CAMR-related emission reductions, and for a future year (2020) approximately corresponding to the implementation of CAMR. EPA conducted the modeling with the peer-reviewed Community Multi-Scale Air Quality (CMAQ) modeling system, with meteorological inputs derived from the Fifth-Generation National Center for Atmospheric Research/Penn State Mesoscale Model. Because of mercury emission reduction co-benefits from the implementation of CAIR, EPA addressed the effects of CAIR together with the effects of CAMR in the analysis (EPA 2005b).

For the 2001 base year deposition modeling, EPA used utility mercury emissions from the National Emissions Inventory for 1999, the closest available year to 2001. For non-utility sources, EPA used data for 2002, the year closest to 2001, where available. EPA developed utility emissions for the 2020 future year using the Integrated Planning Model (IPM) (EPA 2005b). IPM is designed to project the impact of environmental policies on the electric power sector in the 48 contiguous states and the District of Columbia. It provides forecasts of least-cost capacity expansion, electricity dispatch, and emission control strategies for meeting energy demand and environmental, transmission, dispatch, and reliability constraints (EPA 2006a). In its IPM modeling, EPA assumed that all of the 48 contiguous states will implement the trading program prescribed in CAMR (EPA 2005b).

To ensure appropriate geographical representation for modeled deposition, values calculated for the modeled grid cells were averaged over units called Hydrologic Unit Codes (HUCs), which are representations of watersheds. Averaging of modeled deposition values over the watersheds

is a reasonable methodology for predicting the impact of mercury deposition on fish tissue levels in water bodies within a given watershed, since processes occurring over a watershed likely influence methylmercury concentrations in fish at any given location within the watershed ecosystem (EPA 2005a).

EPA examined samples collected from multiple sites in the National Listing of Fish Advisories and National Lake Fish Tissue Survey to determine fish tissue methylmercury concentrations for the 2001 base year. To estimate utility-attributable fish tissue concentrations for the future year after implementation of CAIR and CAMR, base year values of total fish tissue concentration at the sampling sites were scaled with the ratio of utility-attributable mercury deposition modeled in the base year to that predicted for the future year (EPA 2005c).

Summaries of modeling results for utility-attributable mercury deposition for United States and Texas watersheds are presented in Tables 3-1 and 3-2, respectively. Summaries of results for utility-attributable fish tissue concentrations of mercury for the United States and Texas are shown in Tables 3-3 and 3-4, respectively.

Table 3-1. Utility-Attributable Mercury Deposition ($\mu g/m^2$) – U.S.

Deposition	2001 Base Case	2020 Future Case with CAIR Implemented	2020 Future Case with CAIR and CAMR Implemented
Minimum	0.00	0.00	0.00
Maximum	19.71	4.03	3.85
50th percentile	0.39	0.31	0.26
90th percentile	4.08	1.38	1.16
99th percentile	10.15	2.56	2.17

Source: EPA 2005c

Table 3-2. Utility-Attributable Mercury Deposition ($\mu g/m^2$) – Texas

Deposition	2001 Base Case	2020 Future Case with CAIR Implemented	2020 Future Case with CAIR and CAMR Implemented
Minimum	0.06	0.06	0.04
Maximum	9.84	1.94	1.46
50th percentile	0.37	0.27	0.25
90th percentile	1.89	0.69	0.63
99th percentile	6.82	1.53	1.18

Source: Hubbell 2006

Table 3-3. Utility-Attributable Fish Tissue Mercury Concentration (mg/kg) – U.S.

Fish Tissue Concentration	2001 Base Case	2020 Future Case with CAIR Implemented	2020 Future Case with CAIR and CAMR Implemented
Minimum	0.00	0.00	0.00
Maximum	0.85	0.25	0.19
50th percentile	0.03	0.01	0.01
90th percentile	0.11	0.03	0.03
99th percentile	0.26	0.10	0.09

Source: EPA 2005c

Table 3-4. Utility-Attributable Fish Tissue Mercury Concentration (mg/kg) – Texas

Fish Tissue Concentration	2001 Base Case	2020 Future Case with CAIR Implemented	2020 Future Case with CAIR and CAMR Implemented
Minimum	0.00	0.00	0.00
Maximum	0.09	0.04	0.03
50th percentile	0.01	0.00	0.00
90th percentile	0.05	0.02	0.02
99th percentile	0.08	0.03	0.03

Source: Cakir 2006

In these tables, data are presented for minima, maxima, and three percentile categories. As an example for the percentile categories, the "99th percentile" means that 99 percent of the values fall below the deposition or fish tissue concentration values in the applicable rows of the tables. EPA's 2020 future case analysis predicts that after implementation of the cap-and-trade programs of CAIR and CAMR, there will be neither increased utility-attributable mercury deposition nor increased utility-attributable fish tissue methylmercury concentrations relative to the base case levels, either nationally or in Texas. The modeling for the 2020 future case also predicts no utility-attributable hot spots (i.e., no utility-attributable fish tissue concentrations at or above EPA's methylmercury fish tissue criterion of 0.3 mg/kg) (EPA 2005c). Furthermore, the modeling predicts no utility-attributable fish tissue concentrations in excess of the Texas Department of State Health Services mercury advisory level of 0.7 mg/kg. See Chapter 4 for additional information on the state's mercury advisory level. The commission agrees it is unlikely that utility-attributable hot spots will occur after implementation of CAIR and CAMR, but cannot rule out the possibility of such an occurrence, due to uncertainties discussed in subsequent sections.

The modeling results in Tables 3-1 and 3-2 show relatively large decreases in utility-attributable deposition between the 2001 base case and the 2020 CAIR case, yet differences between deposition for the 2020 CAIR and the 2020 CAIR plus CAMR cases are much smaller. This outcome is attributable to the type of controls implemented in response to CAIR and CAMR. CAIR controls will be highly effective in reducing emissions of divalent mercury, which settles readily through wet and dry deposition. CAMR controls will primarily reduce elemental mercury, which is not readily deposited and enters the global pool of mercury. Because Texas EGUs primarily emit elemental mercury, CAMR controls will only negligibly reduce deposition

in the state. As Table 3-2 shows, even removing all mercury emissions from EGUs in the modeling domain would only reduce mercury deposition by 0.04 to 1.46 $\mu g/m^2$ compared to CAMR controls.

Tables 3-3 and 3-4 show that trends for utility-attributable fish tissue concentrations of mercury are similar to those shown for utility-attributable deposition, since the fish tissue concentrations calculated by EPA were based on a proportional relationship between deposition and fish tissue concentration. Notably, EPA's modeling does not account for the time lag between decreases in mercury deposition and decreases in fish tissue concentrations. The response times for changes in fish tissue concentration in freshwater ecosystems typically range between five and 30 years, and some systems will likely take more than 50 to 100 years to reach steady state (EPA 2005c).

Assessment of Uncertainties in the Analysis of CAMR

On May 15, 2006, EPA's Office of Inspector General (OIG) issued a report assessing EPA's determination that CAMR would not result in utility-attributable mercury hot spots (EPA 2006b). OIG recommended that the following uncertainties be acknowledged in EPA's analysis:

- Gaps in available data and science for mercury emissions estimates;
- Limitations in the model used for predicting mercury deposition;
- Uncertainty in how mercury reacts in the atmosphere; and
- Uncertainty in how mercury methylation occurs in water bodies, and how methylmercury accumulates in fish.

Given the uncertainties noted above, OIG concluded that EPA should develop and implement a monitoring plan to assess the impact of CAMR on mercury deposition and fish tissue concentrations. The office also recommended that EPA evaluate and refine mercury estimation tools and models as necessary (EPA 2006b).

EPA responded to the OIG comments by stating that EPA believes it has clearly explained the science and uncertainties in the CAMR documentation. In response to the OIG recommendations that EPA develop and implement a monitoring plan and evaluate and refine scientific tools, EPA explained that it currently operates the Mercury Deposition Network, which is located predominantly in the eastern United States and monitors only wet deposition. EPA further explained that in the CAMR technical support documents, the agency has continually highlighted the need for and the willingness to support additional ambient monitoring, including development of dry deposition monitoring, to enhance its ability to assess the numerical accuracy of sophisticated simulation tools such as the CMAQ model. EPA responded that it has been heavily involved, over the past decade, in developing the CMAQ model and is actively engaged in utilizing ambient data and the latest scientific information to update the model to reflect the best possible chemistry and physics. EPA stated that it is committed to using the best possible information to assess the transport, transformation, deposition, and fate of United States mercury emissions (EPA 2006b).

Trading Issues and Impact on CAMR Modeling Results

EPA's future case mercury inventory for EGUs, developed with the IPM model, is based on EPA's assumption that all of the 48 contiguous states will implement the trading program prescribed in CAMR (EPA 2005b). The specific values resulting from EPA's analysis of mercury deposition and fish tissue concentrations would vary according to the number of states participating and the type of mercury reduction programs actually implemented. However, the commission believes that, for Texas, EPA's modeling prediction of no increases in these values would still hold. The commission believes the most likely scenario is that sources buying credits under the trading program would do so to maintain current emissions, not to increase emissions. In addition, although new EGUs within the state could purchase mercury credits from other states, the Texas budget from EPA will not change.

Other Mercury Assessments

Environmental Defense assessed the potential impact of mercury emissions on deposition at mercury hot spots, defined by the organization as "locations where mercury deposition is highest" (Environmental Defense 2003). Environmental Defense reviewed modeling conducted by EPA for the year 1998 based on use of the Regional Modeling System for Aerosols and Deposition (EPA 2003). The modeling showed that Texas mercury emissions contributed about 50 percent of the deposition at the location in the state having the highest deposition. However, it is not clear from the EPA modeling the extent to which various types of sources, including EGUs, may have contributed to the predicted deposition, or where the contributing sources were located. The commission believes that, based on EPA's modeling output, a primary contributor to the maximum deposition may have been a non-utility industrial source or sources.

The EPA modeling results that Environmental Defense cites, however, are conceptually consistent with deposition information provided earlier in Chapter 1. As depicted in Figure 1-5, United States sources of mercury can have a notable impact on deposition in some areas. CAMR and CAIR are designed to help mitigate the deposition through reductions in mercury emissions. As discussed earlier and as shown by EPA's modeling results provided in Tables 3-2 and 3-4, the CAIR and CAMR programs, particularly CAIR, are predicted to have a beneficial effect on the utility-attributable portion of mercury deposition and fish tissue concentration in Texas.

In comments on the CAMR proposal submitted to EPA, Environmental Defense expressed concern that additional reductions in mercury beyond those occurring from the collateral benefit of CAIR would not be required until 2018 (Environmental Defense 2004). As discussed earlier, however, EPA's CMAQ modeling conducted in support of CAMR indicates only a small additional reduction in deposition within Texas from CAMR, since CAMR controls mainly emissions of elemental mercury which does not deposit readily. Thus, the commission believes it is not critical that the final CAMR reductions be required before 2018 in Texas.

The Electric Power Research Institute (EPRI) studied the impact of CAMR, with its trading provisions, on mercury deposition as did EPA. EPRI's modeling tools and procedures were somewhat different from EPA's (Levin 2006). In its study, EPRI concluded that all states in the country will experience overall reductions in mercury deposition due to the implementation of

CAMR. EPRI also concluded that reductions in deposition will vary somewhat by location depending on variables such as coal type and types of controls (EPRI 2004).

References

Cakir, Janet. Fish tissue data provided via FTP communication on May 30, 2006, and post processed by TCEQ staff. United States Environmental Protection Agency (2006).

Electric Power Research Institute (EPRI). EPRI: "Hot Spots" – Mercury Emissions and Deposition Patterns <http://my.epri.com> (2004).

Environmental Defense. Out of Control and Close to Home – Mercury Pollution from Power Plants (2003).

Environmental Defense. Comments submitted to EPA on the proposed Clean Air Mercury Rule (2004).

Hubbell, Bryan. Deposition data provided via email communication of June 2, 2006, and post processed by TCEQ staff. United States Environmental Protection Agency (2006).

Levin, Leonard, Ph.D. Mercury, State of the Science and Technology presentation given at the Texas Commission on Environmental Quality. Electric Power Research Institute (2006).

United States Environmental Protection Agency (EPA). EPA Draft Mercury REMSAD Deposition Modeling Results (2003).

United States Environmental Protection Agency (EPA). EPA Revision of December 2000 Regulatory Finding on the Emissions of Hazardous Air Pollutants from Electric Utility Steam Generating Units and the Removal of Coal- and Oil-Fired Electric Utility Steam Generating Units from the Section 112 (c) List: Reconsideration. EPA-6560-50-P, 40 CFR Part 63 (2005a).

United States Environmental Protection Agency (EPA). EPA Regulatory Impact Analysis of the Final Clean Air Mercury Rule EPA-452/R-05-003 (2005b).

United States Environmental Protection Agency (EPA). EPA Technical Support Document: Methodology Used to Generate Deposition, Fish Tissue Methylmercury Concentrations, and Exposure for Determining Effectiveness of Utility Emission Controls (2005c).

United States Environmental Protection Agency (EPA). EPA Modeling Applications Using the Integrated Planning Model <http://www.epa.gov/airmarkets/epa-ipm/#intro> (2006a).

United States Environmental Protection Agency (EPA). EPA Monitoring Needed to Assess Impact of EPA's Clean Air Mercury Rule on Potential Hotspots. 2006-P-00025 (2006b).

Chapter 4
Health Issues

Methylmercury

A small fraction of divalent mercury deposited to water and soils ends up in sediments of waterbodies where it is transformed by microbes into methylmercury (Jackson 1998). Methylmercury is retained in fish tissue and is the only form of mercury that accumulates in aquatic food webs (Kidd 1995). Methylmercury is the most toxic of the three primary forms of mercury. Fish consumption is the primary source of methylmercury exposure in humans. Once ingested, 90 to 95 percent of methylmercury is absorbed into the blood from the gastrointestinal tract (EPA 2001). It crosses the blood-brain barrier as a complex with the amino acid, L-cysteine, and accumulates in brain tissue. The half-life of methylmercury varies from tissue to tissue, but is generally between 45 to 70 days. During this time, methylmercury is slowly demethylated and primarily excreted through the feces as divalent mercury (Clarkson 2002).

Health Effects of Mercury

Methylmercury is primarily toxic to the central nervous system. Symptoms vary depending on the dose to which a person is exposed. The primary concern is for the developing brain *in utero*, as methylmercury readily crosses the placental barrier in humans and animals (EPA 2001). At high, acute doses, fetal brain development is severely affected and exposure is often fatal. Mercury intoxication can lead to mental retardation, cerebral palsy, and seizures (Tchounwou 2003). In the mature nervous system, there is often a significant delay between exposure and the onset of symptoms. Some individuals experience numbness or a "pins and needles" sensation in their limbs at low dose which may progress to shaky, unsteady movements caused by damage to the cerebellum, difficulty articulating words, constriction of the field of vision, and hearing loss (Clarkson 2002).

Although the nervous system appears to be the most sensitive target, the cardiovascular system may also be susceptible to mercury toxicity. Correlations have been found between mercury levels and cardiovascular disease in Finnish men (Salonen 1995, Vertanen 2005). However, this association may be the result of the influence of abnormally high data points (Clarkson 2002). One study in the *New England Journal of Medicine* found that mercury levels in European men who experienced heart attacks were 15 percent higher than in controls (Guallar 2002). However, in the same journal issue, another group found no association between mercury levels in American men and coronary heart disease, although these results were based largely on men occupationally exposed to relatively high doses of elemental mercury (Yashizawa 2002). Therefore, effects of mercury on the cardiovascular system are conflicting, and additional research is required.

Health Effects Studies of Methylmercury Exposure

Although acute mercury poisoning brought the toxic effects of mercury to the forefront of public attention, typical exposure in the United States is limited to chronic, low dose exposure through fish consumption. EPA evaluated three primary epidemiological studies based on populations that consume higher than average amounts of fish to derive the most recent reference dose (RfD)

for methylmercury. The RfD is defined (EPA 2001) as, "...an estimate of daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious health effects during a lifetime." For mercury, neurotoxicity is the health effect of greatest concern, and fetuses are considered the most sensitive subgroup. Recent data indicate that cardiovascular and immunological effects may occur at low mercury doses, but neurological defects remain the most sensitive health effect (EPA 2001). Carcinogenic effects have been noted only at extremely high doses in animals and are believed to be secondary to organ damage. Therefore, typical environmental doses of methylmercury are unlikely to be carcinogenic for humans (EPA 2001).

The three epidemiological studies reviewed by EPA included the Seychelles Child Development Study (SCDS), the Faroe Island study, and the New Zealand study. The SCDS was not used to develop the RfD, because neurological defects were not identified with increasing methylmercury exposure. In contrast, both the Faroe Island and New Zealand studies found dose-related neurological deficits. However, the Faroe Island study was chosen to derive the RfD due to its large sample size, good statistical power, use of two different biomarkers of exposure (fetal umbilical cord blood and maternal hair concentrations), comprehensive neurological assessment at stages of development where they would most likely be detected, and extensive review and analysis in the scientific literature (EPA 2001). An external peer review panel and the National Research Council (NRC) reviewed the EPA assessment of the literature and agreed that the Faroe Island study was appropriate for derivation of the RfD.

EPA performed an analysis to determine the lower 95 percent confidence limit of the benchmark dose (BMDL). It is generally accepted by the scientific community that the BMDL is the best quantitative alternative method for determining the no observed adverse effect level (NOAEL) for a chemical. The BMDL was derived by identifying a small but measurable (five percent) change in neurological effects as measured by the Boston Naming Test. This test, originally designed to identify subtle neurological effects in the elderly, was administered to children in the Faroe Island cohort at seven years of age. Multiple regression analysis indicated a statistically significant functional decrease with increased prenatal mercury exposure. Based on these results, the NRC recommended a BMDL of 58 ppb mercury in umbilical cord blood. An external review panel recommended a higher BMDL of 71 ppb mercury in umbilical cord blood to account for potential confounding effects of polychlorinated biphenyls (PCBs), which are present at high levels in the whale blubber consumed in the Faroe Islands. EPA chose to apply the more conservative estimate of 58 ppb to maternal blood levels, assuming a 1:1 ratio between umbilical cord and maternal blood concentrations. This value was then divided by an uncertainty value of ten to account for variability, including potential differences between umbilical cord blood and maternal blood mercury levels and interindividual variability in mercury metabolism, as well as potential long-term effects not yet measured by the Faroe Island study. Therefore, a value of 5.8 ppb mercury in maternal blood was used to estimate a health-protective oral dose. Consumption of 0.1 μg mercury/kg body weight/day was set by EPA as the RfD to protect against neurological effects in the developing fetus. Since the RfD protects the most sensitive subpopulation, it is assumed that adverse health effects for the general population over a lifetime of exposure are prevented (EPA 2001).

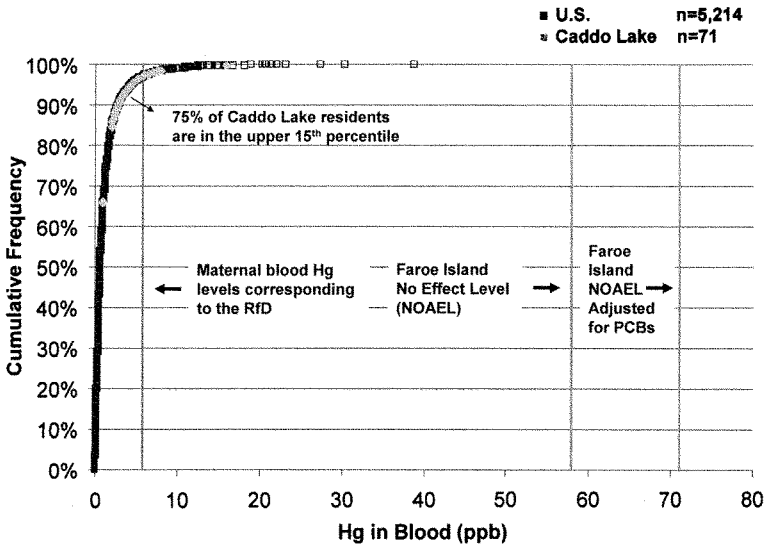
Because methylmercury exposure in humans occurs primarily through fish consumption, EPA also developed a criterion for methylmercury concentrations in freshwater fish tissue to protect human health under the Federal Clean Water Act. To calculate the fish tissue criterion, average default values were applied, including 70 kg (154 lbs) for average adult body weight and 0.0175 kg fish/day (approximately four ounces fish/week or two average fish meals/month) for average adult human fish intake. In addition, because this criterion was established for freshwater fish only, a value accounting for consumption of marine fish (0.027 µg mercury/kg body weight/day) was subtracted from the RfD of 0.1µg mercury/kg body weight/day. The resulting fish tissue criterion is 0.3 mg methylmercury/kg whole fish.

The Texas Department of State Health Services (DSHS) issues species-specific fish consumption advisories when fish fillet testing indicates mercury levels at or above 0.7 mg/kg. The state advisory level was derived using the Agency for Toxic Substances and Disease Registry's minimal risk level of 0.3 µg/kg/day (ATSDR 1999). To calculate the fish tissue concentration, a value of 70 kg (154 lbs) was applied as the average adult body weight and an average fish consumption value of 0.03 kg fish/day (approximately eight ounces fish/week or four average fish meals/month) was used (EPA 2000). Although the Texas DSHS advisory level is less conservative than the EPA fish tissue criterion of 0.3 mg/kg, the estimated blood mercury levels for a person consuming fish containing 0.7 mg/kg methylmercury remain well below the estimated NOAEL.

In 1995, the Texas DSHS issued a consumption advisory due to elevated muscle tissue mercury levels in largemouth bass and drum in Caddo Lake. To determine whether or not additional efforts were needed in the area to protect against potential adverse health effects, DSHS recruited and tested blood mercury levels in 71 area residents (34 male/37 female) in 2004. In addition to blood testing, DSHS issued questionnaires to establish residency duration and fish consumption habits. Average fish consumption ranged from zero to seven meals per week. Average blood mercury levels increased with increasing weekly fish consumption. Higher blood mercury concentrations also corresponded with consumption of fish (largemouth bass and drum) with higher average fillet mercury concentrations (Texas DSHS 2005).

In Figure 4-1, dark blue points indicate the cumulative frequency of blood mercury levels for each individual tested in the nationally representative 1999-2000 National Health and Nutrition Examination Survey (NHANES) study, 96 percent of whom had blood mercury levels below 5.8 ppb (CDC 2006). For comparative purposes, data specific to a sub-population of Caddo Lake residents (represented by the light blue points) are superimposed on the national sample. This Caddo Lake population had higher average blood mercury concentrations, which is expected, due to higher than average fish consumption rates.

Figure 4-1. Cumulative Frequency of Blood Mercury Levels in Caddo Lake Area Residents Relative to the U.S. Population



Data Source: Texas DSHS 2005 and Centers for Disease Control 1999-2002

No observable adverse effects are anticipated at current blood mercury levels for the Caddo Lake sub-population or the representative United States sub-population sampled by NHANES. Total blood mercury levels for Caddo Lake residents ranged from 1.0 to 15.9 ppb, with an average of 2.63 ppb (Texas DSHS 2005). In comparison, total blood mercury levels in the broader United States population ranged from 0.07 to 38.9 ppb, with an average of 1.26 ppb. The current RfD is set to prevent methylmercury blood levels exceeding 5.8 ppb to protect against neurological effects in the developing fetus. Therefore, the primary population of concern is women of child-bearing age. Five of 37 female Caddo Lake residents were of child-bearing age, all of whom had blood mercury levels below 5.8 ppb. Higher mercury concentrations (>58 ppb) can produce visual and motor problems in adults. However, no Caddo Lake or NHANES study participants had blood mercury levels above the NOAEL of 58 ppb.

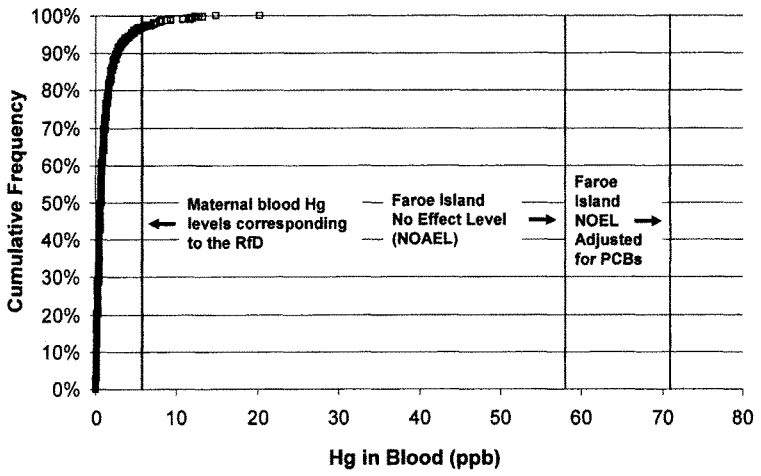
Recently, an ecological study linked autism rates to environmental mercury releases in the state of Texas. This paper asserts there is a 43 percent increase in special education students for every 1000 lbs of mercury released into the environment, and that autism alone accounts for this increase (Palmer 2006). However, as the authors acknowledge, several study limitations exist. One critical limitation is that a link between toxic release inventory (TRI) data and actual

mercury exposure is unclear. As the authors concede, a causal association between environmentally released mercury and autism cannot be established from these data (Palmer 2006). In addition, the only case-control study published in the peer-reviewed literature to date also indicated no causal relationship between mercury and autism (Ip 2004). Finally, although mercury in sediment cores analyzed by Menounou et al. (2003) indicate that coal-fired power plant emissions may have local impacts, other data indicate that a substantial portion of mercury deposited in Texas comes from man-made sources outside of the United States, primarily from Asia (Seigneur 2004). Regardless of its origin, the primary source of human exposure to methylmercury is through fish consumption, which was not evaluated by Palmer et al.

Tresande et al. (2005) conducted an analysis of the financial consequences of reduced intelligence quotient (IQ) due to methylmercury toxicity. Their analysis is based on the assumption that umbilical cord blood levels at or above the EPA RfD of 5.8 ppb, rather than being protective of the fetus, result in observable developmental effects. Due to recent evidence that mercury concentrations in umbilical cord blood may be 70 percent higher than concentrations in maternal blood, the authors contend that children exposed to maternal blood mercury concentrations greater than 3.5 ppb *in utero* may experience adverse neurological effects. The TCEQ believes the RfD provides adequate protection of human health. As mentioned previously, EPA established a BMDL of 58 ppb in umbilical cord blood as the NOAEL and then reduced this value by a factor of 10 to account for various sources of uncertainty, including the assumption that maternal blood and umbilical cord blood levels are equivalent.

The authors' evaluation of the 1999-2000 NHANES data indicates that 15.7 percent of women in the United States between the ages of 16 to 49 had blood mercury levels greater than 3.5 ppb (Tresande 2005). However, TCEQ analysis of the raw data available on the NHANES website indicates that 7.6 percent, rather than 15.7 percent, of women of child-bearing age had blood mercury levels greater than 3.5 ppb, and only 4.1 percent of these women had levels greater than 5.8 ppb. More recent NHANES data (2000-2001) are available than were used by Tresande et al. TCEQ analysis of these more recent raw data indicates only 2.5 percent of women of child-bearing age had levels greater than 5.8 ppb (Figure 4-2).

Figure 4-2. Cumulative Frequency of Blood Mercury Levels in Women of Child-Bearing Age (16-49 years) in the U.S.



Data Source: Centers for Disease Control 1999-2002

In their economic evaluation, Tresande et al. assumed a 30 percent difference (rather than 70 percent) between umbilical cord blood and maternal blood and therefore assumed IQ loss would occur at maternal blood mercury greater than 4.84 ppb. Based on data from the Faroe Islands (Budtz-Jorgensen 2002) and assuming a linear relationship between blood mercury levels and IQ, the authors used an average theoretical loss of 1.5 IQ points for each doubling in maternal blood mercury levels greater than 4.84 ppb (Tresande 2005). The authors concede that this loss in IQ is small compared to the loss in IQ that can occur as the result of other genetic or environmental causes, but argue that the economic impacts over a lifetime are substantial. Using an economic forecasting model, the authors estimated the aggregate cost of lost wages for American children due to mercury exposure from all sources to be $8.7 billion annually, with a range of $4.9 to 13.9 billion. The study further characterized the percentage of lost wages attributed to coal-burning power plants in the United States and estimated these costs to be approximately $1.3 billion annually. However, these calculations do not consider global mercury source contributions and the fact that 42 percent of the fish consumed in the United States are imported from other countries (Tresande 2005). Therefore, it is likely that these estimates overstate the potential cost of mercury exposure in the United States.

Whereas Tresande et al. used an average theoretical IQ loss based solely upon effects seen in the the Faroe Island study, others have performed aggregate analysis of all three primary

epidemiological studies to determine potential methylmercury-related IQ loss. L.M. Ryan provided a report to EPA indicating a central estimate of IQ loss between 0.1 to 0.25 IQ points for every one μg increase in mercury per gram of maternal hair (Ryan 2005). A separate aggregate analysis reported a range of 0 to 1.5 IQ points lost per one μg increase in mercury per gram of maternal hair (Cohen 2005). This range includes the values calculated by Ryan; however, Cohen's central estimate of 0.7 IQ point loss per μg increase in mercury per gram of maternal hair from this study exceeds Ryan's estimates. Several confounding factors should be noted. First, although full-scale IQ was the primary outcome measure, it was not conducted in the Faroe Island study. Second, assumptions regarding the distribution of the data were made which cannot be confirmed. Finally, the normal standard deviation for a full-scale IQ test is 15 points, and therefore, the calculated IQ loss can only be measured on a population basis, not for an individual.

For Texas, EPA utilized the report by Ryan to evaluate the Clean Air Mercury Rule base case scenario in 2001 with no specific mercury control requirements for coal-burning electric generating units. This evaluation predicted an average loss of 0.052 to 0.063 IQ point in children in Texas exposed prenatally to mercury from all sources in 2001. Average IQ is 100 points, and CAMR is estimated in 2020 to reduce IQ loss by 0.0003 to 0.0004 point on average for prenatally exposed children in Texas, above estimated reductions in IQ losses achieved by CAIR alone of 0.0045 to 0.0067 point. Although less conservative than Tresande et al., these values may also overestimate costs associated with mercury exposure, due to confounding factors, including lack of IQ testing in the Faroe Islands and assumption of a linear response in addition to the difficulty in distinguishing the effects of mercury from potentially more influential genetic variability.

References

Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Mercury: TP-93/10. Atlanta ,Georgia. Centers for Disease Control (1999).

Budtz-Jorgensen E, Debes F, Weihe P, Grandjean P. Adverse Mercury Effects in 7 Year-Old Children Expressed as Loss in "IQ" <http://www.chef-project.dk> (2002).

Centers for Disease Control (CDC), National Center for Health Statistics National Health and Nutrition Examination Survey < http://www.cdc.gov/nchs/nhanes.htm> (2006).

Clarkson TW. The Three Modern Faces of Mercury. Environ Health Perspect 110 (1): 11-23 (2002).

Cohen JT, Bellinger DC, Shaywitz BA. A Quantitative Analysis of Prenatal Methyl Mercury Exposure and Cognitive Development. Am J Prev Med 29 (4): 353.e1-353.e24 (2005).

Guallar E, Sanz-Gallardo MI, van't Veer P, Bode P, Aro A, Gomez-Aracena, J, Kark JD, Riemersma RA, Martin-Moreno JM, Kok FJ. Mercury, Fish Oils, and the Risk of Myocardial Infarction. N Engl J Med 347 (22): 1747-1754 (2002).

Ip P, Wong V, Ho M, Lee J, Wong W. Mercury Exposure in Children with Autistic Spectrum Disorder: Case-Control Study. J Child Neurol 19 (6): 431-434 (2004).

Jackson, T.A. Mercury in Aquatic Ecosystems. In: W.J. Langston and M.J. Bebianno, Ed. Metal Metabolism in Aquatic Environments. Chapman & Hall, London, 77-158 (1998).

Kidd K, Hesslein R, Fudge R and Hallard K. The Influence of Trophic Level as Measured by Delta-N-15 on Mercury Concentrations in Fresh-water Organisms. Water Air Soil Pollut 80 (1-4):1011-1015 (1995).

Menounou N, Presley BJ. Mercury and Other Trace Elements in Sediment Cores from Central Texas Lakes. Arch Environ Contam Toxicol 45 (1): 11-29 (2003).

Palmer RF, Blanchard S, Stein Z, Mandell D, Miller C. Environmental Mercury Release, Special Education Rates, and Autism Disorder: An Ecological Study of Texas. Health Place 12 (2): 203-209 (2006).

Ryan LM. Effects of Prenatal Mercury Exposure on Childhood IQ: A Synthesis of Three Studies. Report to the United States Environmental Protection Agency. Boston, MA: Harvard School of Public Health (2005).

Salonen JT, Seppanen K, Nyyssonen K, Korpela H, Kauhanen J, Kantola M, Tuomilehto J, Esterbauer H, Tatzber F, Salonen R. Intake of Mercury from Fish, Lipid Peroxidation, and the Risk of Myocardial Infarction and Coronary, Cardiovascular, and Any Death in Eastern Finnish Men. Circulation 91 (3): 645-655 (1995).

Seigneur C, Vijayaraghavan K, Lohman K, Karamchandani P, Scott C. Global Source Attribution for Mercury Deposition in the United States. Environ Sci Technol 38 (2): 555-569 (2004).

Tchounwou PB, Ayensu WK, Ninashvili N, Sutton D. Environmental Exposure to Mercury and its Toxicopathologic Implications for Public Health. Environ Toxicol 18 (3): 149-175 (2003).

Texas Department of State Health Services (DSHS). Health Consultation: Mercury Exposure Investigation Caddo Lake Area-Harrison County Texas. Agency for Toxic Substances and Disease Registry (2005).

Tresande L, Landrigan PJ, Schechter C. Public Health and Economic Consequences of Methylmercury Toxicity to the Developing Brain. Environ Health Perspect 113 (5): 590-596 (2005).

United States Environmental Protection Agency (EPA). EPA Guidance for assessing chemical contaminant data for use in fish advisories. Vol. 2, Risk assessment and fish consumption limits, 3rd ed. EPA 823-B-00-008. Office of Water (2000).

United States Environmental Protection Agency (EPA). EPA Water Quality Criterion for the Protection of Human Health: Methylmercury. EPA-823-R-01-001. Office of Science and Technology, Office of Water (2001).

United States Environmental Protection Agency (EPA). EPA Regulatory Impact Analysis of the Clean Air Mercury Rule. EPA-452/R-05-003. Air Quality Strategies and Standards Division (2005).

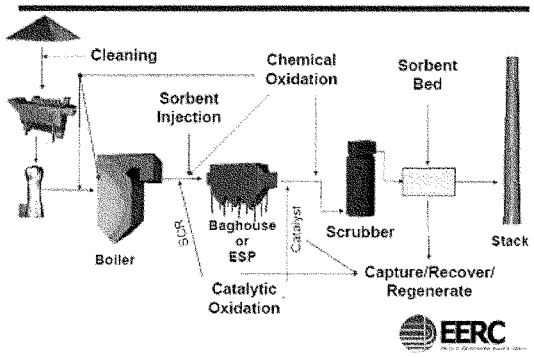
Vertanen JK, Voutilainen S, Rissanen TH, Mursu J, Tuomainen T-P, Korhonen MJ, Valkonen V-P, Seppänen K, Laukkanen JA, Salonen JT. Mercury, Fish Oils, and Risk of Acute Coronary Events and Cardiovascular Disease, Coronary Heart Disease, and All-Cause Mortality in Men in Eastern Finland. Arterioscler Thromb Vasc Biol 25 (1): 228-233 (2005).

Yashizawa K, Rimm EB, Morris JS, Spate VL, Hsieh C-C, Spiegelman D, Stampfer MJ, Willett WC. Mercury and the Risk of Coronary Heart Disease in Men N Engl J Med 347 (22): 1755-1760 (2002).

Chapter 5
Emissions Control Technologies

The type and effectiveness of the particular mercury control approach selected by a plant will depend on the unique characteristics of the coal and electricity generating system being considered. Figure 5-1 indicates many points along the process from the coal pile to the stack exist at which mercury could be removed before it reaches the atmosphere, although not all control strategies are used in one configuration. For example, in some plant configurations, it may be most effective to remove the mercury from the coal before it enters the boiler using "coal cleaning." In other configurations, sorbent injection after the boiler, followed by capture in a particulate control device, may be more successful. Still other coal and system combinations may require a catalyst bed or sorbent bed customized for mercury capture. Research focusing on each of these approaches, and many others, is underway.

Figure 5-1. Mercury Control Options



Source: Energy and Environmental Research Center 2006

Coal-Fired Utility Profile

Mercury allowances and control efficiencies are both impacted by the type of coal combusted. Nationally, 53 percent of coal reserves are estimated to be bituminous, 36 percent are subbituminous and nine percent are lignite (EPA 2002). Texas has 17 coal-fired EGUs with a total of 36 boilers having a total capacity of 19,602 megawatt electrical (MWe) based on TCEQ permit allowable information. Of this capacity, fifteen boilers (representing 8,200 MWe) use lignite, twenty boilers (8,102 MWe) use subbituminous coal, and one boiler (600 MWe) fires bituminous coal. Many of the plants use blends of more than one type of coal. In 2003, almost 39 percent of the total electricity generated in Texas was from coal. The largest amount of electricity was generated from natural gas (49 percent); nuclear generation was almost 9 percent with hydroelectric and other renewables 1.2 percent of the state's generation (EIA 2006).

Mercury Control

Selection of a mercury control method is site specific. It is dependent upon the boiler characteristics, type of coal combusted, operational parameters, intended use of fly ash, and existing environmental controls at the site.

Several ranks of coal are segregated based on thermal properties. Besides the thermal properties, each rank has different levels of mercury and chemical compositions (especially chlorine) that affect the mercury abatement efficiency. Anthracite is the highest grade, followed by bituminous, subbituminous (including Powder River Basin coal), and then the lowest rank, lignite. Lignite, due to its lower grade, is fired at higher temperatures, resulting in higher flue gas temperatures. The higher flue gas temperatures impact the effectiveness and selection of a control strategy. Lignite has high and variable mercury content. For example, the mercury content of Gulf Coast lignite may be double that of North Dakota lignite, making targeted control levels more difficult to achieve (AEMS 2004, Shea 2005). High selenium levels may also impact the mercury emitted. Powder River Basin (PRB) coal has moderate levels of mercury. Numerous tests have shown that mercury capture at plants burning either Powder River Basin (PRB) coal or North Dakota lignite is similar, whether capture is achieved by existing air pollution controls, sorbent injection, or through halogen enhancement of fuel. Researchers believe this is due to the near-absence of chlorine in the flue gas (EPRI 2006).

During combustion, mercury is volatilized and converted to elemental mercury vapor in the high temperature region of the boiler. As the flue gas cools, the elemental mercury is converted, in part, to divalent, or particulate mercury. The reactions are limited and result in the mercury entering control devices as a combination of elemental, divalent, and particulate mercury. The percentage of each is dependent upon the properties of each type of coal. The majority of gaseous mercury in bituminous coal-fired boilers is divalent while the majority of gaseous mercury in subbituminous and lignite-fired boilers is elemental. Elemental mercury is more difficult to control as it is not very water-soluble and passes through most abatement devices.

Chlorine compounds in the flue gas decrease the amount of gaseous elemental mercury at the inlet to air control devices and increase the amount of divalent mercury. The chlorine content of the coal can affect the variation in the removal of mercury across both wet and dry scrubbers. Wet scrubbers remove divalent mercury with approximately 90 percent efficiency. They do not remove elemental mercury because that form is not highly water-soluble. Spray dryer absorbers remove both divalent and elemental mercury for bituminous flue gas but they only remove divalent mercury for low rank coal flue gas. Because of the higher levels of chlorine and divalent mercury in bituminous coals, mercury removal rates are higher. Removal rates for subbituminous and lignite coals are lower.

Multi-pollutant Control Technologies

Two main approaches exist to control mercury emissions. The first is to reduce mercury emissions using technologies, such as selective catalytic reduction and scrubbers, which are primarily designed to control nitrogen oxides (NO_x) and sulfur dioxide (SO_2), or fabric filters and electrostatic precipitators (ESP) designed to control particulate matter. These approaches that remove mercury along with other pollutants are known as multi-pollutant control technologies.

The second approach is to reduce mercury emissions using strategies designed specifically for that purpose, such as sorbents.

For the Clean Air Mercury Rule (CAMR), EPA is relying on mercury reductions as a "co-benefit" of NO_x and SO_2 controls from the Clean Air Interstate Rule (CAIR) to assist EGUs in meeting the Phase I CAMR budgets. Reduction of a pollutant other than the primary one for which a control device is designed is referred to as a "co-benefit." EPA estimates that only three additional scrubbers will be installed in Texas to control SO_2 emissions during CAIR Phase II. However, traditional controls for NO_x and SO_2 will not be as effective for Gulf Coast lignite as they are for bituminous coals because of greater elemental mercury emissions from lignite and subbituminous coals versus divalent mercury emissions from eastern bituminous coals.

Abatement devices do not work equally well for all boilers even when firing configurations and abatement devices are similar (Table 5-1). When the same air pollution control configurations are used, mercury removal is higher for bituminous than for other coals. Mercury removal for a fabric filter is higher than for either cold-side ESPs or hot-side ESPs for both bituminous and subbituminous coal (EPA 2005a). Data for lignite were not available (EPA 2005b) but are assumed to follow the same trend. In several cases, there were high levels of variation in mercury removal over time.

Table 5-1. Mercury Removal Efficiencies

	Typical Mercury Removal Efficiency, %*			
Control Technology	**Bituminous**	**Subbit.**	**Lignite**	**All Coals**
Cold-Side ESP	30-40	0-20	0-10	0-40
Cold-Side ESP + Wet Scrubber	60-80	15-35	0-40	0-80
Dry Scrubber + Cold-Side ESP	35-50	10-35	0-10	0-50
Fabric Filter	40-90	20-75	0-10	0-90
Fabric Filter + Wet Scrubber	75-95	30-75	10-40	10-95
Dry Scrubber + Fabric Filter	65-95	20-40	0-20	0-95
Coal Cleaning	20-40	-	-	0-40

*Typical values based on EPA Notice of Data Availability, Information Collection Request (ICR) data, field tests, and observations. Some values are based on single data points and may not reflect removal for all plants.

Adapted from EERC (2006)

Scrubbers

Many Texas power plants have already installed scrubbers whose main purpose is to control SO_2 but have the added benefit of reducing mercury. Divalent mercury is generally water-soluble and can absorb in the water slurry in a wet scrubber system. However, the gaseous elemental mercury is insoluble and therefore does not absorb in these slurries. Boilers at sixteen Texas EGUs have wet scrubbers installed. Other devices such as selective catalytic reduction (SCR) used to control NO_x and fabric filters used to control particulate emissions also control mercury.

The oxidation to divalent mercury is significant (85 to 90 percent) for bituminous coal but not for subbituminous and no data are available for lignite (Srivastava 2006). EPA and Energy Information Administration (EIA) modeling indicate that coal plants using subbituminous or lignite coals will not be able to comply with a 90 percent removal requirement using SO_2, NO_x, or particulate matter control technologies alone (EIA 2005).

Selective Catalytic Reduction

The role that SCR plays in removing mercury remains uncertain. Evidence suggests that combining an SCR with a wet scrubber shows significant reductions in mercury for bituminous coals but the same has not yet been found for lower grade coals (EIA 2005). Short-term tests on PRB coal have indicated some overall mercury reductions. Research is ongoing with vendors changing SCR catalysts to improve oxidation and capture of mercury (Richardson 2005).

Electrostatic Precipitators and Fabric Filters

ESPs and fabric filters are installed on coal-fired boilers to control particulate matter, but also have a limited ability to control mercury. For lignite, mercury control may be limited due to the high proportions of elemental mercury and low levels of chlorine in the flue gas. Speciation of mercury in flue gases indicates elemental concentrations ranging from 56 to 96 percent and divalent ranging from 4 to 44 percent (Freeman 2004).

City Public Service (San Antonio, Texas) Spruce Station burns PRB coal and is equipped with a reverse jet fabric filter (baghouse) and a wet scrubber. Current studies indicate approximately 65 to 90 percent of elemental mercury is oxidized in the baghouse. Because it is not water-soluble, elemental mercury is more difficult to control than divalent. Conversion of elemental to divalent mercury improves overall capture efficiency. This conversion rate is higher than the typical rate of less than 25 percent experienced for most plants burning PRB coal (EIA 2005). The reason for the higher oxidation is not yet understood but is believed to be intrinsic to the design of the baghouse. Further study is necessary to assess the applicability to lignite and to other control configurations.

Coal Cleaning

Coal can be cleaned of contaminants by physical, thermal, or chemical methods prior to combustion. Coal cleaning has been used more extensively on higher rank eastern bituminous and anthracite coals to reduce ash and sulfur compounds. EPA estimates that 77 percent of the eastern and mid-western bituminous coals are cleaned prior to use in an electric facility (EPA 1997). Pressure and heat are used to increase thermal capacity, reduce sulfur content, and reduce ash. The coal is treated at around 450° F to drive off water and mercury. The water is condensed and passed through a carbon bed where the mercury is captured. Mercury reductions up to 70 percent have been achieved in some tests (Hasse 2005). An additional benefit of cleaned coal is removal of up to 30 percent sulfur and nitrogen from the pre-combusted coal (Richardson 2005). Some coal cleaning operations have resulted in instability of the coal's physical properties, but newer methods claim higher coal stability. This process may or may not be applicable to subbituminous and lignite coals.

Fuel Blending

Many Texas plants already blend lower rank lignite with higher thermal capacity coal, primarily subbituminous. Blending higher chlorine coal to increase oxidation of elemental mercury in flue gas improves mercury removal in the control systems. Reductions of up to 50 percent have been demonstrated at some sites with wet scrubbers (Richardson 2005). Tests in other states have indicated mercury reductions as high as 80 percent for units with spray dryer absorbers and fabric filters (Durham 2005). Some plants may require modifications to accommodate additional material handling for fuel blending.

Mercury-Specific Control Technologies

Several newer technologies are being studied to control mercury. The choice of control technologies used will be specific to each boiler type. Each boiler has its own configuration for fuel and furnace type, boiler operation, fly ash properties, and existing controls. While some boilers may provide significant mercury reductions in their existing configurations, others will require additional controls to meet their mercury budgets. The developing technologies fall into four main categories: adsorption, mercury oxidation, combustion control, and multi-pollutant control. These technologies are in development, but vendors are currently unable to offer unqualified performance guarantees. Although controls for lignite systems have been tested, the testing emphasis has been towards the more commonly combusted coals: bituminous and subbituminous.

Adsorption is a separation process by which mercury in the flue gas is transferred to the surface of a solid adsorbent. The performance of the mercury adsorption depends upon many parameters including contact time between the flue gas and sorbent, the temperature of the flue gas and the type of sorbent. A limited number of full-scale trials up to two months in duration have been carried out that represent short-term continuous operation for some plant configurations. The potential long-term impacts, such as corrosion, are not known.

Oxidation technologies are processes that modify the chemical form of mercury from elemental to divalent to enhance removal across existing control devices. Combustion control involves changing the operation parameters of the boiler to reduce mercury.

Activated Carbon Injection Based Technology

Activated carbon injection (ACI) is the most mature adsorption technology. Vendors assert that ACI has the potential to achieve up to 90 percent control for some types of coal and boiler configurations under some conditions. However, guarantees of control at this rate have not yet been made. At some sites, where the contact time between the carbon and gas is short, the total mercury removal may be only 50 percent (Richardson 2005). Activated carbon performance tends to be poorer in flue gases from lower rank coals with low chlorine content, such as lignite and PRB coal. Testing indicates that sorbent type and properties, gas-phase mercury species, temperature of the flue gas, concentration of acid gases, overall residence time of the sorbent, and dispersion of the sorbent in the flue gas also affect ACI performance (EPA 2005a).

There may be upper limits on the control efficiency achieved with carbon injection. In the Wisconsin Energy Corporation Pleasant Prairie plant, mercury control efficiency of approximately 60 percent was achieved. Additional carbon injection resulted in only minimal improvement. The upper limit may be caused by the lower levels of free chlorine in the flue gas from the subbituminous coal combusted (Srivastava 2006). Increased injection also increases the cost of carbon itself as well as additional collection and disposal processes.

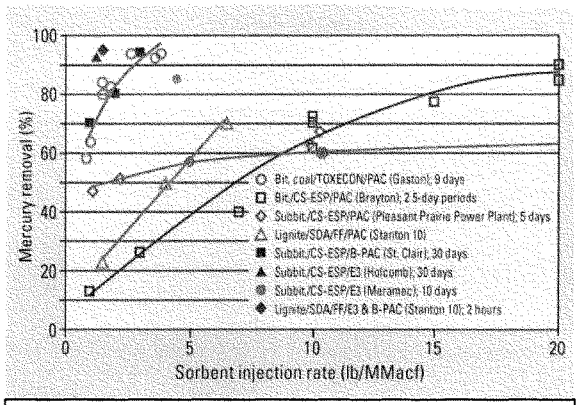
Increasing carbon injection rates results in higher mercury control but changes the composition of fly ash and may decrease its usability in concrete, resulting in increased landfill disposal. Injection of carbon upstream of a baghouse yields higher mercury removal than injection upstream of an ESP, but increases carbon contamination of the fly ash. Approaches are being tested that limit the amount of carbon in the fly ash, such as injection of carbon after a baghouse. These include the Toxecon I and Toxecon II processes. In the Toxecon I process, activated carbon is injected into the ESP after the bulk of the ash has been collected by the ESP but before the baghouse. Toxecon II also preserves the composition of fly ash by delaying the injection of carbon until after the front end of the ESP has collected the bulk of the fly ash (Richardson 2005). Only the ash collected in the back end of the ESP contains activated carbon. A Toxecon system was tested at TXU's Big Brown unit, and testing was completed in March 2006. Results are not yet available (Pavlish 2006). For one plant using Toxecon, the DOE's National Energy Technology Laboratory has estimated the cost of adding an ACI system, complete with a new fabric filter, at $126 per kilowatt (DOE/NETL 2006).

ACI may be used either in conjunction with existing emissions control equipment or with the addition of a fabric filter. However, small-scale ESPs may be overloaded by additional particulate matter in the flue gas (Richardson 2005). A fabric filter provides better contact than an ESP between the sorbent and the flue gas and results in higher mercury removal rates at lower sorbent injection rates. In some cases, carbon injection without a downstream fabric filter may be limited in its mercury removal rates regardless of the amount of activated carbon injected (EPA 2005a).

Halogenated Activated Carbon Injection

The addition of halogens such as chlorine and bromine to the activated carbon may improve its performance in low chloride flue gases. Several full-scale tests using brominated activated carbons show increased mercury control over non-brominated carbon. For example, tests on North Dakota lignite have indicated mercury control around 90 percent at lower brominated sorbent injection rates. These mercury removal rates are similar to eastern bituminous coals with a Toxecon system (Srivastava 2006). Halogenated additives have not been tested long enough to identify potential corrosion and other plant impacts. A typical graph of carbon injection performance on mercury removal is shown in Figure 5-2. Increasing carbon injection improves mercury removal with some tests indicating an upper limit of removal. The brominated carbons have higher mercury removal rates at lower sorbent injection rates.

Figure 5-2. Performance of Halogenated Activated Carbon Compared with Standard Carbon



B-PAC - brominated powdered activated carbon
FF - fabric filter
CS-ESP - cold side electrostatic precipitator
PAC -powdered activated carbon
SDA - spray dryer absorber

Source: Srivastava 2006

Mercury Capture by Adsorption Process (MerCAP)

Parallel plates in the flue ducts are coated with sorbent (such as gold or silver) in a non-carbon-based fixed sorbent process. The process is best for back end polishing of flue gases where the SO_2 was removed in a scrubber. The process recovers mercury by adsorbing mercury onto the plates. The plates are kept in service until the mercury removal falls below a target value. The plates are then removed and regenerated to extract the mercury, then restored to service. Average mercury removal rates can vary from 30 to 35 percent on a boiler burning PRB coal. However, regeneration of acid-treated gold plates may not return the plates to their original effectiveness (EIA 2005). Short-term tests with MerCAP and a wet scrubber have been completed at a power plant firing Gulf Coast lignite; however, results are currently unavailable (Richardson 2005).

Low Temperature Catalyst Oxidation

In plants lacking SCR, installation of a catalyst bed in the low dust region after the baghouse can oxidize elemental mercury. Where the flue gas comes into contact with the catalyst surface, elemental mercury is converted to the divalent form for capture in a scrubber. Pilot tests with six-month durations have been completed with overall mercury removal rates of 60 to 88 percent for lignite fuel and 70 to 90 percent for PRB coal. A regeneration process is required to restore catalyst function after its performance falls below a target value. Full-scale tests with two-year durations are planned for 2007 (Richardson 2006).

Plasma Enhanced ESP (PEESP)

A retrofit has been developed for modifying an ESP to improve mercury removal. Steam and oxygen droplets are injected, become electrically charged, and travel to the ESP plates where they absorb and react with elemental mercury to form divalent mercury. Laboratory scale tests have indicated up to 79 percent removal of elemental mercury (Richardson 2005). Full-scale testing would be required to confirm these results.

Chemical Addition (Halogen) for Oxidation

Another option is to boost the halogen content of the gases by directly adding halogenated species (e.g. bromide or chloride) into the furnace or flue gas stream to improve oxidation of elemental mercury. Most of the chemicals used are common salts. Full-scale tests up to two weeks in duration have been completed with overall mercury removal in the 50 to 80 percent range for a PRB/lignite blend. Long-term potential impacts of corrosion due to increased chlorides in the scrubber are not yet known.

Testing at Texas plants has been summarized by URS and is shown in Table 5-2.

Table 5-2. Mercury Control Technology Testing at Texas Plants

Mercury Control Technology	Fuel Type	Plant Config.	Overall Mercury Removal	Test Scale	Test Duration
Activated Carbon Injection	PRB/Lignite	ESP-Baghouse	To Be Determined: on-going test	Full-scale	1 month
		ESP-Scrubber	TBD: Jan. 2007	Full-scale	2 months
		Toxecon II	TBD: Jan. 2007	Full-scale	1 week
	Lignite	ESP-Scrubber	30 – 60% *	Slipstream	2 – 4 hours
Chemical Addition (Halogen)	PRB	ESP-Scrubber	40 – 65%	Full-scale	24 – 48 hours
	PRB/Lignite	ESP-Scrubber	50 – 80%	Full-scale	2 weeks
Low-Temperature Catalyst Oxidation	Lignite	ESP-Scrubber	60 – 80% **	Pilot	6 months
	PRB	ESP-Scrubber	70 – 90% **	Pilot	6 months
	PRB	ESP-Scrubber	TBD: 2007 test	Full-scale	2 years
SCR Catalyst	PRB	Baghouse-Scrubber	SCR impact <15% Mercury Removal	Full-scale	Short-term evaluation

* Multiple plants; results indicative of short-term data collected across slipstream fixed bed or particulate control device.
** Projected removal based on pilot-scale test data

Adapted from: Richardson 2006

Issues

Lack of full-scale and long-term testing data for all mercury-specific control devices, particularly for lignite-fired boilers, is an important concern. For example, substantial data for activated carbon in municipal solid waste combustors exist, but these systems, with typically lower flue gas temperatures, are not as complex as utility boilers (EPA 1997). Results from activated carbon injection from utility boilers vary, even on systems with similar design.

The increase in particulate matter from a carbon injection system may be less than expected from natural variations in the coal supply. EPA's calculations indicate that the increase in particulate matter to the ESP or baghouse would be about four percent or less with an injection rate of ten pounds per million actual cubic feet (lb/MMacf) of flue gas. Halogenated sorbents will likely be injected at about half that rate (EPA 2005b). Potential loss of fly ash sales, combined with the costs associated with the resulting waste management, remain issues for facilities considering ACI for mercury control.

While EPA assumed that a sufficient supply of activated carbon would become available with increased demand, they recognized that availability of sufficient boilermaker labor may be a limiting factor in timely installation of all controls. EPA states that activated carbon and enhanced multi-pollutant controls for SO_2 and NO_x have been demonstrated also to remove mercury effectively and are expected to be available after 2010 for commercial application on most or all key combinations of coal rank and control technology to provide mercury removal rates between 60 and 90 percent. Halogenated sorbents and other chemical injection approaches may also be available after 2010 for commercial application on most, if not all, key combinations of coal rank and control technology but will provide mercury removal between 90 and 95 percent. EPA further maintains the potential availability of these controls provides justification for a 2018 mercury cap at a level below what is projected to be achieved from SO_2 and NO_x based controls alone. Although mercury controls will be available for use on some scale prior to 2018, EPA does not believe they can be installed and operated on a national scale prior to that date. EPA maintains that the cap-and-trade approach selected for the final regulation is the best method for encouraging the continued development of these technologies (EPA 2006).

Time Necessary for Control Installation

The time necessary to install control devices in existing EGUs depends upon the complexity and scale of retrofit required. A boiler could be retrofitted with SCR, scrubber, particulate matter controls, and mercury controls in approximately three years depending on vendor availability (EPA 2005b). An ACI system could be installed on a new unit in approximately 15 months including initial engineering review, design, installation, and equipment testing. Retrofitting an existing unit may take approximately 26 months (EPA 2005b). As stated previously, EPA recognized that availability of sufficient boilermaker labor may be a limiting factor in timely installation of all controls (EPA 2005c).

Emissions Limitations for New Sources

New EGUs (units that were constructed, modified or reconstructed commencing after Jan 30, 2004) will be subject to new emissions limitations and cannot contribute to an exceedance of the

Texas mercury cap. EPA re-examined the 1999 ICR data and examined the mercury limits in recently issued permits. In their June 9, 2006, revision EPA announced the following New Source Performance Standards (NSPS) mercury limits for new coal-fired power units (EPA 2006):

> Bituminous units): 20×10^{-6} lb/MWh (or 0.020 lb/GWh output)
> Subbituminous units (areas with greater than 25 inches/year precipitation): 66×10^{-6} lb/MWh (or 0.066 lb/GWh output)
> Subbituminous units (areas with less than or equal to 25 inches/year precipitation): 97×10^{-6} lb/MWh (or 0.097 lb/GWh output)
> Lignite Units: 175×10^{-6} lb/MWh (or 0.175 lb/GWh output)

In addition to NSPS, new sources in Texas are subject to best available control technology (BACT). The TCEQ recently issued two air permits for subbituminous coal-fired EGUs with mercury BACT limits of 20×10^{-6} lb/MWh output, 70 percent lower than the corresponding NSPS.

References

AEMS Review and Critique of Data and Methodologies Used in EPA Proposed Utility Mercury MACT Rulemaking: 40 CFR Parts 60 and 63 Proposed National Emission Standards for Hazardous Air Pollutants; and in the Alternative, Proposed Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units; Proposed Rule (2004).

Durham M. Mercury Control for PRB and PRB/Bituminous Blends, ADA-ES, Inc (2005).

Energy and Environmental Research Center (EERC), Mercury Control Short Course Presentation (2006).

Electric Power Research Institute (EPRI), Status of Mercury Controls for Coal-Fired Power Plants, An EPRI Assessment (2006).

Freeman, D. Identical Letters from TXU Re: EPA Proposed Mercury Regulations; Correspondence To: Mr. Michael D. Nickey, Babcock & Wilcox; dated April 12, 2004, and To: Ms. Kim Davis, Wheelabrator Air Pollution Control Inc, dated May 3, 2004.

Haase P. Electric Power Research Institute (EPRI) Journal (2005).

Pavlish H, Hamre L, Thompson J, Martin C. Field Testing of Activated Carbon Injection Options for Mercury Control at TXU's Big Brown Station, Quarterly Progress Report for the Period Jan 1-Mar 31 (2006).

Richardson C, Dombrowski K. Mercury Control Technology Overview, URS Corporation (2005).

Richardson C. Considerations for the Control of Mercury from Coal-Fired Power Plants in Texas presentation given at the Texas Commission on Environmental Quality, URS Corporation (2006).

Shea DA, Parker L, McCarthy JE, Chapman T. Mercury Emissions from Electric Generating Units: A Review of EPA Analysis and MACT Determination, Library of Congress Order Code RL32744, Congressional Research Service (2005).

Srivastava RK, Hutson N, Martin B, Princiotta F, Staudt J. Control of Mercury Emissions from Coal-Fired Electric Utility Boilers. Environ Sci Technol 40 (5): 1385-93 (2006).

United States Department of Energy, National Energy Technology Laboratory (DOE/NETL). DOE/NETL Clarification of the US Department of Energy's Perspective on the Status of Mercury Control Technologies for Coal-Fired Power Plants (2006).

United States Energy Information Administration (EIA). EIA 2004 State Electricity Profiles <http://www.eia.doe.gov/cneaf/electricity/st_profiles/texas.pdf> (2006).

United States Energy Information Administration (EIA). EIA Analysis of Alternative Mercury Control Strategies. Office of Integrated Analysis and Forecasting, US Department of Energy, SR/OIAF/2005-01 (2005).

United States Environmental Protection Agency (EPA). EPA Mercury Study Report to Congress, Volume II. EPA-452/R-97-004b, Office of Air Quality Planning and Standards and Office of Research and Development (1997).

United States Environmental Protection Agency (EPA). EPA Control of Mercury Emissions from Coal-Fired Electric Utility Boilers: Interim Report, including errata. EPA-600/R-01-109, National Risk Management Research Laboratory (2002).

United States Environmental Protection Agency (EPA). EPA Multipollutant Emissions Control Technology Options for Coal-fired Power Plants, EPA-600/R-05/034 (2005a).

United States Environmental Protection Agency (EPA). EPA Control of Mercury Emissions from Coal-Fired Electric Utility Boilers: An Update. Office of Research and Development (2005b).

United States Environmental Protection Agency (EPA). EPA Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units; Final Rule, *Federal Register* (2005c).

United States Environmental Protection Agency (EPA). EPA Revision of December 2000 Clean Air Action Section 112(n) Finding Regarding Electric Utility Steam Generating Units; and Standards of Performance for New and Existing Electric Utility Steam Generating Units: Reconsideration, *Federal Register* (2006).

Chapter 6
Costs of Additional Controls

Cost of Controls to Plant Owners

Costs to comply with the Clean Air Mercury Rule (CAMR) in Texas include costs of installing mercury monitors; costs of complying with CAMR Phase I, which EPA has asserted are negligible due to "co-benefits" of the Clean Air Interstate Rule (CAIR); and costs of complying with CAMR Phase II using mercury-specific controls or purchasing allowances. Based on extensive modeling, EPA maintains that, "no coal-fired generation is projected to be uneconomic to maintain under CAMR" (EPA 2005a).

CAMR requires sources to install and operate monitoring systems. Sources may choose to monitor mercury using a continuous emissions monitoring system (CEMS) or sorbent trap monitor. For a coal-fired unit to install a mercury CEMS, EPA estimates capital costs to range from $95,000 to $135,000 per electric generating unit (EGU), with annual operating and maintenance costs of $45,000 to $65,000. For sorbent trap monitors, EPA estimates the capital cost to be $18,000 per EGU, with annual operating, maintenance, and laboratory costs of $65,000 to $125,000. Based on these estimates, total monitoring costs in Texas could range from about $650,000 to $4.9 million for installation, depending on type of monitor selected, with corresponding annual operation and maintenance costs of $1.6 to $4.5 million (EPA 2004).

Under the cap-and-trade program sources have the choice of controlling emissions or purchasing additional allowances to meet their allowance obligations. Costs may vary substantially depending on whether a source chooses to control emissions or purchase allowances for compliance. Under CAMR, EPA is relying on mercury "co-benefit" reductions from CAIR to assist sources in meeting the Phase I CAMR budgets. Based on fiscal information provided in the docket for CAIR, EPA estimates that only three additional scrubbers will be installed in Texas to control SO_2 emissions during CAIR Phase II. EPA estimates SO_2 control costs to range from $400 to $800 per ton to achieve 30 to 40 percent mercury removal efficiency in subbituminous coal-fired units. No corresponding estimate for lignite-fired units is available (EPA 2005c).

To comply with CAMR Phase II, coal-burning EGUs may choose to invest in controls specifically designed to capture mercury, such as sorbent injection, or they may attempt to purchase allowances to meet their caps, presuming sufficient allowances are available. Costs for emerging mercury control technologies are largely undetermined.

EPA performed extensive computer modeling using the Integrated Planning Model (IPM) to forecast outcomes of mercury control and trading. IPM predicts that with currently available controls and no improvements made over time in performance, a pound of mercury allowances would cost roughly $23,200 ($1,500 per ounce) in 2010 (expressed in 1999 dollars), $30,100 per pound ($1,900 per ounce) in 2015, and $39,000 per pound ($2,400 per ounce) in 2020. With the assumption that mercury capture efficiencies improve over time, the cost estimates dropped considerably: $11,800 per pound ($700 per ounce) in 2010, $15,300 per pound ($1,000 per ounce) in 2015, and $19,900 per pound ($1,200 ounce) in 2020 (EPA 2005a). Based on EPA

estimates of mercury control costs in 2020, Texas could face costs ranging from $112 million to $220 million, using either control technologies or allowance purchases, to move from compliance with the CAMR Phase I cap (4.656 tons) to compliance with the CAMR Phase II cap (1.838 tons).

Preliminary cost estimates from pilot scale testing are available for North Dakota lignite, Powder River Basin subbituminous coal, and bituminous coal. However, these estimates were not generated using a general equilibrium economic model that considers changes in fuels or other market responses, as EPA estimates were. Further, sponsors strongly caution about generalizing results for specific plants, configurations, coals, or other characteristics, to those that have not been directly studied. Because of these, and other, uncertainties, interpretation of preliminary findings must be done cautiously: results are substantially dependent on the unique operating characteristics of the subject facility, existing pollution controls, properties of the coal being burned, target mercury removal rate, and other factors. Table 6-1 illustrates this variability with cost data recently generated by URS Corporation for mercury-specific control approaches.

Table 6-1. Mercury Control Cost Estimates at a PRB-Fired Plant*

Mercury Control Technology	Target Removal Percentage	Capital Costs	Annual Operation & Maintenance
Chemical Addition	45%	$513,000	$479,000
Carbon Injection	45%	$513,000	$310,000
Carbon Injection	80%	$513,000	$620,000
Toxecon	80%	$17,100,000	$510,000
Toxecon	90%	$17,100,000	$659,000

*The average coal-fired boiler in Texas is around 600 megawatt (MW) These results were obtained at a 100-150 MW Powder River Basin (PRB)-Fired Plant with an electrostatic precipitator (ESP).

Modified from Richardson 2006

Substantial uncertainty surrounds existing cost estimates for mercury-specific control. Estimates presented above were generated using data from pilot testing of relatively short durations. Few, if any, approaches have been demonstrated and verified in actual operation over extended durations in commercial EGUs. While a number of pilot tests have been performed, these tests generally last for short periods (e.g., 30 days), are conducted during off-peak periods, and are used to provide guidance on which coals and generating systems respond best to certain technologies. Many promising approaches remain to be tested, having been identified for future scrutiny in very short term testing in laboratory environments. The United States Department of Energy (DOE) and its partners are currently exploring numerous technologies at various stages of development.

Another major source of uncertainty in these estimates is the effect of improvements in technologies over time. EPA ran the IPM model with the assumption of no improvement in mercury control technology, to generate what it considers to be conservative estimates. Sensitivity analyses were conducted to estimate the impact of changing this assumption, i.e., enabling the IPM model to forecast improvements in technologies. As EPA states in the Regulatory Impact Analysis (RIA), "Mercury emissions control is a fast moving area with new developments nearly monthly. Actual costs may be lower than those presented since modeling assumes no improvements in the cost of mercury control technology, while in reality, control costs are expected to improve over time" (EPA 2005a).

Participants in the CAMR trading system may not know the decisions and actions of other participants for many years. They must estimate future costs under conditions of uncertainty. If the assessments regarding whether or not to invest in controls are incorrect, participants could expend more than necessary to achieve compliance (EPA 2005a).

Despite these uncertainties, with appropriate caution in their use and interpretation, the estimates provided here may offer some guidance as to the magnitude of control costs that might be expected for Texas EGUs, as well as the relative difference in costs for different target rates of control for a particular coal type or plant configuration.

Cost of Controls to Consumers

The market for electricity in Texas is substantially deregulated. Deregulated power suppliers pursue strategies that minimize costs to remain competitive. Expenditures required to comply with CAMR must be recouped in product sales; therefore, electricity consumers ultimately pay the expense of pollution control.

Data from the United States Energy Information Administration (EIA) indicate that, of the 106.0 million tons of coal used in Texas in 2004, 96 percent was burned to generate electricity (EIA 2004). EIA also reported that residential electricity consumers in Texas consumed 121,355 gigawatt-hours (GWh) of electricity in 2003 (EIA 2006a), and spent $11.1 billion on electricity (EIA 2006b).

EPA's IPM forecasts that retail electricity prices are likely to fall from 2000 to 2020, whether or not CAMR is implemented, due to projected decreases in energy prices, fuel switching, and other responses. Whether or not these predictions hold true, the model predicts prices will drop less under CAMR than in its absence. Prices in the Electric Reliability Council of Texas region are forecast to drop from 6.51 cents per kilowatt hour (kWh) to 6.34 cents, but they are forecast to fall to 6.26 cents without CAMR (EPA 2005a). Other regions in Texas were predicted to experience similar decreases. Based on these estimates, a typical household using one thousand kWh of electricity per month would see an overall decrease of $1.70 in its monthly electric bill with CAMR, as opposed to an overall decrease of $2.50 without CAMR. Therefore, the net increase in electricity costs due to CAMR is forecast to be about 80¢ per month for the typical household in Texas.

For comparison, a preliminary DOE report on the economics of mercury control technologies estimated that a target mercury capture rate of 50 percent for subbituminous coal would translate into a possible range of increases in electricity costs of 86¢ to $1.75 per month for the typical household. A higher mercury capture rate of 90 percent on PRB coal was estimated to increase electricity costs by $1.09 to $2.37 per month. Monthly electricity costs for lignite were estimated to be between $2.57 and $3.50 per month for 50 percent capture, and between $2.77 and $3.92 per month for 70 percent capture (DOE/NETL 2006). However, these results were generated using North Dakota lignite and may or may not be representative of costs experienced by customers consuming electricity generated at EGUs burning Gulf Coast lignite.

DOE/NETL based their cost analysis on the EPA RIA. EPA has recognized key uncertainties in their benefit-cost analysis of the final CAMR program. They include: "[their] inability to quantify potentially significant benefit categories; uncertainties in population growth and baseline incidence rates; uncertainties in projection of emissions inventories and air quality into the future; uncertainty in the estimated relationships of health and welfare effects to change in pollutant concentrations; uncertainties in exposure estimation; and uncertainties associated with the effect of potential future actions to limit emissions" (EPA 2005b).

References

Richardson C. Considerations for the Control of Mercury from Coal-Fired Power Plants in Texas presentation given at the Texas Commission on Environmental Quality, URS Corporation (2006).

United States Department of Energy, National Energy Technology Laboratory (DOE/NETL). DOE/NETL Phase II Mercury Control Technology Field Testing Program: Preliminary Economic Analysis of Activated Carbon Injection (2006).

United States Energy Information Administration (EIA). EIA Annual Coal Report (2004).

United States Energy Information Administration (EIA). EIA 2003 State Energy Data <http://www.eia.doe.gov/emeu/states/sep_fuel/html/pdf/fuel_es.pdf> (2006a).

United States Energy Information Administration (EIA). EIA Electric Power Annual 2004 Data Tables <http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html> (2006b).

United States Environmental Protection Agency (EPA). EPA Regulatory Impact Analysis of the Final Clean Air Mercury Rule EPA-452/R-05-003 (2005a).

United States Environmental Protection Agency (EPA). EPA Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units; Final Rule, *Federal Register* (2005b).

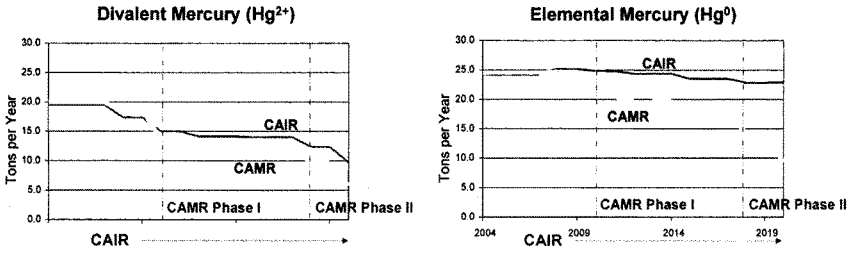
United States Environmental Protection Agency (EPA). EPA Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (Clean Air Interstate Rule); Revisions to Acid Rain Program; Revision to the NO_x SIP Call, *Federal Register* (2005c).

United States Environmental Protection Agency (EPA). EPA Preliminary Estimates of Performance and Cost of Mercury Emissions Control Technology Applications on Electric Utility Boilers: An Update (2004).

Chapter 7
Fiscal Impacts of Mercury Emissions

House Bill 2481instructs TCEQ to examine the fiscal impact on the state of higher levels of mercury emissions between 2005 and 2018. TCEQ interprets this directive to mean that the commission will examine the impact of mercury emissions between 2005 and 2018 that could be higher than they would be if more strict emissions reductions were implemented before 2018. Fiscal concerns regarding potential increased mercury emissions include health impacts on children, impacts on the recreational and economic value of fishing, and potential impacts on the coal mining industry in Texas. Risk is defined by exposure. Therefore, even if emissions increase, risk remains unchanged if people are not exposed. As discussed previously, divalent mercury is the primary form associated with deposition and bioaccumulation. While CAMR will reduce overall mercury emissions, it primarily targets removal of elemental mercury (Figure 7-1). As a result, early introduction of CAMR would have only negligible effects on deposition and bioaccumulation that are linked to health and recreation.

Figure 7-1. CAIR and CAMR Control Efficiencies for Divalent Versus Elemental Mercury



Adapted from Levin 2006

Impacts on Exposed Individuals

While a number of possible fiscal impacts of mercury contamination of fish exist, EPA reports economic values for only one: the value of lost wages attributable to lower cognitive functioning of adults who were exposed to mercury as fetuses through their mothers' ingestion of fish containing mercury. Expressed differently, when mercury-exposed fetuses grow into adults, they are predicted to suffer cognitive deficits that translate into lower wages over their lifetimes than they would have earned, on average, had they not been exposed. Such predictions are based on estimates of cognitive deficits due to mercury exposure, coupled with correlations between measures of intelligence, such as intelligence quotient (IQ), and earnings. However, as EPA notes, "evidence directly linking IQ and [methylmercury] exposure" is limited (EPA 2005).

Although the link between methylmercury exposure and IQ loss is limited, EPA used estimates of mercury exposure and resulting IQ decrements to estimate net present value in 2001 of total

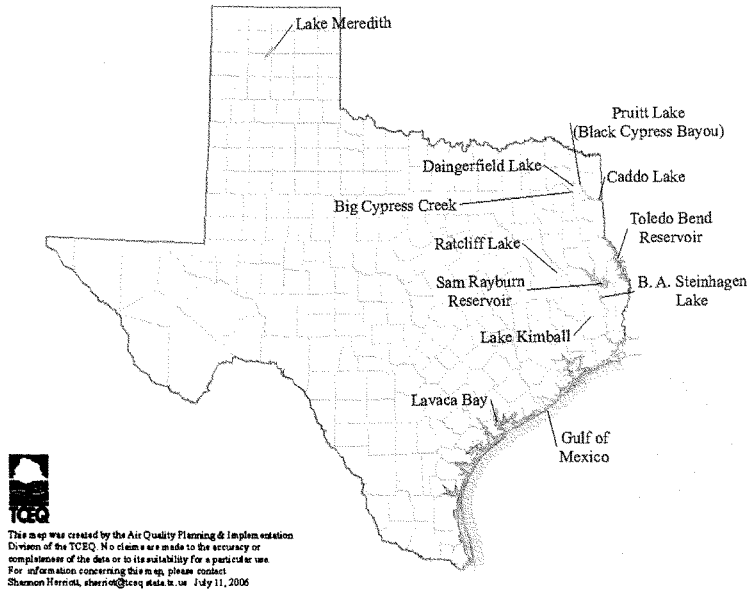
foregone earnings averaging $454 to $557 per child in Texas exposed prenatally to mercury from all sources. EPA estimates that implementation of CAIR alone will increase income by no more than $35 to $54 per child, relative to the 2001 base case estimate. CAMR is projected to contribute further, but only marginally: by no more than $3 per child. If complete elimination of utility-attributable mercury emissions were required, net earnings losses would not fall to zero, but would still range from roughly $427 to $514 due to other sources of mercury. (EPA 2005).

Impacts on Recreation

Mercury contamination of fish can have fiscal impacts beyond those associated with prenatal exposure. Angler avoidance of recreational activities on waters with advisories could impact the recreational angling economy. Over 17 million people visited Texas's 668,000 acres of parks in 2003, generating nearly $13.4 billion in economic activity (DOI/FWS 2003). Many more thousands of acres of private recreational land are maintained for fishing, hunting, hiking, mountain biking, and other outdoor pursuits. The Texas Department of Parks and Wildlife licensed over 1.2 million anglers in 2005, and these anglers are estimated to have spent 34.1 million person-days fishing and over $2.1 billion on travel and supplies for recreational fishing trips that year (DOI/FWS 2003). For comparison, using different methods and sources, EPA estimated 1.8 million freshwater anglers in Texas who spent a total of 28 million person-days fishing in 2001 (EPA 2005).

Twelve mercury fish consumption advisories have been issued for Texas water bodies since the state began issuing such advisories in 1988 (Figure 7-2). The Texas Department of State Health Services considers issuing fish-specific mercury advisories if testing indicates mercury concentrations at or above 0.7 mg/kg. Nine of these advisories pertain to freshwater lakes totaling roughly 363,000 acres of surface water, or approximately one in five lake acres in the state. The balance of advisories covers one 40-mile river segment, one 17-mile estuary, and one advisory for the entire Texas Gulf Coast. Of the lake acres covered by advisories, over half are contained in Toledo Bend Reservoir, and another third are in Sam Rayburn Reservoir. Both of these advisories were issued in 1995.

Figure 7-2. Texas Mercury Advisories for 2005



While mercury fish consumption advisories have garnered much public attention, mercury impairments accounted for only three percent of impairments of Texas water bodies, as reported in the 2004 Texas Water Quality Inventory 303(d) List (TCEQ 2006). Other impairments included pathogens, low oxygen, salinity, and other contaminants (dioxins, poly-chlorinated biphenyls, other metals, sulfates, pesticides, nitrates, and others). Despite its low incidence, however, mercury impairments represent the largest number of acres for which impairments have been recorded. Texas mercury advisories are limited to consumption of specific aquatic life and do not include "recreational" advisories, such as swimming bans.

Determining the impact of mercury fish consumption advisories on angling behavior, and therefore the value of angling, is a complex endeavor. A Maine study found that while roughly two-thirds of anglers in the state were aware of mercury advisories on the water bodies they fished, fewer than one in four altered their fishing behavior (fished other water bodies, fished less often, or limited fish consumption) in response to this knowledge (MacDonald 1997). Although it might be expected that Texas anglers would respond similarly, reliable estimates of economic losses to Texas anglers, and the impact to tourism, due to mercury advisories, are unavailable.

Impacts on Coal Mining

Coal mining sustains the economies of many small communities in Texas. In 2003, the United States Census Bureau estimated roughly 3,700 miners were employed in 13 mines across 11 counties in Texas, generating $166.2 million in payroll income (DOC/BOC 2003). Besides those directly involved in mining, the mining industry also benefits those involved in follow-on industries, such as support services, truck drivers, equipment suppliers, and even restaurants. The United States Energy Information Administration reported that Texas mines extracted 45,939 tons of coal in 2005 (EIA 2006), which, at market rates, would have been valued at roughly $600 million.

Fuel switching away from coal due to increased regulatory burden is possible, though EPA has forecast that consumption of coal for electric generating will increase between 2000 and 2020 (EPA 2005). More stringent mercury emissions regulations could lead to fuel switching among types of coal, negatively impacting lower rank Gulf Coast lignite. Forecasts of future impacts on coal consumption patterns are inconclusive.

References

Department of Commerce/Bureau of the Census (DOC/BOC) County Business Patterns (2003).

Department of the Interior/Fish and Wildlife Service (DOI/FWS) and Department of Commerce/Bureau of the Census (DOC/BOC) 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (2003).

DOI/FWS Net Economic Values for Wildlife-Related Recreation in 2001: Addendum to the 2001 National Survey of Fishing, Hunting and Wildlife-Associated Recreation (Report 2001-EPA's 2002 National Assessment Database) (2003).

Levin L. Mercury, State of the Science and Technology presentation given at the Texas Commission on Environmental Quality. Electric Power Research Institute (2006).

MacDonald HF, Boyle KJ. Effect of a Statewide Sport Fish Consumption Advisory on Open-Water Fishing in Maine. North American J. Fisheries Management 17 (3): 687-695 (1997).

Rice G, Hammitt JK. Northeast States for Coordinated Air Use Management (NESCAUM) Economic Valuation of Human Health Benefits of Controlling Mercury Emissions from U.S. Coal-Fired Power Plants (2005).

Texas Commission on Environmental Quality (TCEQ). 2004 Texas Water Quality Inventory 303(d) List. http://www.tceq.state.tx.us/compliance/monitoring/water/quality/data/04twqi/twqi04.html (2006).

United States Energy Information Administration (EIA). EIA Quarterly Coal Report, October-December 2005 (2006).

United States Environmental Protection Agency (EPA). EPA Regulatory Impact Analysis of the Final Clean Air Mercury Rule (2005a).

Walsh RG, Johnson DM, McKean JR. Review of Outdoor Recreation Economic Demand Studies with Nonmarket Benefit Estimates, 1968-1988. Technical Report No. 54. Colorado State University (1988).

Glossary

Allowance - an authorization to emit a fixed amount of a pollutant

Allowance trading - buying or selling of allowances on the open market

Amino acid - the building blocks of proteins, a simple class of organic compounds containing carbon, oxygen, hydrogen, nitrogen, and sometimes, sulfur

Autism - a brain disorder affecting communication, social interaction, and creativity or imagination that begins in early childhood and persists throughout adulthood

Benchmark dose - the dose causing a predetermined change in response

Benchmark dose lower confidence limit - the lower statistical confidence level of the benchmark dose

Bioaccumulate - the accumulation of a chemical or other substance in various tissues of a living organism

Biomass - a common term used to represent vegetation, as in "biomass burning"

Boston Naming Test - a test, originally designed for the elderly, that assesses word retrieval capacity and naming deficits in learning disabled children and brain-injured adults using 60 line drawings of common objects. Subjects are presented with drawings of objects and are then asked to name them. If a correct response is not produced within 20 seconds, a clue is given describing the type of object represented. If the subject remains unable to identify the object, the first two letters in the object name are given. The test is scored upon the number of correct answers given with and without clues.

Compliance - at the end of each compliance period, each source must own at least as many allowances as its emissions

Deposition - transport of a gaseous or particulate air contaminant from the atmosphere to the soil, water, and vegetation. Dry deposition is deposition that occurs in the absence of precipitation. Wet deposition occurs with precipitation scavenging.

Dissolved organic carbon - the concentration of organic material in a defined freshwater sample that passes through a 0.45 mm filter

Divalent mercury (Hg^{2+} or Hg^{II}) - ionic form of mercury containing two fewer electrons than elemental mercury

Electric Generating Unit (EGU) under CAMR - coal-fired boilers or combustion turbines serving a generator with a nameplate capacity of more than 25 megawatt electrical (MWe) producing electricity for sale. CAMR also applies to co-generation units serving at any time a generator with nameplate capacity of more than 25 MWe and supplying in any calendar year more than one-third of the unit's potential electric output capacity or 219,000 megawatt hours (MWh), whichever is greater, to any utility power distribution system for sale.

Electric Power Research Institute (EPRI) - research group for power production, transmission, and distribution operators

Elemental mercury - a shiny, silver-white, odorless liquid element. Mercury is the only common metal existing as a liquid at room temperature. Elemental mercury vaporizes at 357°C.

Emissions Cap - a limit on the total amount of pollution that can be emitted (released) from all regulated sources (e.g., power plants); the cap is set lower than historical emissions to cause reductions in emissions

Epidemiology - study of the causes, distribution, and control of a disease in a population

ESP, cold-side - electrostatic precipitator located after the air pre-heater and operating in a temperature range of 130-180°C

ESP, hot-side - electrostatic precipitator located before the air pre-heater where the operating temperature is in a range of 300-450°C

Estuarine - an area where a river empties into an ocean resulting in a mixture of salt water and fresh water

Flexibility - as related to the Clean Air Mercury (CAMR) or Clean Air Interstate Rules (CAIR), sources can choose how to reduce emissions, including whether to buy additional allowances from other sources that reduce emissions.

Food chain - a chain of food energy transfer in which each organism is eaten, in turn, by another organism

Food web - interrelated food chains within an ecological community

Gigawatt - one billion watts or one million kilowatts

Half-life - the time required for half the quantity of a substance deposited in a living organism to be metabolized or eliminated by normal biological processes

Hydrologic Unit Codes - a means of identifying the drainage basins in the United States in a nested arrangement from largest to smallest. A drainage basin is an area or region of land that

catches precipitation falling within that area, and funnels it to a particular creek, stream, river, or other body of water until the water drains into an ocean.

Integrated Planning Model (IPM) - a computer model developed by the United States Environmental Protection Agency. It is a multi-regional, dynamic, deterministic linear programming model of the United States electric power sector. The model generates forecasts of least cost capacity expansion, electricity dispatch, and emission control strategies to meet energy demand and environmental, transmission, dispatch, and reliability constraints. IPM can be used to evaluate the cost and emissions impacts of proposed policies to limit emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon dioxide (CO_2), and mercury (Hg) from the electric power sector. For more information, see "Documentation of EPA Modeling Applications (V.2.1) Using the Integrated Planning Model," U.S. Environmental Protection Agency, EPA 430/R-02-004 (March 2002).

Kilowatt (kW) - one-thousand Watts; a unit of power, or energy per unit of time

Kilowatt-hour (kWh) - one kilowatt of power provided for one hour

Ion - an atom, group of atoms, or subatomic particle with a net electrical charge

Measurement - accurate tracking of all emissions

Megawatt (MW) - one million watts or one-thousand kilowatts

Megawatt-hour (MWh)-one megawatt of power provided for one hour

Methylmercury - a methyl group bonded to a single mercury atom. This compound is primarily formed from divalent mercury in the environment by sulfate-reducing bacteria.

Methyl group (CH_3) - an organic compound derived from methane by the removal of one hydrogen atom

Mill - one-tenth of a penny (0.1¢). A standard unit for expressing costs in the electric industry.

Modeled Grid Cells - three-dimensional grid system that can consist of thousands of individual grid cells usually used in complex air quality models of the atmosphere. Values of pollutant emissions, meteorological parameters, and other information are input to the grid cells by the modeler so that the model can be run to simulate atmospheric processes. The output of the model can be designed so that values of the pollutant of interest are available for each grid cell (e.g., mercury concentration or deposition).

Organic - a class of chemical compounds containing at least one carbon atom

Oxidation - a chemical reaction in which electrons are added to an atom

pH - a measure of the acidity or alkalinity of a solution

Reference Dose - an estimate of a daily oral exposure to the human population, including sensitive subgroups, that is likely to be without an appreciable risk of deleterious effects over a lifetime

Transpiration - the passage of vapor from a living body through a membrane or pore; e.g., the transpiration of elemental mercury vapor from vegetation

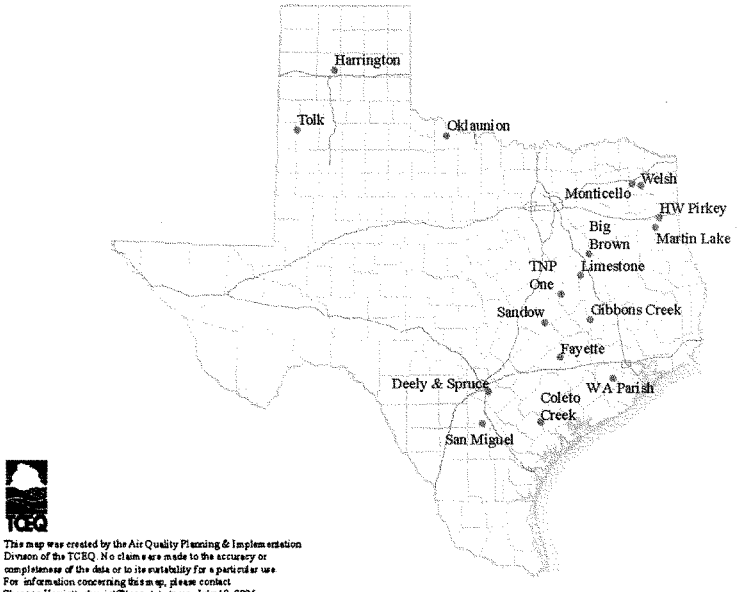
Water Column - the volume of water between the surface and bottom of a water body

Watershed - a region draining into a river, river system, or other body of water

Utility Hot Spot - As related to the Clean Air Mercury Rule (CAMR), a utility-attributable increase in fish tissue methylmercury concentration that exceeds EPA's threshold of 0.3 mg/kg.

Appendix

Coal-Fired Power Plants in Texas Participating in the Clean Air Mercury Rule Program (2006)



This map was created by the Air Quality Planning & Implementation Division of the TCEQ. No claims are made to the accuracy or completeness of the data or to its suitability for a particular use. For information concerning this map, please contact Shannon Herriott, sherriot@tceq.state.tx.us July 19, 2006

Existing Sulfur Dioxide (SO_2) Scrubber and Particulate Control Devices at Texas Clean Air Mercury Rule Electric Generating Units (2006)

Plant Name	Unit ID	Coal type	SO_2 Control	Particulate Matter Control Type
Big Brown	1	Lignite		Cold-side ESP+ Fabric filter
Big Brown	2	Lignite		Cold-side ESP+ Fabric filter
Coleto Creek	1	Bituminous		Hot-side ESP
Gibbons Creek	1	Subbituminous	Wet Scrubber	Cold-side ESP
Harrington Station	061B	Subbituminous		Cold-side ESP
Harrington Station	062B	Subbituminous		Fabric filter
Harrington Station	063B	Subbituminous		Fabric filter
J K Spruce	BLR1	Subbituminous	Wet Scrubber	Fabric filter
J T Deely	1	Subbituminous		Cold-side ESP
J T Deely	2	Subbituminous		Cold-side ESP
Limestone	LIM1	Lignite	Wet Scrubber	Cold-side ESP
Limestone	LIM2	Lignite	Wet Scrubber	Cold-side ESP
Martin Lake	1	Lignite	Wet Scrubber	Cold-side ESP
Martin Lake	2	Lignite	Wet Scrubber	Cold-side ESP
Martin Lake	3	Lignite	Wet Scrubber	Cold-side ESP
Monticello	1	Lignite		Cold-side ESP+ Fabric filter
Monticello	2	Lignite		Cold-side ESP+ Fabric filter
Monticello	3	Lignite	Wet Scrubber	Cold-side ESP
Oklaunion	1	Subbituminous	Wet Scrubber	Cold-side ESP
Pirkey	1	Lignite	Wet Scrubber	Cold-side ESP
Fayette	1	Subbituminous		Cold-side ESP
Fayette	2	Subbituminous		Cold-side ESP
Fayette	3	Subbituminous	Wet Scrubber	Cold-side ESP
San Miguel	SM-1	Lignite	Wet Scrubber	Cold-side ESP
Sandow	4	Lignite	Wet Scrubber	Cold-side ESP
TNP One	U1	Lignite	Wet Scrubber	Fabric filter
TNP One	U2	Lignite	Wet Scrubber	Fabric filter
Tolk Station	171B	Subbituminous		Fabric filter
Tolk Station	172B	Subbituminous		Fabric filter
W A Parish	WAP5	Subbituminous		Fabric filter
W A Parish	WAP6	Subbituminous		Fabric filter
W A Parish	WAP7	Subbituminous		Fabric filter
W A Parish	WAP8	Subbituminous	Wet Scrubber	Fabric filter
Welsh	1	Subbituminous		Hot-side ESP
Welsh	2	Subbituminous		Hot-side ESP
Welsh	3	Subbituminous		Hot-side ESP

Senator CARPER. Mr. Schanbacher, thank you very much, and thanks again for joining us. We look forward to asking you a couple of questions here in a few minutes.

Mr. Scott, again welcome. Commissioner Jackson is not here, and Ms. Wolfe is not here to give her statement, but she will be here to answer all the tough questions that Senator Voinovich and I are going to ask.

I am going to ask unanimous consent that Commissioner Jackson's statement be made a part of the record. Without objection, it will be.

[The referenced document follows on page 156.]

Senator CARPER. The same will be true for each of our other witnesses. We will make your entire statement part of the record, unless there are objections.

Hearing none, Mr. Scott, you are recognized. Thank you.

STATEMENT OF DOUGLAS P. SCOTT, DIRECTOR, ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Mr. SCOTT. Thank you very much, Chairman Carper and Senator Voinovich. My name is Doug Scott. I am the director of the Illinois Environmental Protection Agency. On behalf of Governor Rod Blagojevich, I want to thank you and the committee members for this opportunity to testify on Illinois' recently adopted regulations to control mercury emissions from the State's coal-fired powerplants that also successfully implemented a multi-pollutant strategy to achieve substantial reductions in nitrogen oxide and sulfur dioxide.

I believe our experience has shown that significant mercury reductions beyond those contained in the Federal Clean Air Mercury Rule can be achieved with available technology and at a reasonable cost, while providing substantial benefits to public health.

Like other States, Illinois felt strongly that the Federal rule was inadequate in protecting public health. Like Senator Collins, I come from a State where we have a fish advisory on all waters of the State for all predator fish.

Senator CARPER. I guess that will knock out New Jersey for us for our family vacation, too.

[Laughter.]

Mr. SCOTT. We thought that the Federal rule was too slow in terms of when the restrictions came in; required too little reduction. We had strong objection to the trading of the neurotoxin, which may leave Illinois and other States with no substantial reductions.

But as a result of negotiations with the major coal-fired powerplant operators, we were able to reach agreements that will result not only in significantly exceeding the mercury reductions that would have occurred under CAMR, but also achieve reductions in NOx and SO_2 that go beyond the Federal clean air interstate rule requirements.

Illinois has been aggressive in other mercury legislation as well. There is still an issue in terms of collection of materials that contain mercury. There is still an issue in terms of where that material goes. I know Senator Obama from our State and Senator Murkowski have legislation to address that, that we are very interested

in. But with respect to powerplants, the written testimony that I have filed with the subcommittee details the qualifications and conclusions of the group of respected experts on regulatory, technical controls, economic and health issues relative to mercury reductions from powerplants that assisted us.

Their work and that of our own EPA Bureau of Air staff created a strong case for the Governor's plan to reduce mercury emissions from Illinois coal-fired powerplants by 90 percent beginning in mid-2009. Illinois obtains more than 40 percent of its electricity from 21 coal-fired powerplants, and we sit on top of 38 billion tons of coal, giving us the third largest coal reserves in the Nation.

Coal-fired powerplants in Illinois constitute the largest source of manmade emissions of mercury and sulfur dioxide, and one of the largest sources of nitrogen oxide. After nearly a full year of stakeholder meetings and contested public hearings, rulemaking procedures, and lengthy negotiations, the Illinois mercury rule was unanimously approved, both by our Pollution Control Board and by our Joint Legislative Committee on Administrative Rules, and the rule became effective on December 21 of last year.

The special significance was that the introduction of the Illinois mercury rule became the catalyst for the State to reach landmark environmentally beneficial agreements with the three largest coal-fired powerplant systems operating in Illinois: Midwest Generation, Ameren, and Dynegy. These three companies represent 88 percent of Illinois' coal-fired electric generating capacity, and account for hundreds of thousands of tons of air emissions each year.

After the Illinois EPA presented its findings in support of the mercury rule during 2 weeks of public hearings that were well attended and full of lively debate, the Illinois EPA was approached by one of the power companies who expressed a desire to work toward common goals on a multi-pollutant solution. As a result of long hours of negotiation, an alternative standard was proposed that allowed some limited flexibility in complying with the mercury standards in exchange for commitments to also significantly reduce SO_2 and NOx.

This initial agreement led to similar discussions and similar agreements with Illinois' other two large coal-burning powerplant owners. The outcome is a critical milestone in reducing air pollution and one of the most important environmental and public health advances in Illinois history. It represents the largest reduction in air emissions ever agreed to by individual companies in Illinois under any context, whether through an enforcement action or through a regulation.

The mercury reductions obtained from Illinois' rule will substantially be greater than those under Federal CAMR, and will occur more quickly. Whereas the Clean Air Mercury Rule would cap Illinois' annual mercury emissions at 3,188 pounds by 2010 through 2017, the Illinois rule results in annual mercury emissions of only around 770 pounds beginning in 2009.

Overall, under CAMR, coal-fired power producers in Illinois would have only been required to reduce their mercury emissions by 47 percent in 2010 and 78 percent by 2018, not the 90 percent reduction by 2009 required in the Illinois rule. In addition, trading mercury allowances is not permitted under the Illinois rule to pre-

vent the hotspots that we have already heard about this morning, and to assure that reductions actually occur in Illinois, in contrast to the cap and trade program under CAMR.

Coal-fired powerplant operators covered by the negotiated multi-pollutants standards must also comply with Federal CAIR, the combined impact will be reductions of SO_2 and NOx that will far exceed those required under CAIR alone. Under the proposed CAIR, U.S. EPA estimates that coal-fired power producers in Illinois would have been required to reduce their SO_2 emissions by 34 percent overall by 2019. Under the agreement that we reached with Midwest Generation, the largest coal-fired power generator in Illinois, by 2019 an estimated 80 percent reduction in SO_2 will occur.

Under the multi-pollutant solution, Ameren will be required to reduce emissions of SO_2 by 76 percent by 2015 and Dynegy will be required to reduce emissions by 65 percent by 2015. We project the total emission cuts from all three power companies that will result from a combined CAIR and multi-pollutant solution rule, comparing a baseline in the 2003 and 2005 period with 2019, the reduction will be over 233,000 tons per year of reduction in SO_2 and over 61,000 tons per year reduction of NOx.

They also substantially restrict trading of SO_2 and NOx allowances to assure that the reductions actually occur at the Illinois plants, which is not only good for our citizens, but good for the folks that are to the northeast of us as well. Some mercury emission reductions——

Senator CARPER. Mr. Scott, given the fact that votes are just starting, I am going to ask you to go ahead and wrap it up, if you will.

Mr. SCOTT. Absolutely.

Senator CARPER. So we will have a chance to try to ask the questions of this panel, to excuse this panel, and we will rush off to make our votes. So if you could just wrap it up, please.

Mr. SCOTT. Certainly, thank you, Senator.

Flexibility for mercury control was provided in the form of relief of timing of demonstrating compliance with the 90 percent reduction standard, which we believe is the key to this. It gives the companies some flexibility and some certainty as they not only comply with the mercury rule, but with other legislation to come. We believe that that is one of the reasons why they willingly entered into these agreements with us.

The result for citizens in Illinois, and we think citizens of other States, will be significant public health benefits, while still assuring affordable and reliable energy.

Thank you very much.

[The prepared statement of Mr. Scott follows:]

STATEMENT OF DOUGLAS P. SCOTT, DIRECTOR, ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Mr. Chairman and Members of the Committee: My name is Doug Scott and I am the Director of the Illinois Environmental Protection Agency. I want to thank Senator Carper and the other members of the Senate Subcommittee on Clean Air and Nuclear Safety for this opportunity to testify on Illinois' recently adopted regulations to control mercury emissions from the State's coal-fired powerplants.

I received a Bachelor's Degree with honors from the University of Tulsa in 1982, and received a graduate Juris Doctor law degree with honors from Marquette Uni-

versity in 1985. I served as Assistant City Attorney and City Attorney for the City of Rockford, Illinois from 1985 to 1995. I also represented the City on a number of environmental issues. From 1995–2001 I served as an Illinois State Representative for the 67th District and served on the House Energy and Environment Committee, and was a member of the committee that rewrote the States' electric utility laws. I was elected to the Office of the Mayor of Rockford in April 2001 and served a four-year term and served as President of the Illinois Chapter of the National Brownfields Association. I was appointed as the Director of the Illinois EPA by Governor Rod Blagojevich in July 2005.

I am pleased to be here to provide testimony on behalf of Illinois Governor Rod Blagojevich and the Illinois EPA regarding Illinois' mercury rule and the associated agreements we reached with the State's three largest coal-fired powerplant system owners. My testimony will provide background information and a broad overview of the development of Illinois' mercury rule and the related multi-pollutant reduction agreements. I will address some of the measures the Illinois EPA took during rule development to ensure that we relied on accurate and current information as we crafted the rule.

INTRODUCTION

Illinois is a large industrial state with a population of around 13 million and a gross state product of $522 billion, both of which are approximately four percent of the U.S. total and ranks Illinois as fifth among the 50 states in these categories. Illinois obtains more than 40 percent of its electricity from coal-fired powerplants and sits on top of 38 billion tons of coal, giving it the third largest coal reserves in the nation. Coal-fired powerplants in Illinois constitute the largest source of man-made emissions of mercury and sulfur dioxide (SO_2), and one of the largest sources of nitrogen oxides (NOx).

On January 5, 2006, Illinois Governor Rod Blagojevich announced an aggressive proposal to reduce mercury emissions from Illinois coal-fired powerplants by 90 percent beginning mid 2009. After nearly a full year of stakeholder meetings, contested public hearings, rulemaking procedural processes, and lengthy negotiations, the Illinois mercury rule was unanimously approved by both the Illinois Pollution Control Board (Board) and the Joint Committee on Administrative Rules (JCAR), the two governing oversight bodies for regulations in Illinois. The Illinois mercury rule became effective on December 21, 2006. This rule requires coal-fired powerplants in Illinois to achieve greater reductions of mercury and achieve these reductions more quickly than that proposed in May 2005 by the U.S. EPA under the federal Clean Air Mercury Rule (CAMR). Illinois is not alone in seeking to go beyond the federal CAMR. Other states have made similar decisions. Numerous states have adopted mercury reduction programs that "go beyond" CAMR in their reduction target or timeframe for obtaining reductions, and a number of other states have announced their intentions to do so as well.

Of special significance for Illinois was that the Illinois mercury rule became the catalyst for the State to reach landmark, environmentally-beneficial agreements with the three largest coal-fired powerplant systems operating in Illinois: Midwest Generation, Ameren, and Dynegy. These three companies represent 88 percent of Illinois' 17,007 Megawatts of coal-fired electric generating capacity and account for hundreds of thousands of tons of air emissions each year.

After the Illinois EPA presented its findings in support of the mercury rule during two weeks of public hearings that were well attended and full of lively debate, the Illinois EPA was approached by one of the power companies that expressed a desire to work toward common goals. As a result of long hours of negotiation, an alternative standard was proposed that allowed some limited flexibility in complying with the mercury standards in exchange for commitments to also significantly reduce SO_2 and NOx emissions from the company's coal-fired powerplants. This initial agreement led to similar discussions and agreements with Illinois' other two large coal-burning plant owners.

The agreements reached and memorialized in the Multi-Pollutant Standard (MPS) and Combined Pollutant Standard (CPS) are significant not only for the magnitude of emissions reductions that occur, but also for the mercury rule support that accompanied the agreements. The Illinois mercury rule was initially vehemently opposed by a unified coal-fired power industry. The first agreement established that mutual goals were achievable, set the guiding principles, and opened the door for other companies to follow. Ultimately, the success of the Illinois mercury rule, and in particular the final unanimous approval of the rule, can be widely attributed to the removal of significant opposition and reciprocating support that occurred due to these agreements.

These multi-pollutant reduction agreements are expected to result in measurable improvements to Illinois and regional air quality by dramatically reducing mercury, SO_2, and NOx emissions. The agreed to measures are a critical milestone in reducing air pollution and one of the most important environmental and public health advances in Illinois or this nation's history. They represent the largest reductions in air emissions ever agreed to by individual companies in Illinois under any context, whether through an enforcement action or regulation.

The coal-fired powerplant operators covered by MPS and CPS must also fully comply with the federal Clean Air Interstate Rule (CAIR) and the combined impact will be reductions of SO_2 and NOx that will far exceed those required under CAIR alone. Under the proposed CAIR, U.S. EPA estimates that coal-fired power producers in Illinois would have been required to reduce their SO_2 missions by 34 percent overall, by 2019. Under the CPS, Midwest Generation, the largest coal-fired power generator in Illinois, will have an estimated reduction of 80 percent by 2019 in SO_2. In terms of the emission rate, it would have been an estimated 0.45 pounds per million Btu by 2019 under CAIR only, compared to 0.11 pounds per million Btu with CPS. Under MPS, Ameren will be required to reduce emissions of SO_2 by 76 percent by 2015 and Dynegy will be required to reduce emissions by 65 percent by 2015.

For NOx, the reduction would be a projected 55 percent for all of the coal-fired powerplants in Illinois under CAIR only compared to 62 percent for Midwest Generation under CPS, 52 percent for Ameren and 48 percent for Dynegy under MPS.

The Illinois EPA estimates the total emission cuts from all three power companies that will result from the combined CAIR, CPS and MPS rules, comparing a baseline in the 2003–2005 period and 2019, will be 233,600 tons per year reduction for SO_2 and 61,434 tons per year reduction for NOx.

Just as trading to prevent "hotspots" was prohibited in the mercury rule, in order to receive the maximum benefit in Illinois air quality and to prevent contributions to interstate pollution transport, the CPS and MPS rules also substantially restrict trading of SO_2 and NOx allowances. For Midwest Generation, under the CPS, the allowances can only be initially traded to the company's own generation station in Homer City, Pennsylvania and thereafter only outside Ohio, Indiana, Illinois, Wisconsin, Michigan, Kentucky, Missouri, Iowa, Minnesota, and Texas—all of which are states that have been shown to contribute to pollution in Illinois. For Ameren and Dynegy, there are no restrictions on the trading of allowances interstate amongst their own units, however, they can only interstate trade any additional allowances that occur as a result of controlling emissions beyond the levels required by the MPS. This provides an incentive for these companies to reduce emissions to the greatest extent possible instead of seeking only to control emissions to the exact level of the MPS numeric emission limits. In addition, Midwest Generation, Ameren and Dynegy cannot purchase allowances to assist in meeting the MPS or CPS emission standards.

ILLINOIS MERCURY RULEMAKING PROCESS

The mercury rulemaking process in Illinois began long before 2006 with Illinois providing comments on federal mercury control proposals and indicating to our coal-fired power industry that the State was looking to control mercury emissions to the greatest extent reasonably possible in consideration of technical and economic issues.

Illinois Governor's Rod Blagojevich's January 2006 announcement on mercury control set the rule development process into high gear. The Illinois EPA began to hold stakeholder meetings later that very month and proposed a draft rule to the Board in March of 2006.

Illinois recognized early on that it needed to obtain the highest quality information on the controversial subject of mercury control. We sought out and retained nationally recognized experts on different topics regarding mercury. These experts were utilized to assist the Illinois EPA in rule development and testimony before the Board. Experts were retained that included: Dr. James Staudt, PhD, Andover Technology Partners, on mercury controls and associated costs; Dr. Gerald Keeler, PhD, Professor, University of Michigan, on mercury deposition and local impacts; Dr. Deborah Rice, PhD, Toxicologist, on health effects; ICF Consulting Inc. and Synapse Energy Economics, on regulatory economic impacts; Dick Ayres, Principal, Ayres Law Group, on regulatory issues surrounding mercury control.

The Illinois EPA performed significant outreach to stakeholders on the rule, including the aforementioned stakeholder outreach meetings in early 2006 where we presented information on our findings, updated stakeholders on the rule, requested feedback on issues, and held question and answer sessions. We also provided regular mail and e-mail addresses to allow interested parties to submit comments and

questions that were then answered at the stakeholder meetings. In addition, we repeatedly offered to meet with any stakeholders in smaller groups to discuss the rule and related issues, and, in fact, held many such meetings.

The rule was the subject of much controversy from the outset. Illinois' coal-fired powerplants united in opposition and several court proceedings followed the initial filing of the rule. Nevertheless, the mercury proposal continued to progress through the rulemaking process. As is normal for any controversial rulemaking, the Board scheduled public hearings with the initial round of hearings designated for the Illinois EPA to present its case on why the rule should be adopted.

The proposed mercury rule received support from the State's environmental groups and an alliance of opposition from the State's coal-fired powerplant owners. The first round of hearings lasted a full two weeks and we believe the Illinois EPA and its experts built a strong case for stringent mercury control before the Board, facilitating the subsequent negotiations with the powerplant systems on alternative multi-pollutant regulatory approaches.

The second round of hearings was designed for the coal-fired powerplant representatives to present their findings to the Board on why they believed the rule was flawed. The beginning of these hearings witnessed the introduction of a joint filing by the Illinois EPA and one of the power companies on the agreement reached whereby the company would withdraw all opposition to the proposed mercury rule based on an amendment to the rule that contained an agreed upon multi-pollutant standard. This set the stage for other agreements to subsequently be reached, although the last agreement was not finalized until after the second round of hearings ended and only shortly before the rule was approved by JCAR.

The crux of the multi-pollutant agreements lies in the mutual benefits of multi-pollutant standards for controlling the emissions of mercury, SO_2, and NOx from coal-fired powerplants. Such benefits include an increase in the protection of public health and the environment by achieving greater reductions, reducing pollution more cost-effectively, and offering greater certainty to both industry and regulators. Since mercury emission reductions can be obtained as a co-benefit from the control devices used to reduce SO_2 and NOx, it makes sense to allow companies the option to synchronize the control of these pollutants, provided that public health and the environment are also positively impacted. Flexibility for mercury control in the MPS and CPS was provided in the form of relief in the timing of demonstrating compliance with a 90 percent reduction standard, with the final goal of achieving even greater reductions. In essence, under the MPS and CPS, companies are required to install mercury controls on the vast majority of their units no later than mid-2009 as required in the primary mercury standard. However, actual compliance with the 90 percent standard is not required to be demonstrated until 2015 for those units that are unable to achieve this level of reduction. In providing more time to reach compliance with the 90 percent mercury standard, emission controls that target SO_2 and NOx, and that achieve mercury reductions as a co-benefit, can be installed and thereafter be used to further reduce mercury to the desired level. It is anticipated that companies will install a multitude of pollution control equipment costing billions of dollars on their units, including scrubbers for SO_2, selective catalytic reduction and non-selective catalytic reduction units for NOx, and particulate matter control equipment, such as electrostatic precipitators and fabric filters.

In recognition of the high level of SO_2 and NOx control that result from companies meeting the agreed standards of the MPS and CPS, the Illinois EPA pledged to look first at other sources than those complying with the MPS and CPS in Illinois for future reductions in these pollutants for purposes of meeting the State's air quality goals.

The Illinois mercury rulemaking process culminated with the adoption of the rule with an effective date of December 21, 2006.

MERCURY BACKGROUND AND CONCERNS

Mercury is a persistent, bioaccumulative neurotoxin that presents a serious threat to the health and welfare to the citizens of Illinois and nationwide. Mercury as a pollutant is of particular concern to Illinois due to our large fleet of coal-fired powerplants. Mercury is contained in small amounts in all forms of coal that are burned at Illinois powerplants. The combustion of coal at powerplants represents the largest source category of anthropogenic mercury emissions in Illinois, and for that matter, in the United States. As the coal is burned in a boiler at a powerplant, the mercury is released into the exhaust flue stream and travels through existing ductwork and control devices until it is finally emitted through a stack into the atmosphere.

Mercury is released into the atmosphere from anthropogenic emission sources such as coal-fired powerplants as either a gas or attached to minute solid particles.

These emissions can contaminate the environment both locally near the point of release and many miles away. Mercury emissions in the air are transferred to the earth's surface via wet or dry deposition processes. The wet forms can fall to earth as rain, snow, or fog while the dry forms are particulates.

Mercury that is directly deposited or finds its way into the aquatic systems transforms into methylmercury through a series of chemical reactions involving microbial activity. Methylmercury is toxic and is the most common organic form of mercury found in the environment. It is very soluble and bioaccumulates within the tissues of wildlife (fish, aquatic invertebrates, mammals) as well as humans. Bioaccumulation occurs when an organism's rate of uptake of a substance exceeds its rate of elimination. Fish become contaminated as they feed on contaminated food sources such as plankton or smaller fish. Humans are contaminated as a result of eating contaminated fish.

A key concept in understanding the need and methods for mercury control is that, although mercury air emissions are the target for reductions, the ultimate goal is to reduce methylmercury levels in water bodies, and hence, fish tissue.

The Illinois EPA retained the services of Dr. Gerald Keeler to assist us with understanding mercury deposition and to provide technical information on deposition issues. Dr. Keeler is a recognized leader in the field of mercury deposition and has conducted state-of-the-art research on the relationship of mercury emissions, local impacts, and coal-fired powerplants.

ILLINOIS COAL-FIRED POWERPLANTS AND MERCURY

Today, more than 40 percent of Illinois' electricity comes from coal-fired powerplants. Illinois is home to 21 coal-fired powerplants that are affected by the Illinois mercury rule, most of which are over 25 years old. There are a total of 59 electric generating units operating at these 21 plants. These coal-fired powerplants emitted an estimated 7,022 pounds per year of mercury into the atmosphere in 2002. We estimate that these powerplants make up around 71 percent of Illinois' man-made mercury emissions. The State's fleet of powerplants are scattered throughout Illinois, with many located near major bodies of water.

Mercury emissions from coal-fired powerplants can have both local and downwind environmental impacts and Dr. Keeler assisted the Illinois EPA in understanding the potential for local impacts from powerplants. Illinois EPA believes that the reduction in mercury emissions required by the rule will result in significant reductions of mercury deposition and methylmercury levels in Illinois waters and fish. This belief is reinforced by actual measured reductions in methylmercury fish tissue contents in Florida and Massachusetts that directly coincide with measures taken to reduce mercury emissions from nearby sources.

Because mercury is of such a significant concern to human health and the environment, Illinois has adopted legislation and/or implemented a number of programs to reduce mercury emissions to the environment from sources other than coal-fired powerplants. Illinois' coal-fired powerplants constitute the largest source of uncontrolled mercury emissions in the State.

MERCURY CONTAMINATION IN ILLINOIS

Fish consumption advisories are issued when concentrations above human health-based limits of one or more of contaminants such as polychlorinated biphenyls (PCBs), chlordane, and mercury are detected in fish tissue. One of the most profound statements regarding the status of mercury contamination in Illinois is that there is a statewide advisory for predator fish in Illinois waters due to methylmercury. Fish consumption use is associated with all waterbodies in the State and therefore it is commonly stated that all waterbodies in the State have a fish consumption advisory in place for mercury. According to the latest (2004) Illinois list of impaired waters, there are 61 river segments (1,034 miles) and 8 lakes (6,264 acres) that have mercury listed as a potential cause of impairment due to restrictions on fish consumption.

Our review of fish consumption literature provides convincing evidence that sport anglers currently consume amounts of sport-caught fish that could cause them and their families to exceed health-based limits for mercury contamination. The literature regarding anglers' consumption of their catch strongly suggests that a subset of these anglers have meal frequencies that exceed the state-wide fish consumption advisory for mercury, putting them well above the recommended rates for even fairly low levels of contamination.

The Illinois EPA retained the services of Dr. Deborah Rice, a toxicologist with a background in the health effects of mercury, to assist us with understanding the

human health effects of mercury and to provide technical information on such effects.

MERCURY CONTROL IN ILLINOIS—IDENTIFYING THE NEED TO GO BEYOND CAMR

After earlier activities to determine how best to regulate mercury, on January 30, 2004, U.S. EPA published a notice of proposed rulemaking setting forth three alternative regulatory approaches to reducing emissions of mercury from coal-fired powerplants. In two of the three alternatives, U.S. EPA proposed to rescind its regulatory finding, which would require Maximum Achievable Control Technology (MACT) level control of mercury emissions, and instead impose statewide mercury emissions budgets to regulate powerplants that could be met through a cap and trade program, namely the CAMR.

In response to the proposed rule, the Illinois EPA submitted comments, making the following key points:

- Mercury is a powerful neurotoxin that needs to be regulated under Section 112 of the Clean Air Act (CAA) and as such, the mercury emissions from powerplants must be subject to a MACT standard;
- Mercury limits must be more stringent than set forth in the proposed U.S. EPA rule;
- Any mercury rule for powerplants must be fuel neutral, without favoring coal from any particular region of the country, and thus, there should be a common standard for bituminous and subbituminous coal;
- Illinois EPA opposes emissions trading of mercury allowances unless the units involved in trading can demonstrate that mercury hotspots are prevented; and
- Mercury emission reductions can and should occur by 2010.

The comments also stated that U.S. EPA gave insufficient support for its extended compliance deadline of 2018, which U.S. EPA acknowledged could extend compliance out to 2025 or 2030 due to banking elements of the trading program.

In April 2004, U.S. EPA reversed the regulatory course it established in 2000 for regulation of mercury emissions under Section 112 and announced two key proposals: (1) to remove the source category containing coal-fired powerplants from the list of Hazardous Air Pollutants (HAP) emitters under Section 112 of the CAA, and, (2) to adopt a cap-and-trade program under Section 111 of the CAA instead of MACT standards under Section 112 of the CAA. This regulatory approach adopted none of Illinois EPA's key points on mercury control.

On March 15, 2005, U.S. EPA issued the CAMR to permanently cap and reduce mercury emissions from coal-fired powerplants. Notably, CAMR did not apply a MACT standard to mercury emissions from coal-fired powerplants, and instead created a market-based cap-and-trade program to reduce nationwide powerplant emissions of mercury in two separate phases. The first phase sets a national emissions cap of 38 tons in 2010 that is to be achieved by mercury reductions occurring as a co-benefit of requirements for reducing SO_2 and NOx emissions under the federal Clean Air Interstate Rule (CAIR). No mercury specific controls are required in this first phase. The second phase begins in 2018 and requires coal-fired powerplants to meet a reduced national cap of 15 tons. Illinois' budget, or cap, under CAMR is 1.594 tons per year of mercury for Phase I and 0.629 tons per year for Phase II. U.S. EPA estimates that CAMR provides mercury emission reductions from Illinois coal-fired powerplants of approximately 47 percent by 2010 and 79 percent by 2018.

After review of CAMR, the Illinois EPA determined that CAMR will not result in timely and sufficient reductions of mercury and that the rule contained biased allocation methods that favored non-Illinois coals and thus impeded Illinois' efforts to encourage use of clean-coal technologies involving Illinois coal. Illinois EPA requested that the Illinois Attorney General's Office file an appeal of CAMR and the related U.S. EPA actions. On May 27, 2005, the State of Illinois filed Petitions for Review with the United States Court of Appeals for the District of Columbia Circuit challenging CAMR. Thirteen other states also filed one or more appeals of the CAMR and related actions. These appeals are pending.

Illinois is not required to adopt the CAMR, but must submit a State plan to achieve the statewide mercury emissions budget called for in the rule and must demonstrate that Illinois' plan will achieve at least as much reduction as CAMR. Illinois' plan is afforded the ability to forego trading and the other aspects of a cap-and-trade program. However, if Illinois' submittal is not timely and deemed acceptable by the U.S. EPA, then CAMR will be imposed upon Illinois. Illinois' plan was due to the U.S. EPA by no later than November 17, 2006.

The Illinois EPA determined that the appropriate method to protect the public health and environment while meeting federal requirements was to adopt reason-

able state-specific mercury reduction requirements for Illinois' coal-fired powerplants.

ILLINOIS MERCURY RULE DEVELOPMENT CONSIDERATIONS

In developing the Illinois mercury rule, Illinois EPA took several steps, including consulting recognized experts, holding discussions with stakeholders and interested parties, conducting research and literature reviews, and utilizing internal experts and staff.

A key finding was that mercury control technologies have advanced significantly over the last several years (e.g., use of halogenated sorbents) resulting in both a reduction in costs of mercury control and increased effectiveness. The trend is one where technological advances and vendor expansion should continue to lead to decreasing costs and increasing control efficiencies and options.

The Illinois EPA retained the service of Dr. James Staudt of Andover Technology Partners to assist us in understanding the state-of-the-art in mercury controls, levels of mercury reductions obtainable under different control configurations, and the associated costs. Dr. Staudt is a nationally renowned expert on coal-fired powerplant controls and has done similar work for U.S. EPA, among others.

The Illinois EPA relied on several basic principles as guidance in developing the proposed rule:

- The need to protect human health, fish and wildlife, and the environment from the harmful effects of mercury and methylmercury;
- The need to control the unregulated mercury emissions from Illinois' coal-fired powerplants to the greatest level possible and as quickly as possible in a cost-effective manner;
- Must consider the latest control technology that has been shown effective in controlling mercury emissions and which can be reasonably employed, in a cost effective manner, across the full fleet of Illinois powerplants and coal types;
- Must ensure that the required mercury reductions occur both in Illinois and at every powerplant in Illinois to address local impacts; and
- The rule needs to incorporate flexibility in complying with the proposed standards to assist in widespread compliance and to help reduce compliance costs.

We also sought to ensure that the rule would not encourage a switch to the use of non-Illinois coal and interfere with actions to promote the use of Illinois coal in clean-coal technology applications. Therefore, the rule does not treat sources differently or establish different requirements based on the type of coal being used. This is contrary to CAMR, which established state mercury budgets, as well as proposes a baseline allocation scheme that provides higher allowances for units burning coal types other than Illinois bituminous coal. Furthermore, credit for mercury removal from coal washing was given by establishing an output-based limit that accounts for mercury removal during pre-combustion processes such as coal washing.

Careful consideration was given to the effect mercury control requirements will have on Illinois' economy, including consumers, jobs, and the power sector. Illinois carefully selected an achievable, reasonable, and cost-effective mercury reduction target. Illinois research established that data supported a 90 percent reduction as an achievable and reasonable level of mercury control for Illinois powerplants and that the costs of controlling mercury are consistent with Illinois' goals. In addition, we looked into the amount of mercury reduction in fish tissue levels needed to get below fish consumption advisory levels. The mercury reduction amount required for a selected species (e.g., largemouth bass) in order to reach unlimited consumption levels by childbearing age women and children less than 15 years of age, the most sensitive and restrictive sub-population, is about 90 percent. Moreover, a November 2005 mercury control model rule proposed by then State and Territorial Air Pollution Administrators (STAPPA) and Association of Local Air Pollution Control Officials (ALAPCO) provided two options, both of which had initial Phase 1 compliance dates set at the end of 2008 and required final cuts in mercury equivalent to 90-95 percent by the end of 2012. Illinois also reviewed the actions of several states that have selected compliance dates earlier than 2009 as well as mercury reduction requirements of 90 percent or greater.

In addition to the detailed mercury control and cost analysis performed by Illinois' technical expert, Dr. Staudt, Illinois utilized the services of ICF Resources Incorporated (ICF) to evaluate the economic impact of the rule on Illinois' electricity rates and affected powerplants. While there are some additional costs predicted from the rule when compared to CAMR, the costs are deemed to be reasonable in light of the concerns presented by mercury pollution and the potential benefits of mercury control.

Illinois EPA determined that it can achieve the required mercury reductions proposed by Governor Blagojevich and give compliance flexibility to sources. Giving flexibility serves to reduce compliance costs and increase the probability of widespread compliance.

Illinois was also concerned with the potential for so-called mercury hotspots. We addressed the hotspot issue by not allowing trading, or the banking or purchase of emissions allowances, and by requiring mercury reductions at all powerplants. Ensuring emission reductions take place in Illinois and at all locations where powerplants exist should reduce local impacts and hotspots.

A multi-pollutant approach for controlling the emissions of mercury, SO_2, and NOx from coal-fired powerplants has numerous advantages over a traditional, single regulatory pollutant scheme. For example, a well crafted multi-pollutant standard can increase the protection of public health and the environment, reduce pollution more cost-effectively, and offer greater certainty to both industry and regulators. Since mercury emission reductions can be obtained as a co-benefit from the control devices used to reduce SO_2 and NOx, it makes sense to allow companies the option to synchronize the control of these pollutants, provided that public health and the environment are likewise positively impacted. Whereas the mercury rule single-mindedly tackles mercury emissions, and CAIR concentrates on SO_2 and NOx, both the MPS and the CPS accomplish the aforementioned benefits in the context of a single regulatory framework and in recognition of the timing and other issues that accompany a combined-pollutant control strategy.

MERCURY CONTROLS

Many options exist for curtailing mercury emissions that occur as a result of the combustion of coal at powerplants. These options include the cleaning of coal to remove mercury before combustion, improving boiler efficiencies so that less coal is burned to obtain the same amount of energy output, and the use of add-on air pollution control equipment. All of these options can be used either alone or in combination to arrive at an effective mercury control strategy. Several variables play a role in determining what strategy and control options are best suited and effective for mercury reductions at a given powerplant including, coal type, existing controls, boiler type, fly ash needs, and economic feasibility.

Dr. Staudt with the assistance of Illinois EPA staff conducted a unit-by-unit analysis of Illinois' fleet of coal-fired electric generating units. The results of this analysis are found in Section 8 of the mercury rule's technical support document. In general it was found that a 90 percent reduction in mercury was widely achievable in Illinois in a cost effective manner. Overall, the costs per pound of mercury removed for compliance with the Illinois rule was estimated to be around $8,100 per pound of mercury captured. For comparison, the estimated cost to comply with the 2010 CAMR state budget through use of control technology was lower at around $5,800 per pound of mercury removal, for far fewer reductions.

The use of halogenated activated carbon injection (ACI) was found to provide a high level of mercury control at reasonable costs for the majority of Illinois' units. ACI has been used for years to reduce mercury emissions on municipal waste combustors with mercury removal efficiencies of more than 90 percent. There has been wide-scale testing of ACI systems on numerous coal-fired powerplants with mercury reductions of greater than 90 percent achieved and ACI is now beginning to be deployed on coal-fired units in the United States. ACI vendors have stated they are able to provide large scale installation of ACI systems on powerplants in Illinois and we are aware of several negotiations underway between the parties to test and install ACI systems.

Of course the ultimate decision of strategies and controls employed will be made by the owners and operators of the powerplants themselves, and most likely be governed by the economics at the time. Attempts to predict these decisions are "best guesses" of the types of controls that will be actually put into practice. The noted trend that is expected to continue is one where technological advances lead to decreasing costs, increasing control efficiencies, and expanding options.

ILLINOIS MERCURY RULE

The rule requires mercury reductions from Illinois' coal-fired powerplants in two phases. During Phase I, which begins on July 1, 2009, coal-fired powerplants must comply with either an output-based emission standard of 0.0080 lbs mercury/gigawatt hour (GWh), or a minimum 90 percent reduction of input mercury, both on a rolling 12-month basis. However, plants with the same owner/operator may elect to comply with the limit on a system-wide basis by averaging across their entire fleet of plants in Illinois, provided that each plant meets a minimum output-

based emission standard of 0.020 lbs mercury/GWh or a minimum 75-percent reduction of input mercury.

In Phase II, beginning January 1, 2013, plants must comply with either an output-based emission standard of 0.0080 lbs mercury/GWh or a minimum 90 percent reduction of input mercury, both on a rolling 12-month basis. The rule does not allow for the trading, purchasing or the banking of allowances.

Flexibility provided by the rule includes the following:

• The source has the option of complying with either a mercury reduction efficiency or an output based emission rate;

• The proposed rule does not prescribe how compliance with the selected standard is to be achieved; instead, the affected source makes the ultimate decision on how compliance is obtained;

• The proposed rule phases in standards over a period of 3½ years, with a less restrictive standard in Phase 1;

• The rule allows a source to demonstrate compliance by both system-wide and plant-wide averaging in Phase 1, and plant-wide averaging in Phase 2;

• The rule allows for sources that commit to shutdown within a certain timetable to avoid installing controls.

• The rule has a temporary technology based option that provides relief for a limited number of emission units that install appropriate mercury controls but are unable to achieve compliance. Eligible units are only required to operate the mercury controls in an optimal manner to be deemed in compliance. This provision is available through June 2015 and can be used by up to 25 percent of a company's generating capacity.

• Perhaps most importantly, the rule allows for sources to opt-in to multi-pollutant standards (e.g., MPS or CPS) which allow additional flexibility in regard to mercury for sources that commit to reductions in SO_2 and NOx. The primary mercury compliance flexibility provided by the MPS and CPS is that, although companies are still required to install mercury controls able to achieve a 90 percent reduction on all but a few of the smallest units by no later than mid 2009, actual compliance is not required until 2015 provided they operate the mercury controls in an optimal manner.

The monitoring requirements of the rule are essentially the same as those outlined in the model federal CAMR. However, in addition to monitoring outlet mercury emissions, the Illinois mercury rule also requires sources complying with the rule via the 90 percent reduction standard to determine, through coal analysis, the input mercury in order to determine the removal efficiency.

EFFECT OF THE ILLINOIS MERCURY RULE

The mercury reductions obtained from Illinois' rule will be beyond those of the federal CAMR and will occur more quickly. Whereas CAMR would cap Illinois' annual mercury emissions at 3,188 pounds by 2010 through 2017, the Illinois rule results in annual mercury emissions of only around 770 pounds beginning mid-2009. Therefore, the rule is anticipated to eliminate approximately 2,418 additional pounds per year of harmful mercury pollution, and do so six months earlier than the federal CAMR. The reductions obtained under the Illinois rule will likewise be greater than those required in Phase II of CAMR, which does not go into effect until 2018. The CAMR budget for Illinois in Phase II is 1,258 pounds per year, but with banking allowed under CAMR, it is not expected that actual emission reductions will occur until 2020 or later. Compared to CAMR, the Illinois rule should result in 488 fewer pounds of mercury emissions per year about seven years sooner. It is important to note that CAMR is a cap and trade program and therefore, under CAMR, Illinois powerplants could postpone or avoid some mercury reductions through the purchase or banking of allowances, an option not allowed under Illinois' rule.

Over time, Illinois expects to see reductions in mercury water deposition to Illinois' lakes and streams and corresponding methylmercury decreases in Illinois fish tissues, making fish caught in Illinois waters safer to eat.

We also expect to see significant benefits to human health, although it is difficult to estimate a dollar value for such things as improvements in IQ and less cardiovascular disease. There could also be several recognized benefits to Illinois beyond the expected public health benefits that come with a reduction in water and fish methylmercury levels. Such benefits include support for existing, and the potential for additional, jobs resulting from the installation and operating requirements of additional pollution control devices. There also exists a potential for an increase in tourism and recreational fishing as mercury levels drop in fish, bringing an associated positive impact to local economies and the State overall. With a possible in-

crease in the use of bituminous coal, there should be a positive economic impact on the Illinois coal industry and Illinois coal mining jobs.

ECONOMIC CONSIDERATIONS

In evaluating the economic impacts of the rule, Illinois EPA consulted and retained the services of experts, stakeholders and interested parties, conducted literature reviews, and utilized internal staff.

In order to better understand the economic effects of the mercury rule, Illinois retained the services of ICF Consulting Inc. (ICF), the same firm used by U.S. EPA for CAMR. ICF conducted a study evaluating the economic impacts of the mercury rule using the Integrated Planning Model (IPM®). This study focused on the impacts of the mercury rule in terms of costs to the power sector and costs to electricity consumers.

Of significant importance is that a "more stringent" rule than the final adopted rule was modeled and therefore the results are considered conservative. Illinois EPA discussed modeling parameters with ICF prior to the modeling and it was determined that where the modeling inputs allowed discretion, we would err on the side of being conservative. Some examples of this are that the IPM® was unable to reflect the mid-year Phase 1 compliance date of July 1, 2009 and therefore for modeling we moved the compliance date up to January 1, 2009, six months sooner than that required by the Illinois rule. Also, the IPM® model assumed a mass emissions cap on each and every unit where the rule does not cap emissions but requires compliance with a standard that allows for growth in electricity generation. Emission caps as used in the IPM® Model are more stringent than a percent reduction control requirement or emissions rate since they also limit growth. As a result, the plant output might be severely limited depending upon the cap. This implicit limit to the plant output could create a situation where the modeling forecasts the plant is no longer economically viable whereas it might be viable under a 90 percent reduction requirement or 0.0080 lbs Hg/GWh emissions rate that allows output growth. For accurate assessment of what the modeling predicts, it is critical that the modeling results be viewed in context, i.e., taking the above into consideration.

ICF prepared a comprehensive report for the Illinois EPA in which it provides a summary of the modeling results and identifies what it believes are the principal findings of the study. Of note is that modeling shows only a 1–3.5 percent increase in retail electricity prices and costs across all sectors (e.g., residential, industrial and commercial) from the rule relative to the CAMR. On an average bill basis, residential customers in Illinois would pay less than $1.50 per month more under the Illinois rule relative to CAMR across the study horizon.

IPM® modeling predicts that two powerplants may be adversely impacted to the extent that some small, older coal-fired units are retired, potentially resulting in some corresponding job loss. Note that economic experts consulted by the Illinois EPA who have reviewed the IPM® modeling believe that the modeling is not accurate in predicting the retirement of these plants as a result of the rule. The modeling also forecasts an increase in the use of bituminous coal as a direct result of the mercury rule. This increase should have a positive impact on Illinois coal related operations, such as Illinois coal mines and jobs, since most of the bituminous coal fired in Illinois is mined in Illinois. The modeling further shows corresponding decreases in the use of subbituminous coal, which is mined in western states. Of particular interest is that were Illinois to implement CAMR instead of the mercury rule, IPM® modeling shows a decrease in bituminous coal use.

The Illinois EPA found that there would be no significant adverse impact to the safety and reliability of the electricity distribution grid as a result of the rule. We also found that there could be significant economic benefits as a result of the rule in the form of support for existing jobs and potential for new jobs in the pollution control device installation industry, fishing industry, and Illinois' coal industry.

The Illinois EPA retained the services of Synapse Energy Economics, Inc. (Synapse) to review the modeling performed and to testify before the Board on issues related to the IPM® modeling. In addition, Synapse was asked to assist the Illinois EPA in understanding a wide range of economic issues related to the rule. These include the potential effect of the rule on the reliability of the electricity grid, Illinois jobs, consumer electric rates, competitiveness of coal-fired powerplants, and potential for retirement of coal-fired units, and costs to the power sector. In particular, due to the serious nature of any potential unit retirements and loss of competitiveness of Illinois' coal-fired owner plants in comparison to other states, the Illinois EPA requested further review of these issues by its economic experts, (e.g., Synapse). The Illinois EPA also believed that these issues warranted further review due

to the conservative representation of the rule by the modeling and the corresponding potential for the modeling results to overestimate any negative impacts.

The above considerations focus on the economic impacts associated with issues outside of public health benefits. However, when evaluating the appropriateness of the potential costs of any rule, the costs associated with the rule must be measured against the costs to society of continued contamination from the targeted pollutant and the intimately related monetized health benefits expected from reduced emissions. Illinois reviewed the numerous studies on the monetized health benefits of mercury control of coal-fired powerplants nationwide and found that the annual benefits are conservatively estimated in the range of $10.4 to $288 million. Notably, in the rule development process of the federal CAMR, the U.S. EPA may not have recognized the full societal cost benefit of controlling mercury emissions. This is highlighted by the fact that U.S. EPA did not consider the results of the Harvard/NESCAUM study as well as other recent studies in its analysis of the full benefits of mercury control. Illinois' expert on the health effects of mercury, Dr. Rice, found that the costs to society from cognitive deficits in adults, accelerated aging, and impairment of elderly to live independently due to methylmercury exposure have not been monetized. Therefore, the costs to society from mercury pollution from coal-fired powerplants, although extremely large, may be substantially underestimated. The preponderance of available information indicates potentially huge monetized health benefits from mercury control.

CONCLUSION

Recent advances in mercury control technology have improved control efficiencies and reduced the costs to control mercury. The federal CAMR does not account for these advances and does not go far enough or go fast enough in reducing the emissions of this highly toxic pollutant. Illinois coal-fired powerplants are the largest source of man-made mercury emissions in the State and as such, the Illinois mercury rule aims to eliminate as much of the mercury emissions from these sources as is reasonably possible, and to do so as quickly as possible. The Illinois EPA used several avenues, including the retention of services of nationally recognized mercury and economic experts, in order to obtain the latest, most accurate information on mercury and mercury controls, as well as to assist in rule development and impact analyses. We feel that the rule provides for deep, attainable cuts in mercury emissions while providing compliance flexibility and other measures designed to minimize costs to affected sources. The non-public health economic implications of the rule, although difficult to forecast, are variable with some potential benefits provided in the area of jobs and increased recreational activity and possible negative impacts such as increased costs to the power sector and the potential for the retirement of some coal-fired units. The impact to Illinois consumer electricity bills should be minimal. The potential benefits to the public health of Illinois citizens from the proposed rule are substantial, as the harmful effects from mercury to IQ and cardiovascular systems, to name a few, are lessened. We expect to see lower mercury deposition to Illinois waterbodies and corresponding decreases in methylmercury fish levels, making fish caught in Illinois safer to eat.

The SO_2 and NOx reductions agreed to under the MPS and CPS are expected to go a long way toward helping Illinois achieve its attainment goals for ozone and particulate matter. The final estimates on emission reductions are enormous. The Illinois EPA estimates the total emission cuts from all three power companies at 233,600 tons per year of SO_2, 61,434 tons per year of NOx and 7,040 pounds per year of mercury. This equates to reductions of SO_2 of 76 percent for Ameren, 65 percent for Dynegy, and 80 percent for Midwest Generation. These SO_2 cuts begin no later than 2013 and continue on through 2018. The reductions in annual NOx emissions average around 52 percent and occur no later than 2012.

Under CAMR, coal-fired power producers in Illinois would have only been required to reduce their mercury emissions by 47 percent in 2010 and 78 percent by 2018, not the 90 percent reduction by 2009 required in the Illinois rule. The amount and general timing of mercury reductions for those sources that opt-in to the MPS or CPS are estimated to be essentially the same, although they will not be required to comply on a 12-month rolling basis until 2015. Sources under the MPS and CPS are expected to have mercury emission reductions that exceed even the required 90 percent in the Illinois mercury rule after 2015 due to the co-benefit reductions achieved from the installation of new controls needed to comply with the corresponding SO_2 and NOx standards.

The benefits of removing SO_2 and NOx are well established and most notably will result in reductions in both particulate matter and ozone. SO_2 is a precursor to particulate matter and NOx is a precursor to both particulate matter and ozone. Partic-

ulate matter related annual benefits include fewer premature fatalities, fewer cases of chronic bronchitis, fewer non-fatal heart attacks, fewer hospitalization admissions (for respiratory and cardiovascular disease combined) and should result in fewer days of restricted activity due to respiratory illness and fewer work loss days. Moreover, there should be health improvements for children from reduced upper and lower respiratory illness, acute bronchitis, and asthma attacks.

Ozone health-related benefits are expected to occur during the summer ozone season and include fewer hospital admissions for respiratory illnesses, fewer emergency room admissions for asthma, fewer days with restricted activity levels, and fewer days where children are absent from school due to illnesses. In addition, there should be ecological and welfare benefits. Such benefits include visibility improvements; reductions in acidification in lakes, streams, and forests; reduced nutrient replenishing in water bodies; and benefits from reduced ozone levels for forests and agricultural production.

Thank you again to the committee for allowing me to testify today on behalf of Governor Rod Blagojevich and the Illinois EPA.

RESPONSES BY DOUGLAS P. SCOTT TO ADDITIONAL QUESTIONS FROM SENATOR SANDERS

Question 1. Your state has gone well beyond EPA's "Clean Air Mercury Rule" by requiring faster and deeper mercury reduction from powerplants. Please tell us what you concluded about the current and future state of mercury pollution control technologies during the period in which your rule will be carried out that led you to believe utility owners could achieve the mercury standards in your law. What, if any, communications have you received from EPA regarding your state mercury standards?

Response. Illinois concluded that mercury control technologies currently exist that can provide a high level of mercury reductions in a cost-effective manner for coal-fired powerplants. We found that mercury control technologies have advanced significantly over the last several years, and since U.S. EPA promulgated the Clean Air Mercury Rule (CAMR), and that such advancements have resulted in both increased control effectiveness and a reduction in costs of mercury control. We believe the future of mercury control technologies is one where technological advances and vendor expansion should continue to lead to decreasing costs and increasing control efficiencies as well as a wider variety of mercury control options.

In developing its mercury rule, Illinois took several steps to assess the state-of-the-art in mercury control technologies, levels of mercury reductions obtainable under different powerplant and control equipment configurations, and the associated costs. These steps included consulting recognized experts, holding discussions with stakeholders and interested parties, conducting research and literature reviews, and utilizing internal experts and staff. We also retained the services of Dr. James Staudt of Andover Technology Partners. Dr. Staudt is a nationally recognized expert on coal-fired powerplant controls and has done similar work for U.S. EPA, among others.

Dr. Staudt, with the assistance of Illinois EPA staff, conducted a unit-by-unit analysis of Illinois' fleet of coal-fired electric generating units. The results of this analysis are found in Section 8 of Illinois mercury rule's technical support document. Illinois concluded that a 90 percent reduction in mercury was widely achievable in Illinois in a cost-effective manner. In particular, the use of halogenated activated carbon injection (ACI) was found to provide a high level of mercury control at reasonable costs for the majority of Illinois' units. ACI has been used for years to reduce mercury emissions on municipal waste combustors with mercury removal efficiencies of more than 90 percent. There has been wide-scale testing of ACI systems on numerous coal-fired powerplants with mercury reductions of greater than 90 percent achieved and ACI is now beginning to be deployed on coal-fired units in the United States. ACI vendors have stated they are able to provide large scale installation of ACI systems on powerplants in Illinois and we are aware of several negotiations underway between the parties to test and install ACI systems.

Furthermore, Illinois recognized the importance of providing rule flexibility to address the level of uncertainty inherent in any technology-based regulatory standard. Illinois worked closely with its stakeholders on a wide variety of flexibility provisions that were incorporated into the Illinois mercury rule, including the multi-pollutant standards.

We also found that significant mercury reductions can be obtained as a co-benefit from emission control technologies that target sulfur dioxide (SO_2) and nitrogen oxides (NOx). By adopting mercury control rules that consider SO_2 and NOx control

strategies, and allowing companies to implement an integrated multi-pollutant control strategy for all three pollutants (i.e., mercury, SO_2 and NOx), Illinois concluded that even greater emissions reductions and public health benefits can be achieved than under a strategy that solely focused on mercury control technologies.

The Illinois EPA has had numerous discussions with U.S. EPA regarding the acceptability of the Illinois mercury rule as part of its state plan for mercury control to ensure compliance with the federal CAMR. The U.S. EPA has indicated that they can accept Illinois' mercury rule as demonstrating compliance with CAMR through 2017. However, U.S. EPA has expressed concern that the Illinois mercury rule may not ensure compliance with CAMR beyond 2018. The Illinois EPA adamantly disagrees with this assessment and strongly believes that its mercury rule results in mercury reductions well beyond the federal CAMR even after 2018. U.S. EPA appears to have taken a position that for Illinois to obtain approval for years after 2018, we need to amend our mercury rule to include mercury emissions caps on each of the coal-fired powerplants. We are against such caps at this stage and do not believe they are necessary. Both our projection of actual mercury emissions and an additional conservative projection (sensitivity analysis) of mercury emissions show that the Illinois mercury rule will result in mercury emissions well below the CAMR emissions caps from the beginning of the rule out to 2020. Illinois has proposed to provide an annually updated 10-year mercury emission projection to U.S. EPA and to take significant measures should our emissions projection ever forecast an exceedance of the CAMR caps, including taking steps to amend the rule to include caps. Furthermore, the Illinois state plan contains corrective action measures to be implemented should an exceedance of the CAMR caps ever actually occur. Under the corrective action plan, the State has committed to amending its rule to include unit by unit emission caps and purchasing in the market and retiring mercury allowances to cover any emissions over the annual budget.

It is important to note that the Illinois EPA projects emissions in 2020 to be around 880 lbs of mercury as compared to 1,258 lbs for the CAMR budget. Moreover, during the first eight years of CAMR, Illinois is expected to have accumulatively reduced mercury emissions by 12,628 pounds more than would have occurred under the federal CAMR. Since mercury is a bio-accumulative pollutant these earlier and greater reductions will continue to benefit public health and the environment going forward. We believe U.S. EPA should this factor when evaluating the appropriateness and timeliness of Illinois' actions to remedy any projected or actual exceedances of the CAMR caps in later years. Illinois is considering its options should U.S. EPA formally decide to disapprove its state plan for the years after 2017.

Question 2. EPA declared in it final mercury rules for powerplants that it was not only "unnecessary" but also "inappropriate" to regulate mercury emissions from powerplants under the Clean Air Act's stringent air toxics provisions in section 112. Hasn't EPA long regulated mercury from other types of industries, however, under this same stringent Clean Air Act authority? And if so, what has the experience been there? Does it make sense to you that it is appropriate to regulate mercury emissions from some types of industries using the law's most protective tools, but "inappropriate" to do so when it comes to powerplants?

Response. It is accurate that U.S. EPA has historically regulated mercury emissions under section 112 of the Clean Air Act (CAA). For example, mercury emissions from Municipal Waste Combustors (MWC) and Medical Waste Incinerators (MWI) are both subject to Maximum Achievable Control Requirements (MACT) established under section 112 authority.

Illinois' plan for large MWC was approved by U.S. EPA in December 1997. Illinois has no municipal waste combustion units affected by the small MWC emissions guideline. However, the MWC regulations affected two large sources in Illinois, i.e., Northwest Waste to Energy (Northwest) and Robbins Resource Recovery Company (Robbins). Northwest shutdown incinerator operations during the regulatory development process, and Robbins shutdown incinerator operations in 1998. Thus, Illinois does not have any mercury emissions from the municipal waste combustors category.

Illinois believes that the Clean Air Act requires that U.S. EPA regulate powerplant mercury emissions under section 112 of the CAA as well. In fact, Illinois has elaborated this position to U.S. EPA on at least two circumstances: (1) Illinois EPA submitted comments in response to a January 30, 2004, U.S. EPA proposed rulemaking, and (2) on May 27, 2005, the State of Illinois filed Petitions for Review with the United States Court of Appeals for the District of Columbia Circuit challenging CAMR.

Coal-fired powerplants are the largest source of man-made mercury emissions, and there is nothing unique about mercury emissions from this source category. As such, the timing and level of mercury control should be prompt and stringent. The only policy reason to treat this source category differently from other industrial sources is the goal of allowing mercury control to be achieved as a co-benefit of the control of NOx and SO_2. The Illinois EPA understands this goal, as it is reflected to a degree in our multi-pollutant agreements with Illinois' largest powerplant systems. However, this goal should not result in undue delay of achieving mercury reductions at "MACT-levels", i.e., 90 percent, nor some units escaping any level of mercury control. Moreover, the cap and trade program under CAMR cannot guarantee each unit will install appropriate mercury control technologies or even that the level at which a plant or State is capped is actually met. If the owner or operator chooses, they may comply with the CAMR cap at a given unit or plant using emission allowances rather than reducing mercury emissions. Such a compliance strategy does not provide the appropriate protection for public health and the environment for those affected by the plant's emissions and does not ensure that mercury emissions reduction goals in a State are achieved.

Question 3. In addition to the regulation of powerplants, I understand that your state and other states have been recycling products containing mercury, like auto switches and thermometers. Do you know what happens to the mercury once it has been sent to the recycler? What do you think about closing the loop by banning the export of mercury that is recycled is not then used in ways that pollute the environment?

Response. Mercury recyclers reclaim mercury from products by using a multi-stage process to volatilize the mercury and then condense it back to elemental mercury. The collected mercury is a commodity which is typically sold for reuse. Illinois EPA does not know specifically to whom our contracted recyclers sell the mercury that is collected through state-sponsored household hazardous waste collection and school chemical cleanout programs. More than likely some of it is exported for use in other countries.

Illinois EPA supports a ban on the export of mercury. We would like to point out that in 2001, the Environmental Council of the States formed the Quicksilver Caucus to collaboratively develop holistic approaches for reducing mercury in the environment. Illinois EPA endorses the principles for management of commodity grade elemental developed by the Caucus. These principles include the following elements:

- Reuse of elemental mercury should only be utilized in processes or products deemed essential.
- Following the collection and recycling (retorting) of used mercury-containing products, the mercury should be sequestered and safely stored within the United States.
- The United States should support mechanisms to better track international trade of mercury, mercury compounds, and mercury-containing products.
- The United States should be a leader in proper use and management of elemental mercury by not exporting any mercury-containing products to other countries unless it is related to an essential use. Exporting surplus elemental mercury to developing countries where it can result in unsafe exposure should be prohibited. Elemental mercury should only be exported to other countries for essential uses where it can be demonstrated that the country does not have sufficient domestic sources of secondary (recycled) mercury.

Senator CARPER. Thank you so much. Your full statement will be in the record.

The first question I have, and Mr. Schanbacher, I am going to ask you to just answer this quickly, if you will, but you were good to give us a little bit of a primer, if you will, on the different kinds of coal that we have; the different kinds of mercury that is created, one type which goes up into the air which is transported around the world, and another type that does not go all around the world, and comes down, in many cases, a lot closer to the place from where it is emitted.

My understanding is that one of the types of mercury is easier to capture as it leaves the powerplants, and another is more difficult to capture. Just come back and sort of tie that together for us with respect to, or just revisit again what you said about bitu-

minous coal, sub-bituminous, and the elemental mercury and divalent mercury. Just take a moment to go through this. I think it is important for us to understand this.

Mr. SCHANBACHER. Okay, I will try to do this as quickly as possible. Bituminous coal, which is primarily burned in the eastern part of the United States, has a lot of chlorine in it. The chlorine, when you burn the coal, helps convert mercury from elemental, which is sort of chemically stable, to divalent, which has an electric charge associated with it. Divalent mercury attaches more easily to particles, and also it is water soluble. So in the typical control devices that we use for powerplants, it is a lot easier to catch that kind of mercury than the elemental mercury.

The lignite and sub-bituminous coals that are burned primarily in the western United States don't have a lot of chlorine. So the mercury is not converted in the burning process. Most of it is elemental mercury, which basically is not water soluble and tends to pass through a lot of control devices, because it doesn't attach to particles or wash out in rain. It tends to enter the global mercury pool and travel long distances. Eventually, it would settle out, but it takes quite some time. As I think was previously mentioned, we kind of contribute about 1 percent of the mercury pool.

So the divalent mercury is the stuff that is more likely to cause immediate concerns and local deposition. It is much easier to control divalent mercury from bituminous coal because it is upwards of 80 to 90 percent of the emissions.

Senator CARPER. All right. Thank you.

Mr. Scott, a question coming back to really the statements and the concerns voiced by Senator Voinovich, really. When you presented these requirements and the expectation that the utilities were going to have to dramatically cut their mercury emissions within a relatively few years, my understanding is that they did not react warmly to that suggestion.

Mr. SCOTT. That is correct.

Senator CARPER. In the end, I think I heard you say there was one utility that indicated that they could comply, and that subsequently others decided that they could as well. Talk a little bit about that process.

Then I am going to ask you to reflect on what these rules, what your rules in your State are going to do with respect to cost of electricity or the impact on consumers, shifting from coal to natural gas, because you have a lot of coal in your State, but just start off by the initial reaction of the utilities, the one that said we think we can do this, and how that snowballed from there.

Mr. SCOTT. It started off, as you accurately portrayed, with almost universal rejection by the power producing companies of our rule.

Senator CARPER. What did they say?

Mr. SCOTT. They were saying that they couldn't get to 90 percent. Not so much that it would be too expensive, although we heard some of those arguments, but more that the technology was not available for them to be able to reach 90 percent. So I had a meeting with all of the power companies in which I suggested to them that we were also interested in multi-pollutant solutions. If

one of them was so inclined, or any of them were so inclined, that we would be willing to work with them on that.

Shortly, again, after we presented our case in front of the Pollution Control Board, we were approached by Ameren, one of the companies in our State, and we subsequently were able to negotiate an agreement with them.

Again, I think the key for them is that while we believe that they can achieve those rates of 90 percent by 2009, you know, I may take heed of the statement that Senator Voinovich made in that he is correct. There are not a lot of companies that will guarantee that right now. So that certainty was very important for both Ameren and for the other companies.

So we negotiated in the multi-pollutant solution, giving them a little bit more flexibility, a little bit more time. They have to install all the equipment that we would recommend that we think will get them to 90 percent, but they don't necessarily have to hit that number until a later date. In exchange for that, they were willing to give us much greater reductions of SO_2 and NOx.

We don't believe that it is going to result in fuel switching to natural gas at all, in any of our discussions with any of these companies.

Senator CARPER. Is that a view that is shared by the companies themselves?

Mr. SCOTT. That was shared with us by the companies. In fact, one company, most of them don't burn Illinois coal, surprisingly enough. Most of them are burning western coal, to get back to Mr. Schanbacher's point, but not because of mercury. They don't burn Illinois coal because of the sulfur content in there. It is much more expensive to remove that. But actually, one of the companies told us that with a couple of their plants, they continue to burn Illinois coal as part of this agreement as well. So no real talk of fuel switching at all from any of the companies that were involved there.

Senator CARPER. All right. Is Illinois coal cheaper than western coal?

Mr. SCOTT. Actually, it is not necessarily cheaper. It is more expensive in many respects to burn because of the extra measures that have to be taken to remove the sulfur dioxide. It is our hope that with this and with lots of the equipment that is going to be installed as a result of the multi-pollutant solution, it is our hope that more of the plants will be able to actually burn Illinois coal because they are installing the equipment that will actually allow them to burn it and to still meet the requirements that we have set up with them.

Senator CARPER. So what I understand from you, you are saying initially the targets for the mandates, if you will, rejected, maybe with one exception by the utility companies. You entered into a dialogue and negotiation with them, and by sort of combining the approach with SOx, NOx, as well as with mercury, and showing some flexibility, you were able to eventually bring them on board. You don't think that there is going to be a shifting from coal to gas?

Mr. SCOTT. That is correct.

Senator CARPER. You don't see a significant spike in the cost of electricity?

Mr. SCOTT. The interesting thing about cost, with respect to mercury, we did model the mercury cost because we were doing that as part of our presentation for the rule in order to give weight and testimony behind the rule. We anticipated that that would be less than $1.50 a month for the average consumer in terms of the mercury equipment that was put on there. We think that is a very conservative measure.

With respect to the other equipment that is put on as part of the multi-pollutant solution, that is much more expensive equipment. There, you are talking about baghouses and scrubbers and other equipment that is much more expensive than the injection process to remove mercury. But we did not model those in terms of price because we weren't trying to approve the rule. We had agreement from the companies.

Obviously Illinois is a large power exporter as well, and so most of the power, at least by one of the companies that we negotiated with, is not going to end up in Illinois. It is going to be sold out of State, and they are competing with other States and other power companies to sell into the grid. They firmly believe that they are going to be able to do that economically. So that was the part of our discussion with them, but we didn't model those costs.

Senator CARPER. Great. Thanks.

Ms. Wolfe, we have time for another round. I am going to come back and ask you a question or two as well.

Senator Voinovich? Thank you.

Senator VOINOVICH. Both in Illinois and in New Jersey, you have done differently than what we have in the rule that came out from the EPA. Ms. Wolfe, in New Jersey, you require a 90 percent reduction in mercury emissions from powerplants by the end of this year. Is that right?

Ms. WOLFE. Correct.

Senator VOINOVICH. But the rule allows an additional 5 years of mercury emissions reductions or phase-in with concurrent reductions of particulate sulfur dioxide and nitrogen oxides. The question is: Isn't this very similar to what the EPA rule allows today? Can you quantify the differences? For example, what is the State's requirement for sulfur dioxides versus the Federal requirement, or for nitrogen oxide? I know these are kind of technical questions, but can you help me on that?

Ms. WOLFE. Yes. First of all, I would like to apologize on behalf of Commissioner Jackson for not being able to make it here today. She had an emergency with those wild fires down in South Jersey, so please accept my apology on her behalf.

Getting to your point about, is our rule different than the CAMR rule. I believe it is significantly different than the CAMR rule. The CAMR rule requires reductions of mercury of 20 percent by the year 2010. Our rule requires 90 percent by 2007, but for those facilities with 50 percent of their capacity have to meet that 90 percent reduction, and then for the remaining 50 percent, if they enter into an enforceable agreement with the State, they then get the additional 5 years to come up with the multi-pollutant controls. So they do have to control 50 percent of their capacity by 2007, the end of this year.

In terms of what the NOx and the SO_2 standards are, they are similarly based, I believe, on CAIR. Those standards are CAIR-based. We have had success with one of our facilities, actually, which has entered into a multi-pollutant agreement with us, PSE&G. I believe that their tests are currently achieving our mercury standards by meeting the multi-pollutant standards for SO_2 and NOx in particulates.

Senator VOINOVICH. Isn't the reason why, and I say the same thing in Illinois, they come back and say, look, the cost of putting in this technology for mercury is very expensive and uncertain; we would prefer to do NOx and SOx because we are much more confident of the equipment that is there that has been around for a while; we know we can really make a difference there; and as a result of that, you are going to get some real significant co-benefits in terms of the mercury; so overall, in terms of our costs to our customers, this is a more reasonable approach for us to take.

Ms. WOLFE. If I might just add, Senator Voinovich. We have had tremendous success in the solid waste incineration area, where we are requiring ACI, activated carbon injection, where we have had tremendous success at not such significant costs. We were told when we first adopted our regulations back in 1994 that garbage would be on the streets in Camden because we had such strict regulations. Instead, the technology seemed to follow the regulation, and we were able to have such controls.

We have upwards of 99 percent control on the municipal solid waste industry. We believe that that technology can be transferred and has been transferred to activated carbon injection at various levels, which is up to the facility. We gave the facilities 5 years in order to experiment with trying to figure out what the appropriate levels of carbon injection would be. We have had tremendous success, and we believe that that success at reasonable costs can be applied to the coal-fired power units.

Finally, I want to add that when we adopted our rules that set a 90 percent standard by the end of the year, none of our powerplants challenged our regulation as being technologically or economically unfeasible.

Senator VOINOVICH. Mr. Schanbacher, I would like you to comment on what you have just heard in terms of the state of the technology that is available for mercury.

Mr. SCHANBACHER. Well, I wouldn't compare waste incineration to coal-fired powerplants. I think there are significant differences. I wouldn't look at success there.

Activated carbon injection has been pretty successful with bituminous coal in controlling mercury emissions. I don't know about 90 percent, but I suppose it is possible. That is part of the issue with the different coal ranks, because activated carbon injection certainly has not proven to be effective on elemental mercury.

One of the things that is being experimented with is injecting chlorides or other halogens in with the activated carbon to try to convert the elemental mercury to divalent mercury so it can be more easily controlled. One of the points I tried to make earlier was if your capture rate is not 100 percent, you run the risk of taking, I don't want to say benign, but certainly a less urgent form of mercury, elemental mercury, and converting it into divalent. If you

don't control it, then you run the risk of actually have more deposition.

I do agree that eventually technology is going to catch up. It is possible it could happen on a faster basis than CAMR anticipates, but we don't know right now. Quite frankly, that is one of the reasons we in Texas always go back and look at the underlying risk to see how urgent it is. Given the extensive CDC data, corroborated by Texas data, we don't believe getting out ahead of it is in the best interests of the people.

Senator VOINOVICH. I am glad you do that because we are not allowed to do that on the Federal level.

Mr. SCHANBACHER. Right.

Senator VOINOVICH. We can do it with water, but we can't do it with air, according to the Supreme Court. So we don't do the cost benefit analysis, and then the last thing because we have to go over and vote, but it would be interesting to me to know what metrics New Jersey and Illinois have in place to really determine in the next 5 years whether or not this is really making a difference in terms of your water quality. Do you believe that 5 years from now, you are going to be able to remove the signs that say if you are pregnant, you ought not to eat this fish more than once a month, or whatever your particular advisory is.

I know when I was chairman of the Council of Great Lakes Governors, we always were debating, one State versus the other, because we had different rules about warning people about how much fish that they could eat, and also the different types of fish. But I would really be interested if there is any way you can find out whether or not all of what you are doing is really going to make a difference, particularly when you know that a lot of mercury is coming from other places.

Senator CARPER. Okay. Senator Voinovich, if it is okay with you, I think I am inclined to excuse this panel. We have three votes coming up. We should be back within about 40 minutes to go. I would say to our panelists, thank you, especially Ms. Wolfe for pinch-hitting. Mr. Schanbacher and Mr. Scott, thank you for being here to present to us. It was very informative.

We are going to be asking you some questions, probably some follow-up questions in writing. To the extent that you can respond to those promptly, we would be most grateful.

The subcommittee stands in recess until the completion of these votes. Thank you very much.

[Recess.]

Senator CARPER. I want to thank our panelists for sticking around, so we can hear from you and have a chance to ask you some questions. Senator Voinovich is coming back from the Floor. We have finished our last of three votes, at least for now. My hope is that we will be able to conclude this panel without further interruptions.

First of all, let me take a moment just to briefly introduce our witnesses, and ask them to go ahead and testify, not all at once, but in this order please. We will start with Martha Keating from the Nicholas School of the Environment and Earth Sciences down at Duke. Welcome. We are glad that you are here. I told Ms.

Keating that we share an interest in the name Martha. My wife's name is Martha and she is also from North Carolina.

And Guy Pipitone is here, the senior vice president of Operations, Strategy and Development at First Energy. Where do you live?

Mr. PIPITONE. In Akron, OH.

Senator CARPER. Akron, OH, home of the Zips. Good. All right. Well, welcome.

And David Foerter. He is executive director of the Institute of Clean Air Companies. It is good to see you again. Thanks for joining us today, David.

And Dr. Leonard Levin. Just like Carl Levin, Senator Carl Levin. Yes. He is from the Electric Power Research Institute. Welcome. We are happy that you are here today.

We will ask you to keep your testimony to around 5 minutes. If you get up over 15 minutes, I will probably gavel you down, so stay fairly close to 5 minutes. We would be grateful.

Ms. Keating, I don't know if there is anyone in the audience you would like to introduce, but I see a couple of guys back there that I think you brought along. We are glad they are here, too. Ms. Keating, you are recognized.

STATEMENT OF MARTHA HASTAY KEATING, ASSOCIATE IN RESEARCH, CHILDREN'S ENVIRONMENTAL HEALTH INITIATIVE, NICHOLAS SCHOOL OF THE ENVIRONMENT AND EARTH SCIENCES, DUKE UNIVERSITY

Ms. KEATING. Thank you, Mr. Chairman, and thank you for the occasion to address the subcommittee this morning.

Senator CARPER. Are they brothers, the two in the audience that I alluded to?

Ms. KEATING. My husband, Art Keating, is here with me today, as well as my son Tim. He is hoping to get some extra credit on civics.

[Laughter.]

Senator CARPER. Which is the husband?

Ms. KEATING. My sister, Mary Jane Medeiros.

Senator CARPER. All right. Good. This is a family affair. Welcome.

Ms. KEATING. Thank you again for the invitation. My name is Martha Keating. I am an associate in research with Duke University's Children's Environmental Health Initiative. However, my testimony today reflects only my views.

Humans are exposed to methylmercury almost exclusively from eating fish and shellfish. The primary source of this contamination is industrial mercury emissions, which ultimately deposit from the atmosphere to land in water, where they are converted by bacteria to methylmercury. Methylmercury readily bio-accumulates in the aquatic food chain to levels that make the fish unsafe for humans and wildlife to eat.

Forty-four States currently have fish consumption advisories for mercury contamination. According to EPA's latest estimates, coal-fired powerplants are responsible for more than 45 percent of the country's industrial mercury emissions. Children are the most vulnerable to mercury's effects, whether exposed in utero or as young

children, because methylmercury disrupts the developing brain. Mercury's effects may manifest in school age children as vision and hearing difficulties, delays in language acquisition and fine motor skills, lower IQ, and memory and attention deficits. These effects translate into a wide range of learning difficulties in the classroom.

There is also evidence that exposure to methylmercury can have adverse effects on the developing and adult cardiovascular system. Based on blood monitoring data collected by the Centers for Disease Control, an estimated 200,000 to 400,000 children born in the United States each year have been exposed to mercury levels in utero high enough to put them at risk of neurological effects.

To address powerplant mercury emissions, EPA developed the Clean Air Mercury Rule, or CAMR. However, CAMR is so legally suspect in its cap and trade approach that dozens of environmental groups and States have filed lawsuits, and so lenient in its emission caps and time frames that 22 States have developed programs that are more stringent.

Two investigations by EPA's Inspector General, one by the Government Accountability Office, and two reviews by the Congressional Research Service all have highlighted serious deficiencies in EPA's analyses. The fact that this subcommittee is holding this hearing 2 years after issuance of the final rule illustrates the degree to which EPA has failed in its mission.

A legislative approach integrating requirements for all of the major pollutants submitted by powerplants would address many of CAMR's shortcomings by incorporating the following for mercury: a stringent national cap, accompanied by a percent reduction requirement or efficiency-based emission rate at each boiler; the same emission rates for each coal type; time frames that are realistic, but tight enough to encourage technology development and innovation; regulatory flexibility in the form of averaging times and safe harbor provisions; and a national monitoring program and residual risk analysis.

Why not a cap and trade program for mercury? A cap and trade approach allows facilities to purchase mercury pollution credits, instead of reducing their emissions. The question, then, is whether a regulatory scheme that does not require all sources to reduce emissions will improve local hotspots or worsen them.

The Agency's argument that hotspots are unlikely to occur relies on computer modeling and prior experience with SO_2 trading. However, SO_2 emissions from powerplants are regulated by at least five other regulatory programs under the Clean Air Act, not just the trading program, but no such minimum standards exist as a backstop in the mercury cap and trade rule.

Further, EPA's computer modeling results are not supported by monitoring studies. A comprehensive study in Steubenville, OH and a 10-year study of hotspots in the Northeast measured mercury deposition at levels significantly higher than EPA's modeled estimates for the same areas. The bottom line is that mercury emissions from powerplants do affect local ecosystems and local hotspots.

And lastly, multi-year studies in Wisconsin, Florida and Massachusetts found that fish mercury levels decline rapidly in response to local reductions in mercury emissions, thus bolstering the case

for States to either impose more stringent mercury limits or for Congress to unify this patchwork of State laws with comprehensive legislation.

Thank you again for the opportunity to testify.

[The prepared statement of Ms. Keating follows:]

STATEMENT OF MARTHA HASTAY KEATING, ASSOCIATE IN RESEARCH, CHILDREN'S ENVIRONMENTAL HEALTH INITIATIVE, NICHOLAS SCHOOL OF THE ENVIRONMENT AND EARTH SCIENCES, DUKE UNIVERSITY

INTRODUCTION

Mr. Chairman and distinguished members of the Subcommittee—thank you for the invitation to address the Subcommittee this morning. My name is Martha Keating and I am an Associate in Research with Duke University's Children's Environmental Health Initiative. However, my testimony today reflects only my views. My interest in testifying stems from many years of working on mercury issues, first as an EPA scientist where I was the project director for the Agency's 1997 Report to Congress on Mercury. From 1998 until October of 2006, I was a scientific consultant to numerous environmental advocacy groups on mercury regulatory issues and represented these groups as a member of the EPA's Utility MACT Working Group. My comments this morning will address mercury health effects, the EPA's Clean Air Mercury rule, and my thoughts on federal legislation.

MERCURY AND FISH CONTAMINATION

Outside of occupational settings, methylmercury is the most toxic form of mercury to which humans are regularly exposed and methylmercury exposure is almost exclusively from eating fish and shellfish. The primary source of methylmercury in fish and shellfish is the atmosphere.

From the atmosphere, mercury is ultimately is deposited to land and water where it can be converted by bacteria to methylmercury, a form that is especially toxic to humans and wildlife. Fish absorb methylmercury from the water as it passes over their gills and as they feed on plants and other organisms. As larger fish eat contaminated prey, methylmercury concentrations increase in the bigger fish, a process known as bioaccumulation. The concentration of methylmercury in these fish can be up to 10 million times higher than the surrounding water and reach levels that make the fish unsafe for humans and wildlife to consume. Elevated levels of methylmercury in fish have prompted concerns about the public health hazards from methylmercury exposure. Despite the known nutritional and health benefits from eating fish, in 2004, public health agencies in 44 states issued fish consumption advisories warning citizens to limit how often they eat certain types of fish because the fish are contaminated with high levels of mercury.[1] According to EPA's latest estimates, coal-fired powerplants are responsible for more than 45 percent of the country's industrial mercury emissions.[2]

MERCURY EXPOSURE AND HEALTH EFFECTS

Methylmercury is a neurotoxin—a substance that damages, destroys, or impairs the functioning of nerve tissue. It poses the greatest hazard to the developing fetus. It passes easily through the placenta and impairs the development of the brain and nervous system. Prenatal methylmercury exposure from maternal consumption of fish can cause later neurodevelopmental effects in children.[3] Infants appear normal during the first few months of life, but later display subtle effects. These effects include poor performance on neurobehavioral tests, particularly on tests of attention, fine motor function, language, visual-spatial abilities (e.g., drawing) and memory. These children will likely have to struggle to keep up in school and might require remedial classes or special education.[4]

---

[1] *http://www.epa.gov/waterscience/fish/advisories/fs2004.html#synopsis*

[2] U.S. EPA, 2002 National Emissions Inventory. *http://www.epa.gov/ttn/chief/eiinformation.html*

[3] Committee on the Toxicological Effects of Methylmercury. Board on Environmental Studies and Toxicology. Commission on Life Sciences. National Research Council. Toxicological Effects of Methylmercury, 2000. National Academy Press. Online. Available: *http://www.nap.edu/books/0309071402/html/*

[4] Committee on the Toxicological Effects of Methylmercury. Board on Environmental Studies and Toxicology. Commission on Life Sciences. National Research Council. Toxicological Effects

Methylmercury exposure prior to pregnancy is as critical as exposure during pregnancy because methylmercury stays in the body for months and is slowly excreted. Many of the critical stages of brain and nervous system development occur during the first two months after conception and since many women do not know they are pregnant during that time, the fetus may be exposed to high levels of methylmercury. Because of the risk methylmercury poses to the developing fetus, women of childbearing age (i.e., 15 to 44 years of age) who might become pregnant and pregnant women are the most important members of the population in terms of mercury exposure.[5]

Infants and children are also at risk. Infants may ingest methylmercury from breast milk and children are exposed through their diet. Children and infants may be more sensitive to the effects of methylmercury because their nervous systems continue to develop until about age 16. Children also have higher methylmercury exposures than adults because a child eats more food relative to his or her body weight than an adult does. As a result, they have a higher risk for adverse health effects.[6]

Based on blood monitoring data collected by the National Health and Nutrition Examination Survey (administered by the Centers for Disease Control and Prevention), an estimated 200,000 to 400,000 children born in the United States each year have been exposed to mercury levels in utero high enough to put them at risk of neurological effects.[7]

What do these staggering numbers mean for childhood development, for our education system and for our society? Developmental and learning disabilities, including loss of IQ points, have negative impacts not only on individuals, but also have long-term consequences for the population and society as a whole.[8] Chemical contamination of the brain affects not only the educational attainment, economic performance and income of the individual, but it also has an impact on the performance of the economy as a whole by affecting society's potential production, rate of technical progress, and overall productivity.[9]

Lowered IQ has a documented relationship with economic outcomes such as lifetime earnings.[10] Even small decrements in IQ have been linked with lower wages and earnings. Two recent studies have attempted to calculate the societal cost of methylmercury exposure in the U.S. and the related economic benefits of reducing such exposure. The Center for Children's Health and the Environment at the Mt. Sinai School of Medicine concluded that exposure to methylmercury causes lifelong loss of intelligence in hundreds of thousands of American babies born each year. This loss of intelligence exacts a significant economic cost to American society—a cost that they estimate to be in the hundreds of million dollars each year.[11]

In a different study, the Northeast States for Coordinated Air Use Management (NESCAUM) in collaboration with the Harvard School of Public Health quantified how decreasing mercury emissions from coal-fired powerplants would result in less methylmercury exposure and consequently, IQ point gains for the population of children born each year.[12] According to this study, a 70 percent decrease in coal-fired powerplant mercury emissions by 2018 would result in benefits to society of between $119 million to $288 million every year. Consequently, a reduction in emissions of

---

of Methylmercury, 2000. National Academy Press. Online. Available: *http://www.nap.edu/books/0309071402/html/*

[5] U.S. EPA, 1997b. Mercury Study Report to Congress, Volume VII: Characterization of Human and Wildlife Risks from Mercury Exposure in the United States. EPA–452/R–97–009

[6] U.S. EPA, 1997b. Mercury Study Report to Congress, Volume VII: Characterization of Human and Wildlife Risks from Mercury Exposure in the United States. EPA–452/R–97–009

[7] Hightower, J.M., A. O'Hare, G.T. Hernandez, 2006. Blood mercury reporting in NHANES: Identifying Asian, Pacific Islander, Native American, and multiracial groups. Environmental Health Perspectives, Volume 114, Number 2, February.

[8] Muir, T. and M. Zegarac, 2001. Societal costs of exposure to toxic substances: economic and health costs of four case studies that are candidates for environmental causation. Envr. Health Perspect. Volume 109, Sup. 6, pp. 885–903. December.

[9] Muir, T. and M. Zegarac, 2001. Societal costs of exposure to toxic substances: economic and health costs of four case studies that are candidates for environmental causation. Envr. Health Perspect. Volume 109, Sup. 6, pp. 885–903. December.

[10] Muir, T. and M. Zegarac, 2001. Societal costs of exposure to toxic substances: economic and health costs of four case studies that are candidates for environmental causation. Envr. Health Perspect. Volume 109, Sup. 6, pp. 885–903. December.

[11] Trasande, L., P. Landrigan and C. Schechter, 2005. Public health and economic consequences of methylmercury toxicity to the developing brain. Environ Health Perspect: doi:10.1289/ehp.7743. [Online 28 February 2005] *http://ehp.niehs.nih.gov/docs/2005/7743/abstract.html*

[12] Northeast States for Coordinated Air Use Management. Economic valuation of human health benefits of controlling mercury emissions from U.S. coal-fired powerplants. February, 2005.

more than 70 percent would result in even greater benefits. Extrapolating these results, a 90 percent reduction in emissions would result in benefits to society worth more than $370 million per year.

Effects on IQ however, may be just the tip of the iceberg[13]. A lower IQ may be the easiest to quantify and put a dollar value on, but this effect may not be the most serious in terms of life and career outcomes. Toxicants like methylmercury that affect the nervous system, alter a person's ability to plan, organize, and initiate ideas and which may induce problems with attention, distractibility, impulsive behavior and inability to handle stress and disappointments. These effects could be far more serious with respect to success in school and life.[14]

There is also evidence in humans and animals that exposure to methylmercury can have adverse effects on the developing and adult cardiovascular system, blood pressure regulation, heart-rate variability, and heart disease.[15] The benefit of reducing these adverse health outcomes has been estimated to be in the billions of dollars.[16]

EPA'S CLEAN AIR MERCURY RULE

It was public health impacts that concerned Congress when in the 1990 amendments to the Clean Air Act EPA was directed to investigate mercury and other hazardous air pollutant emissions from coal-fired utility plants, and to determine whether regulation of these pollutants was appropriate and necessary. As you know, EPA has since "revised" its positive regulatory finding, removed coal-fired utility boilers from the list of source categories that emit hazardous air pollutants, and finalized a cap and trade rule. The paper trail in the docket for this rule revealed:

- EPA's verbatim use of language from industry memoranda in numerous sections of the Federal Register notice to justify regulatory decisions,
- the emission limits in the rule were pre-selected by EPA management to mirror the caps in President Bush's Clear Skies Initiative, and
- EPA's models estimated that only a 50 percent reduction in emissions would occur by 2020, not a 70 percent reduction by 2018 as claimed by the Agency.

Two reports by EPA's Inspector General concluded that EPA's regulatory process was "compromised", there was a lack of transparency in the regulatory process, and that EPA did not fully analyze the rule's impacts on children's health.[17] The IG also found that the EPA did not fully address the potential for hotspots and has no plan in place to monitor for such hotspots.[18] A report by the Government Accountability Office highlighted serious deficiencies in EPA's cost-benefit analysis of mercury control options.[19] The Congressional Research Service questioned why the proposed rule was not more stringent given that the benefits of the rule far outweighed the costs[20], and in a follow-up report wondered exactly what EPA's estimated control costs even represent given that so few mercury control installations were predicted.[21]

Two years have already passed since EPA finalized the Clean Air Mercury Rule. However, CAMR is so legally suspect in its cap and trade approach that dozens of environmental groups and states have filed lawsuits, and so lenient in its emission caps and timeframes that 22 states have developed programs that are more stringent. This patchwork approach is the wrong one for a national problem, especially for a pollutant where emissions from one state may affect citizens in other states.

---

[13] Axelrad, D.A., D.C. Bellinger, L.M. Ryan, and T.J. Woodruff, 2007. Dose-response relationship of prenatal mercury exposure and IQ: An integrative analysis of epidemiologic data. Environ Health Perspect.; 115(4): 609–615.

[14] Muir, T. and M. Zegarac, 2001. Societal costs of exposure to toxic substances: economic and health costs of four case studies that are candidates for environmental causation. Envr. Health Perspect. Volume 109, Sup. 6, pp. 885–903. December.

[15] U.S. EPA, 1997b. Mercury Study Report to Congress, Volume VII: Characterization of Human and Wildlife Risks from Mercury Exposure in the United States. EPA–452/R–97–009.

[16] Northeast States for Coordinated Air Use Management. Economic valuation of human health benefits of controlling mercury emissions from U.S. coal-fired powerplants. February, 2005.

[17] U.S. EPA, 2005. Office of Inspector General. Additional analyses of mercury emissions needed before EPA finalizes rules for coal-fired electric utilities. 2005–P–00003, February 3, 2005.

[18] U.S. EPA, 2006. Office of Inspector General. Monitoring needed to assess impact of EPA's Clean Air Mercury Rule on potential hotspots. 2006–P–00025, May 15, 2006.

[19] U.S. Government Accountability Office, 2005. Observations on EPA's cost-benefit analysis of its mercury control options. GAO–05–252. www.gao.gov/cgi-bin/getrpt?GAO–05–252.

[20] Congressional Research Service, 2005. Mercury emissions from electric generating units: A review of EPA analysis and MACT determination. CRS Report RL 32744, January 21, 2005.

[21] Congressional Research Service, 2006. Mercury emissions from electric powerplants: An analysis of EPA's cap-and-trade regulations. CRS Report RL 32868, January 13, 2006.

The fact that the Subcommittee is holding this hearing illustrates the degree to which EPA has failed in its mission.

A LEGISLATIVE SOLUTION

A legislative approach that integrates requirements for all of the major pollutants emitted by powerplants would address many of the shortcomings of CAMR rule by including the following requirements for mercury:

- A stringent national cap accompanied by a percent reduction requirement or efficiency-based emission rate at each boiler.
- The same emission rates for all coal types, not more lenient standards for our nation's most polluting coals.
- Timeframes that are realistic, but tight enough to encourage technology development and innovation, not a wait-and-see attitude.
- Regulatory flexibility in the form of averaging times and safe harbor provisions.
- A requirement for EPA to assess the effectiveness of the standard both through a national monitoring program and residual risk analysis.

HOTSPOTS AND CAP-AND-TRADE

Why not a cap and trade program for mercury? First, let's set aside questions of whether a cap and trade program for mercury is legal under the Clean Air Act, or whether such a program is prudent public health policy for a persistent, bioaccumulative neurotoxicant. A concern with this approach is that some facilities will not reduce their mercury emissions, preferring instead to purchase mercury pollution credits. Thus, emissions at a given facility might stay the same or even increase. The public health and environmental question then is whether mercury hotspots (areas of high mercury deposition, or water quality parameters that favor mercury methylation and high levels of mercury in biota) exist today, and whether a regulatory scheme that does not require all sources to reduce emissions will improve these areas or worsen them.

The Agency's argument that hotspots are unlikely to occur relies on prior experience under the Clean Air Act's sulfur dioxide trading in the Acid Rain program. However, the Clean Air Mercury Rule is not comparable to the Acid Rain program. Sulfur dioxide emissions from powerplants are regulated by at least 5 other regulatory programs under the Clean Air Act, not the trading program alone (for example, National Ambient Air Quality Standards, New Source Review, New Source Performance Standards, Prevention of Significant Deterioration, and haze rules). No such minimum standards exist as a back-stop in the mercury cap-and-trade rule.

The EPA also relies on the results of a computer model that predicts that much of the mercury emitted from a given facility disperses into the atmosphere and does not deposit in the local vicinity, thus there is no risk of hotspots either occurring or becoming worse. However, EPA's computer modeling results are not supported by monitoring results. A comprehensive multi-year EPA-funded study in Steubenville, Ohio measured the amount of local deposition that can be attributed to local coal-burning sources. Contrary to EPA's results that most mercury deposition in the U.S. is from global sources, not local sources, the Steubenville study found that in an area dominated by coal-fired powerplants, 70 percent of the mercury deposition could be attributed (by taking measurements, not by computer modeling) to local sources.[22] These findings are particularly significant because not only do these findings contradict the computer modeling EPA used in developing the Clean Air Mercury Rule,[23] they highlight the potential for reducing local and regional mercury deposition by controlling local sources.

Further, in a just completed 10-year study of hotspots in the northeastern U.S. and southern Canada, researchers found numerous instances of wildlife with blood mercury levels high enough to be poisonous and one hotspot in New Hampshire, downwind of several coal-fired powerplants with mercury deposition five times higher than EPA's modeled estimates for the same area.[24] Given the extent of mercury fish contamination across the country, we can reasonably assume that other such deposition hotspots exist. Therefore, the nation as a whole will not benefit from a cap and trade rule that reduces mercury emissions in some locations, but not all.

---

[22] Keeler, G.J., M.S. Landis, G.A. Norris, E.M. Christianson and J.T. Dvonch, 2006. Sources of mercury wet deposition in Eastern Ohio, USA. Environ, Sci, Tech, 40, 5874–5881.

[23] U.S. EPA, 2005. Technical Support Document for the Final Clean Air Mercury Rule: Air Quality Modeling. Downloaded from: *http://www.epa.gov/ttn/atw/utility/aqm—oar–2002–0056–6130.pdf*

[24] Evers, D. and Charles Driscoll. "The Danger Downwind", New York Times, Op-Ed, April 26, 2007.

Addressing the question of how fish concentrations respond to reductions in mercury emissions and deposition are multiyear studies in Wisconsin, Florida, and Massachusetts. These field studies correlated control of local emission sources with decreases in mercury deposition and subsequent reductions in fish mercury concentrations. Notably, in each case, the reductions in fish tissue concentrations were far greater and occurred much faster than scientists thought the reductions would occur. In fact, research now shows that newly deposited mercury is more reactive in the environment than previously deposited mercury. Thus, aquatic systems can respond rapidly to changes (e.g., decreases) in mercury deposition.[25, 26] In Wisconsin, researchers found that changes in atmospheric mercury deposition had rapid effects on fish mercury concentrations.[27] A 10 percent decline in mercury deposition correlated with a 5 percent decline in fish mercury concentration over a period of 1 year. Researchers measured a 30 percent decline in fish mercury concentration over a 6-year period.

In South Florida, local mercury emission rates from waste incinerators decreased by more than 90 percent since peaking in the late 1980s and early 1990s as a result of pollution prevention and the issuance of stringent State emission limits. As a result, mercury in the fish and wildlife of the Everglades has declined by more than 75 percent since the mid-1990's—a recovery that the researchers called "remarkable" (for both the extent of the recovery and how quickly it occurred).[28] From the time emissions started to decrease, it took from 6 to 36 months before decreases in largemouth bass mercury concentrations were detected.

While industry critics claim that the results in South Florida are not applicable to other parts of the U.S. because of the unique attributes of the Everglades system, these results have been duplicated in Massachusetts as well. In February 2006, the Commonwealth of Massachusetts released the findings from the first 5 years of a multi-year monitoring effort designed to gauge the effectiveness of mercury pollution controls in reducing fish mercury concentrations in local lakes.[29] The study found that declines in fish mercury concentrations correlated with the decline in mercury emissions after the installation of mercury controls on incinerators in Northeastern Massachusetts. The most significant decline in fish mercury concentrations (a decrease of about 47 percent from 1999 to 2004) occurred where numerous local point sources either ceased operation or achieved substantial reductions in mercury emissions.

These studies indicate that fish mercury levels may respond rapidly to changes in mercury deposition, thus bolstering the case for either States to impose more stringent mercury limits on a tighter timeframe than the more lenient federal Clean Air Mercury Rule, or for Congress to unify this patchwork of state laws with comprehensive powerplant air pollution legislation.

Thank you again for the opportunity to testify.

Responses from Martha H. Keating to Additional Questions from Senator Sanders

Question 1. The Bush administration argues that one of the reasons it has not been as aggressive on regulating domestic sources of mercury is because a large portion of the mercury in the U.S. originates from global sources. What, if anything, has the Bush administration done in the international arena to help or hinder reductions in global sources of mercury?

Response. First, I would like to address the Bush administration's argument about the contribution of global sources to mercury deposition in the U.S. Scientists agree that mercury deposition in any one location is a function of mercury emissions from local, regional, and global sources. However, the influence of any one source type (i.e., local, regional or global) varies widely by location. In particular, domestic

---

[25] Hintellmann, H., et al. 2002. Reactivity and Mobility of New and Old Mercury Deposition in a Boreal Forest Ecosystem during the First Year of the METAALICUS Study. Environmental Science & Technology 36(23):5034–40.

[26] Bariarz, C.L., et al. 2003. A Hypolimnetic Mass Balance of Mercury From a Dimictic Lake: Results from the METAALICUS Project. Journal De Physique IV 107:83–6.

[27] Hrabik, T.R. and C.J. Watras, 2002. Recent declines in mercury concentration in a freshwater fishery: isolating the effects of de-acidification and decreased mercury deposition in Little Rock Lake. The Science of the Total Environment, 2002.

[28] Florida Department of Environmental Protection, 2003. Integrating atmospheric mercury deposition and aquatic cycling in the Florida Everglades: An approach for conducting a Total Maximum Daily Load analysis for an atmospherically derived pollutant. Integrated Summary: Final Report. October.

[29] Massachusetts Department of Environmental Protection, 2006. Massachusetts Fish Mercury Monitoring Studies: Long-Term Monitoring Results, 1999–2004. *http://www.mass.gov/dep/toxics/stypes/hgres.htm#monitoring*

mercury sources have been shown to significantly affect numerous regions in the country.

• One study estimated that sources within North America contributed more than 60 percent of the mercury deposition to sections of the northeastern U.S., with northeastern New Jersey estimated to receive over 80 percent of its mercury deposition from North American sources.[1]

• Detailed modeling found that approximately one half to two thirds of the mercury deposited to the Great Lakes is emitted by sources within the U.S.[2] For Lake Erie and Lake Ontario, over half of the deposition was estimated to originate from sources closer than 1,000 kilometers from each lake.

• A comprehensive multi-year EPA-funded study in Steubenville, Ohio measured the amount of local deposition that can be attributed to local coal-burning sources. The Steubenville study found that in an area dominated by coal-fired powerplants, 70 percent of the mercury deposition could be attributed (by taking measurements, not by computer modeling) to local sources.[3]

In a just completed 10-year study of hotspots in the northeastern U.S. and southern Canada, researchers found numerous instances of wildlife with blood mercury levels high enough to be poisonous and one hotspot in New Hampshire, downwind of several coal-fired powerplants with mercury deposition five times higher than EPA's modeled estimates for the same area.[4]

These and other studies[5], [6] indicate that, in general, regions in the U.S. with the highest mercury deposition are the same regions where local and regional sources make significant contributions to the total mercury load.

Thus, U.S. emissions are responsible for a significant part (or, in some areas, an overwhelming part) of the U.S. deposition problem.

Given the Administration's position that it is largely global sources of mercury that are impacting the U.S., one would be inclined to think that the Administration would be fully supportive of binding international agreements that would require reductions in mercury emissions worldwide. Unfortunately, this has not been the case. The Administration has consistently argued against any agreements to reduce emissions if the agreement included binding targets.

The U.S. Government has focused its work on global mercury largely through participation in UNEP (United Nations Environment Program) deliberations. UNEP has made mercury a priority since it issued a Global Mercury Assessment in 2003. Unfortunately, our government's participation has not been constructive; to the contrary, it has opposed efforts by the European Union, Norway and Switzerland, and other countries to develop a coordination global mercury reduction plan. It has vehemently resisted development of a binding treaty like the Persistent Organic Pollutants (POPs) treaty to reduce the use of this toxic metal. It has even resisted the development of quantitative reduction goals (aspirational goals) to guide activities around the world.

EPA and the State Department have promoted voluntary partnerships as the sole mechanism to achieve mercury reduction goals. Although there is nothing wrong with voluntary initiatives per se, they need to be designed carefully and quite deliberately in order to achieve any progress. Partnerships to date have been the opposite; there are no quantitative reduction goals, no identification of key affected parties for membership, or any other measures that would measure progress. UNEP has recently renewed efforts to revitalize these partnerships with the hope that they may someday contribute to actual mercury reductions, but this optimism is surely a triumph of hope over experience; to date the performance of these partnerships has been dismal.

Most recently, EPA has taken a stand on legislation introduced in both the House of Representatives and the Senate to ban the export of surplus mercury into com-

---

[1] Seigneur, Christian, K. Vijayaraghavan, K. Lohman, P. Karamachandani, and C. Scott, 2004, Global source attribution for mercury deposition in the United States, Environ. Sci. Technol., 38, 555–569.

[2] Cohen, Mark, R. Artz, R. Draxler, P. Miller, L. Poissant, D. Niemi, D. Ratte, M. Deslauriers, R. Duval, R. Laurin, J. Slotnick, T. Nettesheim, and J. McDonald, 2004, in press, Modeling the atmospheric transport and deposition of mercury to the Great Lakes, Environmental Research.

[3] Keeler, G.J., M.S. Landis, G.A. Norris, E.M. Christianson and J.T. Dvonch, 2006. Sources of mercury wet deposition in Eastern Ohio, USA. Environ, Sci, Tech, 40, 5874–5881.

[4] Evers, D. and Charles Driscoll. "The Danger Downwind", New York Times, Op-Ed, April 26, 2007.

[5] Bullock, O. R., K. A. Brehme, and G. R. Mapp, 1998, Sci. Total Environ., 213,1. Dvonch, J., J. Graney, G. Keeler, and R. Stevens, 1999, Use of elemental tracers to source apportion mercury in South Florida precipitation, Environ. Sci. Technol, 33, 4522–4527.

[6] Florida Department of Environmental Protection, 2003, *http://www.dep.state.fl.us/secretary/news/2003/nov/pdf/mercury—report.pdf*

merce. This initiative is quite similar to an initiative in the European Union and is widely considered one of the most important things that industrialized nations can do to reduce mercury use in global commerce. EPA did not strongly oppose the bill, but chose to focus on a series of hypothetical problems that the legislation could inadvertently trigger. The bottom line of the EPA testimony was that we should focus on reducing demand instead of supply, a position that was contradicted by both ECOS (Environmental Council of State Governments) and the national environmental community who testified at the same hearing. It is also a position that contradicts the recent UNEP declaration on mercury, which called for reductions of both supply and demand at the same time in order to reduce mercury use and pollution.

Question 2. EPA declared in it final mercury rules for powerplants that it was not only "unnecessary" but also "inappropriate" to regulate mercury emissions from powerplants under the Clean Air Act's stringent air toxics provisions in section 112. Hasn't EPA long regulated mercury from other types of industries, however, under this same stringent Clean Air Act authority? And, if so, what has the experience been there? Does it make sense to you that it is appropriate to regulate mercury emissions from some types of industries using the law's most protective tools, but "inappropriate" to do so when it comes to powerplants?

Response. Section 112(d) of the 1990 Clean Air Act amendments requires the application of Maximum Achievable Control Technology (MACT) to major sources of hazardous air pollutants. Congress provided the list of hazardous air pollutants (which includes mercury and compounds) and EPA devised the list of major source categories. (EPA added coal-fired electric steam generating units to the source category list in December 2000, and then summarily de-listed them in March 2005 under the Clean Air Mercury Rule.) Had EPA adhered to the mandates of section 112(d) since 1990, there would be numerous success stories to report. However, the Agency has been only partially successful in reducing mercury emissions using the authority of this section. For example, the Agency did issue substantive MACT standards limiting mercury emissions from hazardous waster incinerators (a source category that includes commercial and onsite incinerators, cement kilns burning hazardous waste, lightweight aggregate kilns, and boilers). On the other hand, EPA's MACT standard for cement kilns not burning hazardous waste took the position that maximum achievable control technology was "no control"—an approach that has since been rejected by the courts. The MACT standard for industrial, commercial, and institutional boilers results in a paltry 17 percent reduction in mercury emissions. Overall, the Agency's record under section 112(d) is mixed.

The Agency's true success stories in regulating mercury emissions are the standards for medical waste incinerators and municipal waste combustors. Each of these rules required about a 90 percent reduction in mercury emissions, and in practice, far higher reductions have been achieved. While these standards were issued under section 129 of the 1990 amendments, it is noteworthy that the statutory language of CAA section 129 is identical to the MACT requirements of section 112(d).

The success of these standards in reducing mercury emissions can largely be attributed to the use of activated carbon injection at these sources. Numerous opponents of stringent regulations for coal-fired powerplants consistently point out that mercury control at waste combustors are so efficient because these units can operate at lower temperatures, have a smaller volume of stack gas to treat, and have higher a higher chlorine content in the waste than is present in the coal. All of these factors contribute to high capture rates of mercury in waste combustor stack emissions. I agree with each of these points. This does not mean however that the same technology cannot achieve equivalent capture rates at coal-fired powerplants. The emissions data from full-scale tests of the latest technologies (including halogenated carbon and other advancements) continue to demonstrate that mercury can be reduced efficiently and affordably at powerplants.

EPA had the same concerns about the reliability and efficiency of technology when the municipal waste combustor rule was developed. In fact, the Agency had test data from only two combustor facilities, compared to the dozens that are available today for coal-fired powerplants. To address this uncertainty, EPA included a safe harbor provision in the combustor rules that allowed for a different emission limit if the technology did not perform as designed. A similar approach could certainly be taken for coal-fired powerplants. To date, not a single medical waste incinerator or municipal waste combustor has needed the safe harbor provision.

Finally, as I submitted previously, I believe that the cap and trade approach for regulating mercury emissions from coal-fired powerplants is inappropriate. A multipollutant legislation that includes a stringent national cap with emission limits at each boiler, a reasonable timeframe, and regulatory flexibility in the form of a safe

harbor provision, would address the many shortcomings in EPA's Clean Air Mercury Rule.

Senator CARPER. Ms. Keating, thank you so much.

Mr. Pipitone, welcome.

Senator Voinovich, this fellow is from Akron, OH.

STATEMENT OF GUY L. PIPITONE, SENIOR VICE PRESIDENT OF OPERATIONS, STRATEGY, AND DEVELOPMENT, FIRSTENERGY CORPORATION

Mr. PIPITONE. Thank you, Mr. Chairman, Senator Voinovich. My name is Guy Pipitone. I am senior vice president, Operations, Strategy and Development for the FirstEnergy Corporation, which is headquartered in Akron, OH. We are a diversified energy company.

I have been with the company for more than 30 years, the majority of that time spent on the powerplant side of our operations. We believe that one of the promising mercury removal technologies out there is electro-catalytic oxidation, or we refer to it as ECO for short. It is a multi-pollutant removal process that has been developed by a New Hampshire-based energy company, a technology company named Powerspan. FirstEnergy has a 25 percent interest in Powerspan, and I have served on Powerspan's board of directors since 1998.

Another major supporter of the ECO process has been the Ohio Coal Development Office. They have contributed $5.5 million towards the development of this technology.

Powerspan has been operating in an ECO commercial demonstration unit at FirstEnergy's R.E. Burger Plant, which is located on the Ohio River near Shadyside, OH. That plant has been operating for 3 years now. ECO has proven to be effective in reducing sulfur dioxide, mercury, fine particulate, and nitrogen oxides. We have ordered a 325 megawatt ECO unit for installation on our system, and it is scheduled for startup in the first quarter of 2011.

The ECO process works by sending an electrical charge into a proprietary reactor, and this reactor oxidizes the pollutants, including mercury. Next an ammonia-based scrubber is used to capture the oxidized gaseous pollutants. The byproduct from the ECO process passes through a highly efficient carbon filter to remove most of the remaining mercury before it is crystallized into ammonium sulfate fertilizer, which is a very marketable byproduct.

Our test results over these past 3 years have shown ECO's mercury removal rate to average about 83 percent. However, with additional design refinements, a 90 percent removal rate may be achievable. By comparison, at our Bruce Mansfield Plant in Pennsylvania, about 85 percent of the mercury is removed by the combination of our SCR and scrubber systems that are installed there.

Since Powerspan's ECO unit began operating at Burger in 2004, a number of coals and coal blends have been tested. The fuels ranged from 100 percent high sulfur eastern bituminous coal, to 80 percent Powder River Basin with a 20 percent eastern coal blend. The testing indicates that as long as the coal blend is 20 percent or more of eastern bituminous fuel, over 80 percent of the mercury will be removed.

We haven't done testing at the plant with 100 percent Powder River Basin, but Powerspan's laboratory testing of the western fuels at 100 percent show that about 50 percent to 65 percent of the mercury is removed for 100 percent Powder River Basin.

While we are long time supporters of ECO, we know that it has its limitations, as do all of the current pollution control technologies that are out there.

Along with the ECO process, Powerspan is developing an exciting carbon capture process, and it is referred to as ECO_2. The pilot of this system will be installed at our R.E. Burger Plant and the goal of this first of a kind project is to capture powerplant-generated carbon dioxide, transport it to an 8,000 foot deep well that has just been drilled, and then sequester that carbon dioxide underground. These activities are part of FirstEnergy's participation in the multi-year regional carbon sequestration research program that is sponsored by the United States Department of Energy.

The ECO_2 pilot program is scheduled to begin by either the end of this year, just 7 months or so from now, or in the first quarter of 2008. So this is near term. It may be the first such program in the world to demonstrate both CO_2 capture and sequestration at one conventional coal-fired powerplant.

I will conclude my remarks by saying that we have determined that ECO is a viable alternative compared with other technologies.

I thank you for the opportunity to talk about FirstEnergy's effort in this area.

[The prepared statement of Mr. Pipitone follows:]

STATEMENT OF GUY L. PIPITONE, SENIOR VICE PRESIDENT, OPERATIONS STRATEGY AND DEVELOPMENT, FIRSTENERGY CORP.

Good morning Mr. Chairman and committee members. My name is Guy Pipitone and I am the Senior Vice President, Operations Strategy & Development for FirstEnergy, which is a diversified energy company headquartered in Akron, Ohio.

I have been with the company for more than 30 years, with the majority of my career spent on the powerplant side of our operations. I appreciate the opportunity to testify before this subcommittee regarding the current state of mercury technology here in the United States.

We believe that one promising mercury removal technology is the Electro-Catalytic Oxidation, or ECO technology, a multi-pollutant control system developed by Powerspan, a New Hampshire-based energy technology company. FirstEnergy has a 25-percent ownership interest in Powerspan, and I have served on its board of directors since 1998.

Another major supporter of ECO has been the Ohio Coal Development Office, a program of the Ohio Air Quality Development Authority. It has contributed more than $5.5 million to the project.

Powerspan has been operating an ECO demonstration system for the past three years at FirstEnergy's R.E. Burger Plant, located along the Ohio River near Shadyside, Ohio. Through this demonstration, ECO has proven to be effective in reducing SO_2, mercury, acid gases, fine particulate matter, and nitrogen oxides.

The process works by sending an electrical charge into the proprietary ECO reactor that oxidizes pollutants, including mercury. Next, an ammonia scrubber is used to capture the oxidized gaseous pollutants and SO_2. The byproduct from the ECO process then passes through a highly efficient carbon filter to remove all of the mercury before it is crystallized into ammonium sulfate fertilizer, which is a marketable end product. Annually, this filter, with the captured mercury, has to be sent to a permitted hazardous waste facility. This is ECO's only waste. In other words, this process creates a useful fertilizer rather than more landfills.

Test results have shown ECO's mercury removal rate to average about 83 percent. However, with additional design and engineering refinements, a 90-percent removal rate may be achievable. By comparison, FirstEnergy's Bruce Mansfield Plant in Shippingport, Pennsylvania was one of the first powerplants in the world to be built

with scrubbers as original equipment. Our testing indicates that about 85 percent of the mercury is removed by its selective catalytic reduction and scrubber systems.

Since the ECO unit began operating at Burger in 2004, a number of coals and coal blends have been burned in the units supplying the flue gas to the ECO unit. The fuels ranged from 100-percent high-sulfur eastern bituminous coal, to blends with up to 80-percent low-sulfur Powder River Basin western coal.

The testing indicates that as long as some eastern coal is included in the mix, the mercury will be oxidized and can be mostly removed by ECO. Laboratory testing also shows that burning 100-percent Powder River Basin coal only nets about a 50- to 65-percent mercury removal rate through ECO. This is probably because western coal has a high percentage of elemental mercury and is low in chlorine. It is chlorine that combines with the elemental mercury to produce an oxidized form that is easier to remove in the ECO process.

Throughout the testing process, the Electric Power Research Institute has monitored ECO's results. This includes testing of pollutant removal, audits of analyzer readings, fertilizer sampling, and a reliability study, which concluded that ECO is as reliable as a conventional wet flue gas scrubber system.

While we are long-time supporters of ECO, we know that it has its limitations, as do all pollution control technologies. For example, some powerplants might not have the physical space to accommodate an ECO unit and its associated fertilizer plant.

Along with ECO's multi-pollutant removal capabilities, Powerspan also is developing a carbon capture process—known as ECO_2—that can be added to the existing ECO unit. The goal of this first-of-a-kind project is to capture powerplant CO_2, transport it to an 8,000-foot test well that was drilled at the Burger Plant earlier this year, and then sequester it underground. These activities are part of FirstEnergy's participation in a multi-year regional carbon sequestration research program sponsored by the U.S. Department of Energy to determine if CO_2 can be stored deep underground in suitable rock formations.

The ECO_2 pilot program is scheduled to begin by the end of this year, or early 2008. The projects will provide an opportunity to test an integrated CO_2 capture, handling and transportation, and injection system at our Burger Plant, which may be the first to demonstrate both CO_2 capture and sequestration at a conventional coal-fired powerplant.

These all are issues I am sure this committee will debate and discuss at length. I will conclude my remarks by saying we have determined ECO to be a viable alternative compared with other technologies.

Thank you for the opportunity to talk about FirstEnergy's experience with ECO. I'd be pleased to answer your questions at this time.

POWERSPAN ECO_2 TECHNOLOGY UPDATE

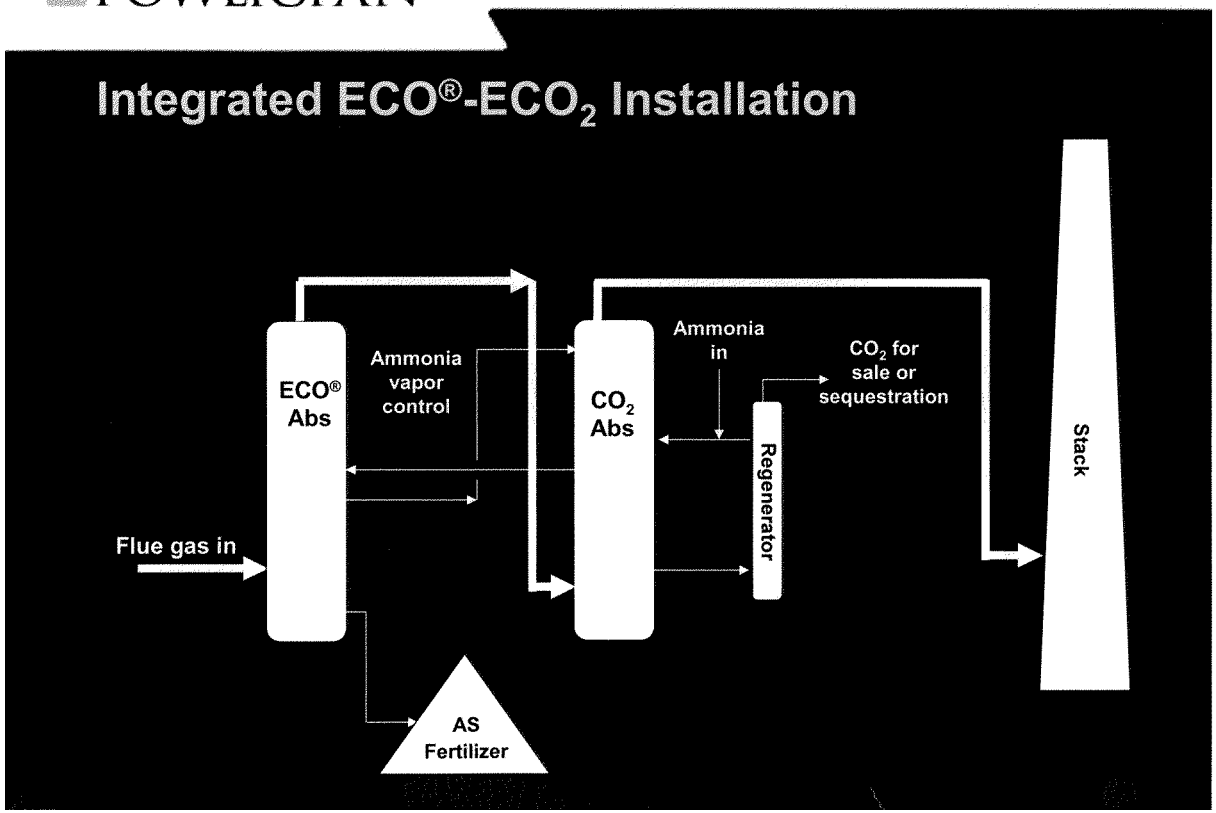
Powerspan has been working to develop the ECO_2 CO_2 capture process in its New Hampshire laboratory. The ECO_2 process is designed to work in conjunction with the ECO multi-pollutant control process. After the incoming flue gas has nearly all of the SO_2, NOx, mercury and the particulate removed in the ECO_2 system, it is sent to the ECO_2 absorber vessel. ECO_2 uses an ammonium carbonate reagent absorber and regenerator system to capture CO_2 in the powerplant flue gas stream, strip off the CO_2 for final cleanup, compress and sell or sequester the CO_2 and send the reagent back into the ECO system. No additional reagent is used in ECO_2 than is already used in the ECO system.

Laboratory results have shown that ECO_2 can capture up to 90 percent CO_2 in the flue gas stream. Measurement techniques have been developed to confirm these results. The process is continuing to be refined to develop design information for a 1 MW ECO_2 pilot unit at FirstEnergy's Burger Power Station, where a 30 MW demonstration of the ECO system has been in operation for about 3 years. The ECO pilot is scheduled to be added by the end of 2007, or early 2008. It is scheduled to operate at least through 2008, capturing approximately 20 tons per day of CO_2.

The captured CO_2 is to be permanently sequestered in an on-site well recently drilled to a 8,000-foot depth at the Burger Power Station as part of the Midwest Regional Carbon Sequestration Project. This may be the first project to capture and sequester powerplant CO_2 in the world.

POWERSPAN

Integrated ECO®-ECO_2 Installation



Senator CARPER. Mr. Pipitone, thank you for sharing all that you are doing there. We look forward to asking you some questions about that to follow up.

All right. Mr. Foerter, welcome.

STATEMENT OF DAVID C. FOERTER, EXECUTIVE DIRECTOR, INSTITUTE OF CLEAN AIR COMPANIES

Mr. FOERTER. Good morning. My name is David Foerter. I am the executive director for the Institute of Clean Air Companies. ICAC is a national trade association of nearly 100 companies that supply air pollution control and monitoring technologies for electric powerplants and other stationary sources across the United States.

The industry develops and deploys control technologies for all pollutants, including all criteria pollutants, air toxics, and greenhouse gases.

ICAC would like to thank the subcommittee for the invitation to talk about the status of control technologies today. As you are aware, air pollution control technologies follow and respond to regulatory drivers. As you will hear from others today, the synergy of State-specific actions and Federal requirements create a control technology market with considerable certainty as to when and what technologies will be needed. ICAC members and the industry at large are responding with an ever-increasing suite of technologies to achieve these mercury control requirements.

All powerplants are not created equally. All are engineered for specific conditions and needs. Likewise, there is no single mercury control technology that will achieve the reductions needed for all types of coals and powerplant configurations.

Rather, there is an expanding suite of control technology options being deployed today. In addition, flexibility within regulations, including tiered approaches and soft landings or safe harbors, are good for technologies, such that the risks are reduced and the lower cost options can be developed and deployed.

Today, I am going to focus on two primary options, one a mercury-specific injection technology; and the other the collection of technologies that integrate to control mercury emissions as a collateral or co-benefit when controlling for other pollutants.

In general, the science and understanding of mercury control technology has moved rapidly from research through development, demonstration, and into full system deployment. We have been here before with other pollutants and have already applied similar mercury controls on the municipal solid waste sources. What is different today is that there is a broader range of available control technologies and the experience of our industry in deploying these technologies.

We have also overturned some of the assumptions on sub-bituminous coal, the western coals, where we thought they originally would be more difficult or the most difficult and most expensive to control. That has been completely overturned in the last couple of years.

Today, control technology vendors are actively installing mercury control systems across the United States, particularly in States with more aggressive implementation schedules and more stringent requirements than those mandated by Federal rule. In 2007, State

programs in Massachusetts and New Jersey go into effect with systems and control strategies in place to meet these requirements.

Also there will be a few newly built plants that begin operation in 2007, and mercury control has been integrated into their design. In addition, the combination of installed controls designed for NOx control and for SO_2 control already achieve mercury control as part of the integrated co-benefits approach. There are reports of high performance of megasystems. However, at a minimum all mercury control systems are designed to meet the regulatory requirements, as well as incorporating any flexibility in regulations. Again, technologies follow and respond to the regulatory drivers.

Over the past year, ICAC members reported booking new contracts for nearly three dozen coal-fired powerplant boilers. These contracts are for new and existing boilers, burning bituminous and sub-bituminous coals, with different equipment configurations. The commercial sales are the result of Federal and State regulations, including new source permit requirements under consent decrees. By the end of this year, vendors anticipate they will have approximately 50 more orders that would come in due to these regulatory drivers.

As previously reported by ICAC, mercury-specific sorbent injection systems became commercially available after being demonstrated at full scale on various coal-fired boilers, coal types, and mission control equipment configurations. Typically, these mercury control systems require relatively small capital investments for materials storage handling and delivery systems. Initially, the sub-bituminous coals posed the greatest challenge to our industry for sorbent injection technology. Today, these challenges have been largely overcome and the technical challenges are mostly now on bituminous coal systems.

It is noteworthy that when you have an injection system, a sorbent injection system, you can change or tweak that system to get different levels of mercury control, by changing the types of carbons or the amounts of carbons that are being used in them. So the same kind of control technology you might put in for 70 percent could also be used for 90 percent.

It is also noteworthy that while I am discussing activated carbon as one technology, there are other different types of sorbents that are being developed and deployed.

It is also evident that significant amounts of mercury are being removed from existing control technologies, or the collateral benefits. When you combine technologies like the particulate and the SO_2 and the NOx controls, and put them together, you ultimately will get some other types of emissions reductions. Although these processes were not originally intended, designed nor optimized for mercury capture, the collateral mercury control is often sufficient to meet current requirements. Because mercury is captured as a co-benefit from these control technologies, the reductions are cost effective.

Many other powerplants are anticipated to install combined controls over the next several years. We have seen some recent information from EPA projecting out to 2020 that there will be 260 gigawatts of power that will be scrubbed, and this is in the context of 330 gigawatts of coal-fired power.

Similarly, for the NOx control, we are looking at about 220 gigawatts of SCRs by 2020. So there is a lot more of these combinations that are coming, and EPA is making those predictions.

Plants are likely to meet the requirements through integrated co-benefit approaches, with the potential to add additional mercury-specific control technologies as needed. Once you have a co-benefit program, you could put in activated carbon injection on top of that. There is nothing in the science that says you cannot do that. Integrated multi-pollutant control systems can also be optimized in many ways to achieve greater amounts of mercury.

Senator CARPER. Mr. Foerter, you are about 7 minutes into your statement. I need to ask you to wrap it up. Senator Voinovich has to leave at 12:30, and I just want to make sure he has his chance. So could you go ahead and wrap it up?

Mr. FOERTER. Okay. A paragraph or two, and I am done.

Recognizing the market demand for activated carbons is driven by regulations, the industry has been developing more carbon. We have a number of different projects. One is the largest activated carbon manufacturing facility in the United States. It is a $280 million project. It is designed to produce 50 percent of the activated carbon under any potential rule and legislation that is being looked at right now, by 2015. So trends are now in the investments being made in those sites in Texas, Louisiana and North Dakota. Texas and North Dakota are sitting on lignite coal, which is used to produce activate carbon.

So they are looking at about 600 million pounds per year of this activated carbon by 2010, and about 1 billion pounds of activated carbon by 2015.

There is an issue of fly ash and commingling with activated carbon. It is being addressed. We have a lot of success going on there. EPRI, who speaks after me, will talk a little about two of their technologies, and we think they have been very successful and have a lot of potential for keeping fly ash good for other things.

We are working responsibly with powerplant operators to create the reliable mercury control systems that are integrated into facility designs.

I thank you very much for this opportunity.

[The prepared statement of Mr. Foerter follows:]

STATEMENT OF DAVID C. FOERTER, EXECUTIVE DIRECTOR, INSTITUTE OF CLEAN AIR COMPANIES

Chairman Carper, Senator Voinovich and Members of the Subcommittee:

Good morning, my name is David Foerter and I am the Executive Director for the Institute of Clean Air Companies (ICAC).

ICAC is the national trade association of nearly one-hundred companies that supply air pollution control and monitoring technologies for electric powerplants and other stationary sources across the United States. The industry deploys control technologies for all air pollutants, including all criteria pollutants, air basics, and greenhouse gases.

ICAC would like to thank Chairman Carper and Senator Voinovich for the invitation to participate in the Subcommittee on Clean Air and Nuclear Safety hearing on "The State of Mercury Regulation, Science, and Technology." It is my privilege to present this testimony on our current understanding of mercury control technologies for coal-fired powerplants and their application to meet regulatory requirements.

As you should be aware, air pollution control technologies follow and respond to regulatory drivers. As you will hear from others today, the synergy of state-specific actions and federal requirements have created control technology markets with con-

siderable certainty as to when and what technologies will he needed. ICAC members, and the industry at large, are responding with an ever increasing suite of technologies to achieve these mercury control requirements. All powerplants are not created equally; all are engineered for specific conditions and needs. Likewise, there is no single mercury control technology that will achieve the reductions needed for all coal types and for all electric powerplant configurations. Rather, there is an expanding suite of control technology options being deployed today. In addition, flexibility within regulations including tiered approaches are good for technologies such that risks are reduced and lower cost options can be developed and deployed. In these comments, I will focus on two of the primary control options; one a mercury specific sorbent injection technology and the other a collection of technologies integrated to control mercury emissions as a collateral, or co-benefit when controlling for other pollutants.

In general, the science and understanding of mercury control technology has moved rapidly from research through development, demonstration and into full system deployment. The success of this rapid progression is the result of strong support from federal and public-private partnerships, and the ability of regulators, particularly in the states, to enact regulatory programs that harnessed the suite of control options in a flexible regulatory framework. For example, the strong research and demonstration program conducted through the U.S. Department of Energy overturned the previous assumption that sub-bituminous coals would be the most difficult and expensive to control. Through the demonstration program, the better understanding of western, sub-bituminous coals led to successes in dramatically reducing the cost of controlling mercury emissions while increasing the control effectiveness. Today, technology vendors are addressing challenging issues surrounding sorbent injection technology as it applies to eastern, bituminous coals, particularly in the presence of sulfur trioxides (SO_3).

Today, control technology vendors are actively installing mercury control systems across the United States, particularly in states that have called for more aggressive implementation schedules and more stringent requirements than those mandated by the federal Clean Air Mercury Rule. In 2007, state programs in Massachusetts and New Jersey go into effect, with systems and control strategies in place to meet these requirements. Also a few newly built powerplants begin operation in 2007 and mercury control has been integrated into their design. In addition, the combination of installed selective catalytic reduction (SCR), primarily designed for NOx control, and wet flue gas desulfurization (wet FGD), primarily designed for SO_2 control, already achieve mercury control as pan of the integrated co-benefits approach. There have ve been reports of high performance of many systems, however, at a minimum all mercury control systems are designed to meet the regulatory requirements as well as any regulatory flexibility mechanisms. Typically, technology performance guarantees will be written around the performance requirements of regulations.

Over the last year, ICAC members reported booking new contracts for mercury control equipment for nearly thirty-six coal-fired powerplant boilers. These contracts are for controlling mercury on new and existing boilers, burning bituminous and sub-bituminous coals, with different particulate captire equipment such as fabric filters and electrostatic precipitators (ESP). The contracts for commercial mercury control systems are attributed to federal and state regulations, including new source permit requirements and consent decrees, which specify high levels of mercury capture. By the end of 2007, vendors anticipate approximately another fifty contracts for mercury control systems will have been awarded.

As reported by ICAC as the federal Clean Air Mercury Rule was being promulgated and as states prepared their response, and in many cases their own programs, mercury specific control technologies such as sorbent injection systems have been commercially available after being demonstrated at full-scale on various coal-fired boilers, coal types, and emissions control equipment configurations. Typically, these mercury control systems require relatively small capital investments for material storage, handling and delivery systems. Initially, sub-bituminous coals posed the greatest challenge for sorbent injection technology. Today these challenges have been largely overcome, and the technical challenges are mostly for bituminous coal systems.

Once a sorbent injection system is installed, the sorbent, typically powdered activated carbon is delivered into the flue gas where it mixes with the gas and flows downstream. This provides an opportunity for the mercury in the gas to contact the powdered activated carbon and he removed. This is called “in flight” capture. The sorbent is then collected in the particulate control device where there is a second opportunity for sorbent to contact the mercury in the gas. Many sorbent injection systems have already been installed, although deployment of the systems will typically conform with the regulatory schedule. It is noteworthy that the same sorbent

injection system can be used to achieve different levels of mercury control, with the level of control modified by the type and amount of the sorbent injected into the flue gas. It is also noteworthy that sorbents other than activated carbon continue to be tested for application to full-scale deployment.

As predicted based on technology demonstrations, significant amounts of mercury are being removed through the use of existing control technologies. Installed technologies including fabric filters, electrostatic precipitators, flue gas desulfurization, selective catalytic reduction, and others currently achieve high levels of mercury reductions. Although these processes were not originally intended, designed, nor optimized for mercury capture, the collateral mercury control is often sufficient to meet current requirements. Because mercury is captured as a co-benefit from these control technologies, the reductions are cost effective. Many other powerplants are anticipated to install SCR and FGD in response to the Clean Air Interstate Rule over the next several years, and are likely to be able to meet requirements through these integrated co-benefit approaches, with the potential to add additional mercury-specific control technologies as needed. Integrated systems can also be optimized to achieve greater amounts of mercury. For example, catalyst manufacturers can reformulate catalysts to increase the oxidation of mercury, making it more soluble for wet removal, or change catalyst formulations to lower the conversion of sulfur dioxide to sulfur trioxide.

Given that a number of powerplants sell flyash that is captured in a particulate control device such as an electrostatic precipitator (analogous to a large scale home electric air cleaner), the presence of activated carbon in flyash became a challenge. Notably, the Electric Power Research Institute (EPRI) developed two control systems to meet these challenges including: TOXECON™ and TOXECON II™. TOXECON allows flyash to be collected by the electrostatic precipitator, then injects the sorbent downstream where it is collected in a fabric filter. This preserves the flyash for sale, and controls mercury emissions. A full scale demonstration at the Presque Isle powerplant in Marquette, Michigan, demonstrated a 90 percent mercury control at relatively low activated carbon injection rates (2.5 pounds per million cubic feet). In a second system, TOXECON II™ injects the sorbent between the last two fields in an electrostatic precipitator, allowing at least 90 percent of the flyash to be sold and only 10 percent of the flyash to be commingled with activated carbon The activated carbon can be either regenerated, recycled or disposed of with the flyash. Both systems continue to be tested to optimize their performance, and both systems preserve most of the flyash for sale for cement manufacturing.

Recognizing the market demand for activated carbon driven by regulations, the air pollution control industry continues to make plans and investments into new and expanded production facilities. Activated carbon is manufactured using lignite coal as the raw material, and manufacturing is typically performed close to this source of coal. For example, the largest powdered activated carbon plant in North America is now in the pre-construction permitting stage to build on multiple sites up to four production lines. The goal of this $280 million project is to manufacture enough product to satisfy 50 percent of the U.S. market in 2015. Facilities would be constructed in close proximity to mine sites in Louisiana, and two in North Dakota. The total activated carbon market in the U.S. is anticipated to be less than 600 million pounds per year in 2010 and approximately 1 billion pounds per year in 2015.

The air pollution control industry continues to work responsibly with powerplant operators to ensure that mercury control systems are integrated into the facility's design and specific coal requirements, and that any operational issues can be addressed. Significant advances continue to be made in mercury control technology performance and commercial deployment is ongoing.

Thank you for the privilege to testify before the Subcommittee on these critically important matters.

Senator CARPER. We thank you very much for your testimony and for the good work you all are doing.

Dr. Levin, welcome and thank you.

STATEMENT OF LEONARD LEVIN, TECHNICAL EXECUTIVE, AIR QUALITY HEALTH AND RISK ASSESSMENT, ELECTRIC POWER RESEARCH INSTITUTE

Mr. LEVIN. Thank you, Senator.

I am Dr. Leonard Levin, technical executive at the Electric Power Research Institute, EPRI. EPRI is an independent nonprofit

research organization based in Palo Alto, CA. Our research programs have investigated all aspects of environmental mercury fate, effects, and controls for more than 20 years, at up to $20 million per year on these efforts.

In the last several years, EPRI research has focused on quantifying the environmental and health benefits that would follow regulatory cuts in U.S. utility mercury. Much of this work has examined what might follow from some States adopting control levels of 90 percent, compared to the national 70 percent cut due to EPA regulations.

EPRI has also been extensively involved in testing and demonstration of mercury controls, working with the U.S. Department of Energy, EPA and many others.

The potential health effects of mercury are almost exclusively due to consumption of fish containing excess levels of the substance. Fetuses are the ones most sensitive to this exposure due to their developing nervous systems. Thus, fish consumption by women of childbearing age is of greatest concern. From national survey data, we know that about 92 percent of the fish consumed in the United States are from global ocean areas. At least three-quarters of that marine portion is from the Pacific, essentially upwind from the United States. For that reason, changes in U.S. mercury emissions are most likely to impact only the 8 percent of the fish consumed that may come from domestic freshwater resources.

There is, in essence, a built-in floor bounding how low mercury exposure can be driven by controlling U.S. sources alone. EPRI research found that the greatest drop in exposure under the EPA CAMR rule will be about 7 percent for some women. Interestingly, EPA reached a similar conclusion, that the greatest exposure drop they could find would be 14 percent. These are essentially identical numbers in risk terms.

These results on how much benefit can be derived from utility mercury controls alone were indirectly confirmed by the work of Dr. Trasande and his colleagues at the Mount Sinai School of Medicine. In their studies of mercury's impacts on IQ levels, they found that U.S. utility mercury is responsible for 0.4 percent of the overall IQ effect. Thus, an independent investigation reached the same conclusion that EPRI did.

There is a limit to how much benefit should be expected from any controls on utility mercury. The data used by Dr. Trasande, from the CDC's National Health and Nutrition Examination Survey, have shown a consistent, statistically significant, and so far unexplained drop in women's mercury exposure in the United States. The number of women with mercury levels above the EPA health threshold dropped from more than 7 percent in 2000 to below 2 percent in 2004. Yet reported fish consumption has increased over that time.

Overall, EPRI and others have found that once utilities reach the EPA 70 percent national control level, further controls on mercury have a declining payback in public health improvement. Nevertheless, it is important to seek viable control measures for utility mercury. Those efforts are now bearing fruit, focusing on two issues:

can controls able to achieve 90 percent mercury reductions across the board be developed; and are such controls commercially ready?

Control performance: Based on collaborative work with many partners, EPRI concludes that mercury controls to date perform quite differently on different powerplants. Plants burning eastern bituminous coals and equipped with nitrogen and sulfur controls for CAIR compliance, capture up to 90 percent of the mercury in the coal. These are the plants generally emitting higher proportions of divalent mercury, the kind that is most soluble in water.

Current research is aimed at improving this to a consistent 90 percent-plus level. Plants burning western coal, such as Powder River Basin coals, can be controlled by injecting bromine-impregnated activated carbon. Tests have found that up to 94 percent mercury removal can be gained at some of these plants. Other plants, however, show continuing issues with both operating lifetime and control efficiency.

Commercial readiness: Regulations necessitating 90 percent mercury removal will require vendor guarantees of that level on every plant. To date, there have been no such assurances made. Additionally, major questions remain about impacts of carbon injection on powerplant operations.

To summarize, some configurations of fuels and controls appear capable of 90 percent mercury removals, but many are not. EPRI is working diligently to expand the range of powerplants that can maintain removals at these high levels.

Further reducing mercury emissions from 70 percent to 90 percent, as shown in the charts that I provided the committee, will not significantly reduce deposition, however, since most of that mercury emitted after CAMR is reached is elemental mercury, which plays little role in U.S. deposition. Furthermore, we face the possibility that post-regulatory measurements to detect declines in mercury in U.S. waters or fish may be masked by significant mercury deposition from distant non–U.S. sources.

In summary, first, data show that mercury exposure in women of childbearing age has declined over the past decade, quite significantly, while fish consumption has increased. Second, controls of mercury more stringent than the EPA's 70 percent national control level appear to have diminishing returns, primarily due to non-U.S. mercury imports and the form of mercury remaining in utility emissions after the EPA CAMR rules. Third, EPRI cannot yet say with confidence that 90-percent effective mercury control technologies are commercially available for all powerplants.

Thank you.

[The prepared statement of Mr. Levin follows:]

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

WRITTEN TESTIMONY

BEFORE THE

SUBCOMMITTEE ON CLEAN AIR AND NUCLEAR SAFETY
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE
WASHINGTON, D.C.

LEONARD LEVIN, Ph.D.
ELECTRIC POWER RESEARCH INSTITUTE
PALO ALTO, CALIFORNIA

May 16, 2007

I am Dr. Leonard Levin, technical executive at the Electric Power Research Institute (EPRI). EPRI is an independent nonprofit research organization based in Palo Alto, CA, with other major offices in Knoxville, TN, and Charlotte, NC. The various research groups at EPRI have been conducting investigations of environmental mercury sources, fate, human effects, and controls for more than 20 years, spending between $10 million and $20 million per year on that research.

In the last several years, much of this work has been spent on clarifying the environmental and health consequences that will ensue from regulation of U.S. utility mercury emissions, and the decline of those emissions over time. Much of this recent effort has examined what the public health benefits might be from individual states, or federal agencies, applying stricter control levels than the ones that would follow from implementation of Clean Air Interstate Rule (CAIR) and the Clean Air Mercury Rule (CAMR) promulgated by the U.S. Environmental Protection Agency. In parallel, EPRI has joined with the U.S. Department of Energy, the utility industry, and equipment vendors in development, testing, and demonstration of effective and predictable mercury controls for the coal-fueled electric utility industry. This testimony summarizes recent findings in both areas -- the presence and effects of mercury in the U.S. environment, and the current status of mercury controls.

SUMMARY OF OUR CURRENT UNDERSTANDING

1. Controls of mercury more stringent than the EPA 70% national level appear to have diminishing returns, primarily due to intercontinental mercury transport from Asia and the form of mercury remaining in utility emissions after reaching the EPA target;

2. Federal data show that mercury exposure in women of child-bearing age appears to have declined over the past decade, for reasons that are unclear (particularly since these women are eating more fish);

3. State-level controls that bypass the Federal cap-and-trade system for mercury may actually lead to higher mercury deposition within that state, even for stricter control levels;

4. EPRI cannot say with confidence that 90%-effective mercury control technologies are commercially available for all affected power plants.

MERCURY IN THE U.S. ENVIRONMENT

Research on mercury in the environment continues to improve our understanding of the substance and its sources, transport, cycling, and human and ecosystem exposure and health. As instrumental and analytical methods improve, and process modeling more rapidly integrates basic scientific findings about the chemical, the ability of investigators to discern effects on the environment improves. This cascade of new information requires diligent integration into an overall understanding of mercury sources and effects, allowing investigators to bound the issue in realistic terms, neither overestimating the impacts of very low exposures nor ignoring the effects manifested in extremely subtle alterations to health and welfare.

This testimony is focused on our state of understanding of mercury, including several critical findings that were developed by EPRI and other investigators primarily during 2006 and early 2007. The investigations reported here are small parts of the work going on globally in each of the areas studied: mercury sources, human exposure, health effects, and subtle lifelong impacts that might evince themselves as study methods improve. That evolution in methodology, measurement, and assessment is integral to all research progress, but in the case of mercury and other toxicants, has a direct link to societal response to the environmental questions raised. That is because policy, particularly regulatory, consequences of what are viewed as environmental pollution problems are linked to the ability of researchers to discern, discriminate, measure, and bound the magnitude of effects from human exposure to toxicants. As the number of studies increases over time, and methods for investigating responses to environmental pollutants improve, the detection of effects will reach finer and finer levels of concentration and dose. We can expect a concomitant evolution in the methods for gauging the significance of subtle effects on human health and welfare.

Mercury As a Global Pollutant

- *Background Sources of Mercury.* As a chemical element in the earth's crust, mercury has always been ubiquitous in trace amounts in the environment, even prior to the Industrial Revolution. There is, for example, good archeological evidence that Native American peoples in the pre-European era used set wildfires for land clearing and herding of wild animals; geological samples from peat bogs and lake sediments show extended periods of elevated mercury in the atmosphere from these occurrences. As a result of this occurrence, and its association with fossil fuels, mercury has a wide suite of sources in the modern world. It is useful to categorize mercury's sources broadly into human, or anthropogenic, sources (such as fossil fuel combustion), and background sources (such as emissions from geothermal vents or from abandoned mine tailings). The category of background sources – natural emissions of native mercury, mercury re-emitted from the surface after earlier deposition, and geological mercury exposed to the atmosphere by human disturbance – has assumed increasing importance in the global and regional mass balances of the substance. Recent findings have indicated that, globally, new natural sources of mercury may be twice as large as previously thought, further reducing the significance of anthropogenic sources in the global mass flow.

- *Anthropogenic Mercury Emissions.* Table 1 shows a recent inventory[1] of global mercury emissions. The notable point is that, not only are total Asian emissions about an order of magnitude greater than those of North America, but Asian sources are the "nearest" upwind sources in the dominant westerly winds that blow at midlatitude in the Northern Hemisphere. In particular, emissions from China are believed to total more than half of all continental emissions from Asia, and China is most directly upwind from the United States. It should also be noted that country-by-country yearly inventories, when available, indicate that emissions on all populated continents except Europe and North America are increasing, while Europe and North America are decreasing, over time.

Table 1. Global anthropogenic emission inventory for total mercury (datum year 2000)

Country or continent	Annual mercury emissions (U.S. tons per yr)	Reference	Possible uncertainty
United States	115	EPA, 2004 (a)	+ 77 tons/yr (b)
Canada	9	EPA, 2004	
Mexico	29	CEC, 2001	Within ±1.8 multiplier (c)
Asia	1327	Pacyna, 2003	x2 (d)
Europe	263	Pacyna, 2003	
South & Central America	101	Pacyna, 2003	
Africa	449	Pacyna, 2003	
Oceania	138	Pacyna, 2003	
Total	**2432**		

(a) 1999 inventory
(b) +50 tons/yr of unaccounted Hg used in chloralkali plants (Southworth et al., 2004); +28 tons/yr of Hg emissions from motor vehicles (Edgerton et al., 2004).
(c) Uncertainty factor derived from the range in Mexican emissions estimated by Pai et al. (2000).
(d) Estimate based on atmospheric Hg ex port estimates from Jaffe et al. (2005).

- *Trends in Mercury Emissions and Concentrations.* Mercury, as a global pollutant, exhibits significant fluctuations in concentrations due to distant sources. Inventories of coal use in China by David Streets, of Argonne National Laboratory, and colleagues showed a year-by-year increase in coal use in China of up to 11% since the 1990s. More strikingly, there is direct evidence of this increase in emissions at distant points on the globe, such as the middle of the Atlantic Ocean, more than

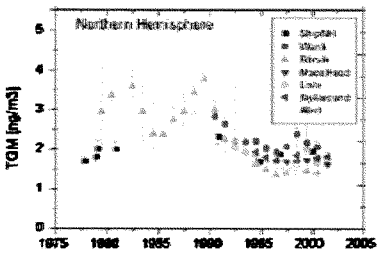


Figure 1.
From: "Worldwide trend of atmospheric mercury since 1977," F. Slemr et al., 2003; ***Geophysical Research Letters, 30,*** 10.

[1] K Lohman, C Seigneur, M Gustin, S Lindberg; 2007; "Sensitivity of the Global Atmospheric Cycling of Mercury to Emissions," *Environmental Geochemistry* (submitted)

half a world away. Work by Franz Slemr et al.[2] shown in Figure 1 found that global atmospheric mercury has generally been declining for 30 years, but has leveled off in the last 10 years. Inventories compiled on mercury emissions from China by Wu et al.[3] of Argonne National Laboratory have shown Chinese mercury emissions growing by up to 10% per year, and on average about 3% per year, since the 1990s. The Slemr et al. results match up with the decline in background mercury levels underway since the 1950s or 1960s, shown in data by Benoit et al.[4] and Swain and Engstrom[5]. Growth in mercury emissions on continents other than Europe and North America (where emissions are declining) may now be impacting the global balance of the substance.

Mercury Exposure and Health Effects

- *Mercury Exposure of U.S. Women.* U.S. federal measurements of the health and exposure status of a cross-section of American residents have been carried out for a number of years. These studies, NHANES (National Health and Nutrition Exposure Study), add several thousand adults and children to the database year. The survey includes data on blood sample levels of trace substances, vital statistics, recall surveys on diet, and other factors. One element of this survey is blood and hair tests of children (ages 0-6) and women of childbearing years (ages 16-49) for mercury levels. The adults are also surveyed for recall of the amounts and types of fish consumed in the month prior to the clinical tests being performed. Samples and surveys are analyzed and coded, and results are issued for biennial reporting periods. By early 2007, results for the 1999-2000, 2001-2, and 2003-4 biennia were published and available for further analysis. The NHANES data have shown a continuing, statistically significant, and so far unexplained drop in women's mercury exposure over the last 8 years (Table 2)[6]. The number of US women with blood mercury levels above the EPA health threshold (a threshold set to be protective of all individuals) has dropped from more than 7% in 2000 to below 2% in 2004. Yet the diet surveys of the tested women showed an increase in fish consumption in that same period.

---

[2] F Slemr, E-G Brunke, R Ebinghaus, C Temme, J Munthe, I Wängberg, W Schroeder, A Steffen, T Berg; 2003; "Worldwide trend of atmospheric mercury since 1977," *Geophysical Research Letters, 30,* 10, 1516, Doi:10.1029/2003gl016954.

[3] Y Wu, S Wang, D G Streets, J Hao, M Chan,J Jiang, 2006; "Trends in Anthropogenic Mercury Emissions in China from 1995 to 2003," Environ. Sci. Technol., 40, 5312-5318

[4] J M Benoit, W.F. Fitzgerald, A.W.H. Damman. 1994. "Historical atmospheric mercury deposition in the mid-continental United States as recorded in an ombrotrophic peat bog." In: C. Watras and J. Huckabee (eds.), *Mercury Pollution: Integration and Synthesis.*Lewis Publ., Boca Raton, FL, pp. 187-202.

[5] D R Engstrom, E B Swain, 1997; "Recent Declines in Atmospheric Mercury Deposition in the Upper Midwest," *Environ. Sci. Technol., 31,* 960-967

[6] C. Whipple, 2007; "Insights From Six Years of Mercury Biomarker Data," in L. Levin, *Mercury in the Environment: A Research Review*, EPRI Report 1012572; Final Report, March 2007; Electric Power Research Institute, Palo Alto.

Table 2. Federal NHANES Survey, Blood Mercury Concentration, U.S. Women Aged 16–49

Survey Biennium	Number of Subjects	Mean Total Mercury in Blood, µg/L	Percent of Women with Blood Mercury Above EPA Health Threshold
1999–2000	1709	2.00	7.1%
2001–2002	1928	1.45	3.4%
2003–2004	1824	1.35	1.9%
1999–2004	5461	1.58	3.96%

- *Mercury Effects on I.Q. Levels.* The NHANES data in turn have implications for analyses of mercury effect on neurobehavioral outcome and indirect consequences, such as the published claim linking losses in lifetime earnings to IQ decrements brought about by prenatal exposure to mercury[7] [8]. The entire Trasande analyses rest on a number of assumptions that link mercury exposure in the U.S. to lifetime earnings of both exposed and unexposed individuals. The initial assumption is that an IQ decrement (excess incidence of below-normal IQs) is related to later-in-life earnings via either lower success in finding employment and staying employed, or lower success in finding high-paying employment. Griffiths et al.[9] recalculated the numbers of Trasande et al. by re-examining the range of values from which each individual value in the original analysis was selected. When Griffiths et al. selected mid-range or "best estimate" values, rather than the extreme values stated to be used by Trasande et al., the dollar cost per year of IQ decrement due to mercury from all sources declined by some 88%. More importantly, Griffiths et al. found that the portion of the annual cost attributable to U.S. power plant mercury was best estimated by a fraction 98% lower (1/50th the value) of the 0.4% attribution cited by Trasande et al. This is another example of the limits – the "floor" – on how much benefit can be gained from controlling only utility mercury.

  When the Trasande et al. analyses published to date are reassessed using more current NHANES findings, the consequences of mercury exposure for performance, labor market participation, lifetime earnings, and other consequences drop by at least an order of magnitude. A paper by Schmier et al. (2007), submitted to *Environmental Research*, also re-examined the Trasande et al. work. Part of the Trasande analysis involved use of the first biennial NHANES data, from 1999-2000. When Schmier et al. recalculated the values using the NHANES results from 2001-2002 and 2003-2004, they found that the overall costs dropped by 60%.

- *Adult Cardiovascular Effects.* Some studies in recent years have hinted at a later-in-life impact from lifetime mercury exposure that evinces itself in male cardiovascular health issues, including elevated rates of myocardial infarction and coronary heat disease. These studies, however, have tended to focus on multiple re-investigations of a single, limited subject cohort in a single region of the world. Unique dietary and lifestyle factors have not, to date, been considered or isolated in those studies, while other

[7] L Trasande, PJ Landrigan, C Schechter. 2005. Public health and economic consequences of methyl mercury toxicity to the developing brain. In: *Environ Health Perspect 11*(5):590-6.

[8] LTrasande, C B Schechter, K A. Haynes, P J. Landrigan, 2006;Mental Retardation and Prenatal Methylmercury Toxicity, in: *American Journal of Industrial Medicine 49*:153–158 (2006)

[9] C Griffiths, A McGartland, M Miller, 2007; A Comparison of the Monetized Impact of IQ Decrements from Mercury Emissions. In *Environ Health Perspect* doi:10.1289/ehp.9797

> investigations using different subject groups show inconsistent results for the same effects. An extensive literature review and analysis (ter Schure, 2007)[10] reports on the findings to date across the research community, weighing the net result of the technical evidence to arrive at an evaluation of the likelihood of later-in-life mercury impacts on cardiovascular health. The conclusion of this weight-of-evidence review is that studies to date do not support increases in coronary heart disease due to higher mercury exposure in children or adults. Such outcomes have been found in a single, relatively small cohort with dietary practices significantly different from those in most western countries, and in the United States in particular.

It is important to remember that the potential health effects of mercury on United States residents is almost exclusively through consumption of fish containing possible excess levels of mercury. Extensive research over several decades has found that the subjects most sensitive to this kind of mercury exposure are developing fetuses, whose nervous systems may experience subtle developmental damage from mercury binding to proteins during periods of critical organ growth. Thus, the fish consumption practices of women of childbearing age are the exposure routes of greatest concern.

From survey data throughout the country, we know that at least 90% of the foodfish in commerce is from global ocean areas. At least ¾ of that marine fraction is from northern or southern Pacific catch areas, essentially the other side of the globe from the United States in the dominant wind direction of west-to-east. For that reason, changes in U.S. mercury emissions reaching domestic freshwater U.S. fish would play a minor role in the overall change in mercury exposure to women, and their developing babies. In essence, there is a built-in "floor" bounding how much mercury exposure – the basic public health concern – can be reduced by controlling U.S. mercury sources alone.

Mercury Deposition Following Federal and Federal+State Regulation of Utilities

Federal and state steps to regulate emissions of mercury from coal-fired power plants (CFPPs) will result in consequences for the deposition of mercury within and external to the U.S. In most cases, reducing mercury emissions will result in reduced deposition, although often in complex patterns not easily related to the emissions drops themselves. This reduction in deposition is conditional, however, on the allowances made for the trading of mercury emissions credits. The U.S. EPA Clean Air Mercury Rule (CAMR) allows utilities which control mercury emissions to below their state-allocated levels to sell the additional mercury "saved" on open markets to buyers (usually other utilities). This provides an economic incentive for some utilities to lower their emissions at individual power plants to below their state allocation(s). Since 2005, however, a number of proposed state-level utility mercury emissions targets (composed of either or both amounts of mercury emitted and target date for achieving these amounts) have been proposed. In many cases, these lower limits are linked to a state-required bar on trading credits either in or out of the state, or in some cases in credit trading at all. (Some proposed state rules are, more simply, imposition of earlier target dates

[10] A. ter Schure, 2007; Critical Review: Methylmercury Exposure and Cardiovascular Effects, in L. Levin, *Mercury in the Environment: A Research Review*, EPRI Report 1012572; Final Report, March 2007; Electric Power Research Institute, Palo Alto.

for compliance, or acceptance of the EPA CAMR limits but barring of trading). EPRI has modeled the resulting emissions, using an economic costing model, as well as the resulting deposition patterns, and compared them individually and in combination to levels that would result if all states instead adopted the Federal CAMR rule (and, where applicable, CAIR leading to mercury reduction as a "co-benefit" of NOx and SO_2 control) and to a theoretical case where all U.S. utility mercury emissions are set to zero. The following paragraphs summarize the findings from those modeling studies of emissions scenarios.

EPRI modeling results found that, in most instances, steps by states to impose utility mercury limits lower than those of the U.S. EPA (CAIR, in the applicable states, plus CAMR, including trading of mercury emissions credits) tend to have little further impact on reducing deposition Indeed, the modeling found that barring of trading may result in slightly higher mercury deposition, in isolated instances, in "90% states" compared to what the EPA rules alone would provide. This is due to the generally earlier and more complete control of divalent mercury emissions by utilities under either Federal or state rules, The form of mercury remaining in utility emissions following this Phase I is mostly the less-easily captured elemental mercury. Elemental mercury typically travels thousands of miles before possibly depositing, and so tends to remain in the global pool instead. In isolated instances, states with utility mercury emissions containing high proportions of divalent mercury may have more notable deposition drops in some locations, though not overall. The imposition of no-trading rules by some states removes economic incentives for utilities to control mercury beyond the Federal or state levels to generate trading credits. The result is some individual locations would experience slightly greater deposition following stricter and earlier state control than would occur under the Federal CAIR/CAMR rules. This is reflected in Figure 2, showing differences in deposition values in Pennsylvania and New Jersey under those states imposing a 90% cut with no trading, compared to the deposition that the EPA rules alone would bring.

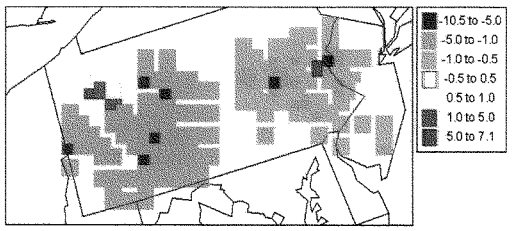


Figure 2
Differences in deposition, micrograms per square meter per year ($\mu g/m^2$-yr), Pennsylvania and New Jersey, for 90% utility controls (no trading) vs. full EPA CAMR compliance

Overall, EPRI (and other) researchers have found that, once utilities attain the EPA 70% national control goal, further controls on mercury have a declining "payback" in public health improvement. That is primarily because the form of mercury remaining in utility emissions nationally, once full compliance is reached with the EPA CAMR, will be the less-easily-deposited elemental mercury. Elemental mercury typically takes thousands of miles from its source point into the atmosphere for even a few percent of the amount emitted to deposit to ground level. Most of it enters the global atmospheric mercury pool, thoroughly mixed with the many non-U.S. emissions of mercury (U.S. utility emissions today are less than 2% of global anthropogenic emissions). Nonetheless, it is important to seek viable control measures for utility mercury, and EPRI has strived to do so for at least 20 years. Those efforts are now bearing fruit.

May 16, 2007

PERFORMANCE AND COST OF MERCURY CONTROLS – STATUS APRIL 2007

This portion of EPRI's testimony provides comments on questions about mercury (Hg) control that are commonly raised during discussions at the state level on adopting the Clean Air Mercury Rule (CAMR) versus a stricter standard. Usually, the control technology discussion revolves around two questions: (1) how effective are mercury controls, and (2) are they commercially ready. Underlying issues often are the ability of mercury controls to achieve 90% reductions across the board and the associated costs.[11] The responses to these questions, provided below, are based on data we have obtained since about 2001 in collaboration with many power companies and, most often, the U.S. Department of Energy - National Energy Technology Laboratory (DOE-NETL).

The fuel a power plant burns and its existing and planned air pollution controls determine (a) the amount of mercury that is captured as a co-benefit of mandated NOx and SO_2 controls (i.e., at very low incremental cost), and (b) the cost of mercury-specific control technologies (e.g., the need to add a baghouse as a secondary particulate control). The NOx and SO_2 controls may be in place due to earlier legislation and regulations or are being installed in response to the Clean Air Interstate Rule (CAIR). Therefore, the following discussion is organized by fuel.

Mercury Capture Performance

Bituminous coal-fueled power plants

Plants equipped with a selective catalytic reduction (SCR) system for NOx control, an electrostatic precipitator (ESP) for particulate control, and flue gas desulfurization (FGD) for SO_2 control have been shown to capture between approximately 70% and 90+% (only ~35% at one site) of the mercury in the coal, as received. This "co-benefit" for mercury capture from the installation of the other air pollution controls occurs because most of the mercury entering the FGD is in a soluble form (e.g., $HgCl_2$ or some other soluble oxidized species, often written generically as Hg^{+2}) due to the combined oxidizing effect of the SCR and the chlorine in the flue gas; elemental Hg is not captured by an FGD. However, it is difficult to predict (or understand) the reasons for the range of results. For example, one site has 95% Hg^{+2} at the FGD inlet and the FGD removes 95%. Theoretically, this should give a total mercury removal of ~90% (95% of 95%). However, due to re-emissions (conversion of the Hg captured by the scrubber back into elemental Hg, which is volatile and escapes from the FGD into the flue gas), the actual Hg removal is 86%. We are currently trying to understand why these co-benefits are so often < 90% and, then, will try to enhance or supplement these co-benefits so as to achieve the desired Hg reduction levels.

Routinely achieving 90+% Hg capture may be harder for plants equipped with a hot-side ESP (HESP)[12], as the test data all come from plants with cold-side ESPs (CESP), which treat flue

[11] A plant would actually need to achieve 93-95% Hg capture routinely in order to assure compliance with a 90% limit.

[12] Cold-side ESPs are located following the air preheater, where the flue gas temperature is about 275°F to 375°F. At that temperature, the small amounts of unburned carbon in the fly ash have some affinity for mercury. Hot-

gas at a temperature where some Hg capture (typically 10-30%) can occur on the fly ash; very little Hg is captured in the higher temperature ESP.

The data obtained by power companies in response to the US Environmental Protection Agency's (EPA) 1999 Information Collection Request (ICR) suggest that plants burning a low-sulfur eastern bituminous coal and equipped with a spray dryer and baghouse can achieve very high mercury removals. We have not collected any independent data on such units, so can provide no comments on the applicability of those results to other plants.

A still-to-be-resolved issue is mercury controls for smaller, older power plants that cannot justify the cost of SCR and FGD. The only tested Hg control for these plants is activated carbon injection. However, because the SO_3 present in the flue gas from such plants inhibits the capture of mercury by activated carbon, the amount of sorbent that would be needed to achieve 90% Hg capture would be very large (e.g., up to 20 lb/Macf[13]), would cost about $6.5M/yr for a 500 MW power plant, and would typically require a major upgrade of the particulate control system. One such upgrade could be EPRI's patented TOXECON™ process, which consists of adding a baghouse (also known as a fabric filter) behind the ESP and injecting the carbon between the ESP and baghouse. This approach has the added benefit of reducing sorbent usage significantly and maintaining the fly ash free of activated carbon, thereby enabling the plant to continue to sell it. While TOXECON may be technically feasible at plants that burn relatively low-sulfur coal (e.g., less than about 1.5% sulfur), it has not been demonstrated at plants fueled by medium- or high-sulfur coal. It is possible that the injection of calcium or sodium compounds to capture the SO_3 produced in these plants may prevent the harm it does to the bag material,[14] but tests of this approach are just now being conducted, and only at sites with ESPs and relatively low SO_3 concentrations.

Powder River Basin coal and Fort Union (North Dakota) lignite-fueled plants

The mercury capture behavior of PRB and Fort Union lignite tend to be similar, so the comments we provide here for the widely used PRB apply to both fuels.

The only approach for capturing high levels of mercury in PRB-fired units that has been tested extensively is sorbent injection. Three configurations have been tested – injection ahead of a cold-side ESP (CESP), TOXECON, and injection ahead of the last 1-2 electrical fields of a large CESP (TOXECON II™).

- *Injection ahead of a CESP.* In tests at several sites injecting ahead of the CESP, researchers have measured as much as 94% mercury removal over a thirty day period using brominated activated carbon. However, at other sites, the results have not been as high, at least not for injection rates in the 2-5 lb/Macf range. Sites that must inject SO_3 into the flue

---

side ESPs are located ahead of the air preheater at temperatures between 600°F and 800°F; at this temperature the unburned carbon captures essentially no mercury.

[13] Activated carbon injection rates are normally reported as pounds of carbon injected for a given volume of flue gas. The volume is expressed as million actual cubic feet, or Macf. Research has shown that results from different tests can be compared rationally using this measure of carbon usage.

[14] The harm is actually caused by the sulfuric acid that forms when the SO_3 and water in the flue gas react at temperatures often experienced in baghouses.

gas upstream of the CESP to achieve acceptable particulate collection will experience poorer activated carbon performance, for the reasons cited in the discussion on bituminous coals. EPRI and others are attempting to overcome this impact of SO_3 on Hg removal rate through such mechanisms as co-injection of the carbon with an alkali sorbent, but the results are not definitive, especially not at the 90+% removal level. The upper injection rate (5 lb/Macf) *may* be the maximum that can be injected without giving rise to particulate emission increases by an amount that triggers New Source Review (NSR); it is possible that NSR could be (a) avoided if the ESP has margin (i.e., is large enough and can be operated at a higher power level than normal), or (b) triggered by lower injection rates if the ESP is small and/or has no margin; the trigger increment is extremely small (e.g., an increase of ~0.001 lb/MBtu for a 500 MW plant). Still remaining to be determined is the potential for bromine emissions when bromine-impregnated activated carbon is used. Earlier tests by EPA at DTE Energy's St. Clair station indicated there were no measurable bromine emissions, but recent tests have found trace amounts in the flue gas – e.g., ~ 1 ppm, which is enough to produce > 10 tons/yr from a large boiler.

With most activated carbons, power plants that use them cannot sell their ash for use as cement replacement in the manufacture of concrete, the most common use of fly ash.[15] While one company offers a "concrete-friendly" brominated activated carbon, we do not know if it can produce >90% Hg capture at comparable injection rates at sites equipped with ESPs. Further, we are just obtaining some very preliminary indications that the bromine in the carbon impacts concrete strength. Further testing is needed to determine if this will be an issue. Other firms are developing non-carbon sorbents that may not hinder the use of ash in concrete, but they have not yet been demonstrated, and certainly not at the 90+% Hg capture level.

- *Injection ahead of a hot-side ESP (HESP).* This configuration has been tested at a few low-sulfur eastern bituminous sites using activated carbons specifically formulated for the higher temperatures in these ESPs. The results have been promising, but generally lower reductions than in CESPs. Tests are currently planned with a non-carbon sorbent called MinPlus that appears to be effective at very high temperatures (> 1500°F). If the developer's results to date in privately-sponsored tests are duplicated in the DOE/EPRI-sponsored tests, this sorbent would provide a useful option for plants firing PRB, independent of the location of the ESP. Those tests will also need to determine if this material can be injected in the amounts needed to achieve ≥ 90% mercury capture without triggering the NSR increment for particulate.

- *TOXECON.* This is the technology being demonstrated at We Energies' Presque Isle power plant under a DOE Clean Coal Power Initiative.[16] In recognition of the risks of installing this new, capital-intensive technology, DOE is providing about half the funds for the project, the first installation designed from the start as a TOXECON application. Its benefits are (a) separation of ash and injected carbon, thereby allowing the plant to retain the sale of 95-99% of the ash, and (b) much lower sorbent consumption. We understand

[15] Carbon interferes with the ability to embed air bubbles in the concrete that allow it to expand and contract without cracking when the ambient temperature changes. The mercury, itself, is not an issue as it is immobilized in the concrete.

[16] Note: TOXECON may not be applicable to plants burning a medium-to-high sulfur coal due to rapid bag deterioration by the sulfuric acid in the flue gas.

from the We Energies Project Manager that the technology is now achieving 90% Hg capture and the team has resolved the hopper fires it encountered during the first few months of operation, but is still working to eliminate the fugitive dust from hopper unloading. We note that both of these issues were unexpected. We also understand that the Hg capture level for a given activated carbon injection rate is very temperature-sensitive, another unexpected finding, and one not seen elsewhere.

- *TOXECON II.* This EPRI-patented variation of TOXECON may be applicable to power plants with large CESPS. It retains the salability of 90-95% of the ash by injecting the carbon ahead of the last 1-2 electrical fields of the ESP, thereby avoiding the large capital cost of a TOXECON baghouse. This approach recognizes that 90-95% of the ash is collected ahead of these fields. The challenge is to inject enough activated carbon to capture substantial amounts of mercury without increasing particulate emissions by more than the increment that triggers New Source Review (NSR). Tests conducted at Entergy's Independence station in Texas, which has a very large ESP (8 fields, specific collecting area [SCA] = 540 ft^2/kacfm), have shown short-term Hg removals of 60-70% at injection rates of 2 lb/Macf and 80-90% at 6 lb/Macf, using brominated activated carbon. Particulate emission tests have not yet been conducted and analyzed. Give the low NSR increment for particulate matter, it is likely that carbon injection at the rates needed for 90+% Hg capture at most power plants will trigger NSR; this would lead to a requirement to upgrade the ESP, thereby decreasing the cost advantage of TOXECON II.

- *Other options for PRB-fired power plants.* All but the last of these options will be capital intensive. They include:

  - Addition of an SO_2 control and mercury-specific catalyst within the ESP. This approach has shown moderate success in some applications and less success in others. Plans are currently underway to demonstrate it at the 200 MW scale on Lower Colorado River Authority's Fayette station. To be cost competitive with sorbent injection (even if ash sales are lost), the catalysts will have to last 1-2 years without needing removal and replacement or external regeneration. Further, the catalysts and configurations tested so far have started by oxidizing ~90% of the elemental mercury and have declined in performance over 6 months. Since the FGD does not capture 100% of the oxidized mercury it sees, the overall performance is unlikely to be 90% with any great frequency and certainly not as a long-term average.

  - Addition of a spray dryer for SO_2 control followed by a baghouse, and use brominated activated carbon. Testing at plants already equipped with these systems showed mercury capture rates > 90% over a 30-day period. We have no data on plants with a spray dryer retrofit ahead of the existing ESP (i.e., without a baghouse), but expect the mercury removals to be much less for any given carbon injection rate.

  - Addition of an SCR and FGD may be effective for mercury control if new catalysts provide the high mercury oxidation rates in PRB flue gas that one supplier has

reported. This is a potentially emerging approach that has just begun to be tested; therefore, it is several years away from being proven.

- Add a halogen to the coal (e.g., a bromine compound) to promote the formation of the soluble oxidized mercury species in the air pollution control zone of the boiler. This emerging concept, still under investigation, would also require an SO_2 control but no baghouse and, possibly, no SCR (for achieving high mercury removals by the FGD).

- Pre-treatment of the PRB to remove mercury. One example is the K-Direct™ process being developed by Evergreen Coal. Through the application of pressure and temperature, they drive off much of the water in the coal and, reportedly, with it up to 70% of the mercury. This approach is still in the development/perfection stage, and it would not achieve 90% mercury reduction (coal-to-stack); that would require a post-combustion control that provided 70% capture of the remaining mercury.

The first four approaches would be economically competitive with other technologies only if the plant had to install the NOx and/or SO_2 controls to meet stricter emission limits than achievable by their current configuration and fuel.

Costs of Mercury Control

EPRI recently updated its cost estimates for mercury capture (see report # 1012672, cited earlier) and predicted the following costs for the above-mentioned mercury controls for plants burning PRB or Fort Union lignite. The cost figures are for 90% control.

Mercury Control	Capital ($/kW)*	Cost of electricity (¢/kWh)	Comments
Activated carbon injection ahead of ESP	4	0.15	Assuming ash not currently sold
		0.36	Assuming ash currently sold and cannot with sorbent injection**
TOXECON	50-250	0.52	Capital costs based on recent bids; range due to wide differences in site configurations/space
TOXECON II	7-20	0.24	Upper capital cost assumes 1 field added to ESP. Technology may be limited to 70% mercury capture.

* For reference, $1/kW equates to $300,000 for a 300 MW plant. Hence the TOXECON capital costs range from $15-75M for this size unit. New plants are estimated to cost around $2,500/kW, so the TOXECON capital costs are equivalent to 2-10% the cost of a new plant.

** Assumes $60/ton ash cost combined revenue loss in ash sales + disposal costs.

To put the capital-intensive technologies for PRB-fueled plants in perspective, typical retrofit capital cost ranges are given below.

Technology	Capital ($/kW)	Impact on cost of electricity (¢/kWh)
Spray dryer (using existing ESP)	300–400	0.7–1.0
Spray dryer/baghouse	400–550	1.0–1.4
SCR	200–300	0.5–0.7
FGD	350–500	0.9–1.2
Oxidation catalyst	~25	<0.1

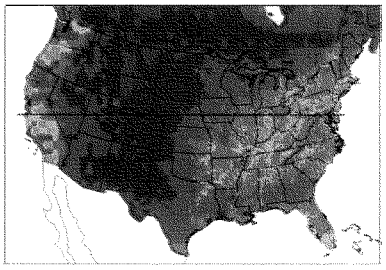
Commercial Readiness

For new technology, the question of when it is "commercially ready" is largely a business assessment by the purchaser on the strength and remedies of the supplier's guarantee (relative to the financial impact on the power plant of not meeting the required emission limit or percent removal requirement). Because this is not a technical question, EPRI does not procure equipment, and we are not privy to contracts between suppliers and power companies, we are not in a position to provide substantive comments on the commercial readiness of the two technologies that have been sold with guarantees – injection ahead of an ESP and TOXECON (according to press releases and Institute of Clean Air Companies (ICAC) information sheets). We can say that EPRI's TOXECON II process is still in the development stage, as we continue to work to improve the sorbent injection system to provide >70% Hg removal. In addition, we have not yet demonstrated that the injection this far back in the ESP does not increase particulate emissions enough to trigger NSR or that the separation of the ash catch from the last fields does not reduce the fines content of the ash sent to the concrete plant to a level that's unacceptably low for them.

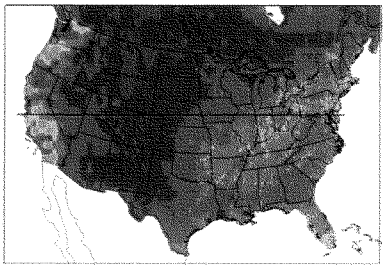
Discussions in the states often leave the impression that they are talking about the commercial readiness of mercury controls that could be used to achieve a 90% reduction in all plants, often without saying so explicitly. The press releases and ICAC information did not state whether <u>all</u> the systems that have been sold or bid for injection ahead of an ESP provide the following set of guarantees: 90% Hg removal, no increase in particulate emissions large enough to trigger NSR, and, for cases where the supplier is providing a "concrete friendly" sorbent, that the ash quality will meet all the concrete manufacturers' quality requirements. For TOXECON, ash quality would not be a guarantee issue, but pressure drop across the baghouse and lifetime of the bags would be. These expectations are akin to the normal practice when procuring an FGD of requiring the supplier to guarantee not only SO_2 removals (or emission levels), but also pressure drop, reagent use rate, particulate/droplet emissions, and gypsum quality, as well as knowing that every supplier can provide a system that achieves a 98% SO_2 removal or even higher.

U.S. MERCURY DEPOSITION BEFORE AND AFTER UTILITY CONTROLS

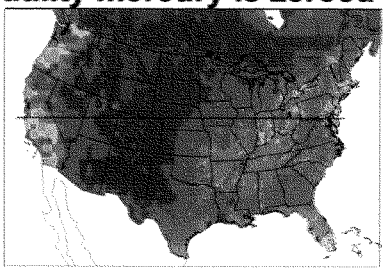
Mercury Deposition Today



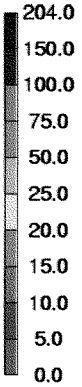
Mercury Deposition in 2020 If All States Follow EPA Rules



Mercury Deposition if all U.S. utility mercury is zeroed out



Mercury deposition ($\mu g/m^2$-yr)



1 $\mu g/m^2$-yr is about 1 ounce of mercury over 10 square miles, per year

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Senator CARPER. Dr. Levin, thank you very much.

Let me just start off by asking Ms. Keating if there is anything that you would like to comment on with respect to Dr. Levin's testimony. Is there anything at all?

Ms. KEATING. Yes, I would like to comment on a few things that Dr. Levin said.

Senator CARPER. I thought I saw you writing furiously over there.

Ms. KEATING. Yes, I was making a few notes.

First of all, as regard to the NHANES results with blood mercury levels, declining over the past 3 years. I would like to think that is a good news story, that these levels are declining, but I would like to say a couple of things about the NHANES survey itself. I am not sure that my colleague who is a statistician, Dr. Eric Tassone, would agree that three points on a line is a trend, but let's assume that that is a good thing over the last 3 years of that survey.

What the survey shows is that fish consumption levels and blood mercury levels differ significantly by race and by geographic area. The NHANES samples only 26 places across the country, for each survey. So you can get different results from each survey depending on where they are sampling.

In addition, we see far greater exposure to women that are Native American and Asian. You can argue about the number of 2 percent, 3 percent, 6 percent, but the numbers for the other populations that are grouped all together is more like 25 percent above the EPA's reference dose. So that is one point about the NHANES.

I would like to say, a couple of years ago I heard Bill Wehrum speak at a symposium here in D.C., and he said 2 percent, 3 percent, this is still a large number of children. There has been an emphasis on quantifying the benefits due to lower IQ, but I would have to say that that is really just the tip of the iceberg in terms of mercury effects. The cognitive effects that are much harder to quantify and so are oftentimes left out of that benefits equation, may be the effects that have a much greater affect in life and relationships and so on than a slightly lower IQ.

Senator CARPER. Thank you. Thanks very much.

Mr. Foerter, let me go back to something that you said not once, but I believe twice. As you know, technologies follow and respond to regulatory drivers. Let me just say to you, when you look at what FirstEnergy has done and the investments they have made. What is the name of the company that you all have invested in?

Mr. PIPITONE. Powerspan.

Senator CARPER. Powerspan, yes. I presume the technologies that Powerspan is developing are not responding directly to regulatory drivers. You must be doing this for some reason. Maybe it is to develop the technology that, when we do have the regulatory requirements in place, that you have the technology there ready to help deliver the results. But maybe the idea of all these new coal-fired powerplants that are coming on line in China, when they finally get serious about reducing emissions that you will be there with a technology that we can export and use.

But your thoughts on the comment from Mr. Foerter, as you know, technologies follow and respond to regulatory drivers, particularly in the context of how your companies are behaving.

Mr. PIPITONE. Our company, we started with Powerspan back in the late 1990s because we recognized that coal was such an important part of our energy mix in the United States, and invested in the technologies in anticipation that multi-pollutant requirements would be coming down the road. It wasn't specifically at that time looking at mercury, but it was primarily focused on SO_2, acid gases, fine particulate, and nitrous oxides.

So we did it in anticipating more stringent regulations and to get a competitive advantage in our business, because we are a completely deregulated entity, and FirstEnergy Solutions part of our generating company. So we compete in a market. We don't get a regulated rate of return on our investments. So that was the driver for our efforts starting in the late 1990s.

Senator CARPER. Okay. Do you believe when Mr. Foerter says technologies follow and respond to regulatory drivers? Do you subscribe to that?

Mr. PIPITONE. I believe there is a relationship, no question about that, and more investment would go towards where the potential regulations are. Of course, there are a lot of risks involved with developing new technologies. The capital investment and the markets are so important to the economy that it is a risky set of circumstances and issues that are being dealt with. But investment will go towards those regulations over time.

Unfortunately, the result and the timing of the result, as we experienced with Powerspan, is very unpredictable. When we started with Powerspan in 1998, we thought by 2001 we would have a commercial product. In fact, really, to prove it to ourselves that we had a commercial product, it took us until last year. I think that is very typical for new technology. The risks are just so high in relation to the investment and the impacts on the economy that that is the nature of it.

Senator CARPER. Let me yield to Senator Voinovich. I will come back to you for some follow-up questions. Thanks.

Senator VOINOVICH. Thank you all for coming.

Mr. Pipitone, is Powerspan applicable to both newly built plants and old plants with other emission control equipment such as scrubbers? That is one thing. The other is, for the old plants with existing equipment for 90 percent mercury, what about the stranded costs and who would pay for these costs?

Mr. PIPITONE. Let me address the question about the applicability of the equipment. For a plant, whether it would be a relatively new installation or old equipment that has been in service a long time, for equipment that has already been fitted with the combination of SCRs and scrubbers, adding a Powerspan ECO unit would not be economical.

Senator VOINOVICH. SCRs and scrubbers?

Mr. PIPITONE. Selective catalytic reduction.

Senator VOINOVICH. Yes, that is right. They are the ones that deal with the nitrous oxides?

Mr. PIPITONE. Nitrous oxides. Yes, I am sorry. It takes the combination of those two technologies to achieve the co-benefits that

have been discussed here today. SCR alone does not do it, and a scrubber alone does not do it. So having both technologies installed, selective catalytic reduction, SCR, for NOx, and scrubber for SO_2 results in the co-benefits that we have been speaking of.

To add an ECO Powerspan technology to a unit——

Senator VOINOVICH. The indirect benefits, where does that take you to in terms of reduction of mercury?

Mr. PIPITONE. On eastern coals, our experience has been that it has been in the 80 percent to 85 percent range.

Senator VOINOVICH. Okay. When you add the ECO, what happens then?

Mr. PIPITONE. If we look at ECO independently as a stand-alone technology, it has been 83 percent in our experience to date. We would not add an ECO unit to a unit that already has a scrubber and SCR because in fact we would be duplicating the SO_2, NOx and NOx removal portion, and then the SCR and the scrubber would become unusable, which I think addresses the question on stranded cost. That would, in fact, be stranded investment and would double the cost of pollution control, if you tried to add an ECO unit to a unit that already had SCR and scrubbers.

Senator VOINOVICH. Okay. Do most of your units have SCR and scrubbers?

Mr. PIPITONE. No, they do not. We currently have three units, 2,400 megawatts total, which is about one third of our fossil fleet, with SCR and scrubbers. We are adding another 1,200 megawatts right now that we are building of additional SCR and scrubbers, which would bring us up to about, in round numbers, 50 percent of our coal-fired fleet.

Senator VOINOVICH. Right. But the fact is that in those cases, you would not be reaching a 90 percent number.

Mr. PIPITONE. That is correct.

Senator VOINOVICH. The question is, and this gets back to Dr. Levin, because I know we debated this on the Floor of the Senate and I defended the rule that came out of the EPA. In other words, others wanted to go to 90 percent over a shorter period of time. When you looked at it in terms of the costs that would be involved to go to 90 percent, and then looked at the benefit that would be derived from going to 90 percent, versus what you are getting, say, at 83 percent with your SCRs. I think if you put the Powerspan on this plant that AmpOhio is going to build, what do you think that will bring them to on mercury?

Mr. PIPITONE. Based on our testing, in the neighborhood of 85 percent.

Senator VOINOVICH. About 85 percent. So the point is, under any circumstance, you are not going to get to the 90 percent.

The next issue is, going from 83 percent to 90 percent, or 85 percent to 90 percent, what benefits are going to accrue in terms of the issue that Ms. Keating has been talking about? Dr. Levin or anybody? Dr. Levin, do you want to comment on that?

Mr. LEVIN. The issue of going from 70 percent mercury controls by an additional 20 percent, up to 90 percent control, should really be addressed in terms of the health benefits, which is the ultimate goal of any regulation. That health benefit relates directly to how much less mercury will be deposited as a result of the control steps.

In the case of stepping from 70 percent to 90 percent nationally, the national gain in deposition is only about 2 percent less mercury being deposited nationally. Now that, of course, will vary point by point. There will be some locations where there will be a further drop in deposition of more than 10 percent, but in general there will be very little additional national gain in terms of health benefits, related to mercury by lowered deposition translating into less mercury in fish and lower mercury exposure to women of childbearing age and their children.

Senator VOINOVICH. The other issue that came up, and I have been told, for example, in the Great Lakes that 20 percent of the mercury comes from overseas. If you calculate what China is doing, particularly on the West Coast, I think not only should we be concerned about what we are doing here, but they are building these new facilities over there, and I would be interested to know, Dr. Levin, do you know anything about what they are doing with these new coal-fired plants that they are building? Are they dealing with NOx and SOx? Are they going to get co-benefit from that, or are they doing SCRs?

Mr. LEVIN. Purely by coincidence, I met with a number of representatives of the Chinese coal and utility industries last week at a meeting hosted by the University of Utah. At this point, the Chinese are not engaging in any significant retrofitting of existing coal facilities with new controls for the standard pollutants, SO_2, NOx, and particulate matter, and none at all specifically for mercury.

Senator VOINOVICH. So they wouldn't be doing scrubbers or SCRs?

Mr. LEVIN. There has been no introduction of SCRs at all. There is control of particulate matter on new coal facilities that are being built, many of them with the assistance of other countries. The retrofitting of their existing coal fleet, which is a far broader range of industrial facilities than just powerplants, is proceeding slowly. Powerplants in China use only about one-half or so of the coal production as opposed to the United States, where power production uses about 90 percent or more of the coal produced.

So there are broadly scattered coal facilities of all sorts throughout China, and none of them are being retrofitted at this point, while all indications are that Chinese mercury emissions (from inventories that have been done over the last few years) are increasing steadily year after year by at least 3 or 4 percent per year. In some years, mercury emissions from China have actually jumped by 8 percent to 10 percent over a single year.

Senator VOINOVICH. Thank you.

Senator CARPER. Mr. Pipitone, you say in your testimony, and I am going to just read it, it says, "test results have shown ECO's mercury removal rate to average about 83 percent. However, with additional design and engineering refinements, a 90 percent recovery rate may be achievable. By comparison, FirstEnergy's Bruce Mansfield Plant in Pennsylvania was one of the first powerplants in the world to be built with scrubbers as original equipment. Our testing indicates that about 85 percent of the mercury is removed by selective catalytic reductions and scrubber systems."

Then you go on to say how at the unit operating in Burger, where they use different kinds of coals and get pretty good results, as long as you have some eastern coal that is included in the mix.

Senator Voinovich and I in our old jobs, we focused a whole lot on how do we preserve existing jobs and go to new jobs. We are always interested in providing a nurturing environment for job creation and job preservation. One of the ways that you do that is to have lower costs of energy. Another thing is access to good health care and affordable health care.

There is a tradeoff here, or at least there has been to some extent in the past, where we have a fair amount of cheap energy, but a lot of bad stuff up in the air. We breathe in and it hurts our health and drives up our health care costs. I don't know if we always can have our cake and eat it too, but it sounds to me like in your testimony you are saying that it is possible to get 83 percent to 85 percent of the mercury without costing consumers an arm and a leg, and at the same time to develop a technology, when we think of all these coal plants coming online in China, to actually have a technology that we can export, that we can sell to them.

Am I missing something here? Is that pretty much what you are saying?

Mr. PIPITONE. It is possible, as has been demonstrated, Mr. Chairman, that we get co-benefits from SCRs and scrubbers that are averaging in the neighborhood of 85 percent. Again, as you mention, or less, depending on the coal mix; 85 percent is the upper end on pure eastern coals. That is the best that it gets.

Senator CARPER. That is with current technology?

Mr. PIPITONE. That is with current technology. You quoted my testimony correctly that it may be possible through further refinements to have the ECO process get up to 90 percent. Time will tell whether that happens.

The issue becomes, though, whether SCRs and scrubbers must be installed on every coal-fired powerplant versus the powerplants that currently exist that are large and base-loaded. When I look at our fleet, which is very typical of fossil-fired fleets, we have a mixture of units that serve different roles that are necessary to match the customer demands.

We have what are called mid-merit coal-fired plants that have relatively low usage over a given year, and they are used only when the customer demand is high. Of course, they turn down at night or come off at night. To install scrubbers and SCRs on those units, in our system we have a number of units that, based on the current economics and the current markets, would likely be taken out of service and shut down, rather than have that investment be put in them.

So investment in SCRs and scrubbers is possible on the large baseload units that we tend to all focus on, but the other units, mid-merit units, are absolutely essential to serving customer needs, and they very possibly could be shut down. In our system, we have a number of those.

Senator CARPER. All right.

Mr. Foerter, given what Mr. Pipitone has testified to, with their technology getting them to maybe 83 percent, maybe even 85 percent, perhaps 90 percent reduction of mercury in time, are there

other technologies that could be used in conjunction with ECO that you might be aware of that are coming about? It sounds like actually with current technologies, we are pretty close to at least 80 percent, 85 percent. We are just knocking on the door of 90 percent.

We are looking at legislation that some of us have introduced that by 2015 to have in place systems throughout the country that reduce emissions from coal-fired plants by 90 percent. But given what they have developed through Powerspan, their ECO technology, and given other technologies that are coming online, how realistic or unrealistic, and how cost effective can the 90 percent goal be?

Mr. FOERTER. For their technology, it is an integrated technology, where they have integrated everything basically in a box, so to speak. So they tend to be conventional technologies, but the integration is the innovation on it. Because they are relying on co-benefits for the mercury, there are ways to actually optimize the co-benefits. They can use oxidizing catalysts, which will help move the mercury into a form that can be picked up a little bit better from a web scrubber, less elemental goes into the air if it is caught by scrubber and taken out of the system.

I don't know if they have used others, like sorbent injection technologies in there. I think it does have a wet electrostatic precipitator at the end, so there are some polishing devices in there. I don't pretend I know their technology fully, but I would expect that there are ways. He seemed to have some optimism about being able to optimize it with a little bit more work. So I will share his optimism.

Senator CARPER. All right. Good. My time has expired.

Senator Voinovich.

Senator VOINOVICH. I haven't given Ms. Keating a chance to talk. You have heard this testimony, and I heard your testimony. From a health benefit, if we can get 80 percent to 85 percent, and I don't know, it will take you, what, a couple of years to know about the ECO and whether it is doing its thing or not. I know we are talking about, this is a big plant in Ohio, AmpOhio, I think it is going to be a 1,000 megawatt plant. They are going to use the Powerspan technology. You are basically saying right now that about 85 percent, but maybe it could be more.

Mr. PIPITONE. We won't know until 2012 or 2011.

Senator VOINOVICH. Yes. So the question I have is this, is that if that is the status of where we are, in other words the level, what kind of additional health benefits are we going to get if we go from 85 percent to 90 percent, where 90 percent seems to be a little bit difficult to reach right now?

Ms. KEATING. Yes. Well, first I would like to say based on these gentlemen's testimony that I think it lends itself to going forward with a multi-pollutant approach, where you control SO_2 and NOx and mercury and maybe something else at the same time, because as it stands now, you have the CAMR rule and the CAIR rule, which are related, but in fact nothing is required under the CAIR rule to reduce mercury. So you might in fact have a plant that decides to scrub one unit and not another and so on, or in the case of a plant in North Carolina, installing NOx controls in the form

of an SCR, which would actually increase oxidized mercury emissions from that plant and potentially exacerbate a hotspot in that region.

So I think this discussion lends itself to looking at the comprehensive Federal legislation.

Now, with respect to your direct question about the health benefits, I think that one misperception that I have heard is that the elemental mercury that is left over that is more difficult to control, admittedly, disappears into the global pool and never affects the United States. I would differ on that. Not a lot is known about the atmospheric chemistry of that particular mercury becoming oxidized in regions of high ozone, when it hits the coastal marine environment, depositing there, affecting ocean fish and so on; as well as dry deposition. I would like to point out that a study in Underhill, VT, where there are no local coal-fired powerplant sources, they are measuring and back-calculating emissions from Midwest powerplants that are affecting that region.

So presumably, these would be elemental mercury emissions that weren't deposited locally.

Senator VOINOVICH. Well, the question I have, though, is from a percentage point of view, if you look at what we see the technology to be.

Ms. KEATING. Is that 5 percent?

Senator VOINOVICH. The question is how much health benefit are you going to derive from that 5 percent? Yes.

Ms. KEATING. Yes. I think that is going to vary by location. I think that some of the regions in the country that are most highly affected, like the Northeast States, are affected by lower deposition than we have in the Southeast. Yet, their fish levels are very high, based on water chemistry parameters and land use patterns and such as that. So I think it is going to vary by location. On a national average, it probably would not be the extra 5 percent, but I believe in some areas it would be more than that.

Senator VOINOVICH. Do you have the ability to measure it?

Ms. KEATING. No, because we don't have the monitoring network in place that Senator Collins was advocating for. Whether you think that 70 percent is the right number or 90 percent is the right number, you can't answer that question without this infrastructure in place.

Senator VOINOVICH. Well, it is a big deal because what we want to do is balance, as I said earlier. You can look at your energy needs and look at your economic needs and you look at your environmental concerns and public health. You have to kind of put those all together and figure out how do you best get the job done.

Ms. KEATING. Right.

Senator VOINOVICH. Then one other issue, and that is, and I am sure you are just as concerned as I am about what is going on in some other places in the world today. We really have to get on this. At one time, we were the real culprit, but now what is happening is that we have other places that we have to be very concerned about.

Ms. KEATING. Right. I understand. I think it lends itself to even looking at other sources like products and closing the loop on that export of mercury for incineration and product use in other coun-

tries like India and so on. So there are lots of complicating issues with this pollutant, besides the one in front of us.

Senator VOINOVICH. Thank you.

Senator CARPER. I would like 30 seconds if I could to kind of, not give the benediction, but sort of give the benediction.

This has been an encouraging hearing for me, and I hope for my friend Senator Voinovich. We know that there is too much mercury going up in the air, not just here, but around the world. I am very much encouraged, Mr. Pipitone, by the work that you all have done at Powerspan and your integration of that technology into the real world.

I am encouraged by what Mr. Foerter tells us that other technology companies are beginning to develop. It is his belief that if we actually say through regulations that we have to do better, that the technology will follow.

I am intrigued at how FirstEnergy seems to be ahead of that curve, and actually helping to develop the technology in anticipation of the requirement to meet it. They are going to be there. They are going to be there not only with lower emissions at FirstEnergy, but they are going to be there with technology that will help reduce emissions at other plants across this country and potentially around the world.

As we see one new coal-fired powerplant coming online almost weekly in China, spewing all kinds of bad stuff up into the air, I think we have the opportunity to actually, instead of them always exporting products to us, we can export a product to them, and they will export a lot less mercury in our direction, which would be a great thing for all of us.

Any closing words?

Senator VOINOVICH. That's it.

Senator CARPER. All right. Our thanks to each of you. I would ask that if you get some questions from us in the week or two ahead that you just respond promptly to us. We are grateful for your testimony and for your being here with us today and the good work that you are doing. Thank you so much.

This hearing is adjourned.

[Whereupon, at 12:40 p.m. the subcommittee was adjourned.]

[Additional statements submitted for the record follow.]

STATEMENT OF HON. BERNIE SANDERS, U.S. SENATOR FROM THE STATE OF VERMONT

Green building is one of those things that makes sense on so many levels that it is truly unbelievable that we haven't already passed strong federal legislation on the topic. From the tracking done by those working with the Leadership in Energy and Environmental Design program, commonly referred to as LEED, we know that certain green building methods not only reduce energy use—thereby reducing energy costs associated with the upkeep of a building—but also offer significant public health benefits. For example, no one can argue with the fact that children learn better when they are in an environment that provides natural lightening and higher quality indoor air, both of which are basic to green building methods. And, as we work to get serious about responding to the greatest environmental threat we have ever faced, global warming, we have to look to our buildings to be as energy efficient as possible. In fact, I have been a strong proponent of weatherizing houses for my entire political career and the concrete benefits of true green building efforts get my interest in a similar way. This is because we have an opportunity to be smarter about the way we do something—and in the process help people save money in the long term and promote a better environment. More specifically, we can help people use less energy, reduce carbon dioxide emissions, and reduce wasteful water use.

So, let's get down to business on this issue. I am a proud cosponsor of Senator Lautenberg's Green Buildings bill, S. 506. I hope that this Committee will soon mark up Green Building legislation and I am sure that today's hearing will be the basis for such action.

STATEMENT OF LISA P. JACKSON, COMMISSIONER, NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

INTRODUCTION

Good morning Chairman Carper, Ranking Minority Member Voinovich and members of the subcommittee. I thank you for the opportunity to come before you today and provide New Jersey's perspective on the threat that the hazardous air pollutant mercury poses to our nation, as well as our state's efforts to address this threat.

While New Jersey is proud of its leadership role in regulating sources of mercury, in many ways we were forced into that position through a lack of federal leadership. I congratulate this committee on highlighting the continuing impacts of mercury on both public health and the environment and hope that New Jersey's perspective is beneficial to your efforts.

MERCURY IMPACTS

Mercury is a highly toxic heavy metal and a potent neurotoxin that attacks the nervous system. It is particularly insidious because its human health impacts focus on the most vulnerable members of our society: infants and fetuses developing in their mothers' wombs. Mercury can cause permanent brain damage to a developing system. It can hurt the ability of children to pay attention, remember, talk, draw, run, see and even play. In New Jersey alone, we estimate that more than 5,000 newborns every year are exposed to dangerous levels of mercury in utero, and our testing has revealed that at least 1 in 10 pregnant women in the State has concentrations of mercury in their hair samples that exceed safe levels. Nationwide, the USEPA has estimated that between 200,000 and 400,000 children are born each year in the United States with pre-natal exposure to mercury sufficient to put them at risk for neurological impairment.

New Jersey and the rest of the mid-Atlantic and northeast regions of the country have been particularly impacted by mercury. powerplants are the single largest source of the country's mercury emissions, emitting almost 50 tons of the neurotoxin per year. The significant number of powerplants, combined with prevailing wind patterns, result in large amounts of mercury being deposited into our soils and watersheds. Recent decades have seen a four- to six-fold increase in the mercury deposited in the northeastern United States.

Human exposure to the most toxic form of mercury comes primarily from eating contaminated fish and shellfish. In aquatic systems, mercury is quickly taken up into larger animals through the food chain, and those animals retain the mercury in their bodies. Levels of methylmercury in fish are typically 100,000 times those in the water in which they swim. High concentrations of mercury in the fish in New Jersey's waterways has led to 100 percent of our lakes, streams and reservoirs being placed under either statewide or regional mercury advisories. This totals more than 4,100 waterbodies in New Jersey alone and is indicative of the grave threat we all face.

Much of the mercury deposited from the air in New Jersey is emitted from sources in upwind states. Even in the remote waterways in the Pinelands, a relatively undeveloped area with no localized industry, we have detected significantly high levels of mercury in fish. This underscores the need for comprehensive protections on the national level that address mercury (and other hazardous air pollutants) that can drift beyond localized areas to affect downwind states.

By no means is New Jersey alone in dealing with the impacts of mercury. Nationwide, 45 states have mercury fish consumption advisories. These advisories cover more than 13 million acres of lakes, and 750,000 miles of rivers. Research has documented the continued existence of "hotspots" of mercury pollution—areas where concentrations of mercury in animals consistently exceeds safe levels. Confirmed or suspected hotspots have been identified throughout the Northeast, in New Jersey, Maine, New Hampshire, Vermont, New York, and Connecticut. It is apparent that these are really "hot regions," not small areas that might be implied with the term "hot spots."

FEDERAL MERCURY REGULATION

Through the 1990 Amendments to the Clean Air Act, Congress sought to address the unique problem of hazardous air pollutants, requiring that EPA set the "most stringent standards achievable" for sources of a specific list of 188 hazardous pollutants, including mercury. The standards must be based on "the maximum reduction in emissions which can be achieved by application of [the] best available control technology" and came to be known as MACT standards, which is short for Maximum Achievable Control Technology. Under the revised hazardous air pollutant section of the Act, Congress required EPA to set such MACT standards for all source categories of the pollutants by the year 2000.

Unfortunately, in 2005 EPA chose to disregard this Congressional mandate and instead exempted powerplants from the stringent MACT standards of the Act. EPA's plan, entitled the "Clean Air Mercury Rule" or "CAMR" has several fundamental problems. First, in violation of the Clean Air Act, CAMR removes powerplants from the typical hazardous air pollutant regulations without meeting the clear statutory requirements for such an exemption. Second, CAMR attempts to set up a cap-and-trade system for mercury. Trading a potent neurotoxin has never been done before and is inherently dangerous, as it will allow certain facilities to purchase emission credits and escape any reduction in their mercury emissions. People living nearby such polluters will be exposed to continuing high levels of mercury for decades. Third, CAMR will take decades to implement. Because emission credits can be banked, the Congressional Research Service reported that full implementation may not occur until 2025 or later. This provides little protection to the thousands of newborns suffering from mercury exposure every year. Finally, even at full implementation in 2025, CAMR requires levels of emission reductions that do not even reflect today's MACT.

STATE LEADERSHIP ON MERCURY REGULATION

Lack of constructive EPA action to address mercury has forced many states to take independent action. In New Jersey, a Mercury Task Force was created in 1992, and a new task force was convened in 1998, to review and study sources of mercury pollution, its impact on health and ecosystem and to develop a mercury pollution reduction plan. The Task Forces were composed of representatives from various sectors, including academia, business and industry, utilities, environmental groups, and federal and local governments. They reviewed mercury emissions data from over 30 source categories in New Jersey.

In the end, the Task Forces recommended a strategic goal of an 85 percent decrease of in-state mercury emissions from 1990 to 2011. This goal was based on the acknowledged threat posed by mercury and the Task Force's determination that significant reductions of mercury from various sources are achievable in New Jersey. It should be highlighted that the Task Force evaluated the feasibility of addressing the whole range of sources of mercury, from powerplants and iron and steel smelters, to mercury switches in automobiles, to amalgam for teeth fillings.

As a result of the Mercury Task Forces' recommendations, in December 2004, New Jersey established stringent new restrictions on mercury emissions from coal-fired powerplants, iron and steel smelters, and medical waste incinerators; and tightened existing requirements for municipal solid waste incinerators. Those rules will reduce in-State mercury emissions by over 1,500 pounds annually, reflecting: (1) over 75 percent reduction from the State's six iron and steel smelters by 2009; and (2) over 95 percent reduction below 1990 levels from the State's five municipal solid waste incinerators by 2011. Details of the iron and steel smelter and municipal solid waste incinerator regulations are attached as an appendix to this testimony.

COAL-FIRED BOILERS

New Jersey's powerplant mercury regulations apply to the ten coal-fired boilers in the State. These electric generating units in New Jersey emit approximately 700 pounds of mercury per year in the State. The source of the emissions is from the mercury contained in the coal. This industry is the second largest source category of mercury emissions in New Jersey. The new rule gives the New Jersey powerplants until December 2007 to begin keeping 90 percent of the mercury in coal from being emitted into the air or to meet a strict regulatory limit (3 milligrams per megawatt hour) that achieves comparable reductions.

Every plant will have to reduce emissions without emissions trading. A company that commits to reducing substantially air pollution that causes smog, soot and acid rain, as well as mercury, will earn an additional 5 years to comply if mercury emission reductions are phased in with concurrent reductions of particulates, sulfur diox-

ide and nitrogen oxides. The Department expects the new rule to result in a reduction in mercury emissions from coal-fired boilers of greater than 400 pounds per year by the end of 2013.

I would like to highlight the particulate component of New Jersey's multipollutant strategy. With the addition of carbon dioxide, New Jersey will have a five pollutant strategy for coal-fired electric generating units (EGUs). Carbon dioxide and particulate distinguish New Jersy's multipollutant strategy from USEPA's three pollutant strategy. Coal EGUs are one of the largest source categories of heavy metals and fine particulates. Many coal EGUs have outdated and poorly performing particulate control. This control needs to be upgraded for:

a. Mercury Control
b. Other toxic heavy metal control
c. Fine particulate control

As you debate whether the federal government should adopt regulations that mirror New Jersey's 90 percent mercury emission requirement, you of course must examine whether this policy is achievable, both economically and technologically. I am here to state to you unequivocally that, based on New Jersey's experience, this reduction target is indeed achievable. Our powerplants, who it should be noted did not challenge this rule, have not given any indications that they will not be able to meet the requirements.

New Jersey's mercury rules reflect the ability of currently available control technologies to achieve significant reductions in mercury emissions from the major sources of the pollutant—including powerplants. USEPA's Utility MACT Working Group, the Mercury Study Report to Congress and the pilot tests conducted in New Jersey at coal-fired boilers for control of mercury emissions all reflect that mercury reductions exceeding 90 percent can be achieved by powerplants across the country.

Furthermore, while New Jersey's rules are some of the most stringent, comparable standards are being adopted by numerous other states. Massachusetts is now requiring 85 percent reduction by 2008 and 95 percent by 2012. Connecticut is requiring 90 percent reduction by July 2008 while Maryland is calling for reductions of 80 percent by 2010 and 90 percent by 2013. All these states clearly feel that large reductions in mercury from powerplants are not only essential to protect public health, but are fully achievable now. Similarly, STAPPA–ALAPCO (now "NACAA"), the association of state and regional air regulators from around the country, came out with a model mercury rule in November 2005, that calls for a 90–95 percent reduction in mercury from powerplants by 2012. The conclusion seems clear, these reductions not only should be implemented, but they in fact can be done. Most telling, EPA's own database, used in the CAMR rulemaking, acknowledged that the cleanest, currently operating powerplants, burning every type of coal, are performing better than CAMR will require them to perform in 2025.

It is now time for the EPA to come to the same conclusion.

MULTI-STATE CHALLENGE TO FEDERAL MERCURY REGULATION

New Jersey did not originally plan to propose New Jersey-only rules for our major sources of mercury emissions. It was only after it became apparent that EPA would be proposing either weak or nonexistent standards for our major emitters that New Jersey and other states were put in a position of having to do their own rules. Numerous other states have decided to opt-out of EPA's CAMR approach, implementing instead an array of regulations more protective of public health than the EPA's.

States, however, should not need to expend valuable resources on a problem that is best addressed consistently nationwide, and New Jersey is proud to lead a coalition that is challenging EPA's failures in court. Seventeen states, including subcommittee members' states such as Delaware, New York, Connecticut, and Vermont, have filed suit in the U.S. Circuit Court of Appeals for the District of Columbia, asserting that CAMR violates the requirements of the Clean Air Act. It is disappointing that this legal action was required as the flaws with CAMR were repeatedly pointed out by countless commenters during the rulemaking process.

It is even more disappointing that the mercury litigation is just one in a series of actions by the states to compel EPA to meet its basic responsibilities under the Clean Air Act.

CONCLUSION

New Jersey's experience with mercury regulation can serve as a model for effective national regulation. Today, a total of approximately 1,800 pounds per year of mercury is being emitted in New Jersey from the 13 municipal solid waste incinerators, three medical waste incinerators, ten coal-burning units, and six iron and

steel scrap melting plants. This is down from about 6,200 pounds per year from these sources in 1990—a seventy percent reduction already and many of the milestone dates are still to come. We expect emissions to be further reduced to about 300 pounds by 2013, after full implementation of New Jersey's rules. If New Jersey's regulations on powerplants were applied nationally, mercury emissions from coal-fired powerplants would decline from approximately 48 tons to about five tons annually.

The leadership of individual facilities and states around the country has shown that the technology is available to meet the legally required standard today and that powerplants can comply with a MACT standard for mercury that protects public health significantly more than EPA's CAMR. For the sake of the health of our children and communities, a more protective standard is warranted that limits exposure to this hazardous air pollutant as soon as possible. Implementing the real maximum achievable protections is simply the only moral and ethical choice available if we are to meet our responsibility as public officials entrusted to protect the nation's environment and health for this generation and the generations that follow.

APPENDIX I

New Jersey's mercury regulations exceed comparable EPA requirements in every category:

New Jersey Performance Mercury Limits vs. USEPA Requirements

SOURCE CATEGORY	**NJ STANDARDS**	**USEPA Requirements (Using equivalent units)**	**RATIO**
Municipal Solid Waste Incinerators	28 µg/dscm or 95% removal	80 µg/dscm or 85% removal	2.9 times
Iron and Steel Scrap Melters	35 mg/ton or 75% removal	No separate mercury emission limits. Mercury emissions are part of total hazardous air pollutant limits and can remain uncontrolled since the limit is 3632 mg/ton	Up to 100 times
Medical Waste Incinerators	55 µg/m^3	550 µg/m^3	10 times
Coal Fired Boilers	3 mg/MW-hr or 90% removal	Equivalent to: 9 mg/MW-hr - Bituminous 30 mg/MW-hr - Subbituminous (wet units) 44 mg/MW-hr - Subbituminous (Dry units) 80 mg/MW-hr - Lignite	2.9 times 10 times 15 times 27 times
	No Mercury Trading	Mercury Trading	

APPENDIX II

Summary of New Jersey Mercury Regulation Development and Implementation

Background

New Jersey created its first Mercury Task Force in April 1992, to review and study sources of mercury pollution, its impact on health and ecosystem and to develop a mercury pollution reduction plan for municipal solid waste incinerators (MSWIs) in New Jersey.

As a result of the first Task Force recommendations, standards for municipal solid waste incinerators (MSWI) were promulgated in 1994, at NJAC 7:27-27: Control and Prohibition of Mercury Emissions. All of New Jersey's MSWI met the mercury standard within one year. Mercury emissions from MSWIs have been reduced by about 97% over the last twelve years.

In 1998, the Department established a second Mercury Pollution Task Force to develop and recommend a comprehensive multimedia mercury pollution reduction plan for the State of New Jersey, including recommendations on mercury emission controls and standards for major sources. The Task Force was composed of representatives from various sectors, including academia, business and industry, utilities, environmental groups, and federal and local governments. The New Jersey Mercury Pollution Task Force reviewed mercury emissions data from over 30 source categories in New Jersey and developed recommendations for reducing mercury use and emissions. This emissions data is presented in Chart 1. Based on the Task Force recommendations, on December 6, 2004, the Department revised its mercury emission regulations for municipal solid waste incinerators and adopted new mercury emissions limits for coal combustion, the iron and steel industry, and medical waste incinerators. The Department adopted the new rules and amendments to its rules at N.J.A.C. 7:27-27, Control and Prohibition of Mercury Emissions.

The second Mercury Task Force recommended a strategic goal of an 85 percent decrease of in-state mercury emissions from 1990 to 2011. The Task Force found that numerous actions were needed to achieve the New Jersey air emissions reduction milestones. These milestones are based on the Task Force's assessment that significant reduction of mercury from various sources can be achieved in New Jersey. The Task Force also recommended as a long-term goal the "virtual elimination" of anthropogenic emissions of mercury.

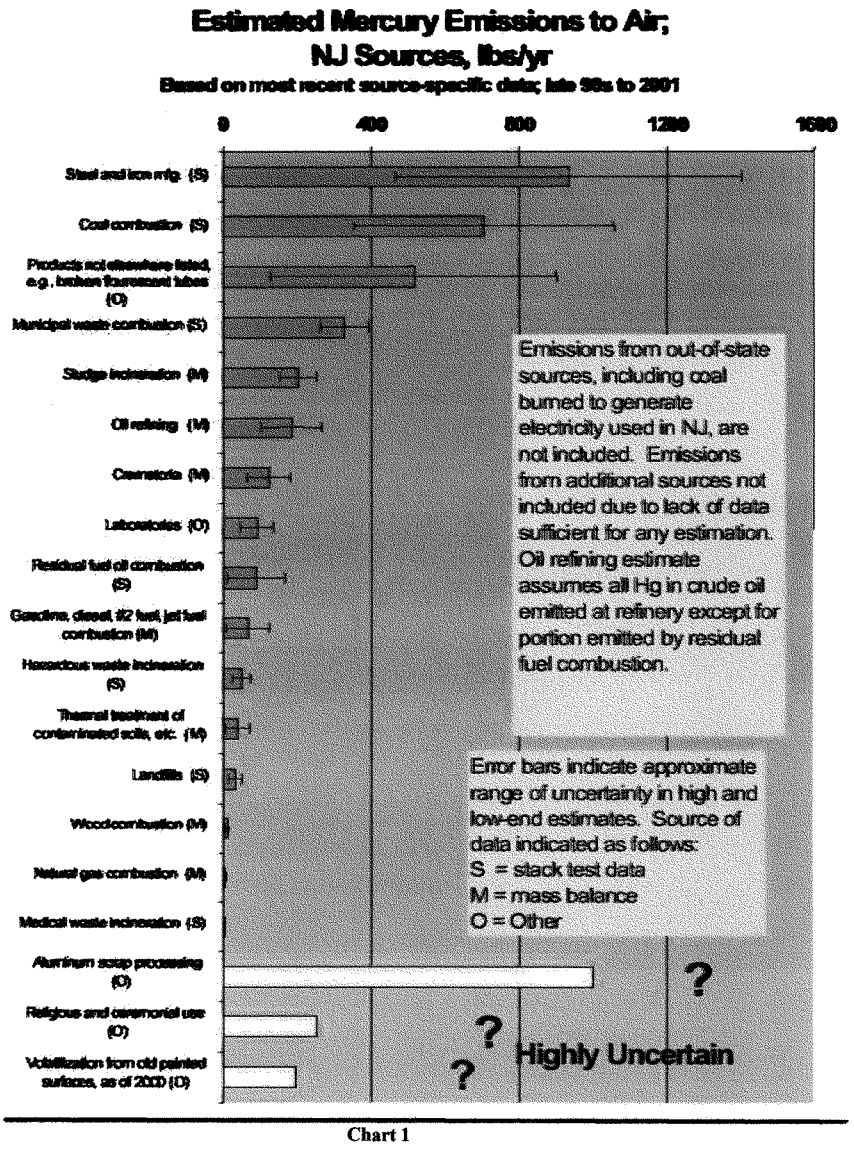

Estimated Mercury Emissions to Air;
NJ Sources, lbs/yr
Based on most recent source-specific data; late 90s to 2001
0
400
800
1200
1600
Steel and iron mfg. (S)
Coal combustion (S)
Products not elsewhere listed, e.g., broken fluorescent tubes (O)
Municipal waste combustion (S)
Sludge incineration (M)
Oil refining (M)
Crematoria (M)
Laboratories (O)
Residual fuel oil combustion (S)
Gasoline, diesel, #2 fuel, jet fuel combustion (M)
Hazardous waste incineration (S)
Thermal treatment of contaminated soils, etc. (M)
Landfills (S)
Wood combustion (M)
Natural gas combustion (M)
Medical waste incineration (S)
Aluminum scrap processing (O)
Religious and ceremonial use (O)
Volatilization from old painted surfaces, as of 2000 (O)
Emissions from out-of-state sources, including coal burned to generate electricity used in NJ, are not included. Emissions from additional sources not included due to lack of data sufficient for any estimation. Oil refining estimate assumes all Hg in crude oil emitted at refinery except for portion emitted by residual fuel combustion.
Error bars indicate approximate range of uncertainty in high and low-end estimates. Source of data indicated as follows:
S = stack test data
M = mass balance
O = Other
?
?
?
Highly Uncertain

Chart 1

Based on stack tests results, it is estimated that today a total of approximately 1,800 pounds per year of mercury is being emitted in New Jersey from the 13 municipal solid waste incinerators (MSWI), three medical waste incinerators, ten coal-burning units, and six iron and steel scrap melting plants. This is down from about 6,200 pounds per year from these sources in 1990. We expect this to be further reduced from these source categories to about 300 pounds per by 2013, after full implementation of New Jersey's rules.

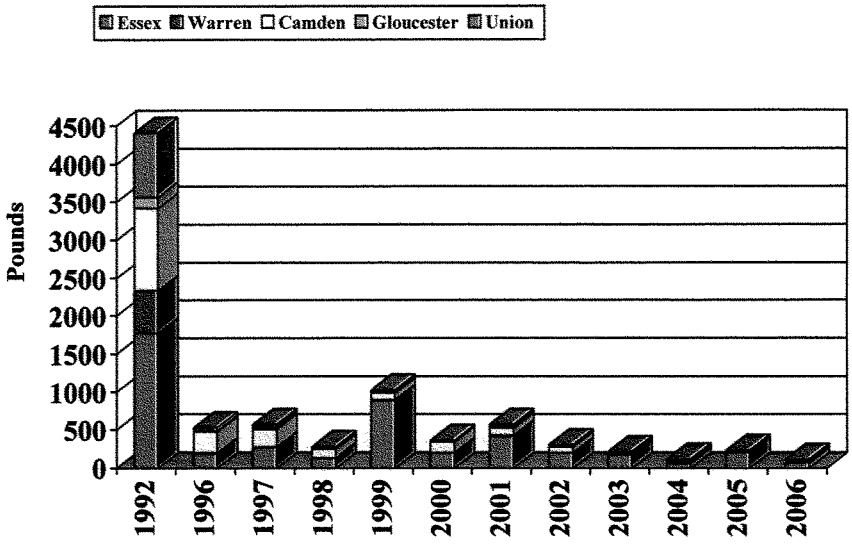
Municipal Solid Waste Incinerators (MSWI)

The first Mercury Task Force estimated that MSW contained approximately 2 ppm of mercury in 1994. The mercury content of municipal solid waste has declined about 70% in the last decade because of pollution prevention efforts. These included the virtual elimination of mercury in dry cell batteries, packaging, and other items required by the Dry Cell Battery Management Act, N.J.S.A., 13:1E-99.59 through 13:1E-99.81, and the Toxic Packaging Reduction Act, N.J.S.A. 13:1E-99.44 et seq.. Separation of mercury containing items from MSW prior to incineration has also reduced mercury emissions from MSWIs.

When waste is incinerated, the mercury contained in the waste is released. The high temperature involved in the solid waste incineration process vaporizes virtually all of the mercury present in the waste. The best emission controls on New Jersey solid waste incinerators, which primarily consist of the injection of finely-divided carbon prior to fabric filters, remove 95% to 99% of the mercury from the combustion exhaust gas stream. All MSW incinerators installed the carbon injection emission controls within one year of rule promulgation and achieved over 89% mercury reduction in the first year of operation. That has increased to about 97%, as a result of improvement in carbon injection systems, primarily improved distribution of carbon in the flue gas prior to the particulate control device.

New Jersey's MSW incinerator facilities are required to report results of stack tests of the mercury, which are done quarterly or annually, depending on performance. These results are converted to pounds-per-year of mercury emissions. These calculations provide evidence of a dramatic decline in mercury emissions as shown below in Chart 2.

Trend of Mercury Emissions from 5 Municipal Waste Incinerator Facilities in N.J.



Based on Average Emissions from stack tests for each facility
Over 97% reduction in actual mercury emissions
Over 99% reduction based on mercury in Waste
Chart 2

The mercury emissions standard of 28 ug/dscm was set in 1994 based on a presumption of at least 80% control with carbon injection and 80 % reduction with source separation/waste stream mercury reduction measures. 80% control was included in NJ first mercury rule as an alternative limit in case source separation was not fully successful.

The resulting installation of carbon injection control devices in 1995, significantly reduced mercury emissions (reducing emissions from about 4,400 pounds per year (lbs/yr) to about 500 lbs/yr in 1996, a reduction of about 89%). Since 1995, carbon injection systems have been very successfully operating on all thirteen units at all five resource recovery facilities in the State of New Jersey. In 2006, mercury emissions were about 3% of 1992 levels.

Testing over the last thirteen years have demonstrated that carbon injection on MSW incinerators can consistently achieve over 95 percent mercury reduction. Based on the demonstrated success of carbon injection, the Department revised the State's air pollution control regulation governing Municipal Solid Waste Incinerator (MSWI)

emissions to further reduce mercury emissions. The 2004 New Jersey rules require an emission standard of 28 micrograms per dry standard cubic meter (ug/dscm) or 95 percent emission reduction as an alternative standard.

The Department estimates that the 2004 amendments will maintain or improve upon the 2006 97% reduction across the control systems because of the compliance margin that results from these performance standards.

MSW Lessons Learned

1. Air pollution control systems have been available for over 10 years for mercury control of large combustion sources.
2. Carbon injection is proven, low capital cost, and quick to install (less than one year).
3. Refinements of carbon injection systems, such as improving carbon distribution, occur after initial installation to improve efficiencies.
4. Carbon injection achieves well over 90% removal of mercury, with some systems near 99%.
5. Good mercury control requires good particulate control. Fabric filters are better than electrostatic precipitators (ESPs).
6. Carbon injection works with a highly variable mercury source. (Mercury in MSW is more variable than mercury in coal.)

Iron and Steel Foundries and Mills

In New Jersey, there are six iron and steel scrap melting facilities, which are the largest mercury emitting source category in the state. Stack tests conducted at five of the facilities indicate that total mercury emissions are in the range of 1000 pounds per year. Mercury emissions are usually in the range 10 to 100 ug/dscm. The second Mercury Task Force recommended mercury emission limits be developed to achieve significant overall mercury emission reduction of at least 75%. Analogous to New Jersey's Municipal Waste Incinerator rules, a performance standard for iron and steel manufacturers was designed to reduce mercury emissions through a combination of pollution prevention, source separation, and available controls.

The three cupola and three electric arc furnaces in NJ melt scrap, which includes recycled metals from the shredding of motor vehicles, home appliances, and waste metals from demolished building structures. Thermostats, relays, switches, control devices, and measuring devices contain mercury and find its way into this metallic scrap.

Reducing mercury emissions from iron and steel manufacturers requires multi-media, multi-sector pollution prevention approaches, including removal of mercury from feedstock scrap. Mercury switches must be removed from cars when they are dismantled or prior to shredding. In accordance with the New Jersey Mercury Switch Removal Act of 2005, automobile manufacturers are required to implement a program to remove mercury switches from end-of-life motor vehicles in New Jersey. This program is

currently underway, and is being monitored by the Department's Solid and Hazardous Waste Program and by the Enforcement program. The first annual report, submitted by the automobile manufacturers' representative organization, End of Life Vehicle Solutions (ELVS), has been submitted to the Department and indicates a capture rate of 6% for 2006, which equals approximately 9.84 pounds of mercury collected. Due to the expiration of the one-year waste retention period, ELVS anticipates a much higher capture rate in 2007. In addition, a national program has been developed and is being implemented in a phased approach. Implementation of a strong national program will be beneficial, because mercury-contaminated scrap metal enters New Jersey from other states.

Under the Department's December 2004 new rules, each facility is currently required to stack test quarterly in order to show the impact of any source separation efforts on their emissions. Under the new rules, if source separation does not succeed in achieving the 35 milligram per ton of steel production (mg/ton), iron or steel melters are required to install mercury control technology. The new rules specify that on and after January 3, 2010, each iron or steel melter must reduce its mercury emissions by at least 75 percent as measured at the exit of the mercury control apparatus; or in the alternative, mercury emissions may not exceed 35 mg/ton, based on the average of all tests performed during four consecutive quarters. This 35 mg/ton standard is also based on an overall 75 percent reduction in mercury emissions from iron and steel manufacturers. The Department expects a reduction in mercury emissions of at least 700 pounds per year upon implementation of the new rules for this industry.

Most of the New Jersey melters have taken significant steps to comply with the rules, including both source separation and add on control. For example, Atlantic States iron and steel foundry in New Jersey recently installed an activated carbon injection system and a baghouse on the cupola. Mercury emission test results at this plant show greater than 90% mercury control and less than three mg/ton mercury emissions. The mercury emissions are well below both of the alternative New Jersey mercury rule limits. Other facilities with existing fabric filter control have also tested carbon injection and have reported significant reduction in mercury.

USEPA's adopted National Emission Standards for Hazardous Air Pollutants (NESHAPs) for Iron and Steel Foundries, that include emission limits of total metal hazardous air pollutants (HAP) for existing iron and steel foundries. Mercury emissions are considered part of total metal HAP emissions. The Department recommended that EPA adopt stand-alone mercury emission standards for iron and steel foundries. EPA's combined HAP limit will likely result in no control being added for mercury emissions and also fails to set a limit to measure the success of mercury in scrap removal efforts.

Iron and Steel Lessons learned

1. Carbon injection appears to work as well on iron and steel scrap melters as on MSW incinerators.

2. As with MSW incineration, removal of mercury prior to heating is a helpful component of a mercury reduction plan. However, achieving high levels of mercury reduction (over 90%) is not likely, at least in the near term.
3. Setting a performance limit for iron and steel scrap melter is necessary to:
   a. Determine the success of mercury switch removal programs.
   b. Ensure that low mercury emissions will be achieved.

Coal-fired power plants

The USEPA adopted mercury trading rules on May 18, 2005, for coal-fired power plants. Because of the inadequacy of EPA's Clean Air Mercury Rule (CAMR), over 20 states have moved forward with their own mercury regulations for power plants, because they understand that the Federal action was inadequate. New Jersey's rules require the seven coal-fired facilities in the State to install mercury control by December 2007, or December 2012. The control deadline can be extended to December 2012, for a company that commits to major reductions in emissions of NOx, SO2, and particulate, along with mercury, to levels significantly below and sooner than what the Bush Administration's Clear Skies Initiative would attain. Hence, NJ's mercury rule contains a multipollutant strategy for mercury, nitrogen oxides, sulfur dioxide, and particulates.

The Department's 2006 rule is applicable to all ten coal-fired boilers in this State. According to the Second Task Force, the coal-fired electric generating units in New Jersey emit approximately 700±300 pounds of mercury per year in the State. The source of the emissions is from the mercury contained in the coal. This industry is the second largest source category of mercury emissions in New Jersey. The new rule specifies that the mercury emissions from any coal-fired boiler shall not exceed 3 milligrams per megawatt hour (mg/MW-hr), based on the annual weighted average of all tests performed during four consecutive quarters; or, in the alternative, the owner or operator of a coal-fired boiler must achieve 90 percent reduction in mercury emissions as measured at the exit of the air pollution control apparatus.

The adopted standards are based on the information from the USEPA's Utility MACT Working Group, the Mercury Study Report to Congress, and pilot tests conducted in New Jersey at coal-fired boilers for control of mercury emissions. The standard is approximately equivalent to an input standard of 0.6 pounds per trillion BTU. New Jersey adopted an output standard to encourage and give credit for energy efficiency.

The New Jersey rules will achieve greater mercury emission reductions in a shorter timeframe than USEPA's Clean Air Mercury Rules. New Jersey does not allow emission trading. This ensures mercury emission reduction at every plant in New Jersey.

Coal – Looking Forward

1. MACT performance standards are appropriate to ensure mercury minimization at every coal-fired power plant.

2. Carbon injection systems have been proven on coal as well as MSW incinerators.
3. Good particulate control is usually necessary to achieve over 90% mercury removal with carbon injection.
4. Emissions trading will likely leave many coal-fired EGUs poorly controlled for mercury.
5. Since a portion of, and sometimes a large amount of, mercury falls locally, control of each coal-fired power plant is needed.
6. Emissions trading is inappropriate for Hazardous Air Pollutants, including mercury.

Sewage Sludge Incinerators

Industrial pretreatment programs have reduced emissions of mercury from sewage sludge incinerators, and emissions will be further reduced as the dental amalgam rules, discussed below, are implemented.

Domestic treatment works are a recipient of mercury from residential, commercial, and industrial source activities. Sewage sludge typically contains mercury in the low parts per million range (2005 median was 1.13 mg/kg). Using existing authority, domestic treatment works can help reduce influent mercury by limiting concentrations in incoming wastewater streams through the establishment of technically based local pretreatment limits, which they can impose on non-domestic users to achieve compliance with applicable environmental endpoints.

The median mercury concentration in sewage sludge has dropped 70% in the past 20 years. Although data are not readily available to pinpoint all reasons for this decline, the following actions have played a significant role:

- The Industrial Pretreatment Program as noted above has reduced the amount of mercury and other pollutants allowed to be discharged from permitted industries to domestic treatment works.
- The Pollution Prevention Program has provided industries with incentives to reduce the amounts of regulated waste produced through process changes and/or substitution.
- Mercury has been removed from household products (e.g., latex paint) that often found their way into domestic treatment works collection/treatment systems.
- Other products and/or technologies have gradually been substituted for historically mercury based products, e.g., electronic thermometers, blood pressure measuring instruments, etc.

Additionally, the Department has proposed new rules to curtail the release of mercury from dental facilities into the environment. Dental facilities contribute 35 to 45 percent of the mercury entering New Jersey's domestic treatment works. This large contribution is attributable to the use of dental amalgam as a direct filling material for restoring teeth. Dental amalgam is approximately 50 percent mercury by weight. Amalgam wastes are often rinsed down the drain in dental facilities, usually to a municipal sewer system and then to the domestic treatment works.

New Jersey's proposed new rules would, under most circumstances, exempt a dental facility from the requirement to obtain an individual permit for its discharge to a domestic treatment works, if it (i) implements best management practices (BMPs) for the handling of dental amalgam waste, and (ii) installs and properly operates an amalgam separator. These measures are expected to prevent 95 percent or more of the dental mercury wastes from being sent to the domestic treatment works. Each facility would have one year from the effective date of the rule to implement the BMPs, and two years to install the separator.

In New Jersey sewage sludge incinerators were estimated to release approximately 150 pounds of mercury in 2005, as compared to approximately 220 pounds in 2002 based on stack testing and monthly sludge quality assurance testing. Depending on the success of the pretreatment program, the Department may set lower mercury limits in sludge or stack emission limits for sludge incinerators in the future.

RESPONSES BY LISA P. JACKSON TO ADDITIONAL QUESTIONS FROM SENATOR SANDERS

Question 1. Your state has gone well beyond EPA's "Clean Air Mercury Rule" by requiring faster and deeper mercury reductions from powerplants. Please tell us what you concluded about the current and future state of mercury pollution control technologies during the period in which your rule will be carried out that led you to believe utility owners could achieve the mercury standards in your law. What, if any, communications have you received from EPA regarding your state mercury standards?

Response. The Department provided detailed comments to USEPA several times in the past concerning proposed USEPA mercury rules for Electric Utility Steam Generating Units (on June 24, 2004), Large Municipal Waste Combustors (on February 7, 2006), and Iron and Steel Foundries (on May 17, 2007). Copies of these comments are attached hereto as Exhibits A, B, & C.

New Jersey's state plan for mercury emissions reductions from powerplants was based on the efforts of two mercury task forces and years of successful regulation of several of the State's other major sources of mercury. New Jersey created its first Mercury Task Force in April 1992, to review and study sources of mercury pollution, its impact on health and the ecosystem and to develop a mercury pollution reduction plan for municipal solid waste incinerators (MSWIs) in New Jersey. As a result of the first Task Force recommendations, standards for municipal solid waste incinerators were promulgated in 1994, at NJAC 7:27–27: Control and Prohibition of Mercury Emissions. All of New Jersey's MSWIs met the mercury standard within 1 year. Mercury emissions from MSWIs have been reduced by about 97 percent over the last 12 years. The MSWIs use Activated Carbon Injection (ACI) to achieve these results.

In New Jersey, there is over a decade of successful use of ACI for MSW combustion. Some incinerators with baghouse control and ACI have achieved 99 percent mercury control. Transfer of such technology to other source categories is clearly feasible from an engineering and cost perspective. ACI use on coal combustion has shown similar emission reduction efficiencies as for MSW incinerators, with the same relationship to the two particulate control devices in widest use by both coal-fired EGUs and MSW incinerators; that is baghouses and electrostatic precipitators. For MSW incinerators with baghouses, mercury emission levels in the vicinity of New Jersey's coal-fired emission limits have been attained, even though MSW incinerator uncontrolled mercury concentrations are much higher. This indicated it was logical that a coal-fired EGU could also meet these emission limits, which has been proven with testing of ACI on coal-fired EGU's in New Jersey and elsewhere. In essence, if a MSW incinerator can meet an emission level with 99 percent control, a coal-fired EGU with 1/10 the uncontrolled mercury can meet the same emission level with 90 percent control efficiency.

Also, USDOE cost analyses indicate that retrofitting the coal-fired boilers with activated carbon injection and baghouses (or polishing baghouses) can achieve 90 percent mercury emission reduction. ACI has a low capital cost. It also has low operating costs if baghouse technology is used. Retrofitting baghouses is a substantial capital cost, but serves to also reduce fine particulate emissions and other heavy metals, in addition to mercury. (Testing of pilot ACI system on coal-fired EGUs with baghouses in New Jersey has shown compliance with the New Jersey mercury limit).

Data also show that ACI is effective with electrostatic precipitators (ESPs), although more carbon is needed, and the operating cost is higher. Two of New Jersey's MSWI facilities have ESPs and use ACI to effectively control mercury. (Also, testing ACI this year at a coal-fired facility with ESPs indicates compliance with the New Jersey mercury limits).

As with any air pollution control system, plant-specific operating parameters may affect the operation of a carbon injection control system. Those effects can only be conclusively determined by installation of a system on a specific unit and determining the best carbon distribution and feed rates for that unit and whether chemically treated carbon is useful. Extended demonstration periods at other plants, while comforting, are not needed or conclusive with respect to the exact operation of a system on another plant. The capital cost of carbon injection technology is sufficiently low that the best way of determining its effectiveness on a unit is to install a system and test various injection rates with different types of carbon. The Department's experience with MSW incinerators shows carbon injection technology can be installed in a matter of months at relatively low cost compared to the cost of the emission unit. There currently is sufficient demonstration of carbon systems on many types of plants, including coal-burning plants, to design and install a carbon injection sys-

tem, which will be highly effective at reducing mercury emissions, with reasonable adjustments of the system to maximize effectiveness.

In 1998, the Department established a second Mercury Pollution Task Force to develop and recommend a comprehensive multimedia mercury pollution reduction plan for the State of New Jersey, including recommendations on mercury emission controls and standards for major sources. Based on the Task Force recommendations, on December 6, 2004, the Department revised its mercury emission regulations for municipal solid waste incinerators and adopted new mercury emissions limits for coal combustion, iron and steel scrap melting, and medical waste incinerators.

New Jersey's rules require all 10 boilers at seven coal-fired facilities in the State to install mercury control by December 2007, or December 2012 if there is a multi-pollutant control commitment. Our December 2004 rule specifies that the mercury emissions from any coal-fired boiler shall not exceed 3 milligrams per megawatt hour (mg/MW-hr) or in the alternative, a coal-fired boiler must achieve 90 percent reduction in mercury emissions across the air pollution control apparatus. The control deadline can be extended to December 2012, for a company that commits to major reductions in emissions of NOx, SO_2, and particulate, along with mercury and controls at least 50 percent of its coal-fired capacity by December 15, 2007. These emission reductions are based on New Source Review (NSR) consent agreements, which are more stringent than CAIR. In short, the New Jersey rules achieve greater mercury emission reductions in a shorter timeframe than USEPA's Clean Air Mercury Rules and achieve those results without emission trading, ensuring mercury emission reduction at every plant in New Jersey and no hotspots.

The New Jersey experience shows that mercury emission standards are achievable for coal-fired powerplants. In fact, none of New Jersey's powerplants challenged the state standards, a telling indication of the standard's achievability PG&E National Energy Group's coal-fired units are already below or close to the New Jersey mercury standard of 3 milligrams per megawatt hour (mg/MW-hr) without activated carbon injection. Some plants in the USA, including these in New Jersey, have already met the New Jersey standards with no mercury-specific control technology, as documented in USEPA's information collection request (ICR), which resulted in the testing of about 80 coal-fired boilers in the USA in 1999. Scrubbers and baghouses in current use at these New Jersey coal-fired powerplants, in conjunction with low NOx burners and selective catalytic reduction to control emissions of nitrogen oxides, have achieved mercury reductions of more than 90 percent (98 percent tested at one plant).

Additionally, "preliminary" results at New Jersey coal-fired powerplants, which are installing ACI to meet our 12/15/2007 deadline, indicate promising results for carbon injection as shown in Attachment 1. Official compliance tests are not due until March 2008, and New Jersey allows until 12/15/2008 to optimize the mercury control system. The sum of New Jersey's experience is that, using either ACI or more traditional controls such as low NOx burners, SCR, scrubbers and baghouses, powerplants can achieve reductions of their mercury emissions far exceeding the requirements in EPA's CAMR.

Question 2. EPA declared in its final mercury rules for powerplants that it was not only "unnecessary" but also "inappropriate" to regulate mercury emissions from powerplants under the Clean Air Act's stringent air toxic provisions in section 112. Hasn't EPA long regulated mercury from other types of industries, however, under this same stringent Clean Air Act authority? And if so, what has the experience been there? Does it make sense to you that it is appropriate to regulate mercury emissions from some types of industries using the law's most protective tools, but "inappropriate" to do so when it comes to powerplants?

Response. The 1970 Amendments to the Clean Air Act (CAA or Act) added section 112 to the Act and specified that the EPA Administrator must list each "hazardous air pollutant for which he intends to establish an emission standard."[1] When EPA failed to meet this mandate—listing only seven pollutants in 20 years—the 1990 Amendments to the Act restructured section 112 and required EPA to set emission standards for all major sources of a list of 188 hazardous air pollutants (HAPs)—including mercury. Emission standards promulgated under section 112 require the maximum degree of reduction in emissions of HAPs or the maximum achievable control technology (MACT).

For HAPs, other than mercury, section 112 has generally been an effective regulatory tool for reducing HAPs in our environment. MACT standards located at *http://www.epa.gov/ttn/atw/mactfnlalph.html* have been promulgated for sources

[1] Pub. L. 91–604, § 4(a), 84 Stat. 1685.

other than EGUs under section 112. However, despite the general success of section 112, EPA has failed to regulate mercury effectively under this section. EPA has yet to set effective MACT limits for coal-fired electric generating units; coal-fired industrial, commercial and institutional (ICI) boilers; and iron and steel swap melters, which are amongst the major sources of mercury emissions in the USA. The only MACT limit that refers to mercury is for ICI boilers, where mercury is combined in a limit for other HAPs that is set too high to result in mercury emission reductions being required. For iron and steel melters, EPA did not even set an emissions limit for mercury, but relied entirely on a work practice standard involving source separation. Even where Congress specifically provided for mercury regulation of municipal solid waste incinerators (MSWI) in section 129 of the Clean Air Act, EPA did not adopt mercury rules for such incinerators until 5 years after New Jersey adopted its first MSWI mercury rules in 1994, and these standards are less stringent than New Jersey's standards.

When Congress amended section 112 in 1990, it included a specific provision, section 112(n), for the regulation of HAPs from electric utility steam generating units (EGUs). Under this section, Congress required EPA to study the hazards to public health reasonably anticipated to occur as a result of HAP emissions from EGUs. This section also required EPA to regulate EGUs under section 112, if EPA concluded that such regulation was "appropriate and necessary" after considering the results of the study. In February 1998, EPA completed its study, and in December 2000, concluded that it is "appropriate and necessary" to regulate EGUs under section 112. Despite this finding, EPA's recent Clean Air Mercury Rule (CAMR) fails to establish an effective MACT standard for HAPs such as mercury under section 112 for EGUs, and instead regulates mercury under a cap-and-trade program promulgated under section 111 of the Clean Air Act.[2]

For source categories other than EGUs, Congress did not require EPA to make the "appropriate and necessary" finding prior to setting a MACT standard, but rather required EPA to list source categories pursuant to section 112(c) that emit HAPs listed in section 112(b), and to set emission standards that reflect the maximum degree of reduction of HAP emissions, as required by section 112(d). As stated above, EPA has failed to set effective MACT standards for mercury reductions from coal-fired industrial, commercial and institutional (ICI) boilers, and iron and scrap melters.

Since mercury represents a potent neurotoxin, which has been proven to cause serious neurological and developmental impacts, including loss of IQ in infants and children, it should be regulated in the most rigorous manner as provided for under section 112. Since EPA made the finding that it was "appropriate and necessary" to regulate mercury emitted from EGUs and cannot justify delisting EGUs as a source category under section 112(c), it must regulate this pollutant in accordance with section 112. Once this finding was made, there is simply no justification to regulate mercury from EGUs differently from any other industry that emits mercury or any other HAP. Congress directed EPA to regulate mercury in a manner that represents MACT, and EPA should act in a manner that fulfills that statutory mandate for all source categories of mercury.

Question 3. In addition to the regulation of powerplants, I understand that your state and other states have been recycling products containing mercury, like auto switches and thermometers. Do you know what happens to the mercury once it has been sent to the recycler? What do you think about closing the loop by banning the export of mercury so that mercury that is recycled is not then used in ways that pollute the environment?

Response. Pursuant to New Jersey's Mercury Switch Removal Act of 2005, which became effective March 23, 2005, manufacturers of motor vehicles sold in New Jersey have developed and are now implementing a plan to remove mercury-containing switches from end-of-life vehicles. These switches are sent to a mercury recycling facility, with mercury retorting equipment, where they are heated until the mercury vaporizes, and then the vapor is condensed as pure mercury. Other mercury-containing items, including thermostats, are recycled in the same manner. There are several mercury retorting facilities in the U.S. In addition to the mercury recycled from discarded switches, etc., mercury is supplied by gold mines in the western U.S. where it is produced as a byproduct. It also enters the marketplace in significant quantities in the U.S. through the decommissioning of mercury cells at chlor-alkali

[2] New Jersey and coalition of 16 states are challenging EPA's mercury rules in the Circuit Court of Appeals for the District of Columbia. The brief in that matter highlights the legal shortcomings of EPA's rules, and is attached as Exhibit D.

plants, which occurs periodically as these units are phased out in favor of newer membrane cell technologies.

According to a November, 2006 report, Summary of supply, trade and demand information on mercury prepared by the United Nations Environment Programme: Chemicals, the United States is currently a net exporter of mercury. This report also states that a major portion of mercury that enters the international market is used to amalgamate and extract gold particles from soil and gravel in the relatively unregulated artisanal and small-scale gold mining sector, and that this use of mercury is the largest global source of mercury releases to the environment, accounting for 650 to 1,000 metric tons of mercury releases per year, equivalent to about one-third of all global anthropogenic releases. The report notes that this use of mercury, which is largely limited to the developing world, involves serious occupational health hazards and "has generated thousands of polluted sites, with impacts extending far beyond localized ecological degradation, often presenting serious, long-term environmental health hazards to populations living near and downstream of mining regions."

The Quicksilver Caucus organization formed by state environmental associations *(http://www.ecos.org/section/committees/cross—media/quick—silver)*, to foster the development of holistic approaches for reducing mercury in the environment, has developed a set of principles regarding trade in mercury. These principles indicate that mercury should be stored and not exported, unless it is clearly going to an essential use. Essential uses include lamp manufacture, and the manufacture of selected pieces of scientific or technical apparatus.

The Department also understands that the European Union, which expects to see many of its chlor-alkali plants phase out their mercury cells over the next few years, is likely to soon ban mercury exports. A similar ban by the U.S. could help reduce the current ready availability of mercury in the international market to dispursive uses such as that of the artisanal and small-scale gold mining sector, and thus help lower mercury pollution internationally.

ATTACHMENT 1

Preliminary results at New Jersey coal-fired power plants

Plant Name	Test Results	Approximate pound per trillion BTU	NJ STANDARDS	USEPA Requirements (Using equivalent units for bituminous coal)***
Mercer	2.66 mg/MW-hr (gross)	0.57	3 mg/MW-hr or 90% removal	9 mg/MW-hr
Deepwater	1.51 mg/MW-hr (net)	0.28	Same as above	Same as above
Chambers**	1.5 mg/MW-hr Unit 1 2.6 mg/MW-hr Unit 2	0.68 1.2	Same as above	Same as above
Logan**	non-detect at < 6 mg/MW-hr*	<1.5	Same as above	Same as above

* Compliance testing will be required to have a lower detection limit

** No mercury specific control. These modern electric generating units have low NOx burners, selective catalytic reduction, baghouses, and acid gas scrubbers.

*** EPA limits for subbituminous and lignite coals are even higher.

June 24, 2004

EPA Docket Center (Air Docket)
Attn: Docket ID No. OAR-2002-0056
U.S. EPA West (6102T), Room B-108
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

RE: **Hazardous Air Pollutants (HAP)** Emissions from Electric Utility Steam Generating Units Docket ID No. OAR-2002-0056

Dear Sir or Madam:

Thank you for the opportunity to comment on the January 30, 2004 proposal and March 16, 2004 supplemental proposal by the United States Environmental Protection Agency (USEPA), to regulate hazardous air pollutant emissions from power plants.

I believe that the USEPA proposals themselves are deeply flawed, for the reasons outlined in this letter, in the more detailed comments attached to this letter, and in comments submitted by a group of state Attorneys General and environmental agency heads led by New Jersey. It troubles me even more to understand the mercury proposals as just one component of the Bush Administration's approach to regulating air pollution from power plants. That approach protects coal-fired power plants as much as possible from having to install modern air pollution control technology, while leaving the health of residents of New Jersey and much of the eastern United States without protection from the emissions from those power plants.

Mercury, a potent neurotoxin that damages the developing brains of fetuses and young children, is just one of the important air pollutants (or a condition caused by pollutants) that power plants emit in enormously damaging quantities. Others include:

- Oxides of nitrogen (NO_x), a precursor to ground-level ozone, acid rain, fine particulate matter, and haze. Power plants are responsible for about 25% of the NO_x emitted nationwide;

- Sulfur dioxide (SO_2), a precursor to acid rain, fine particulate matter, and regional haze. Power plants are responsible for at least 60% of the SO_2 emitted nationwide; and

Exhibit A

- Carbon dioxide (CO_2), a greenhouse gas which is contributing to global warming. Power plants are responsible for about 40% of the CO_2 emitted nationwide.

Just a few years ago, a series of air pollution initiatives had already begun to drive power plants to control emissions of all four of these pollutants as well as a number of other toxic pollutants. The strict health standards that the USEPA established for ozone and fine particulates in 1997 were upheld by the U.S. Supreme Court in 2001, with the expectation that those standards would drive major reductions in power plant emissions of NO_x and SO_2. The 1999 regional haze rules were expected to yield pollution control upgrades to reduce NO_x and SO_2 emissions at virtually every coal-fired power plant built since 1962. Better understanding of global warming, and of how CO_2 emissions from power plants is contributing to it, was spurring the construction of much more efficient power plants and the development of much cleaner and more efficient technologies to generate electricity from coal. Enforcement of the Clean Air Act's New Source Review (NSR) requirements had led to agreements for power plants to reduce their NO_x, SO_2 and mercury emissions by 90 percent or more. Finally, the USEPA's commitment in 2000 to develop a Maximum Achievable Control Technology (MACT) standard for power plant emissions of mercury and other toxics was expected to yield 90 percent reductions of emissions of mercury, because that is what the technology used today by the best-performing coal-fired power plants is achieving. That same technology would also have cut SO_2 emissions by 90 percent or more, and substantially cut emissions of particulates and other toxics.

One by one, we have seen all of these air pollution initiatives undermined:

- The USEPA's NSR changes virtually eliminated NSR for existing power plants, foregoing the opportunity to reduce NO_x, SO_2 and mercury emissions by 90 percent or more;

- In its proposed Interstate Air Quality Rule (IAQR), the USEPA has proposed to cap power plant NO_x emissions at the level no more strict than what it established in the 1998 NO_x SIP Call, leaving much of the Northeast unable to attain the health standards for ozone;

- The IAQR would allow power plants to continue emitting at least five times as much SO_2 as either full enforcement of NSR or true application of a power plant MACT would allow, making it difficult or impossible for New Jersey and other states to attain the health standards for fine particulates;

- The USEPA has also proposed to eliminate the requirements for any action under the regional haze rules through the end of the next decade, and substitute the IAQR for those requirements; and

- The USEPA has reversed its prior position that CO_2 is a pollutant that can be regulated under the Clean Air Act.

Now, the USEPA has also proposed two alternatives to regulate power plant emissions of mercury (and none of the other toxics emitted by coal-fired power plants): a cap-and-trade system that flatly contradicts what the Clean Air Act requires, and a weak set of plant-by-plant emission standards that does not begin to approach what would be considered MACT. Those emission standards also allow plants fueled by sub-bituminous coal, mined in Wyoming and other areas of the Powder River Basin, to emit three times as much mercury as plants fueled by bituminous coal mined from the Appalachian region and elsewhere.

As a result of all of these rollbacks, the USEPA is no longer even attempting to substantially reduce emissions of the four major pollutants emitted by coal-fired power plants. Instead, it now seeks only to reduce emissions of one pollutant, SO_2, to some extent. At the same time, it has expressly written off CO_2, more or less preserved the status quo for NOx, and sought no near term reductions in mercury emissions beyond what its modest efforts on SO_2 can deliver. It has also written off any effort to reduce emissions of other hazardous air pollutants such as arsenic, chromium, cadmium, hydrogen chloride, and hydrogen fluoride.

Furthermore, the combination of rollbacks sends a strong message to coal-fired power plants that they need not install up-to-date air pollution controls. Instead, they can comply with the USEPA's suite of proposals without installing any air pollution controls, simply by using sub-bituminous coal instead of bituminous coal. Switching coals will reduce emissions of SO_2 and NO_x to some extent, but not nearly as much as what today's air pollution control technology can achieve. At the same time, the USEPA's proposals will allow a power plant that switches coals to emit far more mercury than would have been permissible without a switch.

Although I am deeply concerned about the role of the mercury proposals as part of a coordinated effort to protect coal-fired power plants from having to upgrade their air pollution controls, I must emphasize how harmful the mercury proposals are on their own. Mercury poses a serious threat to public health. It can cause permanent brain damage to the fetus, infant, and young child. It can hurt the ability of children to pay attention, remember, talk, draw, run, see, and play. Even exposure to low levels can permanently damage the brain and nervous system and cause behavior changes. In New Jersey alone, we estimate that more than 5,000 newborns every year are exposed to dangerous mercury levels *in utero*.

With the stakes in public health so high, it is especially important that mercury regulations be based on sound science and strict compliance with the law. Unfortunately, the USEPA's proposals contradict both science and the law, leading to far smaller emission reductions than what is now feasible, and delaying those reductions by 10 to 20 years.

The Clean Air Act requires the USEPA to set a mercury emissions standard based on the emissions of the best-performing facilities. The USEPA's proposals fall far short of that

mark. The best-performing facilities are already using well-established technology to control power plant mercury emissions today. Two coal-fired power plants in New Jersey, using pollution control technology about a decade old, have reduced their mercury emissions by well over 90 percent compared with uncontrolled levels. Three more coal-fired units in New Jersey have committed to install pollution controls expected to yield about a 90 percent reduction in their mercury emissions. A host of municipal solid waste incinerators have reduced their mercury emissions by 90 to 99 percent for the past ten years, burning fuel that is far more variable than coal (and therefore presenting a greater challenge to control mercury emissions).

A legally sustainable MACT standard would reflect that many coal-fired facilities are already achieving better than 90 percent reductions in mercury emissions, and would require similar reductions by the December 2007 deadline that the USEPA acknowledges in its proposals. In contrast, the USEPA proposes only a 30 percent reduction within the next decade, delivers not much more than that by 2018, and even a decade after that delivers at best no more than 70 percent.

Rather than develop standards based on the straightforward requirements of the Clean Air Act, the USEPA manipulates statistics to support far more lax standards. Building on industry concerns that power plant mercury emissions can vary, the USEPA based the proposed standards on worst case emissions. As a result, the USEPA proposed to allow mercury emissions for bituminous coal 17 times higher, and for sub-bituminous coal eight times higher, than what would be allowed under a straightforward application of the law. At the same time, the USEPA ignores how municipal solid waste incinerators have demonstrated over several years that they can deliver consistent 90 to 99 percent reductions in mercury emissions, even though mercury emissions from burning trash vary far more than mercury emissions from burning coal.

The USEPA also justifies its approach by claiming that the court-approved December 2007 MACT deadline is too tight to accommodate the necessary installation of pollution controls. Based on this claim, the USEPA weakens the legally required emissions standard - and then proceeds to extend unilaterally the 2007 deadline that was the basis for the weaker standard. If the deadline were indeed too tight, and if this fact were even relevant to how the Clean Air Act directs the USEPA to establish a standard, the USEPA's proposed timing would certainly provide enough time for power plants to meet a true MACT standard. In any event, the emissions standard cannot be a function of ability to meet the December 2007 deadline. The standard must instead conform to the legal requirements. If the timing proves to be an obstacle, the Clean Air Act provides specific procedures for the USEPA to extend the deadline by a year, and for the President to grant one or more two-year extensions beyond that.

The USEPA's lack of an effective national strategy to control mercury in the USA has driven states to do state mercury rules. So far Massachusetts, Connecticut, New Jersey and Wisconsin have either new legislation or rule actions to reduce mercury emissions from coal fired power plants. Others are sure to follow. States should not need to expend valuable resources on a problem that is best addressed consistently nationwide. We did

not originally plan to propose a New Jersey-only rule for power plant mercury emissions. It was only after it became apparent that EPA would be proposing a weak rule with an extended timeframe that New Jersey and other states were put in a position of having to do their own rules.

Many more states are deeply concerned about the USEPA's proposal and about its disregard of the views that stakeholders expressed in a lengthy advisory process. On April 20, 2004, the Environmental Council of the States (ECOS) resolved that:

> ECOS expresses its disappointment that EPA has not represented the views of its working group stakeholders in the rule consultation process.
>
> ECOS is concerned that neither of EPA's proposed approaches is adequate to protect the public health of sensitive populations from the dangers posed by mercury in the environment, nor are they consistent with requirements of the Act nor do they fully take into account the current status of available technology to control mercury emissions from power plants.

Of, course, mercury is not the only hazardous air pollutant of concern emitted by coal-fired power plants. The USEPA's 1998 report to congress also noted the importance of arsenic, chromium, cadmium, dioxin, hydrogen chloride, and hydrogen fluoride. These toxics can be controlled effectively by the same air pollution control technology, especially scrubbers and baghouses, that is already successfully controlling mercury emissions at power plants. Exposure to these toxic substances can irritate the lung, skin, and mucus membranes, affect the central nervous system, damage the kidneys, and cause cancer. The USEPA has the obligation to set emission limits for these other toxics along with mercury.

Considering the difficulty and the complexity of the issues involved in developing a mercury regulation, I appreciate your extension of the comment period to June 29, 2004 and your decision to undertake further analysis of the USEPA proposals and of alternative regulatory strategies. Your commitment to a reevaluation of these proposals is both encouraging and important. I look forward to seeing the fruits of that further analysis.

Thank you for providing us with the opportunity to comment on the proposed rules. The NJDEP's detailed comments on these proposed rules are attached to this letter. We appreciate your consideration of our comments. If you have any questions, please contact William O'Sullivan by telephone at (609) 984-1484 or by e-mail at bill.o'sullivan@dep.state.nj.us to discuss these comments.

Sincerely,

Bradley M. Campbell
Commissioner

C (w/enclosure):

EPA Docket Center (Air Docket)
Attn: Docket ID No. OAR-2002-0056
U.S. EPA West (6102T), Room B-108
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460
(2 copies)

Via email:
a-and-r-docket@epa.gov
Attn: Docket ID No. OAR-2002-0056

Mr. William H. Maxwell
Combustion Group (C439-01)
Emission Standards Division
Office of Air Quality Planning and Standards
U.S. EPA
Research Triangle Park, NC 27711

Bc (w/enclosure):
Samuel Wolfe, Assistant Commissioner
William O'Sullivan, PE, Director
Iclal Atay, Assistant Director
Sunila Agrawal, Section Chief
Alyssa Wolfe, DAG

N:\SHARED\AC Office\ERACO\Wolfe\Air\Mercury - cover letter for comments on EPA proposal.doc

Docket ID No. OAR-2002-0056
Technical Comments of the New Jersey Department of Environmental Protection

Organization of Comments- These comments are organized using the same outline in the USEPA's Federal Register notice dated January 30, 2004, for ease of the USEPA staff in responding to our concerns, along with similar concerns expressed by others.

i. **Health effects of Mercury emitted from coal- and oil-fired utility units**

The USEPA has underestimated and distorted the health effects caused by mercury emitted from power plants.

Any reduction in mercury emissions, even the modest and delayed reduction likely to result from adopting the proposed rule, will theoretically reduce risk. However, the salient public health consideration is the extent of the risk reduction.

The USEPA has either ignored or misinterpreted the science documenting the serious public health impacts caused by ingestion of methylmercury contaminated fish. The very brief discussion of the potential cardiovascular effects of methylmercury concludes that the existing studies present conflicting results.[1] This statement is not documented, and is largely not the case. Furthermore, the citations given to support this statement are not provided in a References section in the Federal Register entry. In particular, the reference to a Bolger 2003 paper is not given in the text, and no likely candidate for this reference appears in a PubMed search.

The USEPA identifies those at risk from methylmercury as "...Those who regularly and frequently consume large amounts of fish..."[2] This is not necessarily the case, and is misleading. Even moderate consumption of fish with high concentrations of mercury, either marine (e.g., swordfish, "sushi-grade" tuna), or freshwater (e.g., walleye, northern pike, largemouth bass) can lead to significantly elevated body burdens of mercury and significantly elevated risk.

The USEPA's brief discussion of the potential links between utility emissions and methylmercury concentration in fish fails to take into account the recent findings in Florida, where substantial reductions in mercury emissions from industrial sources resulted in significant reductions in mercury concentrations in freshwater fish over a relatively short time frame[3]. While these findings do not necessarily yield a quantitative relationship between utility emissions and fish concentration that can be generalized to other regions, they clearly make the case that local and regional emissions can have significant and short-term reversible impacts. Other studies also demonstrate that significant regional differences exist in mercury deposition and that local and regional sources are important contributors to mercury deposition. One study estimates that over 80% of the mercury deposition in northeastern New Jersey are contributed by sources within North America.[4] Another recent study found that local and

[1] FR 69, p. 4658.
[2] FR 69, p. 4658.
[3] http://www.dep.state.fl.us/evergladesforever/news/2003/110603.htm

[4] Siegneur, Christian, K. Vijayaraghavan, K. Lohman, P. Karamachandani, and C. Scott, 2004, Global source attribution for mercury deposition in the United States, *Environ. Sci. Technol., 38*, 555-569.

regional sources are important contributors to mercury deposition and that coal combustion was generally found to be the largest contributor to atmospheric deposition to the Great Lakes.[5]

The request on the USEPA's part for information on how mercury emissions from U.S. power plants may effect mercury concentrations in shrimp, tuna and other marine fish is, in part, misleading. Although these are, indeed, the major types of fish consumed by the U.S. public on average, they do not represent the most consumed species (or the species most likely to result in significant methylmercury exposure) for distinct subgroups in the population. These include subsistence freshwater fishers and freshwater fishers who supplement their diets significantly with freshwater fish. In specific, relatively large areas of the U.S., consumption of freshwater fish constitutes not only the major source of fish consumption, but also a major dietary component. Such consumption patterns are seen e.g., among Native American populations in the northwest, as well as among many southern rural populations. Freshwater fish are more likely to be impacted by local and regional mercury emissions from power plants, and less likely to be impacted by global sources than marine fish. The USEPA's emphasis on exposure from marine fish ignores the potentially large impact of power plant emissions on freshwater fish and the sub-populations that consume them.

This is not to say that mercury in marine fish is unimportant. The consumption of marine fish is a significant source of mercury in the U.S. diet. Many marine fish are harvested in coastal waters and spend considerable parts of their lives in coastal waters. Coastal waters are the source of many organisms that serve as food for wider-ranging marine fish. The deposition of mercury to coastal waters should be included in the deposition that is considered important to the health of the U.S. fish-eating population. Further, since an estimated 10-20% of mercury deposited on land surfaces is exported to streams,[6] runoff of atmospheric deposition from land surfaces draining to coastal areas must also be considered. Coal-burning plants can be expected to cause not only local, but also regional deposition of mercury.

Health Effects of Nickel[7]

Cancers of the lung and nasal sinus have resulted when workers breathed dust containing high levels of nickel compounds while working in nickel refineries or nickel processing plants. The Department of Health and Human Services (DHHS) has determined that nickel metal may reasonably be anticipated to be a carcinogen and that nickel compounds are known human carcinogens. The International Agency for Research on Cancer (IARC) has determined that some nickel compounds are carcinogenic to humans and that metallic nickel may possibly be carcinogenic to humans. The EPA has determined that nickel refinery dust and nickel subsulfide are human carcinogens.

---

[5] Cohen, Mark, R. Artz, R. Draxler, P. Miller, L. Poissant, D. Niemi, D. Ratte, M. Deslauriers, R. Duval, R. Laurin, J. Slotnick, T. Nettesheim, and J. McDonald, 2004, in press, Modeling the atmospheric transport and deposition of mercury to the Great lakes, *Environmental Research*

[6] Castro, Mark, Scudlark, Joseph, Church, Thomas, and Robert Mason, 2000, *Input-Output Budgets of Major Ions, Trace Elements and Mercury for a Forested Watershed in Western Maryland*, prepared for John Sherwell, Maryland Department of Natural Resources, Power Plant Research Program, Tawes State Office Bldg., Annapolis, MD.

[7] Agency for Toxic Substances and Disease Registry (ATSDR), ToxFAQs for Nickel, 9/2003 (www.atsdr.cdc.gov/tfacts15.html)

The most common adverse health effect of nickel in humans is an allergic reaction. Once a person is sensitized, further contact with it will produce a reaction, most commonly, a skin rash at the site of contact. Some people who are sensitive to nickel may have asthma attacks following exposure to nickel in the air. Some sensitized people react when they eat nickel in food or water or breathe dust containing it.

II. Proposed National Emission Standards for Hazardous Air Pollutants for Mercury and Nickel from Stationary Sources: Electric Utility Steam Generating Units

A. Statutory Authority

The following responds to specific USEPA requests for comment.

1. The USEPA is required to regulate all HAPs listed in Section 112(b) as a result of its Dec. 2000 finding that it is "necessary and appropriate" to regulate electric utility steam generating units under Section 112. (P. 4659-4660).

   Emissions of non-Hg and non-Ni HAPs do warrant regulation at this time. The USEPA should also address other hazardous air pollutants emitted in large quantities from coal-fired power plants pursuant to section 112. While the USEPA's Utility Report to Congress (Study of Hazardous Air Pollutants from Electric Steam Generating Units, February 1998) stated that mercury is the HAP of "greatest potential public health concern;" it also concluded that other air toxics "of potential concern" are arsenic, chromium, cadmium, dioxins, hydrogen chloride, and hydrogen fluoride."

   These other HAPs can be effectively controlled by best available control technology in use at some power plants (like the Carneys Point Generating Station and Logan Generating Station in New Jersey). Scrubbers control acid-gas HAPs, including hydrogen chloride and hydrogen fluoride. Baghouses control particulate HAPs including arsenic, cadmium, chromium, and dioxins. These same control technologies also have been demonstrated effective at removing mercury from most power plants. Consequently, there is synergy in addressing all the major HAPs emitted by coal-fired power plants in a single MACT rule. The synergy between the control of mercury and particulate HAPs is useful. A baghouse is clearly MACT for particulate HAPs. A baghouse also enables efficient and cost effective control of Hg with carbon injection.

   Also, if coal-burning units are not subcategorized based on coal rank, the ICR III data demonstrates that units with baghouse control are the lowest 9 out of the lowest 10 emitters for mercury, and units with baghouses make up 13 of the lowest 15 emitters. From a mercury perspective, use of a baghouse makes sense. From a particulate HAP (arsenic for example) standpoint, a baghouse also makes sense. From an overall perspective, baghouse particle control is clearly MACT for coal fired power plants.

   On February 26, 2004, the USEPA promulgated national emission standards for hazardous air pollutants (NESHAP) for industrial, commercial, and institutional boilers and process heaters. Electric Utility Steam generating units are exempt from this rule. The final rule implements

section 112(d) of the Clean Air Act (CAA) by requiring all major sources to meet HAP emissions standards reflecting the application of the MACT. The HAPs emitted by facilities in the boiler and process heater source category include arsenic, cadmium, chromium, hydrogen chloride (HCl), hydrogen fluoride (HF), lead, manganese, mercury, nickel, and various organic HAP. In this rule, the USEPA admits that exposure to these substances has been demonstrated to cause adverse health effects such as irritation to the lung, skin, and mucus membranes, effects on the central nervous system, kidney damage, and cancer. These adverse health effects include chronic health disorders (e.g., irritation of the lung, skin, and mucus membranes, effects on the central nervous system, and damage to the kidneys), and acute health disorders (e.g., lung irritation and congestion, alimentary effects such as nausea and vomiting, and effects on the kidney and central nervous system). The USEPA grouped the HAPs into four common categories: mercury, non-mercury metallic HAP, inorganic HAP, and organic HAP and said that in general, the pollutants within each group have similar characteristics and can be controlled with the same techniques. Next, they identified compounds that could be used as surrogates for all the compounds in each pollutant category. For the non-mercury metallic HAP, the USEPA chose to use PM as a surrogate. Most, if not all, non-mercury metallic HAP emitted from combustion sources will appear on the flue gas fly ash. Therefore, the same control techniques that would be used to control the fly ash PM will control non-mercury metallic HAP.

Similarly for utility MACT, the USEPA should be regulating all non-mercury HAPs such as organic HAPs (dioxins) and acid gas HAPs (HCl and HF). On page 4688 of the January 30, 2004 proposal, the USEPA states that "The USEPA also intends to continue to study dioxins, HCl, and HF in the future, but, at this time, the study and the information the USEPA has obtained since the study reveal no public health hazards reasonably anticipated to occur as a result of these HAP emissions from Utility such that they warrant regulation." This is contrary to the statement in the final rule dated February 26, 2004, national emission standards for hazardous air pollutants (NESHAP) for industrial, commercial, and institutional boilers and process heaters that has identified these HAPs emissions as a public health concern.

The USEPA also promulgated the Federal Plan to fulfill the requirements of sections 111(d)/129 of the Clean Air Act for Municipal Waste Combustors (MWCs). The Federal Plan imposes mercury and non-Mercury HAPs emissions limit and control requirements for existing MWC units. These two precedents on smaller source categories for HAP emissions make it obvious the USEPA should also regulate all significant HAP emitted by EGUs.

2. For the reasons explained in the detailed comments of the Multi-State Coalition led by the New Jersey Attorney General, the USEPA's alternative proposal to revise the Dec. 2000 regulatory finding and remove coal- and oil-fired utility units from Section 112(c) list and regulate Hg emissions from coal-fired utility units and oil-fired utility units pursuant to authority under Section 111 is not permissible under the Clean Air Act (CAA).

3. The USEPA's other alternative proposal to leave the December 2000 regulatory finding in place as to coal-fired units and promulgate a MACT cap-and-trade program for Hg emissions from utility units under Section 112(n) is also not consistent with the requirements of the CAA. Also, the USEPA's statement that the cap-and-trade program under Section 112 would be "somewhat

like the one the USEPA is today proposing pursuant to CAA section 111" (P. 4661) is insufficient to evaluate a trading program, even if allowed.

4. The USEPA may not expand on an approach used in previous MACT rulemakings (e.g., to use Section 112(d) authority to establish source-wide emissions averaging provisions), and use Section 112(d) as authority to allow for cap-and-trade program. (P. 4662.) Even sourcewide emission averaging is questionable under Section 112, but justifiable if local impacts are the same as unit specific performance limits.

5. The USEPA should not design a trading program under Section 112. The Title IV Acid Rain SO2 program, Acid Rain NOx program, NOx SIP call and proposed Section 111 program are not allowable models for regulating Hg emissions (P. 4662)

Discussion of items 3, 4 and 5 above

There are many reasons why emissions trading under either Section 112(n) or Section 111(d) is not a viable option for regulating mercury emissions. Emissions trading is illegal and inappropriate for regulation of Hazardous Air Pollutants (HAPs) under Section 112 of the CAA. Emissions trading of HAPs with localized impacts, such as mercury, is also not a performance standard to be applied to each emission source under 111(d), even if 111(d) were a legally viable option.

Even if trading was authorized under either Section 111(d) or 112(n), the trading scheme proposed for mercury is inappropriate. Emissions' trading has been advocated as a way to get more emission reductions, sooner. When the caps are set as loosely as the USEPA has proposed, trading becomes a way to get less emission reductions, later. The natural result of an emission standard, which applies to each facility by a set deadline, is that each facility complies earlier and with a margin of compliance. This is obviously good for the environment. If emissions trading results in real reductions to be made below the limit by some units who install controls, then other units are clearly allowed to avoid reductions until a later date and the environment is hurt. Trading only makes sense from an environmental perspective if the caps are set at levels well below the performance standards that would have otherwise been set. That is not the case with the mercury proposal. We believe the MACT standard should result in allowable emissions in the 5 to 10 tpy ranges, which is a considerably greater reduction than 15 tpy actual in 2018 as proposed by USEPA.

Further, the proposed emissions trading cap will avoid entirely or delay mercury emission reductions at many coal fired power plants. The proposed cap is 15 tons per year by 2018, and the USEPA has acknowledged that this cap will not be achieved until a decade or more later. The USEPA has proposed an interim "cap" to be imposed in 2010. This is not a cap at all, merely a projection of the mercury emission reductions that the industry will achieve without any effort beyond what will be needed to comply with the 2010 NO_x and SO_2 caps under the proposed Interstate Air Quality Rule.

To adequately address impacts of mercury everywhere, emission standards under Section 112(d) of the CAA that will reduce emissions from every facility are necessary and legally required.

The USEPA's arguments in support of emissions trading for mercury have stressed that health risks associated with mercury emissions from power plants are "uniquely global, rather than local."[8] Such arguments miss the importance of local impacts from heightened deposition near coal-burning power plants, and ignore the regional impacts from overlapping deposition patterns of multiple coal-burning power plants. In general, regions in the U.S. with the highest mercury deposition are the same regions where local and regional sources make significant contributions to the total mercury load. It is clear that mercury emitted from coal-burning power plants is deposited much more in some regions than others. In addition to "hot spots," these are "hot regions" of mercury deposition.

A cap-and-trade approach may well exacerbate the regional impact of deposition of mercury emissions from coal-burning power plants. The USEPA's coal-burning electric generating unit information[9] indicates that, of the total U.S. electricity generating capacity from coal combustion of 315,000 MW, about 92,800 MW (30%), represents capacity of units with stacks less than 142 meters. These shorter stacks tend to result in more local deposition of mercury. The units with these shorter stacks are usually smaller, older plants that would likely not be controlled given the flexibility offered by a cap-and-trade program. Avoiding the expense of installing and operating air pollution controls makes increased utilization of these smaller, older plants more likely. As a result, regional and local impacts of mercury could increase in regions where smaller units are prevalent. The smaller units represent much of the coal-fired capacity in the Northeast.

The USEPA's reliance on state air agencies to address local impacts if the USEPA fails to do so is hollow and will be ineffective. Many states are prevented by state law from implementing rules more stringent than the USEPA rules. Even states like New Jersey, which are adopting a more stringent mercury rule, are not protected because of transported mercury from other states.

As noted above, large hot spots exist now across areas far too broad to be called "spots." Entire regions of the U.S. have high levels of mercury deposition, especially in the Northeast and around the Great Lakes. These areas are obvious on the mercury concentration maps provided by the National-scale Air Toxics Assessment (NATA 1996), and they are confirmed by deposition monitoring data collected by the states and by the widespread necessity for fish advisories in these regions. Marginal decreases regionally will not solve the regional problem. Nor will marginal decreases solve local high levels of mercury deposition as a result of nearby power plants. Also, emission increases could occur if, some plants increase coal use, thereby exacerbating mercury levels near those existing power plants.

To adequately address impacts of mercury everywhere, stringent emission standards that meet the requirements of Section 112(d) apply to every facility are necessary, and are legally required given EPA's December 2000 regulatory finding that it is "necessary and appropriate" to regulate power plants.

---

[8] Wyman, Robert, Claudia O'Brien, and Jeffrey Hamlin, 2003, A system-wide compliance alternative for mercury emissions from electric utility steam generating units – legal and policy basis, Latham & Watkins, 555 11th St., NW, Suite 1000, Washington, DC 20004.

[9] The USEPA, 2004, Emission Factor and Inventory Group, OAQPS, Research Triangle Park, NC 27711, February 9, 2004.

C. Rationale for the Proposed Section 112 MACT Rule

1. Affected sources

a. Subcategorization of Coal Units

The Department disagrees with the USEPA's subcategorization of coal-fired units based on coal rank. The USEPA has offered insufficient justification that it is necessary or desirable. The mercury rule as proposed in effect encourages the use of subbituminous coal by units currently burning bituminous coal. Because the proposed higher limit for subbituminous coal could lead to fuel switching and blending to take advantage of the higher limit. This could even result in actual emission increases at some units.

Subcategorization could result in converting existing units to subbituminous coal.

The rules, as proposed, allow subbituminous coal almost 3 times the emissions of bituminous coal. The limit for subbituminous coal is so high that it would result in little, if any, reductions in mercury from subbituminous coal.

In contrast, almost all the USEPA's projected mercury emission reductions from the proposed MACT standards are from bituminous coal. One likely response to this approach is widespread switching from bituminous to subbituminous coal. That response will allow a plant to emit more mercury while avoiding the capital and operating costs for mercury control technology. Exacerbating the problem, the lower costs for operating subbituminous units (compared to better controlled units burning bituminous coal) is likely to result in more utilization of the subbituminous units. The increased utilization, combined with the higher emission limits, will bring higher mercury emissions than what the USEPA projects.

Review of ICR II data reveals that the proposed subbituminous MACT limit of 5.8 lbs per trillion Btu (TBtu) is above the average mercury content of subbituminous coal, assuming all the mercury in the coal is emitted. With co-benefits of existing controls, over 80 percent of the subbituminous coal could likely be burned without any additional control. About two thirds of the subbituminous coals have mercury content of less than 5.8 lbs per trillion Btu. Assuming a 30 percent co-benefit of minimal existing control[10], this results in equivalent mercury content of greater than about 8.3 lbs/TBtu for which added control would be required. Only about 15 percent of subbituminous coal is above this level. Also, when long term averaging to determine compliance is considered, even fewer subbituminous coal-burning units are likely to need to take any action to reduce mercury emissions. Even if no units switch from bituminous to subbituminous, Western states will obtain little or no mercury reductions under the USEPA's proposal. If, as is likely, widespread switches to subbituminous coal occur, the Eastern half of the nation will have much higher mercury emissions than the USEPA projects.

Conversely, the proposed bituminous coal limit, while relatively high compared with the capability of air pollution control technology, will require some air pollution control for multiple pollutants (i.e., NO_x, SO2, and particulate control) to be used by most in order to simultaneously catch mercury. The issue here is not the extent of bituminous coal needing further control. In fact tighter limits, further control and more reductions are appropriate and

[10] Control of Mercury Emissions from Coal-fired Electric Utility Boilers at edocket # OAR-2002-0056-0463

achievable under current technology. The issue here is that the competing subbituminous coal requires almost no control anywhere. The consequence for eastern states is that current bituminous units might be encouraged to convert to subbituminous units to obtain higher allowable mercury emissions. Also, the USEPA's broad relaxation of NSR might allow this to occur without the converted unit being treated as a new unit.

Subcategorization results in more blending subbituminous coal at existing bituminous units
While converting a unit from 100 percent bituminous to 100 percent subbituminous presents challenges that do not make this a likely choice for most plants, blending coals is less challenging and is becoming more common. New Jersey's experience suggests that such blending can result in mercury emission reductions. Blending about 30 to 40 percent subbituminous coal with about 60 to 70 percent bituminous coal actually reduced the mercury emissions by about 35 percent at Unit 1 of Connectiv's B.L. England Station in NJ. This emission reduction appears to have occurred because subbituminous coal has less mercury in it, and the combination of blend characteristics and the existing control system for the bituminous coal maintains the efficiency of mercury control for the blend. This result is counter to the USEPA's assumption that it is harder to control subbituminous coal mercury. (In fact, it may be that it is the lack of control systems, especially the lack of NO_x control systems, which cause lower mercury removal at some subbituminous plants). Blending of subbituminous coal can be a positive means to reduce mercury provided it does not result in a higher emissions limit.

b. Limits for Blended Coals should not be prorated
Under the USEPA's proposal, blending of subbituminous coal with bituminous coal would inappropriately increase allowable emissions for a facility previously burning bituminous coal only. Pursuant to the proposed rule's blending provisions for example, a 50 percent bituminous/subbituminous blend would result in an allowable emission of about 3.9 lb per trillion Btu, almost 2 times that for bituminous alone. Replacing a portion of bituminous coal with subbituminous (i.e. blending) has already become popular for reducing SO_2 and NO_x emissions. The added benefit of lower mercury emissions and the USEPA's proposed higher mercury allowable would further increase the incentive to replace portions of bituminous coal use at many plants. As noted above, subbituminous coal is now being shipped to NJ for blending in a formerly 100 percent bituminous coal power plant on the Atlantic coast for the purpose of achieving lower SO_2 emissions. The mercury and NO_x reductions that have been shown are ancillary benefits. If subbituminous coal is being shipped to the Atlantic seashore, it can likely be shipped to any bituminous coal-fired plant in the USA.

In addition to adding some subbituminous coal to bituminous coal, which is a common practice, the converse might also be done as a means to better control mercury emissions. A minor amount of subbituminous coal may be sufficient to bring chlorine concentrations into a range to promote ionization of mercury and more effective mercury removal. Such coal blending can have multiple benefits. The subbituminous component lowers mercury emissions. Coal trains could be used in both directions to transport more coal for blending.

The fact that coal blending provides a facility with the benefit of a higher emission standard is a clear rationale that the USEPA should adopt one standard for bituminous and

subbituminous coal. At the very least, if there are different standards, then where blending occurs, the standard should be the lowest applicable standard, not a prorated higher standard. New Jersey's experience demonstrates that blended coal does not need a higher standard, such as the one that is derived by the USEPA's proposed prorating bituminous and subbituminous limits.

Just as the addition of subbituminous to bituminous coal can reduce mercury emissions, the converse is also likely to be true. The USEPA indicates that the higher chlorine content of bituminous coal helps convert mercury to its ionic form and increase the mercury removal efficiency of scrubbers and particulate control. If true, then blending some bituminous coal at current subbituminous plants would be a viable mercury emission reduction strategy. It may also be economically attractive given the empty subbituminous coal cars now returning west after delivering subbituminous coals for blending with bituminous coal.

A single limit for both coal types is justified to reflect the reality that blending is a common and increasing occurrence, and apparently a practice to be encouraged to reduce emissions, not increase allowable emissions.

2. The USEPA's proposed format of the emission standards

a. General Form of Standard

The USEPA's form for a standard is wrong for a contaminant where variability of the concentration of the contaminant in a fuel is an important consideration. The precedents for setting a standard in an appropriate format developed with Municipal Solid Waste (MSW) incineration and the NSPS for sulfur dioxides from coal fired power plants, both of which have a combination standard (X ug/m^3 or W percent control for MSW) and (Y lbs/Btu or Z percent control for sulfur dioxide emissions from coal). To base the mercury MACT standard on the worst outliers statistically predicted from the data collected by the USEPA means the average coal unit gets insufficient control, clearly not maximum achievable control. As previously stated, for subbituminous coal, the average coal requires no mercury control. This subverts the statutory requirement that MACT must be the maximum achievable control on all facilities. The logical way to structure a combination standard is to base the pounds of mercury per trillion Btu (or pounds per MW hr) on the median case coal and to base the percent reduction on the worst case coal. This ensures that real reductions occur for the median coal, and the worst case coal can still be burned with good air pollution control. However, this is not the case for the USEPA's proposal limits, which result in less than maximum control - and no control at all for subbituminous.

Type of coal	Median mercury content of coal (lbs/trillion BTU)	the USEPA's proposed input based standard (lbs/trillion BTU)	Percent reduction for avg. coal
Bituminous	8	2	75
Subbituminous	5	5.8	0
Lignite	11	9.2	16

The median mercury content of bituminous coal is about 8 lbs per trillion Btu. Control technology vendor stakeholders in NJ recommended a 90 percent control level be required. The best plants did better than 95 percent. 90 to 95 percent controls would result in an emission limit between 0.4 and 0.8 lbs per trillion Btu for an average bituminous coal burning unit. The average of the best 12% would be even less. The USEPA's proposed 2 lbs per trillion Btu is too high for the bituminous coal.

The median mercury content of subbituminous coal is about 5 pounds per trillion Btu. Control technology vendor stakeholders in NJ recommended a 70 percent control level be required. USDOE pilot test results on a baghouse with carbon injection on plants burning subbituminous coal indicate that greater than 90 percent control is feasible. Emission levels with 70 to 90 percent controls would result in an emission limit between 0.5 and 1.5 lbs per trillion Btu for an average subbituminous coal. The USEPA proposed 5.8 pounds per trillion Btu.

b. Output Based Standards using Net Electric Output

The USEPA's selected format for the standard of "lb/MWh gross" should be changed to "lb/MWh net" to encourage improvement in overall energy efficiency at electric utility plants. (P. 4667)

The USEPA's proposed mercury emission limits provide an option of either output-based standards or input-based standards for existing units, and require output-based standards for new units. In both cases, the output-based standards are based on total megawatt hours generated (MWhr gross). NJDEP recommends that mercury emissions be expressed in terms of net MWhr, not gross MWhr. New Jersey's proposed mercury emission limits are based on net MWhr. A net MWhr standard is more productive in encouraging overall energy efficiency at electric utility plants. Use of a net MWhr-based standard should in the long run lead to lower mercury emissions from the electricity generation sector per a given amount of useful electricity production.

c. 12 Month Rolling Average

NJDEP supports the USEPA's proposal that a 12-month rolling average be used to determine compliance with the mercury limits (p. 4668). NJDEP recommends that for a 12-month rolling average, the mass of emissions over the entire 12 months be added and then divided by the net BTU generated over the entire 12 months. This calculation should be performed every month for the past 12 months. The department disagrees with the proposed approach of averaging monthly averages because months of low coal use and low mercury emissions would have the same weight as months of high coal use and higher mercury concentrations. Based on New Jersey's experience the high coal use periods would likely correspond to higher hourly capacity factors, higher flue gas flows, and lesser control efficiency.

3. Proposed MACT floor for existing units

The USEPA erred in calculating the MACT floors primarily because of its flawed variability analysis discussed below.

a. Variability

There are numerous aspects of the approach used by the USEPA to derive the proposed MACT floor standards for mercury that are, based on the Department's analysis, unwarranted, unreasonable and not supported by a proper interpretation of section 112(d). Important steps in the USEPA's approach, and the technical and methodological problems associated with these steps, are described in Appendix B to the comments.

Initially, the USEPA decided that separate standards should be developed for each of several different types, or ranks, of coal. The ranks chosen are bituminous, subbituminous, lignite, waste coal, and IGCC units. The rationale for the USEPA's decision to develop separate standards for each of these five groups is not sufficiently explained. However, it is questionable if the other coal ranks are qualitatively different. As discussed above, subbituminous coals or blends of subbituminous and bituminous can frequently be burned in units previously burning bituminous exclusively without extensive retrofitting of the boilers. Combustion of waste coals or anthracite coals also results in similar emissions. For these reasons, the establishment of separate limits for bituminous, subbituminous and waste coal is questionable.

For purposes of discussion of the USEPA's methodology in determining MACT limits and incorporating consideration of variability into these limits, the NJDEP, in the discussion below, focuses on bituminous coal. These comments apply in principle to other ranks of coal as well.

Section 112(d) of the Clean Air Act requires the MACT standard to be based on the average emission rate of the best performing 12 percent of the units in a group based on data the Administrator has. A standard acceptable statistical approach with a group of data that represents a larger group is to determine a confidence interval around the mean of a group of data that is itself a sample of a larger group of data. This approach assumes that the data are normally distributed. A 95 percent confidence interval is often used.

In the case of the bituminous coal subgroup, there are four units that make up the top 12 percent of the units for which data exist in the ICR III stack test database. The mean of the measured mercury emissions from these four units is 0.12 lbs Hg/TBtu. Because this group is a subset of the larger group representing the best performing 12 percent of all bituminous units in the U.S., it can be argued that the upper limit of the 95 percent confidence interval around this mean would be an appropriate standard.

However, the USEPA decided that this straightforward statistically accepted approach was insufficient, and that additional statistical and analytical manipulations were necessary to account for variability in coal. In its variability, coal is not unlike other mercury-containing fuels, e.g. petroleum and municipal solid waste (MSW). (See Appendix A for discussion of New Jersey's experience in managing variability in MSW combustion.) In addition to variations in coal, the USEPA identified other sources of variability, including uncertainties in measurement and other parameters.

The USEPA commissioned several studies of variability in coal and how best to accommodate it. These include reports by RTI[11] and SAIC.[12] The agency apparently determined that a study prepared for WEST Associates (WEST) by ENSR Corporation was most useful, and a WEST report[13] appears to have been used, in some cases word for word, as the basis for the approach presented in the proposal.

The USEPA, apparently basing its conclusions on the WEST Associates report, states that a relationship exists between chlorine (Cl) and mercury (Hg) control.

WEST developed several equations that, in their view, reflected predictable relationships between chlorine content and mercury emissions for some units within some groups of control configurations. The Department's analysis indicates that 1) correlation between chlorine content and mercury emissions is either weak or non-existent; and that 2) the WEST equations were improperly derived and do not in fact represent the data. In the Department's view, use of these equations is arbitrary, capricious and unreasonable.

The USEPA next proceeded to use the ICR II data, which includes Hg and Cl content of coal purchased by units including those units for which stack test data exist in the ICR III database.

The USEPA multiplied these coal data by various factors, based in some cases on the questionable WEST equations. The result of this multiplication process was a series of "distributions" for each unit. These distributions are estimated Hg emissions for that unit assuming that the coal it would burn over the course of a year would be the same as the coals reported in the ICR II database for that unit.

With the assumption that these distributions represent the Hg emissions associated with each separate coal shipment likely to be used by each unit over the course of a year, a mean emission from each unit, and a confidence interval around the mean of these means, can be calculated.

An approach of multiplying coal Hg content by average removal applied to the four best-performing bituminous units, generates a mean emission rate of 0.28 lbs Hg/TBtu. A basic statistical approach might suggest that the 95 percent confidence upper limit of this mean be determined with use of the student's t statistic method. However, a more appropriate approach takes account of the fact that each of the four values is in fact a mean derived from numerous values (the distributions). The standard error and within-unit variance of these

[11] Cole, Jeffrey, 2002, Memorandum from Jeffrey Cole, RTI, to William Maxwell, the USEPA, Statistical analysis of mercury test data variability in support of a determination of the MACT floor for the regulation of mercury air emissions from coal-fired electric utility plants, August 28, 2002.

[12] SAIC, 2003, Calculation of possible mercury MACT floor values for coal-fired utilities: Influence of variability and approach, prepared by SAIC, 11251 Roger Bacon Drive, Reston, VA, for U.S. Dept. of Energy, National Energy Technology Laboratory, Pittsburgh, PA, December, 2003.

[13] WEST Associates, 2003, Multivariable Method to Estimate the Mercury Emissions of the Best-performing Coal-fired Utility Units Under the Most Adverse Circumstances which Can Reasonably Be Expected to Recur, ENSR Corporation, West Associates, Tucson, AZ, March 4, 2003.

means can be determined, and then the variance of the across unit mean can be derived, and used to calculate the 95% upper confidence limit. The Department's use of this approach results in a 95% upper confidence interval of 0.31 lbs/TBtu. This value could be considered an appropriately derived standard for bituminous coal combustion if subcategorized. Even use of 99% confidence level upper limit results in a value of 0.32 lbs/TBtu.

The use of an upper confidence limit of the mean value of these distributions is consistent with the USEPA's decision to base compliance on a 12-month rolling average of values derived from continuous emission monitors (CEMS).

Use of a straightforward process consistent with the Clean Air Act and accounting for mercury variability in coal based on the ICR II and ICR III data suggests that the MACT limit for bituminous units should be a maximum of 0.31 lbs/TBtu. If additional allowances were to be built in for other sources of variability, a rationale might exist for raising the standard somewhat higher. However, no such rationale is presented in the proposal.

But the USEPA, apparently following the recommendation of WEST Associates, decided that the calculation described above was not accurate. They next selected an upper percentile value of the distributions of estimated emissions discussed above. A 95th percentile value, for example, would be exceeded only 5 percent of the time by any single value selected during the course of a year. Use of an upper percentile value such as this might be appropriate if compliance were to be determined by one yearly stack test. A rationale for using this approach with a 12-month rolling average compliance determination is not presented in the proposal. WEST Associates, perhaps with the assumption that compliance would in fact be determined by a single yearly stack test, recommended this approach, and stated that the 95 percent value of the distribution would "represent the operation of the unit under 'worst conditions'"[14]

The USEPA took additional steps that raised the proposed standard even further. They used both a 97.5th percentile and a 97.5 percent confidence upper limit of the mean of the 97.5th percentile values for the four units. Much of the language in the section of the USEPA proposal that describes these steps is virtually identical to language in the referenced WEST Associates report. However, the USEPA changed WEST's "worst case" phrase to read, "The 97.5th percentile value of this distribution....was determined to represent the operation of the unit under conditions reasonably expected to occur at the unit."[15] A standard based on "worst case" is expected to be higher than a standard based on conditions reasonably expected to occur.

The final result of the USEPA's series of data manipulations are proposed standards which are excessively high, unwarranted and in violation of Section 112(d)(3) of the CAA. As discussed in more detail in Appendix B, most if not all, of these data manipulations are either based on weak or non-existent correlations or based on inappropriate or incorrect statistical procedures. The Department concludes that there is no valid basis for the proposed standard,

[14] WEST Associates, 2003, Multivariable Method..., STATISTICAL APPROACH chapter, page 14.
[15] Federal Register, 69, p. 4673, January 30, 2004.

and that the USEPA's calculation of standard is arbitrary and capricious, and contrary to Section 112(d)(3) of the CAA. Because, essentially, the USEPA used the same approach to develop the standards for the other coal ranks, the Department concludes that the standards for the other coal ranks are also without basis, are also arbitrary and capricious, and are also contrary to Section 112(d)(3) of the CAA.

b. General Comments on the USEPA's MACT floor emission limits for existing sources

Maximum Achievable Control Technology is what the Clean Air Act requires for mercury and the other HAPs emitted by coal fired power plants.

The control technologies that would result from the USEPA's proposal do not meet the intent of Section 112 of the Clean Air Act - Maximum Achievable Control Technology (MACT). The USEPA's proposal is not MACT, nor is it BACT or RACT. These are air pollution control acronyms for Maximum Achievable Control Technology (which is what is required for mercury and the other HAPs emitted by coal fired power plants), Best Available Control Technology, which is required for non-HAP air pollutants emitted by new or modified plants, and Reasonably Available Control Technology, which is required for non-HAP air pollutants emitted by existing plants. The control technology proposed is not the maximum, not the best, and not a reasonable reduction amount.

c. Existing Control Technology can Effectively Control Mercury Emissions

Controls in use today to reduce emissions of sulfur dioxide and particulates are already demonstrated to be very effective in reducing mercury emissions. Scrubbers and baghouses in current use at New Jersey coal-fired power plants, in conjunction with selective catalytic reduction to control emissions of nitrogen oxides, are already achieving mercury reductions of more than 90 percent, in some cases more than 98%.

d. Baghouse Control is Clearly MACT

The USEPA's failure to set mercury limits that require effective particulate control of power plants is an example of the overall failure of this proposal. For bituminous and waste coal, the lowest emission rates achieved were at plants with baghouse control. Yet the proposal fails to require the use of such technology, which is clearly maximum achievable control technology for these coals.

Based on the Department's review of stack test data, the best mercury control of existing plants seems to be associated with both baghouse control and low NOx burners (which tend to generate carbon that is caught by the bags and then may adsorb mercury). It can thus be argued that use of carbon for control of mercury is already available. Rather than being injected as with Activated Carbon Injection (ACI), the carbon is being produced with the low NOx burners (LNB). This is especially true for the bituminous plants which are eastern plants (east of Mississippi) and which generally have low NOx burners and these burners are generally operated at extreme operating conditions to reduce NOx and avoid or reduce the cost of ammonia injection with selective catalytic reduction (SCR) or selective non-catalytic reduction (SNCR) systems. All of the lowest emitting bituminous plants in EPA's database of top 12% performers had baghouse control. They all also have low NOx burners that created sufficient carbon in the ash to adsorb the mercury.

It is not surprising that western plants have less mercury capture, even with baghouse control, because western plants generally are not required to reduce NOx as low as eastern plants and hence, do not operate at extreme operating conditions their burner controls towards lower NOx and higher CO (and carbon in the ash). One western plant, which did get high mercury removal, is noteworthy because it did have high carbon in the ash (as noted in a DOE report on the effectiveness of SCR and SNCR on mercury removal).

The role of chlorine content of coal as an indicator of mercury removal may be much less important than the role of carbon in the ash. Neither USEPA's ICR II nor III data included carbon in the ash. Had these data been collected, the mercury removal might be better explained for the western coals. LOI (loss on ignition) is an important parameter for each plant, so the carbon in ash data is available, and should have been collected by EPA in its ICR II or III database.

Use of baghouse control will also reduce the direct emissions of fine particulate matter, another CAA mandate. The November 2003 US DOE report on "Preliminary Cost Estimate of Activated Carbon Injection for Controlling Mercury Emissions from an un-scrubbed 500 MW Coal Fired Power Plant" indicates that a coal-fired power plant with a baghouse can be retrofitted with activated carbon injection to achieve the greatest reductions of mercury emissions, in a highly cost-effective manner. The focus of this report is on cost reduction, not the viability of the technology. In fact this report indicates that for the 4 and 5 scenarios evaluated, carbon adsorption with a baghouse is either the most cost effective or the second most cost effective choice. What this means is use of the best technology both reduces mercury the most and is most cost effective. The cost per pound of mercury captured would likely be minimized if the USEPA required mercury emission reductions of 90 percent. The less stringent control levels were generally less cost effective. Baghouses and ACI achieve the most mercury emission reductions and the most cost-effective mercury emission reductions at the same time.[16]

While available and cost effective, it is not necessary to rely on ACI to require a MACT standard that results in 90% or greater mercury reductions. ACI simply provides another available compliance system. Controls in use today to reduce emissions of sulfur dioxide and particulates are already demonstrated to be very effective in reducing mercury emissions. Scrubbers and baghouses in current use at New Jersey coal-fired power plants, in conjunction with low NOx burners and selective catalytic reduction to control emissions of nitrogen oxides, are already available and have achieved mercury reductions of more than 90 percent (98 percent tested at one plant).

e. Achieved and Available

These terms relate to determining the MACT floor and determining the compliance deadline are sequential and independent determinations.

[16] US DOE report on "Preliminary Cost Estimate of Activated Carbon Injection for Controlling Mercury Emissions from an un-scrubbed 500 MW Coal Fired Power Plant," November 2003

"Achieved" is used in 112(d) to set the floor as "the average emission limitation achieved by the best performing 12 percent of the existing sources."

"Available" is used in 112(i)4 where the President can exempt any source from compliance with the MACT standard for 2 year periods if the technology is not available and it is in the national security interests of the U.S. to exempt the source.

What is relevant for the MACT floor is what the best 12 percent have achieved (past tense). If in fact a MACT is not achievable by some sources within the presumptive 3 year time provided for MACT compliance in Section 112(I)(3), Congress provided for a one year administrative extension and a 2-year Presidential exemption (s) to address this. Assuming that it is in the national security interests to not shut down a significant number of the USA coal-fired power plants by 12/15/2007, if in fact this is insufficient time to install MACT on all plants, Section 112(i)(4) provides a mechanism for more time, in 2 year increments.

f. Activated Carbon Injection (ACI) is Available

Activated carbon injection is available today commercially. The technology transfer from MSW use is clearly feasible. ACI will likely be optimized and will become cheaper in the future. See DOE report on economics of carbon adsorption.[17] Engineering is appropriate to optimize the transfer (minimize emissions and minimize costs). However, such optimization is not a prerequisite for requiring ACI on coal. By focusing on the best 12 percent of existing sources have achieved, Congress, in enacting Section 112 of the CAA, was forcing technology transfer, as well as technology development.

g. Timing of the MACT Compliance Deadline – Independent of the MACT Floor

Industry and the USEPA's concern with a 112 MACT standard appears to be primarily time. Most[18] recognize that a MACT in the range of 90 percent emission reductions can already be achieved by many plants (including the average of the best 12 percent) and can also be achieved by all the others given sufficient time. Yet, the USEPA has focused on setting a standard that all can meet by doing little or nothing in the 3-year period between 12/15/2004 and 12/15/2007. This is inconsistent with Section 112 of the CAA. The standard setting must be independent of the presumptive 3-year time frame to achieve compliance because there are other provisions in 112 (i) to provide more time if necessary.

h. "Achieved" is Past Tense

A new focus on the word "achieved" as used in Section 112 is appropriate. The word is not synonymous with achievable (future tense). "Achieved" means what has been achieved in the past based on the emissions data that the administrator has. The CAA is prescriptive on

[17] Science Applications International Corporation, November 2003, Preliminary Cost Estimate of Activated Carbon Injection for Controlling Mercury Emissions from an Un-Scrubber 500 MW Coal-Fired Power Plant, Final Report, prepared for U.S. Department of Energy, National Energy Technology Laboratory, Innovations for Existing Plants Program

[18] Department of Energy, USEPA, Clean Air Task Force, National Wildlife Federation, National Environmental Trust, Natural Resources Defense Council, Environmental Defense, Majority Industry Group was principally represented by Cinergy, Class of 85 Regulatory Response Group, Edison Electric Institute, Latham & Watkins, National Mining Association, Seminole Electric cooperative, Southern Company Generation, United Mine Workers, Utility Air Regulatory Group, West Associates, American Public Power Association, and National Rural Electric Cooperative Association.

the calculation of the limit, i.e., the average emissions of the best 12 percent of the existing sources. The USEPA must set an emission limitation, which the existing 12 percent of the sources on the average have already achieved, based on existing information.

The USEPA's use of variability analysis to project potential worse case future emission is wrong both because the USEPA's compliance determination will be for an average case (discussed previously) and because its guessing at future emissions data, rather than using existing emissions data as required by Section 112.

By manipulating the actual emissions data from the best 12 percent, the USEPA is in fact setting emission limitations achieved by far more than 12 percent of the sources. Review of the ICR III data reveals that, of the 28 units burning exclusively bituminous coal, 11 (39%), had an average measured emission rate of less than the proposed bituminous standard of 2.0 lbs/TBtu. Of the 27 units burning exclusively subbituminous coal, 18 (67%) had an average emission rate less than the proposed standard of 5.8 lbs/TBtu. Of the 12 units burning lignite, 6 (50%) had an average emission rate lower than the proposed standard of 9.2 lbs/TBtu.

i. What is achievable?

Coal-fired plants can achieve better than 90 percent Hg emission reductions as did municipal waste combustors and health, medical and infectious waste incinerators in the 90s. (P. 4674). (Control of Mercury Emissions from Coal-Fired Electric Utility Boilers dated February 27, 2004). The USEPA's proposal fails to achieve significant reductions of mercury despite the availability of technology, both existing at many plants (scrubbers, baghouses, and SCR), and available by technology transfer from other source categories (such as municipal waste combustors and health, medical and infectious waste incinerators in the 90s).

j. What is available?

As previously stated, Activated Carbon Injection (ACI) technology is available today. There is over a decade of successful use of Activated Carbon Injection for Municipal Solid Waste (MSW) combustion. In NJ, MSW incinerators with baghouse control and ACI have achieved 99 percent mercury control. Transfer of such technology to coal combustion is clearly feasible. The DOE cost analyses indicate that retrofitting the coal-fired boilers with activated carbon injection (ACI) and baghouses (or polishing baghouse) can achieve 90 percent mercury emission reduction. ACI has a low capitol cost. It also has low operating costs if baghouse technology is used.

4. The USEPA's Proposed Nickel limit for Oil Fuel EGU

a. ESPs - N.J. supports the USEPA's proposal to require electrostatic precipitations (ESP) for heavy oil burning EGUs and to require a minimum of 90% efficiency for existing units. ESPs should be required on all heavy oil units to minimize emissions of particulate matter, especially fine particulates, and particulate HAPs. A particulate emission limit is preferable to a limit on the nickel in oil.

b. Ni in Oil Limit - The Department is not in favor of using a Ni in oil limit alone, except possibly for number 2 oil or lighter. Nickel emissions at the stack will depend on the

nickel content in the oil. If stack testing for Ni is the method of compliance, all deliveries of oil should be analyzed for Ni content and the stack testing shall be done with the oil with highest Ni content. Stack testing for particulates is preferable. Also, the NJDEP has concerns with the nickel variability analysis, similar to our concerns about the mercury variability analysis.

c. Use of Oil for Startup – The 2 percent breakpoint is a reasonable basis for allowing those units that use oil only for startup purposes to be exempted from regulation under the proposed MACT rule (P. 4675). A definition of start-up should be added to the proposed rule.

d. Ni emission limits - There is inconsistency in emission rates cited in the preamble and proposed rule.

It is not clear what actual emission rates is the basis for the standard or how variability analysis was used to derive the proposed limits. We are concerned that some of the data indicates that the limits are much higher than the actual emissions at the best-controlled units.

5. Beyond-the-floor options for existing units

See previous comments. Sorbent injection should be considered a viable beyond-the-floor option for existing coal-fired units. (P. 4676). Baghouses should also be required as a floor requirement. See prior discussion on availability of activated carbon injection. NJDEP also supports the use of sorbent bed technology for existing IGCC units. (P. 4677).

6. Proposed MACT floor for new units

a. New Coal Units

The proposed MACT floor standard for Hg from new coal-fired units, which fire bituminous coal, is approximately the same as New Jersey's proposed mercury limits for existing units. We recommend that mercury emissions limits be determined for new units on a case by case basis and be no higher than the USEPA's proposed limits for new bituminous coal units. We also recommend that this ceiling be adopted for all coal, with the additional provision of a 90% control option to address high mercury coals.

b. New Oil Units

NJDEP recommends that the USEPA requires ESPs on all new heavy oil EGUs, and such ESPs should have a high particulate control efficiency, on the order of 99%.

7. Testing and monitoring requirements

The rule requires only 75 percent of the data (18 hours) to be collected for any given day for that day's data to be considered valid. It further requires only 21 days of valid daily data (about 70 percent) to be collected during each month to validate the monthly averages. If less data is collected on a monthly basis, the mean of the individual monthly emission rate values determined in the last 12 months (63.10008(d)(4)(iii)) must be submitted.

If the facility were to operate 24 hours a day, seven days a week for an entire month, they would only be required to capture data for the equivalent of 14 days. Only 75 percent (three

of four, 15 minute readings) of each hour for 21 days amounts to less than 16 days of hourly data, 9 days of which would require no data at all. How is a data capture requirement of less than 50 percent justified when the variability of the process is considered? Even if one were to believe that there could not be significant variability in the process in the half hour between monitoring events if one 15 minute reading is missed, 9 days of "no data" per month is about 30 percent downtime. This could result in large blocks of time, up to 18 consecutive days of operation, with no valid data collection.

There should be an additional data capture requirement that would also impose limits on a quarterly basis. For example, requiring 90 percent valid data capture, on a quarterly basis, would provide flexibility to have reasonable downtime while at the same time greatly improving the value and quality of the data.

The proposal to allow long term collection of a mercury sample is a poor alternative to a method based on CEMS because, generally, CEMS are defined as equipment that samples at least every 15 minutes and the proposed method 324 takes an integrated sample weekly.

Further concerns on this issue center on the option to use an alternative to a Hg CEMS, Method 324. No criteria are listed as to when this option can be utilized. More importantly, the rule does not appear to specify the duration and frequency of Method 324 sampling. Is the facility required to sample continuously (24 hour sampling runs)? Are they subject to the same data capture requirements (18 hours per day / 21 days per month) as a CEMS? The rules governing the use of Method 324 should be more clearly specified so that the quality, quantity and value of the data can be assured. If not substantially equivalent to a CEMS, the option to use Method 324 should not be allowed. However, use of Method 324 to supplement the CEMs during times of CEM downtime would be reasonable.

Proposed 40 CFR §63.10000 indicates that compliance with emission limitations applies during all times except periods of startup, shutdown or malfunction. This is not appropriate for a 12-month average standard. The regulation also does not limit the duration of startup, shutdown or malfunction periods, other than what might be approved in a startup, shutdown and malfunction plan.

Proposed 40 CFR §63.10041(c)(5) does not allow delegation for approval of the unit-specific monitoring plans under §63.10000(c) to the States. States should have a role in review of such plans.

Regarding stack testing (after the initial test), proposed 40 CFR §63.10031(a)(8)(iii) requires submission of a full stack test report only if an exceedance is indicated. This does not allow for quality assurance of all stack test reports. NJ routinely finds errors in stack test reports that in some cases results in either a requirement to repeat the testing or ends up changing the compliance status. All stack test reports should be submitted regardless of whether there is a deviation from the mercury or nickel emission limits. Also, NJDEP recommends annual mercury stack sampling in addition to continuous emission monitoring for the reason discussed in the following paragraph .

In the proposed Mercury MACT for power plants, mercury would be monitored only by vapor-phase mercury CEMS; which misses an important component of the mercury emissions. If the USEPA is measuring vapor-phase mercury only, particulate mercury emissions will be missing. Part of the particulate will be captured by the ESP or baghouse, but some particulate emissions will occur. A review of the ICR III data shows that, for most units, the particle-bound portion of the Hg emitted is in the range of 1 or 2 percent or less. There are some units in the ICR III database, however, that show particle-bound mercury representing as much as 12% of emitted mercury. (Better particulate control is indicated for these units). Power plants using CEMs are required to conduct annual Relative Accurate Test Audits (RATA) tests on the Hg CEMS (or on the alternative Method 324, if approved). To certify the CEMS, only the vapor phase is proposed to be considered. The Department recommends that particulate phase concentrations also be reported. The rule should require that facilities perform an annual stack test, in addition to use of CEM, and add in the portion of particle-bound Hg from that stack test to each subsequent emission report.

8. **Compliance dates**

The NJDEP recommends mercury emission limits should reflect maximum achievable control as mandated by Section 112 of the CAA, independent of the compliance date required by that Section. The compliance date is a secondary decision, and more than 3 years to comply can be granted if justified consistent with extensions provided for in the CAA.

Section 112 of the CAA provides for additional time for Compliance with the MACT standard, if necessary. There is a 1-year administrative extension available. Also, there are 2-year presidential extensions available if justified by national security concerns and unavailability of control. Hence, the control limits selected under MACT should not be a function of ability to meet the 3-year deadline. The control limits should conform to the intent of maximum achievable control, and the timing can be extended accordingly, consistent with the provisions of the CAA.

9. **Facility-wide averaging**

Averaging is appropriate for units in the same subcategory at the same facility. Averaging should not be allowed between new and existing units, or between units in different subcategories.

III. Proposed Revision of Regulatory Finding on the Emissions of Hazardous Air Pollutants from Electric Utility Steam Generating Units

1. Coal and Oil-fired utility units should not be deleted from the Section 112(c) list. (P. 4683-4684)

2. Congress' intended that HAPs from utility units be regulated under Section 112. (P. 4684).

3. Regulation of utility units under Section 112 is necessary. Section 111 is not a legal option and would not adequately address public health hazards posed by utility unit emissions. (P. 4684)

4. Mercury emissions remaining after compliance with cap-and-trade requirements (2010 and 2018) would cause unacceptable adverse health effects. Hotspots would remain from cap-and-trade approach. (P. 4686).
5. A cap-and-trade program can be in addition to 112 MACT standards, but may not substitute for 112 MACT.
6. Relying on Hg emission reductions as a "co-benefit" of controlling SO2 and NOx from same EGUs is inadequate. (P. 4687).
7. A good MACT standard will provide co-benefits for criteria pollutants . The same measures that effectively control mercury emissions also reduce emissions of criteria pollutants. It is cost effective and in the best interests of public health to address all pollutants from coal fired power plants in a comprehensive and timely way. If the USEPA addresses the direct emissions of particulate HAPs and acid gas HAPs from all power plants, this would result in much greater reductions of fine particulates than the proposed Interstate Air Quality Rule. Reductions in sulfur dioxide and oxides of nitrogen would be reduced much more as well.
8. The USEPA states that "overly ambitious Hg mandates in the near-term could actually hamper innovation toward more effective and less costly technologies." (P. 4687). It is more likely that the USEPA's minimal reductions over the next decade would hamper innovation. It is certain the USEPA's proposal would hamper improvement of public health. USDOE has been studying mercury control for a decade. Technologies like ACI are available now. Others will be available soon if an effective MACT is adopted. DOE has a goal to get costs of ACI down to $1/4^{th}$ current costs. That is laudable. However, the current costs of ACI are less than the economic costs of mercury poisoning and so are justified now. The sooner ACI with baghouses, or combinations of other readily available traditional control technologies, are encouraged by a stringent MACT standard, the sooner costs of such controls will drop. Such cost reductions should not be a requirement to proceed, recognizing these costs are currently reasonable now from an overall societal cost perspective, and engineering and competition will inevitably drive these already reasonable costs down further. (November 2003 US DOE report on "Preliminary Cost Estimate of Activated Carbon Injection for Controlling Mercury Emissions from an un-scrubbed 500 MW Coal Fired Power Plant".) Also, ACI has a low capital cost, which provides the opportunity for replacement with other technologies if shown to have a lower operational cost.
9. Reliance on co-benefits of the IAQR for compliance with 111(d) would slow mercury control technology.
10. A traditional MACT rule based on the best 12% better stimulates development and adoption of new technologies sooner than the USEPA's proposed cap-and-trade. For example, MSW MACT rules have stimulated ACI technology.
11. The USEPA may only de-list of coal- and oil-fired utility units using the procedures of Section 112(c)(9). We do not believe that the USEPA has justified delisting coal and oil-fired EGUs from regulation under section 112, or that it can do so.

IV. Proposed Standards of Performance for Mercury and Nickel From New Stationary Sources and Emission Guidelines for Control of Mercury and Nickel From Existing Sources: Electric Utility Steam Generating Units [P. 4655]

Statutory authority is lacking for the proposed section 111 rulemaking. See the detailed comments of the Multi-State Coalition led by the New Jersey Attorney General.

A. **Proposed New Standards and Guidelines**

See NJDEP's comment II.C.

B. **Rationale for the Proposed Subpart Da Standards**

1. **Rationale for the proposed subpart Da Hg and Ni standards**

In this section, the USEPA states that the December 2000 regulatory findings reveals that oil-fired utility units emitted approximately 322 tons of Ni in 1994. In a December 2003 Memorandum to Bill Maxwell from RTI International, *Methodology of estimating cost and...For hazardous air pollutant Page 4*, the estimated Ni reduction is 620 tons/yr. It appears that the estimated reduction in nickel emissions is greater than total nickel emissions from oil-fired EGUs as of 1994. This does not appear to be possible.

2. **Performance of control technology on Hg**

The Department believes that theUSEPA is incorrect that there are no commercially available control technologies specifically designed for reducing Hg emissions. (P. 4691). Activated carbon injection (ACI) is commercially available today for mercury control (November 2003 US DOE report on "Preliminary Cost Estimate of Activated Carbon Injection for Controlling Mercury Emissions from an un-scrubbed 500 MW Coal Fired Power Plant".) Ten years of experience with ACI on MSW incinerators in NJ lead us to the conclusion that the technology transfer from MSW use is clearly feasible. Carbon injection has been used on all thirteen NJ MSW incinerators since 1995, some of which have achieved 99 percent mercury control with baghouses. Better control of direct emissions of particulates creates the direct benefit of reduced fine particulate emissions and opportunities to efficiently and very cost-effectively reduce mercury (with reagent injection, such as carbon) and sulfur dioxide (with reagent injection, such as lime). The USEPA inappropriately discounts carbon injection because it has only been pilot tested or short-term demonstration tested at full-scale units, and has not been in long term use at any coal units. It will be used long term if required.

In New Jersey, National Energy and Gas Transmission Company's Carneys Point and Logan Township boilers are each equipped with LNB, SCR, dry scrubber, and baghouse. Good air pollution control in use at these plants reduces mercury emissions by over 90 percent (98% tested).

The Northeast States for Coordinated Use Management's report dated October 2003 on Mercury Emissions from Coal-Fired Power Plants, full-scale demonstration of ACI technology indicates that mercury removal of over 90 percent is feasible, with costs that are comparable to the costs of NOx removal. An example of a recently issued Iowa permit is used in the report where ACI is required to control mercury from a proposed bituminous coal-fired power plant. DOE pilot studies show up to about 95 percent control for both bituminous and subbituminous control with baghouse and carbon injection.

3. **Testing and monitoring requirements for the proposed standards**

See NJDEP's comments in section II.

Mercury CEMS are at a sufficient technical point where they are ready to be put on stacks. The PS12A specification has sufficient latitude to allow mercury CEMS to meet the standard.

C. **Rationale for the Proposed Hg Emission Guidelines**

The following are in response to specific USEPA requests for comment:

1. Emissions trading is not appropriate for HAPs. The NO_x and SO_2 trading programs need to be improved to better control NOx and SO2. The current Acid Rain and NOx SIP call programs are not a model for advancing the criteria pollutant trading, or setting up a mercury trading program. This is because, some components of the existing emissions trading programs have proven problematic. Unrestricted banking has been shown to be inappropriate in the SO2 trading program. The 2000 acid rain cap has yet to be met because of banking. If it is met anytime soon, it will because of New Source Review (NSR) settlements, not the acid rain trading program. The USEPA's proposed 15 tpy cap for mercury in 2018, would not be achieved until a decade later, if then, because of banking.

2. We see no basis for the USEPA's belief that full scale technologies (ACI and/or other breakthrough technologies) can not be developed and widely implemented within the next six years (p. 4699).

3. A mandatory 70 percent reduction in Hg emissions from each plant should substantially reduce public health risks from local Hg deposition near plants because a significant portion of mercury emissions is likely to deposit locally. (P. 4699). But 70% would not be MACT for some units with high emissions, and would be more stringent than MACT for some units.

4. States should have authority not to participate in emission trading programs and to require emissions reductions beyond those specified in a State budget (P. 4699).

5. Estimating national mercury emissions based on sampling coal from all coal fired units and testing approximately 80 units is appropriate. However, these tests are too limited for allocations to specific states or specific plants. Testing at more than 80 units would be necessary for allocation of allowances.

6. Delaying 70 percent emission reduction until about 2030 in the proposed section 111 rule perpetuates local and regional hot spots for a quarter of a century, and thereafter for the many (probably more than 30%) areas affected by plants that will not install controls at all under a cap-and-trade system. (P. 4700). Proposals to adjust emissions trading to attempt to address hot spots are likely to fail based on perceptions they would complicate and reduce efficiency of cap-and-trade program. (P. 4701)

7. For all of the reasons set forth in these comments, cap-and-trade is not appropriate for regulation of Hg or other HAPs (P. 4701)

Emissions trading discussion

Emissions' trading has been advocated as a way to get more emission reductions, sooner. Although the Department does not believe that emissions trading is legally authorized under either Section 111 or 112 of the CAA, even if it were, the proposal does not result in adequate reductions in mercury emissions from power plants. When the caps are set as loosely as the USEPA has proposed, trading becomes a way to get less emission reductions, later. The natural result of an emission standard, which applies to each facility by a set deadline, is that each facility generally complies earlier and with a margin of compliance. This is obviously good for the environment. Since emissions trading takes those real reductions below the allowable limit from those who install control and allows some facilities to avoid mercury emission reductions until a later date, then the environment is hurt. Trading only makes sense from an environmental perspective if the caps are set at levels well below the emission standards that would have otherwise been set under Section 112 of the CAA. That is not the case with the mercury proposal. We believe an appropriate MACT standard should result in allowable emissions in the 5 to 10 tpy ranges; this would result in actual emissions less than 5 tpy, much sooner than the USEPA's proposal of 15 tpy allowable in 2018. (Which in actuality would result in considerably greater than 15 tpy actual emissions in 2018).

On page 4702 the USEPA states: "the USEPA does not anticipate significant local health-based concerns under a national Hg trading program." (Emphasis added) "The Agency..... believes that the cap-and-trade system, coupled with related Federal and State programs will effectively address local risks." (P.4702) The Department is unclear what these related Federal and State programs are. In fact, many states are not authorized to adopt rules that are more stringent than USEPA rules. "Hot spots" will therefore continue to exist after implementation of the rules.

Safety valve

The safety valve provision to avoid air pollution control if the cost of control is greater than $35,000 per pound is inappropriate and arbitrary. This dollar amount is not linked to the environmental cost, which would result from excess mercury emissions. It appears to be arbitrarily linked to the USEPA's preconceived notion of what level of cap is supported by the proposed regulation. Costs of controls well in excess of $100,000 per pound are justified based on the economic loss of fish, economic loss of the sports fishing industry, and most importantly, the lifetime economic loss of brain damaged people because of the mercury exposure in *utero*.

V. Impacts of the Proposed Rule

The USEPA's emissions trading proposal would stall significant mercury reductions for more than 15 years, and even then would allow two to three times more mercury emissions than federal law requires. Alternatively, if the USEPA's weak mercury MACT option is adopted, the limits would be four to seven times higher than what could be achieved by a strong mercury MACT standard.

Every day, children suffer needlessly from brain or nervous system damage caused by high levels of mercury in the environment emitted by power plants, waste incinerators, and iron/steel scrap-melters. Mercury is deposited on land and in water throughout New Jersey and most of the U.S., and subsequently accumulates in the fish and shellfish. As a result of their mothers eating this contaminated fish and shellfish, many children are born with attention or memory deficits, or are handicapped in their ability to see, to speak, or to be active as a result of their mother's exposure. Even exposure to low levels of mercury can permanently damage the brain and nervous system and cause behavioral changes.

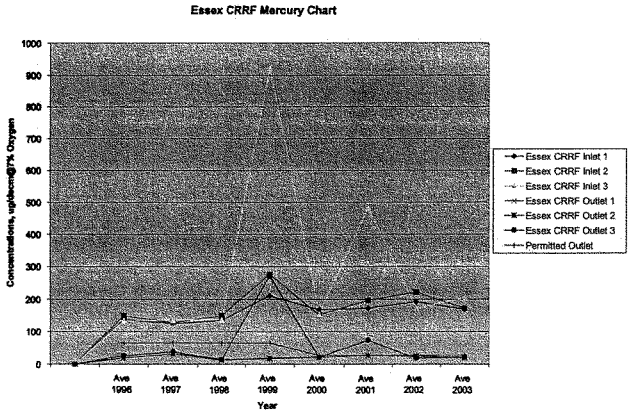
At least 1 in 10 pregnant women in New Jersey has concentrations of mercury in their hair that represents unsafe levels of mercury in their bodies. If we could reduce mercury exposure to safe levels for even half of these women, over 5,000 newborns per year in New Jersey alone could be saved from the threat of developmental abnormalities linked to mercury.

Mercury levels in fish can be substantially reduced. If maximum achievable control technology for reducing mercury and other air contaminants emissions were applied nationwide (and even just to coal-fired plants); mercury levels in freshwater fish could be cut in half.

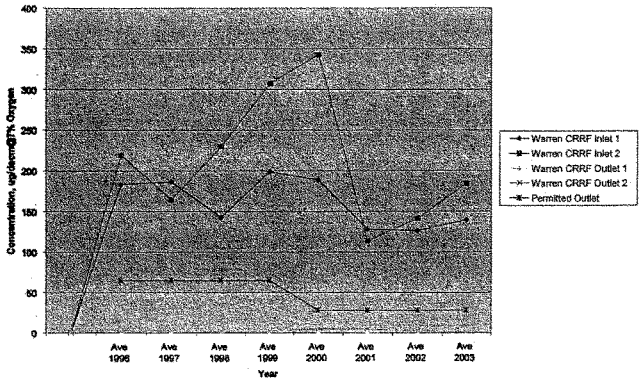
APPENDIX A
Management of mercury variability at operating MSW incineration facilities in New Jersey

In its variability, coal is not unlike other mercury-containing fuels such as petroleum and municipal solid waste (MSW). New Jersey's five MSW incinerators have been controlling mercury emissions with carbon injection since 1994. Mercury inputs at these facilities, because of the heterogeneous nature of waste materials, show frequent spikes. Review of inlet concentrations at these facilities collected with stack tests performed from 1996 to 2003 show a range of inlet concentrations from 23 to 3915 micrograms per dry standard cubic meter (ug/dscm), a range of over 100 times. The range from the 5th percentile to the 95th percentile is approximately 50 to 1180 ug/dscm, and the yearly average inlet concentration is as high as 1000 ug/dscm.

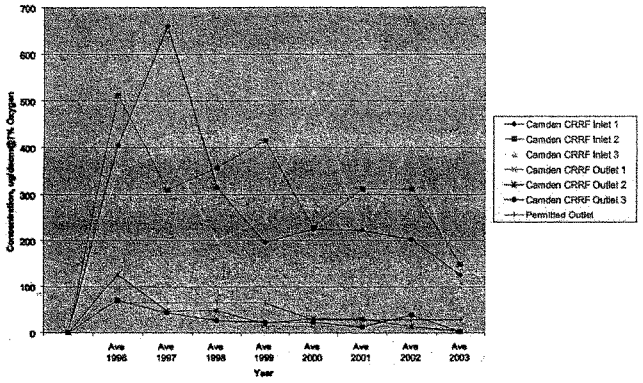
Currently these can emit no more than 28 ug/dscm or show 80% control, based on comparison of inlet with outlet concentration. Throughout the period of from 1996 to the present, with brief exceptions in the case of two facilities, the facilities have met their permit limits through the use of selective catalytic reduction, carbon injection, dry scrubbing, and particulate control. Carbon injection and good particle control appear to be the most important devices for effective mercury reduction. See charts below.

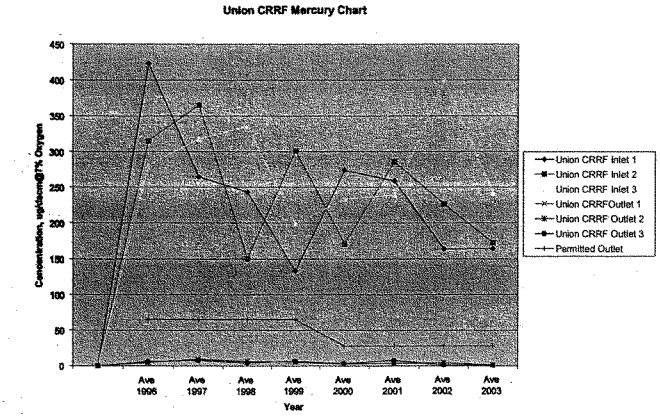


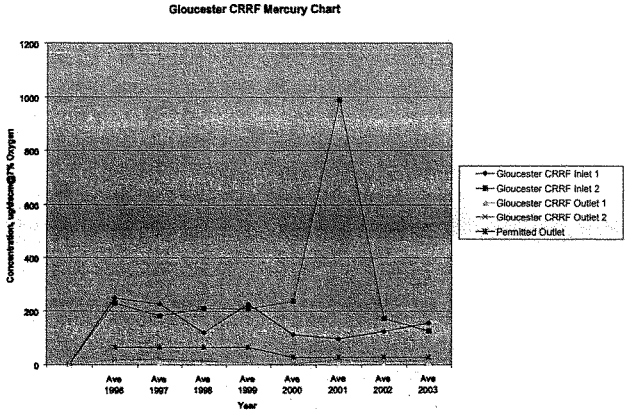
Warren CRRF Mercury Chart



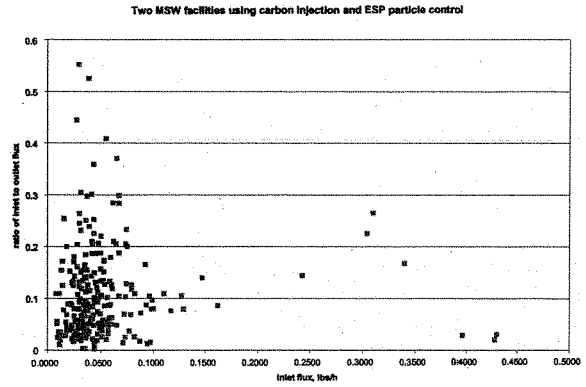
Camden CRRF Mercury Chart

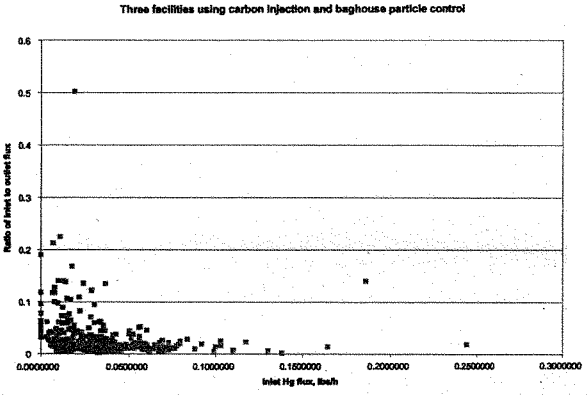






The average inlet concentration for the group of facilities is approximately 250 ug/dscm. There does not seem to be a relationship between inlet concentration and the degree of mercury control at these facilities. See charts below showing ratio of inlet flux to portion emitted (outlet flux/inlet flux). It appears that the control systems, which combine carbon injection with particle control, operate effectively regardless of the inlet concentration.





The above charts show inlet fluxes and ratio of inlet to outlet fluxes for each stack test data point for all MSW incinerators during the period 1996 to early 2003. These plots indicate that baghouse control consistently achieves greater mercury reductions than ESP control, and more effectively handles variable mercury input levels. New Jersey has proposed to increase the percent reduction component of its mercury standard from 80% to 95%, based on the success of the combination of carbon injection and baghouse particle control.

Appendix B – Details and Background Discussion of NJDEP's Analyses of Correlation of Chlorine with Mercury Control and of the USEPA's Methods in Attempting to Account for Variability in Coal Mercury Content

There are numerous statistical and analytical problems with the approach used by the USEPA to derive the proposed MACT floor standards. These problems include those discussed below, organized sequentially for purposes of discussion.

Categorization of coals by rank

Initially, the USEPA decided that separate standards should be developed for each of several different types, or ranks, of coal. The ranks chosen were bituminous, subbituminous, lignite, waste coal, and IGCC units. The latter represents a coal combustion technology, not a type of coal. The rationale for the USEPA's decision to develop separate standards for each of these five groups is not sufficiently explained. It is questionable whether the chosen coal ranks are qualitatively different. For example, subbituminous coals or blends of subbituminous and bituminous can frequently be burned in units previously burning bituminous exclusively. Combustion of waste coals or anthracite coals in these units is also typically feasible. For these reasons, the establishment of separate limits for bituminous, subbituminous and waste coal is questionable.

Failure to use average emission rate of best-performing 12% of units

With the assumption that separation of coals by rank could be justified, the USEPA could have based a proposed a standard on a straightforward determination of the average emission rate of the top 12 percent of the units based on available data. Such a determination appears to be called for in the Clean Air Act. In the case of the units considered by the USEPA to fall into the bituminous group, the average mercury (Hg) emissions of the four best-performing units, as determined by the ICR III test data, is 0.118 lbs/TBtu. A standard statistical approach[19] would have suggested that the upper limit of the likely range of this average could be as high as 0.16 lbs Hg/TBtu.[20]

[19] A standard statistical approach with a group of data such as this would be to consider that it is in effect a sample of a larger group of data (i.e. all the bituminous units in the U.S.), and to determine a confidence interval around the mean. This approach assumes that the data are normally distributed. A 95 percent confidence interval is often used. This interval represents the range of numbers within which one can be 95 percent confident that the actual mean exists. In other words, there is a 5 percent chance that the actual mean of the larger group is greater or lesser than the range of numbers encompassed by the 95 percent confidence limits. If the data are not normally distributed, as is often the case, the interval will have an unknown probability of containing the true mean. Also, when the interval is based on a very small sample size, it tends to be very wide due to the poor estimate of variability.

[20] If a 95% confidence interval was chosen, the upper limit would be 0.14 lbs/TBtu. If a 99% confidence interval was used, the upper limit would be 0.16 lbs/TBtu.

However, the USEPA, deciding that additional effort was necessary to account for variations in coal and other sources of variability, did not take this straightforward approach, and instead attempted to develop a proposed standard with additional accommodations for variability.

Failure to consider data on management of mercury variability from operating facilities

In its variability, coal is not unlike other mercury-containing fuels such as petroleum and municipal solid waste (MSW). New Jersey's five MSW incinerators have been controlling mercury emissions with carbon injection since 1994. Despite variations of inlet mercury concentrations spanning a range greater than a factor of 100, these facilities have consistently complied with mercury limits. (See Appendix A for discussion of New Jersey's experience in managing variability in MSW combustion.) Instead of seeking additional actual data on mercury control performance of existing units, including these MSW combustion facilities, the USEPA instead embarked on a path involving a variety of statistical and analytical manipulations.

Failure to select a form of the standard that best addresses variability

The USEPA has previously developed effective standards to regulate emissions that derive from variable constituents. Such standards have the form of a concentration limit and percent reduction limit, where the facility may choose the less restrictive. The NSPS for EGUs has the form of "x lbs. per trillion Btu or y percent reduction." The mercury limit for MSW incineration has the form of "w micrograms per dry standard cubic meter or z percent reduction." This form allows the concentration limit to be based on the average level of the constituent, because the percent reduction limit can be used for situations where the constituent is much higher.

Failure to consider the averaging time in determining compliance with the standard

The USEPA has proposed determining compliance with an annual average. However, the USEPA's variability analysis attempts to estimate the worst case short-term emission rate for all units and all units within a subcategory. If compliance is to be based on a long-term average, the USEPA should be estimating long-term averages to determine the MACT floor.

Acceptance of claim that coal chlorine content has a significant impact on mercury emissions controllability

The USEPA commissioned several studies of variability and how best to accommodate it. These include reports by RTI[21], SAIC[22] and a study prepared for WEST Associates (WEST) by ENSR Corporation.[23] This latter report appears to have been used, in some cases virtually word for word, as the basis for the approach presented in the proposal.

---

[21] Cole, Jeffrey, 2002, Memorandum from Jeffrey Cole, RTI, to William Maxwell, the USEPA, Statistical analysis of mercury test data variability in support of a determination of the MACT floor for the regulation of mercury air emissions from coal-fired electric utility plants, August 28, 2002.

[22] SAIC, 2003, Calculation of possible mercury MACT floor values for coal-fired utilities: Influence of variability and approach, prepared by SAIC, 11251 Roger Bacon Drive, Reston, VA, for U.S. Dept. of Energy, National Energy Technology Laboratory, Pittsburgh, PA, December, 2003.

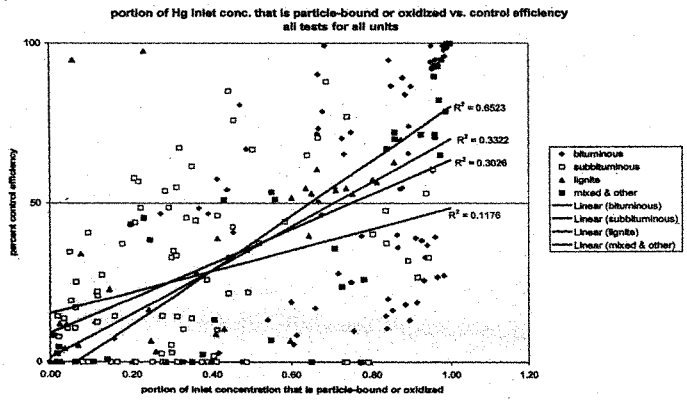
[23] WEST Associates, 2003, Multivariable Method to Estimate the Mercury Emissions of the Best-performing Coal-fired Utility Units Under the Most Adverse Circumstances which Can Reasonably Be Expected to Recur, ENSR Corporation, West Associates, Tucson, AZ, March 4, 2003.

The USEPA, apparently basing its conclusions on the WEST Associates report, states that a relationship exists between Cl and Hg control. More specifically, the agency states that the Cl content of coal can be used to predict Hg emissions, and that "the higher the Cl:Hg ratio, the more likely the formation of mercuric chloride (ionic or oxidized Hg) that is more readily captured by existing controls," and "This Cl:Hg ratio is independent of the coal rank as an indicator of Hg controllability."[24]

However, while a relationship between coal chlorine (Cl) content and the production of chlorinated Hg species in the exhaust stream is plausible, the USEPA does not offer evidence or cite sources to demonstrate a significant correlation.

Analysis of ICR III data by the NJDEP suggests that there is a relationship between mercury control and the portion of inlet mercury that is either oxidized or particle-bound.

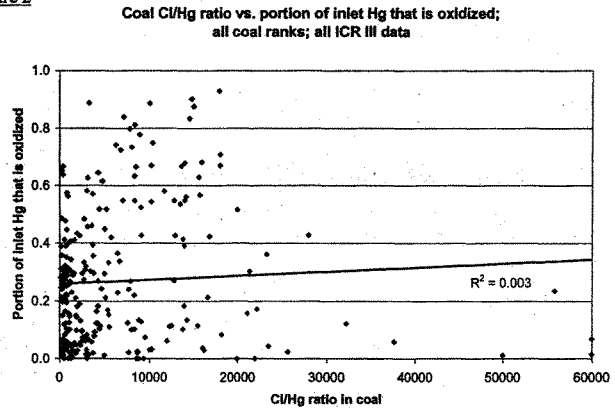
See Figure 1.
Figure 1.



However, there is wide variation in the data, and as Figure 2 shows, there is no apparent correlation between the Hg/Cl ratio of all coals and the portion of the inlet concentration that is oxidized.

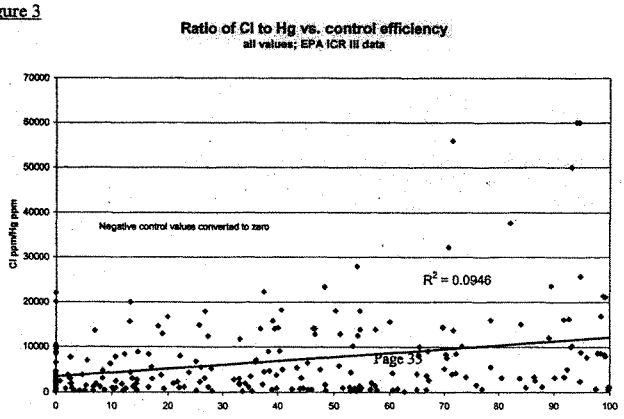
[24] Maxwell, William, 2003, Letter to Utility MACT Project Files from William Maxwell, The USEPA, CG/ESD (C439-01), November 26, 2003.

Figure 2



It is plausible that there may be a weak correlation between the chlorine/mercury ratio of the coal to the percent of mercury emissions controlled; as Figure 3 shows, the highest Cl/Hg ratios are associated with relatively good control. However, as is also clear from Figure 3, there are just as many, if not more, units with good control that are burning coals with low Cl/Hg ratios. Clearly other factors are involved in the achievement of good control than coal's chlorine content.

Figure 3



Use of equations based on coal chlorine content to estimate mercury emissions

Nevertheless, without demonstrating that a significant correlation between coal chlorine content and degree of control actually exists, the USEPA used equations developed for WEST Associates[25] to quantitatively relate Hg emissions to the amount of Cl in coal. The first step in WEST's approach to developing these equations relating coal chlorine content and mercury emissions appears to have been a grouping of units in the ICR III database by type of control. In one such case, WEST identified 10 units that use a combination of a fabric filter (baghouse) and a spray dryer absorber (FF/SDA units). Four of these units burn bituminous coal, including two that are among the four bituminous burners with the lowest mercury emissions (WEST actually looked at the five best-performing units). The other six units in the FF/SDA grouping burn either subbituminous or lignite.[26]

An equation form of $y = 1 - \beta e^{-\alpha x}$ was selected. WEST states that in the equation form selection process "care was taken that the mathematical expression accurately reflected the physical and chemical process by which chlorine contributes to the controllability of stack mercury emissions."[27] Work efforts, research reviewed, etc. that might demonstrate that such care was in fact taken are not provided. Nor is there any discussion of whether other equation forms were considered, or if so, why they were rejected.

In some cases, WEST found that an equation of the form chosen could not be found that fit the actual data sufficiently well to justify its use. In those cases, they elected to use the average removal efficiency as reported in the ICR III database.

In other cases, they found equations that they considered to have sufficient predictive value based on the R^2 value. One of these equations, the one chosen to represent the relationship between Cl and mercury emissions for the fiber filter/spray dryer absorber (FF/SDA) units, was used by the USEPA to estimate mercury emissions of three of the four best-performing bituminous units. WEST claims that the best-fitting equation, $F_{rem} = 1 - 0.8188 * e^{(-0.002164 * Clppm)}$ is associated with an R^2 value of 0.935. In graphing the data, WEST stated that it did not use the data from one unit because its coal chlorine measurements were so low as to be of questionable accuracy. The DEP used the data listed by WEST[28] to develop its own plot of the data. It appears that WEST actually plotted 8, not 9, of the 10 units. A recreation of the WEST analysis by the DEP (Figure 4) found that the R^2 value is closer to 0.85.

---

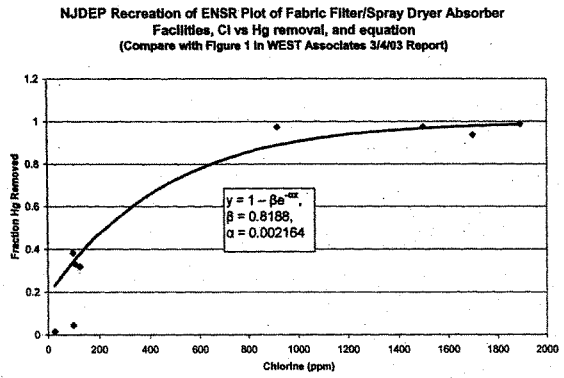
[25] WEST Associates, 2003; see especially, chapter "Development of Mercury Removal Correlation Equations for Each Particulate/SO2 Control Combination"

[26] NOTE: Grouping coals of different rank on the basis of control technology is at odds with the USEPA's assertion, stated in the proposal, that coal rank is of overriding importance and that limits would be established for Hg depending on the rank of coal. It is unclear why WEST in this part of its analysis considered that control technology configuration superseded coal rank as a valid consideration, and it is unclear why the USEPA accepted this approach given its decision to base regulation of coal units on coal rank.

[27] WEST Associates, 2003, Chapter "Statistical Approach", p. 7.

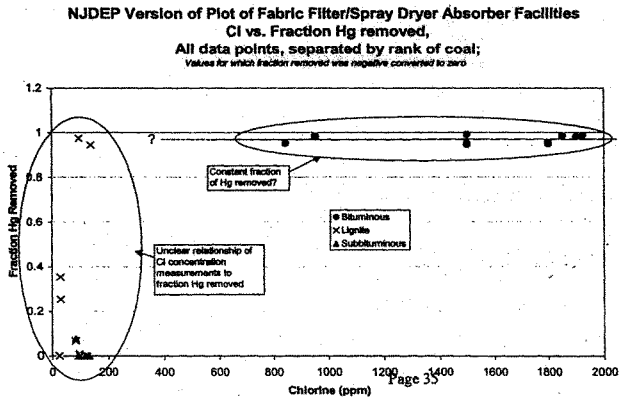
[28] WEST Associates, 2003, Chapter "Statistical Approach", P. 10 & 11.

Figure 4



However, closer analysis reveals the fit is even less good. See Figure 5. This figure shows all the data for the FF/SDA units instead of the averages of the three values for each unit as WEST did. The figure also separates the coals by rank instead of lumping them together as WEST did. Inspection of the figure suggests that there could be other models that might fit the data better than the equation form used. It could be that there are in fact two sub groups of units in this group, bituminous coal burners and those burning other ranks of coal. The best approach might be to fit a separate equation to each group. One such equation, for bituminous burners, might be virtually a horizontal straight line, with control efficiency above 90% regardless of chlorine concentration.

Figure 5



Particularly problematic is the fact that, as shown in Figure 5, the range of values corresponding to the fraction of mercury removed for concentrations between approximately 150 ppm and 850 ppm is totally undefined by the data. Nevertheless, the equation used by the USEPA, corresponding to the values depicted in Figure 4, was used to predict mercury emissions from some of units burning coal with chlorine content corresponding to these undefined values.

The problems evident in the development of the above equations indicate that it is invalid as a basis for estimation of mercury emissions. There were other equations developed through apparently similar processes that were also used by the USEPA to estimate mercury emissions based on coal chlorine content. Review by the DEP suggests that these too are invalid.

Development of distributions of emissions estimates based in part on equations based on coal chlorine; selection of 97.5th percentile values of these distributions

The USEPA next proceeded to use the ICR II data, which includes Hg and Cl content of coal purchased by units including those units for which stack test data exist in the ICR III database. The USEPA took the mercury content of the coals purchased by the best-performing 12% of units in the chosen subcategories and multiplied each of these values by a value representing the fraction of that mercury that would be likely to be removed by the unit's control systems prior to emission. This value, the fraction removed, or Fr, was derived by the USEPA in one of two ways. It was either:

1) the average fraction removed by the unit in the three tests reported in the ICR III database, or,
2) the value calculated by the WEST-derived equation, as discussed above, for those units.

Approach 2) was used only where the USEPA assumed that the equation sufficiently represented the relationship of Hg in the coal to Hg emissions. As discussed above, in the NJDEP's view, in no case do these equations sufficiently represent the relationship of Hg in the coal to Hg emissions, and so approach 2) should not have been used. Approach 1) appears to have more potential validity.[29]

The result of this multiplication process was a series of "distributions" for each unit. These distributions are estimated Hg emissions for that unit assuming that the coal it would burn over the course of a year would be the same as the coals reported in the ICR II database for that unit.

With the assumptions that these distributions represent the Hg emissions associated with each separate coal shipment likely to be used by each unit over the course of a year, and that the same group of units will still represent the best-performing units after these calculations, the USEPA determined the 97.5th percentile of these distributions for each unit considered. This represents a value that, based on these data, would likely be exceeded only 2.5% of the time.[30]

It is interesting that, while basing much of its procedure on the procedure described in the WEST report to relate Cl to Hg emissions, WEST recommended using a 95th percentile value, stating that this represented "the

[29] However, this approach is based on an assumption that emissions of Hg are linearly related to Hg in coal, which may not be valid in all cases.
[30] However, this approach is relevant only if compliance is based on a short-term test, e.g., three test runs of one hour each in one day. Where compliance is based on an annual average, a lower percentile, such as the 50th percentile, would be more relevant.

operation of the unit under 'worst conditions'."[31] the USEPA, however, used 97.5th percentile value of the cumulative distributions, and stated that the resulting number represents "the operation of the unit under conditions reasonably expected to occur at the unit."[32]

Given that the proposed rules indicate that a rolling average of a year's worth of data will be used to determine compliance, it is unclear why the USEPA considered selecting a 97.5th percentile value, or, for that matter, why WEST recommended the 95th percentile. A high percentile, such as a 95th percentile value, might be appropriate if compliance were to be determined with a once-a-year stack test, but is inappropriate for a yearlong averaging process.

A variety of other approaches that were not based on questionable assumptions could have been taken.[33] Nevertheless, the USEPA selected the 97.5th percentile values. These, coupled with the use of distributions discussed above that, in some cases, predict much higher Hg emission rates than a unit's (ICR III) stack test data show, result in estimated emission rates in many cases much higher than the stack test data for the best-performing units.

Treatment of 97.5th percentile values as if they were data, and determination of means and upper confidence interval limits of these "data"

The USEPA then treated these 97.5th percentile values as if they were data points, and determined the average 97.5th percentile value and 97.5% upper confidence limit of this average for each set of units. Because there are only a small number of units under consideration (e.g., in the case of bituminous and subbituminous, only four units each), the use of statistical procedures that are intended for normally distributed data inappropriately results in a still higher value.

Since these percentile values are statistics derived from data, the variance estimate for each of these statistics should have been used when constructing confidence intervals. This would remove the variability due to unit, which should not have been included in the error variability. It should also be noted that such a high percentile value is difficult to estimate with data sets of moderate sample size, such as those used here. Considering that the data come from imprecise modeling and non-random sampling, these percentiles are likely highly inaccurate.

---

[31] WEST Associates, 2003, chapter, "STATISTICAL APPROACH", p.14.

[32] The USEPA, 2004; Federal Register, Vol. 69, January 30, 2004, page 4673.

[33] One approach would have multiplied the Hg content of the coal in the ICR II database by the average removal efficiency in the ICR III database for all units considered. In the case of the four best-performing bituminous units, this multiplication process generates a mean emission rate of 0.28 lbs Hg/TBtu. A basic statistical approach might suggest that the 95 percent confidence upper limit of this mean be determined with use of the student's t statistic method. However, a more appropriate approach would account for the fact that each of the four values is in fact a mean derived from numerous values (the distributions). The standard error and within-unit variance of these means can be determined, and then the variance of the across unit mean can be derived, and used to calculate the 95% upper confidence limit. The DEP's use of this approach results in a 95% upper confidence interval of 0.31 lbs/TBtu. This value could be, in the DEP's view, an appropriately-derived standard for bituminous coal combustion. Use of 99% confidence level upper limit results in a value of 0.32 lbs/TBtu.

This last data manipulation completes a tortuous process and results in proposed limits that are, in the case of bituminous coal burners, seventeen times higher than the average of the best-performing 12% of tested units. This is an inappropriate outcome, especially considering the flaws and questionable assumptions in the USEPA's analysis.

State of New Jersey

JON S. CORZINE
Governor

Department of Environmental Protection

LISA P. JACKSON
Commissioner

Division of Air Quality
P. O. Box 027
Trenton, NJ 08625-0027

February 7, 2006

EPA Docket Center (EPA/DC)
Environmental Protection Agency
Mailcode 6102T
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Attn: Docket ID No. EPA-OAR-2005-0117

RE: Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Large Municipal Waste Combustors (Proposed Rule)

Dear Sir/Madam:

On behalf of the New Jersey Department of Environmental Protection (the Department), I am writing to comment on EPA's proposed rule to the standards of performance (NSPS) for new stationary sources and emission guidelines for existing sources: large municipal waste combustors. The proposed rule would revise the emission limits in the NSPS and emission guidelines to reflect the levels of performance actually achieved by the emission controls installed to meet the emission limits set forth in the December 19, 1995, NSPS and emission guidelines. The proposed rule would amend Subpart Cb and Subpart Eb, 40 CFR part 60. The proposed amendments appeared in the December 19, 2005 Federal Register (Vol. 70, No. 242). We agree that setting lower emission standards for dioxin/furan, cadmium, lead, PM, SO2, and mercury consistent with available technology is a practical and effective way to minimize the impact of these pollutants on the environment.

We recommend EPA further tighten the standards for mercury with the following comments, based on New Jersey's extensive experience with MWCs:

1. Mercury Emission Limits

EPA is proposing to keep the emission limits for mercury 80 micrograms per dry standard cubic meter or 85-percent reduction by weight, corrected to 7 percent oxygen in Subpart Cb §60.33b(a)(3) for existing units, and is proposing to reduce the emission limits for mercury to 49 micrograms per dry standard cubic meter or 90-percent reduction by weight, corrected to 7 percent oxygen in Subpart Eb §60.52b(a)(5) for new units. The Department recommends lower mercury emission limits, based on over 10 years of experience.

Exhibit B

In New Jersey, there are 13 large municipal waste combustors (MWC) at 5 facilities. Seven units are equipped with fabric filters (baghouse), and 6 units are equipped with Electrostatic Precipitators (ESPs). These units now remove about 95 to 99.7% of the mercury, as determined by inlet testing (before activated carbon injection, dry scrubbers and particulate control device) and outlet (stack) testing. The units with baghouses achieve higher control efficiency (typically over 99 percent) and the units with EPS achieve lower control efficiency (typically over 95 percent). The MWCs with baghouse particulate control are consistently achieving outlet mercury concentrations less than 10 micrograms per cubic meter corrected to 7 percent oxygen. Two of these facilities with baghouse and higher carbon injection rates achieved less than 5 micrograms per cubic meter corrected to 7 percent oxygen. The MWCs with ESP particulate control are consistently achieving outlet mercury concentrations less than 28 micrograms per cubic meter corrected to 7 percent oxygen, which is the New Jersey concentration limit since 2000.

New Jersey's MWC mercury rule was revised in November 2004, to limit mercury emissions to 28 micrograms per cubic meter corrected to 7 percent oxygen or 95% control efficiency. Our standard was to 28 micrograms per cubic meter corrected to 7 percent oxygen or 80% control. The 95% control efficiency is to be achieved in two steps: 85% control efficiency by January 3, 2006, and 95% control efficiency by January 3, 2012.

As stated above, even the ESP equipped units are now meeting the standard, well in advance of the deadlines in the amended rules. New Jersey MWCs are achieving these limits without going through any major modification. Attached is a summary of New Jersey's MWC's test data. The Department recommends that EPA tightens MWC mercury emission limits to 28 micrograms per cubic meter corrected to 7 percent oxygen or at least 95% percent reduction by weight for both Subpart Cb and Subpart Eb. The Department also recommends that any municipal waste combustors (MWCs) to be constructed after December 19, 2005, be equipped with fabric filter (baghouse) emission control to minimize mercury and fine particulate emissions, including other heavy metals and dioxin.

2. Monitoring Carbon Injection

EPA requested comments on the reasonableness of monitoring the pneumatic injection pressure at the location where the activated carbon is injected into the flue gas (P 75353 item F). The mercury removal efficiency, to a great extent, depends on the proper injection and distribution of activated carbon into the flue gas stream. Any injector nozzle clogging will result in poor emission control. We agree that timely detection of any injector nozzle clogging will improve the annual control efficiency. The Department supports this proposed measure.

3. Reduced Stack testing for Mercury for Consistently Low Emitting Units

The EPA is proposing to amend the NSPS and emission guidelines provisions to allow reduced frequency for testing of "exceptionally well-operated" MWC units in Subpart Eb §60.58b(g)(5)(iii). Well-operated MWC units are those with emissions significantly below the emission limits. The proposed amendments would allow the owner or operator to conduct annual performance tests for one unit per year at each facility. To qualify for this reduction in testing, all units at the facility must achieve both dioxin/furan emission of less than 7 nanograms per dry standard cubic meters (total mass) and mercury emissions less than 25 micrograms per dry standard cubic meter corrected to 7 percent oxygen, which is half the emission limits allowed for the MWCs in this subpart. The Department supports the proposed reduction of testing for consistently low emitting MWC units in Subpart Eb §60.58b(g)(5)(iii). However, the Department recommends EPA reduce testing for the mercury emission levels less than 14 micrograms per dry standard cubic meter corrected to 7 percent oxygen for "exceptionally well-operated" MWC units. The Department also recommends including this provision in Subpart Cb. The Department considers this as an incentive for owners or operators of the existing MWC units to optimize an MWC unit's carbon injection system and other operating parameters to minimize both mercury and dioxin/furan emissions. Please see N.J.A.C. 7:27-27.4(d) for a similar, but not identical version in using the 14 micrograms per dry standard cubic meter corrected to 7 percent oxygen level in the New Jersey rule.

Thank you for the opportunity to comment on the proposed regulation for Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Large Municipal Waste Combustors.

If you have any questions, please contact Sunila Agrawal at (609) 292-9202.

Sincerely,

William O'Sullivan, P.E.
Director

Encl:

c: Sam Wolfe, Assistant Commissioner
Lou Mikolajczyk
Sunila Agrawal
Hironmoy Sikdar

SUMMARY OF OUTLET MERCURY TEST RESULTS OF NEW JERSEY MUNICIPAL WASTE INCINERATORS

(Mercury Concentrations in ug/dscm @7% Oxygen)

Name of the Facility	Unit #	2001					2002					2003					2004		2005	
		1st Q	2nd Q	3rd Q	4th Q	Annual Avg.	1st Q	2nd Q	3rd Q	4th Q	Annual Avg.	1st Q	2nd Q	3rd Q	4th Q	Annual Avg.	1st Q	Annual Avg.	1st Q	Annual Avg.
Essex CRRF (PI 07736)	1	51.7	22.2	14.5	20.2	27.1	10.1	26.3	22.0	24.1	20.6	17.4	20.7	18.6	18.4	18.8	7.2	7.2	23.9	23.9
(ESP, Dry Scrubber, SNCR,	2	29.2	29.9	17.3	29.9	26.6	29.5	19.5	20.0	33.6	25.7	22.8	15.2	24.2	22.4	21.2	8.0	8.0	31.0	31.0
and Activated Carbon)	3	30.5	198.1	33.3	31.2	**73.3**	18.0	18.4	16.4	22.2	18.7	9.4	16.7	42.5	20.5	22.3	6.2	6.2	14.3	14.3
Warren CRRF (PI 85455)	1	1.4			3.5	2.5	1.4				1.4	0.7				0.7	0.3	0.3	0.4	0.4
(Baghouse, Dry Scrubber,	2	6.4			2.1	4.2	2.1				2.1	1.1				1.1	0.5	0.5	0.5	0.5
and Activated Carbon)																				
Camden CRRF (PI 51614)	1	19.1	INV	INV	16.7	17.9	9.2	6.9	13.6	7.4	9.3	1.8				1.8	16.1	16.1	3.5	3.5
(ESP, Dry Scrubber,	2	45.2	INV	INV	13.9	**29.6**	12.5	30.7	5.0	5.9	13.5	3.4				3.4	3.5	3.5	3.7	3.7
and Activated Carbon)	3	18.0	INV	INV	6.6	12.3	7.4	8.1	4.3	134.3	**38.5**	2.1				2.1	2.0	2.0	4.1	4.1
Union CRRF (PI 41814)	1	4.1				4.1	1.4				1.4	0.6				0.6	6.6	6.6	1.1	1.1
(Baghouse, Dry Scrubber,	2	3.7				3.7	4.4				4.4	1.2				1.2	2.5	2.5	0.5	0.5
SNCR, and Activated Carbon)	3	7.4				7.4	1.5				1.5	1.3				1.3	1.2	1.2	0.4	0.4
Gloucester CRRF (PI 55793)	1	2.1				2.1	7.9				7.9	6.5				6.5	4.3	4.3	3.1	3.1
(Shaker Baghouse, Dry	2	18.1				18.1	9.5				9.5	15.8				15.8	4.2	4.2	6.3	6.3
Scrubber, and Actd. Carbon)																				

ug/dscm = microgram per dry standard cubic meter
All results are rounded to the 1st decimal point.
INV = Invalid data

SUMMARY OF MERCURY REMOVAL EFFICIENCY AND CARBON USAGE OF NEW JERSEY MUNICIPAL WASTE INCINERATORS

(Removal Efficiency, lb/hr basis and Carbon Usage in lb/hr)

Name of the Facility	Unit #	2001									2002										2003										2004			2005		
		1st Q		2nd Q		3rd Q		4th Q		Annual Avg.	1st Q		2nd Q		3rd Q		4th Q		Annual Avg.		1st Q		2nd Q		3rd Q		4th Q		Annual Avg.		1st Q		Annual Avg.	1st Q		Annual Avg.
		Eff. %	C (lb/hr)	Eff. %	C (lb/hr)	Eff. %	C (lb/hr)	Eff. %	C (lb/hr)	Eff. %	Eff. %	C (lb/hr)	Eff. %	C (lb/hr)	Eff. %	C (lb/hr)	Eff. %	C (lb/hr)	Eff. %		Eff. %	C (lb/hr)	Eff. %	C (lb/hr)	Eff. %	C (lb/hr)	Eff. %	C (lb/hr)	Eff. %		Eff. %	C (lb/hr)	Eff. %	Eff. %	C (lb/hr)	Eff. %
Essex CRRF (PI 07736)	1	63.8	34.0	87.0	36.0	91.6	36.0	87.5	36.0	82.5	92.3	36.0	88.3	26.3	90.1	36.0	86.3	36.0	89.3		88.5	36.0	88.8	36.0	89.0	36.0	89.6	36.0	89.0		94.0	36.0	94.0	87.1	36.0	87.1
(ESP, Dry Scrubber, SNCR,	2	86.0	34.0	85.4	36.0	88.9	36.0	85.9	36.0	86.5	85.6	36.0	91.2	19.5	87.5	36.0	89.0	36.0	88.3		88.0	36.0	86.7	36.0	98.1	36.0	87.6	36.0	90.1		88.4	36.0	88.4	90.3	36.0	90.3
and Activated Carbon)	3	86.5	34.0	83.8	36.0	83.5	36.0	54.6	36.0	77.1	90.1	36.0	91.9	18.4	87.0	36.0	88.2	36.0	89.3		95.2	36.0	90.6	36.0	85.6	36.0	91.2	36.0	90.7		95.1	36.0	95.1	92.3	36.0	92.3
Warren CRRF (PI 85455)	1	98.8	9.0	-		-		97.6	9.0	98.2	98.9	9.0	-	-	-	-	-	-	98.9		99.5	9.2							99.5		99.7	9.2	99.7	99.6	9.0	99.6
(Baghouse, Dry Scrubber,	2	94.9	9.0	-		-		98.3	9.3	96.6	98.3	9.0	-	-	-	-	-	-	98.3		99.3	9.3							99.3		99.4	9.2	99.4	99.6	9.1	99.6
and Activated Carbon)																																			
Camden CRRF (PI 51614)	1	93.0	25.2	-	-	-	-	92.3	28.1	92.6	94.6	26.2	94.9	23.9	94.2	28.8	96.0	26.8	94.9		98.3	28.1							98.3		96.9	29.2	96.9	96.2	27.8	96.2
(ESP, Dry Scrubber,	2	88.7	25.5	-	-	-	-	94.2	27.3	91.4	95.3	25.5	91.3	24.9	94.6	24.7	97.7	28.8	94.7		97.5	28.1							97.5		91.9	33.1	91.9	97.2	32.2	97.2
and Activated Carbon)	3	88.7	26.1	-	-	-	-	96.6	28.4	92.6	96.2	27.9	94.7	26.3	96.8	29.6	90.9	30.3	94.6		97.1	28.2							97.1		97.7	35.7	97.7	97.2	30.1	97.2
Union CRRF (PI 41814)	1	98.3	21.0	-		-		-		98.3	99.2	21.0	-	-	-	-	-	-	99.2		99.6	21.0							99.6		97.7	21.0	97.7	99.2	21.0	99.2
(Baghouse, Dry Scrubber,	2	98.4	21.0	-		-		-		98.4	97.7	21.0	-	-	-	-	-	-	97.7		99.1	21.0							99.1		98.4	21.0	98.4	99.7	21.0	99.7
SNCR, and Activated Carbon)	3	96.4	21.0	-		-		-		96.4	99.5	21.0	-	-	-	-	-	-	99.5		99.4	21.0							99.4		99.2	21.0	99.2	99.7	21.0	99.7
Gloucester CRRF (PI 55793)	1	97.8	2.0	-		-		-		97.8	90.7	2.0	-	-	-	-	-	-	90.7		93.8	2.0							93.8		95.6	2.0	95.8	97.4	3.0	97.4
(Shaker Baghouse, Dry	2	97.3	2.0	-		-		-		97.3	93.2	2.0	-	-	-	-	-	-	93.2		81.9	2.0							81.9		95.1	2.0	95.1	94.7	3.0	94.7
Scrubber, and Activ. Carbon)																																			

Notes:
1. All efficienfies are based on average pound per hour emission rates
2. All results are rounded to the 1st decimal point.
3. INV = invalid data

JON S. CORZINE
Governor

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Air Quality Permitting Program
P. O. Box 027
Trenton, NJ 08625-0027

LISA P. JACKSON
Commissioner

May 17, 2007

EPA Docket Center (EPA/DC)
Environmental Protection Agency
Mailcode 6102T
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Attention Docket ID No. EPA-HQ-OAR-2002-0034

RE: Proposed Amendment to the National Emission Standards for Hazardous Air Pollutants for Iron and Steel Foundries

Dear Sir:

On behalf of the New Jersey Department of Environmental Protection (Department), I am writing to comment on USEPA's proposed amendments to the National Emission Standards for Hazardous Air Pollutants (NESHAPs) for Iron and Steel Foundries, which appeared in the Federal Register on April 17, 2007. One of the proposed amendments to the NESHAPs would include emission limits of total metal HAP for existing iron and steel foundries. In this proposed rule, mercury emissions are considered part of total metal HAP emissions. The Department recommends USEPA adopt stand-alone mercury emission standards for iron and steel foundries. Iron or steel scrap melters in New Jersey are collectively the largest source of mercury emissions to the air in the State.

The Department adopted mercury regulations for iron and steel scrap melting in December 2004. These regulations are codified at N.J.A.C. 7:27-27.6. These will achieve over 75 percent reductions of mercury emissions from the New Jersey's six iron and steel melters by 2010. The new rules specify that mercury emissions from each iron or steel melter of any size shall not exceed 35 mg/ton of steel produced or in the alternative, shall reduce its mercury emissions by at least 75 percent as measured at the exit of the mercury control apparatus. The December 2004 rules allow these facilities time to reduce mercury emissions through programs to remove sources of mercury including mercury switches, from the scrap they process. Additional air pollution control technology is required if the source separation program proves insufficient to meet emission limits. The emission limit determines the success of the source separation program and the need for add on mercury control measures on the exhausts of the melters.

Exhibit C

A national association representing iron and steel melters challenged the regulations, claiming that the requirements were too stringent and requiring the use of emission control technologies that are neither commercially available nor of proven effectiveness. The court disagreed, finding that the state had acted well within its "broad authority to issue health-based regulations." In its unanimous decision on April 13, 2007, (copy enclosed) the Appellate Division of the Superior Court of New Jersey affirmed the Department's regulations to protect citizens from the impacts of mercury emissions from iron and steel melters. In re Adoption of Amendments and New Regulations at N.J.A.C. 7:27-27.1 et al., ____ N.J. Super. _____, 2007 N.J. Super. LEXIS 109 (Appellate Division April 13, 2007).

Most of the New Jersey melters have taken significant steps to comply with the rules, including both source separation and add on control. For example, Atlantic States iron and steel foundry in New Jersey recently installed activated carbon injection system for mercury control and a baghouse serving the cupola. Mercury emission test results at this plant show greater than 90% mercury control and mercury emissions less than three mg/ton. The mercury emissions are well below both the New Jersey mercury rules limits. Other facilities with existing fabric filter control have also tested carbon injection and have also reported compliance with the New Jersey rule were achieved. However, formal test results have not been submitted to date.

Based on New Jersey's experience, I recommend that the USEPA adopt mercury emission standards at least as stringent as contained in the New Jersey mercury rule for iron and steel foundries.

Thank you for the opportunity to comment on the Proposed Amendment to the National Emission Standards for Hazardous Air Pollutants for Iron and Steel Foundries. If you have any questions, please contact Sunila Agrawal at 609-292-9202.

Sincerely,

William O'Sullivan, P.E.
Director

Enclosure

c: Nancy Wittenberg, Assistant Commissioner
John Preczewski, Assistant Director

NOT FOR PUBLICATION WITHOUT THE
APPROVAL OF THE APPELLATE DIVISION

SUPERIOR COURT OF NEW JERSEY
APPELLATE DIVISION
DOCKET NO. A-2445-04T2
A-2476-04T2

APPROVED FOR PUBLICATION

April 13, 2007

APPELLATE DIVISION

IN RE ADOPTION OF AMENDMENTS AND NEW REGULATIONS AT N.J.A.C. 7:27-27.1, -27.2, -27.4, -27.5, -27.6, -27.7, -27.8, -27.9 and -27.11, and N.J.A.C. 7:27A-3.10.

IN RE CONTROL AND PROHIBITION OF MERCURY EMISSIONS (ADOPTED AMENDMENTS OF N.J.A.C. 7:27-27.1, -27.2, -27.4, -27.9 and 7:27A-3.10, and NEW RULES N.J.A.C. 27.5, 27.6, 27.7, AND 27.8).

Argued March 14, 2007 – Decided April 13, 2007

Before Judges Lefelt, Parrillo and Sapp-Peterson.

On appeal from the Department of Environmental Protection, issuance of certain regulations controlling atmospheric emissions of mercury, 36 N.J.R. 5406(a) (December 6, 2004).

Marty M. Judge argued the cause for appellant Gerdau AmeriSteel in A-2445-04T2 (Drinker Biddle & Reath, attorneys; Mr. Judge, of counsel and on the brief).

Joseph J. Green (Kelley Drye Collier Shannon) of the Virginia and District of Columbia bars, admitted pro hac vice, argued the cause for appellant Steel Manufacturers Association in A-2476-04T2 (Kirkpatrick & Lockhart Nicholson Graham and John L. Wittenborn (Kelley Drye Collier Shannon) of the District of Columbia, Indiana and Ohio bars, admitted pro hac

vice, attorneys; Brian S. Montag, of counsel; Mr. Wittengorn, of counsel and on the brief).

Howard Geduldig, Deputy Attorney General, argued the cause for respondent NJDEP in both appeals (Stuart Rabner, Attorney General of New Jersey, attorney; Michael J. Haas, Assistant Attorney General, of counsel; Mr. Geduldig, on the brief).

The opinion of the court was delivered by

PARRILLO, J.A.D.

On November 4, 2004, the New Jersey Department of Environmental Protection (DEP) issued the first regulations ever to control mercury emissions from iron and steel melters. The only prior controls on mercury emissions were in the melters' operating permits, which are specific to each facility and widely different. Moreover, none of the iron and steel facilities in New Jersey is currently covered by federal regulation. The new rules require a 75% reduction in mercury emissions starting in 2010, achieved through source separation measures and, if necessary, installation of additional exhaust controls. These rules, which exceed federal requirements, affect electric arc furnace steel manufacturers who are members of appellant Steel Manufacturers Association (SMA), including appellant Gerdau AmeriSteel, who owns and operates two mini-mills in New Jersey that utilize electric arc furnaces to recycle scrap metal to produce new steel products. Appellants support source separation, but object to the mandatory

installation of additional exhaust controls should source separation measures fail to achieve the DEP's reduction goals. Consequently, in these consolidated appeals, they challenge the newly promulgated regulations on a variety of grounds, arguing, among other things, that DEP exceeded its statutory authority; acted arbitrarily, unreasonably and without a legitimate technical basis by requiring use of emission control technologies that are neither commercially available nor of proven effectiveness for the forms of mercury generated by the mini-mills; and violated the rulemaking requirements of the Administrative Procedure Act (APA), N.J.S.A. 52:14B-23.

By way of background, the record discloses that there are six "melters" or "mini-mills" in New Jersey, which are facilities that turn mercury-containing scrap metal into iron or steel. Three of them, including the two operated by Gerdau, utilize electric arc furnaces (EAF) to recycle or melt the scrap metal, and the other three use a vertical furnace called a cupolo. Collectively, their permitted production capacity is approximately three million tons per year. Together, they constitute the State's largest single "source category" for atmospheric emissions of mercury, and DEP estimates that they discharge about 1000 pounds of mercury per year as a byproduct

of the melting process, even after treatment by some form of emission-control technology.

Mercury is a heavy metal which is regulated because it is a "hazardous air pollutant" (HAP) under both federal and state law. 42 U.S.C.A. § 7412(b); N.J.S.A. 26:2C-2. Mercury has high toxicity and a tendency to persist in the environment and become concentrated in food sources, particularly fish. In fact, mercury has far greater toxicity compared to the air pollution "criteria pollutants." 36 N.J.R. 5412, response to comment 31. Inorganic mercury is commonly released to the environment by burning fuels and wastes containing mercury. The likely source of mercury in New Jersey is from "feedstock ferrous scrap", which includes recycled motor vehicles, home appliances, and waste metal from demolished buildings. More specifically, the mercury in switches, sensors and thermostats that those items contain is the likely source of the mercury in a melter's exhaust.

To date, only a modest proportion of the reduction in mercury emissions by melters has been achieved through source separation, namely, having scrap dealers and recyclers, which supply mini-mills with the end-of-life vehicles that are the largest source of their feedstock, remove electrical switches that contain mercury from the vehicles before processing them.

To be truly effective, source separation has to occur before scrap is processed for delivery to the mini-mill, because the receipt of scrap in bulk quantities prohibits a mini-mill from identifying and removing the "relatively minute quantities of mercury-containing components". Yet, the regional scrap metal industry, which has been largely unregulated in New Jersey, has very little incentive to comply. Devices such as switches, sensors and thermostats simply do not have enough intrinsic value for dismantlers or recyclers to remove them before processing, so even if the use of mercury in new devices were phased out, the old ones would continue to appear in the feedstock for years to come. In addition, scrap processors sometimes lack necessary information from vehicle manufacturers about the exact location of those devices. As a representative for one of the melters, United States Pipe and Foundry[1], testified at public hearings on DEP's proposed regulations at issue here, his company spent more than a year demanding mercury-free scrap from its eleven suppliers and offering "an incentive," but only one of them even tried to remove switches containing mercury. According to the representative, in the currently tight market for scrap metal, "if you can get it anywhere, even from overseas, you need to try to get it or you

[1] U.S. Pipe and Foundry withdrew its appeal in this matter.

don't operate". Thus, while source removal may be a reasonable and cost-effective emissions control measure – DEP having estimated the cost of switch removal at $2 per switch, or $1140 per pound of mercury removed – DEP also concluded from the results of a pilot project demonstrating only a 50% reduction, that such an approach by itself "will not necessarily" achieve a sufficient reduction in mercury emission. 36 N.J.R. 5413-14, response to comment 34; 36 N.J.R. 5411, response to comment 25.

In addition to source removal, four of the six melters in New Jersey (three EAFs and the one cupola), including Gerdau's facilities in Raritan and Sayreville, use an emission control technology called a "baghouse," which is essentially a fabric filter. However, in one melter's operations, the baghouse reduced mercury emissions by only 34%. In fact, recent stack test data show that the mean mercury emission rate from iron and steel melters, weighted based on production capacity, was 137 milligrams of mercury emissions per ton (mg/ton) of iron or steel production, an emissions rate deemed by DEP to be causing an unacceptable degree of human exposure to mercury.

Because of the threat to the public health and welfare posed by the inadequacy of then current mercury pollution policies, DEP established the New Jersey Mercury Task Force (Task Force) on March 9, 1998. Its charge was to "review

innovative and low cost emission reduction strategies available in various industrial sectors", and to "[r]ecommend mercury emission controls and standards for in-state sources."

In carrying out its duties, the Task Force looked to mercury control technologies in related industries, particularly coal power plants and municipal solid waste (MSW) incinerators, as well as European mini-mills. To be sure, there were differences: the levels of mercury in the melter's scrap feed were highly variable and unpredictable compared to the far less variable levels in coal plants due to the homogenous nature of their fuel supplies. There were also differences in the balance or "speciation" between ionic and elemental forms of mercury in the source material in the exhaust stream as well as the temperatures of the exhaust or "flue gases." Indeed, DEP agreed that elemental mercury might represent "a relatively large portion" of a mini-mill's mercury emissions and that ionic forms of mercury are easier to capture than the elemental mercury that predominates in melting operations. Despite these differences in characteristics, however, studies assessing the prospects for adapting the mercury control techniques used in other industries concluded that the technology is readily transferable.

On November 30, 2000, the consulting firm of BE&K Terranext issued a report analyzing the "best available control

technology" and the "state of the art" (SOTA) for reducing mercury emissions from a mini-mill. Terranext noted the "potentially applicable" technology of injecting activated carbon into the melters' exhaust gas streams, which MSW incinerators were doing and which coal power-plants were testing.[2] In fact, one company, ADA Environmental Technology, advised Terranext that its experience relating to coal power-plants "is expected to be similar to what may be encountered in the steel industry". ADA accordingly assumed that a baghouse would collect "essentially 100% of the mercury associated with particulate matter," and that "[t]he relatively low temperature of 200°F should lend itself to effective capture of vapor phase mercury by carbon based sorbents". The only variable, depending on the mercury vapor's speciation, was the amount of carbon-based sorbent that would have to be injected to capture 90% of total mercury vapor.

The Task Force agreed that activated carbon injection (ACI) technology is commercially available, having been used for well over a decade by operators of MSW incinerators to significantly reduce mercury emissions, and that this technology was readily

[2] In addition to activated carbon, Terranext also referenced other injection technologies involving the chemical reagents sodium tetrasulfide and oxidized lime sorbent, and estimated their costs per pound of mercury removed from a mini-mill's exhaust.

transferable to New Jersey's iron and steel melters, particularly those that already have baghouses for control of particulate emissions melters. Thus, recognizing that source reduction measures alone may not fully achieve the Task Force's mercury emission reduction goals of 75%, the Task Force issued Volume I of its Report in December 2001, recommending a cooperative three-year effort "to reduce mercury contamination of scrap through elimination and separation measures," followed by the mandatory installation of exhaust controls if the source-separation measures by themselves did not achieve the Task Force's emission-reduction goal of 75%. In Volume III, issued in January 2002, the Task Force, obviously impressed by the 95% reduction of exhaust mercury levels for MSW incinerators, and finding that both the volume of a melter's flue gas flow and the concentrations of mercury in it were not outside the range for MSW incinerators or coal power-plants, concluded that, for the three EAFs and the one cupola already using a baghouse, the amount of carbon injection needed for additional reductions to achieve compliance would be "a relatively low capital cost option". The two cupolas that used scrubbers "would need to rely on scrap management or evaluate measures to remove mercury switches," or develop another way to oxidize the mercury vapor into an ionic form before it enters the scrubber.

Subsequent studies confirmed this view. A February 27, 2004 EPA report about mercury-control technology for coal power-plants described how the mercury, which "in the high temperature regions of" the boilers becomes elemental vapor, "begins to convert" to ionic or other non-elemental forms, and then turns solid or gets "absorbed onto the surface of other particles". The report related a "very limited set of short-term full scale trials" of activated carbon injection for power-plants using subbituminous or lignite coal, and noted that such injection, in conjunction with an electrostatic precipitator, "has the potential to achieve" a 70% reduction, or even 90% if a fabric filter is also used.

Along similar lines, a March 11, 2002 DEP memo explained that the mercury vapor at the U.S. Pipe and Foundry facility was three-quarters elemental at the baghouse inlets, where the temperature averaged 718°F. However, at the baghouse outlets, where the average temperature was 170°F, only three-eighths of the mercury vapor was elemental, meaning that half of the elemental mercury had changed to ionic, which DEP presumed was "likely related in part" to the temperature change.

A subsequent DEP memo, dated June 10, 2003, acknowledged that source separation could reduce emissions "to a level in the range of 35 mg" per ton, but only if it resulted in feedstock

that was entirely free of mercury. Accordingly, the memo recommended that New Jersey's four facilities with baghouses (which included Gerdau's in Sayreville and Raritan) might have to achieve further reductions by injecting activated carbon into their exhaust gas stream. The memo also referred to other injectable sorbents, including "oxidized hydrated lime and inexpensive silicate substrates impregnated with chemicals that possess a strong affinity for mercury," which, in addition to activated carbon, were being used in the MSW incinerators and tested at coal power-plants. The memo stated that "amended silicates" were "projected to be commercially available within 1 year with lower price[s] than" activated carbon. It also alluded to some success in Europe with the injection of sodium tetrasulfide, either alone or in addition to activated carbon. The memo recommended that melters be given three years to achieve the Task Force's emission-reduction standard of 75% or 35 mg per ton through source separation, with another two years to meet the standard by whatever means necessary.

The regulations at issue, proposed on January 5, 2004, adopted and incorporated these findings. They set stringent limits on mercury emissions from four classes of industrial

sources, including iron and steel melters,[3] with different standards for each "based on an independent evaluation of the source characteristics and mercury control methods that exists for each source category." 36 N.J.R. 123. With regard to melters, the proposed rule required either a mercury emissions cap of 35.0 mg/ton or alternatively, a 75% reduction of mercury in the flue gas by a pollution control apparatus. 36 N.J.R. 126; 36 N.J.R. 138; N.J.A.C. 7:27-27.6(a). These limits would be enforceable in five years, i.e., January 3, 2010. N.J.A.C. 7:2 7-27.6(a). Moreover, "if source separation does not succeed in achieving" that level, the regulation would require a melter "to install mercury control technology" in order to "reduce its mercury emissions by at least 75 percent as measured at the exit of the mercury control apparatus." 36 N.J.R. 126.[4]

However, in the interim five years, DEP expected that strategies would be developed to remove mercury from scrap, permitting compliance with the 75% reduction or 35.0 mg/ton

---

[3] The other three sources were MSW incinerators, incinerators of infectious wastes, and coal power-plants.

[4] Compliance with these standards is to be determined through mandatory quarterly emission testing beginning one year after the operative date of the rules. So long as an operator achieves compliance for eight consecutive quarters, subsequent compliance may be demonstrated by testing only once each year, during the fourth quarter, for as long as compliance with the standard continues to be so demonstrated. 36 N.J.R. 138-39.

limits without the need for facility operators to install additional air pollution controls. 36 N.J.R. 5412. To this end, the proposed regulations would require "work practice standards for iron or steel melters similar to the recently adopted Federal MACT [maximum achievable control technology] rules applicable to iron and steel industry,"[5] namely, a "certified mercury minimization or source separation plan" that includes a program to purchase and use only mercury-free scrap and a plan for inspecting incoming scrap to assure that it is mercury-free. 36 N.J.R. 129, 132, 139. Compliance with those standards would not impose any costs on melters beyond what they must incur under the MACT rules that "already require these procedures." 36 N.J.R. 129.

Moreover, consistent with the recommendations of the Task Force, the Mercury Switch Removal Act of 2005 (MSRA), N.J.S.A. 13:1E-99.82 to -99.90, was enacted on March 24, 2005, requiring those providing end-of-life vehicles (EOLVs) to scrap recycling

[5] The federal requirements for source separation and related work practices are indeed similar to the ones DEP proposed, but the federal requirements only apply to a facility that is "a major source" of a HAP, meaning with the potential to emit 10 tons per year. 40 C.F.R. §§ 63.7681, 63.7700. Furthermore, while EPA has set limits for total emissions of HAPs and particulate matter by iron and steel melters that use EAFs, those limits do not contain a particular limit for mercury, 40 C.F.R. § 63.7690(a), and no party here has attempted to correlate that overall limit to mercury emissions of any type or amount from any kind of industrial operation.

facilities, or scrap recycling facilities prior to crushing or shredding EOLVs, to remove all EOLV mercury switches. N.J.S.A. 13E:1E-99.87. Under the MSRA, automobile manufacturers are required to provide reimbursement for mercury switch removal, N.J.S.A. 13E:1E-99.85f, which DEP had estimated to be $2 per switch, or $1140 per pound of mercury so removed. 36 N.J.R. 129. Thus, given implementation of the MSRA and similar programs mandated by the regulations, DEP believed it increasingly feasible for iron and steel melters to restrict their charge solely to mercury-free scrap.

In the event, however, that source separation alone did not meet the regulatory standard, 36 N.J.R. 5413-14, response to comment 34; 36 N.J.R. 5411, response to comment 25, operators would be required under the mercury rules to install mercury control technology. 36 N.J.R. 126. Here again, DEP's expectation was that the four melter facilities in New Jersey that use baghouses "can comply with the standard by injecting powdered activated carbon (PAC) if source separation alone does not reduce mercury emissions to the new limit." 36 N.J.R. 129. The two facilities with scrubbers could use the same control technology, or they might "add chemicals such as sodium hypochlorite to their scrubbing solution to remove mercury from the gas stream." Ibid.

In further clarification, in response to industry's comments published after the November 4, 2004 adoption of the regulations as proposed, DEP explained why no characteristic of melters' operations, not even the variability in the amount of mercury or the proportion of elemental to ionic mercury in the source material, weakened the prospect of successfully adapting these control technologies to their operations, especially when DEP was conservatively requiring only a 75% reduction rather than the 90% already shown to be attainable:

> Activated carbon injection (ACI) is a technology that is commercially available today, based on experience with MSW incinerators using ACI. Activated carbon effectively controls both ionic and elemental mercury.
>
> Three of the five MSW incinerators in New Jersey were built with fabric filters. After those facilities were retrofitted with ACI, they achieved well over 90 percent mercury emission reduction, with two of the three achieving 99 percent with higher carbon injection rates than the third.
>
> The Department believes that the experience in the MSW sector can be applied to iron and steel melters, and understands that the ACI technology has already been successfully applied to iron and steel melters in Europe. Even assuming that the proportion of mercury at the MSW facilities is 90 percent ionic and 10 percent elemental, to achieve 99 percent overall control, those facilities must be controlling elemental mercury by at least 90 percent. These reductions have been

achieved even with greatly variable fuel entering the MSW incinerators.

Furthermore, more recent studies in the United States have shown that powdered ACI used with [an electrostatic precipitator and a baghouse] has been very effective in controlling emissions of elemental mercury. ADA-ES, Inc., a vendor of air pollution controls, has demonstrated that this technology has reduced elemental emissions from bituminous coal-fired powered plants by more than 99 percent, while also removing more than 85 percent of ionic mercury.

. . . .

[United States Department of Energy reports] show that with the appropriate level of carbon injection, mercury removal with this technology exceeds 90 percent. An even more recent study has shown that power plants burning subbituminous coal, which yields a much higher proportion of elemental mercury than bituminous coal, have achieved mercury removal rates at or near 90 percent.

The fundamentals of ACI technology are essentially the same in different types of facilities. In an MSW incinerator, in a coal-fired boiler, or in an iron and steel melter, ACI involves injecting carbon into the flue gas, where mercury adsorbs to the carbon and is captured in a particulate control device. MSW incinerators have used the technology successfully for more than a decade, and the USDOE has demonstrated that coal-fired boilers can also use the same technology successfully. The Department has not identified any circumstances specific to iron and steel melters that would indicate that such facilities could not use the same technology. However, by promulgating a 75 percent removal standard for iron and steel melters, which is significantly lower than the 90 percent or more that other types of

> facilities have achieved with ACI, the Department has sought to accommodate possible (but unproven) differences in the effectiveness of ACI in iron and steel melters.
>
> [36 N.J.R. 5411, response to comment 26 (citations to studies omitted).]

DEP justified inclusion of the alternative performance standards on the basis of the "adverse health effects caused by consuming mercury contaminated fish, and the existence of technology at a reasonable cost"[6] to provide any additional reduction that is needed beyond what source separation proves to afford. 36 N.J.R. 133. Moreover, the alternative standard of a 75% reduction in mercury emissions was recommended by the Task Force, and was actually equivalent to a limit of 34 mg per ton when applied to the production capacity of the six melters in the State. 36 N.J.R. 5411, response to comment 27. Indeed, DEP deemed the 75% figure "conservative" for being significantly lower than the reduction of "over 90 percent" that it believed the record showed to be achievable by melters through the

[6] DEP estimated that EAFs would, depending on facility size, incur control technology costs ranging from $6000 to $38,000 per pound of mercury removed. 36 N.J.R. 129. Quarterly stack testing costs were projected to be between $10,000 and $15,000 each, but, as noted, the frequency for facilities demonstrating compliance would be reduced to only once per year. 36 N.J.R. 129.

application of existing technology. 36 N.J.R. 5412, response to comment 27.

Thus, DEP determined that a "transfer" of the MSW industry's three approaches of "pollution prevention, source separation, and air pollution control technology is clearly feasible for iron and steel manufacturers[,]" 36 N.J.R. 5413, response to comment 34, especially given the five-year window of implementation. And the potential costs were reasonable in light of the benefits of reducing mercury emissions and bioaccumulation, and of the far greater toxicity of mercury compared to the air pollution "criteria pollutants." 36 N.J.R. 5412, response to comment 31. Indeed, both the "total capital cost and annual operating costs" of achieving the reduction were comparable to those for controlling certain other air pollutants such as particulate matter. Ibid.

(i)

On appeal, appellants' principal contention is that DEP overstepped its authority by issuing air-pollution regulations that impose stricter requirements than federal standards, in violation of a state statute that expressly incorporated those standards as the maximum that DEP could impose. Appellants argue that federal law requires only "major sources" of mercury to use Maximum Achievable Control Technology (MACT), that

federal law lists EAFs in the lesser category of "area sources," and that N.J.S.A. 26:2C-9.2c(2)(a), the statute governing operating permits, requires emission standards for area sources to be based on "reasonably available control technology." We hold that DEP was well within its authority under N.J.S.A. 26:2C-8 to issue these regulations and that the provisions of N.J.S.A. 26:2C-9.2 do not limit the exercise of that authority.

The interpretation of a statute begins with its plain language, which is to be given its ordinary meaning as long as there is no indication that the Legislature had a different intent. Koch v. Dir., Div. of Taxation, 157 N.J. 1, 7 (1999); Merin v. Maglaki, 126 N.J. 430, 434-35 (1992). Our courts defer to the interpretation of the agency charged with the statute's enforcement, Koch, supra, 157 N.J. at 8; Smith v. Dir., Div. of Taxation, 108 N.J. 19, 25 (1987), and it will prevail "as long as it is not plainly unreasonable." Koch, supra, 157 N.J. at 8 (quoting Metromedia, Inc. v. Dir., Div. of Taxation, 97 N.J. 313, 327 (1984)).

Regulations that "come within the ambit of delegated authority" are presumed to be reasonable unless the party challenging them shows them to be "arbitrary, capricious, unduly onerous or otherwise unreasonable." N.J. Guild of Hearing Aid Dispensers v. Long, 75 N.J. 544, 561 (1978); accord In re

Freshwater Wetlands Prot. Act Rules, 180 N.J. 415, 430-31 (2004). However, "an administrative agency may not, under the guise of interpretation, extend a statute to give it a greater effect than its language permits," so "regulations that flout the statutory language and undermine the intent of the Legislature" are invalid. GE Solid State, Inc. v. Dir., Div. of Taxation, 132 N.J. 298, 306-07 (1993) (citations omitted). The interpretation of regulations follows the principles of statutory interpretation. See State v. Hessen, 145 N.J. 441, 456 (1996) ("The same understanding of the principles of statutory construction apply to the interpretation of court regulations.").

The "mercury rules" at issue are sustainable under DEP's broad authority to issue health-based regulations under N.J.S.A. 26:2C-8. See Dep't of Health v. Owens-Corning Fiberglas Corp., 100 N.J. Super. 366, 393-94 (App. Div. 1968), aff'd o.b., 53 N.J. 248 (1969), ("[I]t is not unreasonable for the State, in the interest of the public health and welfare, to seek to control air pollution," and that, "[e]ven if this means the shutting down of an operation harmful to health or unreasonably interfering with life or property, the statute must prevail."). Contrary to appellants' assertion, DEP did rely on a health-based justification for these regulations, because the 75%

reduction standard was based on Task Force reports that included a health analysis, and used it to recommend the maximum reduction in mercury emissions that melters could actually attain. Moreover, N.J.S.A. 26:2C-8 does not reference the N.J.S.A. 26:2C-9.2 limitations on the performance standards that it may impose in an operating permit. Quite the opposite, the accommodation provision of N.J.S.A. 26:2C-9.2c(2)(c), which appellants themselves claim to be applicable, expressly states that the facility would have to show compliance with "any other applicable State or federal standard, code, rule, or regulation[,]" N.J.S.A. 26:2C-9.2c(2)(c), and clearly allows for no exception to this requirement. We discern no conflict between N.J.S.A. 26:2C-8 and the operating permit statute, N.J.S.A. 26:2C-9.2, and DEP was well within its discretion to reconcile these provisions as it did. Cf. In re Adoption of Amends. to N.J.A.C. 7:27-16, 244 N.J. Super. 334, 340-45 (App. Div. 1990) (no mention of N.J.S.A. 26:2C-9.2 in industry association's challenge to regulations issued under N.J.S.A. 26:2C-8 about emissions of volatile organic substances by auto refinishing businesses).

(ii)

Appellants next argue that the regulations are arbitrary and unreasonable, setting a performance standard that is

"aspirational" rather than technology-based, and solely on speculation that the necessary control technology is available. Specifically, they contend that the record fails to support DEP's conclusion that the control technology used in MSW incinerators and coal power-plants can effectively reduce mercury emissions from melting operations and that DEP ignored critical differences in variability of mercury content, speciation and temperature. We disagree.

In determining whether an agency's exercise of rulemaking was arbitrary or unreasonable, our courts require an assessment of "whether there is substantial evidence in the record to support the findings upon which the agency based" its actions. Pub. Serv. Elec. and Gas Co. v. N.J. Dep't of Envtl. Prot., 101 N.J. 95, 103 (1985). As long as the agency acted within the scope of its statutory authority, "'[f]acts sufficient to justify the regulation must be presumed,'" and the burden "'is not upon the Commissioner to establish that the requisite facts exist,'" but rather "'on the petitioners to establish that they do not.'" In re Adoption of N.J.A.C. 10:52-5.14(D)2 & 3, 276 N.J. Super. 568, 575 (App. Div. 1994) (quoting Consolidation Coal Co. v. Kandle, 105 N.J. Super. 104, 114 (App. Div.), aff'd o.b., 54 N.J. 11 (1969)) (alteration in original), certif. denied, 142 N.J. 448 (1995).

The agency's factual findings enjoy a presumption of correctness as long as they are supported by "sufficient credible evidence in the record as a whole." Bd. of Educ. of Englewood Cliffs v. Bd. of Educ. of Englewood, 257 N.J. Super. 413, 456-57 (App. Div. 1992), aff'd o.b., 132 N.J. 327, cert. denied, 510 U.S. 991, 114 S. Ct. 547, 126 L. Ed. 2d 449 (1993). Accord Dennery v. Bd. of Educ. of Passaic County, 131 N.J. 626, 641 (1993); Clowes v. Terminix Int'l, 109 N.J. 575, 587 (1988). An appellate court applies these standards in order to avoid substituting its own judgment for the agency's exercise of expertise. In re Distribution of Liquid Assets, 168 N.J. 1, 10 (2001); In re Authorization for Freshwater Wetlands Gen. Permits, 372 N.J. Super. 578, 593 (App. Div. 2004).

When the record would support two distinct courses of action, the agency's choice of one over the other will not be deemed arbitrary or capricious as long as it was reached "honestly and upon due consideration, even though it may be believed that an erroneous conclusion has been reached." Worthington v. Fauver, 88 N.J. 183, 204-05 (1982) (quoting Bayshore Sewerage Co. v. Dep't of Envtl. Prot., 122 N.J. Super. 184, 199 (Ch. Div. 1973) (declaring such agency action "not arbitrary or capricious"), aff'd o.b., 131 N.J. Super. 37 (App. Div. 1974)). Due consideration requires that DEP have a

"scientific justification" for its choice, as opposed to relying on "'no more than a regulatory guess.'" In re Protest of Coastal Permit Program Rules, 354 N.J. Super. 293, 348-49 (App. Div. 2002) (quoting N.J. Chapter of Nat'l Ass'n of Indus. & Office Parks v. N.J. Dep't of Envtl. Prot., 241 N.J. Super. 145, 163 (App. Div.), certif. denied, 122 N.J. 374 (1990)). A successful challenge to the regulations implementing the agency's chosen course will require more than just a showing "that compliance with the regulations may be expensive." In re Adoption of Amends. to N.J.A.C. 7:27-16, supra, 244 N.J. Super. at 344-45. By the same token, "[a]n achievable standard need not be one already routinely achieved in the industry," although it must be achievable "on a regular basis." Nat'l Lime Ass'n v. EPA, 627 F.2d 416, 431 n.46 (D.C. Cir. 1980).

The National Lime court remanded not for want of an actual demonstration of effectiveness in the industry being regulated, but because EPA failed "to consider the representativeness along various relevant parameters of the data relied upon" and thus failed "to explain how the standard proposed is achievable under the range of relevant conditions which may affect the emissions to be regulated." Id. at 431-33. Similar concerns figured in Natural Res. Def. Council, Inc. v. EPA, 655 F.2d 318, 331 (D.C. Cir.) (affirming auto-emission regulations), cert. denied, 454

U.S. 1017, 102 S. Ct. 552, 70 L. Ed. 2d 415 (1981), where the court observed that when a new EPA regulation requires one industry to adopt emission-control technology "already in use in other industries," the EPA should show some evidence "that the technology can be transferred . . . or at least that relevant dissimilarities have been considered." Ibid.

Failings like those of the EPA in National Lime are simply not present here. The record contains substantial evidence that the mercury emission reductions of 75% to 90% in MSW incinerators, coal power-plants, and European mini-mills were being achieved on a regular basis. There is also substantial evidence concerning the differences between on the one hand, MSW incinerators and coal power-plants, and melters, on the other hand, in baghouse temperature, mercury speciation, and continuity of production to support the conclusion that melters would not have to perform much in the way of adapting the sorbent-injection control technology beyond determining the amount of sorbent that their operations require. That conclusion is even more reasonable because the control technology will only have to achieve the final 25% reduction needed to reach the limit of 35 mg per ton after the 50% reduction from source separation, and in five years' time rather than imminently.

Furthermore, those control technologies would not necessarily be more expensive than source separation. DEP estimated the cost of switch removal at $1140 per pound of mercury removed, whereas Terranext estimated that one of the injection technologies would cost $1300 per pound of mercury removed. Indeed, even if N.J.S.A. 26:2C-9.2c(2)(a) were applicable, as appellants argue, the record supports a finding that mercury emission-control technology is "reasonably available" to melters. To sum, DEP here relied on a considerable volume of scientific evidence. While appellants dispute its accuracy and the validity of the conclusions that DEP drew therefrom, no one may reasonably contest its existence.

(iii)

Appellants next claim that the regulations are invalid because DEP failed to provide a federal standards analysis, which is the assessment of costs and benefits that the Administrative Procedure Act (APA), N.J.S.A. 52:14B-1 to -25, requires to justify imposing standards that are stricter than applicable federal regulations. They argue that the regulations clearly exceed the federal standards, notwithstanding DEP's characterization of them as merely adding a backstop to the federal requirement of source separation, and that DEP failed to

provide a cost-benefit analysis for imposing stricter standards. The argument is without merit.

Under the APA, a regulation is invalid "unless adopted in substantial compliance with this act." N.J.S.A. 52:14B-4(d). The APA recognizes "the declared policy of the State to reduce, wherever practicable, confusion and costs involved in complying with" regulations, which problems "are increased when there are multiple regulations of various governmental entities imposing unwarranted differing standards in the same area of regulated activity." N.J.S.A. 52:14B-22. It is therefore "in the public interest that State agencies consider applicable federal standards when adopting, readopting or amending regulations with analogous federal counterparts and determine whether these federal standards sufficiently protect the health, safety and welfare of New Jersey citizens." Ibid.

Accordingly, when an agency adopts or amends a rule "in order to implement, comply with or participate in any program established under federal law or under a State statute that incorporates or refers to federal law, federal standards or federal requirements," N.J.S.A. 52:14B-24, it must provide "a statement as to whether the rule or regulation in question contains any standards or requirements which exceed the standards or requirements imposed by federal law." N.J.S.A.

relied, depriving Gerdau of the opportunity to comment thereon. We have considered these remaining contentions and find them of insufficient merit to warrant discussion in a written opinion. R. 2:11-3(e)(1)(D) & (E). As to the disclosure issue, suffice it to say, the June 10, 2003 memo used data that Gerdau itself had supplied from a facility with a baghouse, and as to the other three documents, there is no indication that they contained information on which DEP needed to rely, especially the October 2004 spreadsheet that was compiled nine months after the proposed regulations were issued.

Affirmed.

ORAL ARGUMENT NOT YET SCHEDULED

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

STATE OF NEW JERSEY, et al., Petitioners, v. UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, Respondent.	No. 05-1097, and consolidated cases **Complex**

On Petitions for Review of Final Actions
of the United States Environmental Protection Agency

OPENING BRIEF OF GOVERNMENT PETITIONERS

The States of New Jersey, California, Connecticut, Delaware, Illinois, Maine, Massachusetts, Michigan Department of Environmental Quality, Minnesota, New Hampshire, New Mexico, New York, Pennsylvania Department of Environmental Protection, Rhode Island, Vermont, and Wisconsin, and the City of Baltimore

---

STUART RABNER
Attorney General of New Jersey

CHRISTOPHER D. BALL, JUNG KIM, RUTH CARTER
Deputy Attorneys General
R.J. Hughes Justice Complex
25 Market Street, PO 093
Trenton, New Jersey 08625-0093

(Additional counsel for Government Petitioners listed in signature pages)

Dated: January 11, 2006

Exhibit D

CERTIFICATE AS TO PARTIES, RULINGS, AND RELATED CASES

Pursuant to Circuit Rule 28(a)(1), the undersigned counsel of record certify as follows:

A. PARTIES AND AMICI

1. Parties to the Challenges to the EPA Delisting Rule: 70 Fed. Reg. 15994 (March 29, 2005)

Petitioners

The following parties appear in these consolidated cases as petitioners:

In case no. 05-1097, filed March 29, 2005, the State of New Jersey, State of California, State of Connecticut, State of Maine, Commonwealth of Massachusetts, State of New Hampshire, State of New Mexico, State of New York, State of Vermont.

In case no. 05-1104, filed April 1, 2005, the Commonwealth of Pennsylvania, Department of Environmental Protection.

In case no. 05-1116, filed April 11, 2005, the State of Delaware.

In case no. 05-1118, filed April 8, 2005, the State of Wisconsin.

In case no. 05-1158, filed May 18, 2005, Chesapeake Bay Foundation, Inc., Conservation Law Foundation, Waterkeeper Alliance.

In case no. 05-1159, filed May 18, 2005, Environmental Defense, National Wildlife Federation and Sierra Club.

In case no. 05-1160, filed May 18, 2005, Natural Resources Council of Maine, Ohio Environmental Council and U.S. Public Interest Research Group.

In case no. 05-1163, filed May 18, 2005, Natural Resources Defense Council.

In case no. 05-1174, filed May 27, 2005, State of Illinois.

In case no. 05-1176, filed May 27, 2005, the State of Minnesota.

Respondent

The United States Environmental Protection Agency is respondent in these consolidated cases.

Intervenors

The following parties have intervened in these consolidated cases for Respondent: Utility Air Regulatory Group, Cinergy Corp., PPL Corp., PSEG Fossil LLC, NRG Energy, Inc., Florida Power & Light Company, State of Alabama, State of Indiana, State of Kansas, State of Nebraska, State of North Dakota, State of South Dakota.

The following parties have intervened in these consolidated cases for Petitioners: Physicians for Social Responsibility, American Nurses Association, The American Public Health Association, American Academy of Pediatrics, Adirondack Mountain Club, Aroostook Band of Micmac Indians, Houlton Band of Maliseet Indians, Penobscot Indian Nation, The Passamaquoddy Tribe at Pleasant Point (Sipayik), The Passamaquoddy Tribe at Indian Township, The City of Baltimore.

Amici

The following parties appear as amici in these consolidated cases:

In support of respondent EPA: Washington Legal Foundation

2. Parties to the Challenges to the EPA Clean Air Mercury Rule: 70 Fed. Reg. 28606 (May 18, 2005)

Petitioners

The following parties appear in these consolidated cases as petitioners:

In case no. 05-1162, filed May 18, 2005, the State of New Jersey, State of California, State of Connecticut, State of Maine, Commonwealth of Massachusetts, State of New Hampshire, State of New Mexico, State of New York, Commonwealth of Pennsylvania, State of Vermont, State of Wisconsin.

In case 05-1164, filed May 19, 2005, Ohio Environmental Council, Natural Resources Council of Maine, U.S. Public Interest Research Group.

In case 05-1167, filed May 19, 2005, Natural Resources Defense Council.

In case 05-1175, filed May 27, 2005, State of Minnesota.

In case 05-1183, filed May 31, 2005, State of Delaware.

In case 05-1189, filed May 27, 2005, State of Illinois.

In case 05-1263, filed July 12, 2005, Mayor and City Council of Baltimore.

In case 05-1264, filed July 13, 2005, Southern Montana Electric Generation & Transmission Cooperative, Inc.

In case 05-1267, filed July 14, 2005, Chesapeake Bay Foundation, Inc., Environmental Defense, National Wildlife Federation, Sierra Club, Waterkeeper Alliance.

In case 05-1270, filed July 15, 2005, American Coal for Balanced Mercury Regulation, Alabama Coal Association, Coal Operators & Associates, Inc., Maryland Coal Association, Ohio Coal Association, Pennsylvania Coal Association, Virginia Coal Association, West Virginia Coal Association.

In case 05-1271, filed July 15, 2005, ARIPPA.

In case 05-1275, filed July 18, 2005, Utility Air Regulatory Group.

In case 05-1277, filed July 18, 2005, United Mine Workers of America, AFL-CIO.

In case 05-1280, filed July 18, 2005, Producers for Electric Reliability.

Respondent

The United States Environmental Protection Agency is respondent in these consolidated cases.

Intervenors

The following parties have intervened in these consolidated cases for Respondent: Utility Air Regulatory Group, Edison Electric Institute, State of Alabama, State of Kansas, State of Nebraska, State of South Dakota, State of North Dakota, Producers for Electric Reliability.

The following party has intervened in these consolidated cases for Petitioners: Michigan Department of Environmental Quality.

Amici

No parties appear as amici in these consolidated cases:

3. Parties to the Challenges to EPA's Final Action on Reconsideration: 71 Fed. Reg. 33388 (June 9, 2006)

Petitioners

The following parties appear in these consolidated cases as petitioners:

In case no. 06-1211, filed June 19, 2006, the State of New Jersey, State of California, State of Connecticut, State of Delaware, State of Illinois, State of Maine, State of Minnesota, State of New Hampshire, State of New Mexico, State of New York, State of Rhode Island, State of Vermont, State of Wisconsin, the Commonwealths of Massachusetts and Pennsylvania, and the Michigan Department of Environmental Quality.

In case no. 06-1220, filed June 23, 2006, National Congress of American Indians, Little River Band of Ottawa Indians, Bay Mills Indian Community, Grand Traverse Band of Ottawa and Chippewa Indians, Jamestown S'Klallam Tribe, Lac Courte Oreilles Band of Lake Superior Chippewa Indians, Little Traverse Bay Bands of Odawa Indians, Lower Elwha Klallam Tribe, Lummi Nation, Minnesota Chippewa Tribe, Nisqually Tribe, Swinomish Indian Tribe Community.

In case no. 06-1231, filed June 26, 2006, American Nurses Association, The American Public Health Association, American Academy of Pediatrics, Chesapeake Bay Foundation, Inc., Conservation Law Foundation, Environmental Defense, National Wildlife Federation, Natural Resources Council of Maine, Natural Resources Defense Council, Ohio Environmental Council, Physicians for Social Responsibility, Sierra Club, U.S. Public Interest Research Group, Water Keeper Alliance.

In case no. 06-1287, filed July 26, 2006, Mayor & City Council of Baltimore.

In case no. 06-1291, filed August 8, 2006, American Coal for Balanced Mercury Regulation, Alabama Coal Association, Coal Operators and Associates of Kentucky, Maryland Coal Association, Ohio Coal Association, Pennsylvania Coal Association, Virginia Coal Association, West Virginia Coal Association.

In case no. 06-1293, filed August 8, 2006, ARIPPA.

In case no. 06-1294, filed August 8, 2006, Alaska Industrial Development and Export Authority.

Respondent

The United States Environmental Protection Agency is respondent in these consolidated cases.

Intervenors

No parties appear as intervenors in these consolidated cases.

Amici

No parties appear as amici in these consolidated cases.

B. RULINGS UNDER REVIEW

Petitioners State of New Jersey et al, in these consolidated cases seek review of final actions by EPA:

1. A rule entitled "Revision of December 2000 Regulatory Finding on the Emissions of Hazardous Air Pollutants from Electric Utility Steam Generating Units and the Removal of Coal- and Oil-Fired Electric Utility Steam Generating Units from the Section 112(c) List," 70 Fed. Reg. 15,994 (March 29, 2005).

2. A rule entitled "Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units," 70 Fed. Reg. 28,606 (May 18, 2005).

3. A rule entitled "Revision of December 2000 Clean Air Act Section 112(n) Finding Regarding Electric Utility Steam Generating Units; and Standards of Performance for New and Existing Electric Utility Steam Generating Units: Reconsideration, Final Rule" published at 71 Fed. Reg. 33,388 (June 9, 2006).

C. RELATED CASES

The matter on review has not been previously heard in this or any other court. There are no related cases pending before the Court.

TABLE OF CONTENTS

PAGE

TABLE OF AUTHORITIES

CASES

STATUTES

FEDERAL REGULATIONS

FEDERAL REGISTER

LEGISLATIVE HISTORY

OTHER AUTHORITIES

JURISDICTIONAL STATEMENT

This Court has exclusive jurisdiction to review any "nationally applicable regulations promulgated, or any final action taken" by EPA under the Act. 42 U.S.C. § 7607(b). In these consolidated cases, Government Petitioners challenge EPA's nationally applicable regulations at 70 Fed. Reg. 15,994 (Mar. 29, 2005), and 70 Fed. Reg. 28,606 (May 18, 2005), and its final action on reconsideration of these regulations at 71 Fed. Reg. 33,389 (June 9, 2006). As set forth in the Certificate as to Parties, supra, Government Petitioners filed petitions for review of these regulatory actions within the sixty-day period provided in 42 U.S.C. § 7607(b).

STANDING

Government Petitioners suffer injuries due to EPA's mercury rules sufficient to confer standing. First, the rules impose a regulatory and economic burden on the states to either participate in a cap-and-trade program promulgated under section 111 of the Act, or obtain reductions in mercury emissions through other mechanisms. States have incurred economic costs in either promulgating state plans or joining the cap-and-trade program, and will continue to incur costs through the lifetime of the regulations. See Aff. of William O'Sullivan ("O'Sullivan Aff.") ¶ 4; 71 Fed. Reg. 75,117 (Dec. 14, 2006). Second, the rules will make it more difficult for states to comply with water quality standards required under the Clean Water Act. See O'Sullivan Aff. ¶ 7; 33 U.S.C. § 1313(d); West Virginia v. EPA, 362 F.3d 861, 868 (D.C. Cir. 2004) (Injury sufficient to confer standing found where an EPA rule made the state task of devising an adequate state implementation plan more difficult). Finally, the rules injure the interests of Government Petitioners by allowing continued high levels of mercury emissions from power plants. These emissions play a significant contributory role in ongoing impacts to the

natural resources of, and economic burden on, Government Petitioners. See Idaho v. ICC, 35 F.3d 585, 591 (D.C. Cir. 1994) (State standing established based on pollution damage to its natural resources)' O'Sullivan Aff.. ¶¶ 8-9; Decl. of Ray Vaughan ("Vaughan Decl") ¶¶ 3, 6-13; Comments of Hubbard Brook Research Foundation ("Hubbard Brook Comments") at 7-9, OAR-2002-0056-2038 [JA_]. These injuries can be redressed by a ruling from this Court vacating EPA's mercury rules and requiring the agency to establish source-specific emissions standards for all power plants as required under section 112 of the Act. See O'Sullivan Aff.. ¶¶ 8-9; Vaughan Decl. ¶¶ 14-17; Hubbard Brook Comments at 13; 42 U.S.C. § 7412(d).

STATEMENT OF ISSUES

1. In December 2000, EPA added EGUs to the list of sources subject to regulation under section 112 of the CAA, 42 U.S.C. § 7412, but has now removed EGUs from that list without satisfying the removal criteria in section 112(c)(9). Did EPA exceed its statutory authority, fail to observe procedure required by law, or otherwise act arbitrarily or capriciously?

2. In the Delisting Action, EPA rescinded its December 2000 conclusion that EGUs should be regulated pursuant to CAA section 112. Was EPA's decision to rescind the December 2000 conclusion in excess of statutory authority, arbitrary, capricious, or an abuse of discretion?

3. Through CAMR, EPA uses CAA section 111 to establish a cap-and-trade system for the regulation of a hazardous air pollutant, mercury. Did EPA exceed its statutory authority under CAA section 111(d) which prohibits the use of section 111 to regulate hazardous air pollutants and/or act arbitrarily and capriciously in light of the requirements for a "standard of performance" under section 111?

STATUTES AND REGULATIONS

The relevant provisions of the Act are 42 U.S.C. §§ 7411 (Standards of performance for new stationary sources), and 7412 (Hazardous air pollutants). The rules were promulgated at 40 C.F.R. Parts 60, 63, 72, and 75. The rules, together with relevant portions of statutory and regulatory provisions and legislative history, are contained in the Addendum.

STATEMENT OF THE CASE

State and municipal petitioners ("Government Petitioners") seek review of two rules promulgated by the Environmental Protection Agency ("EPA") relating to the emission of hazardous air pollutants ("HAPs") from electric utility steam generating units ("EGUs" or "power plants"). In 2000, EPA concluded that such emissions, including mercury, warranted regulation pursuant to section 112 of the Clean Air Act ("Act") and added power plants to a list of sources subject to such regulation (the "112(c) List"). 65 Fed. Reg. 79,825, 79,830-31 (Dec. 20, 2000). Having taken that action, EPA was required to establish plant-specific limits on power plant emissions reflecting the maximum degree of reduction in HAP emissions achievable for similar sources. See 42 U.S.C. § 7412(d)(3). EPA was further prohibited from removing power plants from the 112(c) List unless certain criteria were met. See 42 U.S.C. § 7412(c)(9).

EPA failed to meet its statutory duties and instead published two rules that seek to exempt power plants - emitters of more than 150,000 tons of HAPs annually, including over 30% of the nation's mercury emissions, U.S. EPA, Mercury Study Report to Congress, EPA-452/R-97-005 (Dec. 1997) ("RTC"), at ES-5, 14-1 [JA_] - from the stringent regulatory framework of section 112. In the first rule, the "De-Listing Action," EPA removed EGUs from the 112(c) List without attempting to satisfy the statutory removal criteria. 70 Fed. Reg. at 16,002-16,008. EPA

then promulgated in the second rule, the "Clean Air Mercury Rule" ("CAMR"), regulations under section 111 that govern power plant mercury emissions through a cap-and-trade scheme, not the statutorily-required plant-specific approach. 70 Fed. Reg. at 28,624-30. Petitioners ask this Court to correct EPA's legal errors, vacate the rules, and direct the agency to promulgate emission standards for the hazardous air pollutants emitted by power plants under section 112 as required by the Act. By orders dated December 8, 2005, and August 21, 2006, this Court consolidated these petitions and designated New Jersey v. EPA (No. 05-1097) as the lead case.

STATEMENT OF FACTS

A. Hazardous Air Pollutant Regulation Under the Clean Air Act

The 1970 Amendments added section 112 to the Act, which specified that the EPA Administrator must list each "hazardous air pollutant for which he intends to establish an emission standard." Pub.L. 91-604, § 4(a), 84 Stat. 1685. After a pollutant was listed, the Act required EPA to propose emission standards set at a level that "provides an ample margin of safety to protect the public health" from the pollutant. Id.

Between 1970 and 1990 when the Act was again amended, EPA established standards under section 112 for only seven hazardous air pollutants. Nat'l Mining Ass'n v. EPA, 59 F.3d 1351, 1353 and n.1 (D.C. Cir. 1995) (citing S. Rep. No. 228, 101st Cong., at 131 (1989)). Of these seven, mercury, along with asbestos and beryllium, were the first pollutants listed as hazardous. See 36 Fed. Reg. 5,991 (Mar. 31, 1971). For even these listed pollutants, EPA established emission standards for only a small subset of their sources. Nat'l Mining Ass'n, 59 F.3d at 1353 and n.1 (citing S. Rep. No. 228, 101st Cong., at 128 (1989) and H.R. Rep. No. 490(I), 101st Cong., at 322 (1990)).

To address the slow pace of EPA's regulatory action, the 1990 Amendments to the Act completely restructured the regulation of HAPs under section 112. Id. These amendments continued the Act's distinct treatment of HAPs[1], and required EPA to set the "most stringent standards achievable" for sources of HAPs which are standards "based on the maximum reduction in emissions which can be achieved by application of [the] best available control technology" ("MACT Standards").[2] Cement Kiln Recycling Coalition v. EPA, 255 F.3d 855, 857 (D.C. Cir. 2001). The new amendments established a list of 188 HAPs, 42 U.S.C. § 7412(b)(1), set a mandatory schedule for issuing emissions standards for the major sources of these pollutants, 42 U.S.C. §§ 7412(c) and (e), and established a "non-discretionary duty" on EPA to promulgate technology-based emission standards for all categories of major emitting sources of listed HAPs. See S. Rep. 101-228, at 3385, 3518, 3541, reprinted in 1991 U.S.C.C.A.N.; 42 U.S.C. § 7412(b),(c), and (e). The only exception to the mandatory standards applies to source categories either: a) listed for regulation because of a single HAP which was later removed from the list of HAPs under section 112; or b) for which EPA makes a formal determination that the emissions of no source in the category exceeds risk thresholds set by Congress. See 42 U.S.C. § 7412(c)(9)(B).

The 1990 Amendments imposed an additional requirement on EPA before regulating EGUs under section 112. Section 112(n) required EPA to perform by 1993 a study of the health

---

[1] See H.R. Rep. No. 101-490, at 3339 (May 21, 1990) ("The Clean Air Act distinguishes between two categories of pollutants: hazardous air pollutants and criteria or conventional air pollutants.")

[2] For existing major sources of HAPs, MACT standards must be no less stringent than the "average emission limitation achieved by the best performing 12 percent of the existing sources." 42 U.S.C. § 7412(d)(3)(A).

hazards posed by toxic substances emitted from EGUs and determine whether it is "appropriate and necessary" to regulate such emissions as HAPs under section 112. 42 U.S.C. § 7412(n). Once such a determination was made and EGUs were placed on the source category list, Congress required that EPA "shall" regulate EGUs under section 112 through the promulgation of MACT standards. Id.

B. EGU Study and Appropriate and Necessary Determination

EPA undertook the study of hazards to public health reasonably expected to be caused by power plant emissions and in February 1998, five years after the statutory deadline, the agency released its utility report to Congress and the public. 65 Fed. Reg. 79,825 (Dec. 20, 2000). EPA concluded that "mercury from coal-utilities is the HAP of greatest potential concern," RTC, at ES-26, [JA_], and estimated that approximately sixty percent of the total mercury deposited in the United States comes from "U.S. anthropogenic air emission sources; the percentage is estimated to be even higher in certain regions (e.g., northeast U.S.)." 65 Fed. Reg. at 79,827.

On December 20, 2000, after years of peer-reviewed scientific and technical study including a National Academy of Sciences report, numerous public hearings, and extensive public comment, EPA published its regulatory finding on the emissions of HAPs from EGUs. 65 Fed. Reg. 79,825. In this action, EPA added EGUs to the section 112 List of source categories after concluding that the "regulation of HAP emissions from [EGUs] under section 112 of the [Act] is appropriate and necessary." Id. at 79,826 ("[T]his notice adds coal- and oil-fired [EGUs] to the list of source categories under section 112(c) of the CAA."). EPA determined that: "[m]ercury is highly toxic, persistent, and bioaccumulates in food chains"; "[m]ost of the U.S. population consumes fish and is exposed to methylmercury as a result"; and "[m]ost of the

mercury currently entering U.S. water bodies and contaminating fish is the result of air emissions." Id. at 79,829-30. The agency further found that EGUs:

> are the largest source of mercury emissions in the U.S., estimated to emit about 30 percent of current anthropogenic emissions. There is a plausible link between emissions of mercury from anthropogenic sources (including coal-fired electric steam generating units) and methylmercury in fish. Therefore, mercury emissions from [EGUs] are considered a threat to public health and the environment.[3]

Id. at 79,827. In 2002, EPA formally revised the section 112(c) List to reflect the addition of EGUs pursuant to the December 20, 2000 notice. 67 Fed. Reg. 6,521 (Feb. 12, 2002).

C. 2004 Proposed Rulemaking

On January 30, 2004, EPA proposed two regulatory alternatives to control mercury emissions from EGUs. 69 Fed. Reg. 4,652 (Jan. 30, 2004). The first alternative maintained EPA's December 2000 listing of EGUs and "appropriate and necessary" determination and sought to regulate EGU emissions under section 112 either through MACT standards, or a cap-and-trade plan under section 112. Id. at 4,659-83. Under the second regulatory alternative, EPA proposed to remove EGUs from the section 112(c) List by revising its December 2000 "appropriate and necessary" determination, id. at 4,683-89, and instead use section 111 of the Act to set standards and a cap-and-trade program for mercury emissions from coal-fired EGUs and nickel emissions from oil-fired EGUs, id. at 4,689-4,706.

---

[3] Mercury converts to methylmercury, a toxic compound, after mercury is "precipitated from the air and deposited into water bodies or land." 70 Fed. Reg. at 16,011. For the sake of simplicity, this brief will refer to mercury concentrations in waterbodies and fish tissue, while recognizing that the actual compound at issue is frequently methylmercury.

D. The Final Rules

In the final Delisting Rule, EPA followed the second regulatory alternative of the proposed rule and removed EGUs from the 112(c) List. See 70 Fed. Reg. 15,994. This delisting did not follow the removal requirements of section 112(c)(9), but was instead based solely on the agency's rescission of the December 2000 "appropriate and necessary" determination. Id. at 16,002. As support, EPA "newly interpreted" section 112(n)(1)(A) to require EGU regulation under section 112 only if no other authorities under the Act, "if implemented," would eliminate the public health threat posed by EGU emissions. Id. at 15,997-99. EPA concluded that mercury reductions from two rules yet to be finalized - the Clean Air Interstate Rule ("CAIR") and CAMR - addressed mercury from EGUs sufficiently so that their regulation under section 112 was neither appropriate nor necessary. Id. at 15,997-16,002.[4]

CAIR was published on May 12, 2005, 70 Fed. Reg. 25,162 (May 12, 2005), and CAMR followed six days later. CAMR regulates mercury emissions from EGUs under section 111 of the Act, entitled "Standards of performance for new stationary sources." 42 U.S.C. § 7411. The rule establishes performance standards for new sources under section 111(b) and a cap-and-trade system for mercury from existing power plants under section 111(d). 70 Fed. Reg. at 28,624-30. This system caps nationwide mercury emissions from coal-fired EGUs at thirty-eight tons beginning in 2010 and fifteen tons beginning in 2018, reductions of 21% and 69% respectively from the approximately forty-eight tons currently emitted from EGUs. 69 Fed. Reg. at 4,691; 71

[4] CAIR establishes budgets for emissions of nitrogen oxides ("NO_x") and sulfur dioxide ("SO_2") for the twenty-eight states in the eastern United States. 70 Fed. Reg. at 28,618. CAIR does not regulate EGUs directly and contains no mercury reduction requirements. See id.; 70 Fed. Reg. at 25,209.

Fed. Reg. at 33,395. Regulated power plants can either reduce their mercury emissions under the plan or buy credits for such reductions from other plants. 70 Fed. Reg. at 28,632. Credits can also be "banked" to meet future compliance requirements, potentially substantially delaying full implementation of the plan.[5] Id. at 28,629. EPA predicts that as of 2020 — two years after mercury emissions are supposed to be capped at fifteen tons per year — actual mercury emissions will still be at least twenty-four tons per year. Id. at 28,619.

Several parties petitioned for reconsideration of the rules, and on October 28, 2005, EPA granted reconsideration on several issues. 70 Fed. Reg. 62,200. On June 9, 2006, EPA issued its decision on reconsideration to continue with the final Delisting Rule. The agency made only two changes to CAMR relating to state mercury allocations under the cap-and-trade plan and the standards of performance for certain new sources. 71 Fed. Reg. 33,389.

SUMMARY OF ARGUMENT

Both the plain language and purpose of the Act dictate a ruling in petitioners' favor as EPA's mercury rules violate the Act in at least three ways, each warranting that the rules be vacated.

EPA's first error is to disregard the plain language of section 112. The Delisting Rule, which removed EGUs from the list of regulated sources under section 112, is based solely on EPA's rescission of its December 2000 regulatory determination under section 112(n). Section 112(n), however, grants EPA no authority to make such a rescission, and the agency has thus

---

[5] See Congressional Research Service, Mercury Emissions from Electric Power Plants: An Analysis of EPA's Cap-and-Trade Regulations, The Library of Congress (Apr. 15, 2005), OAR-2002-0056-5686 [JA__] (reporting that EPA officials do not expect full compliance with the 2018 cap until 2025 or beyond).

exceeded its statutory authority with the rule. Moreover, a rescission of the December 2000 determination provides no basis to remove EGUs from the section 112(c) List. Section 112(c)(9) alone establishes the requirements necessary to remove "any" source from the list of regulated sources and applies unambiguously to all such sources. EPA admits that it has not met those requirements in the Delisting Rule but contends that section 112(n) somehow exempts power plants from the requirements of section 112(c)(9) and allows the agency to arbitrarily reverse course regarding their regulation. The plain language of the Act, however, belies EPA's claims as section 112(n) evinces a clear congressional desire that EPA "shall regulate [EGUs] under this section" following an appropriate and necessary determination.

EPA's second legal error is its "new interpretation" of a discrete portion of section 112(n) to support a "revised" determination that regulation of EGUs under section 112 is no longer appropriate and necessary. EPA's legal interpretation of section 112(n) contravenes the Act and cannot be squared with Congress's clear desire that all major sources of HAPs be regulated in an expeditious manner through the implementation of plant-specific technology-based standards to address the unique public health threat that HAPs pose. Neither CAIR nor CAMR provide any basis on which EPA may "revise" its determination.

EPA's third error is to disregard the scope of, and requirements for, regulation under section 111 of the Act. CAMR establishes mercury emissions standards through a cap-and-trade system under section 111. Subsection (d) of section 111, however, explicitly limits the scope of that section to those air pollutants that are not "emitted from a source category which is regulated under section 7412 of this title." Mercury is a listed HAP under section 112, emitted from a number of source categories currently regulated by section 112, and therefore not subject to

regulation by section 111. Even if EPA can regulate mercury under section 111, CAMR fails to meet the requirement that standards of performance under that section reflect the "best system of emission reduction . . . adequately demonstrated." 42 U.S.C. § 7411(a). CAMR fails to meet this standard as the rule: a) will allow many power plants to increase their mercury emissions for years; b) sets emission reduction standards that are already significantly exceeded by numerous existing power plants; c) is expected to take at least two decades to reach full implementation; and d) fails to address public health impacts of mercury "hot-spots" near power plants.

STANDARD OF REVIEW

The Court should reverse an agency action if it is arbitrary, in excess of statutory authority, or without observance of procedure required by law. 42 U.S.C. § 7607(d)(9). An agency rule is arbitrary and capricious if the agency relied on factors that Congress did not intend it to consider, failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the record, or is so implausible that it could not be the product of agency expertise. Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Ins. Co., 463 U.S. 29, 43 (1983).

In evaluating EPA's interpretation of the statute, the Court must first "determine whether, based on the Act's language, legislative history, structure and purpose, 'Congress has directly spoken to the precise question at issue.' If so, EPA must obey." New York v. EPA, 413 F.3d 3, 18 (D.C. Cir. 2005) (quoting Chevron v. NRDC, 467 U.S. 837, 842 (1984)). If that evaluation is inconclusive, EPA's interpretation must nevertheless be rejected under Chevron if "it appears from the statute or its legislative history that the accommodation is not one that Congress would have sanctioned." Chevron, 467 U.S. at 845.

ARGUMENT

POINT I

EPA EXCEEDED ITS STATUTORY AUTHORITY AND VIOLATED THE CLEAN AIR ACT BY REMOVING EGUS FROM THE SECTION 112 LIST WITHOUT COMPLYING WITH THE MANDATED PROCEDURE

EPA acted without statutory authority and contravened the clear expression of Congress's intent when the agency removed EGUs from the list of source categories without following the procedure laid out in section 112(c)(9). An agency is bound by the limits of the authority delegated to it, and where the language is clear, as here, the agency simply has no discretion to deviate from the statute's mandate. See Arlington Cent. School Dist. Bd. of Educ. v. Murphy, 126 S. Ct. 2455, 2459 (2006).

A. EPA exceeded its statutory authority in revising the 112(n) determination

EPA's delisting action is based solely on the agency's revision of its six-year-old determination pursuant to section 112(n) of the Act that EGUs should be regulated under section 112. 70 Fed. Reg. at 16,002. The plain language of section 112(n), however, clearly indicates that Congress gave EPA only limited authority to make a single regulatory determination. See 42 U.S.C. § 7412(n). EPA's action was thus unlawful and must be vacated.

Section 112(n) requires EPA to "perform a study of the hazards to public health reasonably anticipated to occur as a result of emissions by EGUs," report the results of that study to Congress by 1993, and requires that the agency "shall regulate [EGUs] under this section, if the Administrator finds such regulation is appropriate and necessary after considering the results of the study." 42 U.S.C. § 7412(n)(1)(A). Nothing in this language authorizes EPA to revisit the appropriate and necessary determination once made. If the initial listing was in error, the

regulatory avenue Congress provided EPA to delist EGUs is section 112(c)(9). See 42 U.S.C. § 7412(c)(9) ("Deletions from the list"). Indeed, if Congress had wanted to authorize EPA to periodically revisit its determination - as EPA asserts - Congress would have done so, as it did in other subsections of the Act. See, e.g., 42 U.S.C. § 7412(b) (EPA shall "periodically review the list established by [112(b)]. . . and, where appropriate, revise such list by rule"); 42 U.S.C. § 7409(d)(1) (EPA to perform periodic review of national air quality standards). No such provision is present in section 112(n), however, and "it is generally presumed that Congress acts intentionally and purposely when it includes particular language in one section of a statute but omits it in another." City of Chicago v. Envtl. Def. Fund, 511 U.S. 318, 338 (1994).

EPA attempts to avoid the plain language of the Act by asserting an "implied" authority based solely on the lack of a deadline in section 112(n)(1)(A) by which EPA must make its appropriate and necessary determination. See 70 Fed. Reg. at 16,001-16,002. From this, EPA claims "sufficient discretion under section 112(n)(1)(A) - in terms of both the substance and the timing of the appropriate and necessary finding - that nothing precludes us from revising our. . . finding." Id. (emphasis added). The tenets of statutory construction, however, do not require Congress to employ superfluous language to proscribe the bounds of agency authority. See Louisiana Pub. Serv. Comm'n v. FCC, 476 U.S. 355, 374 (1986) ("an agency literally has no power to act . . . unless and until Congress confers power upon it"); New York v. EPA, 443 F.3d at 880, 887 (D.C. Cir. 2006) ("Only in a Humpty Dumpty world would Congress be required to use superfluous words while an agency could ignore an expansive word that Congress did use.").

Moreover, the context of the 1990 amendments to the Act, see infra at I.B., indicate that Congress - far from providing implied authority and discretion to EPA - moved to limit the

agency's discretion to promote rapid regulation of HAPs. See S. Coast Air Quality Mgmt. District, No. 04-1200, slip op. at 20 (D.C. Cir. 2006) ("EPA's interpretation of the Act in a manner to maximize its own discretion is unreasonable because the clear intent of Congress in enacting the 1990 Amendments was to the contrary."). Indeed, because of Congress' concern for the prompt and effective regulation of HAP emissions, section 112 does not allow judicial review of the listing until emissions standards are promulgated. See 42 U.S.C. § 7412(e)(4); 65 Fed. Reg. at 79,831; S. Rep. No. 101-228, at 3559 ("The Administrator's determination of priorities is given insulation from court challenge because of the complexity of the balancing involved and the extended nature of the litigation that might ensue if all of the schedule were open to challenge in court."). The provision for judicial review at such time does not render the listing any less final. As "[a]n agency construction of a statute cannot survive judicial review if a contested regulation reflects an action that exceeds the agency's authority," EPA's Delisting Rule, based on a faulty claim of implied authority, must fail. Aid Ass'n for Lutherans v. U.S. Postal Serv., 321 F.3d 1166, 1174 (D.C. Cir. 2003).

B. EPA's Delisting Rule Contravenes the Plain Language of Section 112(c)(9)

Even if EPA has authority to revise its appropriate and necessary determination, EPA still may not remove EGUs from the section 112(c) List without following the mandated procedure. Once a source is listed – as EGUs were with the December 20, 2000 Notice of Regulatory Finding, 65 Fed. Reg. 79,825 – EPA is authorized to remove that source from the list under only two circumstances, neither of which is the case here. See 42 U.S.C. § 7412(c)(9).

First, under 112(c)(9)(A), EPA shall delete a source if "the sole reason" that the source was included on the list is the emission of a unique chemical substance and EPA determines that

"there is adequate data on the health and environmental effects of the substance to determine that emissions, ambient concentrations, bioaccumulation or deposition of the substance may not reasonably be anticipated to cause any adverse effects to the human health or adverse environmental effects." 42 U.S.C. §§ 7412(c)(9)(A); 7412(b)(3)(9)(C). Here, EPA acknowledges, and the scientific literature and the Act itself are clear, that mercury causes significant adverse impacts to both human health and the environment. See, e.g., 42 U.S.C. § 7412(b); 70 Fed. Reg. at 16,011-12; 69 Fed. Reg. at 4,657; RTC, at 7-13 to -18 [JA_].

Second, under section 112(c)(9)(B), EPA "may delete any source category from the list under this subsection . . . whenever the Administrator makes the [applicable] determination." 42 U.S.C. § 7412(c)(9)(B). For non-cancerous pollutants such as mercury, section 112(c)(9) requires "a determination that emissions from no source in the category or subcategory concerned . . . exceed a level which is adequate to protect public health with an ample margin of safety and no adverse environmental effect will result from emissions from any source." 42 U.S.C. § 7412(c)(9)(B)(ii).

Here, EPA failed to make the determination that is a mandatory prerequisite to removing EGUs from the list of regulated sources under section 112. Indeed, EPA has plainly acknowledged that the agency used section 112(n) itself as the basis for delisting EGUs. See 70 Fed. Reg. at 15,994 ("The EPA is revising the regulatory finding that it issued in December 2000 pursuant to section 112(n)(1)(A) of the [Act], and based on that revision, removing coal- and oil-fired [EGUs] from the CAA section 112(c) source category list.") (emphasis added)).

EPA offers no justification for its action sufficient to depart from the literal interpretation of the Act. The agency's argument rests on its claim that section 112(n)(1)(A) "occupies the

field in section 112 with regard to Utility Units," and therefore EGUs are not subject to the section 112(c)(9) delisting requirements. 70 Fed. Reg. at 16,032-33. However, "[f]or EPA to avoid a literal interpretation . . . it must show either that, as a matter of historical fact, Congress did not mean what it appears to have said, or that, as a matter of logic and statutory structure, it almost surely could not have meant it." Friends of the Earth v. EPA, 446 F.3d 140, 146 (D.C. Cir. 2006) (quoting Engine Mfrs. Ass'n v. EPA, 88 F.3d 1075, 1089 (D.C. Cir. 2006)). The language of section 112(n)(1)(a) itself provides that EPA "shall" regulate EGUs under section 112 if the"appropriate and necessary" determination is made. 42 U.S.C. § 7412(n)(1)(A). Section 112(n), in other words, plays a threshold role, not a preemptive one. The presence of an express exemption for EGUs from section 112(c)(6), where no such exemption exists in section 112(c)(9) further supports the conclusion that Congress did not mean to preempt the regulatory scheme of section 112 through section 112(n)(1)(A). Compare 42 U.S.C. § 7412(c)(6) with 42 U.S.C. § 7412(c)(9); see Russello v. United States, 464 U.S. 16, 23 (1983) ("where Congress includes language in one section of a statute, but omits it in another . . . it is generally presumed that Congress acts intentionally . . . in the disparate inclusion or exclusion").

The legislative framework and history of the 1990 Amendments supports the Act's plain language. First, Congress created a strict framework for effective and expeditious regulation of HAPs, "precisely because it believed EPA had failed to regulate enough HAPs under previous air toxics provisions." Nat'l Lime Ass'n v. EPA, 233 F.3d 625, 634 (D.C. Cir. 2000). Because "very little has been done since the passage of the 1970 Act to identify and control hazardous air pollutants" Congress greatly restricted EPA's discretion. See S. Rep. No. 101-228, at 3, 1990 U.S.C.C.A.N. at 3389. It is only logical, then, that Congress intended section 112(c)(9) to apply

to EGUs once listed as the delisting requirements complement the legislature's desire to limit EPA's discretion and promote regulation of all major sources of HAPs.

Second, section 112(n) was the product of a congressional compromise and introduced only to "determine the nature of utility boiler emissions and whether their control is warranted enacted as part of the 1990 amendments to the Act." S. Rep. 101-228, at 414, 1990 U.S.C.C.A.N. at 3794. EPA's broad claims of discretion to avoid the requirements of section 112(c)(9) must fail as the agency may not interpret the Act "in a way that completely nullifies textually applicable provisions meant to limit its discretion." Whitman v. Am. Trucking Ass'ns, 531 U.S. 457, 458 (2001).

POINT II

EPA'S ACTION VIOLATES THE CAA BY EXEMPTING EGUS FROM SECTION 112 BASED ON AN ERRONEOUS "NEW INTERPRETATION" OF SECTION 112(n) AND CAMR AND CAIR

EPA ignored section 112(c)(9) and removed power plants from the 112(c) List based solely on its rescission of its December 2000 appropriate and necessary determination. 70 Fed. Reg. at 16,002. Even assuming EPA had the authority to take such action, EPA's Delisting Rule must still be vacated because EPA's rescission of the December 2000 determination relies on a "new" interpretation of section 112(n) that is contrary to the language and purpose of the Act. The agency's regulatory conclusion – that CAMR and CAIR obviate the need for EGU regulation – is similarly contrary to clear congressional intent and lacks support in the record.

A. EPA's Interpretation Ignores the Purpose, Structure and Context of Section 112(n).

EPA's Delisting Rule rescinds the agency's listing of EGUs as a source regulated under section 112 based on a new legal interpretation of section 112(n). See 70 Fed. Reg. 15,997-99. According to EPA's new interpretation, two threshold questions must be answered affirmatively before EPA can conclude that regulation of EGUs is appropriate and necessary. The first question is: Are the power plant mercury emissions that remain after the CAA's other requirements have been implemented (the "Remaining Emissions") – standing alone – responsible for causing hazards to human health? See 70 Fed. Reg. at 15,997-16,002 (explaining EPA's new understanding of 42 U.S.C. § 7412(n)(1)(A)); 70 Fed. Reg. at 16,022-25 (concluding that the Remaining Emissions do not result in hazards to human health); 70 Fed. Reg. at 16,028 (insisting that EPA cannot consider the effects of power plant emissions in combination with emissions from other sources). If the answer is "no," EPA concludes that it is not "appropriate" to regulate power plant emissions under section 112 and the inquiry ends. See 70 Fed. Reg. at 16,000.

EPA also concludes that even if regulation of power plant emissions under section 112 is "appropriate," it may not be "necessary." According to EPA, such regulation is "necessary" "only if there are no other authorities available under the CAA that would, if implemented, effectively address the remaining HAP emissions from Utility Units." 70 Fed. Reg. at 16,001 (emphases added).

EPA's approach based on EPA's new legal interpretation contravenes the Act. First, section 112(n) does not limit EPA to consider public health impacts arising solely from EGU

emissions. Rather, the section requires EPA to assess the "hazards to public health reasonably anticipated to occur as a result of emissions from [EGUs]." 42 U.S.C. § 7412(n)(1)(A) (emphasis added). EPA's interpretation therefore inserts a new requirement into the act as it reads "as a result of" to mean "solely as a result of." If Congress had intended EPA to focus on hazards resulting solely as a result of EGU emissions, it would have used the word "solely," as it has numerous times even within section 112. See 42 U.S.C. §§ 7412 (b)(2); 7412(b)(3)(A); 7412(r)(4)(B). Cf. New York v. EPA, 443 F.3d 880, 887 (D.C. Cir. 2006) (rejecting EPA's expansive interpretation as "the court must presume that Congress acted 'intentionally and purposely'" when Congress expressly includes a limitation). This statutory context reinforces the plain meaning of "as a result of" to include results that are caused by EGU emissions acting in concert with other sources of mercury. Cf. Kreindler & Kreindler v. United Tech. Corp., 985 F.2d 1148, 1158 (2d Cir. 1993) (the phrase "based upon" does not mean based "solely" upon).

Second, the Act requires EPA to study the hazards posed by EGU emissions after imposition of the "requirements" of the Act, not those emissions projected to be remaining after "authorities" not yet enacted take effect. See 42 U.S.C. § 7412(n)(1)(A). The plain meaning of "requirement" as something "necessary" or "an essential condition" indicates that Congress wanted EPA to look at existing requirements actually imposed on EGUs by the 1990 Amendments such as the Title IV program for SO_2, not authorities that may be implemented as EPA asserts. See New Webster's Dictionary 815 (1984). Here, EPA identifies CAIR and CAMR as available authorities and then looks to the year 2020 to determine if any EGU emissions then remaining pose a threat. Nothing in section 112(n) suggests that the legislature, in 1990, intended that EPA look ahead thirty years and consider the effects of regulatory programs that

would not be promulgated for fifteen years to determine whether regulating EGUs under section 112 was appropriate and necessary. On the contrary, Congress gave EPA until 1993 to study the health hazards reasonably anticipated to occur as a result of EGU mercury emissions, 42 U.S.C. § 7412(n)(1)(A), and clearly expected an appropriate and necessary determination shortly thereafter. EPA utterly fails to explain how its interpretation can possibly comport with the congressional intent for rapid and stringent HAP regulation found in the 1990 Amendments.

Finally, EPA's interpretation would "abrogate[] the enacted statutory text" of section 112. See Sierra Club v. EPA, 294 F.3d 155, 161 (D.C. Cir. 2002) (citing Appalachian Power Co. v. EPA, 249 F.3d 1032, 1041 (D.C. Cir. 2001)). Rather than considering the purpose, structure and context of Section 112(n), see Chemical Manuf. Ass'n v. EPA, 217 F.3d 861, 864-67 (D.C. Cir. 2000), EPA's new interpretation focuses on one sentence: "The Administrator shall perform a study of the hazards to public health reasonably anticipated to occur as a result of emissions by [EGUs] of [HAPs] after the imposition of the requirements of this chapter." 70 Fed. Reg. at 15,997. From this sentence, EPA "extrapolates" its new questions for determining whether regulation of power plant HAP emissions pursuant to section 112 is "appropriate and necessary." Id.

This new interpretation leads EPA to ignore three critical aspects of section 112. The framework of section 112 establishes that regulation provide for an ample margin of safety for public health, 42 U.S.C. § 7412(d)(4); (c)(9)(B)(ii), and address environmental impacts of HAPs, 42 U.S.C. § 7412(f);(c)(9)(B)(ii), and is generally structured to recognize the contributory impacts of the various sources of HAPs by requiring MACT standards for all major sources regardless of the significance of their respective emissions. EPA, however, determines that, in

assessing whether EGU regulation under section 112 is appropriate and necessary, the agency does not have to provide for an ample margin of safety for public health, 70 Fed. Reg. at 15,998, and does not have to address the environmental impacts of EGU emissions in the Delisting Rule, but rather only public health impacts, 70 Fed. Reg. at 15,997-98. EPA also determines that the Act constrains it to examine only the health effects caused solely by power plant emissions, i.e., in isolation from all other mercury source emissions, and cannot consider the contributory impacts of EGU emissions to overall mercury loading in our waterbodies. See 70 Fed. Reg. at 16,028-29. EPA, in other words, determines that Congress meant for all of the facets of effective regulation under section 112 to be abandoned simply because they are not referenced in the single line of text EPA chose to consider.

Congress, however, does not modify fundamental aspects of a regulatory scheme in vague terms or ancillary provisions. Gonzales v. Oregon, 126 S. Ct. 904, 921 (2006) (quoting Whitman v. Am. Trucking Ass'ns, 531 U.S. at 468). It is also "emphatically not within an agency's authority to set regulatory priorities that clearly conflict with those established by Congress." See Sierra Club v. Johnson, 444 F. Supp. 2d 46, 58 (D.D.C. 2006). The plain language of section 112 exhibits Congress's priorities for the regulation of HAPs that cannot be disregarded on the weight of a single "extrapolated" line of statutory text. See Sierra Club v. EPA, 294 F.3d at 161 ("the most reliable guide to congressional intent is the legislation the Congress enacted").

B. CAMR And CAIR Do Not Obviate The Need For, Or Appropriateness Of, EGU Regulation Under Section 112

EPA's conclusion that EGU regulation is not appropriate under section 112 because of CAMR and CAIR also contravenes the Act and is unsupported by the record such that the Delisting Rule must be vacated. Section 112 provides a regulatory framework evincing congressional priorities for HAP regulation. First, the MACT emission standards of section 112 "require the maximum degree of reduction in emissions." 42 U.S.C. § 7412(d)(2)(emphasis added). Second, MACT standards under section 112 apply to all major sources of the listed pollutants. 42 U.S.C. § 7412(f)(4). These technology-based standards are designed to protect both the environment and public health. See, e.g., 42 U.S.C. § 7412(d) (permitting EPA to create so-called "beyond-the-floor" standards based on "environmental impacts and energy requirements"). Third, after standards are set, section 112 requires the installation of pollution controls and full compliance within three years. 42 U.S.C. § 7412(i)(3). In other words, section 112 is designed to address the pressing public health threat posed by HAPs.

In contrast, CAMR and CAIR fail to effect any of the congressional priorities for HAP regulation. While a MACT standard for power plants under section 112 would require approximately 90% reductions of mercury emissions[6], CAMR requires only a 20% reduction for the next decade. As a cap-and-trade program, CAMR will also only reduce emissions at those power plants that do not buy credits for emission reductions and will do nothing to protect

---

[6] MACT standards require emission standards for existing sources to be no less stringent than the average emission limitation achieved by the best performing 12% of existing sources. 42 U.S.C. § 7412(d)(3). Of the eighty EGUs for which EPA has data, the top 12% have an average control efficiency for mercury of more than 93%. See 69 Fed. Reg. at 4,673; EPA Memoranda by Bill Maxwell ("Maxwell Memoranda") (Nov. 26, 2003), OAR-2002-0056-0006 [JA_] and (Oct. 21, 2005), OAR-2002-0056-6305 [JA_].

communities and areas near such plants. In fact, EPA's own modeling predicts mercury emission increases under the plan in sixteen states and numerous individual plants until 2018. Compare http://www.epa.gov/ttn/atw/combust/utiltox/unitxunit2.xls (Column F) (listing EPA's unit-specific 1999 emission data) with EPA's Final CAMR Unit Mercury Allowances (final two columns), OAR-2002-0056-6155 [JA_]. Finally, CAMR's timeline for compliance is drastically longer than section 112 regulation as CAMR requires no significant reductions until 2018 when its second-phase cap becomes effective. See 70 Fed. Reg. at 28,606. Compliance with the second-phase cap is expected to be significantly delayed due to the banking of emission credits; a 69% reduction in mercury emissions from EGUs will not likely occur until at least 2025. See 70 Fed. Reg. at 28,619 (EPA estimating that under CAMR, EGU mercury emissions in 2020 will still be 24.3 tons); see also Congressional Research Service, supra note 5.

EPA also asserts that the indirect reduction in mercury emissions from EGUs resulting from CAIR provides an alternative basis for its determination that it is not appropriate to regulate EGUs under section 112. 70 Fed. Reg. at 16,004. CAIR, however, is limited to the establishment of emission budgets for NO_x and SO_2 for twenty-eight states in the eastern portion of the country and the District of Columbia, and EPA expects mercury emissions increases under CAIR in areas not addressed. See 70 Fed. Reg. at 28,639. Furthermore, states may seek to comply with CAIR by regulating sources other than power plants, and even if they do regulate power plants, nothing in CAIR requires states to address mercury emissions. See 70 Fed Reg. at 25,162. Thus, EPA's assertion that CAIR will reduce mercury emissions from power plants to levels protecting public health is based purely on an assumption of the indirect benefits to mercury emissions that EPA speculates will result from control technologies used to reduce NO_x

and SO_2 emissions. This assumption is tenuous at best as there is no guarantee that EGUs, even if they are regulated, will use the pollution controls that EPA expects. In light of the congressional mandate in the 1990 Amendments to rapidly and effectively control HAP emissions such as mercury, EPA's assumptions and speculation provide no basis for removing EGUs from section 112.

In sum, CAMR and CAIR will take decades longer to reach full implementation than section 112, while providing for only a portion of the mercury emission reductions achieved under section 112 and no comparable public health assessment to address lingering threats. While EPA may believe its cap-and-trade plan to be better policy, the agency may not impose such policy choices over the statute's express mandate, and its approach must be rejected. See Sierra Club v. Johnson, 444 F. Supp. 2d at 58.

C. EPA's Public Health Conclusion in the Delisting Rule is Contrary to the Act and Arbitrary and Capricious

Finally, EPA based its "revised" delisting determination on a public health analysis that considered only those impacts on public health that result solely from EGU mercury emissions and only one pathway of exposure. This approach fails to protect the public and defies the plain language of the Act, and must be rejected.

First, as mercury moves from power plants, to waterways, and to fish, the mercury bioaccumulates, getting more concentrated at every level of the food chain, and joins with mercury from other sources such as incinerators. See RTC [JA_], 65 Fed. Reg. at 79,827; Hubbard Brook Comments, at 6 [JA_]. The impact on an individual is then determined by the cumulative level of mercury in fish consumed, regardless of where that mercury originated. Any

individual who consumes more than 0.1 micrograms of mercury per kilogram of his or her body weight per day is exceeding health safety criteria. See 65 Fed. Reg. at 79827. EPA's limited analysis, however, recognizes a health threat only where this safety level is exceeded solely because of mercury from EGUs.

EPA's approach has been rejected by this Court and must be rejected here. This Court has recognized that "an analysis cannot treat an identified environmental concern in a vacuum," but must address the accumulated impacts of various sources. Grand Canyon Trust v. FAA, 290 F.3d 339, 346 (D.C. Cir. 2002); see also Michigan v. EPA, 213 F.3d 663 (D.C. Cir. 2000). Research indicates that approximately 630,000 U.S. babies are annually born to mothers whose blood levels of mercury exceed safety levels. See Comments of New Jersey et al., Decl. of Alan Stern ¶¶ 7-8, OAR-2002-0056-5460 [JA_]. For these babies, each additional increment of utility-attributable mercury carries a predictable risk of additional IQ loss and other neurological effects. Id. at ¶ 10; see also National Research Council, Toxicological Effects of Methylmercury at 56-60 and 112-117, OAR-2002-0056-5927; 5928; 5929 [JA_]. EPA's health analysis fails to address these incremental impacts and consequently, leaves unaddressed these thousands of babies affected by EGU mercury emissions.

Second, EPA considered only a single pathway through which people are exposed to mercury: "freshwater fish caught and consumed by recreational and subsistence anglers." 70 Fed. Reg. at 16,012. Thus, EPA's analysis disregarded all marine fish, commercially caught fish, and fish caught in estuaries such as the Chesapeake Bay. Id. These pathways account for millions of pounds of fish consumed by U.S. citizens annually and are significant pathways through which mercury reaches people. See e.g., EPA Technical Support Document ("TSD") at

24, OAR-2002-0056-6186 [JA_] (recognizing that marine fish represent more than four million metric tons of caught fish in the United States annually).

EPA attempts to justify its disregard of other pathways of mercury exposure by claiming that analysis of U.S. EGU mercury impacts on marine and estuarine fish is uncertain, and that commercial fish do not represent a significant dietary pathway of U.S. EGU mercury. See EPA TSD, at 34 [JA_]. The statutory responsibility facing EPA, however, is to assess all impacts from EGU emissions that are "reasonably anticipated." 42 U.S.C. § 7412(n)(1)(A). Individuals who ingest mercury through marine and commercial fish can be expected to suffer health impacts by the mercury additionally ingested through the single pathway EPA considered. By excluding the pathways through which individuals are exposed to mercury, EPA has disregarded the plain language of section 112(n) and abdicated its statutory responsibility. EPA's approach must be rejected.

POINT III

CAMR'S REGULATION OF MERCURY UNDER SECTION 111 IS CONTRARY TO THE STATUTE

As EPA concedes, if the Delisting Rule is unlawful, CAMR similarly cannot stand. See Letter from Jeffrey R. Holmstead, EPA, to Peter C. Harvey, Attorney General of New Jersey (June 24, 2005) attached to Comments of New Jersey et al., OAR2002-0056-6282 [JA_]("staying the final section 112 rule would necessitate staying the final CAMR rule."); EPA's Opp. to Mot. for Stay Pending Review at 20 (July 18, 2005)(admitting same). Assuming, however, that EPA may exempt EGUs from regulation under section 112 – which EPA may not, as demonstrated

above – EPA still violates the Act by regulating mercury, a potent neurotoxin, under section 111 with a cap-and-trade program.

A. EPA's Attempt to Regulate Mercury Under Section 111 is Contrary to the Plain Language of the Act

Section 111 authorizes EPA to promulgate New Source Performance Standards ("NSPS"), technology-based standards for new sources of "air pollution which may reasonably be anticipated to endanger public health and welfare." 42 U.S.C. § 7411(b)(1)(A). Subsection (d) of Section 111 provides authority for regulation of existing sources, but is explicitly limited to those air pollutants that are not "emitted from a source category which is regulated under section 7412 of this title." 42 U.S.C. § 7411(d)(1). Thus, listed HAPs emitted from source categories regulated under section 112 are not to be regulated under section 111. Id. Mercury is a listed HAP under section 112, 42 U.S.C. §§ 7412(b)(1), 7412(c)(6), and is emitted from a number of source categories currently regulated by section 112. E.g., 71 Fed. Reg. 76,518 (Dec. 20, 2006) (establishing emission standards for HAPs including mercury from Portland Cement manufacturers); 69 Fed. Reg. 55,238 (Sept. 13, 2004) (establishing emission standards for mercury emissions from Industrial, Commercial, and Institutional Boilers and Process Heaters). Therefore, EPA may not regulate mercury emissions from EGUs under section 111, See Arlington Cent. School Dist. Bd. of Educ., 126 S. Ct. at 2459 (statutory construction analysis begins with the statute's plain language).

EPA attempts to avoid this clear limit on the scope of section 111(d) by claiming a conflict between the 1990 House and Senate versions of the amendments to section 111(d). See 70 Fed. Reg. at 16,030. Slightly differing language in the versions, however, does not alter

Congress' expressed intent that section 111 was not meant to regulate HAPs. See 42 U.S.C. § 7411(d)(1). Ambiguity between the amendment versions cannot be relied upon to avoid the plain meaning of the statute, but rather, the versions must be harmonized in light of the Act as a whole. See, e.g., FDA v. Brown & Williamson Tobacco Corp., 529 U.S. 120, 133 (2000); Citizens to Save Spencer County v. EPA, 600 F.2d 844, 851, 890 (D.C. Cir. 1979). Under these established canons of statutory interpretation, EPA's attempt to regulate existing sources of mercury under section 111 must be rejected.

The regulatory framework and legislative history of the Act further support the finding that listed HAPs emitted from source categories regulated under section 112 may not be regulated under section 111. First, the statutory limits on the applicability of section 111(d) demonstrate that it serves a backstop role in the Act to account for existing sources of air pollutants that are not controlled under any other provision. 42 U.S.C. § 111(d)(1). Second, as noted supra, Congress explicitly recognized the differences between sections 112 and 111 and the need to regulate HAPs under the former. See S. Rep. No. 101-228, at 167, 1990 U.S.C.C.A.N. at 3552 ("An emissions limitation based on section 112(d) will, in most cases, be more stringent than a new source performance standard for the same category of sources or pollutants . . . that is appropriate as this program is for the control of extremely harmful air pollutants"). Section 112 was enacted to address the public health threat posed by HAPs and required EPA to set standards at a level providing an ample margin of safety to protect the public health. 42 U.S.C. § 7412(c)(9)(B)(ii). In contrast, section 111 was largely designed as a technology forcing provision to promote long-term economic benefits through nationalized standards. See H.R. Rep.. 95-294,

at 186 (1977), reprinted in 1977 U.S.C.C.A.N. 1077, 1264 ("[T]he best technology requirement [of Section 111] was intended to create incentives for improved technology").

B. Even if EPA Has Authority to Regulate Mercury Emissions from EGUs Under Section 111, CAMR Violates the Requirements of That Section.

Section 111 requires EPA to set a standard of performance defined as an air pollutant emissions standard that "reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated." 42 U.S.C. § 7411(a)(1) (emphasis added). See also 42 U.S.C. §§ 7411(g)(4)(B), 7602. CAMR violates this express mandate of section 111 because: (1) existing sources already utilize control technologies that achieve much greater emission reductions than what CAMR requires; (2) the rule will actually result in future emission increases in many states; and (3) the rule will perpetuate dangerous, local "hot-spots" of mercury severely endangering public health. As CAMR conflicts with the language, purpose and intent of the CAA, and is not supported by a reasoned analysis, the Court should vacate CAMR as an abuse of discretion and arbitrary and capricious rulemaking. 42 U.S.C. § 7607(d)(9)(A); see Nat'l Asphalt Pavement Assoc. v. Train, 539 F.2d 775, 786 (D.C. Cir. 1976).

1. CAMR Violates Section 111 Because Currently Utilized Control Technologies and Source Specific Mercury Controls Achieve Substantially Greater Emission Reductions Than CAMR Requires.

Section 111 requires EPA to propose regulations establishing air pollutant emission standards that, applying the "best system of emission reduction," reflect the degree of achievable

emission limitation. 42 U.S.C. §§ 7411(a)(1) (emphasis added) and (f)(1). CAMR will result in a 21% emission reduction by 2010 through an annual emissions cap of thirty-eight tons from a 1999 base line level of forty-eight tons. In contrast, EPA's estimates predict that existing sources will already have reduced their emissions to thirty-one tons - seven tons better than CAMR's phase one requirement - as of 2010. 70 Fed. Reg. at 28,619. EPA offers no explanation for how a cap set at a level seven tons above what the agency expects EGUs to be emitting at the time it becomes operational can possibly reflect the best system of reduction.

Full implementation of CAMR will ultimately result in reductions of mercury emissions from power plants of 69% somewhere around 2025. See 69 Fed. Reg. at 4,691; 71 Fed. Reg. at 33,395; Congressional Research Service, supra note 5. EPA's data, however, demonstrates that the current best performing power plants reduce their mercury emissions by an average of 93%.[7] EPA in fact concluded that currently available control technologies have shown "mercury capture in excess of 90 percent." 65 Fed. Reg. 79,828. Thus CAMR requires only a fraction of the efficiency achieved by existing and available control technologies. In fact, existing power plants of every category established by EPA currently exceed CAMR's performance standards for new sources.[8] These weak standards are unsupportable given Section 111's express language. See 42 U.S.C. § 7411(a)(1).

---

[7] This percentage is derived from the average of the actual emissions achieved by the top 12% of the eighty coal-fired sources for which EPA has data (ten units, two that are coal-refuse-fired units and eight that are bituminous-fired). See 69 Fed. Reg. at 4,673; EPA Maxwell Memoranda [JA_].

[8] For instance, CAMR's new source limit is 74% for plants burning bituminous coal while the best performing bituminous plant (Mecklenberg Co-Gen Facility) achieves 98.8% reductions in its mercury emissions. See October 21, 2005 Memorandum from Bill Maxwell to Robert Wayland at 7-10, OAR-2002-0056-6305 [JA_]; 70 Fed. Reg. at 28,610 (establishing emissions limits which were converted to a percentage reduction format).

The weak standards are further diluted by EPA's subcategorization scheme in establishing the NSPS. 70 Fed. Reg. at 28,612. Although EPA "may" subcategorize based upon different classes, types, and sizes, 42 U.S.C. § 7411(b)(2), EPA is nevertheless statutorily required to implement standards that "reflect the degree of emission limitation achievable through the application of the best system of emission reduction." 42 U.S.C. § 7411(a)(1). EPA's subcategorization scheme, based on the different types of coal EGUs burn, fails to reflect that "a number of Utility Units co-fire different ranks of coal." 70 Fed. Reg. at 28,612-13. Moreover, EPA further subcategorizes units burning subbituminous coal based upon the type of pollution control that is being utilized. Id. at 28,615 (EPA setting different NSPS limits for subbituminous-coal burning EGUs based on the type of Flue Gas Desulfurization or "FGD"system used); EPA's Response to Significant Public Comments at 265, OAR-2002-0056-6722 [JA_]. Subcategorization based on technology, however, defeats the very purpose of establishing NSPS limits, because, as EPA itself acknowledged, subcategorization based on the type of air pollution control device "leads to situations where floors are established based on performance of sources that are not the best performing." 69 Fed. Reg. 394, 403 (Jan. 5, 2004). CAMR presents this situation, as a power plant using a wet FGD system is allowed to emit twice the amount of mercury as a power plant similar in every other respect except its use of a dry FGD system. 70 Fed. Reg. at 62,216.

2. CAMR Violates Section 111 Because the Rule Will Result in Emission Increases in Some States Even Beyond 2018.

CAMR further violates section 111's requirement that standards reflect the best system of emission reduction achievable because EPA's program will actually result in emission increases

in numerous states and individual plants. Comparing CAMR budgets to 2003 actual mercury emissions, sixteen states can increase their mercury emissions between now and 2018 while four states can continue to lawfully increase their emissions even beyond 2018. Compare Unit specific estimated mercury emission rates in 1999, at http://www.epa/gov/ttn/atw/combust/utiltox/unitxunit2.xls with 70 Fed. Reg. at 28,649-50. The difference between the allowed emissions under CAMR and states' actual emissions amounts to eighteen tons of excess mercury for the period between 2010 and 2018, a result that Congress could not have intended in enacting section 111. A program that allows emissions increases clearly violates section 111. See 42 U.S.C. § 7411(a)(1).

3. CAMR Cannot Be The Best System of Emission Reduction Adequately Demonstrated Because EPA Ignored Critical Nonair Quality Health and Environmental Impacts Resulting From the Cap-and-Trade Program

Finally, section 111 requires a standard of performance that takes into account "any nonair quality health and environmental impact." 42 U.S.C. § 7411(a)(1). Well-documented and adverse health and environmental impacts from mercury emissions include mercury "hot-spots," areas where the species living in waterbodies exhibit consistently high levels of mercury contamination. See Decl. of David Evers, Ex. B at 19, OAR-2002-0056-5460 [JA_]. At least nine such hot-spots have been identified in the area from New York to Nova Scotia, affecting both the environment and public health in those areas. Id.; see also Decl. of Charles Driscoll ¶ 4, OAR-2002-0056-5460 [JA_]; Hubbard Brooks Comments, at 13-14 [JA_].

Research has repeatedly noted that EGU air mercury emissions play a significant role in the creation of these hot-spots. Hubbard Brooks Comments, at 7-11 [JA_]. An EPA-funded

study found that approximately 70% of mercury wet deposition in Steubenville, Ohio, which is located in close proximity to several major coal-fired power plants, is attributable to the local sources. See Gerald J. Keeler et al., Sources of Mercury Wet Deposition in Eastern Ohio, USA, 40 Environ. Sci. & Technol. 5874 (2006), OAR-2002-0056-6748 [JA __]. Emission reductions from local source contributors have also been accompanied by significant decreases in the mercury concentrations in fish in local waterbodies, highlighting the role these local sources play. See Hubbard Brook Comments at 13-14 [JA_]. The record therefore reflects that individual EGUs can have significant impacts on local hot-spots of mercury contamination and a cap-and-trade program allowing individual plants to avoid any reduction can reasonably be anticipated to impact public health and the environment.

EPA has previously recognized the potential impacts of a cap-and-trade system for hazardous pollutants. See EPA, Tools of the Trade, A Guide to Designing and Operating a Cap and Trade Program for Pollution Control at 2-5 (June 2003), available at http://www.epa.gov/airmarkets/international/tools.pdf [JA_] (command and control regulations work better than cap-and-trade programs where emissions are toxic and have serious local health impacts). In fact, a cap-and-trade program has never been attempted for a neurotoxin such as mercury and EPA's Office of Inspector General concluded that CAMR as initially proposed failed to adequately address either the potential for hot-spots or the potential impact on children. See EPA Office of Inspector General, Evaluation Report: Additional Analyses of Mercury Emissions Needed Before EPA Finalizes Rules for Coal-Fired Electric Utilities (Feb. 3, 2005), OAR-2002-0056-5686 [JA_].

In the final mercury rules, EPA neglects the potential impacts of a cap-and-trade program for mercury, instead erroneously concluding that the final rule is "not significant" in light of CAIR, 70 Fed. Reg. at 28,639, and referring to the CAMR docket generally for a discussion of any impacts, 70 Fed. Reg. at 28,616. First, EPA's reliance on CAIR is misplaced as the agency acknowledges that CAIR will result in "both increases and decreases in [mercury] deposition" with increases expected in areas not covered by CAIR. 70 Fed. Reg. at 28,639. Thus, CAIR provides no assurance to individuals living in the twenty-two states not under its authority. See 70 Fed. Reg. at 28,618.

Second, the rest of the CAMR docket also fails to address the environmental and public health impacts of the cap-and-trade plan. The rulemaking relied on a modeling program to estimate the levels of mercury deposition in the future and concluded, "we do not currently have any facts before us that would lead us to conclude that utility-attributable hot spots exist."See 70 Fed. Reg. at 16,027-28 (emphasis added). By looking solely for "utility-attributable" hot-spots, however, EPA ignores the threats to public health posed by mercury hot-spots created by EGU emissions acting with other sources of the pollutant. As noted supra, EPA coined the "utility-attributable" term in the context of its flawed interpretation of section 112(n)(1)(A). Just as EPA's interpretation was unlawful for section 112, the interpretation equally contradicts the mandate by section 111 that EPA consider both the health and environmental impacts resulting from a promulgated performance standard. See 42 U.S.C. § 7411(a)(1).

Finally, EPA's reliance on large-scale modeling to predict future hot-spots is misplaced. Hot-spots are frequently created not by generalized mercury deposition over large areas, but rather by local sources such as those studied in Ohio and watershed characteristics such as the

terrain and surrounding ground cover. See Comments of New Jersey et al., Evers Decl., Ex. B at 4, 19 [JA_]. EPA's model averages the impacts from mercury emissions over 500 square miles using thirty-six square kilometer grids, and misses the local hot-spots that pose threats to the public and the environment. See Comments of The New Hampshire Department of Environmental Services at 3, OAR-2002-0056-6490 [JA_].

For these reasons, EPA set standards that contravene Congress' intent that standards of performance in Section 111 drive technology and provide for the best system of emission reduction and must be overturned.

CONCLUSION

Because EPA exceeded its statutory authority and acted arbitrarily and capriciously, Government Petitioners respectfully request that the Court vacate the Delisting Rule, 70 Fed. Reg. 15,994, and vacate CAMR, 70 Fed. Reg. 28,606, with instructions to EPA to promulgate emissions standards for HAPs emitted by EGUs under section 112 of the Act.

Dated: January 11, 2007

Respectfully submitted,

FOR THE STATE OF NEW JERSEY

STUART RABNER

Attorney General

By: _____

CHRISTOPHER D. BALL
JUNG W. KIM
RUTH E. CARTER
Deputy Attorneys General
R. J. Hughes Justice Complex
25 Market Street
P.O. Box 093
Trenton, NJ 08625
(609) 292-6945

FOR THE STATE OF CONNECTICUT

RICHARD BLUMENTHAL

Attorney General

By: _____ CDB

MATTHEW LEVINE
Assistant Attorney General
P.O. Box 120
55 Elm Street
Hartford, CT 06141-0120
(860) 808-5250

FOR THE STATE OF CALIFORNIA

EDMUND G. BROWN JR.
Attorney General

By: _____ CDB
SUSAN DURBIN

Deputy Attorney General
California Department of Justice
300 I Street
P.O. Box 944255
Sacramento, California
94244-2550
(916) 324-5475

FOR THE STATE OF DELAWARE

JOSEPH R. BIDEN III
Attorney General

By: _____ CDB
VALERIE S. CSIZMADIA
Deputy Attorney General
Department of Justice
102 W. Water Street, 3rd Floor
Dover, DE 19904
(302) 739-4636

FOR THE STATE OF ILLINOIS

LISA MADIGAN
Attorney General
MATTHEW DUNN
Chief, Environmental Enforcement
Asbestos Litigation Division

By: _____
ANN ALEXANDER
Assistant Attorney
General and Environmental Counsel
188 West Randolph Street, Suite 2001
Chicago, IL 60601
(312) 814-3772

FOR THE COMMONWEALTH OF MASSACHUSETTS

THOMAS F. REILLY
Attorney General

By: _____
WILLIAM L. PARDEE
Assistant Attorney General
Environmental Protection Division
1 Ashburton Place--Suite 1813
Boston, Massachusetts 02108
(617) 727-2200 ext. 2419

FOR THE STATE OF MAINE

G. STEVEN ROWE
Attorney General

By: _____
GERALD D. REID
Assistant Attorney General
Department of the Attorney General
State House Station #6
Augusta, Maine 04333-0006
(207) 626-8545

FOR THE MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

MICHAEL A. COX, Attorney General
Thomas L. Casey, Solicitor General
Counsel of Record

By: _____
ALAN F. HOFFMAN
NEIL D. GORDON
Assistant Attorneys General
Environment, Natural Resources
and Agriculture Division
P.O. Box 30755
Lansing, MI 48909
(517) 373-7540
Attorneys for the Michigan Department
of Environmental Quality

FOR THE STATE OF MINNESOTA

LORI SWANSON
Attorney General

By: _____
ALAN C. WILLIAMS
Assistant Attorney General
Atty. Reg. No. 117328
445 Minnesota Street, Suite 900
St. Paul, Minnesota 55101-2127
(651) 296-7200 (Voice)
(651) 296-1410 (TTY)

FOR THE STATE OF NEW MEXICO

GARY KING
Attorney General

By: _____
KAREN L. REED
Assistant Attorney General
New Mexico Attorney General's Office
P.O. Drawer 1508
Santa Fe, New Mexico 87504
(505) 827-6695

FOR THE STATE OF NEW HAMPSHIRE

KELLY A. AYOTTE
Attorney General

By: _____
MAUREEN D. SMITH
Senior Assistant Attorney General
Office of the Attorney General
33 Capitol Street
Concord, New Hampshire 03301-6397
(603) 271-3679

FOR THE STATE OF NEW YORK

ANDREW M. CUOMO
Attorney General

By: _____
JARED SNYDER
JACOB HOLLINGER
Assistant Attorneys General
Environmental Protection Bureau
The Capitol
Albany, New York 12224
(518) 402-2594

FOR THE COMMONWEALTH OF PENNSYLVANIA, DEPARTMENT OF ENVIRONMENTAL PROTECTION

SUSAN SHINKMAN
Chief Counsel

By: _____
ROBERT A. REILEY
Assistant Counsel
RICHARD P. MATHER, SR.
Deputy Chief Counsel
Rachel Carson State Office Building
P.O. Box 8464
Harrisburg, PA 17105
(717) 787-7060

FOR THE STATE OF VERMONT

WILLIAM H. SORRELL
Attorney General

By: _____
KEVIN O LESKE
Assistant Attorney General
Office of the Attorney General
109 State Street
Montpelier, Vermont 05609-1001
(802) 828-3186

FOR THE STATE OF RHODE ISLAND

PATRICK C. LYNCH
Attorney General

By: _____
Terence Tierney
Special Assistant Attorney General
Department of Attorney General
150 South Main Street
Providence, Rhode Island 02903-2907
(401) 274-4400

FOR THE STATE OF WISCONSIN

J.B. VAN HOLLEN
Attorney General

By: _____
THOMAS J. DAWSON
Assistant Attorney General
Wisconsin Department of Justice
17 West Main Street
P.O. Box 7857
Madison, Wisconsin 53707-7857
(608) 266-9945
(608) 266-8987

FOR THE MAYOR & CITY COUNCIL OF
BALTIMORE

RALPH S. TYLER
City Solicitor

By: _____
RALPH S. TYLER
JOSHUA N. AUERBACH
Baltimore City Department of Law
100 Holliday Street
Baltimore, Maryland 21202
(410) 396-3940

○