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HEARING ON MERCURY LEGISLATION

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED TENTH CONGRESS

SECOND SESSION

MAY 13, 2008

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COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ONE HUNDRED TENTH CONGRESS
SECOND SESSION

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TUESDAY MAY 13, 2008

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WITNESSES

HEARING ON MERCURY LEGISLATION

TUESDAY MAY 13, 2008

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The full committee met, pursuant to notice, at 10 a.m. in room 406, Dirksen Senate Building, Hon. Thomas R. Carper presiding.

Present: Senators Carper, Lautenberg, Cardin, Klobuchar, Whitehouse, Voinovich, Barrasso, Craig

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

Senator CARPER. The hearing will come to order. Good morning, everyone. We will be joined later this morning by a number of our colleagues.

Our Chair, Senator Boxer, will not be able to attend. She has asked me to express her appreciation to those of you who have come to join us to testify and respond to our questions. She has also left with me a statement that we would ask for unanimous consent to be included in the record. Without objection, it will be.

Senator CARPER. Today's hearing is focused, as you know, on mercury legislation, bipartisan legislation S. 2643, the Mercury Emission Control Act, and Senator Obama's legislation, S. 906, the Mercury Market Minimization Act of 2007. The Senators will have roughly 5 minutes for our opening statements, then I will recognize the EPA Assistant Administrator who is at the table, Bob Meyers. Following his statement, he is going to be joined by one other person from EPA for our questions. We will probably have two rounds of questions.

I will then ask for our second panel of witnesses to come forward. Their testimony will be followed by one round of questions. Finally, our third panel will be invited to the witness panel with questions to follow their statements.

We expect to have a series of votes at 11 o'clock. I think we will have four votes, and we will probably be here with testimony and questions until about 11:15, and then we will recess until we finish our last vote and come right back.

I expect the hearing will be over before 12:30, and that is certainly our goal.

Mercury pollution can be a serious health threat when it is released into the air by power plants and settles into the oceans and into our waterways where it accumulates in fish and animal tissue. Children and women of child-bearing age are most at risk.

Studies show that 1 in 17 women of child-bearing age have mercury in their blood at levels that could pose a risk to their unborn children. In 2005, EPA went against the mandates of the Clear Act and finalized the flawed Clean Air Mercury Rule. This regulation ignored Federal law. It did not go far enough to protect the health of America's vulnerable populations.

On February 8th, 2008, a Federal court rejected the Bush administration's Clean Air Mercury Rule. The U.S. Circuit Court of Appeals for the District of Columbia ruled that EPA failed to fulfill its obligations under Section 112 of the Clean Air Act because the rule established a weak cap and trade program which would allow many power plans to avoid installing any mercury controls at all.

In its decision, the court said EPA's mercury rule was based on "the logic of the Queen of Hearts, substituting the EPA's desires for the plain text of the law." Americans have waited too long for mercury pollution to be addressed. The EPA must now act quickly to implement pollution requirements that are absolutely necessary to protect American lives. We know that cost-efficient, practical technology is available today to regulate mercury emissions from power plants. I have requested an update to the May 2005 GAO report that reviewed emerging mercury control technologies to document this.

On February 15th of this year, I introduced bipartisan legislation to help protect Americans from the harmful effect of mercury pollution. The Mercury Emissions Control Act would require the U.S. Environmental Protection Agency to issue new, stronger rules to control mercury emissions from power plants as required by the Clean Air Act. Our legislation, which has 11 bipartisan co-sponsors, would require EPA to propose a regulation of hazardous air pollutants from power plants as originally prescribed by the Clean Air Act. The legislation would also require reduction of mercury pollution by at least 90 percent, I believe by 2015 or 2016.

Our Mercury Emissions Control Act would also require that mercury controls be installed at every coal-fired plant in America that needs them.

Although the focus of today's hearing is mercury, as we move closer to a floor debate on global warming, we must consider many pollutants that threaten our health and our environment. When dealing with air pollution from power plants, it makes sense to address all the pollutants at the same time, whether it is ozone-forming nitrogen oxide, asthma-causing sulfur dioxide, toxic mercury emissions or global warming causing CO2, they all come out of the same smoke stack. By addressing all four pollutants as a system, power plants will have the flexibility and regulatory certainty needed to plan for the most cost-effective control strategy.

Our witnesses today will testify about the State of mercury control technology, about health effects and the need for strong regulation, as well as progress that States are making. Ms. Lisa Jackson from New Jersey has joined us today. In addition, I received a compelling letter from Douglas Scott, who is the director of the Illinois EPA, supporting our mercury bill and discussing efforts that his State, Illinois, is making to reduce mercury pollution. Without objection, I will ask that that letter be entered into the record.

[The referenced material was not received at time of print.]

Senator CARPER. We are grateful to all of our witnesses that are here today and we look forward to your testimony.

With that having been said, let me turn to Senator Voinovich for his opening statement. Then we will come to Senator Lautenberg and Senator Barrasso.

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

Senator VOINOVICH. Thank you, Mr. Chairman.

I would like to mention that Senator Inhofe would be here today, but he is traveling back to Oklahoma with Secretary Chertoff to review the tornado damage in northeast Oklahoma.

I want to thank the witnesses for taking time out of their busy schedule to testify today. I have long supported decreasing mercury missions and sponsored the Clear Skies Act, which would have cut emissions by 70 percent, and was supportive of the Administration rulemaking effort which set up the Clean Air Mercury Rule. I think we are the first country in the world to set up recommendations in terms of mercury.

Both Clear Skies and CAMR sought to usher in phased reductions in mercury emissions in a manner that was consistent with the development of control technologies. The first phase of reductions leveraged what is referred to as co-benefit reductions from what may be achieved through the implementation and application of control technologies to reduce sulfur and NO_x. The second phase ushered in control requirements that would require mercury-specific controls, activated carbon injection, for example.

Now the D.C. Circuit has vacated CAMR. We are again faced with the question of what is the appropriate level of control for mercury emissions. When we debated mercury controls previously, reasonable people disagreed as to what technology could deliver. There was significant concern that while certain technologies would work well for certain coal types, other coal types, particularly lower-ranked coals, were more difficult to control. The Administration finalized a trading program in part because it allowed sources flexibility in meeting aggressive compliance obligation should technologies fail to deliver as promised.

The bill we now consider, the Emissions Control Act, amends the Clean Air Act and requires a 90 percent reduction in emissions of mercury from new and existing power plants. As I understand the legislation, this is a source-specific control requirement. There is no flexibility in meeting the 90 percent reduction requirement.

Now I understand that good progress has been made in advancing mercury control technologies, and I would be interested in hearing more about it today. However, it doesn't sound as if all the technology challenges have been resolved. As with the previous debate, the experts before us disagree about what technology can deliver. It is less than clear that a 90 percent requirement can be met on a consistent, reliable basis for all plants, particularly older facilities. Indeed, given the wide range of coal types and plant configurations, it seems that Congress, acting too broad to apply aggressive mercury control requirements is something that is inadvisable from a national policy perspective.

Section 112 of the Clean Air Act lays out a process for the EPA to establish technology-based standards for new and existing sources of hazardous air pollutants. This process allows for a detailed review of available control technology and provides that control requirements be applied based on what is achieved in practice. Importantly, the Clean Air Act provides that separate standards may be established for sub-categories of sources. For example, the different coal types prove more difficult to control and provides for the adoption of less stringent requirements for existing sources.

The bill we now consider does not provide even this modest flexibility. Moreover, the bill preempts expert agency judgment concerning what technology can deliver. In the absence of legislation that provides for more flexible compliance requirements I believe we should allow the agency experts to follow the existing Clean Air Act, which provides for a thorough technical review of mercury control technologies before a determination is made concerning the appropriate level of control. I do not believe that we should arbitrarily impose our determination of what is achievable, no matter how well intended.

And two final points. First, as in the debate in 2004, little regard has been paid to the impact a 90 percent MACT would have on our Nation because coal plants unable to attain it would be shut down. This would result in fuel switching away from coal 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 a family to pay their utility bills. I can say that regardless of what we do, we are going to see increased costs of natural gas in this Country.

But the increased costs may be worth it if a 90 percent mercury reduction was expected to provide significant public health benefits beyond those derived from the EPA's now-vacated rule. EPA estimated the cost of its cap and trade rule at about $2 billion. In 2005, the Energy Information Administration projected the costs for 90 percent MACT standard as high as $358 billion with an average increase in national electricity prices of 20 percent. The additional reduction in U.S. mercury disposition was projected to be just 2 percent, an almost immeasurable decline in people's exposure to mercury.

Because these numbers are not dated, however, I would ask Senator Carper if we might have EPA run an economic analysis of this legislation before we move to a Committee vote. As with all legislation we consider, I believe we need to have a sense of the costs it will impose on society before we proceed.

I have run out of time and I will ask that the rest of my statement be put into the record. But I have to say, Senator Carper, that we passed out one of the most significant pieces of legislation several months ago dealing with climate change. I insisted at that time that we ought to have an EPA evaluation and an Energy Information evaluation. We didn't have it. Didn't have it. Went ahead and passed it out. And now the information is coming in, and it is pretty devastating in terms of its impact on the Country.

It seems to me we would have been far better off if we had had that information before we shoved the legislation out of committee, so that maybe we might have made some adjustments in it to re-

spond to those numbers. So I think when you are dealing with this kind of legislation, let's figure out what impact it is going to have. Is 70 as good as 90? If it is not, then let's see what health benefits would go from 70 to 90. Again, harmonizing our environment, energy and our economy.

Thank you.

[The prepared statement of Senator Voinovich follows:]

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

Thank you Madame Chair for calling this hearing today on the Mercury Emissions Control Act. And thank you to the witnesses who have taken time from their schedule to testify today. I have long supported decreasing mercury emissions—I sponsored the Clear Skies Act, which would have cut emissions by 70 percent, and was supportive of the Administration's rulemaking effort which set up the Clean Air Mercury Rule (CAMR).

Both Clear Skies and CAMR sought to usher in phased reductions in mercury emissions in a manner that was consistent with the development of control technologies. The first phase of reductions leveraged what is referred to as "cobenefit" reductions from what may be achieve through the application of control technologies to reduce sulfur dioxide and nitrogen oxides. The second phase ushered in control requirements that would require mercury specific controls—activated carbon injection, for example.

Now that the DC Circuit has vacated CAMR, we are again faced with the question of what is the appropriate level of control for mercury emissions. When we debated mercury controls previously, reasonable people disagreed as to what technology could deliver. There was significant concern that while certain technologies would work well for certain coal types, other coal types—particularly lower ranked coals—were more difficult to control. The administration finalized a trading program, in part, because it allowed sources flexibility in meeting aggressive compliance obligations should technologies fail to deliver as promised.

The bill we now consider—the Mercury Emissions Control Act—amends the Clean Air Act, and requires a 90 per cent reduction in emissions of mercury from new and existing power plants. As I understand the legislation, this is a source specific control requirement and there is no flexibility in meeting the 90 percent reduction requirement.

Now I understand that good progress has been made in advancing mercury control technologies—particularly on lower ranked coals. However, it doesn't sound as if all the technical challenges have been resolved. As with the previous debate, the experts before us disagree about what technology can deliver. And it's less than clear that a 90 percent control requirements can be met on a consistent and reliable basis by all plants—particularly older facilities. Indeed, given the wide range of coal types and plant configurations it seems that Congress, acting to broadly apply aggressive mercury control technology requirements, is something that is inadvisable, from a national policy perspective.

Section 112 of the Clean Air Act lays out a process for the EPA to establish technology based standards for new and existing sources of hazardous air pollutants. This process allows for a detailed review of available control technologies and provides that control requirements be applied based on what is achieved in practice. Importantly, the Clean Air Act provides that separate standards may be established for subcategories of sources (for example, if different coal types prove more difficult to control) and provides for the adoption of less stringent requirements for existing sources.

The bill we now consider does not provide even this modest flexibility. Moreover, the bill preempts expert agency judgment concerning what technology can deliver. In the absence of legislation that provides for more flexible compliance requirements, I believe we should allow agency experts to follow the existing Clean Air Act—which provides for a thorough technical review of mercury control technologies before a determination is made concerning the appropriate level of control. I do not believe that we should arbitrarily impose our own determination as to what is achievable, no matter how well intended.

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ther increase prices, seriously impacting the ability of businesses to compete in the global marketplace and of families to pay their utility bills.

But the increased costs may be worth it if a 90 percent mercury reduction was expected to provide significant public health benefits beyond those to be derived from the EPA's now vacated rule.

EPA estimated the cost of its cap-and-trade rule at about $2 billion. In 2005, the Energy Information Administration projected the costs for a 90-percent MACT standard as high as $358 billion, with an average increase in national electricity prices of 20 percent. The additional reduction in U.S. mercury deposition was projected to be just 2 percent—an almost immeasurable decline in people's exposure to mercury.

Because these numbers are now dated, however, I would ask Senator Carper if we might have EPA run an economic impact analysis of this legislation before we move to a committee vote. As with all legislation we consider, I believe we need to have a sense of the cost it will impose on society before we proceed.

Second, I remind members of this committee that we are set to take up S. 2191 on the Senate floor next month. This bill, if implemented, would dramatically alter the nation's electricity portfolio. Indeed, the Clean Air Task Force preformed an analysis that indicated S. 2191 would cut the nation's mercury emissions by as much as 82 percent—largely because coal would be virtually eliminated from the generation mix. While I oppose S. 2191, I don't believe these two bills should be viewed in a vacuum. Should S. 2191 be implemented, it's unclear why this legislation is necessary.

With regard to S. 906, the Mercury Market Minimization Act of 2007, I am particularly concerned as the Senate bill does not propose a specific means to address the long term storage and responsibility for the expended mercury inventory from the private sector. Instead it proposes the creation of an entity that will study the issue before proposing a solution. The bill reported out of the House, H.R. 1534, by contrast, requires the Department of Energy to accept the mercury inventory, be paid for doing so, and then indemnifies the contributing company against future claims.

I also have concerns regarding the bill's definition of "elemental mercury." If mercury is found in a material, such as coal, is coal then banned from export? I believe a provision should be added that excludes materials that naturally contain trace amounts of elemental mercury. Finally, I believe we should require a report after several years that the ban on the export of mercury has resulted in no harm to our industries and our economy and had no unintended consequences.

None of these deficiencies are in the House version of this legislation, which I believe S. 906 should be amended to conform to.

Senator CARPER. I would be happy to discuss it further with my friend. I would just ask us to remember that it was, I think about 3 years ago, that EPA, after a lot of pushing and encouraging, actually modeled several multi-pollutant bills, including the one that a number of us introduced many years ago that included sulfur dioxide, nitrogen oxide, mercury and CO2. But I would be pleased to discuss it with you. Thanks.

Senator LAUTENBERG.

OPENING STATEMENT OF HON. FRANK LAUTENBERG, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator LAUTENBERG. Thanks, Mr. Chairman. I want to commend you for your introduction of a bill to reduce the presence of mercury in our communities and throughout our Country.

While I have great respect for our colleague from Ohio, I kind of looked at these problems from the back end forward and questioned what it is that we want to do. It may alter the costs from the costs of a life, of a child's inability to function properly because of a neurological disturbance, it may affect the health and well-being of a new child. So I say, well, how do you measure that human cost with a dollar cost?

And I think there is a distinct difference in the view. Mercury, we know, is a proven threat to our health, even in low doses. Mer-

cury can permanently affect a child's development. And in adults, chronic exposure to mercury can cause vision loss, contribute to heart disease, among other ailments. With such clear and severe health risks that no scientist or doctor disputes, we should have strong laws, strong as we can take, to protect our residents. But as it has so many times, the Bush administration fails to protect the health of the public or our environment.

In 2005, the EPA overturned the requirement for all of America's power plants to upgrade their technology to the best emission control available. The EPA also created a cap and trade system to reduce mercury emissions at power plants. Cap and trade works in the fight against global warming. But it does not work in the fight against mercury emissions.

If you live in a community near a coal-fired plant that buys its way out of mercury regulations, you pay the cost with increased mercury in the food you eat and the water you drink. It is not just communities in the immediate area around the power plants that are affected. Studies show that emissions from coal-fired power plants in the Midwest affect residents in the Northeast, including my State of New Jersey and the Chairman's State of Delaware.

New Jersey is one of the Nation's leaders when it comes to environmental law. But New Jersey's laws are being undermined by the Bush administration's weak environmental policies that affect the Country as a whole. Thankfully, the courts decided common sense was in order and overturned the Administration's policy. To me, this is one more chapter in an ongoing story that we have seen from this EPA. It forgets its mission and neglects public health. From greenhouse gas emission to toxics to mercury, the courts have stepped in and set things right where the Administration went wrong.

After the court decision, Senator Carper introduced a bill to require major mercury reductions at our Nation's power plants. I am a co-sponsor, I am proud to be a co-sponsor of this legislation, which would protect the health of residents who are affected by power plant emissions. And I look forward to working with my colleagues on this Committee to set things right and pass the Carper bill.

Thank you, Mr. Chairman.

Senator CARPER. Senator Lautenberg, thank you very much for your statement and for your strong support.

Senator BARRASSO.

OPENING STATEMENT OF HON. JOHN BARRASSO, U.S. SENATOR FROM THE STATE OF WYOMING

Senator BARRASSO. Thank you very much, Mr. Chairman.

Mr. Chairman, we must protect our environment, and we must do so while ensuring that our Nation is powered into the future and has adequate power. Over the last few decades, our Nation's air has dramatically improved. Those are the effects of environmental laws enacted by Congress. They have been very positive. Over the last 36 years, carbon monoxide emissions have fallen dramatically, nitrous oxide emissions have fallen dramatically, as has sulfur dioxide. Particulate emissions are down 80 percent, lead emissions are down.

Should we do more? Certainly. There is always room for improvement. Health issues associated with atmospheric mercury have been identified. The accumulation of mercury in fish is a recognized problem.

My concern with the Mercury Emission Control Act are the findings that State that we can reduce coal-fired power plant mercury emissions by 90 percent by the year 2010. And the technology is just not there——

Senator CARPER. Senator Barrasso, it is by 2015.

Senator BARRASSO. Thank you very much, Mr. Chairman.

I want to make sure that the technology is there to do the sorts of things that we talk about, because the EPA estimates that removal technologies still need to be advanced. So what happens if we try to go too fast? Well, power plants could reduce mercury emissions by switching from one type of coal to another. And the switch would be from low sulfur coal to high sulfur coal. But with that switching, other pollutants are going to rise, so we will have more sulfur dioxide and nitrous oxide and less mercury. You can't get them all out at the same time. The technology is not there to do it.

Some generators may switch from coal to natural gas. There is a GAO study, and I would like to introduce this as part of the record, Mr. Chairman, that says that the ability of U.S. electricity-generating units to switch from coal to natural gas is limited, and fuel switching could cause adverse economic consequences. Wyoming is a major supplier of natural gas. So something like this can help Wyoming's natural gas economy, but it won't help families and businesses in other parts of the Nation who are saddled with high energy costs.

The concern continues, Mr. Chairman, that to me, we need to continue with the technology. Coal is our best domestic energy source. We need to make this industry stronger and yes, cleaner, but we need to have the technology to be able to do those things, which is going to involve an additional investment on the part of our Nation.

Thank you, Mr. Chairman.

Senator CARPER. Thank you, Senator Barrasso.

Senator Whitehouse, welcome.

OPENING STATEMENT OF HON. SHELDON WHITEHOUSE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Senator WHITEHOUSE. Thank you, Chairman. Good to be here with you.

Really, I think, Mr. Chairman, for as long as there have been Americans, there have been dads who took their sons fishing. It was kind of an emblematic thing. You can imagine the Norman Rockwell picture. And for the first time in any generation, we are in a situation now where that is not really feasible any longer, because the fish that the sons and daughters may catch is polluted with mercury in many places to the point where it is no longer safe to eat.

That is a significant piece of thievery, if you will, from the American experience. And it is unnecessary. And States like mine can do very little about it. We are in the same position that Senator

Lautenberg's State of New Jersey is. We can legislate all we want, but what rains in on us from Midwestern power plants has profound health effects in Rhode Island. And we don't have the power as a single State to regulate what happens elsewhere in the Country. That is why we count on the Environmental Protection Agency.

That is why it is so frustrating to see an Environmental Protection Agency that doesn't take its duty seriously, where the courts over and over again have to knock them up side the head and say, come on, get this right. It was this mercury issue that caused the court to describe the Queen of Hearts logic from Alice in Wonderland that the agency was applying in order to delay applying technically feasible protections that help Americans, that help our lakes, that help our fish. But because they weren't welcomed by industry, this EPA simply wasn't serious about them. And it is very frustrating.

So I am very glad to join, Mr. Chairman, the Carper legislation and be here to hear about it and show my support, and to join Senator Lautenberg, who has such a long and distinguished record of fighting for the safety of Americans from various toxic contaminants. To be here with the two of you makes me very proud. I will end it there.

Senator CARPER. We are honored to have you joining us and welcome your support.

I want to go back to a point that Senator Barrasso made earlier with respect to the date by which we expect reductions of roughly 90 percent to have been achieved. Under the Clean Air Planning Act, which is a separate piece of legislation, it is multi-pollutant legislation, which involves sulfur dioxide, nitrogen oxide, mercury and CO2, that legislation requires a 90 percent reduction overall in mercury emissions by 2015.

The legislation that is before us today, if passed, if signed into law, would require EPA to promulgate by the end of this year, I believe, a proposed rule for consideration. That proposed rule would then be finalized some time, I presume, next year. I believe that power plants would have as many as 3 years to actually install the technology.

So we are not talking as late as 2015, but it would be somewhere between 2011 and probably 2014.

Senator BARRASSO. Thank you for that clarification, Mr. Chairman. Because in the findings of the bill, it does say feasible by calendar year 2010, using current methods. It is my understanding from all my research that the current methods are not there to have something feasible in 2010.

Senator WHITEHOUSE. We will have an opportunity to hear from some folks later today who are going to talk to us about how feasible it is to do it now or in 2010 or 2015.

Senator BARRASSO. Thank you, Mr. Chairman.

Senator CARPER. We have been joined at the table today by our Assistant Administrator from EPA. I want to thank Mr. Meyers for joining us. You have been here before. We will ask you, I think you may have someone join us for Q&A. We may take as many as two rounds for your testimony and for Q&A.

We welcome you. We will ask you to keep your comments close to 5 minutes. If you go a little beyond that, it is all right. You are

recognized at this time. Your full statement will be made a part of the record.

STATEMENT OF ROBERT J. MEYERS, PRINCIPAL DEPUTY ASSISTANT ADMINISTRATOR, OFFICE OF AIR AND RADIATION, U.S. ENVIRONMENTAL PROTECTION AGENCY ACCOMPANIED BY: JAMES GULLIFORD, ASSISTANT ADMINISTRATOR, OFFICE OF PREVENTION, PESTICIDES AND TOXIC SUBSTANCES

Mr. MEYERS. Thank you. I appreciate the opportunity to discuss the important issue of reducing mercury emissions and public health and environmental risks that such emissions present. With me today, as you have noted, is Jim Gulliford, who is the Assistant Administrator for the Office of Prevention, Pesticides and Toxic Substances.

Overall, for important public health and environmental reasons, EPA remains committed to achieving mercury emission reductions. Over the past two decades, EPA has issued a number of regulations to control mercury emissions from large sources. These includes standards for waste combustion, medical incinerators, chloralkali plants, industrial boilers and other sources.

EPA has also initiated other efforts to control mercury emissions through innovative means. In August 2006, the agency announced a program to retrieve mercury switches from automobiles before they were shredded and melted. This program removed its millionth switch this past February.

The agency is additionally focusing efforts on international emissions through the Global Mercury Partnership. I think it bears repeating, as was mentioned earlier, that when EPA promulgated the CAMR rule in March 2005, the U.S. became the first country in the world to permanently reduce and cap mercury emissions from coal-fired power plants. CAMR built upon EPA's Clean Air InterState Rule and when fully implemented, as mentioned also, the rules would reduce mercury emissions from approximately 48 tons a year to 15 tons.

Under the cap and trade system utilized by CAMR, emissions were capped permanently and nationwide. The trading program provided a continuous incentive for technology innovation and flexibility for compliance by the power sector while retaining requirements at new plants also meet new source performance standards. CAMR additionally included rigorous continuous mercury emissions monitoring provisions which reflected the State of the science. EPA worked through an intensive cooperative effort and consensus among diverse stakeholders to advance and upgrade the quality of emissions, measurement and monitoring.

Over the last 3 years, EPA and the States have made considerable progress in implementing CAMR. By February 2008, a total of 34 States had submitted plans for approval and most of the rest required State plans were in development. At the same time, the power industry was deploying mercury-specific control technology and so by the beginning of 2008, the industry had already installed activated carbon injection systems on approximately 2.7 gigawatts of coal-fired capacity.

As mentioned also, on February 8th of this year, a three-judge panel of the D.C. Circuit Court of Appeals vacated CAMR and re-

lated Section 112(n) revision rule. Following the decision, on March 14th, the Court issued its mandate which caused the vacatur of CAMR and related 112(n) revision rule to take effect. While EPA respects the District Court's decision in this matter, we fundamentally disagree with the Court's opinion.

Therefore, on March 24th, the Department of Justice filed a motion for rehearing en banc bond, asking the full Court to reconsider the three-judge panel's decision. In presenting our arguments for rehearing, EPA points to the absurd result occasioned by the three-judge panel's interpretation of the Clean Air Act. If the decision stands without revision, it would result in a rulemaking the agency previously determined through notice and comment rulemaking not to be appropriate and necessary. Moreover, challenge to the initial 2000 listing decision could occur only after such rulemaking was finalized.

Turning to legislation, the Mercury Emissions Control Act amends the Clean Air Act to require EPA to propose Section 112(d) MACT regulations. As mentioned, these regulations would be due to be proposed within 180 days of enactment or no later than October 1st of this year. The bill further specifies that any final regulations promulgated by EPA attain the pre-determined result of reducing mercury emissions from new and existing utility steam generating units by not less than 90 percent.

My written testimony indicates that the Administration does not have a formal position on legislation but notes difficulties we have with the current construction of the bill.

Turning to S. 906, the Mercury Market Minimization Act, Mr. Gulliford will be available for questioning on this legislation. I would note the Administration has already issued a statement of Administration policy on H.R. 1534, stating the legislation is premature, pending further analysis of the main issues raised by such a ban. While there are some differences between the House and the Senate bills, the issues raised by the SAP are also relevant to the Senate bill.

In general, we regard S. 906, it is our view there is inadequate understanding of the potentially negative consequences of an export ban on the environment, industry, both domestic and international, and the Federal Government. A ban would also prompt questions under international trade rules.

I would cut my remarks short at this point in time to respect the 5-minutes and then be available to address questions concerning S. 2643 and invite Mr. Gulliford to address questions regarding S. 906.

[The prepared statement of Mr. Meyers follows:]

TESTIMONY OF
ROBERT J. MEYERS
PRINCIPAL DEPUTY ASSISTANT ADMINISTRATOR
OFFICE OF AIR AND RADIATION
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
U.S. SENATE

May 13, 2008

Madame Chairman and members of the Committee, thank you for the opportunity to discuss with you today the important issue of reducing mercury emissions and the public health and environmental risks they pose. In my remarks today, I will review the significant progress EPA and the States have made in requiring substantial reductions in mercury emissions from the U.S. utility sector. I will also describe the related litigation and our work to address the results of that litigation to date. EPA remains committed to achieving mercury emission reductions from the utility sector as provided under the Clean Air Act.

Mercury is a toxic, persistent pollutant that accumulates in the food chain. Fossil fuel-fired utilities are the largest source of human-generated mercury emissions in the U.S. Concentrations of mercury in the air are usually low and of little direct concern. However, atmospheric mercury falls to Earth through rain or snow and enters lakes, rivers and estuaries. Once there, it can transform to its most toxic form, methylmercury, and accumulate in fish and animal tissues. Americans are exposed to mercury primarily by eating contaminated fish. Because the developing fetus is the most sensitive to the toxic effects of mercury, women of childbearing age are regarded as the population of greatest concern. Children who are exposed to low concentrations of methylmercury

prenatally are at increased risk of poor performance on neurobehavioral tasks, such as those measuring attention, fine motor function, language skills, visual, spatial abilities, and verbal memory.

EPA has issued a number of regulations to control emissions of mercury from large sources, including standards for waste combustion, chlor-alkali plants and others.

The Clean Air Mercury Rule

EPA sought to address the consequences of utility mercury emissions through the first-ever federal rule to permanently reduce and cap mercury emissions from coal-fired power plants. Issued on May 18, 2005, the Clean Air Mercury Rule (CAMR) built on EPA's Clean Air Interstate Rule (CAIR) to significantly reduce emissions from coal-fired power plants -- the largest remaining sources of mercury emissions in the country. Upon full implementation, these rules would have reduced utility emissions of mercury from 48 tons a year to 15 tons, a reduction of nearly 70 percent or more than 80 percent of the mercury in coal.

CAMR established standards of performance to limit mercury emissions from new and existing coal-fired power plants. The rule required new plants (under the rule, "new" meant construction starting on or after January 30, 2004) to meet new source performance standards (NSPS) in addition to being subject to the CAMR emission caps. The rule also created an optional market-based multi-State emissions cap-and-trade program to reduce nationwide utility emissions of mercury in two distinct phases. Under the cap-and-trade system, emissions were capped permanently and nationwide --

emissions could only go down. The trading approach provided a continuous incentive for technology innovation and flexibility for compliance by the power sector.

CAMR applied to plants in all 50 States, the District of Columbia, and Tribes, and required each jurisdiction to submit a State Plan (with the exception of the Tribes). This State Plan had to demonstrate that CAMR mercury reduction requirements would be met in that State. CAMR State Plans were due to EPA by November 17, 2006. On December 22, 2006, EPA proposed a Federal Plan as a backstop measure which, if finalized, would have ensured that power plants affected by CAMR reduce their mercury emissions on schedule.

CAMR also included rigorous continuous mercury emissions monitoring provisions. The monitoring methodologies adopted represent the "state-of-the-science," and were the result of an intensive cooperative effort and consensus among diverse stakeholders including EPA, States, the utility industry, equipment vendors, the Electric Power Research Institute (EPRI), and the National Institute for Standards and Technology (NIST) to advance and upgrade the quality of mercury emissions measurement and monitoring. Numerous field tests and laboratory experiments have been performed to refine and develop these methodologies. In a few short years, this cooperative effort has advanced the state-of-the-science in the measurement of mercury emissions to enable the use of high quality emission monitoring systems that provide continuous hourly mercury emissions measurements.

Currently, EPRI, NIST, and equipment vendors, in collaboration with EPA, are conducting a demonstration program at participating coal-fired utilities to assess the field performance of these new monitors.

In CAMR, EPA offered States considerable program flexibility to meet their assigned mercury budget. Besides the option of joining the EPA-run multi-State emissions trading program, States could have source-specific controls, intrastate trading, or shift from trading to source controls over time. States that wanted to be in the multi-State trading program could decide how to distribute allowances (including auctions) and whether to award all allowances. There were also some core rules for participation in the EPA-run trading program that were intended to prevent companies from having unfair economic advantages and to ensure the program was environmentally effective.

For States that chose not to allow trading, EPA evaluated the plans to ensure they met the basic requirements of CAMR and that they were at least as stringent as EPA's trading program. In practical terms, "at least as stringent" meant the plan ensured that all State electric power plant mercury emissions would remain below the State emissions cap and that those emissions would be measured properly.

Considerable progress was made in implementing CAMR. By February 2008, a total of 34 States had submitted plans for approval, and most of the rest of the required State Plans were in development. EPA believes that all of the State Plans, including those requiring more stringent controls, were developed through a cooperative approach between EPA and the States.

At the same time, the power industry was deploying mercury-specific control technology. According to the National Electric Energy Data System -- which is used for EPA modeling -- at the start of 2008, the power industry already had installed activated carbon injection systems (ACI) for mercury control on more than 2 gigawatts of coal-fired capacity. EPA is expecting the installation of another 2 gigawatts in the next

several months. EPA was expecting the industry to install ACI on an additional 20 gigawatts of capacity by 2012. (Additionally, in response to CAIR, EPA expects that by the end of 2010 over 110 gigawatts of coal-fired capacity will have both scrubbers and selective catalytic reduction controls operating that often achieve high levels of mercury removal while removing sulfur dioxide and nitrogen oxides, respectively.)

During this period also, sources had installed and were testing approximately 200 continuous mercury emissions monitoring systems. Vendors were in the process of shipping another 500 of these monitors.

Court Challenge

On February 8 of this year, a three judge panel of the D.C. Circuit Court of Appeals vacated CAMR and the related Section 112(n) Revision Rule in State of New Jersey v. EPA; then, on March 14, the court issued its mandate which actually caused the vacatur to take effect. In the Section 112(n) Revision Rule, EPA had revised its earlier decision in 2000 to add utilities to the "section 112(c) list," the list of source categories for which EPA will issue regulations for hazardous air pollutant emissions under section 112. Based on an analysis of mercury emissions and deposition from utilities, and on other requirements of the Act, EPA concluded in 2005 that it was neither appropriate nor necessary to regulate utility mercury emissions under section 112.

In its briefs before the D.C. Circuit, EPA argued that the Clean Air Act treats utilities differently from other source categories of hazardous air pollutants, because section 112 contains a special provision that applies only to utilities. This provision is section 112(n)(1)(A), and it requires EPA to first conduct a scientific study of hazardous

air pollutant emissions from utilities and then to determine, based on the results of that study, whether it is "appropriate" and "necessary" to regulate those emissions under section 112, after accounting for the other requirements of the Clean Air Act. By contrast, other major source categories must be regulated under section 112 solely on the basis of whether the category emits a certain quantity of hazardous air pollutants.

In its February 8 decision, the court disagreed with EPA's argument, and held that EPA could not remove utilities from the 112(c) list without making the findings that applied to removal of other source categories. For this reason, the court vacated EPA's Section 112(n) Revision Rule, which had removed utilities from the section 112(c) list. Further, because EPA's interpretation of the Act is that hazardous air pollutant emissions from a source category regulated under section 112 cannot be regulated under section 111, the court also vacated CAMR which had been promulgated based on section 111 authority. The court did not address any of the litigant's other challenges concerning CAMR, including the validity of the cap-and-trade program.

While EPA respects the D.C. Circuit's decision in this matter, we fundamentally disagree with the court's opinion. Therefore, on March 24, EPA filed a motion for rehearing en banc, asking the full court to reconsider the three-judge panel's decision. Other parties responded to EPA's motion, at the court's request, on April 22. We believe that the panel erred in failing to fully consider the implications of the separate and different provision Congress adopted to govern regulation of power plants. We also felt that it was particularly important to seek rehearing in this case because the panel's decision has significant and important implications. First, if the court's decision remains in force it would require EPA to spend considerable time and resources to issue standards

for power plants under section 112 when the Agency has already concluded, through a notice and comment rulemaking, that it is neither appropriate nor necessary to do so. Second, until EPA issues such standards, the decision subjects affected entities to case-by-case standards as a consequence of section 112(g) of the Act. We are now waiting for a decision as to whether the full court will agree to rehear the case.

Clean Air Act Section 112(g)

As a result of the vacatur of the Section 112(n) Revision Rule and the subsequent issuance of the mandate by the Court, the requirements of section 112(g) of the Clean Air Act now apply. Under section 112(g), no person may begin actual construction or reconstruction of a major source of HAP unless the permitting authority determines on a case-by-case basis that new-source Maximum Available Control Technology (MACT) requirements will be met. New-source MACT determinations under section 112(g) shall not be less stringent than the emission control which is achieved in practice by the best-controlled similar source as determined by the permitting authority based on available information. We understand that there are a number of section 112(g) permit applications that are under consideration by State permitting authorities.

Pursuant to the request of the Subcommittee, I would now like to address two pieces of legislation that are the subject of this hearing.

The Mercury Emission Control Act

The Mercury Emission Control Act calls for EPA to propose regulations limiting hazardous air pollutant emissions, including mercury emission reductions of not less than

90 percent, from coal-fired power plants within 180 days of enactment of the bill, but no later than October 1, 2008. The Administration has not taken a formal position on this legislation; however I would like to note at the onset, that October 1, 2008, is now less than 180 days away. While EPA appreciates the basic objective of this bill, with regard to any new requirements under section 112, we would be concerned that 180 days would be an insufficient time period to gather the data, undertake the analysis and prepare a national emission standard for power plants.

Second, the bill assumes that a 90 percent reduction in mercury emissions from coal-fired power plants is feasible by 2010 using current technologies and at a reasonable cost. Those assumptions may not be valid. While there has been technological progress on controlling mercury from power plants since CAMR was promulgated, we have not done the sort of data collection and analysis that would be required to determine what level of emissions reduction is achievable today. Considerably more time would be necessary to thoroughly investigate the current status of such controls for the wide variety of coal ranks utilized in the United States without prejudging the level of control that may be appropriate.

Finally, the legislation dictates that standards be promulgated under section 112. As a matter of policy, we continue to believe that a cap and trade approach is the appropriate mechanism to control mercury emissions. The technology to control mercury emissions specifically from coal-fired electric generation boilers is new, and there are still challenges in applying it to some boilers. A cap and trade approach promotes the application of the controls to units that can provide the greatest reductions, fosters the development of new technologies and other compliance innovations, and offers cost

savings by providing flexibility while phasing in tighter controls over time. Based on analysis of EPA's acid rain and NOx trading programs and projections of likely application of controls under CAMR, the Agency concluded that its mercury cap-and-trade program was unlikely to result in any hotspots and committed to monitor program implementation carefully to ensure that any problems came to light."

Mercury Export Ban Legislation

Administration efforts are also focused on reducing global, anthropogenic mercury releases to air, water, and land. Much of this work is being undertaken through partnership efforts under the auspices of the United Nations Environment Programme. Examples of these efforts include educating artisanal gold miners on the risks of using mercury and the advantages of using improved technologies and practices; developing mercury use inventories; and building capacity to phase out certain uses of mercury in products. We are also sharing information on technologies to reduce mercury emissions from combustion sources, emphasizing multi-pollutant reduction approaches.

Domestically, in addition to regulatory action, EPA has spearheaded a voluntary program with private industry for the removal of mercury-containing switches in older motor vehicles in order to prevent air emissions during vehicle scrappage and steel recovery. The federal government also remains committed to a safe and effective long-term storage of federal stockpiles of surplus mercury.

S. 906, the "Mercury Market Minimization Act of 2007", is similar to House-passed legislation, and would ban the exportation from the United States of elemental mercury beginning January 1, 2010. The Administration issued a Statement of

Administration Policy (SAP) on H.R. 1534, stating that this legislation is premature pending further analysis of the many issues raised by such a ban. While there are some differences between the House and Senate bills, the issues raised by the SAP that are of concern to EPA are also raised by the Senate bill.

It is our view that there is an inadequate understanding of the potentially negative consequences of an export ban on the environment, industry (both domestic and international), and the Federal government. A ban could also prompt questions under international trade rules. Specifically, analysis should be conducted on whether such a ban (together with a European Union ban) might lead to an overall increase in mercury releases into the environment as the ban would seemingly prevent available stocks of mercury, be they in the United States or elsewhere, from being drawn down or recycled to meet unchanged global demand. Furthermore, it is not clear that a ban would lead to the reduction in high-mercury release uses, such as artisanal gold mining, in developing countries. The Administration has urged the Congress not to legislate until potential impacts are better understood and efforts have progressed to reduce mercury demand and improve mercury management in key countries.

EPA is committed to continuing its work in developing and implementing an effective global solution for reducing mercury risk. EPA believes our current domestic efforts as well as our international partnership work are critical to reducing mercury demand and use worldwide. We are committed to finding protective and comprehensive solutions, and we look forward to working with the Committee and others on this issue.

That concludes my remarks. Mr. Gulliford and I would be happy to answer any questions you may have.

Senator CARPER. Mr. Gulliford, you are welcome to join us at the table. Thank you for your presence today.

Mr. Meyers, in the Clean Air Act, Congress asked EPA to determine if power utilities should be regulated under Section 112, the Air Toxics program. In 2000, the EPA came to us with a resounding yes. Utilities are a major source of hazardous air pollutants, specifically they mentioned mercury, and should be regulated with the maximum achievable control technology.

Five years later, the EPA changes its mind to remove utilities from the program. Could you just start off by explaining the rationale for this?

Mr. MEYERS. The rationale regarding that was detailed in 112(n) revision rule, which was promulgated at the same time as CAMR was. Essentially, we considered that the appropriate and necessary determination made in 2000 was in error and that the provisions of 111 provided a context for regulating mercury under Clean Air Act provisions allowed by 112(n). And on the basis of the 111 provisions, we thought that the 112 provisions were essentially unnecessary.

Senator CARPER. In your testimony, I think you discuss the rigorous continuous mercury emissions monitoring provision that is included in the Clean Air Mercury Rule. You describe the methodologies adopted as "State of the science."

If the Court does not agree to re-hear the Clean Air Mercury Rule case, will EPA use the same State of the science methodology in adopting emissions control standards?

Mr. MEYERS. The monitoring specifically, or the standards themselves?

Senator CARPER. The standards.

Mr. MEYERS. Well, we are requesting rehearing by the full panel D.C. Circuit. We do, as I said, respect the opinion of the Court. If the opinion of the Court stands, our rule is vacated and we would need to proceed under the listing decision in 2000.

Senator CARPER. If the Court doesn't rule in EPA's favor, well, first, let me ask you, when do you expect to hear from the Court?

Mr. MEYERS. That is usually at the pleasure of the Court. Briefs were filed within about the last 6 weeks or so. So I would imagine we would hear relatively soon on the rehearing request.

Senator CARPER. Some time this summer?

Mr. MEYERS. Presumably. The Court has latitude to request further briefing. We don't know exactly until we hear from the Court. They could deny rehearing very quickly or have some further process.

Senator CARPER. If the Court does not rule in EPA's favor, how long would it take to establish standards for hazardous air pollutants, including mercury under Section 112 of the Clean Air Act?

Mr. MEYERS. Well, a typical 112 rulemaking requires, one thing to remember is that the 2005 regulations were based on a 1999 inventory of information requests that we did back then. So the information in 2008 is obviously almost a decade old. So the first step in terms of a 112 process would be information collection, necessary updating of our information on both the emissions and the control technology that has been installed.

We have some information concerning that, but we need to do this in a comprehensive manner, in order to evaluate what, under 112 compiles the best performing 12 percent. So we would do an information request, we would have some analysis of that, public comment. Typically, in terms of MACT, the process for proposal is 12 to 18 months and the process for final is 12 to 18 months, in a range of 2 to 3 years total.

Senator CARPER. With our second panel today, we are going to hear about the mercury emission control technology. I welcome that. I think one of the critical questions to answer with respect to reducing mercury emissions is, how good is the technology today, how good is the technology likely to be three, four, 5 years from now. And does the adoption of a rigorous emissions standard, does it actually incentivize and hasten the development of the technology that will enable us to reduce mercury emissions further.

I am confident that reductions well beyond what was required under the Clean Air Mercury Rule are available with today's technology.

Let me just ask you, do you believe that Section 112 of the Clean Air Act has the flexibility to establish a standard that will require every power plant to install control technology that needs it, while still allowing for some averaging to meet an overall 90 percent reduction? I would just reemphasize the last part of that question, while still allowing for some averaging to meet an overall 90 percent reduction.

Mr. MEYERS. That is a more complicated question than it might appear to be, Senator. But I would answer it briefly, that there are certain flexibilities available within 112 that we have utilized with regard to sub-categorization of sources. In other words, we have looked at different source types and sub-categorized from among the broader source to create different technology requirements.

But 112(d) is a fairly straightforward constraining provision. So each of the standards basically have to be met. The concept of averaging, I would like to get back for the record to search for any examples where we've used averaging broadly across a category. Our approach has been in terms of differences within a category of subcategorization rather than averaging.

Senator CARPER. That is one that we would like for you to get to us on, if you would, please.

[The referenced material was not submitted at time of print.]

Senator CARPER. Senator Voinovich.

Senator VOINOVICH. Thank you very much.

I spent a lot of time the last couple of weeks at home. A great, great complaint from my constituents in regard to the cost of heating their homes. Natural gas costs have skyrocketed, and it appears that they are going to be going up a lot more in the next couple of years.

Is it your opinion that if the technology, and we are going to be hearing more about it today, is not available, commercially and viable, that utilities will fuel switch to natural gas?

Mr. MEYERS. I think a number of analyses that we have performed on various bills, including Clear Skies provisions, including some of what we have done in climate change, so that the economic

incentive is there, fuel switching will definitely occur as a response to constraints.

Senator VOINOVICH. I will tell you, I looked at my utility bill and my wife said to me, she just couldn't believe it, and she said, how can other people be paying the cost of this? I think so often, when we consider some of these things here before Congress, that we give little consideration to the impact that it has on just the average person's standard of living. And you add that on now to the cost of gasoline, and we are hearing a howl come out across the United States of America.

The other issue that I am interested in is the one that I raised in my opening statement, and that was the issue of going from 70 to 90 percent in terms of reducing mercury. Have there been any authoritative studies to indicate the health benefits that would be derived for the American people by going from 70 to 90 percent, understanding that the cost of going from 70 to 90 might be extraordinary?

Mr. MEYERS. I don't know of a specific study that we have done analyzing 70 versus 90. In 2005 we did a considerable amount of detailed work on the health benefits of the emission controls that we were putting in place. It is certainly a question of whether there is a linearity in those between 70 and 90. Again, we will provide information. In other words, whether you get corresponding rate of health benefit for the improvement. We would be happy to provide that information for the record, Senator.

Senator VOINOVICH. In other words, you could provide information on that?

Mr. MEYERS. I believe we can. I don't off the top of my head know of an incremental analysis between 70 and 90. One would expect improvements, benefits between 70 and 90. As I said, I am not sure if that is in a linear fashion or not. But we will provide what information we can.

Senator VOINOVICH. Do you have any information on the additional cost that would be incurred by going from 70 to 90?

Mr. MEYERS. Well, if the reference is between the CAMR rule, which is a cap and trade, versus a 90 percent, 112(d), certainly the cost would be much higher under a unit by unit provision compared to one that required or allowed for trading. If it is not on a unit by unit basis, then it will be less.

The experience and other witnesses in the second panel will, I am sure, get into their experience of installing, is that we have variable results. There are some good results, there are some results over 90 percent, in some cases much over 90 percent. But there are also some challenges with regard to certain ranked coals, lignite and other coals that have difficulty in attaining consistent results of removal. So the cost for a unit that has that problem could be considerable.

Senator VOINOVICH. Off-hand, would you be able to share with us the reduction in mercury as a co-benefit from reducing NO_x and SO_x?

Mr. MEYERS. Yes. I think that is what we detailed in the analysis to accompany the CAMR rule, the first phase of the CAMR rule was linked to the CAIR reductions, which are essentially aimed at NO_x and SO_x and installation of fluidized gas

desulfurization units and SCR technology, which can in certain combinations, certain coals, bituminous coals, give very good results for mercury. Additionally, other technologies, like fabric filters, et cetera, for particulate control, can result also in mercury reductions.

Senator VOINOVICH. What do you mean by good results, 40 percent? Fifty percent? Sixty percent?

Mr. MEYERS. There is a range, sir. Some of the information I looked at in preparation for the hearing would show ranges from 60 to 80, CAMR itself we thought was about an 80 percent overall full effect out of coal. On some bituminous coals, again, we see results that go over 90 and in some cases, waste coal can get 98 percent or more. So it is a range, and it depends, as mentioned before, on the configuration of the plant, the coal, even if it is a certain type of coal, even the sulfur content, various constituents of that, sulfur content, other things are important in how the control technology affects the emissions.

Senator VOINOVICH. And you are talking about that, those are the kinds of numbers you could get from just the co-benefit? Because most of the new facilities or the ones that they are modernizing have——

Mr. MEYERS. We certainly felt the first phase of CAMR would get us to a co-benefit level of at least 38 tons. After that, we saw the installation of ACI technology in the 2010 to 2018 period to reduce further to the 70 percent level. But we would be happy to provide our most updated estimates of the co-benefits from current technology and we have a Clean Air Markets Division that can provide that information to you readily, sir.

Senator VOINOVICH. Thank you.

Senator CARPER. Thanks, Senator Voinovich.

Senator Lautenberg, you are recognized, then we will come to Senator Barrasso, and we have been joined by the Senator from Idaho. Welcome.

Senator Lautenberg, you are recognized at this time.

Senator LAUTENBERG. Thank you, Mr. Chairman.

Mr. Meyers, if we have covered anything that I am asking about, please remind me.

The Federal Court determined that your agency should have required better technology to reduce emissions at all power plants, as opposed to using a cap and trade approach. While you appeal this ruling, there is currently no Federal regulation in place for mercury emissions. How can we further delay regulating the emissions through litigation at the same time that your own website warns of the danger of exposure to mercury?

Mr. MEYERS. Sir, the court decision turned on the objection that the agency had not used what is known as the 112(c)(9) delisting process so the court did not hear arguments further other than to say that the agency was in error for not going through the (c)(9) delisting process in 2005, once it had listed the units in this category in 2000.

But with respect to what we are very seriously looking at our options after the court's decision, I have met several times with my staff to analyze the immediate result. There are some immediate

results, as we indicated in our filing to the court. Section 112(g) applies to units, 112(g) applies to construction, major modification.

Senator LAUTENBERG. In the simplest of languages, please. The nomenclature means a little bit more to you than it does to me. So there is no doubt about the danger of mercury, particularly to pregnant women, their babies. And so do you think it is urgent that we get on with regulating mercury emissions?

Mr. MEYERS. We certainly do think it is important. That is why the agency has taken a number of actions over——

Senator LAUTENBERG. Urgent, Mr. Meyers?

Mr. MEYERS. It is very, very important, urgent. We have many, I would say, health threats that could be considered urgent. Mercury is a very important health threat. We are very serious about addressing it. As I mentioned, in the wake of the court's decision with regard to new, modified plants, you have 112(g). Also right now we have our CAIR program, which effectively, the early actions that are being taken right now with the 2.7 gigawatts of ACI that is installed, I mentioned in my testimony, and the other actions that have been taken to comply with SO_2 and NO_x, we will see mercury reductions. We will see mercury reductions in 2010 and beyond as a result of CAIR.

So we are seriously looking at the options. We do think that the court opinion was in error, as I said. But we will comply with the court opinion.

Senator LAUTENBERG. Studies show that mercury emissions from power plants in the Midwest do lead to mercury hot spots in the Northeast, including in my State of New Jersey. How do we defend a cap and trade system that does not prevent mercury pollution from spreading across the Country? It can move the emissions facility. But that doesn't mean that it isn't putting other people, subjected to the mercury emissions, or mercury consequences.

Mr. MEYERS. When the original rule was promulgated in 2005, we included an analysis on this point in terms of what we saw from cap and trade. Our experience with cap and trade led us to believe that the highest emitters would be incentivized to be the first to control. This is what we saw in the acid rain program, we did an analysis for the record that would show the same effect in the cap and trade. So we thought that the hot spot issue, the localized emissions was adequately addressed by the cap and trade mechanism.

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

Senator CARPER. Thank you, Senator Lautenberg.

Senator Barrasso.

Senator BARRASSO. Thank you very much, Mr. Chairman.

Mr. Meyers, I wanted to talk a little bit about the storage of excess mercury and the Senate bill. There is a House version of the bill as well. I had received a letter from the National Nuclear Security Administration that was sent to me in my ranking role on the Subcommittee on the Superfund, and it was also sent to Senator Boxer, Senator Inhofe. Specifically, it deals with the storage of excess mercury and some concerns that they have from a security standpoint. The letter talks about the House bill contains a provision that would direct the Department of Energy to accept non-Federal commodity grade mercury for log-term storage. I am op-

posed to this provision. This is speaking here, the National Nuclear Security Administrator, he says, "I am opposed to this provision for several reasons, including the impact it would have on the Department of Energy's primary mission and the cost to the taxpayer."

Do you know what the plan is for the storage and the cost related to that, Mr. Gulliford?

Mr. GULLIFORD. If I may, Senator Barrasso, yes. We have conducted an interagency work group on commodity mercury. We have looked at the issues related to storage of mercury. We have commitments from the Department of Energy, Department of Defense, for long-term storage of Federal mercury reserves and products.

We also went to a stakeholder panel to talk about the potential for further storage of privately held mercury stocks, and several things that we learned from that stakeholder panel. First, that there are a lot of technologies, a lot of container options for storage of mercury. Clearly, it is not the problem, for example, of unspent uranium or other nuclear waste.

But still, two things. Basis for the position of the U.S. Government is that it really isn't in the Department of Energy's mission to store private stocks of mercury. So we are not interested in that. And second, that the costs for doing and storing private mercury can be absorbed by private sector, and that there can be private sector solutions to storing long-term storage of mercury as well.

So there are options that are available to the public and there are safe storage containers for mercury storage.

Senator BARRASSO. So in terms of the national security concern, it is not there with this. It is the expense specifically related to it, and the Government shouldn't be the one, or the American taxpayer shouldn't be the one bearing the brunt of that?

Mr. GULLIFORD. Expense and mission.

Senator BARRASSO. I wanted to get to another thing, following up on what Senator Voinovich was talking about, with SO_x and NO_x and mercury and the technology. When I visit with scientists that I am working with, it seems like the research and development results to date, at least, we haven't had the long-term testing, is that if you remove the mercury, then you will substantially lessen trying to simultaneously remove the other emissions, such as the NO_x and the SO_x and particulate matter. It is not like just washing something twice and you get it twice as clean, it doesn't balance exactly. Is that your understanding as well, Mr. Meyers? At least from what we know today?

Mr. MEYERS. Yes, the various coal types, but certain combinations of control equipment, like an SCR, along with back-house or a scrubber on the back end of a unit, can result in very good efficiency and removals. In particular, I think, since the 2005 rulemaking, we are encouraged by the progress that has been made on sub-bituminous coals, which we thought at the time, and it still poses challenges, but were more difficult to control.

Senator BARRASSO. Thank you very much. Thank you, Mr. Chairman.

Senator CARPER. Senator Whitehouse, I think you are next.

Senator WHITEHOUSE. Thanks very much, Chairman.

Mr. Meyers, mercury is extremely toxic, is it not?

Mr. MEYERS. It is a neurotoxin, sir, yes. It is certainly toxic to humans. We have evidence of that through gross poisoning incidents that occur through feed grain, and in Japan. So we have no doubt it is a neurotoxin with very serious effects.

Senator WHITEHOUSE. And Congress demanded that it be controlled through the best available control technologies, correct?

Mr. MEYERS. Congress provided in Section 112(n) for the treatment of power plants and it went through revisions in the 1990 amendments. So it provides a special subsection to the overall section controlling hazardous air pollutants.

Senator WHITEHOUSE. But the idea was that there would be best available control technology to limit mercury emissions, not so?

Mr. MEYERS. Section 112(n) as we read it required the agency to conduct a study and then based on the study, it made a determination, if the agency determined after the study it was appropriate and necessary to regulate it, then provide for regulation. It did not——

Senator WHITEHOUSE. By best available control technology?

Mr. MEYERS. Section 112(n) does not specifically mention best available control technology.

Senator WHITEHOUSE. Do you dispute that that was Congress' intent?

Mr. MEYERS. I think everything we reanalyzed in 2005 in our petition for rehearing speaks of our view that the Congress, in setting up 112(n), set up a special provision for utility units.

Senator WHITEHOUSE. Are coal-fired power plants the largest source of human-caused mercury pollution?

Mr. MEYERS. In the world or in the United States?

Senator WHITEHOUSE. In the United States.

Mr. MEYERS. I think they are the largest remaining source. They did not used to be the largest source.

Senator WHITEHOUSE. But they are presently the largest source?

Mr. MEYERS. Of the category, yes, I think they are the largest remaining source.

Senator WHITEHOUSE. And EPA exempted, in effect, coal-fired power plants from best available control technology through the administrative stratagem of proceeding to the cap and trade program, correct?

Mr. MEYERS. We did not exempt, we sought to control them under Section 111 versus Section 112 under a new source performance standard versus a MACT standard.

Senator WHITEHOUSE. Which did not require that best available control technologies be currently applied.

Mr. MEYERS. It did not require best available control technology on each unit, sir, that is correct.

Senator WHITEHOUSE. And the court found that to be unlawful, correct?

Mr. MEYERS. The court found that our delisting decision was unlawful. In other words, the court said that once EPA had listed the substance, it could not delist it, which we did in the 112(n) revision rule, without going through Section 112(c)(9).

Senator WHITEHOUSE. And having departed from the per plant best available control technology requirement, and gone to the administrative stratagem of the cap and trade program, did you con-

sider that there might be any legal risk whatsoever to that program?

Mr. MEYERS. Well, I was at the agency during that period of time. Certainly we evaluated legal risk with all our regulations. That is——

Senator WHITEHOUSE. Did you see any legal risk in not going forward that way, that this might be challenged and overturned by courts? Was that a hypothesis that you considered?

Mr. MEYERS. I would say there is some degree of legal risk in every decision that we make. There was a legal decision in this——

Senator WHITEHOUSE. Legal risk in this decision? Yes. Despite that, was there any kind of backstop regulation or effort to followup under a pure best available control technology regime?

Mr. MEYERS. I think in this case, sir, the backstop was CAIR. The backstop was our separate regulation on SO_x and NO_x which produced the co-benefits.

Senator WHITEHOUSE. Which mercury just followed along on, right?

Mr. MEYERS. Yes, although those same controls can be optimized for mercury control.

Senator WHITEHOUSE. Was that mandated that they be optimized for mercury control?

Mr. MEYERS. No. It was incentivized through the cap and trade system that we promulgated. It was not mandated for each unit.

Senator WHITEHOUSE. If it was the agency's intention to avoid controlling the release of emissions of mercury by coal-fired power plants, if it was their intention to avoid that——

Mr. MEYERS. No, not at all.

Senator WHITEHOUSE. Hang on. That is the hypothesis. Let me ask the question. Can you think of any better way you could have achieved it than to establish a parallel, unlawful cap and trade program that was itself defeated without any backstop so that you leave nothing but the SO_x and NO_x program to protect Americans from mercury emissions? If you said to them, no, we are just not going to do it, there would be an easier challenge. It strikes me that this is the best conceivable way to avoid doing this. And it is a very clever, if you wanted to follow a very clever stratagem to avoid meeting your duties, it would be hard, I can't think of a better one than this. Could you think of a better one?

Mr. MEYERS. Sir, at the end of the day, we promulgated regulations to control mercury in two phases. So it was our intention to control mercury emissions from power plants.

The basis of your hypothesis is that we would know in advance how a court would rule and essentially use that unknowable to affect our behavior before we got to court. Our intention was to control mercury emissions, which we thought we did in the best manner through a cap and trade system.

Senator WHITEHOUSE. My time has expired.

Senator CARPER. Thank you for those questions. Senator Craig, your turn.

Senator CRAIG. Thank you very much, Mr. Chairman. As it relates obviously to your legislation and the concern we all have about mercury emissions, this is a timely and important hearing. I guess my frustration is, where do we begin and how do we handle

it in lieu of the technology that isn't available yet or isn't available as readily and applicable to retrofitting current generation capability as it is possibly to future.

Deputy Administrator Meyers, as EPA looks at this issue and the knowledge over mercury grows, how does mercury transported from China affect the United States? My point is, once mercury is gasified and goes airborne, how long does it stay airborne. We have all gotten a big surprise here in the last year. China wasn't to surpass the United States for some time in coal-fired emissions. Well, they did in June. And within those emissions and the technology that produces them, I have to assume there is a high level of mercury along with CO2.

Do we know about how long it stays airborne and with the rate of growth and the online coming of generating capacity in China, they do it now weekly, bringing new coal-fires online, what kind of an impact is that, or do we understand what kind of an impact that is having on the United States as it relates to mercury?

Mr. MEYERS. Sir, we do have some ideas. In answer to your first question, mercury is emitted in essentially three different forms. Depending on the form, it can be transmitted for very long distances for very long periods of time. Essentially there is transport, international transport within the continental U.S. The effect of international transport versus local sources varies. On the West Coast, it is higher, you see perhaps 85 percent international transport contribution on the West Coast. On the East Coast, the number is more like about 50 percent.

But there is variability in the regions. There is variability also, I would say, too, with respect to the ultimate health effect, because what we were talking about, the mode of exposure of any of this, is consumption of fish. So it doesn't matter to the water body how the mercury gets there. It doesn't matter if it came internationally or if it came from a local source or if it came through some other source of pollution or leaching from soil.

What matters is that there is methylation in the pond and that the mercury then bioaccumlates through the food chain and is consumed on a regular basis, causing the health effects. So the short answer to your question is that there is transport, the degree varies. It is substantial, but it is something that we are continuing to evaluate. We have observatories in Mauna Loa in Hawaii that are trying to assess this right now.

Senator CRAIG. So in other words, we don't really know yet? We know it is happening?

Mr. MEYERS. We know it is happening. We have a rough idea of the extent. But I don't think the State of our science is such that we could point to China or any other country and say with certainty X amount of mercury comes and is deposited in Rhode Island or Iowa or any other State.

Senator CRAIG. As compared to, OK.

Mr. MEYERS. It is a global pool of mercury and it is emitted from a lot of different sources.

Senator CRAIG. We have heard a lot today about what some people think is wrong about EPA's approach toward controlling mercury. Can you explain to me, Administrator Meyers, what the bene-

fits of the cap and trade approach are that haven't been brought out here today?

Mr. MEYERS. Yes. I think we demonstrated the benefits of cap and trade, and one prime example is Title IV of the Clean Air Act, the Acid Rain program. Congress approved that in 1990. The performance of that program to date, we have exceeded expectations in terms of the cost, reducing the cost of control. It is a very transparent system for compliance, too. It doesn't take many resources to know what is going on, because we have tracked the allowances.

So we believe that system was appropriate in mercury. We analyzed it. We were concerned, and we have heard the concern over hot spots. We did an analysis to indicate, as I indicated, that the larger sources, those that emit a lot under a system that incentivizes and essentially makes somebody pay a price for pollution, they have the most incentive to control. So we would expect to see the reductions at the largest sources first. That is what we saw in acid rain.

Senator CRAIG. But in the end, if coal continues to be used in the way we are currently using it, in the same ratios of electrical generation, technology has to be the answer to keep it out of the environment to begin with?

Mr. MEYERS. Absolutely. With regard to mercury, mercury is in coal. So you either capture through traditional air pollutant control technology or you move to ACI, activate carbon injection or some other sorbent controls that have been or are being demonstrated right now.

Senator CRAIG. Thank you. Thank you, Mr. Chairman.

Senator CARPER. Thank you, Senator Craig.

Senator Klobuchar, welcome.

Senator KLOBUCHAR. Thank you very much, Mr. Chair. And thank you for being here, Mr. Meyers.

As you know, Minnesota is the Land of 10,000 Lakes. However, mercury contamination has already cast a shadow over our fine tradition of grilling walleye and northern pike over our campfires. More than two-thirds of the lakes that have been tested in Minnesota are contaminated with mercury levels that exceed the Clean Water Act standards.

A number of the species of fish in our lakes can't be eaten safely once a month. The mercury in the fish, of course, passes through the people who eat it, and is especially dangerous for pregnant women. Data from 2001 indicates that one of every 70 babies born in Minnesota each year may be affected by mercury toxicity.

The good news is that Minnesota has been very proactive on mercury, and we are a national leader. Starting in the early 1990's, Minnesota has passed a number of State laws. These efforts culminated in a comprehensive law in 2007 where Minnesota banned nearly every remaining use of mercury in consumer products, even in thermostats and thermometers. We have also passed a law requiring the three largest power plants in the State to reduce their mercury emissions by 90 percent by 2015, and our utilities were actually supportive of these measures.

All told, our efforts have resulted in a reduction of 70 percent of Minnesota's mercury emissions since 1990, and we will go even higher with the effects of our new law.

So my questions are along those lines. My State's efforts in banning mercury from consumer products, cleaning up power plants, have resulted in this reduction. But I have been told by our State experts that 90 percent of the mercury that is deposited in our lakes comes from outside of Minnesota. So what good does it do for our States to undertake these efforts if the Federal Government doesn't follow suit? That is my question.

Mr. MEYERS. In response to your question, I think we did take action to address the concerns of your State and other States through our rule. We thought that the 70 percent control levels, and we effectively think, when we further analyze it, it would be up to 80 percent from coal, mercury from coal-fired power plants, would be produced under our CAMR regulations.

So when the court vacated our regulation, in a sense, there is no mercury regulation at the Federal level right now. We are disappointed in that decision because we thought we were moving in the right direction.

Senator KLOBUCHAR. But even your direction was not as aggressive as Minnesota has been, that is my understanding.

Mr. MEYERS. I will posit that is true. One thing about CAMR, when we started, before CAMR existed, there were I think three or four State programs to control mercury. In the years since CAMR, I think over a couple dozen or more States have taken action.

One of the benefits of CAMR, I think, was that States did act. I think your action may predate CAMR, it probably does. But I am not claiming causality here. The States have focused, were allowed to go stricter, and they could go stricter then have direct control programs under the CAMR system.

Senator KLOBUCHAR. Our utilities, as I said, agreed to reduce their mercury emissions by 90 percent by 2015. That would be Excel and Minnesota Power. If they have agreed to do this, why can't the rest of the Country do the same?

Mr. MEYERS. I would have to look into the configuration and the coal types that are used by the utilities in your State. I don't know also in terms of some of the State programs that are enacted, also I am not sure if this is the case in Minnesota, but I am aware in some States there were escape clauses on the provision. They were providing for 90 percent, as long as the control technology proved out.

Again, I am not aware——

Senator KLOBUCHAR. Well, you should also know Excel agreed to a 30 percent, that 30 percent of their electricity be provided by renewables by 2025. So they have been very devoted to this idea.

My last question, actually, another topic. In the past, one large source of mercury emissions in Minnesota was the incineration of trash to produce electricity at our nine waste-to-energy facilities. I understand that there have been enormous strides made in cleaning up the emissions from these plants, such as to the extent that they no longer really rank among our principal mercury sources. Could you talk about the progress that has been made with this technology and what are your thoughts on the expansion of waste-to-energy as another source of electricity for our Country?

Mr. MEYERS. Certainly there has been progress. We promulgated rules to require those reductions. Waste-to-energy has been around for a couple of decades, different incentives have caused its growth including PURPA and qualified facilities under that law, which initially provided for purchase by traditional utilities of that power that avoided cost. I am not an expert in waste-to-energy, I assume there is some room for growth, as there is in most endeavors.

We are supportive of those efforts, as long as they are in compliance with our regulations.

Senator KLOBUCHAR. Thank you very much.

Senator CARPER. Senator Cardin, I believe you are next.

Senator CARDIN. Thank you, Mr. Chairman.

Let me ask unanimous consent that my opening statement can be made part of the record.

Senator CARPER. Without objection, so ordered.

[The prepared statement of Senator Cardin follows:]

STATEMENT OF HON. BENJAMIN CARDIN, U.S. SENATOR FROM THE STATE OF MARYLAND

Madame Chairman, thank you.

In my home State of Maryland there are 14 water bodies listed for not meeting water quality standards due to mercury pollution. Marylanders are can't eat all the fish they catch because fish from some Maryland streams and lakes contain mercury. Eating these fish can be especially dangerous to women of child bearing age and to young children. Unfortunately, Marylanders are not alone—nationwide, mercury pollution has contaminated 12 million acres of lakes, estuaries and wetlands—30 percent of the national total—and 473,000 miles of streams, rivers and coastlines.

Mercury is a persistent, bioaccumulative toxic metal—it accumulates and concentrates up the food chain. Although it occurs naturally in the environment, over the past century human activities, including industrial emissions or practices and poor waste management, have substantially increased the amount of mercury released to the environment, particularly via atmospheric emissions. Each year, U.S. power plants and other industrial facilities spew about 150 tons of mercury into the air.

Once released to air, mercury can be transported long distances. Consequently, a large portion of mercury that is deposited in Maryland originates from other sources. A 2007 Maryland Department of Natural Resources report estimates that about 88 percent of the total mercury deposition in the Chesapeake Bay watershed originates from outside of Maryland.

While concentrations of mercury in the air are usually low, mercury eventually reaches our waterways where it can be transformed into methylmercury by bacteria, a form of mercury that readily bioaccumulates in fish tissue. Humans can become exposed to this form of mercury via eating fish.

Mercury is toxic to the developing nervous system and can impact brain development—particularly in the fetus and young children. Due to these concerns, the Maryland Department of the Environment issues guidelines for how much recreationally caught fish (mostly freshwater fish) can be safely eaten, while the U.S. Food and Drug Administration issues guidelines for commercially marketed fish.

MDE considers a waterbody to be impaired—that is to say, not meeting its "fishable" use—when, for indicator fish species, the methylmercury concentration exceeds 300 parts per billion of edible fish tissue. Water bodies with average fish tissue methylmercury levels above 300 ppb are listed as "impaired" under the U.S. Clean Water Act. Such listing triggers the need for a future Total Maximum Daily Load analysis.

Issuing waterbody impairment advisories and recommending reduced fish consumption do protect human health, but represent insufficient action on the part of the Federal Government in fully protecting human health and that of the environment. We should act to reduce mercury emissions, remove mercury from all industrial practices—particularly those for which there are cleaner and safer alternatives, and not export mercury overseas where it might endanger the lives of others.

Because of my concern for public health and protection of the environment, I've co-sponsored legislation related to reducing mercury in our environment by banning particular industrial practices as in the making of chlorine and caustic sodas.

I look forward to hearing from our witnesses about their support and concern for this and other legislation. I hope that we can act promptly on the issue of mercury to improve global public and environmental health.

Thank you Madame Chairman.

Senator CARDIN. Let me just make a quick observation before I ask Mr. Meyers a couple of question. There are 14 water bodies in Maryland that have now been listed as not meeting safe standards as far as mercury pollution is concerned. The consequence is that there are fish that are caught that are not safe for human consumption. Warnings have been issued, as you know, for women of child-bearing age and children. We know that mercury can have a devastating effect on children as far as their brain development. So it is a serious health issue.

And just to underscore a point that has been made by some of my colleagues in their questions, there was a 2007 Department of Natural Resources State study that showed that 88 percent of the mercury pollution in the Chesapeake Bay comes from outside the State of Maryland. So the airborne problems are real and they are having an effect in our States.

Mr. Meyers, my question to you is that the EPA, in conjunction with other Federal agencies, has convened a stakeholders group to look at ways to deal with non-Federal sources of mercury. It is my understanding that the last meeting was in September 2007. My question is, when could we anticipate recommendations coming out of that stakeholders meeting on non-Federal supplies of commodity-grade mercury?

Mr. MEYERS. Senator, if I could, let me have Mr. Gulliford answer that.

Mr. GULLIFORD. We have concluded that stakeholder group. They have provided input to us on a variety of issues related to mercury management options from Federal storage to private storage to the issue on the export ban and a lot of issues associated with it.

Clearly, some of the issues that are important to us from a Federal Government standpoint are the costs of doing that. Should those costs be borne by the American public or should they be borne by those private companies that own that mercury? Second, is it a part of the Department of Energy's mission to have the responsibility to store non-Federal sources of mercury?

So clearly, a lot of the conclusions from the interagency work group on commodity mercury are that one, we are certainly supportive of the decision by both the Department of Energy and the Department of Defense to store for considerable terms the Federal Government's mercury that is in the possession of the Federal Government.

Second, we don't believe that it is the Federal Government's responsibility to store privately held mercury. Clearly, there are technologies in terms of containers that are adequate to safely store mercury for an extended period of time, that can be done by the private sector as easily as it can be done by the Federal Government. At this point in time, we believe that it is probably more appropriate for private industry to store their own mercury.

Senator CARDIN. Do you anticipate that there would be recommendations to restrict the exporting of excess mercury here from the United States to other countries?

Mr. GULLIFORD. A little bit more on background of the commodity mercury stakeholder panel. It was not a FACA, so we did not ask them for recommendations. We asked them for input. There was no attempt to arrive at a consensus opinion. There are a variety of opinions held. I think there was, if you were to look at the type of input that we got, clearly there was an interest on the part of industry for the Federal Government to be the storer of excess commodity mercury. I think of non-Government organizations as well, there was that interest as well.

But the facts clearly don't require the effective storage of commodity mercury, that it has to be done by the U.S. Government.

Senator CARDIN. I understand that, I am somewhat disappointed, but I am somewhat disappointed there are not recommendations. My interest is getting the best information available to try to make the right policy judgments. It seems to me that one of the avenues that should be explored is that perhaps the Federal Government should take on a greater responsibility in the storage of mercury in exchange for which there would be restrictions on the export of excess mercury, so that we don't have other countries that have been more careless in the use of mercury having additional sources.

Now, some have argued that that might just increase the mining of mercury. I am not aware, maybe you are, of any evidence to that effect. It seems to me if we can control what is in this Country and make sure they are not getting into the hands of irresponsible users, that would be in our interest.

Mr. GULLIFORD. Again, several points to your question, your series of questions there. First, all the information that came from the stakeholder panel is available to the public. It is available on our website. We collected that information, reviewed it with the members to make sure that it was accurately reflected in that. So that information clearly is available.

Second, however, we believe that at this point in time, the most appropriate actions that we can take with respect to mercury in products and mercury that is released as a part of processes or uses of mercury in processes, that the actions we can take to most appropriately be protective are to reduce the demand for mercury.

It is clear that mercury is available from a variety of sources, and simply prohibiting the export of U.S. sources of mercury, it is very difficult to predict what the outcome of that would be with respect to mercury uses. You speak to issues of mining. Again, we believe that the most appropriate action we can do is to discourage or take actions to eliminate existing mining activities that are occurring.

The U.S. Government has supported initiatives by the Swiss to look at an analysis of mercury mining in Kyrgyzstan, the largest mine that still operates and produces mercury, to look at options for reapplying the mining industry there in a way that does not, rather than mine mercury, looks at other products to mine in a way that can still support the economy that mining is important to in Kyrgyzstan, but reduces the additional input of mercury into whatever the global amount of mercury that exists, again, in the

area of commodity-grade mercury that is available for products or processes.

Senator CARDIN. That is a very helpful answer. I would just point out, if we restrict the export of mercury there will be less mercury. The bottom line is going to be less.

Mr. GULLIFORD. I think, though, one of the points you ought to also consider is what are the impacts on trade, and that there are a lot of uses of mercury still in this Country that are allowed. We assume that those uses are still allowed in other countries as well, and the ability of those countries to have access to mercury for those acceptable, allowable uses, is something that we ought to be concerned about with respect to our trade commitments and our trade agreements.

Senator CARDIN. Thank you, Mr. Chairman.

Senator CARPER. Thank you, Senator Cardin.

We have votes which are expected to start around 11, then 11:10 and 11:25. I am told that the debate is winding up on the flight insurance bill and that we can expect to start those votes soon but not immediately.

We are going to get into a second round here, I think it will probably be truncated somewhat. But let me just start off by asking Mr. Meyers, as you may recall, a number of my colleagues have joined, Democrat and Republican colleagues, have joined me in introducing our Clean Air Planning Act, re-introducing our Clean Air Planning Act, which would require power plants to significantly reduce nitrogen oxide, sulfur dioxide, mercury and CO2 emissions.

With the Clean Air InterState Rule and the Clean Air Mercury Rule both involved in court challenges, do you think that this might now be the right time for EPA to consider combined multi-pollutant regulation of power plant emissions?

Mr. MEYERS. Well, sir, as you know, at the time you introduced your legislation, the Administration also had the Clear Skies Act that was before Congress and actually considered by this Committee in early 2005, I believe. So we certainly, as an Administration, have always advocated a multi-pollutant approach, and have never wavered in that.

With respect to where we are, there is a difference between CAMR and CAIR. In CAMR, we clearly have a court vacatur and with regard to CAIR, arguments have been heard, oral arguments and there is no decision yet. We await that court's review and decision.

Senator CARPER. All right.

One of the questions, maybe Senator Craig asked the question about the source of mercury emissions that come to this Country, how much might be coming from China. My staff did a little bit of homework here, and it looks like somewhat, something maybe just a bit less than half of the mercury emissions that are deposited in this Country come from sources that emit in this Country, so maybe just a bit less than half come from sources within the U.S., and the remainder come from sources outside of the U.S.

Question one for Mr. Gulliford, and then I will have some other questions for the record, Mr. Gulliford, in Mr. Meyers' written testimony, potentially negative consequence are mentioned in association with an export ban. I don't know of any consequences worse

than the negative health impacts on our children. Could you please explain for us the anticipated negative consequences that would justify delay in implementing an export ban?

Mr. GULLIFORD. Again, the issues of an export ban really aren't very well studied in terms of what the implications may be on additional mining. We do believe we understand the Kyrgyzstan mining situation and that it is unlikely that additional mining could occur there. I don't think we do understand very well the potential implications for mining in China. So that is the first issue with respect to unintended consequences.

Second, do we achieve the consequences that we want to. If you look at the use of a lot of the mercury where uses are currently increasing, it is in artisenal mining. We know that people in different countries, poor countries where people do artisenal mining, they look at mercury as a way to enhance their recovery of gold. For that reason, they pay for mercury. We have no reason to expect that mercury export ban would change the dynamics of the mercury that gets into the hands of those people and allows them to use it.

Clearly, we believe that the better approach is the one that we have chosen to work with UNEP and mercury partnerships, to work with those people to help them understand that there are alternatives to the use of mercury, and there are also safer ways, even, to use mercury in artisenal mining. We believe that the benefits of that work is clearly superior.

Senator CARPER. Thank you. I have used 4 minutes and I am going to relinquish the remainder of my time, and Senator Voinovich, if you could just keep your questions to about 4 minutes, that would be good.

Senator VOINOVICH. I have no questions.

Senator CARPER. Senator Voinovich has no questions.

Senator Lautenberg? All right. Senator Whitehouse? Last opportunity.

Senator WHITEHOUSE. I am told that the vote has been called.

Senator CARPER. Yes, the vote has been called.

Gentlemen, the record will remain open for about another week. A number of our colleagues, including myself, will want to ask some additional questions. We would ask that you respond in writing as promptly as you could.

Senator Lautenberg?

Senator LAUTENBERG. When we are we going to leave for the vote?

Senator CARPER. My inclination is actually to get started on the second panel.

Senator LAUTENBERG. Then if I might just take a minute to introduce Ms. Jackson.

Senator CARPER. Sure. We are happy to do that.

With that, the first panel is excused. Thank you very much for joining us today.

I would invite the second panel to come forward.

Senator Lautenberg, please feel free to introduce Commissioner Jackson. My recollection is, Commissioner Jackson, that you had been invited to testify a couple of months ago at another panel, and you were unable to come, someone else did come in your absence.

As I recall, she did an excellent job. We are delighted that you are here today.

Senator LAUTENBERG.

Senator LAUTENBERG. She is committed to New Jersey, Mr. Chairman. Thank you very much.

Mr. Chairman, I am honored to introduce to our Committee the Commissioner of New Jersey's Department of Environmental Protection, Lisa Jackson. Commissioner Jackson is a highly effective advocate for our environment in New Jersey, and I think probably does some good for Delaware, even in her pursuit of that assignment. She has dedicated her career to public service, having previously served 16 years at the Federal level with EPA. Together, we have worked on project important to New Jersey, keeping our air clean, fighting global warming and protecting our State's strong chemical security laws.

So as usual, I look forward to her testimony and to her continuing to work on her protection of our environment. We thank you very much for being here.

Thanks, Mr. Chairman.

Senator CARPER. Senator Lautenberg, thank you for that introduction. I think what I am going to do is just briefly introduce the other panelists, and then ask Commissioner Jackson to actually begin her testimony. Then when you conclude, we will probably run and begin the first of four votes.

Our second panelist, following Commissioner Jackson, will be Dr. Michael Durham, Officer and Board Member of the Institute of Clean Air Companies. Thank you for coming today.

Next is Dr. Steven Benson, Senior Research Manager and Advisor of the Energy and Environmental Research Center. Thank you for coming.

Dr. Leonard Levin, Technical Executive of Air Quality, from the Electric Power Research Institute. Thank you for joining us.

Finally, Vickie Patton, Deputy General Counsel, Climate and Air Program of the Environmental Defense Fund. It is good to see you. Thank you so much for coming.

Commissioner Jackson, your entire testimony will be made a part of the record. In fact, the same is true for all of our witnesses. Feel free to summarize as you see fit. I will ask you to stay within a 5-minute time period, if you could. Thank you.

STATEMENT OF LISA P. JACKSON, COMMISSIONER, NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

Ms. JACKSON. I am happy to. Thank you, Mr. Chair.

I have to thank Senator Lautenberg for that lovely introduction, but also for his leadership on so many environmental issues in our State and for his support of me personally and for the Governor's environmental agenda.

And Senator Carper, I have to thank you for keeping a multi-pollutant focus, first and foremost, when it comes to air emissions. I think that will in the end be a good solution to many of our problems, including the mercury problem that we discuss here today.

I will summarize my remarks as follows. The court cited Lewis Carroll in vacating the rule, so I will keep the same analogy and ask members of the panel and members of this Committee to look

through the looking glass at an alternative reality to where we find ourselves nationally with respect to mercury regulation. The State of New Jersey really has been a leader on regulating mercury. And it is regulation, it is strong regulation for mercury.

But like the State of Minnesota, it was regulation that was supported by our electric generating industry within the State. As a result of having moved forward with regulation, decades ago, a decade ago at least, we have experience now that we offer to this Committee that we hope is instructive to you as you consider S. 2643. Certainly, New Jersey supports S. 2643. We believe it is the right path in terms of continuation of mercury regulation. New Jersey has a long history of working with its stakeholders as well, and on implementing regulation, and, I have to note, fine-tuning them as we learn. Because have learned in New Jersey and in States throughout the Northeast that forcing technology in American ingenuity means that we learn to improve technology as we go. I think that is my lesson here.

Indeed, Alyssa Wolfe was here about a year ago. I couldn't appear at that time because of wildfires in our State. I am glad to say that is not the case today.

New Jersey is not alone in supporting S. 2643. The Environment Council of the State recently adopted a resolution at their meeting in New Orleans encouraging EPA to expeditiously issue a mercury rule.

I would like to talk a little bit about the technology, because I know that is the focus of this panel. In the last year, mercury control projects in New Jersey confirm that 90 percent control of mercury from coal-fired electric generating units is achievable, is achievable now. Our first experiences with municipal solid waste incinerators, we have 12 years of having required mercury regulation of MSWs, and in that time, mercury emissions have dropped by about 90 percent in the first year of carbon injection installations on 13 incinerators.

After years of experience, mercury control levels are now between 95 and 99 percent for all units in the State. Carbon injection for those units has proven to be low cost, quick to install and highly effective on units as long as those units have good particulate control. For the 13 incinerators in New Jersey, carbon injection took less than 1 year to install, and that was back in 1995.

With respect to coal, the ten facilities in our State are in various stages of implementing mercury control. What we have learned so far is that carbon injection prior to fabric filters achieves over 90 percent mercury control and very low emissions of mercury. We have some units in our State, particularly the connective deepwater facility, which achieves our mercury emissions requirements without injecting any extra carbon, primarily because their process produces carbon and that provides enough carbon to effectively control mercury emissions as well.

Initial testing shows units with well-designed electrostatic precipitators, ESPs, can achieve close to or greater than 90 percent reduction. Some ESPs do need to be supplemented with fabric filters as we are finding out at the PSEG facility in Mercer County. And recent tests of carbon injection at RC Cape May's BL England Plant showed over 95 percent control. I would like to note for the

Committee that that is with high sulfur coal. So we are seeing 90 percent removal, and that is a high sulfur coal, which I know has been a concern. I am sure we may hear from some members of the panel with respect to that issue.

Units with less effective particle control are less effective at capturing the mercury, even if you inject carbon. So some units in the U.S. will likely need to upgrade particulate control in order to achieve 90 percent. That is in my mind very appropriate, this is maximum available control technology. It is very important to remember when you look at costs and benefits that you remove much more than mercury. You deal with hazardous metals, hazardous organics, particulate matter, even dioxins in some cases.

Addition of fabric filters can take longer than a year.

I will not talk about the court action, although I am happy to in my remarks, and we certainly have a section in my written testimony.

In summary, I would just like to say that continuing to have a 90 percent reduction option is extraordinarily appropriate in my mind for mercury. Ninety percent reduction in mercury emissions from coal-fired plants is achievable. It is an appropriate requirement of S. 2643. I applaud the fact that that piece of legislation would look at more than just mercury, would be multi-pollutant in its approach.

And I would suggest only one, with respect, potential modification, which is to do what we have done in New Jersey, which is to provide an emission rate option, so that you have an option of 90 percent removal or a rate of emissions per megawatt hours, say, or megawatt, such that if you start with very low mercury coal, you are not trying to get to an extraordinarily low level of mercury if you mandate 90 percent across the board.

I do not believe emission trading for neurotoxins is an appropriate approach, frankly. Mandating a Section 112 MACT performance standard will ensure that kind of trading does not occur.

I also believe we need MACT standards for all hazards. Thank you very much.

[The prepared statement of Ms. Jackson follows:]

Statement by
Lisa P. Jackson
Commissioner, New Jersey Department of Environmental Protection

on
"The Mercury Emission Control Act"

Before the

U.S. Senate Committee on Environment and Public Works

May 13, 2008

Introduction

Good morning Chairman Boxer, Ranking Minority Member Inhofe and members of the committee. I am Lisa Jackson, Commissioner of the New Jersey Department of Environmental Protection. I thank you for the opportunity to come before you today and provide New Jersey's perspective on S.2643, the "Mercury Emission Control Act."

The New Jersey DEP strongly supports the enactment of S. 2643. This bill would require the US Environmental Protection Agency (EPA) do what it should have done in the first place: impose regulations on electric generating utilities to meet Maximum Achievable Control Technology and significantly reduce those facilities' emission of mercury. It was just a year ago that my Counselor, Alyssa Wolfe, appeared before your subcommittee on Clean Air and Nuclear Safety to testify on the importance of regulating mercury. Since then the court has vacated EPA's mercury trading rule. The enactment of S. 2643 will direct EPA to now do the right thing, adopt performance standard that are Maximum Achievable Control Technology (MACT).

It should also be noted that control of mercury emissions is not simply an issue affecting a few States. The Environmental Council of the States (ECOS), a national non-profit, non-partisan association of state and territorial environmental agency leaders, has called on "the President and Congress to pursue substantial reductions in mercury releases" and to "obtain the most aggressive mercury emissions reductions achievable, consistent with the provisions, intent and goals of the Clean Air Act." ECOS agrees that EPA should proceed expeditiously to issue the mercury rule.

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 one in ten pregnant women in the State have concentrations of mercury in their hair samples that exceed safe levels. Nationwide, the EPA 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. Credible epidemiological evidence also strongly indicates an association between methyl mercury exposures in adults and increased risk of fatal and non-fatal heart attacks resulting in premature mortality.

New Jersey and the rest of the mid-Atlantic and northeast regions of the country have been particularly impacted by mercury. Power plants are the single largest source of the country's mercury emissions, emitting almost 50 tons of the neurotoxin per year. The significant number of power plants, 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 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% 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, forty-five 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 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 USEPA chose to disregard this Congressional mandate and instead exempted power plants from the stringent MACT standards of the Act. EPA's plan, entitled the "Clean Air Mercury Rule" or "CAMR" had several fundamental problems. First, in violation of the Clean Air Act, CAMR removed power plants from the typical hazardous air pollutant regulations without meeting the clear statutory requirements for such an exemption. Second, CAMR attempted 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 would have allowed certain facilities to purchase emission credits and escape any reduction in their mercury emissions. People living nearby such polluters would be exposed to continuing high levels of mercury. Third, CAMR would have taken decades to implement. In the final CAMR, EPA admitted that despite a "hard cap" of 15 tons in 2018, due to banking, its own analysis projected that mercury emissions would be reduced by only about 50% in 2020 from a 1999 baseline of 48 tons. The cite is 70 Fed. Reg. 28,606, 28,619 (May 18, 2005). Because emission credits can be banked, the Congressional Research Service reported that full implementation would not have occurred until 2025 or later. This rule would have provided little protection to the thousands of newborns suffering from mercury exposure every year. Finally, even at full implementation in 2025, CAMR levels of emission reductions (70%) did not even reflect today's MACT (90% or better).

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 power plants 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 power plants, 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 2010; 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 power plant 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 power plants 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. The Department adopted this combination standard to base the mercury on the median mercury coal and the percent reduction on the worst case mercury coal. This ensures that significant reductions occur for the median coal, and the worst case coal can still be burned with good air pollution control. You may want to add an emission rate as an alternative limit for the same reason.

Final compliance with the New Jersey rule is required by December 2012, for companies implementing a multi-pollutant control strategy. Every plant will have to reduce emissions without using emissions trading. A company that commits to reducing substantially air pollution that causes smog, soot and acid rain, as well as mercury, has an additional five years to comply if mercury emission reductions are phased in with concurrent reductions of particulates, sulfur dioxide 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 2012.

I would like to highlight the particulate emissions 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 emissions. Many coal EGUs have outdated and poorly performing particulate control equipment. This control needs to be upgraded for:

a. Mercury Control
b. Other toxic heavy metal control, and
c. Fine particulate emissions control

Recent mercury stack test data with carbon injection control on coal fired boilers indicate compliance with the New Jersey standard is achievable. I am here to state to you

unequivocally that, based on New Jersey's experience, the 90 percent reduction target is indeed achievable. This is true for all types of coals burned in New Jersey including eastern bituminous coals with high sulfur contents. Recent tests of carbon injection at the BL England power plant showed over 95% mercury control when burning high sulfur coal. Our power plants, 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 power plants. EPA's Utility MACT Working Group, the Mercury Study Report to Congress and the tests conducted in New Jersey at coal-fired boilers for control of mercury emissions all reflect that mercury reductions exceeding 90% can be achieved by power plants across the country.

Furthermore, while New Jersey's rules are among 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 power plants 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% reduction in mercury from power plants 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 power plants, burning every type of coal, are performing better now than CAMR would have required them to perform almost twenty years from now, in 2025.

It is now time for the EPA to come to the same conclusion. However, even with the defeat of CAMR in the court, EPA is still dragging its feet on setting MACT performance standards for coal combustors, which is why enactment of S.2643 is so important.

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 extremely weak or ineffective 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 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 challenged EPA's failures in court. Seventeen states, 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. The court has agreed and vacated the EPA's CAMR rule.

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.

Discussion of Court Action and Potential Delays Because of Additional Legal Maneuvering

On February 8, 2008, eighteen years after Congress directed EPA to study the hazards to public health reasonably anticipated to occur as a result of HAP emissions by power plants, 15 years after Congress directed EPA to report the study results to Congress, and eight years after EPA determined that regulation of coal- and oil-fired power plants under Section 112 is appropriate and necessary, the Court of Appeals for the D.C. Circuit vacated EPA's mercury rules that replaced stringent MACT standards for power plant HAP emissions with a weak mercury pollution trading scheme. As EPA conceded, power plants were listed under Section 112, and EPA did not make the findings that Section 112(c)(9) requires to delist source categories. Because EPA could not meet the high risk-based standard for delisting, EPA had to find another -- illegal -- way to remove power plants from the Section 112 list of source categories in order to implement its cap-and-trade system under Section 111. EPA's "solution" was to claim "inherent authority" as an agency to reverse the regulatory determination it made, after notice and comment, in December 2000. In other words, EPA argued that its delisting action did not violate the plain language of the Act because a "reversal" of its "appropriate and necessary" finding obviated the need to follow Section 112(c)(9).

The Court, in a unanimous decision by a 3-judge panel, disagreed with EPA's reasoning, which the Court found "deploys the logic of the Queen of Hearts, substituting EPA's desires for the plain text of section 112(c)(9)." Quite simply, once power plants were listed under Section 112(c), Congress gave EPA no discretion to remove power plants without following the mandated delisting procedure.

Despite the Court's unequivocal rejection of EPA's maneuvers to avoid strict regulation of power plant HAP emissions, EPA has persisted in arguing that it has the authority to ignore Congress' mandate in the CAA. On March 24, 2008, EPA along with the Utility Air Regulatory Group petitioned the D.C. Circuit for rehearing *en banc*. In its petition, EPA complained that the agency is now "compelled" to expend resources to promulgate standards that "EPA itself believes are unsupportable . . . ." EPA had argued this to the Court, and the Court directly responded that "Congress was not preoccupied with what EPA considers 'anomalous,' but rather with the fact that EPA had failed for decades to regulate HAPs sufficiently." This was Congress' concern in enacting the 1990 Amendments, and is a concern that continues today.

In its petition, EPA also continued to promote its illegal cap-and-trade scheme, which ignored mercury hotspots and would have delayed any significant mercury reductions

until at least 2025. Responses were filed on April 22, 2008, and the parties now await the Court's decision to grant or deny the petition for rehearing.

Section 112(c)(5) states that emission standards "shall be promulgated . . . within 2 years after the date" of the listing of the category. EPA is therefore already well past the statutory deadline for promulgating MACT standards for power plants. Although case-by-case MACT now applies to new and modified sources under Sec. 112(g), existing power plants continue to emit HAPS and can continue to do so until EPA promulgates emissions standards. Unfortunately, there is simply no way to predict when EPA will do so. If EPA's actions – or perhaps more appropriately, inaction – in other rulemaking proceedings are any indication, however, we should not hold our breaths for quick action. For example, on June 8, 2007, the D.C. Court of Appeals vacated the Industrial Boilers Rule upon a petition for review by various environmental organizations, and EPA still has not proposed new MACT standards for this source category. The concern for continued agency delay here is heightened given EPA's reluctance to regulate toxic pollutants emitted by power plants. EPA is already behind in issuing proper MACT standards, and power plants in the meantime continue to emit large quantities of HAPs unabated, to the detriment of the public health and welfare.

We are tired of suing EPA to force the agency to comply with Congress' clear mandate, and therefore urge Congress to act so that power plants implement maximum achievable control technology for their hazardous air pollutant emissions.

Conclusion

New Jersey's successful experience with our own mercury regulation leads us to supports S-2643, the Mercury Emission Control Act. If New Jersey's regulations on power plants were applied nationally, mercury emissions from coal-fired power plants would decline from approximately 48 tons to about five tons annually, an overall reduction of about 90%.

The leadership of individual facilities and states around the country has shown that the technology is available and affordable to meet the legally required standard today and that power plants can comply with a MACT standard for mercury that protects public health significantly more than EPA's failed strategy. It is apparent that EPA needs explicit direction from Congress to move expeditiously to adopt a MACT standard. As indicated in the Bill, it is appropriate that these rules address other hazardous air pollutants, in addition to mercury. For the sake of the health of our children and communities, more protective standards are warranted that limits exposure to hazardous air pollutants 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 OF EPA STANDRADS TO NJ STANDARDS**
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 $\mu g/m^3$	550 $\mu g/m^3$	10 times
Coal Fired Boilers	3 mg/MW-hr or 90% removal No Mercury Trading	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 Mercury Trading	2.9 times 10 times 15 times 27 times

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 thirteen 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

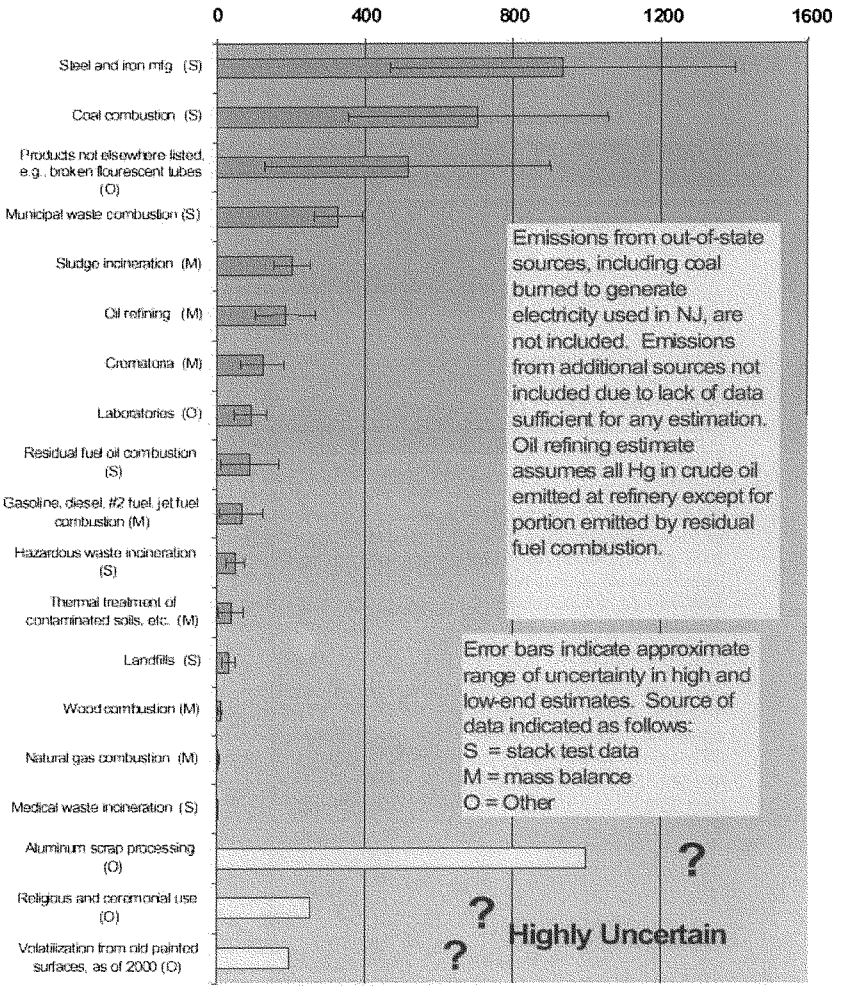


Chart 1

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.

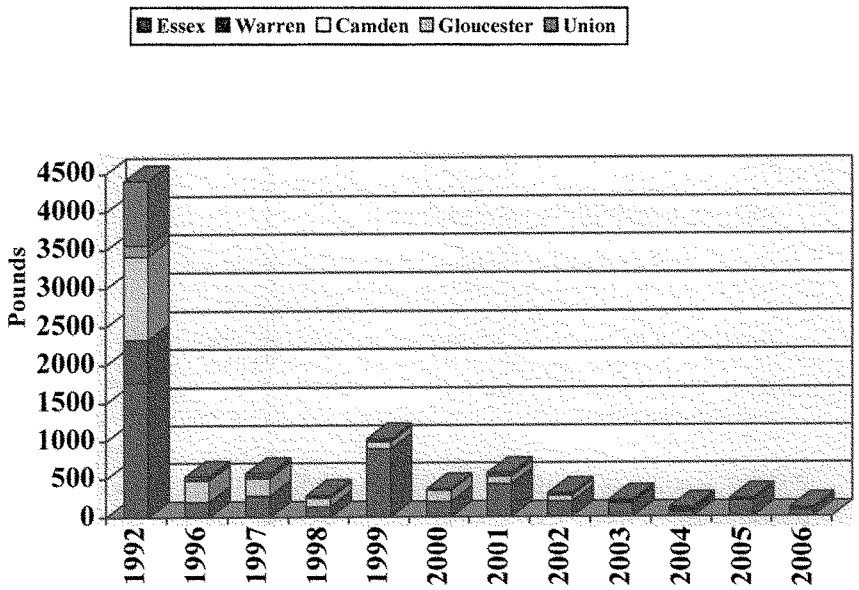
Municipal Solid Waste Incinerators (MSWI)

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 second annual report, submitted by the automobile manufacturers' representative organization, End of Life Vehicle Solutions (ELVS), has been submitted to the Department and indicates 13,407 switches have been collected since 2005, yielding 29.56 pounds of recovered mercury. ELVS is taking a variety of actions to increase the participation in the program including mailing reminder cards to all vehicle recyclers, conducting a survey of all vehicle recyclers that have not submitted switches, and production of additional educational information. In addition, the National Vehicle Mercury Switch Recovery Program has been implemented. 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 (2006 median was 1.28 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 adopted new rules on August 20, 2007, 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 new rules, 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 Carper

1. Question: Mercury Emissions Reduction Technology
Can you please describe how difficult it is for electric utilities to get technology that reduces their mercury emissions by at least 90 percent?

Response: The Department's experience shows activated carbon injection (ACI) technology for mercury control can be installed in a matter of months at relatively low cost compared to the cost of the emission unit or other air pollution controls. For example, capital cost of carbon injection is $5.0 million at a 341 megawatt unit at PSEG's Mercer plant in New Jersey, and its annual operating cost is estimated to be $1.75 million. There currently is sufficient demonstration of carbon injection systems on many types of plants, including coal burning plants, to design and install a carbon injection system which will be highly effective at reducing mercury emissions, with reasonable adjustments of the system to maximize effectiveness. New Jersey provides up to one year after installation for such adjustments to minimize mercury emissions.

The New Jersey experience shows that more stringent mercury emission standards than CAMR are achievable for coal-fired power plants which have installed ACI (please see the attached summary of test results). None of New Jersey's power plants challenged the state mercury emissions standards of 3 milligram per megawatt hour or 90% mercury control, a teJ1ing indication of the standards achievability. Bag houses in current use at some of the New Jersey coal-fired power plants, in combination with low NO_x burners, have achieved mercury reductions of more than 90 percent (98 percent tested at one plant) without carbon injection.

2. Question: EPA's Appeal of DC Circuit Verdict. As the head of New Jersey's Department of Environmental Protection and someone who is concerned with safeguarding public health, what is your opinion about EPA's decision to appeal the DC Circuit Court's verdict vacating EPA's Illegal cap and trade mercury rule?

Response: I would be surprised and disappointed if EPA appeals the DC Circuit Court's verdict vacating EPA's cap and trade mercury rule. Most interested parties, including industry, did not expect CAMR to survive legal challenge. Emission trading of hazardous air pollutants (HAP's) is clearly illegal. EPA's CAMR rule and any appeals only serve to delay the required reduction in mercury emissions. Because of the weak 2010 mercury cap and the banking provisions of

CAMR, EPA's goal of 70% mercury reductions would not have been achieved until after 2025. In contrast, if EPA proceeds to adopt Maximum Achieved Control Technology (MACT) limits for mercury, about 90% mercury reductions could be achieved within about 5 years. The difference in mercury emissions is dramatic, with MACT resulting in about 5 tons per year (TPY) in about 5 years, and CAMR resulting in about 15 TPY of mercury from EGU's in over 15 years. EPA's rules would leave three times the mercury remaining in the air, and not get to even that level for over three times the timeframe.

ATTACHMENT 1

Stack test results at New Jersey coal-fired power plants

Plant Name	Mercury Control	Test Results	Removal Efficiency (%)	NJ STANDARD
Mercer Unit 2	Carbon and ESP	2.00 mg/MW-hr (gross)	**	3 mg/MW-hr or 90% removal
BL England Unit 2	Carbon, ESP, and scrubber	1.24 mg/MW-hr (gross)	96.8	Same as above
Deepwater	None added*	1.51 mg/MW-hr (net)	**	Same as above
Chambers Unit 1 Unit 2	None added*	1.5 mg/MW-hr 2.6 mg/MW-hr	** **	Same as above
Logan	None added*	1.15 mg/MW-hr	> 96	Same as above

* No mercury specific control. These electric generating units have low NOx burners (which generate carbon), and baghouses (which provide a substrate for catching the carbon and mercury).

** Not tested. 3 mg/MWhr is about 90% control for average mercury content coal.

Note: These results are for the six units that already comply with the New Jersey mercury standard. The remaining four units are due to comply between 2010 and 2013.

INSTITUTE OF CLEAN AIR COMPANIES

Environment and Public Works Committee Hearing
On May 13, 2008

July 8, 2008 Response to Follow-Up Questions for Written Submission to Dr. Michael Durham Representing the Institute of Clean Air Companies

Questions from: Senator Barbara Boxer
Question #1: Impact of Safeguards on Innovation
Would a regulation requiring a 90% reduction in mercury emissions drive innovation for better and cheaper mercury control technologies?

We can look at the history of air pollution control technology for coal-fired power plants over the past 40 years and see that the regulations for SO_2, NO_x, and particulates have led to continuous improvements in the technology; resulting in more effective pollutant removal and lower costs.

There are two primary reasons why regulations are the drivers of innovation in emission control technology. The first is due to the fact that the power generation industry has to operate under very tight cost structures. For the regulated producers, their operating expenses and capital budgets are fixed by PUCs. For the non-regulated producers they have to compete on the open market for a commodity. In both cases, they make decisions within a business environment in which they cannot economically justify the addition of new emission control equipment unless they are mandated by regulations. Therefore, from the perspective of manufacturers of emission control technologies, without a market for a product, there is no incentive to invest in a new technology or improvements of an existing technology.

In the early stages of technology development, government supported R&D is critical to overcoming the "chicken and egg" dilemma in which there is no control technology on which to base a regulation and without a regulation there is no incentive for private industry to invest in the development of the control technology. The progress made to date has been the result of funding from the DOE National Energy Technology Laboratory (NETL), which was supplemented by funding from the Electric Power Research Institute (EPRI) and directly from power companies to support over 40 full-scale demonstrations of mercury control technology.

The success of this mercury control program provides evidence of how R&D funding can be effectively used to stimulate the development of clean coal technology. It also shows how such funding in the early development stages provides a huge highly leveraged return to the American people. The Federal funding reduces the risk to the technology developer, including both technology risk and the risk that no market is created for potential future sales. Once the technology has been proven, regulations can be put in place, and then the market forces can take over to further stimulate investment by the private sector.

The second reason that regulations drive innovation is that most improvements in emission control technologies result after the equipment has been installed and operated. Again

looking at past history, there has been a consistent pattern of engineering and installing new emission control technology, discovery of any operating issues and side effects, followed by vigorous competition among equipment providers for the development of innovative solutions and improvements that can then be incorporated throughout the industry. Therefore, once the regulations drive the installation of new equipment, improvements follow.

We have already seen examples of cost reductions for mercury control that have resulted from operating experience gained after installation of activated carbon injection (ACI) equipment. In 2004, the difficulties related to capturing mercury from western coals resulting in cost estimates in excess of $100,000 per pound of mercury removed. Control at a 90% level was not achievable for many plants burning Western fuels. However, technology developers working in concert with their power producing customers discovered the root cause of this limitation, then they developed new chemically-treated sorbents to overcome the problem, and now 90% control of mercury from power plants burning Western coals is readily achievable at costs under $10,000 per pound of mercury removed. Future cost reductions are likely to occur with the development of improved sorbents designed to overcome other limitations such as higher operating temperatures, reduced interference with acid gases, and reduced impact on the sale of flyash with activated carbon for use in concrete.

Question #2: Safeguards Impact on Green Collar Jobs
Dr. Durham, are you looking to expand production if the federal government requires utilities to reduce their mercury emissions by at least 90 percent?

Mercury control regulations will have a significant impact on growth of new jobs as have previous regulations of other pollutants. Some of the growth will come from installation of additional scrubbers for SO_2 and catalysts for NO_x in which mercury is captured as a co-benefit, as well as fabric filters for both particulate and mercury reduction when used in addition to activated carbon injection (ACI). For a mercury specific control technology, such as ACI, a great deal of expansion of activated carbon production is currently being planned, but is largely contingent on a Federal mercury regulation.

ACI involves two different business elements, the fabrication of the injection equipment, and the manufacturing of activated carbon to provide a continuous supply of sorbent to capture mercury. On the equipment side, there are currently eight companies supplying ACI equipment for the U. S. power industry. Several of these companies are in the process of expanding fabrication capabilities in order to be able to respond to a Federal and State's mercury regulations. It is estimated that such a rule would create a $1 Billion business.

There are four member companies of ICAC that are providing activated carbon for mercury control. Three of these companies, ADA-ES, Calgon, and Norit Americas have publicly announced their involvement in the design, engineering, and permitting of new production facilities in the U.S. for activated carbon. These expansions plans will be implemented in a timely manner to meet the market created by a Federal and individual State's mercury control rules. It is estimated that a 90% mercury control rule could require

capital investments for these new AC production plants in excess of $2 Billion. In addition to the construction jobs to build the plants, there will be continuous operating jobs to run the new facilities, as well as mining jobs to supply the feedstock material needed to make activated carbon.

The importance of regulations on the commercial markets was dramatically demonstrated with the recent vacature of CAMR. There were competitive bids submitted by ICAC members for over a dozen ACI systems in which the awarding of contracts was imminent. In addition, there were negotiations for hundreds of millions of dollars of contracts for activated carbon. However, the day after CAMR was vacated, these procurement activities were cancelled as were a number of test programs. Without the regulation, there is no market.

Questions from: Senator James M. Inhofe
Question #1: ***Dr. Durham, you state in your testimony that flexibility within regulations is good for technology suppliers and users so that risks are reduced and least cost options can be deployed. What kind of flexibility do you envision should be included in the MACT rule?***

All power plants are not created equal; each one is engineered for specific conditions and needs. Different coal types, boiler designs, and power plant configurations provide a variety of technical challenges that will result in significant plant by plant variations in the costs to implement high levels of mercury reductions. This has also been the challenge for the application of emissions control technologies for other pollutants on coal-fired power plants that has spurred the development of a suite of control technology options for each pollutant.

Flexibility as a part of emission regulations is good for both technology suppliers and users so that risks are reduced and least cost options can be deployed. The more stringent the regulation, the more important the issue of flexibility becomes. With a potential 90% mercury reduction regulation, flexibility can be invaluable in reducing costs and risks.

ICAC supports flexibility in a regulation because it reduces overall costs of controlling emissions including significant burdens for the most challenging applications. In addition, a well designed program will ultimately result in achieving greater reductions in mercury emissions without jeopardizing the reliability of electricity supply. While ICAC recognizes the benefits of regulatory flexibility, especially when coupled with strong compliance limits or caps, the Institute does not recommend any particular form of flexibility in rulemakings. Historically, some options for providing flexibility include:

- To level out site by site differences in the costs to implement mercury control strategies, market-based cap-and-trade programs or system-wide averaging have proven effective. While the emission control cap required by CAMR was much too low to overcome concerns over hotspots, a 90% requirement would minimize this concern.

- Phased approaches that incrementally require more emissions reductions over time reduce risk to both the power generator and the equipment supplier. An example would be a 70% reduction in three years followed by a 90% rule two years later. This gives the user an opportunity to install and evaluate lower cost approaches and determine the capability to achieve the highest emission control level. Several states have used a two phase approach to get equipment installed sooner with reduced risk.

- Concepts such as "soft landings" and "safety valves" permit the installation of the technology and set the emissions limits based on the best performance achievable from the newly installed equipment. This greatly reduces costs and risks at any plant that because of specific design or operating characteristics runs into unexpected limitations on performance. For example, if a plant is only able to achieve 80% mercury removal using a technology that readily achieves 90% at most other applications, it would be given additional time to achieve compliance.

- Flexibility in the form of a multipollutant approach can potentially create the greatest cost reductions. All mercury control technologies incorporate interactions with other air pollution control equipment often resulting in co-benefits. This includes oxidation of mercury across SCRs, capture of mercury in wet scrubbers, and increased fine particle capture and higher mercury removal when ACI is used with a fabric filter. Therefore, costs can be minimized under a multi-pollutant regulatory framework in which decisions about mercury can be integrated with strategies to address other criteria pollutants.

There are many examples of these types of flexibility that have been used in the more than a dozen state regulations that have been implemented for mercury control. However, options are significantly limited to EPA under the a MACT regulatory environment. To fully take advantage of all of the options for flexibility and maintain the certainty of mercury control regulation, Congress is well positioned to address this issue through comprehensive legislation.

Question #2: ***Dr. Durham, what kind of guarantees are you offering now with your technology? Are they site specific? Do they include hold harmless guarantees?***

The concept and practice of guarantees is broadly misunderstood only in regulatory and legislative forums as it applies to emission control systems for electric power producers. Outside of these forums, parties involved in guarantees, including electric power producers, fully understand and through considerable operating history, have accepted the nature of guarantees. As a trade association with its member companies operating in competitive markets, ICAC has no opinion regarding equipment and service guarantees. However, historically there appears to be some simple truths regarding guarantees of emission control equipment for electric power producers.

Mercury is the fourth pollutant that coal-fired power plants have been regulated to control. The first was fine particles as part of the original Clean Air Act, followed by SO_2 and NO_X as part of subsequent Clean Air Act Amendments. The contracts for emission control

technologies for all pollutants such as electrostatic precipitators, fabric filters, scrubbers, and SCRs/SNCRs, and now ACI have evolved over the years and similar features have also evolved relative to guarantees. However, equipment guarantees are not necessarily part of competitive bids and subsequent contracts, but where they occur, experience has shown there are features that are shared by other air pollution control systems:

- Because of the differences in power plant designs, coal characteristics, operating conditions, and emissions regulations, all guarantees for emission control equipment for all pollutants are site specific. The contracts specify the specific coal or range of coals, the location and design of the plant, and the range of expected operating conditions such as temperature, flow rate, and gas constituents. The guarantee for the specific plant will then apply to all conditions that fit within the specified ranges.
- The guarantees are performance-based and often include liquidated damages if the equipment does not perform as expected.
- No emission control equipment guarantees include 'hold harmless' clauses for payment of consequential damages.

There has been a misconception perpetuated in regulatory and legislative forums that suppliers of commercial emission control systems must provide hold harmless guarantees. This misconception exists only in these forums, given that electric power producers fully understand that they do not require nor receive any hold harmless guarantees from any equipment they buy, and likely would be unwilling to pay for such guarantees if offered. More broadly, hold harmless guarantees are not part of any contracts in the power generation value chain. Power producers do not provide hold harmless guarantees for the electricity they provide to their customers; coal companies do not provide hold harmless guarantees for the coal they sell to power plants; and boiler manufacturers and equipment providers do not provide hold harmless guarantees on their equipment. Yet all the components in this chain: electricity, coal, power plants, and emission control technology; are all considered commercially available.

Guarantees fundamentally represent a shared risk situation between the supplier of the emission control equipment and the power producer who will rely on the performance of the equipment to meet a standard. The guarantee does not mitigate the risk, as failure of the equipment to perform presents a "lose-lose" situation for the both parties. The supplier risks large payments for liquidated damages for lack of performance which can also adversely affect their ability to compete in the market place; and the power producer faces loss of generating revenues and potential fines. Therefore, it is critical to both parties involved that the emission standards be established at levels and conditions that are achievable.

Senator CARPER. Commissioner Jackson, thank you for your testimony.

Given the experience that you have in New Jersey, what you have done is actually quite relevant to what we are considering here today. So we are grateful for the example and also for your input.

We are going to recess the hearing for about 35 minutes or so. We are in our first vote, we have about three more to follow, and I hope to be back to reconvene at about 12:15. For this time, the hearing is recessed.

[Recess.]

Senator CARPER. We just finished four votes, now we are done, we will be able to complete our hearing and go on with our lives.

Dr. Durham, you are next. You are recognized for 5 minutes and your entire statement will be part of the record for you and for each of our other witnesses. Thank you for your patience.

STATEMENT OF MICHAEL D. DURHAM, PRESIDENT AND CEO, ADA ENVIRONMENTAL SOLUTIONS

Mr. DURHAM. Thank you, Senator Carper.

Good morning. I am Michael Durham, President of ADA Environmental Solutions, a company that develops and commercializes air pollution control technology. I am here today as an officer of the Institute of Clean Air Companies, a national trade association of more than 100 companies that supply air pollution control and monitoring technologies for electric power and industrial plants. We thank you for the invitation to testify on the status of mercury control technologies.

When I first testified to this Committee in 2002, we had completed only two full-scale tests of activated carbon injection. While we had achieved 90 percent capture of mercury in the first test on eastern coal, we discovered limitations of the technology in the second test on western coal. This issue is highlighted in a January 2005 report to this Committee, referenced earlier by Senator Voinovich, in which EIA projected the legislation requiring 90 percent mercury control could cost $358 billion.

Since 2002, the science and understanding of mercury control has moved rapidly from R&D into full system deployment. Through funding for DOE, EPRI and power companies, we have been able to discover the root cause of, the limitations on western coals and successfully develop different solutions so that now 90 percent capture can be readily achievable. Today, control of mercury on western coal represents our easiest and lowest-cost application for mercury control.

Demonstrations have also been conducted on other control technologies, such as mercury removal in wet scrubbers, and enhancements such as oxidizing catalysts. ACI has now been tested full-scale on over 50 plants, representing a variety of power plant configurations burning different coals. Today we have more operating and performance data on mercury control than was available for any other pollutant prior to Federal regulation. Recent analyses by DOE and EPA suggest that cost will only be a small fraction of early EIA estimates.

Following the rapid development of a number of viable control technologies, strict regulations were enacted over a dozen States, and new power plants were required to achieve 90 percent capture. This has created a healthy market for commercial mercury control technology and today vendors are actively installing systems across the Country.

In addition to mercury that will be captured as a result of the installation of SO_2 scrubbers and NO_x control catalysts, there have been over 85 commercial contracts awarded for ACI. Systems are being installed on new and existing power plants representing 40,000 megawatts of power, approximately 12 percent of the fleet.

Because of the simplicity and versatility of ACI, systems were purchased for boilers with different equipment configurations ranging in size from 50 to 900 megawatts, burning all three of the U.S. coals, including bituminous, sub-bituminous and lignite. In addition to these 85 contracts, another 70 ACI systems will be awarded in the next 2 years to meet the latest State regulations.

As you consider a Federal mercury regulation, you should be aware that because of differences in the age, location and design of the 1,100 plants within the U.S. fleet, there will be significant plant by plant variations in cost and technical difficulties of achieving high levels of mercury control. There have been similar challenges faced by other regulated pollutants that have spurred the development of a suite of technology options for each pollutant.

ICAC recommends that you consider flexibility in the legislation as a way to address differences in plant by plant operations. Flexibility can reduce overall costs, and alleviate burdens for the most challenging applications. A well-designed program with flexibility can ultimately achieve greater reductions in mercury emissions without jeopardizing the reliability of electricity supply.

There are a number of examples of flexibility in recent State mercury regulations, such as system-wide averaging, two-phase approach, soft landings and safety valves. You might also consider the fact that all mercury control technologies incorporate interactions with other air pollution control equipment, often resulting in co-benefits. Therefore, costs can be minimized under a multi-pollutant regulatory framework in which decisions about mercury can be integrated with strategies to address the other criteria pollutants.

In summary, I would like to add that there are still challenges remaining for some power plant applications that provide opportunities for technology innovations and further cost reductions. We are working with the electric power industry to develop and implement new clean coal technologies to continue the progress the industry has made over the past decades burning coal with significantly lower emissions.

Thank you.

[The prepared statement of Mr. Durham follows:]

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Written Testimony of

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Before the Senate Committee on Environment and Public Works Hearing on Mercury Legislation

May 13, 2008
Dirksen Office Building Room 406

Chairman Boxer, Senator Inhofe and Members of the Committee:

Good morning, I am Dr. Michael Durham, President and CEO of ADA Environmental Solutions (ADA-ES). ADA-ES is a company that develops and commercializes air pollution control technology for the power industry. I am here today representing the Institute of Clean Air Companies (ICAC), for which I serve as an Officer and a Director. ICAC is the national trade association of more than one-hundred companies that supply air pollution control and monitoring technologies for electric power plants and other large industrial facilities across the United States. Our industry deploys control technologies for emissions from the combustion of fossil fuels, such as flue gas desulfurization (FGD), selective catalytic reduction (SCR), fabric filters (FF), electrostatic precipitators (ESPs), and activated carbon injection (ACI) systems to control criteria pollutants (e.g. SO_2, NO_x, PM), air toxics (e.g. mercury), and greenhouse gases.

ICAC would like to thank Chairman Boxer and Senator Inhofe for the invitation to participate in this hearing on Mercury Legislation. It is my privilege to present this testimony on our current understanding of mercury control technologies for coal-fired power plants and their application to meet regulatory requirements. In this testimony, I would like to focus on the following key points:

- ICAC believes that the continued use of our natural resource coal for a significant portion of our electrical power generation is critical to both our economy and natural security. We are working with the electric power industry to develop clean coal technology to allow the industry to maintain progress demonstrated over the past decades toward burning coal with significantly lower emissions.

- Regulations provide certainty that drive investments, innovation, cost reductions, and implementation of emission control technology.
- The accelerated development of mercury control technology has been a major success story with significant improvements in technologies resulting in higher mercury capture efficiencies and lower costs.
- Because of differences in the age, location, and design of the 1100 plants in the US coal-fired generating fleet, there will be differences in the costs and difficulties of achieving high levels of mercury control at each plant.
- The commercial mercury control market is well under way with over 85 contracts awarded to date for mercury specific control technologies driven by new regulations in over a dozen states, as well as existing Federal regulations on new power plants.
- Multiple control technologies are now commercially available to meet the needs for controlling mercury from different coals and various equipment configurations.
- Mercury control technologies can also take advantage of co-benefits with other air pollution control equipment for criteria pollutants. Therefore, costs can be minimized under a multi-pollutant regulatory framework in which decisions about mercury control can be integrated with decisions to address control of sulfur dioxide, nitrogen oxides, and fine particles.
- There are still challenges remaining that provide additional opportunities for technology innovations and further cost reductions.
- Flexibility in a mercury control regulation can be used to address differences in plant by plant operations resulting in reducing overall costs of implementation, overcoming technical challenges of the most difficult applications, and minimizing potential impacts on the reliability of electrical supply, while still obtaining overall high mercury removal. The recent mercury control regulations enacted in a number of states provide good examples of providing flexibility in the form of safety valves, phase in periods, and averaging between plants.

Regulations Drive Technology Investment, Innovation, and Implementation

As you should be aware, air pollution control technologies follow and respond to regulatory drivers. The synergies of state-specific actions and federal requirements have created control technology markets with considerable certainty as to when and what technologies will be needed. These regulations drive implementation of emission control technology; stimulate innovation to overcome operating issues, ultimately resulting in improved reliability, increase emission reductions, and lower costs.

For example, over the for the past four decades, ICAC member companies, working in collaboration with power generation partners have developed technology and solutions that have achieved reductions in emissions of criteria pollutants SO_2, NOx, and particulates from the existing fleet of coal fueled power plants that are lower today than they were in 1970 even as power produced from coal plants has increased by 173% (See

Figure 1). This has been the result of more stringent regulations on emissions, which were in turn based on numerous improvements in control technologies. As an example, in the early 1970's flue gas desulfurization equipment, commonly referred to as "scrubbers", was new and suffered from poor reliability and performance. Over time, as experience was gained and equipment modified, efficiencies rose from about 70 percent sulfur dioxide (SO_2) removal to today's 95-98 percent with similar improvements in reliability.

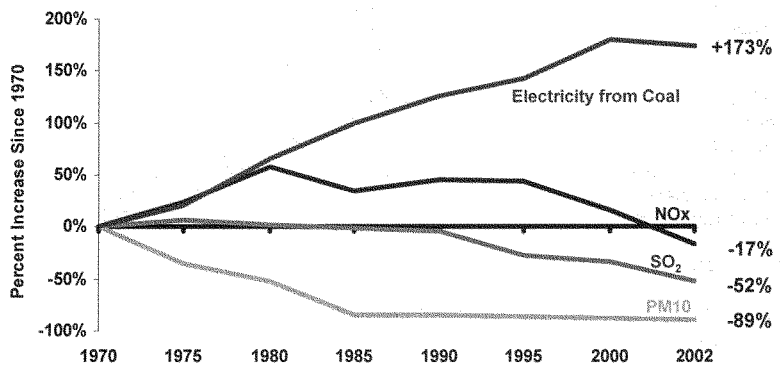

Figure 1. Changes in Coal-Fueled Electricity & Emissions since 1970.

Another example of this has been the case with the application of NO_x control technologies on coal-fired boilers and it will be the case for mercury control technologies as well. In the mid-1990s, States in the Northeast began requiring selective catalytic reduction technologies to be installed on coal-fired boilers to address regional ozone issues. Selective catalytic reduction technology is a major capital project that requires the integration of the technology with boiler components and other downstream emissions control equipment. A typical 500 MW installation requires over 1,000 tons of steel; 200 tons of catalyst; 300,000 man-hours of construction labor; and 2-3 years to engineer and construct. At the time, SCR technology had not been commercially applied on any coal-fired boilers in the U.S. although the technology had been applied on 100s of boilers in Germany and Japan. State regulatory agencies in the Northeast provided the regulatory drivers that required the installation of the technology even though it had never been tested at full scale on any boilers in the U.S. Currently, there are over 200 commercial, full-scale SCR systems installed on coal-fired boilers in the U.S. with an additional 100 installations projected to start-up over the next several years due to regional clean air regulations. Selective catalytic reduction installations on coal-fired power plants in the U.S. demonstrated that strong, flexible policies that rest on a sound technical basis drive emissions control installations.

Multiple Technologies Are Available for Reducing Mercury Emissions

There are many approaches that can be taken to achieve mercury emission reductions depending on the stringency of the regulatory requirement and the boiler's operating parameters (e.g. coal type, existing emissions control systems, boiler size). Technology demonstrations have proven that 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.

Recent clean air regulations for coal-fired power plants have required the installation of a significant number of flue gas desulfurization systems on coal-fired boilers to reduce emissions of SO_2. Approximately one-third of the coal-fired power plant capacity has some form of FGD installed and an additional one-third of the units are expected to have FGD systems installed by 2015. Wet flue gas desulfurization systems or wet scrubbers are able to simultaneously capture mercury as a co-benefit of the SO_2 control process.

Additional mercury control can be achieved by modifying these emission control technologies to enhance their operation to capture mercury. Enhancing the performance of flue gas desulfurization systems provides one method of achieving mercury control with existing emissions control equipment. The mercury that is captured in the FGD is in the form of oxidized mercury, which is soluble in liquids. The extent of capture varies based on a number of parameters but can be enhanced with the addition of chemicals to the wet scrubber and/or through the oxidation of mercury as it passes through a selective catalytic reduction system situated upstream of the wet scrubber. Full-scale test results have demonstrated greater than 90 percent mercury removal from coal-fired power plants with SCR and wet scrubber emissions control combinations. Co-benefit control of mercury through a wet-FGD is likely the least cost option as a minimal amount of new capital equipment is required to achieve enhanced mercury removal.

For other mercury control options, elemental mercury can be converted to oxidized mercury so that the mercury is more easily captured in downstream air pollution control equipment. A number of these approaches are being tested and deployed today. One example of a mercury oxidizing technology that will provide additional mercury reductions is with the addition of an oxidation catalyst upstream of a wet scrubber. The catalyst oxidizes elemental mercury to oxidized mercury, which is more readily captured in liquids such as those found in wet scrubber processes. The oxidation catalyst can be installed upstream of an SCR system or as an alternative to installing an SCR system. The Department of Energy has funded a project on a 200 MW coal-fired boiler that will test this method of mercury control starting in April 2008. A second generation of oxidation catalyst is currently being developed and tested that would both oxidize and bind both elemental and oxidized mercury. This oxidation catalyst technology would be placed downstream of the particulate control device. Short term testing has been successful with longer term demonstrations scheduled for 2008. Another method of achieving mercury control reductions is by optimizing the combustion conditions in the furnace to enhance native mercury oxidation that occurs under firing conditions. The mercury oxidation technologies

mentioned above provide a few examples of mercury control approaches that can enhance mercury capture and optimize control costs.

Mercury Specific Control Technology

Concerning mercury specific control technologies, activated carbon injection (ACI) has been successfully applied in the United States and Europe on waste-to-energy plants for over a decade with the technology being transferred to coal-fired power plants in the U.S today. The technology injects activated carbon upstream of a particulate collection device and has demonstrated mercury emission reductions as high as 80-95 percent.

The technology, which is shown in Figure 2, is relatively simple in comparison to typical emission control equipment such as the SO_2 scrubber and fabric filter shown in the photograph. An ACI system consists of a storage silo for the activated carbon and pneumatic conveying system that injects the activated carbon at a controlled feed rate at the desired locations in the ductwork prior to the particulate control device. The mercury reacts with the particulate sorbent which is then removed in the particle control device along with the flyash. Tests have shown that the mercury is not leachable from the sorbent so that it can be disposed of in a landfill without concern for contamination of waterways. Because of their simplicity and small size, ACI systems can be retrofit on virtually any power plant with minimal engineering. In most cases, installations can be completed in as little as nine months after an order is placed. ACI technology has been tested at full-scale on over 50 coal-fired boilers in the U.S. under the Department of Energy's demonstration program and through the Electric Power Research Institute (EPRI) and other self-funded electric power industry initiatives. Because of the extensive number of full-scale demonstrations on a variety of power plants burning different coals with a broad range of equipment configurations, we now have more full scale operating and performance data on activated carbon injection technology for coal-fired power plants than was available in past instances for any other emissions control technology, such as selective catalytic reduction, prior to the development of regulations by state and federal clean air agencies.

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. This issue was highlighted in a January 2005 report by the Energy Information Administration report to the Senate Environment and Public Works Committee entitled "Analysis of Alternative Mercury Control Strategies". In this report, EIA projected that mercury control regulations could increase electricity prices by as much as 2.5 cents per kW-hr. because of difficulties in treating mercury from Western coals. As a result, the report concluded that a 90% mercury control regulation would increase resource costs by $358 billion.

Through these demonstration programs, 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. With the improvements in technology developed under DOE and EPRI funding, the most recent cost analyses by both EPA and DOE suggest that the costs will be less only a small fraction of the earlier EIA estimates. 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).

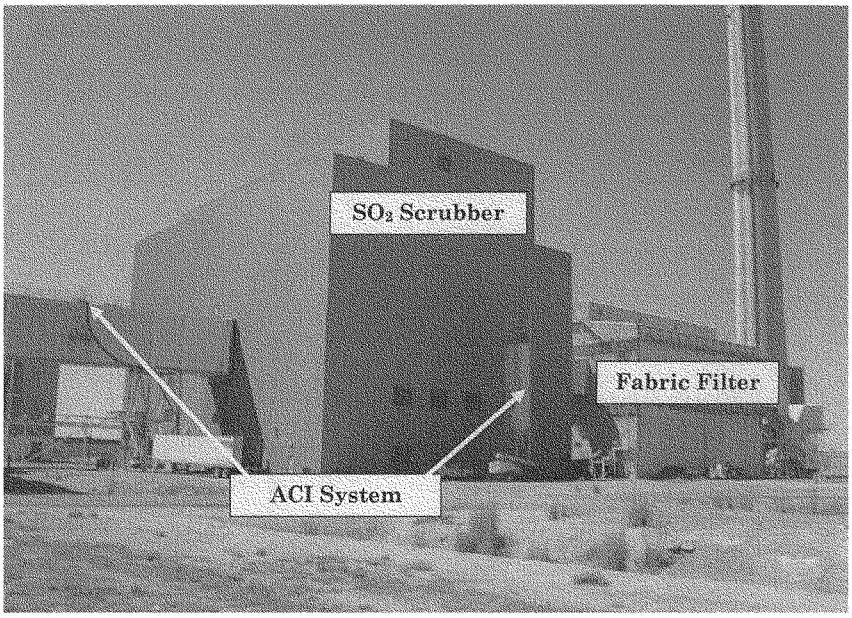

Figure 2. Activated Carbon Injection System Capable of Achieving 90% Capture of Mercury Emissions at a Power Plant.

Other innovations have also occurred in control technology to address specific issues. Given that a number of power plants 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. To avoid the potential loss of flyash sales to the concrete industry, 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, and then injects the sorbent downstream where it is collected in a fabric filter. This preserves the flyash for sale, and controls mercury emissions. 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 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.

The installation of a TOXECON™ system at the WE Energies Presque Isle Power Plant in Marquette, Michigan as part of a DOE Clean Coal Program represented the first commercial operation of a mercury specific control system to the power industry. Typical of many first installations of emission control technology, some operating problems were encountered during startup. The root cause of the problems was discovered, and new operating procedures were developed and implemented. The Presque Isle system has been operating at 90% mercury control levels for well over a year now. The new operating procedures are being implemented with all of the new TOXECON™ systems being installed.

Commercial Market

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. State programs in Massachusetts and New Jersey have gone into effect, with systems and control strategies in place to meet these requirements. Also a few newly built power plants have begun operation and mercury control has been integrated into their design. In addition, the combination of installed selective catalytic reduction (SCR), primarily designed for NO_x control, and wet flue gas desulfurization (wet FGD), primarily designed for SO_2 control, already achieve mercury control as part of the integrated co-benefits approach. There have 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.

For mercury specific control technologies, primarily activated carbon injection, the air pollution control industry has reported booking new contracts for mercury control equipment on coal-fired power plant boilers across the U.S. representing a vast range of boiler configurations, sizes, and coal-types. This has been a very competitive market with more than six companies having won contracts for ACI systems. Over 85 commercial contracts have been awarded to date with an additional 70 expected to be awarded in the next two years. The cumulative generation capacity of these initial contracts is more than 40,000 MW, which is around twelve percent of the nation's coal-fired power plant capacity. These bookings are for controlling mercury on new and existing boilers ranging in size from 52 to 880 MW in capacity with the average size unit being 500 MW in size. The technology bookings are for all three of the predominant types of coal burned in U.S. electric power plant boilers including subbituminous, bituminous, and lignite coals. The diversity of coal burned by the units is broad including units burning high sulfur bituminous, low sulfur subbituminous, bituminous blended with biomass, western bituminous and subbituminous blends, bituminous blends, and lignite/subbituminous multi-fuel applications.

The mercury control technology bookings are also to be integrated with a broad range of existing emissions control technology configurations that are designed to control other emissions from the coal-fired boilers. The complete list of the mercury specific control bookings is given at the end of this document. The following is a list of each of the different control configurations that the mercury specific controls that have been booked to date will be applied to, including boilers with:

Cold-Side ESP
ESP
ESP/FF
ESP/FF (TOXECON)
ESP/FF Parallel Flow
ESP/WFGD
ESP/WFGD/WESP
FT-SNCR/CDS/FF
HS-ESP/FF/WFGD
Lime Injection/ESP/WFGD/WESP
Lime Injection/ESP/WFGD/WESP
Multi-pollutant
SCR/FF
SCR/FF/WFGD
SCR/FF/WFGD
SNCR/ACI/CDS-DFGD/FF (CFB Boiler)
SDA/FF
TOXECON

Mercury control is a good example of the fact that once mercury control regulations are put in place, the resulting market forces stimulate investment by the private sector. Recognizing the market demand for activated carbon driven by the State regulations, the air pollution control industry continues to make plans and investments into new and expanded activated carbon production facilities. ICAC member companies have announce several hundred million dollars in expansion plans to production activated carbon to meet the market of approximately 400 million pounds per year of AC for the existing state regulations. In addition, permitting is under way for new Greenfield AC production facilities to produce the approximately 1 billion pounds per year activated carbon that may be required to meet a strict Federal rule. This would result in capital investments of nearly $2 Billion.

Flexibility in the Regulation Reduces Costs and Enables Smooth Implementation

All power plants are not created equally; all are engineered for specific conditions and needs. Different coal types, boiler designs, and power plant configurations will provide a variety of technical challenges that will result in significant plant by plant variations in the costs to implement high levels of mercury reductions. This has also been the challenge for the application of emissions control technologies for other pollutants on coal-fired power plants that has spurred the development of a suite of control technology options for each pollutant.

Flexibility within regulations is good for technology suppliers and users so that risks are reduced and least cost options can be deployed. Some means of providing flexibility include developing market-based cap-and-trade programs or averaging, phased approaches that incrementally require more emissions reductions over time, and "soft landings" and "safety valves" that permit the installation of the technology and set the emissions limits based on the best performance achievable from the newly installed technology. There are many examples of this type of flexibility that have been used in the more than a dozen state regulations that have been implemented for mercury control. ICAC supports flexibility in a regulation because it reduces overall costs including significant burdens for the most challenging applications. In addition, a well designed program will ultimately result in achieving greater reductions in mercury emissions without jeopardizing the reliability of electricity supply.

In summary, the air pollution control industry continues to work responsibly with power plant 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 and commercial deployment is ongoing.

For further information of the recent advances in mercury control technologies, I have attached a bibliography of a few of the many technical papers describing full-scale demonstrations of different approaches to reducing mercury emissions from coal-fired power plants.

Sincerely,

Dr. Michael D. Durham
Officer and Director

Terminology:

- ESP – Electrostatic precipitators use electrical fields to remove pollutants such as particulates and mercury from boiler flue gases. The electric field drives particulates to the collecting electrodes where they are periodically dislodged using a mechanical process.
- Cold-Side ESP – Cold side electrostatic precipitators are ESPs located on the downstream side of the air preheater or heat exchanger (which transfers heat from the flue gas to the air to be fed into the furnace) and therefore operates at relatively low temperatures (i.e., temperatures of no more than about 200° C).
- HS-ESP – Hot side electrostatic precipitators are ESPs are located on the upstream side of the air preheater and therefore operate at relatively high temperatures (i.e., more than about 250° C).
- WESP – Wet electrostatic precipitators use electric fields to remove pollutants such as particulates and mercury from boiler flue gases. The electric field drives particulates to the collecting electrodes which are periodically washed off with a liquid.
- ACI – Activated carbon injection is a form of sorbent injection technology that injects powdered activated carbon into the flue gas where it mixes with the gas to contact the sorbent. The sorbent is then collected in the particulate control device where there is a second opportunity for sorbent to contact the mercury in the flue gas.
- FF – Fabric filter, commonly referred to as a baghouse, is a particulate control device that also captures mercury. Fabric filter collectors pass the flue gas through a tightly woven fabric where the particulates in the flue gas will be collected on the fabric by sieving and other mechanisms. The dust cake which forms on the filter is periodically removed from the fabric and collected in a hopper.
- TOXECON – TOXECON is an EPRI patented technology in which sorbents, including activated carbon is injected into a pulse-jet baghouse installed downstream of the existing particulate control device.
- WFGD – Wet flue gas desulfurization or wet scrubber is control system designed to remove SO_2 from flue gases and can also capture mercury. In a wet scrubber, a liquid sorbent is sprayed into the flue gas in an absorber vessel. The pollutant comes into direct contact with the sorbent and forms a wet slurry waste that is separated from the process stream.
- DFGD – Dry flue gas desulfurization or dry scrubber injects an alkaline sorbent into the flue gas to remove SO_2 and particulates but can also capture mercury. Dry flue gas desulfurization produces a dry solid by-product as the flue gas leaving the absorber is not saturated like in a WFGD.
- SDA – Spray dryer absorber is a form of dry flue gas desulfurization system.
- SCR – Selective catalytic reduction is a NO_x control device that can oxidize mercury. The basic principle of SCR is the reduction of NO_x to N_2 and H_2O by the reaction of NO_x and ammonia (NH_3) within a catalyst bed.
- SNCR – Selective non-catalytic reduction is a NO_x control device that utilizes a chemical process where a reducing agent, typically ammonia or urea, is injected into the process gases to convert nitrogen oxides into molecular nitrogen.
- CFB – Circulating fluidized bed is a combustion process where crushed coal is mixed with limestone and fired in a process resembling a boiling fluid.
- APC Configuration – Air pollution control configuration refers to the emissions control technologies that are currently on the boiler or that contribute to mercury control.

Mercury Control Technical Papers & Presentations

Technology Overview
Current and Emerging Mercury and Multi-Pollutant Control Technologies - Oct 2003

Mercury Control Technology: Tools for Planning and Implementing

Mercury: Myths and Realities - Mar 2003

Mercury Control Alternatives for Coal-Fired Power Plants - Dec 2002

Field Experience

TOXECON Clean Coal Demonstration for Mercury and Multi-Pollutant Control at We Energies Presque Isle Power Plant –August 2006; Steven Derenne, Paul Sartorelli, We Energies, Jean Bustard, Robin Stewart, Richard Schlager, Sharon Sjostrom, ADA-ES, Inc., Ramsay Chang, EPRI, Ron Utter, Jeffrey Cummings, Cummins & Barnard, Inc., Ted McMahon and Fred Sudhoff, U.S. DOE-NETL

Multi-Pollutant Emissions Control with SDA/FF Technology at Black Hills Power– August 2006; Bryan J. Jankura, Kevin E. Redinger, P.E. and Scott A. Renninger, The Babcock & Wilcox Company, Royd Warren, Black Hills Power

Enhanced Vapor Phase Mercury Removal Using Activated Carbon Injection Across the Indigo Agglomerator –August 2006; Robert Glesmann, ADA-ES, Inc., Mark Berry Southern Company Generation, Theron Furr, Mississippi Power Company, Rodney Truce, Bob Crynack, Ph.D., Indigo Technologies USA, Ralph Altman, EPRI, Kenneth Cushing, Southern Research Institute, Wallis Harrison, Particulate Control Technologies, Inc.

Mercury Reduction in Coal Fired Power Plants using MinPlus Sorbent through Furnace Sorbent Injection –August 2006; Joep J.P. Biermann, MinPlus, Inc.; Brian Higgins, Mobotec USA; Peter Hoeflich, Progress Energy; Bruce W. Ramme, We Energies.

Impact of Coal Blending and SO_3 Flue Gas Conditions on Mercury Removal with Activated Carbon Injection at Mississippi Power's Plant Daniel–August 2006; Tom Campbell, Sheila Glesmann, Robert Glesmann, ADA-ES, Inc., Mark Berry, Southern Company Generation, Richard Semmes, Mississippi Power Company

Testing of K-Fuel™ at Coal-Fired Units- August 2006;
Ted Venners, Carrie Atiyeh, KFx Inc.;

SCR Catalyst with High Mercury Oxidation and Low SO_2 to SO_3 Conversion- August 2006; Keiichiro Kai*, Hirofumi Kikkawa,Yasuyoshi Kato, Yoshinori Nagai, Kure

Division, Babcock-Hitachi K.K.,William J. Gretta, P.E., Hitachi Power Systems America, Ltd.

Mercury Oxidation Across SCR Catalyst at LG&E's Trimble County Unit 1- August 2006; William J. Gretta, P.E, Hitachi Power Systems America, Ltd., Isato Morita, Babcock Hitachi, John W. Moffett, EON-US Services, Inc.,

Field Test Program to Evaluate Mercury Emissions from Coal-Fired Facilities with SCR-FGD Systems - Oct 2003; J.A. Withum, S.C. Tseng, J.E. Locke, Consol Energy

Full-Scale Results of Mercury Control by Injecting Activated Carbon Upstream of ESPs and Fabric Filters - Oct 2003; Michael Durham, ADA-ES;

Full-Scale Evaluation of Mercury Control across a Wet Particulate Scrubber - May 2003; Sharon Sjostrom, ADA-ES

Modeling Mercury Control with Powdered Activated Carbon - May 2003; James Staudt, Andover Technology Partners, Wojciech Jozewicz, ARCADIS, Ravi Srivatava, EPA-ORD

Operating Experiences of Mercury Collection by PAC Injection in Bag Filters - May 2003 ; Leif Lindau, Alstom Power

$PM_{2.5}$ and Mercury Emissions From a High Ratio Fabric Filter after a Pulverized Coal Fired Boiler - May 2003; L. Lillieblad, P. Wieslander, Alstom Pwer, J. Hokkinen, T.Lind, VTT Technical Research Center of Finland

We Energies; *Results of Activated Carbon Injection for Mercury Control Upstream of a COHPAC Fabric Filter* - May 2003; Jean Bustard, Michael Durham, Charles Lindsey, Travis Starns, Camerson Martin, Richard Schlager, Sharson Sjostrom, ADA-ES, Scott Renninger, Ted McMahon, US DOE-NETL, Larry Monroe, John Goodman, Southern Company, Rich Miller, Hamon Research Cottrell, Ramsay Chang, EPRI and Dick Johnson ,

Results of Activated Carbon Injection Upstream of Electrostatic Precipitators for Mercury Control - May 2003 Travis Starns, Jean Bustard, Michael Durham, Cam Martin, Richard Schlager, Sharon Sjostrom, Charles Lindsey and Brian Donnelly, ADA-ES, Rui Afonso, Energy and Environmental Strategies, Ramsey Chang, EPRI and Scott Renniger, US DOE-NETL

Characterization of Fly Ash from Full-Scale Demonstration of Sorbent Injection for Mercury Control on Coal-Fired Power Plants - Mar 2003; Contance Senior, Reaction Engineering Intl., Jean Bustard, Kenneth Baldrey, Travis Strarns, Michael Durham, ADA-ES

Demonstration of Additive Use for Enhanced Mercury Emissions Control in Wet FGD Systems - Sept 2002; Paul Nolan, Kevin Redinger, B&W, Gerald Amrhein, Gregory Kudlac, McDermott Technology

Full-Scale Evaluation of Sorbent Injection for Mercury Control on Coal-Fired Power Plants - Sept 2002 ; Travis Starns, Jean Bustard, Michael Durham, Cam Martin, Richard Schlager, Kenneth Baldrey, ADA-ES;

Combustion Control

On-Line LOI Analyzers for NOx and Mercury Control - Oct 2003 ; Stephen Johnson, Quinapoxet Solutions, John Comer and Cal Lockert, Stock Equipment, Travis Starns, ADA-ES

Catalytic Oxidation

Study of Speciation of Mercury under Simulated SCR NOx Emissions Control Conditions - Oct 2003
C.W. Lee and Ravi Srivastava, USEPA-ORD, S. Behrooz Ghorishi, ARCADIS, Thomas Hastings and Frank M Stevens, Cormetech, Inc.

Sorbents

FA100: Mineral Based Mercury Sorbents - August 2006; Pascaline Tran, PhD., Xiaolin Yang, PhD., Larry Shore, PhD., William Hizny BASF

Full-Scale Evaluation of Carbon Injection for Mercury Control at a Unit Firing High Sulfur Coal – August 2006; Sharon M. Sjostrom, Cody Wilson, Jean Bustard, ADA-ES, Inc., Gary Spitznogle, Aimee Toole, American Electric Power Corporation, Andrew O'Palko-US DOE-NETL, Ramsay Chang, EPRI;

Field Evaluations of Carbon Sorbents-August 2006; Nicholas Pollack, Ward Rogers, Nicholas Pollack,David Fair, Calgon Carbon Corporation ,Trevor Ley Apogee Scientific, Inc.

A Novel Process for Onsite Production of Mercury Sorbents -May 2006 ; Lawrence Bool, Jurron Bradley and David Thompson, Praxair;

Toxecon and High Temperature Reagents or Sorbents for Low Cost Mercury Removal-Nov. 2005; David Muggi, Michael Durham, Tom Campbell, Richard Schlager and Cody Wilson, ADA-ES, Andrew O'Palko, US DOE-NETL, Ramsey Chang, EPRI, Kevin Dodson, Raon Unser, Mid Amercian, Richard Roberts, Mike Kolbus, Mike Rees, Entergy Corporation

Mercury Controls for PRB and PRB/Bituminous Blends-Nov. 2005; Michael Durham, Sharon Sjostrom, Travis Strans, Cody Wilson, ADA-ES, Ramsey Chang, EPRI, and Andrew O'Palko-US DOE-NETL;

Coal-Fired Power Plant Mercury Control by Injecting Sodium Tetrasulfide - Oct 2003; Anthony Licata, Babcock Power Environment Inc. , Roderick Beittel and Terence Ake, Riley Power

A Novel Technology to Immobilize Mercury from Flue Gases - May 2003; Vincent Durant, Stephen Stark, Richard Gebert, Zhengtian Xu and Richard Bucher, W.L. Gore, Robert Keeney and Behrooz Ghorishi, ARCADIS

Development and Demonstration of Mercury Control by Adsorption Processes (MerCAPTM) - May 2003 ; Sharon Sjostrom, ADA-ES, Ramsay Chang, EPRI, Mark Strohfus, Great River Energy, Dick Johnson, We Energies, Tim Hagley, Minnesota Power, Tim Ebner, Apogee Scientific, Carl Richardson, URS Corp., Vic Belba, Belba & Associates

Evaluation of Amended Silicate Sorbents for Mercury Control - May 2003; James Butz, John Lovell, Thomas Broderick, Rod Sidwell, Craig Turchi, ADA Technologies Alfred Kuhm, CH2M Hill

Amended Silicates™ for Removing Mercury from Power Plant Flue Gas - Jan 2003; James Butz, ADA Technologies, Inc., Gary Brown, CH2M Hill

Multi-Pollutant Applications

Impact of Fabric Filter Media and SDA Operations on Multi-Pollutant Emissions-August 2006; Michael McMenus, Kansas City Power & Light, Robert E. Snyder, P.E.* and Kevin E. Redinger, P.E.,The Babcock & Wilcox Company

Commercial Demonstration of ECO Multi-Pollutant Control Technology - Nov. 2005; John Boyle, Powerspan, Corp.

Full-Scale Evaluation of a Multi-Pollutant Control Technology: SO_2, Hg, and NO_x - Oct 2003; John Ralston, Edwin Haddad, Geoff Green, Mobotec, Steven Castagnero, Progress Energy;

Summary of Air Emissions from the First Year Operation of JeA's Northside Generating Station - Oct 2003; William Goodrich, JEA, Michael Sndell, Vince Petti, Louis Rettura, Wheelabrator Air Pollution Control

Application of Wet Electrostatic Precipitation Technology in the Utility Industry for Multiple Pollutant Control Including Mercury - Aug 2003; Ralph Altman, EPRI, Wayne Buckley and Dr. Isaac Ray, Croll Reynolds Clean Air Technologies

Latest Developments of the Plasma-Enhanced Electrostatic Precipitator for Mercury Removal in Coal-Fired Boiler Flue Gas - Sept 2002;
John Montgomery, Daniel Battleson, Clarence Whitworth, MSE Technology, Ralph Altman, EPRI, Wayne Buckley, James Reynolds, and Dr. Isaac Ray, Croll Reynolds Clean Air Technologies

NOx and Mercury Control by Combustion Modifications - Sept 2002;
V. Lissianski, V. Zamansky, P. Maly, R. Seeker, and G. England, GE EER

Additional Information: available at www.icac.com

ICAC Mercury Control Fact Sheets:

1. MERCURY CONTROL WITH FABRIC FILTERS FROM COAL-FIRED BOILERS
2. SORBENT INJECTION TECHNOLOGY FOR CONTROL OF MERCURY EMISSIONS FROM COAL-FIRED BOILERS
3. ENHANCING MERCURY CONTROL ON COAL-FIRED BOILERS WITH SCR, OXIDATION CATALYST, AND FGD
4. PRE-COMBUSTION AND COMBUSTION TECHNOLOGY FOR CONTROL OF MERCURY EMISSIONS FROM COAL-FIRED BOILERS

ICAC Comments to EPA & U.S. Senate

Mercury Control Technologies - January 3, 2005, Utility MACT Rule NODA Comments

U.S. Senate Hearing - July 9, 2004, Democratic Policy Committee Hearing on Mercury

Mercury Control Technologies - June 2004, Utility MACT Rule Comments

Mercury Monitoring Technologies - June 2004, Utility MACT Rule Comments

Senator CARPER. Dr. Durham, thanks, and I look forward to following up on some of the points that you have raised during our Q&A. Thank you.

Dr. Benson, welcome.

STATEMENT OF STEVEN A. BENSON, SENIOR MANAGER, ENERGY AND ENVIRONMENTAL RESEARCH CENTER, UNIVERSITY OF NORTH DAKOTA

Mr. BENSON. I would like to thank the Chair and members of the Committee for the opportunity to testify today. I am a senior research manager at the Energy and Environmental Research Center at the University of North Dakota.

At the EERC, we conduct research, development and demonstration projects on a wide range of energy and environmental issues, including energy production and environmental issues associated with the utilization of renewable as well as fossil energy resources. For the past 20 years, we have been involved in the development and testing of mercury measurement and control technologies in bench, pilot and full-scale systems. To date, we have conducted mercury emissions control testing in over 80 power plant units that fire lignite, sub-bituminous and bituminous coals in the United States and Canada.

Today I will provide a perspective on the status of mercury control technologies and coal-fired power plants. Over the past 5 years, a variety of technologies have been tested, including sorbents to capture mercury, such as activated carbons, metals, silicates. There has been chemical addition and catalyst used to oxidize mercury to a soluble form for capture in scrubbers, as well as combinations of sorbents and oxidizing agents.

While significant progress has been attained for achieving greater than 90 percent removal of mercury from combustion flue gases for selected coals and selected system configurations during short-term testing, technology necessary to maintain 90 percent mercury control throughout the coal-fired fleet has not been demonstrated adequately to ensure long-term performance and reliability. Demonstrated technology performance and reliability to meet mercury emission standards is essential to ensuring reliable electricity generation at low cost.

I will comment on both performance and reliability relative to mercury control technologies. Typically, the most important factors that limit technology performance are coal composition, coal composition variability and plant configurations. Remember that coal fired, plant configurations and operations are typically unique to each plant.

We found that in order to attain optimum mercury capture performance, the technology must be tailored based on the forms of mercury in the flue gases, which are driven by coal composition, system configuration and operating parameters. For example, injection of plain and enhanced activated carbon upstream of particulate control devices in power plants has shown greater than 90 percent control in some cases. However, in other cases, difficulty in obtaining greater than 60 percent mercury control has been observed, even with injection of high levels of enhanced activated carbon.

Broadly applying mercury control technologies across the fleet of more than 1,200 power plants requires long-term demonstrated performance of the suite of technologies based on fuel type and plant configuration. Technology reliability is essential for the electric power industry. The technologies must provide high levels of mercury removal efficiency 24 hours a day, 365 days a year, as a function of fuel variability, plant operations and seasonal changes. Uncertainties exist in the ability of the technology to maintain high levels of mercury control if changes occur in coal composition, fuel blending ratios and load conditions. In addition, concerns for the performance of the technology under very low temperature conditions and high temperature conditions exists.

In conclusion, we have made significant progress in the development of mercury control technologies for coal-fired power plants. However, unresolved issues remain. The wide range of coal types, plant configurations, increases the uncertainties in the ability to effectively control mercury emissions. Less than 10 percent of the power plants in the United States have been tested. Technology performance is typically based on short-term testing of a few hours or a month.

Longer term testing of mercury emissions control technologies on selected power plant configuration and fuel properties as needed to reveal any unintended environmental side effects of the mercury control strategy, identify and minimize the effects of sorbent poisons, such as SO_3, and also identify other balance of plant issues, such as corrosion that may limit the lifetime of the power plant. Longer term testing must be designed to address these remaining issues, as well as refine the technologies to ensure that the electric utility industry can meet new mercury standards while providing low cost, reliable electricity in the future.

However, the number of projects and programs on mercury control have dropped off sharply recently and the funding for future long-term testing is very limited and in some cases, has been zeroed out.

Thank you for the opportunity to testify and I will be glad to answer any questions.

[The prepared statement of Mr. Benson follows:]

Committee on Environment and Public Works
United States Senate
Hearing on Mercury Legislation
Testimony of Dr. Steven A. Benson
Energy & Environmental Research Center
University of North Dakota
May 13, 2008

Introduction
Thank you, Madam Chair and members of the Committee, for the opportunity to testify today. My name is Steve Benson, and I am a Senior Research Manager at the Energy & Environmental Research Center (EERC) at the University of North Dakota in Grand Forks, North Dakota. I have conducted and managed research, development, and demonstration projects on combustion, gasification, and environmental control systems for over 25 years, with an emphasis on new technology commercialization for utility applications.

The EERC has worked on mercury-related issues facing industry for over 20 years through projects supported by the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), state agencies, and industry and is recognized as a world leader on mercury fate and behavior in combustion systems, mercury measurement, sorbent development, and mercury emission control demonstrations. The EERC has conducted over 2000 bench-scale tests, over 200 pilot-scale tests, and over 80 mercury field tests at more than 60 power plants in the United States and Canada over the past decade related to mercury measurement and evaluation of control technologies. We have made significant progress and have been able to attain greater than 90% mercury removal for selected coals and system configurations. We continue to work on a few projects related to mercury measurement and control for the coal-fired power industry. However, future funding for these efforts have significantly decreased or have been zeroed out.

On February 8, 2008, the U.S. District of Columbia Circuit Court of Appeals voted to vacate the Clean Air Mercury Rule (CAMR). As a result of vacating CAMR, utilities will not be allowed to buy credits at plants where mercury emissions are difficult to control effectively. Instead, the utilities will need to meet the more stringent Maximum Achievable Control Technology (MACT) standard at ALL power facilities rather than follow the CAMR cap-and-trade approach. In addition, a bill, S. 2643, was introduced to amend the Clean Air Act requiring a reduction in emissions of mercury from new and existing electric utility steam generating units of not less than 90%. Mercury control technologies necessary to maintain 90% mercury emission control throughout the coal-fired power industry are not proven because of the wide variability in coal composition and plant configurations. The percent reductions that are typically quoted are generally best case and based on short-term testing; that is, not worst case and not long-term mercury removal averages which are generally lower and likely due to variability in coal and plant operations. Also, the values generally quoted assume (or imply) that the mercury control technology is 100% available. Mercury control solutions for all combinations of coal and plant configurations have not been sufficiently proven and require additional development as well as longer-term demonstration.

This is of critical national importance as our nation faces concerns over energy and electrical shortages yet calls for environmental stewardship.

While advancements have been made, many significant challenges and questions remain, especially in light of CAMR being vacated; new technologies and longer-term testing are vitally needed. Today, I will provide a perspective on the status of mercury control technologies and specific issues associated with the control of mercury emissions from coal-fired plants. These issues include coal characteristics, flue gas composition, control technology application, and system configuration.

Coal Composition and Flue Gas Characteristics
Coal composition dictates the characteristics of the flue gas produced upon combustion. The flue gas components influence the form of mercury and the selection of the optimum mercury control option. Appalachian and interior bituminous coals typically contain high levels of chlorine, sulfur, and iron-rich materials that, when combusted, convert mercury to, mainly, a more easily captured oxidized form, with minor amounts in the more-difficult-to-capture elemental form. Subbituminous coals usually have low sulfur and chlorine levels that produce flue gas where most of the mercury is in the elemental form. Lignite coals are highly variable in composition. The northern Great Plains lignites contain lower sulfur relative to bituminous coals, low chlorine, and ashes that are rich in alkali and alkaline-earth elements and produce flue gases where the elemental form of mercury is dominant. Gulf Coast region lignites typically have higher ash than northern lignites, sometimes higher sulfur contents, and produce a flue gas where the mercury can range from 50% to over 90% elemental. In summary, the mercury forms produced from each coal are different and thus require a different mercury control strategy.

Control Technology Application and System Configuration
The technologies that show the greatest promise for mercury emission control include sorbent injection upstream of existing particulate control systems and chemical addition to oxidize mercury species for capture in downstream air pollution control devices such as sulfur scrubbers:

- Activated carbon injection using an enhanced or chemically treated activated carbon shows promise in attaining mercury removal of over 90% in selected applications (Feeley and Jones, 2008). The utility industry is beginning to install activated carbon injection systems.
- Untreated activated carbon combined with injection of chemical additives called sorbent enhancement additives (SEAs) has shown removal rates of greater than 90% in many applications.
- Inorganic sorbents, such as amended silicates and other materials, have shown mixed success. In full-scale application, amended silicates showed only 40% mercury removal efficiency. In pilot-scale testing, higher levels of control were observed.
- Elemental mercury oxidation through injection of chemical additives into the furnace or added with the coal for removal in scrubbers has shown varying degrees of success, ranging from 44% to 92% removal.
- Mercury oxidation through the use of oxidation catalysts has shown the ability to oxidize elemental mercury for capture in scrubbers. The use of selective catalytic reduction (SCR) for NO_x emission control has shown increases in mercury capture from a baseline of 60% to nearly 90% mercury control for bituminous coals.

The aforementioned levels of mercury emissions control are from specific cases and short-term testing.

Particulate Control – ESP-Only

Numerous short-term tests, from a few hours to monthlong periods, have been conducted on a wide range of coal types in plants configured with a cold-side electrostatic precipitator (ESP) only. The results of testing injection of chemically treated activated carbons or injection of untreated carbons with SEAs upstream of cold-side ESPs show that removal rates of over 90% can be attained, but removals vary widely with coal characteristics. For example, in flue gases containing even minor amounts of SO_3, the removal rates were significantly decreased, especially for some bituminous coals. The SO_3 competes with or "poisons" the active sites on the enhanced activated carbons, impeding mercury capture. Limited testing has been conducted with hot-side ESP's 60% to 73% control has been achieved.

Particulate Control – ESP and Fabric Filters

In plants configured with the combination of an ESP and fabric filters, a Toxecon™ configuration, the combination has shown the ability to have high removal rates with both untreated and treated activated carbon. However, handling and storage of the activated carbon and ash may be an issue because of its ability to ignite and burn in hoppers. Additionally, this method requires a very large capital addition (fabric filter) to the power plant.

Dry Scrubbers

The injection of activated carbon, enhanced activated carbon, and SEA combined with activated carbon has shown removal efficiencies of over 90% in spray dryer absorber and fabric filter (SDA–FF) applications.

SCR and Dry Scrubber

Initial testing of SEA and activated carbon injection in a plant configured with SCR and an SDA–FF showed high mercury removal efficiencies of greater than 90%. However, recent testing showed much lower removal efficiencies, likely due to minor deactivation of the SCR catalyst. Testing is ongoing.

ESP–Wet Scrubbers

Chemical additives to increase the oxidation of elemental mercury have shown a range of removal rates from 60% to 92%. These removal rates are highly dependent upon coal composition. Reemission of mercury from the scrubber can often cause reduced removal rates. While technologies for preventing mercury reemission have been developed, their performance again varies with coal characteristics and system design and operation.

SCR ESP–Wet Scrubber

The use of SCR for NO_x emission control has shown an increase in mercury capture from a baseline of 60% to nearly 90% mercury control for bituminous coals, during limited testing.

In summary, the testing results show promise in removing mercury from flue gases. However, attaining greater than 90% removal for all coal types and system configurations has not been demonstrated.

Remaining Issues

- **Lack of Long-Term Testing**
  Only short-term, approximately monthlong, tests have been completed for the technologies described above. While some technologies have shown promise, many issues remain unresolved, such as long-term performance, reemission of mercury, the impact of SO_3, balance-of-plant impacts, the impact of blending coal with renewable fuels, and possible unwanted (unknown) environmental side effects.

- **Limited Number of Plants and Coal Types Tested**
  The MACT standard will require that all 1200-plus plants/units in the United States apply mercury control technologies. To date, fewer than 10% have been tested. Consequently, many coal types, blends, unit configurations, and variations in operating parameters have not been tested. This lack of data leads to uncertainty for utilities in making decisions as they determine what technologies will work best given their coals and individual unit configurations.

- **Combustion By-Product Utilization**
  Limited progress has been made to develop mercury sorbent materials that will not impact utilizing the ash for cement replacement and other applications.

- **Development of Long-Term Mercury Sampling and Analysis**
  Robust systems that are reliable and economical are still needed to meet the tremendous market need for the power sector.

- **Integrating Mercury Capture with Gas Conditioning for CO_2 Separation and Capture Technologies**
  Many of the CO_2 technologies require extremely clean flue gas. Mercury is known to have a negative impact on many of these systems, and its impact on others is under investigation. As a result, increased levels of mercury and trace element control will likely be required to enable the use of some CO_2 capture technologies.

- **Development and Testing of Multipollutant Control Technologies (including CO_2)**
  Development and testing of new-generation multipollutant control devices must continue to provide more integrated and cost-effective solutions that address all pollutants of concern collectively, rather than on a single-pollutant basis. Multipollutant technologies and their impact on advanced energy conversion systems using elevated pressures and temperatures must be tested to ensure system reliability and continued emission performance.

Conclusions

Over the past 5 years, significant progress has been made in the development and testing of mercury control technologies for coal-fired power plants. However, with this significant progress, unresolved issues remain. The wide range of coal types and plant configurations increases uncertainties in the ability to effectively control mercury emissions. Each plant has a unique design, configuration, operating parameters, and suite of fuels fired that make broadly applying mercury control technologies very difficult.

To date, short-term testing has been conducted, but in order to further develop and demonstrate mercury control technologies, a logical product development path must be followed to ensure required performance and reliability. Most product and technology failures are due to insufficient or poor testing. For mercury emission control, the path must include longer-term tests to reveal any unintended environmental effects and tests on a range of power plant configurations and fuel properties. Longer-term testing programs must be designed to address the remaining challenges as well as to refine the technologies to ensure that the electric utility industry can meet new mercury standards while providing low-cost and reliable electricity in the future.

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Thomas J. Feeley and Andrew P. Jones. An Update on DOE/NETL's Mercury Control Technology Field Testing Program. www.netl.doe.gov/technologies/coalpower/ewr/mercury/pubs/netl%20Hg%20program%20white%20paper%20FINAL%20Jan2008.pdf (accessed Jan 2008).

Environment and Public Works Committee Hearing
May 12, 2008
Follow-Up Questions for Dr. Steven A. Benson: from Senator James M. Inhofe

1. Mr. Benson, Can you tell me how much activated carbon injection is currently installed in baseload power plants 365 days a year at full capacity?

   Response: Based on information from the Institute for Clean Air Companies, four plants have installed activated carbon injection systems, with anticipated start-up dates prior to second quarter 2008. Two of the units are plants equipped with spray dryer absorber fabric filter (SDA–FF) systems, one has an electrostatic precipitator followed by a fabric filter (TOXECON™ configuration), and one is unspecified. The total capacity of these units is 1095 MW.

2. Mr. Benson, according to an April 25th 2006 DOE National Energy Technology Laboratory Mercury Controls Clarification, a number of critical technical and cost issues remain that need to be resolved through additional research before these technologies can be considered commercially available for all U.S. coals and the different coal-fired power plant configurations in operation in the U.S. One size does not fit all in regards to controlling mercury from the broad range of coals burned by, and various pollution control equipment installed on, today's coal-fired power plants. Recognizing these constraints, what kind of flexibility is there in this bill? Is there any flexibility in the MACT process?

   Response: Senate Bill 2643 requires 90% reduction of mercury emissions and does not allow for flexibility. The MACT process can be used to evaluate mercury control options on a plant-by-plant basis to determine the best technology. In addition, categorization of certain fuel types and configurations can be used. However, the most significant challenge for MACT is the availability of reliable data. The data from the Information Collection Request is out of date. The DOE field test data are limited and typically consist of short-term testing. The ability to incorporate flexibility is possible but will likely require more data that can be used to determine the MACT.

3. Mr. Benson, we hear from the representative of the state of New Jersey that some plants are *currently* achieving high reductions (80-90+ percent.) When will we know whether these levels can actually be met?

   Response: We do not know when data will be available. The information that we have on the New Jersey plants is summarized below.

*Power Plants Affected by the New Jersey Mercury Rule**

Plant	***No. of Affected Units***	***Coal***	***Total MW***
Logan	*1*	*Bituminous*	*230*
Mercer	*2*	*Bituminous*	*653*
Carneys Point	*2*	*Bituminous*	*590*
B. L. England	*2*	*Bituminous*	*300*
Deepwater	*1*	*Bituminous*	*74*
Hudson	*1*	*Bituminous*	*660*
Vineland	*1*	*Bituminous*	*25*

**The B.L. England and Vineland facilities were scheduled for shut down prior to December 15, 2007.*

Selected power plants in New Jersey have installed or are currently installing nitrogen and sulfur oxide reduction technologies along with mercury reduction through the use of activated carbon. The installations consist of selective catalytic reduction (SCR) for NO_x control followed by a dry scrubber and fabric filter system (SDA–FF) to control SO_2 and particulates. The technologies are designed to take advantage of cobenefits that can be attained while low-sulfur bituminous coals are fired. In order to attain cobenefit for mercury removal the coal must contain an optimum level of chlorine. In addition lower sulfur coals may be required in SDA-FF in order to meet SO_2 emission standards. This system may result in lower fuel flexibility because of required low-sulfur and optimum chlorine contents of the bituminous coal. The availability of these types of low-sulfur bituminous coals may be limited in the future.

At Carneys Point Power Plant, SDA–FF systems are already installed, resulting in a natural mercury capture of > 65%. Mercury testing has been conducted at Carneys Point using activated carbon injection, and >90% mercury control has been achieved (1).

SCR and dry scrubber technologies are being installed at Hudson and Mercer Generating Stations. In addition, a FF will be installed at Hudson. PSEG Fossil is expecting a 90% reduction in mercury emissions at these plants through the cobenefits of these control technologies. Activated carbon will be injected upstream of the SDA–FF for mercury control.

4. Mr. Benson, your testimony indicates that the efficiency claims associated with mercury control technologies are typically based on short-term tests, and that longer term applications show more variability. Would you explain the operating cycle of a base-load power plant and why you believe that longer-term tests would provide more meaningful data?

   Response: Typically, a base load power plant has significant variations in load and coal properties that occur over time lines greater than 1 month. Currently, short-term testing of mercury control technologies has not been conducted over sufficient periods of time to account for changes in plant operations, coal composition, and weather conditions as well as determining if unintended environmental consequences exist. The following is a listing of data gaps that would be filled with data obtained during longer-term testing of approximately 1 year.

   Plant operational changes:
   - *Operations at a coal-fired power plant are very dynamic and change over time. The changes have the potential to degrade the performance and reliability of the mercury control technology. Examples of the changes that occur include gas temperature, gas composition, gas velocity, and component wear.*
   - *The mercury control technology performance during start up and turn down processes.*

   Coal composition changes:
   - *Mercury levels in flue gas and mercury control technology response.*
   - *Mercury speciation in flue gas on mercury control efficiencies.*

   Seasonal changes:
   - *Extreme changes in weather condition impact storage and handling of carbon and other materials for mercury control.*
   - *Seasonal operation of SCR catalyst in ozone nonattainment regions.*

   Unintended environmental consequences:
   - *Spent mercury sorbents and additives may produce unintended unknown pollutants that require extended periods of time to form and accumulate.*

Balance-of-plant impacts:

- *Corrosion of system components due to the addition of sorbents and oxidizing agents.*
- *Long-term impact of mercury control technology on air pollution control device operation and reliability. Issues such as bag life in fabric filter systems, combustible carbon buildup in control devices, and reduction in ESP particulate collection performance have been identified as problems associated with the implementation of mercury control technologies.*

5. Mr. Benson, your testimony notes that power plant use many different coal types, blends, unit configurations and variations in operating parameters. Would you expect these variables to affect the removal efficiency of mercury pollution control equipment?

Response: Yes, the following are specific issues related to these variables.

Coal-type impacts on removal efficiency:

- *Changes in the abundance of mercury in the coal will change the level of mercury in the flue gas, so the mercury control technology must have sufficient sophistication to respond rapidly to these changes.*
- *Changes in chlorine level will impact the level of oxidized mercury in the flue gas and will change the mercury capture efficiency of the sorbent or other technology.*
- *Changing the composition of flue gas and ash materials can influence the characteristics of the wet scrubber, resulting in reemission of captured mercury.*

Blends – biomass, petroleum coke, and coal:

- *Cofiring biomass with coal has the potential to have a significant impact on mercury emission as well as other pollutant control systems because of the presence of high levels of chlorine and phosphorus in some biomass. The effects of biomass cofiring are not well understood.*
- *Cofiring petroleum coke can increase the level of SO_3, reducing the efficiency of mercury capture because SO_3 will poison active sites on sorbents.*
- *Blending various types of coals and changes in blending ratios will impact control technology application. Blending of coals can influence sorbent poisoning and reemission from scrubbers.*

Unit configurations (plants equipped with air pollution devices):

- *Plants equipped with electrostatic precipitator (ESP- only configurations are currently the most numerous in the United States). Mercury control options for ES-only systems consist of sorbent and/or oxidation technology.*
- *Plants equipped with an ESP and FF are very few but require the use of a sorbent or oxidizing agent depending upon the coal fired.*
- *Plants equipped with wet FGD systems typically require an oxidation agent to capture the mercury. In some cases, reemission of elemental mercury can occur from the scrubber requiring the addition of other components to the scrubber.*
- *Plants equipped with dry scrubbers and fabric filters such as SDA–FF require the addition of an oxidizing agent or activated carbon upstream of the system.*

Plant operating parameters:

- *Changing the operations of the plant influences temperature, composition, velocity, and particle loading of the gas stream. These factors influence the effectiveness of mercury control technologies.*

6. Mr. Benson, I understand that significant amounts of the ash currently produced by power plants is beneficially recycled into building materials and other products. We certainly want to encourage these types of recycling practices. Are we certain that mercury pollution control equipment will allow power plants to continue to recycle ash?

Response: No, the presence of activated carbon in ash significantly limits the ability to utilize the ash in cement application because the carbon interferes with the air entrainment admixture chemicals that are used for workability and freeze–thaw capability. Mercury control sorbents that do not impact ash utilization are currently under development.

7. Mr. Benson, if you are familiar with the data responses to EPA' original request to certain power plants for data on the mercury content of feedstock coal, was there any variability in the mercury content of coal and of the ash tested after combustion? [answer will be yes, highly variable] Would such variability make it easier or harder to implement consistent, effective mercury control technology at a power plant?

   Response: Yes, we are familiar with the data and the variability is high.

   Higher variability in coal characteristics will make it much harder to maintain consistent, effective, and reliable mercury control technologies at a power plant.

   Reference

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Senator CARPER. Dr. Benson, thank you very much for that testimony.

Now we will turn to Dr. Levin. Welcome, and thank you, sir.

STATEMENT OF LEONARD LEVIN, PH.D., TECHNICAL EXECUTIVE, ELECTRIC POWER RESEARCH INSTITUTE

Mr. LEVIN. Thank you, Chairman Carper, members of the Committee.

I am Dr. Leonard Levin, Technical Executive at the Electric Power Research Institute, located in Palo Alto, California. I am here at the request of the Senators to discuss some recent research findings that relate the sources of mercury to its movement in the atmosphere, its ultimate fate when deposited to U.S. waterways and to the fish populations that live there, and how those findings relate back to mercury source management.

Mercury reaches humans primarily by the consumption of fish that may have elevated mercury levels. For that reason, public health benefits can in part be indirectly evaluated by how much less mercury deposits from the atmosphere to waterways containing these fish, once controls are placed on mercury sources. One newly published study provides a good picture of links among U.S. and global mercury emissions, how those have changed over the last 10 years and what we can expect to see in the resulting deposition of mercury in the United States from the atmosphere.

This study, and other new findings based on observed data, join a record of extensive modeling studies over the past few years, to provide a more understandable picture of the benefits to public health from regulating U.S. mercury sources. There are some key points relating to mercury deposition that relate back to this link between source controls and public health benefits. First, every source of mercury to the atmosphere emits three principal forms kinds of mercury. These three forms behave quite differently in the environment. One form of mercury is water soluble and is readily washed out of the atmosphere by precipitation. The other two forms of mercury are not water soluble and are more likely to be dispersed by large-scale wind patterns and pass out of national airspace before eventually being removed from the atmosphere at greatly reduced levels.

Second, more than 95 percent of global emissions of mercury originate outside the United States. Some of this global emissions total will deposit within U.S. waters. This establishes in essence a limit on how much the mercury entering fishable U.S. waters can be reduced by controls on U.S. sources alone.

Third, by far, most of the fish consumed by women of child-bearing age in the United States, the most sensitive individuals via potential exposure of developing fetuses, are sold in commerce and are harvested in the North Pacific, upwind from the United States, or come from farmed fish. For that reason, even severe cuts in U.S. emissions are bound to have limits on how effective they are in reducing U.S. mercury exposure generally.

It is increasingly evident that specific control approaches tailored to the particular source being managed will provide the greatest return in overall public health benefits. The continuing development and testing of new control technologies is a needed step in this

process. The forms of mercury emitted dictate that, beyond a certain point for each mercury source, further controls will lead to less and less additional health benefit.

Together, all these factors and the scientific evidence for them call for close scrutiny of mercury in the U.S. both prior to and following any control steps. That scrutiny is just beginning with testing of required new measurement methods and the initial design of a multi-year national monitoring network for environmental mercury.

We should not anticipate rapid and obvious declines in fish mercury everywhere in the Nation once even the largest mercury sources are controlled, but instead look forward to an extended effort to manage mercury wisely and be vigilant about any resulting environmental health benefits.

Thank you.

[The prepared statement of Mr. Levin follows:]

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Written Testimony

before the

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE
WASHINGTON, D.C.

Leonard Levin, Ph.D.

Technical Executive
Electric Power Research Institute
Palo Alto, California

May 13, 2008

I am Dr. Leonard Levin, technical executive at the Electric Power Research Institute (EPRI). EPRI is an independent nonprofit organization carrying out research on technology, operations and the environment for the global electric power industry. EPRI brings together scientists and engineers, along with experts from academia, industry and other research centers, to address the major issues facing the electric sector. The various research groups at EPRI have been conducting investigations of environmental. mercury sources, fate, human health effects, and emissions controls for more than twenty years, spending between $10 million and $20 million per year on that research.

EPRI appreciates the opportunity to provide testimony to the Senate Committee on Environment and Public Works on the topic of mercury sources, health effects, and controls. The recent court decision by the D.C. Circuit Court of Appeals is leading to a re-evaluation of necessary mercury control regulations on electric utility coal-fired power plants. If utility mercury regulation moves back to Section 112 of the Clean Air Act, that change is likely to entail future risk-related studies under provisions for evaluating residual risk (risk remaining after full implementation of the initial regulatory control steps) and urban air toxics. For that reason, EPRI and others are now re-examining the mercury exposure and health impacts under different utility emissions scenarios. The lessons from those re-examinations are instructive in informing the community about the role of emissions controls in protecting public health, and the breadth of effort necessary to stem exposure to a global pollutant such as mercury.

SUMMARY OF OUR CURRENT UNDERSTANDING OF MERCURY SOURCES, HEALTH EFFECTS, AND CONTROLS

1. Increasingly, observations, measurements, and sophisticated modeling studies have demonstrated the significant role played by various mercury sources located in other countries to US mercury deposition.

2. Emissions of mercury in most countries outside the industrialized west are increasing at a rate of about 5 to 8% per year. This is especially true in China where emissions are growing rapidly despite application of new control technology which captures some mercury.

3. U.S. deposition of mercury has measurably declined in recent years in the northern tier of states from the Midwest to Maine, although such a decline is not evident in the southeastern U.S.

4. Sources as far away as 600 miles have been shown to contribute to mercury deposition at Steubenville, Ohio. This data-based finding tends to contradict modeling results attributing deposition only to nearby power plants.

5. Repeated studies by EPRI and by EPA have shown that health-related benefits from controls on power plant mercury emissions will not change significantly between a scenario in which all power plants are controlled to levels up to 90% vs. a cap and trade scenario in which the average reduction industry-wide is about 70%.

MERCURY IN THE U.S. ENVIRONMENT

Recent studies on mercury from all sources – natural and industrial, distant and domestic – have reinforced the complex nature of mercury input to the U.S. environment. The improvement in instrument and analytical methods, airborne and ground measurement protocols, and process modeling allows a more effective integration of data, the "gold standard" in any scientific endeavor, with computer simulations to provide an integrated understanding of mercury in the environment. Though many aspects of the substance are still poorly understood, the bounds on our understanding are narrowing and allowing us to more confidently link mercury concentrations in precipitation and in waterways to particular source areas and source categories.

Mercury as a Global Pollutant

- *Background Sources of Mercury.*

  Because mercury is a mass-conserved chemical element associated with geological formations in the earth's crust, it has long been ubiquitous in trace amounts in the human environment. This presence and potential impact were evidently common even prior to the Industrial Revolution. There is, for example, good archeological evidence that Native American peoples in the pre-European era set wildfires for land clearing and herding of wild animals. Geological cores from peat bogs and lake sediments show extended periods of elevated mercury in the atmosphere from these occurrences. There are many areas in the rural western United States with fish populations in local stream and lake systems bearing mercury at or above health advisory levels, even though no current or prior atmospheric or surface sources of the metal are evident nearby.

  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, 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 recently published 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 to North America at mid-latitude in the Northern Hemisphere. Following a recent global emissions re-evaluation by the United Nations Environment Program, emissions from China are believed to total more than half of all those from Asia, while Indian emissions may be half of what was earlier estimated. Country-by-country inventory estimates, when available, indicate that emissions on all populated continents except Europe and North America are increasing over time.

Country/continent	Hg annual emissions (Mg/y)	$Hg^0/Hg^{II}/Hg_p$
United States	104	60/31/9
Canada	8	54/35/11
Mexico	26	71/20/9
Asia	1204	57/34/9
Europe	239	61/32/7
South & Central America	92	71/23/6
Africa	407	65/28/7
Oceania	125	55/36/9

Table 1. Global anthropogenic emission inventory for total mercury (datum year 2000)

- *Trends in Mercury Concentrations.*

  Mercury, as a global pollutant, can exhibit significant fluctuations in concentrations due to local meteorological and environmental factors. Day-night cycles can bring oxidized mercury down to near the earth's surface by nocturnal cycling, displacing some of the normally prevalent elemental form. Nearby industrial areas can provide oxidizing agents, such as ozone, to convert ambient elemental to divalent mercury, while surface vegetation and porous soils can serve as temporary mercury reservoirs.

  These shorter term cycles tend to be smoothed out when examined from a global perspective using data from locations distant from emission sources and less subject to diurnal cycles. These global data will be more reflective of long-term trends in concentration, for example, driven by shifts in emission sources. Work by Franz Slemr et al.[2], shown in Figure 1, reveals that, over the past thirty years, global atmospheric mercury levels have apparently varied substantially. Those data indicate an apparent increase in emissions until about 1970-1980, then a decline for about 20 years or so, followed by a leveling-off in the past 10 years.

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[1] K Lohman, C Seigneur, M Gustin, S Lindberg; 2007; "Sensitivity of the Global Atmospheric Cycling of Mercury to Emissions," *Applied Geochemistry 23* (2008) 454–466

[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.

Investigators are still unable to determine whether this most recent change in trend is real and long-term, or an artifact of data coverage and time intervals. 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 Engstrom and Swain[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.

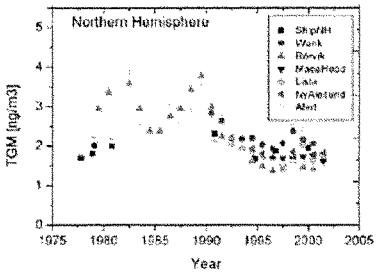

Figure 1.
From: "Worldwide trend of atmospheric mercury since 1977," F. Slemr et al., 2003; *Geophysical Research Letters, 30*, 10.

- *Mercury Deposition Trends.*

Mercury emitted to the atmosphere can be carried to great distances, and globally, by atmospheric circulation. Eventually some of this mercury will be deposited to the earth's surface, in part by dissolving in atmospheric precipitation and in part by simply contacting the earth's surface and being sequestered temporarily into soils and vegetation, or onto constructed surfaces. There are at present no field-capable means of consistently measuring this second form of deposition, referred to as dry deposition. The first type, wet deposition, is regularly measured around the United States in a network of precipitation collection stations termed the Mercury Deposition Network (MDN). This network is maintained and its samples analyzed for mercury by a voluntary system of sponsors, including state and federal agencies, universities, and private institutions such as EPRI. The samples are collected weekly, then analyzed for both the rate of mercury transfer to the surface in precipitation and the concentration of the mercury (all divalent form) in the precipitation itself. Figure 2 shows the most recent annual compilation of these national data.

Trends in the MDN data sets have been difficult to discern statistically, because the network itself is generally growing in coverage with time and the first of its stations has only been in operation since 1995. Two recent analyses by Han et al.[6] and by Butler et al.[7] have found by both modeling and data analysis that, in recent years, mercury deposition in the northeast,

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[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] JM Benoit, WF Fitzgerald, AWH. 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] DR Engstrom, EB Swain, 1997; "Recent Declines in Atmospheric Mercury Deposition in the Upper Midwest," *Environ. Sci. Technol., 31*, 960-967

[6] Y-J Han, TM Holsen, DC Evers, CT Driscoll, 2008; "Reduced mercury deposition in New Hampshire from 1996 to 2002 due to changes in local sources," *Env. Poll.* (prepub.)

[7] TJ Butler, MD Cohen, FM Vermeylen, GE Likens, D Schmeltz, RS Artz, 2008; "Regional precipitation mercury trends in the eastern USA, 1998–2005: Declines in the Northeast and Midwest, no trend in the Southeast," *Atmosph. Env. 42*, 1582–92

and specifically southern New Hampshire has declined significantly. Importantly, the latter paper is a re-investigation of deposition trends in the same area of New England modeled in a 2006 paper by some of the same authors. That earlier paper attributed most of the deposition and fish levels of mercury in southern New Hampshire to nearby utility coal-fired power plants, including sources no further from the receiving waters than western Massachusetts from the receiving waters in New Hampshire. The new paper by Butler et al. interestingly notes the difficulties in that approach, by remarking upon the lack of inclusion in either study of any mercury sources more distant than the adjoining state. The authors found an incommensurate decline in deposition with their modeled emissions cuts: emissions cuts of 50% and 90% in their scenarios led to general declines in deposition of 5% and 9% respectively, in their regional-scale domain, with greater proportional declines in deposition at finer scale closer to their largest modeled power plant source (in that case, they found a 23% deposition drop for a 50% emission cut).

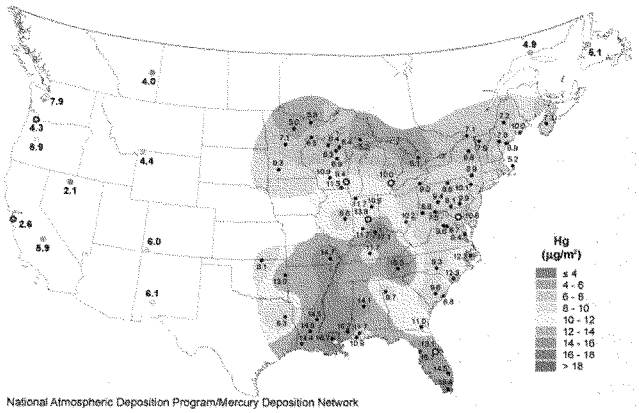


Figure 2.
Annual Mercury Wet Deposition, 2006.
From: National Atmospheric Deposition Program at
http://nadp.sws.uiuc.edu/mdn/maps/map.asp?imgFile=2006/06MDNdepo.gif

These findings, in a limited modeling study, reflect the conclusions of earlier emissions-deposition scenario calculations carried out for the entire United States. In those simulations, reductions in utility mercury emissions of 75% and 83% (the equivalent of about 25% and 27% national mercury emissions cuts, respectively, with other U.S. sources assumed to remain unchanged) both resulted in U.S. national average deposition drops of about 6%[8]. The differences between these national modeling simulations and the more constrained New Hampshire simulations lies primarily in the inclusion of many other (unchanged) sources, nationally and globally, in the U.S. simulation. But the general trend –

[8] C Seigneur, K Vijayaraghavan, K Lohman, P Karamchandani, C Scott, 2004; "Modeling the atmospheric fate and transport of mercury over North America: power plant emission scenarios," *Fuel Proc Tech. 85*, 441-50.

a small "payback" in deposition reduction for relatively large cuts in utility emissions – leads to the possibility of further investigation of how potential cuts in utility mercury emissions may play out in changes in local-scale deposition.

Mercury Deposition under Regulatory Scenarios

- *Pathways of Human Exposure to Mercury.*

  Nearly all community exposure to mercury occurs via consumption of food fish that may contain mercury levels of concern. These fish may be self-caught by anglers, individually distributed from anglers to family and community, or (in most instances) purchased in commerce. A number of studies have shown that the most sensitive individuals to mercury exposure are unborn fetuses, for whom mothers' consumption of fish represents the likely route of exposure through the umbilical blood system. Several studies of children in island nations, where consumption of locally caught fish is a major portion of the diet for young and old alike, have indicated that there is a threshold for (mothers') mercury exposure above which decrements in neurobehavioral achievement (ages of walking and talking; attention span; reaction time) are likely.

  It is this critical link, through fish consumption, that leads to the evaluation of mercury deposition in current and future policy scenarios as an indicator of how public health might benefit from willful control of source emissions. More importantly, current data and numerical tools allow us to study the marginal benefits of marginal source control strategies: what additional public health benefit (in lowered levels of fish mercury due to lowered levels of mercury input to waterways because mercury deposition has been reduced) can be expected if emissions are increasingly reduced from current emissions levels?

- *Patterns of Mercury Deposition.*

  Modeling studies over the past five years by the U.S. EPA, EPRI, and by others have shown quite clearly that, beyond a certain national level of emissions control, the net change in human health benefits (as measured by a decline in mercury deposition) becomes quite small. There are several reasons for this "declining marginal benefit." The primary reason is due to the two primary forms of mercury emitted by power plants, and their differences in both capacity for being captured before emissions and in atmospheric behavior.

  The divalent form of mercury, Hg(II), makes up roughly 40% of U.S. utility emissions, while elemental or metallic mercury, Hg(0), constitutes, on average, the remaining 60%. For an individual coal-fired power plant, these relative fractions can range from nearly 0 to nearly 100% for each (in addition to the differences in absolute amounts emitted). But divalent mercury is more easily captured within power plant facilities by existing and newly introduced control devices, such as flue gas desulfurization (FGD) systems or "scrubbers." Elemental mercury, conversely, is very difficult to capture by existing commercial control devices, primarily due to its very low chemical reactivity and its insolubility in water.

  These differences in ability to be captured at the source are, in a sense, counterbalanced by the two forms' behavior in the atmosphere once emitted. Divalent mercury, whose combined forms are generally water-soluble, is more readily removed from the atmosphere and from stack plumes by atmospheric precipitation, in which it will dissolve. Even though precipitation occurs only about 3-4% of the time in most of the United States, this small

fraction of time is very effective in removing the divalent mercury then present in the atmosphere in the areas of precipitation. The remainder of the time for divalent mercury, and all of the time for the elemental form, represents atmospheric transport away from the source points and dispersion into large volumes of the atmosphere. Simultaneously, atmospheric chemistry can oxidize elemental to divalent mercury, or reduce divalent to the elemental form.

Generally, this atmospheric dispersion carries elemental mercury thousands of miles from its source before, eventually, some of it becomes oxidized and entrained into precipitation carrying it to the earth's surface. Remembering that, like any plume of emitted material, longer transit time from the source point equals longer distance from the source and more mixing and dilution in the surrounding atmosphere, the picture emerges that elemental mercury plays little role in overall mercury deposition at locations close its atmospheric sources, while the divalent form plays a larger such role.

When this information is combined with the general pattern of mercury emissions from U.S. power plants, where power plants in the east generally emit higher fractions and higher mass flows of divalent mercury than those further west, a picture emerges that helps explain in part the deposition patterns seen in Figure 2. Mercury deposition generally increases from west to east in the United States for three primary reasons: first, rainfall is generally higher moving from west to east, and from northwest to southeast; second, there are increasing numbers of U.S. mercury emissions sources upwind, or generally west, of locations as one traverses from west to east, adding to the input of mercury at each location; and third, more of those sources may be preferentially emitting the more easily deposited divalent mercury.

- *Performance and Cost of Advanced Mercury Controls*

The effectiveness and cost of mercury control technologies, such as activated carbon injection (ACI), are determined by both the coal a power plant burns and a plant's existing or planned air pollution control equipment.

For many plants burning bituminous coal, removal of mercury at levels of 90% or more is potentially feasible with a combination of flue gas desulfurization (FGD) device, or "scrubber," for removing SO_2 and selective catalytic reduction (SCR) systems for NOX. However, this mercury removal can be affected by conversion of a portion of the captured mercury to elemental mercury, which escapes from the control device. Thus, the net removal may be less than 90%.

Plants that do not have an FGD and SCR system would be likely to use ACI for their mercury control. However, those plants that burn a medium-to-high sulfur coal can have the mercury reduction effectiveness of an introduced ACI system degraded by sulfur trioxide present in their flue gases, driving up the costs due to their need for increased carbon use. For higher sulfur coals, most plants can achieve mercury removal of about 50% even at high levels of carbon injection.

In the case of subbituminous and lignite-fueled power plants, test results to date have shown capture at levels of 90% or beyond when halogens such as bromine are either injected in the boiler or on the coal or are present in the activated carbon. However, additional issues arise regarding bromine in wastewater streams or the ability to use the coal ash in construction applications. These additional issues can add significantly to the true costs of ACI even

when capture efficiency is at high levels, for which the average capital cost for an ACI system is $4 per kilowatt.

- *Mercury Deposition under Utility Regulation.*

Because of the "co-benefit" of capturing divalent mercury with current (and planned) control equipment, every simulation run of control strategy economics and timing has indicated that the utility sector will significantly reduce mercury emissions as more plants are retrofit with SO_2 scrubbers and selective catalytic reduction (SCR) systems for NOx control (SCR systems can oxidize elemental mercury to the divalent form in some instances). Reductions in elemental mercury will require either in-plant oxidation to the divalent state for removal in FGD systems or application of additional technology such as activated carbon injection (which removes both forms of mercury). The tradeoff is that the elemental form plays very little role in nearby deposition, requiring some 3000 km before even half of an emitted amount of elemental mercury is removed from the atmosphere by chemical or physical processes. Thus we can see that most of the elemental mercury emitted in the United States is likely to disperse into the prevailing westerly wind patterns and pass out of national airspace before being removed from the atmosphere. Modeling studies have accounted for this behavior by tracking all the mercury to its eventual removal, even following repeated circumglobal transects before oxidation and precipitation to the surface.

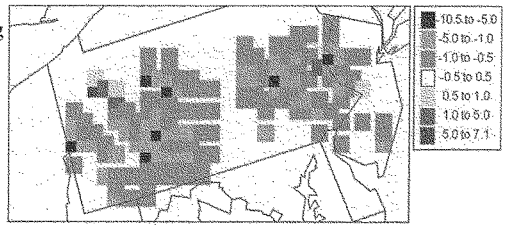


Figure 3
Differences in deposition, micrograms per square meter per year ($\mu g/m^2$-yr), Pennsylvania and New Jersey, for 90% utility controls vs. national 70% controls

The impacts of this differing behavior can be seen in Figure 3, a simulation of the differences in deposition in the states of Pennsylvania and New Jersey for two power plant control scenarios: a 90% cut from baseline (2004) emissions applied equally at each power plant, vs. state-designated "CAMR" levels under the former EPA control regulation (a 70% mercury reduction with the capability for emissions trading).

The patterns of differences seen between the two simulations are somewhat surprising but understandable once the data are carefully analyzed. We find that for most locations, in going from the 70% to the 90% control scenario, mercury deposition is incrementally reduced by 5 micrograms per cubic meter per year ($\mu g/m^2$-yr) or less. Some locations drop by up to 7 $\mu g/m^2$-yr. From Figure 4 below, it is evident that these additional reductions are only about 1/10th of current deposition in that region. (A few locations show a modest increase in deposition for a further cut in emissions. This is due to the 70% scenario including a provision for emissions trading. Since a 90% across-the-board reduction would leave no "excess" emissions for trading, power plants would have no economic incentive to cut emissions beyond 90% as they might under a 70% cap and trade.)

For the entire eastern US, the results are much the same. Going from a 70% average reduction as part of a cap and trade program to 90% control at all coal-fired power plants

results in a rather small change in mercury deposition (again typically about 5 $\mu g/m^2$-yr) which is a reduction of about 5-10% compared to the average deposition in the region, depicted in Figure 4.

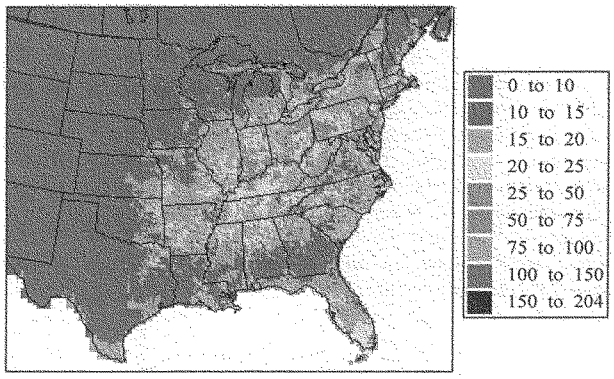


Figure 4
Total mercury deposition, micrograms per square meter per year ($\mu g/m^2$-yr), eastern United States, for 2004 mercury emissions from all sources U.S. and global

CONCLUSIONS REGARDING MERCURY FATE AND TRANSPORT

Based on these results we reach the following conclusions:

- Increasing required mercury emissions reductions from a 70% cap and trade scenario to a 90% plant by plant scenario results in very small marginal differences in mercury deposition. This is due to the fact that elemental mercury plays only a small role in U.S. mercury deposition as well as the continuing (and growing) role of non-U.S. mercury sources over time contributing to US deposition.
- The additional public health benefits that result in going from a 70% control strategy to 90% mercury controls on individual plants are minimal. The average decline in mercury exposure of U.S. women (as measured by projected drops in blood levels of mercury) is about 1%, with a maximum reduction of less than 7% under a 70% control strategy[9]. Going to 90% control, further reductions in exposures are insignificant. These findings closely match those of EPA, which found that the maximum decline in exposure was 15% under a roughly 70% decline in emissions.
- These relatively small drops in mercury exposure of U.S. women of childbearing age following large proportional cuts in U.S. utility mercury emissions are chiefly because

[9] L. Levin, 20 August 2004, "Mercury Research Update," U.S. EPA Headquarters, Washington, D.C.

consumption surveys by the Centers for Disease Control and Prevention have shown that women primarily consume fish purchased in commerce, of which about 70% come from the North Pacific, a region where mercury deposition is relatively insensitive to changes in U.S. mercury emissions. Due to prevailing wind patterns, that region is essentially upwind of American mercury sources, and their changes, so will reflect little change in resulting deposited mercury or mercury in fish native to the region.

- Current modeling tools allow the scientific community to effectively determine at which locations control of mercury emissions can have the greatest impact in reducing deposition of, and exposure to, mercury. By examining the major contributors to deposition in watersheds with the greatest sensitivity to changes in mercury input, effective management strategies can be designed. The complex relationships between water chemistry and aquatic ecosystems can be used to target particular sources that may strongly contribute to fish levels of mercury in those water bodies. An across-the-board reduction in mercury emissions of 90% from one source category appears, by all evidence, to have little additional benefit for human health compared to either focused reduction strategies or an average 70% emissions control approach.

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Response to Written Questions
from

Senator James M. Inhofe
Committee on Environment and Public Works
United States Senate
Washington, D.C.

to

Dr. Leonard Levin
Electric Power Research Institute
Palo Alto, CA 94304

July 11, 2008

Introduction

On June 24, 2008, a message from Senator Barbara Boxer, Chairman, and Senator James M. Inhofe, Ranking Member, on the U.S. Senate Committee on Environment and Public Works was received at the Electric Power Research Institute, Palo Alto, California. The message was addressed to Dr. Leonard Levin of EPRI, who had provided written and oral testimony to a committee hearing of May 13, 2008, regarding environmental mercury, its sources and fate, and related questions concerning human health effects, management, and controls.

To facilitate senatorial and staff information, the core portions of those questions are repeated below, along with EPRI's summary reply to each in order, followed by the in-depth replies grouped together. Dr. Levin has prepared responses to Questions 1 and 2, while Dr. Ramsay Chang of EPRI has provided the information in response to the third question.

Summary EPRI Replies to U.S. Senate Questions

Question 1 from the Senate: Impacts of non-U.S. sources on U.S. mercury levels

Can you further explain how mercury transported from China affect the U.S.? Can we solve our mercury problem while China continues to increase the amount of uncontrolled coal that they bum?

Summary EPRI Reply to Question 1:

Aircraft and ground measurements have shown that between 600 and 750 tons of mercury cross the Pacific each year from Asia into the United States. This mercury has been traced to sources both within mainland Asia, particularly China, and to points further west on that side of the Pacific. A large portion of this mercury deposits within the United States as rainfall and atmospheric chemistry remove it from the atmosphere to the ground surface. This non-domestic mercury makes up a large fraction of the mercury depositing within the United States. In western U.S. states, mercury originating from Asian sources is a significant proportion of the mercury deposition. In eastern states, where U.S. sources are more dominant, this non-U.S. mercury is a smaller fraction of the contribution. The non-domestic mercury deposition is a growing background portion that will become increasingly important in the future as U.S. industrial

sources contribute less to domestic mercury deposition. In essence, mercury arriving via the atmosphere from China, the rest of Asia, and the balance of the globe forms a "management floor," a baseline deposition rate of mercury in the United States that is not reducible by national action alone.

Question 2 from the Senate: Changes in mercury exposure from stricter utility controls

Would you give us some additional detail regarding your conclusion that a 90% source-by-source reduction level does not provide significant exposure reduction when compared to a 70% reduction under a cap-and-trade approach?

Summary EPRI Reply to Question 2

The two primary forms of utility-emitted mercury behave quite differently in the atmosphere, and in the manner in which they contribute to United States mercury deposition. The first of these two forms, divalent mercury, is more easily controlled by existing and planned emission control technologies, such as "scrubbers" to capture sulfur dioxide (SO_2) emissions. This divalent mercury also plays the dominant role in mercury deposited within the U.S. The second form, elemental mercury, is more difficult to capture by SO_2 scrubbers, and also plays a much smaller part in mercury depositing within the U.S. Many power plants that have SO_2 scrubbers (and selective catalytic reduction systems for capturing nitrogen oxides, NOx) will remove a large fraction of the divalent Hg as a "co-benefit." Under the former 70% control scenario, many plants would have taken advantage of this co-benefit to capture most of their otherwise-emitted divalent mercury, as well as to install mercury-dedicated controls on those plants where it is least expensive to do so. Thus, a significant portion of the divalent mercury, the most readily deposited mercury form, would be removed from power plant emissions. Going from a 70% control target to controls of 90% or beyond at individual plants will have little further effect on deposition in the U.S. That is because the additional controls, of whatever type, will be trying to capture the mostly elemental mercury that would still be left in the stack emissions following the earlier installation of divalent mercury-dominant capture devices. That elemental mercury tends to leave U.S. airspace to disperse into the global atmosphere, and plays almost no role in mercury entering U.S. waters. So its capture will make nearly no difference in lessening U.S. mercury exposure.

Question 3 from the Senate: Commercial readiness of mercury controls

According to an April 25th 2006 DOE National Energy Technology Laboratory Mercury Controls Clarification, number of critical technical and cost issues remain that need to be resolved through additional research before these technologies can be considered commercially available for all U.S. coals and the different coal-fired power plant configurations in operation in the U.S. One size does not fit all in regards to controlling mercury from the broad range of coals burned by, and various pollution control equipment installed on, today's coal-fired power plants. Recognizing these constraints, what kind of flexibility is there in this bill? Is there any flexibility in the MACT process?

Summary EPRI Reply to Question 3

The development of mercury (Hg) control technology options has progressed significantly in the past several years and some technologies are near commercial readiness. However, there are still a number of outstanding issues that need to be addressed before we can confidently predict performance and cost for all coal types and emission control technology configurations. The effectiveness and cost of Hg control technologies, such as activated carbon injection (ACI), are highly dependent on the coal a power plant burns and a plant's existing or planned air pollution control equipment. For bituminous-coal plants, co-benefits from existing air pollution control technologies (such as selective catalytic reduction and flue gas desulfurization) can potentially capture more than 90% of the mercury, but not in a consistent manner

across all configurations. There needs to be a better understanding of the factors affecting removal, as well as more development work to find mitigation options to ensure consistently high removals. For the many subbituminous and lignite-fueled power plants, bromine addition into the boiler in conjunction with a wet scrubber or the use of brominated activated carbon injection has demonstrated high mercury removal effectiveness over short (less than one month) evaluation periods. However, the ultimate fate of the captured mercury in waste streams, as well as any unintended impacts on power plant operation, are not fully understood. In all cases, no significant long-term tests have yet been done that ensure full operational readiness of mercury-focused controls, so that no assurances can yet be given to regulatory bodies that the promised control levels will be consistently attained.

In-Depth EPRI Replies to Senate Questions

Question 1 from the Senate: Impacts of non-U.S. sources on U.S. mercury levels

In-Depth EPRI Reply to Question 1:

We have a number of measurements from both surface and aircraft instrumentation of plumes of mercury entering the Pacific Ocean airspace from mainland Asia, and crossing the west coast of the United States from the Pacific. Aircraft measurements were done by scientists from the National Center for Atmospheric Research, Boulder, Colorado, in 2000. These measurements extended from the China coast to about 400 miles out in the Pacific, and vertically in the atmosphere. The output of mercury in that experiment, extended to the entire year, totaled about 660 tons of the substance crossing the Pacific. The following year, NCAR scientists flew measurement instruments along the West Coast of the United States between Oregon and California, and up to the lower stratosphere. They found two mercury plumes entering the U.S., at twelve thousand and sixteen thousand feet, respectively.

Starting in 2004, scientists from the University of Washington, Seattle, measured mercury plumes crossing over the island of Okinawa in the western Pacific. Similar measurements, still underway, also began in the United States at nine thousand feet atop Mount Bachelor, Oregon, in the Cascade Range. Simultaneous aircraft measurements are often carried out as well. These measurements have repeatedly found distinct plumes of mercury, along with elevated levels of carbon monoxide, a tracer for industrial combustion of fossil fuels, penetrating U.S. airspace. The 2004 measurements showed that roughly 750 tons of mercury enter the United States in these Asian plumes each year. By contrast, total U.S. mercury emissions from all sources are about 110 tons per year, of which utilities represent about 42 tons per year (a portion of which escapes U.S. airspace to cross the Atlantic).

It is not possible to locate the exact points of origin of such incoming trans-Pacific plumes. Instead we use global weather data and models to track the plumes backward in time and space. When we do so, the farthest upwind point to which these "back-trajectories" can be traced, the point where they reach sea level on the western side of the Pacific, is usually either near Shanghai or in the region of Beijing. The higher 16 000 foot plume in 2001 was tracked back to Central Asia, perhaps the signal from an even further removed source area in eastern Europe. Some mercury plumes have been traced back to large wildfires in southeast Asia, where mercury is released from surface deposits by the intense heat.

The fate of that mercury from Asia, once it enters U.S. airspace, is still unmeasured. Some Asian plumes, after detection at Mount Bachelor, have later been tracked at a station in the Colorado Rockies by University of Nevada scientists. Essentially all of this Asian plume mercury is in the elemental form, which will only slowly deposit to the ground surface over time. Model calculations show that the plume formations will mix mercury downward as they move across the U.S., as well as experience chemical reactions with other atmospheric constituents to form the divalent, water-soluble, form of the chemical. Once that occurs, more rapid removal from the atmosphere within the U.S. will occur during the traverse of the country from west to east.

When we model the contribution of these mercury plumes to the amount deposited at ground level within the United States, and add to that the mercury which originates elsewhere in the world, in addition to U.S. mercury sources, we can compute the total deposition of mercury from all sources. These totals tend to increase from west to east, and from north to south, across the country. That pattern is due to three factors: (1) the west-to-east pattern of prevailing winds; (2) the increasing number of domestic mercury

sources in the U.S. proceeding from the Pacific to the Atlantic; and (3) the generally greater levels of intense rainfall from west to east and north to south. As more U.S. mercury sources add their input to this atmospheric transport stream, the divalent (water-soluble) form is subject to greater rainfall and greater removal from plumes to the ground.

Since the U.S. is at a relatively great distance from Asian (and other non-domestic) sources, their mercury concentrations and absolute contributions to deposition do not vary very much from west to east, nor north to south. So these non-U.S. sources represent a relatively constant background source within the overall deposition in the country. The net result is that Asian and other non-U.S. mercury is a large percentage contributor to deposition in the western U.S., where the absolute amount of mercury deposition is smaller than in the east (due to both more U.S. sources toward the east, and greater rainfall from west to east). Figures 1 and 2 show, respectively, the patterns of mercury deposition due to all sources, and the percent of that deposition made up of mercury coming from non-U.S. sources. In most of the western part of the country, more than half of the mercury deposition is due to non-U.S. sources, while in much of the eastern U.S. most mercury deposition is from domestic sources. In some isolated instances near large U.S. sources, non-U.S. mercury makes up 20% or less of the contributions to ground-level values.

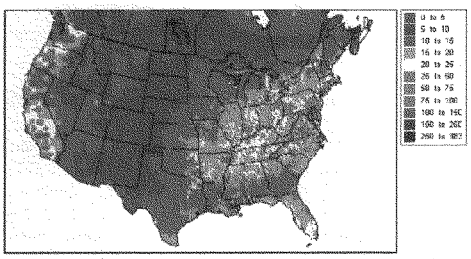
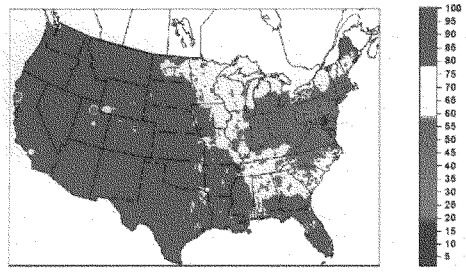


Fig. 1: Calculated total mercury deposition in the United States (units: micrograms per square meter per year).



Fig, 2: Fraction of deposited mercury in the United States due to non-domestic sources of mercury (in percent).

Question 2 from the Senate: Changes in mercury exposure from stricter utility controls

In-Depth EPRI Reply to Question 2:

Every power plant emits some combination of the three forms of inorganic mercury: elemental mercury, divalent (or oxidized) mercury, and particle-bound mercury. The amount emitted of each, and what proportion that makes up of the total mercury emitted, varies significantly, however. Some power plants emit nearly 100% elemental, while others are nearly all the divalent form (particle-bound mercury is typically 3% or less of the total). Roughly speaking, coal-fired power plants in the eastern United States emit slightly more divalent mercury proportionally than those in the mid-west, but the differences are only about 6% or so. Currently, existing controls on power plants remove about 36% of the mercury originally present in the coal.

These three forms of mercury are important because existing and planned control technologies for SO_2 and NOx are generally more effective at removing the divalent than the elemental form. This is because the divalent form is much more water-soluble than elemental, and is also electrically polarized. This "co-benefit" of mercury removal from SO_2 and NOx controls will significantly reduce mercury emissions as more of these controls are installed. These controls were being retrofit in many plants for regulatory compliance with the Clean Air Interstate Rule (CAIR), which was just overturned by court action. The expectation was for divalent mercury emissions to decline relatively soon as these controls were introduced for CAIR compliance; the amount and timing of the anticipated mercury co-benefit is now in question.

These anticipated control measures as a result of the CAIR requirement would have had a positive effect on reducing mercury deposition from U.S. utility emissions. The reason is that the divalent form is much more readily deposited closer to and at higher concentrations near its emission source. Numerous model calculations for different types of power plant emissions controls, coal, and stack configurations show that between 7% and 17% of the emitted amounts of divalent mercury typically deposit within 30 miles of the emission source (depending on local weather conditions, coal type, controls, etc.), whereas no more than 3% or so of the elemental form will deposit within the same distance. Most of the elemental mercury emitted by a power plant, no matter where that plant is located in the United States, tends to enter the global background atmosphere, diffusing to much lower concentrations as it is transported by winds, and depositing far from American shores at very low concentrations.

The result is that the introduction of additional SO_2 and NOx controls as a result of CAIR would have selectively captured mostly divalent mercury and, more significantly, impacted local and regional deposition, particularly deposition within U.S. boundaries. The former two-stage CAMR rule was designed around this former CAIR-driven first stage of "co-benefit" mercury capture followed by a second-stage mercury-dedicated capture-with-trading requirement. This approach was aimed at allowing full development and commercialization of technologies required to capture the remaining mostly elemental mercury, following the early control of mostly divalent mercury, in a cost-effective manner.

The second stage of CAMR would have been applied to power plants whose divalent mercury had, for the most part, already been controlled and thus prevented from potential deposition to U.S. waters. Likewise, any additional mercury reductions beyond CAMR mandated by some states (in some cases requiring 90% or more mercury control) would also have had minimal impact on local mercury deposition, Thus, moving from an average 70% mercury reduction to a 90% control on a plant-by-plant basis would result in removing mostly elemental mercury and thus would result in only a very small additional decline in U.S. deposition and an even smaller drop in levels of mercury in any U.S.-consumed fish.

EPRI calculations for a theoretical zeroing-out of U.S. utility mercury emissions show that the largest single point difference in deposition anywhere in the U.S. in going from the CAMR rule to a complete 100% ban on any utility mercury is a 12% drop in deposition, and the average drop is about 3%. So taking the slightly less restrictive step of going to 90% from CAMR, instead of going to 100%, will produce even lower "payback" in improved levels of mercury in atmospheric deposition and exposure through fish consumption.

Question 3 from the Senate: Commercial readiness of mercury controls

In-Depth EPRI Reply to Question 3:

Activated Carbon Injection (ACI) data for mercury removal from Municipal Solid Waste (MSW) plants are not applicable to coal-fired boilers for four reasons. First, MSW flue gas has much higher Hg concentrations than coal plants (approximately 100 times as high), so it is much easier to obtain a specific percentage reduction in these waste combustors. In fact, controlled MSW emissions (on a mass concentration basis) are about the same as or higher than uncontrolled power plant mercury emissions. Second, the flue gas from an MSW facility contains a great deal of chlorine, so the Hg is almost entirely divalent Hg (Hg^{+2}) and, therefore, easier to capture by ACI and SO_2 scrubbers. Third, MSW flue gas is at lower temperatures than in a power plant, so a sorbent such as ACI is more effective than in a power plant. Lastly, MSW flue gas ducts are smaller, so it's easier to get good contact between any mercury sorbent and the mercury in the flue gas passing through the ducts.

Mercury removals from coal-fired power plants are dependent upon the type of coal burned and the emission control equipment installed. For that reason, the effectiveness of the controls can be classified by coal type.

1. *Bituminous coal plants:* For many plants burning bituminous coal, removal of mercury at levels of 90% or more is potentially feasible with a combination of flue gas desulfurization (FGD) device, or "scrubber," for removing SO_2 and selective catalytic reduction (SCR) systems for NOx. However, this mercury removal can be affected by conversion of a portion of the captured mercury to elemental mercury, which is then re-emitted from these control devices. Thus, the net removal may be less than 90%. Also, the fate of the mercury captured in the scrubber is poorly understood. That mercury which winds up in the scrubber solids may get re-released during wallboard production. Mercury in solution may enter the plant wastewater stream. More research is needed to understand this partition and to develop strategies to remove mercury from the wastewater or minimize loss during wallboard production.

Plants that do not have an FGD and SCR system would be likely to use ACI for their mercury control. Most of these plants have electrostatic precipitators (ESPs) because fabric filters (FFs, the other particulate collection option for most power plants) do not work well in bituminous coal applications, especially for higher sulfur conditions. Further, those plants that burn a medium-to-high sulfur coal can have the mercury capture effectiveness of an introduced ACI system degraded by sulfur trioxide present in their flue gases. This results in operating costs being driven up at these plants, due to their need for compensating increased ACI use or the need to add additional sorbent materials to remove the sulfur trioxide. For the highest sulfur coals, mercury removals of greater than 50% have not been readily achievable, even at very high levels of carbon injection. In addition, injection of activated carbon prior to an ESP can increase stack emissions of particulate matter (PM) due to additional particle loading on the device. Thus, more development will be needed to assess if practical options can be found to achieve high mercury removals.

2. *Plants burning subbituminous or lignite coal*: In the case of subbituminous and lignite-fueled power plants, test results to date have shown Hg capture at levels of 90% or beyond when halogens such as

bromine were also injected in the boiler or on the coal, in conjunction with use of a scrubber. The bromine increased the oxidation of mercury (to the divalent form) and its removal in the scrubber. High mercury removals were also observed with brominated activated carbon. However, additional issues arise regarding bromine in wastewater streams and increased corrosion in ductwork or the scrubber. Activated carbon in coal ash can reduce the ability to use the ash in construction applications, thus potentially resulting in increased waste disposal volumes and costs. Injection of activated carbon prior to an ESP can increase the stack PM emissions, as is the case with bituminous coals. Increases in PM emissions can also trigger a New Source Review of the facility and potentially require a power plant to install additional air pollution control equipment at significant cost. In some instances, fires have occurred in the ash collection hoppers due to the presence of activated carbon. These additional issues can add significantly to the true costs of ACI, even when capture efficiency is at high levels. More and longer term testing will be needed to understand, quantify, and mitigate these "balance-of-plant" impacts.

While several newer mercury control technologies (mainly ACI and bromine addition to boilers) may be "offered for sale commercially," EPRI does not yet consider them to be "commercially available" from the user's perspective for the following reasons:

- Their performance cannot always be predicted with confidence (especially for use with medium- to high-sulfur bituminous coals).
- Insufficient long-term tests have been conducted of the mercury removal capability of any single technology or control strategy. Few studies have lasted as long as one month and only one as long as 12-18 months to ensure long-term performance at high removal levels with no unmanageable impacts on the power plant.
- The performance of these controls with certain configurations/coal types has barely been investigated (especially at plants burning coal blends).

The balance-of-plant impact costs (such as lost ash sales, waste stream treatments, increased PM emissions, corrosion, fires) are not well understood and could increase the anticipated cost of mercury control dramatically. In some cases, these costs may exceed the cost of the mercury control itself, such as that of ACI or bromine addition.

Senator CARPER. Dr. Levin, thank you so much.

Ms. Patton, thank you for joining us today.

STATEMENT OF VICKIE PATTON, DEPUTY GENERAL COUNSEL, ENVIRONMENTAL DEFENSE FUND

Ms. PATTON. Thank you very much, Senator Carper and Senator Voinovich and Senator Barrasso for the opportunity to be here.

My name is Vickie Patton. I am the Deputy General Counsel at the Environmental Defense Fund. I served in EPA's Office of General Counsel both in the first Bush administration and then also under the Clinton administration, where I had the privilege of working with a number of technical experts on air pollution.

In 1990, Congress debated with overwhelming bipartisan support an overhaul to the 1990 Clean Air Act Amendments, in which it laid out a blueprint to address the most toxic, indeed, hazardous air pollutants, including mercury pollution. Since that time, since Congress laid out its blueprint for action, we have made a lot of progress. We have plowed a lot of ground through good American ingenuity and innovation.

EPA has issued a 1,700 page report to Congress laying out the very serious health effects of mercury pollution. The National Academy of Sciences has issued a similar report, documenting the toxicological effects of mercury pollution. And what it has instructed us is that mercury poses a particularly serious threat to our most vulnerable populations, our children. Since that time, there has been a new body of data highlighting the connection between mercury exposure and the environment and heart disease, cardiovascular effects.

At the same time, a number of scientists have looked at the societal benefits of controlling mercury pollution from coal-fired power plants, the Nation's largest source of man-made mercury pollution. Scientists at the Harvard Center for Risk Analysis examined the societal, the monetary benefits of protecting Americans from the cardiovascular effects, from heart disease, children from cognitive developments.

Similarly, a group of scientists at Mount Sinai Medical Center teamed up with scientists at Children's Hospital and they conducted an assessment of the benefits of protecting children, their cognitive development, from mercury pollution. Both of these studies revealed that the monetary benefits of controlling coal-fired power plants at a high degree were in the billions of dollars. Of course, to a parent who is faced with a young child who has been exposed to mercury pollution, the value of protecting that child and securing its potential is priceless.

While we have been looking at the very serious health effects, American engineering firms have been demonstrating the great capacity to control mercury pollution. There have been pilot scale tests, there have been full-scale tests, we have examined the potential to control mercury at all coal types: lignite coals, bituminous coals, sub-bituminous coals, at all sorts of control technology configurations. And today, if you look at the Institute for Clean Air Companies website, you will see that there 90 bookings for advanced mercury controls at coal plants across the Nation, all parts

of the Country, burning all sorts of coal types with all different kinds of control technology configuration.

These bookings reflect some 40,000 megawatts of coal-fired capacity in America. This is good news. And it is not surprising, because 10 years ago, when EPA put in place a protective program to control mercury, 90 percent for medical waste incinerators and trash combusters, it was the same technology that proved that we could in fact reduce mercury dramatically from those sources of pollution.

While we have made great strides in terms of understanding the health effects of mercury and American innovation in bringing technology to bear, our national policy has faltered. EPA has put in place a flawed program to address this neurotoxin, using a meager trading program, a trading program that would in its first phase reduce mercury by only 20 percent and postpone any meaningful reductions for yet another generation of children. While Environmental Defense Fund has been a strong proponent of trading programs and using market-based mechanisms to solve environmental problems, trading is inappropriate for a neurotoxin that has very serious health effects.

In fact, there are a body of studies that show us that coal-fired power plants are associated with depositional hotspots. There was a landmark study done by EPA scientists and Michigan scientists in Steubenville, Ohio that associated coal-fired power plants with some 70 percent of the mercury deposited at this monitoring site that operated for 2 years continuously at the Franciscan University in Steubenville, Ohio. Similarly, scientists have looked at thousands of data points across New England and found evidence of serious biological hotspots. They have done sophisticated modeling analysis to show that if you reduce mercury in the immediate vicinity of where we are finding hotspots of mercury in the common loon and the yellow perch that it will have significant benefits.

But we also have real world empirical studies where State scientists in Florida looked at the benefits of reducing mercury from medical waste incinerators and combusters in South Florida. What they found is when they cut pollution 90 percent from those units that there was an immediate and commensurate response in the health of the Everglades in South Florida. So the mercury pollution in largemouth bass has been demonstrably reduced, as has other evidence of mercury pollution in the environment, and the grand egret.

So there are lots of examples where we know that when we reduce mercury pollution in our local environment, it has real world benefits. And we can demonstrate that through real world studies.

Sometimes when we debate air pollution issues in America it is easy to kind of lost sight of time, it is easy to lose sight of the perspective because we get caught up in issues about technology, we get caught up in issues about D.C. Circuit cases. But I want to thank you, Senator Carper and Senator Voinovich, for trying to help keep America's eye on the ball and ensure that we don't lose our perspective and lose our way. Coal-fired power plants are the Nation's largest single source of man-made mercury pollution. The National Academy of Scientists issued a seminal toxicological study in which it found that the children who are exposed at these envi-

ronmental levels to mercury pollution may struggle to keep up in school, they may require remedial classes, they may require special education. This has real world impacts in thwarting the potential of our children.

EPA's own toxicologist, Dr. Kathryn Mahaffey, looked at umbilical cord data. What she found is some 630,000 children each year are exposed to mercury levels that can impede their neurological development. This is EPA's own toxicologist. If you look at the consequences over the last 18 years of debate and delay, that means some 11 million children have been exposed to mercury pollution in our environment. While we have struggled federally to solve the problem, States have really charted the way. States across the Country have adopted very protective programs to address mercury pollution.

So with your leadership, I would like to respectfully request that we follow the lead of the States like Delaware and Illinois and Arizona and Colorado and Oregon and Washington and New Jersey and Massachusetts and Michigan that have adopted very protective programs, and we do the same to ensure that each child can realize its full potential. Thank you very much.

[The prepared statement of Ms. Patton follows:]

Before the United States Senate
Committee on Environment and Public Works

HEARING ON MERCURY LEGISLATION

Testimony of Vickie Patton
Deputy General Counsel
Environmental Defense Fund

May 13, 2008

Thank you very much Madam Chair and members of the Committee for the opportunity to testify about the *Mercury Emissions Control Act* (S. 2643).

My name is Vickie Patton. I am the Deputy General Counsel at Environmental Defense Fund, a national non-partisan science-based environmental organization, where I manage the national and regional air quality programs. I previously served as an attorney in the U.S. Environmental Protection Agency's Office of General Counsel under the George H.W. Bush and William Clinton administrations where I worked on a variety of Clean Air Act matters.

OVERVIEW

In 1990, the U.S. Congress charted the course for the nation in addressing the most deleterious airborne contaminants. The 1990 Clean Air Act Amendments, forged with strong bipartisan support and signed into law by Republican President George H.W. Bush, pointedly identified mercury as a harmful – indeed hazardous – air pollutant. The statute also singled out power plants, directing EPA to assess the health hazards due to mercury from power plants as a prelude to regulatory action.[1] Coal-fired power plants are the nation's largest source of human-caused mercury emissions.[2]

Nearly fifteen years later, EPA finalized a national policy for the mercury released by coal-fired power plants. In 2005, EPA announced a policy that recklessly misapplied an emissions trading system to mercury, a bioaccumulative neurotoxin.[3] EPA's policy was constructed on an

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[1] EPA was instructed to "perform a study of the hazards to public health reasonably anticipated to occur as a result of emissions by electric utility steam generating units" of mercury and other hazardous air pollutants and to report the results of the study to Congress. See Clean Air Act §112(n)(1)(A), 42 U.S.C. §7412(n)(1)(A). EPA was commanded to regulate if appropriate and necessary considering the study of public health hazards. *Id.*

[2] Northeast States for Coordinated Air Use Management, *Mercury Emissions from Coal-Fired Power Plants: The Case for Regulatory Action,* available at: http://www.nescaum.org/documents/rpt031104mercury.pdf (2003); see also U.S. Environmental Protection Agency, *Mercury Study, Report to Congress,* Volume II: An Inventory of Anthropogenic Mercury Emissions in the United States, EPA-452/R-97-004 (Dec. 1997), available at: http://www.epa.gov/mercury/report.htm.

[3] See 70 Fed. Reg. 15,994 (March 29, 2005) ("Revision of December 2000 Regulatory Finding on the Emissions of Hazardous Air Pollutants from Electric Utility Steam Generating Units from the Section 112(c) List"); 70 Fed. Reg. 28,606 (May 18, 2005) ("Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units").

insecure foundation that EPA declined to buttress with the enduring pillars of science, technology and law.

EPA disbelieved the potential for mercury discharged by power plant smokestacks to contribute to serious impacts in surrounding communities and glossed over the pointed concerns about mercury hot spots raised by the Agency's own Inspector General.[4] But landmark field studies have inextricably connected the mercury released from coal-fired power plants with deposition hot spots and with biological hot spots.

EPA was skeptical about the availability of advanced mercury control technology. But today engineering firms have contracted to install advanced mercury control systems at about 90 coal-fired power plants encompassing over 40,000 megawatts in electric generating capacity. The coal plants deploying advanced mercury removal systems combust the full range of coal types and operate in all parts of the nation.[5]

And EPA construed the law to remove coal plants from the carefully woven textual fabric designed to protect human health from each large source of hazardous air pollution. But in February the federal court of appeals in Washington, D.C. unanimously found that EPA stretched the law well beyond its elasticity in impermissibly substituting the Agency's desires with Congress' protective directives.[6]

Fortunately, our nation has a dynamic and resilient system of government. While EPA veered from science, technology and law, some states charted a sure and steady course. A number of states have crafted policies to secure considerable reductions at each power plant by establishing protective emissions standards based on advanced mercury removal technologies. These state programs provide a demonstrably firm and stable foundation for federal action.[7]

Today, we respectfully ask Congress to ensure EPA takes prompt corrective action that protects the entire nation from power plant mercury pollution. Forty-eight states have fish consumption advisories for mercury. An extensive and rigorous body of science documents the toxicological effects of mercury on human neurological development, particularly newborns and young children, and on the human cardiovascular system. Fortunately, clean air solutions are at hand. American innovation has once again prevailed over skepticism. Technologies to remove 90 percent or more of the mercury from coal-fired power plants are readily available and cost-effective.

But nearly eighteen years after Congress chartered its course for the nation – national policy is far adrift from the science that compels action, from the clean air solutions widely available and from the plain text of the law that instructs each power plant to do its part in maximizing reductions of the most toxic contaminants. Today, we respectfully ask Congress to adopt the

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[4] EPA Office of Inspector General, *Additional Analyses of Mercury Emissions Needed Before EPA Finalizes Rules for Coal-Fired Electric Utilities,* Report No. 2005-P-00003 (Feb. 3, 2005) ("the proposal does not adequately address the potential for hot spots").

[5] Institute of Clean Air Companies, *Commercial Electric Utility Mercury Control Technology Bookings* (updated April 21, 2008), available at: http://www.icac.com/files/public/Commercial_Hg_Equipment_042108.pdf.

[6] *New Jersey, et al. v. EPA*, No. 05-1097 & consolidated cases (D.C. Cir. decided Feb. 8, 2008).

[7] See National Association of Clean Air Agencies, *State Mercury Programs for Utilities* (Dec. 4, 2007).

Mercury Emissions Control Act and to end the protracted delay in protecting the public's health from hazardous air pollutants.

MERCURY IS A BIOACCUMULATIVE NEUROTOXIN THAT HARMS HUMAN HEALTH AND THE ENVIRONMENT

Mercury is a toxic heavy metal that contaminates water bodies across the nation, threatens the development of newborns and children, and contributes to the risk of heart disease.

Mercury vented into ambient air deposits from the atmosphere in precipitation or attached particles, and through runoff or deposition can end up in lakes, rivers and the ocean. Toxic methylmercury results from the transformation of mercury by microorganisms in the sediments of water bodies. The methylated mercury readily accumulates in the aquatic food chain with the concentrations increasing at each level in the food chain. According to EPA, the concentrations of mercury and other bioaccumulative contaminants in fish tissue far exceed the concentrations found in the waterbodies: "top predators in a food chain, such as largemouth bass or walleye, may have concentrations of bioaccumulative contaminants in their tissues a million times higher than the concentrations found in the waterbodies."[8]

Forty-Eight States have Mercury Fish Consumption Advisories

Humans are exposed to methylmercury predominantly through the "[c]onsumption of contaminated fish."[9] As of 2006, forty-eight states have mercury fish consumption advisories. A total of 3,080 advisories for mercury have been issued at water bodies across the nation encompassing 14,177,175 lake acres and 882,963 river miles. Thirty-one states have issued statewide fish consumption advisories due to extensive mercury contamination in freshwater lakes or rivers, coastal waters, or marine fish: Alabama, Connecticut, Florida, Georgia, Hawaii, Illinois, Indiana, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Montana, New Hampshire, New Jersey, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Texas, Vermont, Washington, West Virginia, and Wisconsin.[10]

Mercury Threatens the Neurological Development of Newborns and Young Children

Each year approximately 630,000 newborns in the United States are exposed to mercury levels in blood above the levels designed to protect the developing nervous system.[11] The neurological effects of mercury include documented impairments "in ability to use language, to process information, and in visual/motor integration."[12]

The developing brain of infants and young children is distinctly vulnerable to exposure of methylmercury:

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[8] U.S. EPA, 2005/2006 National Listing of Fish Advisories, Fact Sheet, EPA-823-F-07-003 (July 2007).
[9] Leonardo Trasande, Philip J. Landrigan, and Clyde Schechter, *Public Health and Economic Consequences of Methyl Mercury Toxicity to the Developing Brain*, Environmental Health Perspectives, Vol. 113, No. 5 (May 2005).
[10] *Id.*
[11] Kathryn Mahaffey, Ph.D., U.S. EPA, *Methylmercury: Epidemiology Update* (Fish Forum 2004).
[12] U.S. EPA, Methylmercury Exposure at www.epa.gov/mercury/exposure.htm.

> The vulnerability of the developing brain to methyl mercury reflects the ability of lipophilic methyl mercury to cross the placenta and concentrate in the central nervous system (Campbell et al. 1992). Moreover, the blood-brain barrier is not fully developed until after the first year of life, and methyl mercury can cross this incomplete barrier (Rodier 1995).[13]

The National Academy of Sciences' National Research Council found that the brain development of infants and young children is threatened by chronic, low-dose environmental exposures to methylmercury:

> Chronic, low-dose prenatal MeHg exposure from maternal consumption of fish has been associated with more subtle end points of neurotoxicity in children. Those end points include poor performance on neurobehavioral tests, particularly on tests of attention, fine-motor function, language, visual-spatial abilities (e.g., drawing), and verbal memory.[14]

In children, low doses may produce deficits in vision and hearing, delayed walking and speech development, and other developmental delays.[15]

Methylmercury Exposure is Also Associated with Adult Heart Disease

The National Research Council assessment of the toxicological effects of methylmercury found evidence of "adverse effects on the developing and adult cardiovascular system (blood-pressure regulation, heart-rate variability, and heart disease)" including potential impacts below neurodevelopmental effects.[16] The National Research Council's analysis spurred scientific research to examine the potential for cardiovascular effects.

In 2005, an extensive review of studies examining cardiovascular health effects sharpened the focus on the potential connection between adult heart disease and methylmercury exposure. The review determined that the body of available epidemiological studies "suggest an association between MeHg exposure and heart disease, including (but possibly not limited to) AMI [acute myocardial infarction]."[17]

MERCURY FROM COAL PLANTS IS ASSOCIATED WITH DEPOSITION HOT SPOTS AND BIOLOGICAL HOT SPOTS

Mercury has a complex fate and transport with both local and far-reaching dimensions. EPA's policy approach focused on the potential for long-range transport and deposition of mercury, glossing over the potential for local and regional hot spots. Two major field studies, reflecting

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[13] Trasande, et al., *Public Health and Economic Consequences of Methyl Mercury Toxicity to the Developing Brain*, at p. 590.
[14] National Academy of Sciences' National Research Council, *Toxicological Effects of Methylmercury* (2000), p. 4.
[15] Castoldi, Coccini, Ceccatelli, and Manzo, *Neurotoxicity and molecular effects of methylmercury*, Brain Res. Bull., 55:197–203 (2001).
[16] *Toxicological Effects of Methylmercury* at p. 4.
[17] Alan Stern, "A review of the studies of the cardiovascular health effects of methylmercury with consideration of their suitability for risk assessment," *Environmental Research*, Vol. 98, Issue 1 (May 2005) ps. 133-142.

volumes of data and analyses, have documented the potential for mercury to cause both deposition and biological hot spots.

Scientists at the University of Michigan and EPA conducted an extensive mercury monitoring and source apportionment study to evaluate the potential connection between local and regional coal plants and mercury deposited in the Ohio River Valley. The study was based on a two-year record of mercury deposition monitored in Steubenville, Ohio at the campus of Franciscan University. Seventeen coal plants are located within 100 kilometers of the monitoring site. The study found that local and regional coal plants were the dominant contributor to mercury wet deposition, responsible for an estimated 70% of the mercury deposited during precipitation events:

> The results of the multivariate statistical analysis (~70% of the Hg in the wet deposition at Steubenville coal combustion sources), and meteorological analysis (highlighting the importance of local regional sources), consistently point toward the dominant influence by local and regional coal-burning sources.[18]

Another major field study examined the potential for biological mercury hot spots, defined as areas with "elevated concentrations of Hg in biota (e.g., fish, birds, mammals) that exceed established human or wildlife health criteria as determined by a statistically adequate sample size."[19] The study assessed over 7,000 observations of mercury concentrations for seven species including yellow perch and the common loon while also considering factors such as surface water chemistry and land cover.

The Merrimack River watershed was identified as a biological hot spot. Further investigation revealed both the potential for local emission sources to amplify the adverse biological effects of mercury at the hot spot and, conversely, the benefits of measures to reduce emissions from large local sources of mercury. Modeling analysis, for example, suggested "that emissions from coal-fired power plants in the study region account for a large fraction of the total Hg deposited in the Merrimack River watershed hotspot."[20] The data also showed biological exposure to mercury "can change rapidly in response to changes in atmospheric emissions and deposition from local and regional sources."[21] Protective emission limitations on the mercury from local incinerators substantially reduced overall mercury in the region. The field data revealed "consistency between the timing and magnitude of Hg emissions reductions and the declines in Hg concentrations in common loons, fish, and zooplankton."[22]

Measures to cut mercury in south Florida similarly revealed the close nexus between local sources of mercury and local impacts. Mercury emissions in south Florida were reduced by

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[18] Gerald J. Keeler, Matthew S. Landis, Gary A. Norris, Emily M. Christianson, and J. Timothy Dvonch, *Sources of Mercury Wet Deposition in Eastern Ohio, USA,* Environ. Sci. Technol., Article 10.1021/es060377q S0013-936X(06)00377-4 (published on web Sept. 8, 2006).

[19] David C. Evers, Young-Ji Han, Charles T. Driscoll, Neil C. Kamman, M. Wing Goodale, Kathleen Fallon Lambert, Thomas M. Holsen, Celia Y. Chen, Thomas A. Clair, and Thomas Butler, *Biological Mercury Hotspots in the Northeastern United States and Southeastern Canada,* BioScience, Vol. 57, No. 1 (Jan. 2007) at 29-30.

[20] *Id.* at p. 41.

[21] *Id.* at p. 38.

[22] *Id.* at p. 39.

about 90 percent largely due to effective mercury emission limitations on incinerators. The mercury in the fish and wildlife of the Everglades, in turn, declined by about 75 percent.[23]

In Massachusetts, a multi-year monitoring program found that mercury concentrations in yellow perch and largemouth bass declined substantially. The monitored changes were consistent with substantial reductions in mercury pollution from several local incinerators.[24]

Field studies demonstrate that mercury emissions, deposition and bioaccumulative effects can have a cascade of local impacts. Conversely, empirical data show that measures to reduce nearby sources of mercury pollution can secure rapid, real-world results in cooling hot spots, and protecting human health and the environment.

EPA TRAMPLED SCIENCE AND LAW IN APPLYING AN EMISSIONS TRADING POLICY TO THE TOXIC MERCURY POLLUTION FROM POWER PLANTS

In 2005, EPA put in place a fundamentally misdirected trading system for the mercury from coal-fired power plants. Environmental Defense Fund has long been a proponent of properly designed emissions cap-and-trade policies. When properly applied and well-designed, such market-based measures can secure important and robust results through a flexible and highly cost-effective trading system.

But such policies must be properly applied. Mercury is toxic. The health effects of mercury can be potent, impairing brain development and contributing to heart disease. Mercury also bioaccumulates. Mercury pollution that deposits locally not only has the potential for hazardous local effects but its toxic properties can be magnified and amplified through bioaccumulation. Finally, extensive field studies have directly associated mercury from coal-fired power plants and other large industrial sources with surrounding hot spots.

To effectuate its flawed cap-and-trade policy, EPA wrenched the regulation of mercury for coal plants out of the Clean Air Act's distinct protections for toxic contaminants and endeavored to shoehorn its policy into another Clean Air Act program. EPA's misguided and strained approach was unanimously rejected by the federal court of appeals in Washington, D.C.[25]

EPA's application of a trading system to toxic mercury pollution has been opposed by some of the nation's leading medical and public health organizations. The American Public Health Association, the American Nurses Association and the American Academy of Pediatrics were compelled to take the unusual step of joining the lawsuits against EPA's action.[26] The

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[23] Florida Dept. of Environmental Protection, *South Florida Mercury Science Program,* available at: http://www.dep.state.fl.us/labs/mercury/index.htm.

[24] Massachusetts Dept. of Environmental Protection, *Freshwater Fish in Mass. Lakes Show Reductions in Mercury*, available at: http://www.mass.gov/dep/public/publications/mercury.htm.

[25] *New Jersey, et al. v. EPA*, No. 05-1097 & consolidated cases (D.C. Cir. decided Feb. 8, 2008).

[26] Bridget M. Kuehn, *Medical Groups Sue EPA Over Mercury Rule,* Journal of the American Medical Association (July 27, 2005) at p. 415.

American Medical Association adopted a resolution finding that EPA's rule "is inconsistent with the AMA's health-protective approach to air pollution."[27]

STATE LEADERSHIP AND TECHNOLOGICAL INNOVATION PROVIDE THE FOUNDATION FOR PROTECTIVE NATIONAL STANDARDS

While EPA veered recklessly in addressing the mercury pollution from coal plants, many states took protective action. The National Association of Clean Air Agencies has compiled information on the status of state mercury pollution control programs.[28] The summary shows that a number of states have adopted programs that require substantial mercury reductions.

These more protective state policies have spurred deployment of advanced mercury control technology.[29] By contrast, during the course of its national rulemaking, EPA repeatedly rejected claims that advanced mercury control systems were available. While federal policy has floundered, state policy leadership to protect human health has propelled technological innovation.

CONCLUSION

Coal-fired power plants are the nation's single largest source of anthropogenic mercury. Today, nearly eighteen years since the passage of the 1990 Clean Air Act Amendments, EPA has failed to address mercury and other toxic air contaminants from coal plants. EPA's failure to craft a protective program based on science, technology and law has imposed a heavy burden on human health.

The National Research Council's assessment of the toxicological effects of methylmercury found that young children bear the highest health risks:

> The population at highest risk is the children of women who consumed large amounts of fish and seafood during pregnancy. The committee concludes that the risk to that population is likely to be sufficient to result in an increase in the number of children who have to struggle to keep up in school and who might require remedial classes or special education.[30]

We respectfully ask that Congress adopt the *Mercury Emissions Control Act* and end the delay in protecting our most vulnerable population from the hazardous airborne contaminants released by coal-fired power plants.

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[27] American Medical Association, Report 1 of the Council on Science and Public Health (I-06), *Mercury Pollution* (Nov. 2006), available at: http://www.ama-assn.org/ama/pub/category/17010.html#resolution.

[28] National Association of Clean Air Agencies, *State Mercury Programs for Utilities* (Dec. 4, 2007), available at: http://www.4cleanair.org/Documents/StateTable.pdf.

[29] Institute of Clean Air Companies, *Commercial Electric Utility Mercury Control Technology Bookings* (updated April 21, 2008).

[30] National Academy of Sciences' National Research Council, *Toxicological Effects of Methylmercury* (2000), p. 9.

Responses by Vickie Patton to Additional Questions
From Senator Carper

Question No. 1: Importance of Reducing Emissions

"Can you please describe the human health benefits of reducing mercury emissions from power plants?"

Coal-fired power plants are the nation's largest single source of anthropogenic mercury emissions. Mercury is a toxic heavy metal that contaminates water bodies across the nation, threatens the development of newborns and children, and contributes to the risk of heart disease.

Mercury vented into ambient air deposits from the atmosphere in precipitation or attached particles, and through runoff or deposition can end up in lakes, rivers and the ocean. Toxic methylmercury results from the transformation of mercury by microorganisms in the sediments of water bodies. The methylated mercury readily accumulates in the aquatic food chain with the concentrations increasing at each level in the food chain. According to EPA, the concentrations of mercury and other bioaccumulative contaminants in fish tissue far exceed the concentrations found in the waterbodies: "top predators in a food chain, such as largemouth bass or walleye, may have concentrations of bioaccumulative contaminants in their tissues a million times higher than the concentrations found in the waterbodies."[1]

Two of the central human health benefits associated with reducing mercury emissions from power plants include mitigating the adverse effects on the neurological development of newborns and young children, and reducing risks of myocardial infarction and premature mortality in adults. These benefits were examined in a February 2005 study prepared for the Northeast States for Coordinated Air Use Management by the Harvard Center for Risk Analysis.[2] The study modeled the potential health benefits of reducing mercury from U.S. power plants based on limited pollution cuts and considering these two central human health hazards associated with mercury exposure: "The model accounts for potential changes in two health effects: cognitive abilities and cardiovascular events."[3]

The adverse effects of mercury on the developing brain of children are well-documented. Each year approximately 630,000 newborns in the United States are exposed to mercury levels in blood above the levels designed to protect the developing nervous system.[4] The neurological effects of mercury include documented impairments "in ability to use language, to process information, and in visual/motor integration."[5]

The developing brain is distinctly vulnerable to exposure of methylmercury:

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[1] U.S. EPA, 2005/2006 National Listing of Fish Advisories, Fact Sheet, EPA-823-F-07-003 (July 2007).
[2] Glenn Rice and James K. Hammitt, *Economic Valuation of Human Health Benefits of Controlling Mercury Emissions from U.S. Coal-Fired Power Plants* (Harvard Center for Risk Analysis) (March 2005).
[3] *Id.* at xvii.
[4] Kathryn Mahaffey, Ph.D., U.S. EPA, *Methylmercury: Epidemiology Update* (Fish Forum 2004).
[5] U.S. EPA, Methylmercury Exposure at www.epa.gov/mercury/exposure.htm.

> The vulnerability of the developing brain to methyl mercury reflects the ability of lipophilic methyl mercury to cross the placenta and concentrate in the central nervous system (Campbell et al. 1992). Moreover, the blood-brain barrier is not fully developed until after the first year of life, and methyl mercury can cross this incomplete barrier (Rodier 1995).[6]

The National Academy of Sciences' National Research Council found that the brain development of infants and young children is threatened by chronic, low-dose environmental exposures to methylmercury:

> Chronic, low-dose prenatal MeHg exposure from maternal consumption of fish has been associated with more subtle end points of neurotoxicity in children. Those end points include poor performance on neurobehavioral tests, particularly on tests of attention, fine-motor function, language, visual-spatial abilities (e.g., drawing), and verbal memory.[7]

In children, low doses may produce deficits in vision and hearing, delayed walking and speech development, and other developmental delays.[8]

Recent research also associates mercury exposure with adult heart disease. The National Research Council assessment of the toxicological effects of methylmercury found evidence of "adverse effects on the developing and adult cardiovascular system (blood-pressure regulation, heart-rate variability, and heart disease)" including potential impacts below neurodevelopmental effects.[9] The National Research Council's analysis spurred scientific research to examine the potential for cardiovascular effects.

In 2005, an extensive review of studies examining cardiovascular health effects sharpened the focus on the potential connection between adult heart disease and methylmercury exposure. The review determined that the body of available epidemiological studies "suggest an association between MeHg exposure and heart disease, including (but possibly not limited to) AMI [acute myocardial infarction]."[10]

Question No. 2: Mercury Hotspots

"Can you describe some of the latest findings on mercury hot spots, and the human health and environmental benefits of reducing emissions that cause these hotspots?"

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[6] Trasande, et al., *Public Health and Economic Consequences of Methyl Mercury Toxicity to the Developing Brain*, at p. 590.
[7] National Academy of Sciences' National Research Council, *Toxicological Effects of Methylmercury* (2000), p. 4.
[8] Castoldi, Coccini, Ceccatelli, and Manzo, *Neurotoxicity and molecular effects of methylmercury*, Brain Res. Bull., 55:197–203 (2001).
[9] *Toxicological Effects of Methylmercury* at p. 4.
[10] Alan Stern, "A review of the studies of the cardiovascular health effects of methylmercury with consideration of their suitability for risk assessment," *Environmental Research*, Vol. 98, Issue 1 (May 2005) ps. 133-142.

There are a variety of hot spots associated with mercury pollution including deposition hot spots and biological hot spots. Major field studies, reflecting volumes of data and analyses, have documented the potential for mercury to cause hot spots. At the same time, several empirical analyses have demonstrated that reducing local and regional mercury emissions has substantial benefits in mitigating hot spots.

Scientists at the University of Michigan and EPA conducted an extensive mercury monitoring and source apportionment study to evaluate the potential connection between local and regional coal plants and mercury deposited in the Ohio River Valley. The study was based on a two-year record of mercury deposition monitored in Steubenville, Ohio at the campus of Franciscan University. Seventeen coal plants are located within 100 kilometers of the monitoring site. The study found that local and regional coal plants were the dominant contributor to mercury wet deposition, responsible for an estimated 70% of the mercury deposited during precipitation events:

> The results of the multivariate statistical analysis (~70% of the Hg in the wet deposition at Steubenville coal combustion sources), and meteorological analysis (highlighting the importance of local regional sources), consistently point toward the dominant influence by local and regional coal-burning sources.[11]

Another major field study examined the potential for biological mercury hot spots, defined as areas with "elevated concentrations of Hg in biota (e.g., fish, birds, mammals) that exceed established human or wildlife health criteria as determined by a statistically adequate sample size."[12] The study assessed over 7,000 observations of mercury concentrations for seven species including yellow perch and the common loon while also considering factors such as surface water chemistry and land cover.

The Merrimack River watershed was identified as a biological hot spot. Further investigation revealed both the potential for local emission sources to amplify the adverse biological effects of mercury at the hot spot and, conversely, the benefits of measures to reduce emissions from large local sources of mercury. Modeling analysis, for example, suggested "that emissions from coal-fired power plants in the study region account for a large fraction of the total Hg deposited in the Merrimack River watershed hotspot."[13] The data also showed biological exposure to mercury "can change rapidly in response to changes in atmospheric emissions and deposition from local and regional sources."[14] Protective emission limitations on the mercury from local incinerators substantially reduced overall mercury in the region. The field data revealed "consistency

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[11] Gerald J. Keeler, Matthew S. Landis, Gary A. Norris, Emily M. Christianson, and J. Timothy Dvonch, *Sources of Mercury Wet Deposition in Eastern Ohio, USA*, Environ. Sci. Technol., Article 10.1021/es060377q S0013-936X(06)00377-4 (published on web Sept. 8, 2006).

[12] David C. Evers, Young-Ji Han, Charles T. Driscoll, Neil C. Kamman, M. Wing Goodale, Kathleen Fallon Lambert, Thomas M. Holsen, Celia Y. Chen, Thomas A. Clair, and Thomas Butler, *Biological Mercury Hotspots in the Northeastern United States and Southeastern Canada*, BioScience, Vol. 57, No. 1 (Jan. 2007) at 29-30.

[13] *Id.* at p. 41.

[14] *Id.* at p. 38.

between the timing and magnitude of Hg emissions reductions and the declines in Hg concentrations in common loons, fish, and zooplankton."[15]

Indeed, effective local mercury emission reduction strategies have been demonstrated to mitigate mercury hot spots. Measures to cut mercury in south Florida revealed the close nexus between local sources of mercury and local impacts. Mercury emissions in south Florida were reduced by about 90 percent largely due to effective mercury emission limitations on incinerators. The mercury in the fish and wildlife of the Everglades, in turn, declined by an estimated 75 percent.[16]

In Massachusetts, a multi-year monitoring program found that mercury concentrations in yellow perch and largemouth bass declined substantially. The monitored changes were consistent with substantial reductions in mercury pollution from several local incinerators.[17]

Thus, studies demonstrate that mercury emissions, deposition and bioaccumulative effects can have substantial adverse local impacts. Conversely, empirical data show that measures to reduce nearby sources of mercury pollution can secure rapid, real-world results in cooling hot spots, and protecting human health and the environment.

Question No. 3: EPA Decision to Appeal Verdict

"If you were still at EPA, what guidance would you have given the political appointees after the DC Circuit's recent decision vacating EPA's illegal cap and trade program for mercury?"

I would advise EPA officials to promptly propose and, after public notice and opportunity for public comment, to promptly finalize hazardous air pollutant emission standards for electric generating units reflecting the "maximum achievable control technology" consistent with section 112 of the Clean Air Act, 42 U.S.C. § 7412. I would recommend EPA's resources be dedicated to adopting and carrying out such emission standards under section 112 for electric generating units rather than filing an appeal.

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[15] *Id.* at p. 39.

[16] Florida Dept. of Environmental Protection, *South Florida Mercury Science Program*, available at: http://www.dep.state.fl.us/labs/mercury/index.htm .

[17] Massachusetts Dept. of Environmental Protection, *Freshwater Fish in Mass. Lakes Show Reductions in Mercury*, available at: http://www.mass.gov/dep/public/publications/mercury.htm; see also Massachusetts Dept. of Environmental Protection, *Massachusetts Fish Tissue Mercury Studies: Long-Term Monitoring Results, 1999-2004* (2006) ("The results from the first 5 years of this effort are contained in this report and in particular highlight the changes in fish tissue mercury concentrations which have taken place in the high mercury deposition area during a period when emissions from major point sources of mercury to the atmosphere have declined substantially in Massachusetts and across the region.")

Responses to questions from EPW committee

Questions from Senator Boxer:

1. **American Mercury on the International Market**

The demand for mercury in the US has dropped dramatically in the last 20 years, as many of its uses have been phased out or substantially declined. The US supply of mercury, however, has not declined as rapidly due to the availability of mercury from the closure of old-fashioned mercury cell chlor-alkali manufacturing plants, the capture of mercury impurities during gold ore processing, and recovery of mercury from mercury-bearing wastes and spent products. As a result, US supply now consistently exceeds US demand, and the excess stocks are sold on the world commodity market. In contrast, in the developing world, mercury is still used in many industrial applications, including small scale gold mining, and demand exceeds domestic supply in those countries. As a result, these countries are by far the most likely buyers for excess US mercury stocks.[1]

The mercury export ban bill would eliminate US-exported mercury as a source of mercury on the global market. Since the US is one of the world's largest exporters of mercury, eliminating this source of mercury would decrease the overall amount available for global trade. This would be a substantial reduction: for the years 2000-2004, the US was routinely in the top five exporters in the world, exporting on average 254 tons per year, according to the COMTRADE database.

2. **Safeguards for Storing Mercury**

The bill expressly provides that mercury stored at a facility designated by the Department of Energy must be permitted under Subtitle C of the Solid Waste Disposal Act (SDWA). These permitting requirements will include design and performance standards aimed at preventing mercury releases, monitoring and corrective action in the unlikely event releases occur to minimize the potential for human exposure, and operation/training measures to ensure personnel are qualified to operate the facility safely. It should be noted that DOE and DOD have been storing mercury for decades already without serious incident. The SWDA safeguards in the bill will provide an additional margin of safety, as well as state oversight.

Since the permitting authority provided in the bill is associated with hazardous waste facilities, and DOE is prohibited under the bill from reselling the mercury, we believe the mercury at the DOE facility will be considered a hazardous waste. The permitting standards applied to the facility will most likely be a hybrid of requirements applicable to storage and disposal facilities. EPA and the states have ample authority to fashion protective standards tailored for the mercury storage, in accordance with section 3005(c)(3) of the Solid Waste Disposal Act.

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[1] UNEP Chemicals Branch. 2006. Summary of supply, trade and demand information on mercury. UNEP Governing Council, Geneva.

Questions from Senator Inhofe:

1. **China's Mercury Mining**

China mines mercury to meet its domestic supply needs, not to export mercury on the global market. UN COMTADE data and other sources indicate virtually no China exports of mercury, notwithstanding an increase in the global price of mercury and domestic production over the last few years. This situation is unlikely to change because China will require increasing supplies of mercury in the next few years to meet the needs of its expanding PVC manufacturing sector. Moreover, China's Ministry of the Environment reports its high quality mercury reserves will be depleted shortly, which will make it more difficult to even sustain current production levels, let alone increase production capacity further. Therefore, China will likely face a domestic mercury supply shortage in the next 5-10 years, not an excess supply situation, and thus are highly unlikely to begin exporting substantial quantities of mercury.

2. What impact does the price of gold have on artisanal mining?

The recent increase in the price of gold has led to a sharp rise in the number of people engaged in artisanal/small scale gold mining. Reuters recently reported that the number of artisanal/small scale gold miners is now estimated to be between 13 and 20 million worldwide.[2] The current explosion in small scale gold mining is one reason why the passage of S906 is so urgent: limits on supply are needed deter the use of mercury as a gold extraction technique among this new cohort of miners.

How would HR 1534 and S906 decrease artisanal mining if the price of gold continues to rise and the demand for mercury continues to rise?

It is not the intention of HR1534 or S906 to decrease artisanal gold mining; rather, the intention is to **decrease the use of mercury** in artisanal gold mining. There are several low-cost, mercury-free alternative techniques that can be used to extract gold from ore at a small scale; in fact some of these practices are **more effective** than mercury at extracting gold (depending on the type of ore), and result in better yield (and thus higher incomes) for the miners, although they may require higher initial capital investment. Further, even where mercury-free techniques are infeasible due to the nature of the ore or other factors, there are low-mercury techniques that can be employed, such as ore concentration and the use of retorts (devices that capture evaporated mercury); these techniques still allow miners to recover gold economically but use (and release) far less mercury than current practices. However, there is no incentive for miners to switch to mercury-free and low-mercury techniques because mercury is relatively cheap and readily available, and requires little technical knowledge to use. It is difficult to convince miners to use even low-cost, easy-to-use technologies, such as retorts, because they have no cost incentive to recover and recycle mercury.

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[2] Stablum, A. 2008. Big increase in illegal gold mining as price rockets. Thomson Reuters, London.

The intention of HR1534 and S906 is to make mercury more expensive and less accessible on the global market, giving artisanal miners an incentive to switch to mercury-free or low-mercury gold recovery techniques. In fact, there is evidence from the field that when local mercury prices increase, miners show an interest in recycling and re-using the mercury they already have in hand.[3]

3. What other nations have taken action?
Other than the nations of the EU and the US, no other nations have taken action to ban exports of mercury, to our knowledge. However, the US and the EU exports combined accounts for up to 34% of global mercury supply[4]; further, if China is excluded from global supply figures (because China neither imports nor exports significant quantities of mercury and thus does not participate in the global market), the percentage represented by US and EU exports combined rises to as much as 52%. Therefore, the actions taken by the US and the EU alone will dramatically impact global supply, enough to affect price and availability of mercury.

In addition, with support from the governments of Switzerland and the United States, several organizations within the United Nations (UNITAR, UNEP) are evaluating the options for closing down the remaining mine producing mercury for export purposes in Kyrgyzstan. A final report expected in 2009 will identify appropriate next steps. This mine currently produces 300-350 tonnes of mercury annually.

What steps have China, Vietnam, Peru, and India taken?

To our knowledge, China, Vietnam, Peru and India have not taken any measures to restrict exports of mercury. However, as stated above, China has very high domestic demand for mercury and has had little (<300kg) to no exports reported to COMTRADE during the years 2002 to 2004. Similarly, Vietnam and India have had very low contributions to overall global trade during the past 5 years, presumably because these countries are active users of mercury with little excess to export. Between 2001 and 2004 India exported 3.6 tons of mercury and Vietnam had no exports. Peru's average annual exports (averaging 78 tons from 2002-2004) have been higher than those of China, Vietnam and India; however, our understanding is that these exports come from one major gold mine owned by Newmont (an American mining company), that has been capturing mercury impurities from its gold ore processing and sending the mercury to the US for further refinement.

It should be noted that efforts are underway to develop a regional strategy for storing excess mercury in Asia, in order to curtail the availability of mercury in these countries as uses are phased out in these regions, such as the phase out of mercury used in chlor-alkali

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[3] Telmer, K. Export bans and reducing mercury consumption in artisanal and small scale gold mining. Global Mercury Project, University of Victoria: slide 88.
http://epa.gov/mercury/stocks/Export%20Bans%20and%20Reducing%20Mercury%20Consumption%20in%20Artisanal%20and%20Small%20Scale%20Gold%20Mining.pdf
[4] UNEP Chemicals Branch. 2006. Summary of supply, trade and demand information on mercury. UNEP Governing Council, Geneva: 56.

plants, which is underway in India. This fall, the first meeting of an Advisory Committee will be held to begin a process for creating the necessary storage capacity. This effort is a collaboration involving the Zero Mercury Working Group and UNEP, with financial assistance from Japan. UNEP is planning a similar effort to cover Latin America.

4. Why has global consumption hovered around 3500 tonnes for the past ten years?

As reported by the UN report on global trade in mercury[5], global consumption has remained steady at around 3500 tonnes per year since around 1998; however viewed regionally, the picture is more complex. As mercury uses and demand have declined in the developed world, consumption in those countries has dropped[6]; at the same time, the uses and demand for mercury have grown in the developing world, largely because of increase consumption of mercury by China, as a consequence of China's overall economic boom and because of its particular uses of mercury in certain sectors (e.g., manufacture of plastics). The significant increase in small scale gold mining has also contributed to rising demand in the developing world. So, while overall the global consumption has been steady, the real story has been a dramatic shift in this consumption from the developed to the developing world. This shift was facilitated by the easy availability of mercury in the global marketplace, which is why the passage of S906 is so important.

[5] UNEP Chemicals Branch. 2006. Summary of supply, trade and demand information on mercury. UNEP Governing Council, Geneva: 35.
[6] USEPA. 2006. EPA's roadmap for mercury, figure 4. see: http://www.epa.gov/mercury/pdfs/FINAL-Mercury-Roadmap-6-29.pdf

Senator CARPER. Thank you very much.

Senator Voinovich has to leave at 1 o'clock. I am going to ask just one question and then turn the time over to Senator Voinovich for his questions.

My question is, and this really is a question that draws from Senator Voinovich's earlier comments and concerns, I will attempt to paraphrase him. Among the concerns that he and a couple other of my colleagues and one or two of our witnesses has raised is, is there technology in existence today that will actually enable us to reduce our emissions from most different kinds of mercury, from different kinds of coal, different kinds of plants? Do we have the technology today that would enable us to reduce emissions by 70, 80 or 90 percent or more? That is the first part of the question.

If we do, or if we don't, let's say if we don't, is it really going to cost something like $300 billion, I think that was one of the numbers I heard, over $300 billion to actually develop the technology and implement and deploy it across the thousand-plus coal-fired plants? So the cost of deployment, Dr. Durham, I think I heard you say the cost is actually a good deal less than that.

A third related question is cost benefit analysis, given whatever cost it is likely to take, does the benefit actually convince us that we ought to undertake the cost? And last, a concern that Senator Voinovich is consistent in raising in hearings of this nature, is the question of fuel shifting. Half of our electricity comes from coal. The concern is, if we undertake this step to dramatically reduce mercury emissions over the next half dozen or so years, what does that do for folks who are paying their utility bills? Also, what does it do in terms of encouraging fuel shifting to natural gas, something we don't want to encourage?

Commissioner Jackson, given the experience you have had in New Jersey, could you start off, please?

Ms. JACKSON. I am happy to, Senator, thank you. New Jersey's experience is that the technology is available today for our plants. It is either in implementation, being implemented now and we expect to see full implementation easily well in advance of 2012, which is our latest deadline for implementation. Our rules gave until 2007 if you were only controlling mercury. But if you were doing a multi-pollutant approach, you have until 2012. We will probably make 2010 for our ten plants.

In terms of cost, I will defer to Dr. Durham. But clearly, our experience has been whether it is municipal incinerators or these plants that it this is a low-cost, carbon injection has proven to a very low-cost alternative. The benefit of making sure that you have good particulate control extends beyond mercury to a range of other potential pollutants, not to mention particulates.

Senator CARPER. So your experience in New Jersey is that the technology is available now, the cost is not prohibitive for the plants it is being incorporated into. Thank you.

Dr. Durham?

Mr. DURHAM. In the study referenced by Senator Voinovich by EIA, those costs were based around the fuel switching issue. At the time, we were struggling with controlling mercury from western coals. So with a premise that EIA could only consider technologies

capable of achieving 90 percent without technology for western coals, it assumed they would all have to switch to natural gas.

Since then, we have come up with technology solutions for the western coals that are significantly lower than we had ever hoped for. And as a result, most of the commercial mercury control systems being sold today on new power plants, most of them burn western coals, achieving 90 percent. The first one, the permit for a new power plant, the Council Bluffs Station, is now operating at a level of about a factor of five lower than the system was designed for. So it is using a fifth the carbon it was designed for and achieving 90 percent. The first commercial system on an existing power plant has been operating over a year at 90 percent mercury removal on western coal.

So the issue around switching away from western coals because of this has actually been switched because of technology advances. Now western coals are our easiest and cheapest application.

Senator CARPER. Let me turn to Senator Voinovich. I want to make sure he has some time before he has to run off. Senator Voinovich.

Senator VOINOVICH. You are basically taking it down the road I was going, thank you.

If I heard correctly before, if you do aggressive SO_x anSO_x reduction, you get co-benefits. Does anyone want to comment about how much reduction do you get from that procedure? In other words, the argument is that when we looked at this the last time that the cost of the controls for mercury were very expensive and that we would be better off not mandating a high level and that we would give the technology a chance to mature and take advantage of co-benefit, which does reduce the mercury emissions. That is a comment on that.

The second question is the one I asked the other panel, and that is the difference between 70 and 90 percent, in so many instances, how much more health benefit are you going to get between 70 and 90 percent? And how much additional cost do you incur by going that extra 20 percent? So the first question I think would be just how much are we getting when we have co-benefit?

Dr. DURHAM. The co-benefits issue is primarily on eastern coals. That is because as Dr. Levin talked about, different forms of mercury are produced. The eastern coals produce a form that can be captured in the wet scrubbers. So the use of wet scrubbers for capturing mercury is probably one of the primary means of capturing mercury.

Senator VOINOVICH. In other words, when you use high-sulfur coal, you use scrubbers. When you use scrubbers, you reduce the mercury emissions. When you use low-sulfur coal, in many instances you don't use the scrubbers and as a result, you don't get the co-benefit because you are not using scrubbers?

Dr. DURHAM. Not necessarily. Actually, many of the plants burning western coals do have scrubbers. But the form of mercury that is created by the western coals is not removed in a scrubber, because it is not water soluble. So the issue of co-benefits is pretty much localized around the eastern coal applications. That range is, I think Dr. Benson mentioned 60 to 90 percent. We're looking at ways of enhancing it. Dr. Levin's organization, EPRI, is doing a lot

of work on enhancing how do we get more of that co-benefit, either by oxidation catalysts or improving the chemistry within a scrubber to try to assure that 90 percent level for the scrubbers on eastern coals.

Senator VOINOVICH. Dr. Levin.

Mr. LEVIN. My specialization in particular is on environmental effects of mercury. Regarding the health benefits that the Senator referred to, the modeling that we have looked at shows that in moving from a 70 percent to a 90 percent national control goal, there is decreasing health benefit as measured by lower deposition into U.S. waters resulting from going between 70 percent and 90 percent. The reason is that the incentive for any source is to capture early and more readily the water-soluble form of mercury at the emission point, and then to later introduce controls such as activated carbon that will more effectively capture the less water-soluble form.

The problem is that this elemental form of mercury, because it is less water soluble, is also less likely to be deposited within the United States, more likely to be widely dispersed into the atmosphere. Some of it will eventually deposit to the United States. Most of it will remain in the atmosphere or be deposited elsewhere around the globe.

That is the reason that there is not a commensurate decrease in deposition, and therefore potential health benefits, in going from 70 to 90 percent. You would hope to find an additional 20 percent increase in health benefits. Instead what we find is deposition decreases of anywhere from 5 to 10 percent; in many cases less than 5 percent, due to that additional 20 percent control level, because of the different form of mercury that is being captured at the margin.

Senator VOINOVICH. Dr. Benson, do you want to comment on that?

Mr. BENSON. Relative to the control technologies and the effectiveness of control technologies, it is very coal-dependent. Typically, we get the opportunity to work on very challenging cases of mercury capture where there are poisons and that impact the ability of mercury control technologies to capture the vapor phase mercury.

With respect to the co-benefits, I agree with Dr. Durham's perspective. There are ways to enhance western coals for SCRs and scrubbers to capture the mercury but you need to add something like a chemical or enhance the operation of a catalyst to make sure you control the mercury emissions.

Senator VOINOVICH. Thank you. I appreciate it.

Senator CARPER. Let me go back and ask the panel, someone mentioned the word flexibility and why it was important that we just not mandate a particular standard for every single power plant, but to realize that there are differences in coal, there are differences in the way these plants operate. Could somebody just take a minute and talk to us about flexibility? I don't know if it was Ms. Patton or Dr. Durham, but someone mentioned the need for flexibility in terms of as we go forward with legislation.

Dr. DURHAM. As we have talked about, each plant was designed with different equipment, different coals, all these characteristics.

Even for plants that may be identical, we see differences in operation. So the flexibility comes about in that there are going to be some that can easily achieve 90 percent, and others, it is going to be a struggle where it may end up being two or three times the cost to get 90 percent mercury control from that one unit.

And it may be an issue that you can have two operating units, one that Ms. Jackson mentioned that got 95 percent. That could be sitting next to an identical unit that is only getting 85 percent. With some flexibility to average those at 90 as opposed to now, how do we get that 85 to 90, it may cost twice as much as it took to get from zero to 85. So that kind of flexibility allows balancing, it allows the utility to consider low-cost options across their fleet.

Senator CARPER. That is a very helpful point.

I have a question, if I could, for Commissioner Jackson, please. The actions taken and the results achieved by the Garden State to reduce mercury pollution are, I think most of us would have to agree, impressive. How would a Federal rule build on the health benefits realized by your State's action?

Ms. JACKSON. Thank you, Senator. A Federal rule would, quite simply, eliminate or at least begin to eliminate the mercury emissions that come to us from upwind, which we believe remain and are significant. We have done a lot of work to address our plants and our neighbors downwind, but we are looking for help from the Federal Government. New Jersey is not un-used to going first, but we tend to look back and hope that the rest of the Country will join us.

Our experience is, this is not expensive. A small amount of flexibility goes a long way. The ability to look at an annual average gives plants a lot of ability to manage their individual plant emissions. And we would look for some recognition that averaging across the fleet might be too large an area, that looking at a plant or an area might make sense. But we are very concerned about our upwind neighbors.

Senator CARPER. Thank you.

Let me ask a question of Ms. Patton. In your opinion, why do you suppose EPA would want to regulate mercury through a cap and trade regimen, but be against a cap and trade approach for CO_2?

Ms. PATTON. Senator Carper, the history with emissions trading is a very robust and good history. When Congress in 1990 applied emissions cap and trade system to the challenge of reducing sulfur dioxide by millions of tons, the Nation secured very important health and environmental benefits at a fraction of the estimated cost. So it doesn't make sense for the Environmental Protection Agency to oppose addressing the urgent challenge of global warming with the same tool that has proven so effective in securing societal benefits at a fraction of the cost. We would hope that EPA does, as it grapples with these issues, look at the authorities it has under the Clean Air Act to address global warming, pollution in a thoughtful, cost-effective way, in the same way that we have addressed other problems.

But with mercury, we have to be very judicious in how we use emissions cap and trade tools and emissions trading tools, because if we misapply them and we don't apply them constant with what the science tells us and what is necessary to protect human health,

not only do we risk creating hot spots or not addressing the problem we set out to address, but we undermine the legitimacy of these very important public policy tools in the public square and that doesn't serve anyone's interest.

Senator CARPER. Thank you.

A question for Dr. Durham, then I have one last question to ask Dr. Levin and Dr. Benson. I will just telegraph my pitch and tell you what I am going to ask you so you can think about it while I ask this question of Dr. Durham.

If we were to go down the road and adopt legislation in markup and Committee and take to the floor legislation similar to that which a number of us have co-sponsored on mercury, what would be some advice that you would have for us? Similar to what Dr. Durham said, he said make sure you provide for some flexibility. If you have one plan alongside another, 85, 95 percent example that he gave us, to get 85 percent up to 90 costs a whole lot of money, and just make sure that we can take advantage of the 95 percent, which was more cost-effective, and settle for 85 percent in the other plant. That is the kind of advice I would welcome for our consideration today.

While you are thinking about that, let me ask Dr. Durham one last question. What impact do you suppose we see with the multi-pollutant regulation like the Clean Air Planning Act that a number of us have co-sponsored and introduced? What impact would it have on the cost effectiveness and overall efficiency of control technology?

Dr. DURHAM. As I mentioned, Senator Carper, all of the mercury control technologies interact one way or another with one of the other air pollution control systems. There is no single box for mercury control. So for example, on the eastern coals, one of the most cost effective approaches is through what started out as the CAMR program, building on the CAIR, is that we are going to get a lot of mercury capture in scrubbers and SCRs for NO_x control. They can be modified, our companies have technologies for improving the mercury removal in scrubbers and improving what a catalyst can do for that. So that would be very significant.

On the ACI technologies, the addition of fabric filters not only enhances the mercury capture in an ACI system, it lowers the amount of carbon that is being used and has a co-benefit of increased fine particle capture. So because of these interactions, it is really difficult to make a decision about mercury in a vacuum. It is much more cost effective if you consider all the other pollutants at one time.

Senator CARPER. Thank you.

Dr. Benson and Dr. Levin, if we are to proceed with this legislation, what are some things you would have us keep in mind to address some of the concerns that you have raised and maybe the concerns that others have raised, including my colleagues?

Mr. BENSON. I think one of the key things you need to keep in mind is that there is a wide distribution of fuel types, there is a wide distribution of power plant types that are out there. Dr. Durham has indicated, some of them are going to be fairly easy, fairly cost effective to enhance the mercury control, or to provide mercury controls that can meet 90 percent and above.

However, for other power plants, because of either a coal property that is different or a blending scenarios, something in the operations, mercury is very difficult to control. Allowing some flexibility, since most mercury control technologies are tailored to a specific coal type, boiler operations, as well as a design so you can meet the 90 percent standards, or, it depends upon the cost of getting there.

In some cases, equipment will have to be added to a plant, in other cases all you need to do is add in an oxidizing agent and an activated carbon for example. Flexibility and an understanding that tailoring is required for optimum mercury control.

Senator CARPER. Thank you, sir. Dr. Levin, the last word.

Mr. LEVIN. Thank you. If the ultimate goal of environmental regulation is the protection of human health and welfare, it is not sufficient to control sources without monitoring the results and being vigilant about the effects of that regulation on human health, in particular. For that reason, it is important that the national monitoring program of mercury in the environment proceed as quickly as are the steps to impose controls on mercury sources of any sort.

That mercury monitoring network has barely begun at the moment and has to increase substantially in effort and in time and spatial coverage, as well. The first steps of that effort were taken several years ago with a scientific meeting in Florida to designate the compartments of the environment that should be monitored for changes in mercury over time as sources change. The most recent step was the meeting in Annapolis last week of scientific specialists under EPA's sponsorship to get down to more detailed monitoring network design.

The bill that was before the Senate last year to institute a large national effort with Federal agencies to undertake a measurement and monitoring network was a good step toward that as well. I think that effort to look at the consequences of controls is a very important and integral part of the national effort.

Senator CARPER. Thank you both.

For our other witnesses, any other very brief closing comments that you would like to leave us with before we turn to our final panel? Commissioner?

Ms. JACKSON. Thank you, Senator. I would just like to emphasize again, I would ask the Committee to consider a hybrid standard, a removal percentage and perhaps a mass rate per megawatt hour, which would allow flexibility but still give a strong regulatory signal and a strong regulatory standard that could be measured easily and effectively and I think at a low cost.

Senator CARPER. Good. Thank you. Dr. Durham? Just a very brief closing statement.

Dr. DURHAM. Yes, Senator. Again, just to emphasize that technology is making huge advances, it will continue. There are still challenges out there, but a rule with flexibility will assist that situation and regulations provide the certainty for investments in this activity.

Senator CARPER. Thank you. Ms. Patton, just a very brief closing comment.

Ms. PATTON. Sure. I would just respectfully request that any flexibility be firmly rooted in science and fleet-wide averaging has

the risk of creating uneven distribution of a neurotoxin. So you can achieve a great deal of flexibility through a plant-wide approach rather than unit-specific limits and through the annual averaging that Commissioner Jackson described.

There was a big mercury meeting in Knoxville, Tennessee last month. I brought with me a presentation from Alstom, one of the Nation's, if not the world's, largest engineering firms. I will just wrap up with the words of the Alstom engineer who was there, who said, "Technology is ready, let's resolve the politics." With your leadership, we look forward to resolving the politics and moving forward to protect children's health.

Senator CARPER. That is a good note to close this portion of our hearing on.

Our thanks to each of you. I apologize that our four votes delayed this hearing. Thank you for sticking with us and for your testimony and for your willingness to respond to the questions that we will submit within the next week. Thank you so much.

Our final panel includes two witnesses, Dr. Linda Greer, who is the Director of the Public Health Program of the Natural Resources Defense Council, and also Arthur Dungan, who is the President of the Chlorine Institute, Inc. It is good to see you both. Thank you for joining us today. I regret that you have had to wait so long.

We are anxious to hear your testimony. I will not ask a large number of questions but will have a couple of questions, I am sure, that I will ask of each of you.

Dr. Greer, if you will go ahead, and each of you, feel free to summarize your testimony. Your entire testimony will be made part of the record. Welcome and thanks for joining us.

STATEMENT OF LINDA E. GREER, PH.D., DIRECTOR, PUBLIC HEALTH PROGRAM, NATURAL RESOURCES DEFENSE COUNCIL

Ms. GREER. Thanks very much and good afternoon. I want to compliment the Committee for holding this mercury hearing and particularly for this third panel on mercury export and trade.

As we have heard today, many people are aware of the great problems of mercury contamination of the food supply in our Nation and for that matter, many people are also aware of the largest source of domestic mercury pollution in the United States, which is coal-fired power plants. But most people are very much less aware or unaware of another source of global mercury pollution, a very important source, which is from the intentional use of mercury as a commodity metal in industrial process and processes.

Unfortunately, most of those uses occur in the developing world in very highly polluting industries, particularly such as artisenal and small-scale mining, where mercury is released virtually uncontrolled in very large quantities every year. Unfortunately also for us, mercury is a global pollutant. There has been a lot of handwringing about that today in this hearing. And as a result of that, mercury used and abused elsewhere in the world comes right back at us, both in our air currents over the Pacific Ocean, also in the fish that we eat, because 75 percent of the fish that Americans eat is imported fish. Much of this fish is swimming in the South Pacific off the shores of countries that use very large quantities of mercury and release a lot of mercury pollution.

The solution to this problem is not to stop eating fish, which is otherwise a very healthy food for us. The solution to the problem is to stop global mercury pollution. And as we have already mentioned today in other testimony, to address this comprehensively requires that we address the global stage and not just mercury within our own borders.

So really the key question for us in the United States is, what should we be doing about global mercury pollution; what is the contribution that we can make to most substantially reduce the mercury in our food supply?

Well, we in the United States have already substantially reduced our use of mercury within our borders. We have gone from about 2,000 tons a year in 1980 to less than 500 tons a year in the year 2000. That downward trend is continuing. I believe Art Dungan will talk about that from his own industry after me.

Studies therefore reveal that where we really are making a contribution, a continuing and large contribution, is in supplying mercury to other users around the globe. The single most important thing that we could do in this Country to stem the tide of mercury pollution globally would be for us to curtail the surplus mercury that we are no longer using that we are sending into global trade which is then being used in these highly polluting industries, which of course, brings us to the topic of this third panel.

So it is a very simple proposition. What we need to do is take what we are selling off the global market and store it and do it as soon as possible. What is recommended in both the House and Senate bills is by 2010.

And I had to chuckle a few times during your questioning on the coal-fired power plants, because in this case, we have very low-hanging fruit. There is no question that the technology is here today to do this. As a matter of fact, both the Department of Defense and the Department of Energy have been safely storing vast stockpiles of mercury for decades without any major incident.

As a technical matter, it is quite easy. Mercury is not reactive, it is not explosive, it doesn't take up much space. NRDC has calculated that it would take essentially one U-Haul rental truck to store all of the Nation's exported mercury for 1 year. And the cost of storage is very cheap, it is essentially pennies per pound.

Mercury is also not a valuable commodity that we are taking off the market. The 2006 figures for the value of all of our exported mercury was $7.6 million, which is roughly a quarter of the quantity of money that was in the tuna industry's advertising campaign to get us to eat more of that product.

In my remaining minute, I have just a couple of important details that I would like to hit about the differences between the House and Senate bill on the mercury export ban. As you know, both the House and Senate introduced bills in 2007. Since then, the House bill was subject to extensive review and negotiation with interested parties. EPA held four meetings to review issues such as U.S. supply and demand, technical capabilities to store, cost for storing, et cetera. The result was a modification to the Senate bill, S. 906, that creates a safe and legal storage option for the mercury that we would cease to export into global commerce, and the result is also a bill that now has very wide political support.

There was one misunderstanding that came out earlier in the hearing when we were discussing the House bill, when EPA witnesses were here. That was whether or not the U.S. taxpayers would be paying for this storage. In the House bill, the U.S. taxpayers are not paying, the cost is borne by the generators of the surplus mercury and is paid to the Department of Energy so that it would cover the expenses, not just of day-to-day storage, but of any possible problems in the future that might occur because of storage.

So whereas the Senate set up a task force to address the storage issue, time has marched on since the introduction of the Senate bill. The House basically fast-tracked that task force by calling the interested parties together and resolved the matters. We are urging the Senate to take a close look at this consensus legislation from the House and use the House bill as an alternative for markup.

In closing, I would like to emphasize that the opportunity that we have before us will really make a huge difference. The U.S. is one of the top five mercury exporting nations. There are seven to eight times the amount of mercury that we release annually from coal-fired power plants that we ship into global commerce every year. For literally pennies a pound, we can take out of circulation and out of the hands of extremely poorly controlled industrial uses around the world this toxic substance.

Furthermore, industry, State regulators and the environmental community agree that this is a good idea and we have worked diligently to craft a path forward for safe storage that is acceptable to all of us. Truly, if we can't do this in 2008, we can't do anything. So I hope that we can work together in the coming weeks to make good on this opportunity.

Thank you.

[The prepared statement of Ms. Greer follows:]

TESTIMONY OF
LINDA E. GREER, Ph. D
SENIOR SCIENTIST
NATURAL RESOURCES DEFENSE COUNCIL

ON BEHALF OF:
NATURAL RESOURCES DEFENSE COUNCIL

BEFORE THE
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

AT HEARING ON MERCURY LEGISLATION

MAY 13, 2008

Good morning and thank you for this opportunity to testify on the harm caused by the export of elemental mercury from the United States and legislation to address mercury pollution from this source. I am Linda E. Greer, Ph.D., the Director of the Health Program at the Natural Resources Defense Council (NRDC). I have a Ph.D. in environmental toxicology and have worked at NRDC on environmental health issues for over 15 years. NRDC is a not-for-profit environmental advocacy organization with over 1 million members and activists whose mission is to safeguard the Earth: its people, its plants and animals and the natural systems on which all life depends.

NRDC's Health program focuses on toxic chemical pollutants in air, water, food, shelter and household products. Over the years, we have focused our attention particularly on the "biggest pollutants" in these media, the ones disproportionately responsible for the biggest threats to human health. This has led to successful efforts to substantially reduce diesel air emissions from trucks and buses, for example, and to take a number of dangerous and outdated pesticides off the market. There are more than 70,000 chemicals in commerce, but some are much more toxic than others, and we can make great progress in environmental health protection if we focus on the smaller number of chemicals that have the biggest impact.

Mercury pollution is a top priority for NRDC because it is one of the most serious, if not *the* most serious, toxic contaminant in the U.S. food supply. Even in low doses, mercury

exposure can permanently affect a child's neurological development, influencing attention span, fine-motor function, language, and visual-spatial abilities (such as drawing). In adults, chronic mercury poisoning can cause memory loss, tremors, vision loss, and numbness of the fingers and toes and can contribute to heart disease among other problems. Unfortunately, the U.S. population is widely exposed to mercury, primarily through consumption of contaminated fish. A recent study conducted by the NY City Department of Health, for example, found that fully 25 percent of sampled New Yorkers had levels of mercury in their blood deemed unsafe; the exposure was attributed primarily to consuming fish[1].

In fact, according to the Food and Drug Administration (FDA), most commercial fish and shellfish in the U.S. contains some mercury, [2] with larger fish such as swordfish and tilefish containing the highest levels. Every state represented by members of this committee has issued fishing advisories for one or more of its lakes or streams, because of mercury contamination. In fact, fourteen of the nineteen states represented on this committee have restrictions banning the consumption of certain fish across *every water body in their entire state* because of mercury problems.

To help people avoid risks, both the Environmental Protection Agency (EPA) and FDA calculations show that not only pregnant women and nursing mothers, but all women of

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[1] McKelvey, W., Gwynn, C., Jeffery, N., Kass, D., Thorpe, L., Garg, R., Palmer, C. and P. Parsons. 2007. A biomonitoring study of lead, cadmium and mercury in the blood of New York City adults. *Environmental Health Perspectives*, Volume 115, Number 10, October. Available at: *http://ehp.niehs.nih.gov/members/2007/10056/10056.html- 82.8KB*

[2] http://www.cfsan.fda.gov/~frf/sea-mehg.html

childbearing age should eat no more than 12 ounces of fish per week, which is only two cans of tuna fish or one fish dinner and a tuna fish sandwich per week, to avoid unsafe exposures to this toxic metal. Children should eat much less. This advice is based on an analysis undertaken by the National Academy of Sciences, which reported on this issue in 2000.

Of course, the solution to this problem of mercury pollution is not to stop eating fish, an otherwise healthy food. The solution is to eliminate mercury pollution. And this mission brings us to today's hearing, and the need for legislation to reduce the amount of mercury that is contaminating water in the United States and around the globe.

The time is ripe for action. The United States and most of the rest of the developed world is already well on its way to eliminating most intentional uses of mercury in industry. However, while policies to further reduce demand for mercury here in our country are important, they should not be the only way to address this issue. To the contrary, we need to also focus attention on the U.S. contribution to the global *supply*. In fact, the single most important step that the U.S. and other developed nations must do to reduce pollution from industrial uses of mercury is to collect and store the surplus mercury we are accumulating as we remove this toxic chemical from our products and industrial processes, rather than "recycle" it by selling it onto the global market. Permanent storage of the surplus we are accumulating will stem the tide of mercury flowing into the developing world, where demand for this toxic metal in industry remains robust and pollution from its use is widespread.

Legislation to take this important first step on the global mercury pollution problem was introduced in the Senate and House in 2007. As introduced, both the House and Senate bills would ban the export of surplus mercury from the U.S. Such legislation provides an opportunity for our country to take leadership on reducing mercury in the food supply.

Since the House and Senate bills were introduced, the House bill was the subject of extensive review and negotiation among the most interested parties. The result was an amended bill, which I describe in greater detail below, endorsed by NRDC, the American Chemistry Council, the Chlorine Institute, the National Mining Association, and the Environmental Council of States (ECOS), which passed the House by voice vote last November. We urge this committee to take a close look at the consensus legislation that passed the House, and use the House-passed bill as the vehicle for Senate action.

Why should we care about U.S. exports of mercury?

Ask most people to identify the major sources of mercury pollution, and they will correctly point to coal-fired power plants. Mercury is a naturally-occurring ("unintentional") contaminant of coal released during combustion, and power plants comprise the largest remaining source of mercury pollution within the U.S., contributing a little less than 50 tons annually to the global total.

However, there are other large and important sources of mercury pollution in the world that stem from the intentional use of mercury as a commodity metal in products and industrial processes. Specifically, 3000-3900 tons of mercury are consumed each year by various industries around the world -- in chemical manufacturing, mining, battery production, and more. And, because of the highly dispersive nature of most of these uses and the poor degree of environmental control where used, much of the mercury "consumed" in these sectors ultimately winds up as air and water pollution, where it becomes available to enter our food chain.

What's worse, mercury is a global pollutant; when released from a source in one country, it readily disperses around the world, often falling far from its source of release and entering distant food supplies. These characteristics have led to surprisingly and disturbingly high concentrations of mercury in places with no significant local mercury pollution sources at all. The Arctic region, in particular, is a global mercury hotspot, acting as a giant "sink" for the pollutant circulating in the Earth's atmosphere. People there are some of the most highly contaminated on Earth.

Scientists have estimated that up to a third of U.S. mercury air pollution has traveled to the U.S. from Asia, where mercury pollution is extensive.[3] [4] And, much of the fish that we eat in the U.S., including tuna fish, is caught in the south Pacific, off the coast of China and other Asian countries, and is highly vulnerable to proximate sources of

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[3] C. Seigneur et al.2004. "Global Source Attribution for Mercury Deposition in the U.S.". Environmental Science and Technology 38: 555-569.

[4] U.S. sources of mercury pollution such as from coal fired power plants remain quite important nonetheless, because so much of the mercury emitted from these sources deposits locally and regionally quite heavily.

contamination from immediately adjacent shores. Mercury exported around the world thus returns right back at us, in the tuna fish cans in our pantry and in the air that we breathe.

These facts underscore the need for a *global focus* on mercury to substantially reduce mercury contamination of the U.S. food supply. Unlike diesel pollution or pesticides applied to cracks and crevices in your home, many of the major sources of mercury contamination in our food come from quite a far distance from our shores.

In addition, export of mercury overseas undermines the efforts of state and local governments to collect mercury before disposal to keep it from contaminating the environment. An increasing number of states, alarmed by the ubiquitous high levels of mercury in their lakes and streams, have initiated collection efforts to retrieve mercury from products such as auto switches, thermometers, and thermostats at the end of their useful lives. This collection and separation from the waste stream is important to prevent mercury releases from the almost inevitable product breakage and/or releases from combustion that would occur during incineration or other disposal.

Currently, the mercury that is collected by state and local authorities is consolidated, processed and ultimately sent to companies which trade in mercury as a commodity metal, much like silver or zinc or copper. The problem is that recyclers often sell this mercury to buyers in the developing world, or to traders who resell it to the developing

world, for use in highly polluting industries. Recycling mercury for re-use in such sectors is not a step in the right direction for environmental or public health protection.

Fortunately, as a technical matter, the solution is simple: it is quite easy to store mercury, which is not reactive explosive, or otherwise difficult to contain. Storage in flasks or stainless steel tanks in a warehouse will do the trick. Only a very small amount of space is needed for this storage. NRDC has calculated that the typical annual U.S. export of mercury could fit comfortably into one U-Haul rental truck.[5] And we are not talking about something with enormous value: in 2006 our exports (390 tons) were worth roughly $ 7.6 million[6] -- a bit more than a quarter of the advertising campaign the tuna industry announced in 2005 to encourage people to eat more of its product.[7]

Global mercury use and trade

The last 40 years have witnessed a significant increase in mercury emissions from coal combustion around the world. This trend has been offset to some degree by a reduction in industrial uses of mercury worldwide, from more than 9000 tons per year in the 1960's to less than 4000 tons per year today. The overall decline in industrial mercury use has occurred largely because various developed countries including the U.S. have consciously decided to decrease mercury use, by eliminating it in products, such as

[5] NRDC calculation is as follows: 390 tonnes of mercury at a density of 13.55 g/cubic centimeter requires 1016.3 cubic feet of storage space. A 24-foot long box U-Haul truck contains 1401 cubic feet.
[6] Based on 390 tonnes exported in 2006, at a market value of about $670 per flask (34.5 kg/flask). See http://minerals.usgs.gov/minerals/pubs/commodity/mercury/myb1-2006-mercu.pdf
Table 1
[7] San Diego Union Tribune, July 27, 2005. "As canned tuna sales dive, companies plan ad blitz to reel buyers in". by Terry Rogers.

batteries and paints, and by converting industrial processes, such as chlor-alkali plants, to mercury-free technology.

However, the reductions have stagnated in the past 10 years; we are hovering at continued consumption of about 3500 tons per year globally. What's worse, over the past decade, the location and type of demand has shifted to the developing world, into applications that are more highly polluting and dispersive. (Figure 1) As I will detail below, the industrial uses typical of the developing world, such as artisanal and small scale gold mining, pose large local risks to human health and contribute substantially to the total quantities of mercury pollution circulating the globe. Therefore, although we are holding steady in total global use, we are losing the war against mercury pollution, because the types of uses that are occurring are more dispersive than those used in the industrialized world.

Specifically, let us take a look at where U.S. mercury exports went in 2006, the latest year with comprehensive statistics available. U.S. Geological Survey (USGS) statistics show that about 40% of the mercury exported from our country that year went to just two countries: Vietnam (74 tons) and India (80 tons).[8],[9] Because the mercury was very likely used in poorly regulated and highly dispersive applications, some of this mercury is returned to us in the fish we eat or the air we breathe. Thus, storing mercury, rather than

[8] In 2006, thirty percent of our mercury went to the Netherlands, but did not stay there; the Netherlands has a booming business in global mercury trade, with large quantities exported to the developing world annually.
[9] USGS Mineral Yearbook 2006. July 2007. Table 2. Found at http://minerals.usgs.gov/minerals/pubs/commodity/mercury/myb1-2006-mercu.pdf

shipping it abroad for re-use and re-contamination of our waters and food supply is a critical cornerstone to any initiative to reduce global mercury pollution.

Reduction of Mercury in Commerce

Fortunately, economically viable alternatives to mercury are available for nearly every industrial use. The United Nations Environment Program (UNEP), which has considered mercury a global priority since 2001, recently reported that even under the "status quo," mercury demand in most of the major industrial uses in the world would decrease by 535 tons by 2015. If countries undertake feasible policies to discourage and discontinue mercury use, UNEP predicts demand reduction by 1115 tons by 2015.[10]

Use in artisanal and small scale gold mining: a clarion call for the need to restrict supply

The positive trend in reduction in demand for mercury in key sectors is a very welcome development. However, in response, it is critical to reduce supply. Otherwise, we will flood the market with excess mercury, lowering prices, and beckoning new and wasteful uses of the toxic metal.

In particular, we are concerned about further promotion of one largely unregulated, extremely dangerous and rapidly growing use of mercury – artisanal and small scale gold

[10] UNEP Chemicals. Summary of Supply, Trade and Demand Information on Mercury. November 2006.

mining (ASM). Roughly one-third of global mercury consumption occurs in this sector, a terrible practice for the world's poorest citizens, and a terrible practice for global health.

In ASM, miners with little or no economic capital separate trace quantities of gold from soil or sediment by mixing it with mercury. The mercury amalgamates with the gold, and the mixture of mercury and gold is then heated with a blow torch. The heat vaporizes the mercury, which escapes into the atmosphere, leaving a small trace of the gold for collection and sale.

With few exceptions, these miners do not conserve or capture any of the mercury used in their daily operations; the price of mercury is low enough relative to the value of the gold that its loss is economically inconsequential. Virtually one hundred percent of the mercury is lost to the environment.

An ASM resurgence began in the early 1980s, accelerated by the rising value of gold, and it is booming. The practice takes place all over the developing world, particularly in China and Indonesia, but also in many countries of South America and Africa. The United Nations Industrial Development Organization (UNIDO) estimates that there are between 10 to 15 million artisanal miners world wide in 55 countries, forty percent of whom are women, and 1 million who are children, involved in this practice.

With nearly 100 percent of the mercury used by these miners being dispersed into the environment, the health and environmental impacts of the practice are staggering.

Mercury concentrations at the mining sites are often exceedingly high, and many miners themselves exhibit severe mercury-poisoning symptoms such as tremors, vision loss, and the inability to reproduce simple geometric shapes. In addition, air and local waterways are heavily contaminated, greatly expanding the number of people whose health is affected by these practices.

Notwithstanding focused work by UNIDO and others to address this problem, the scale of the resources available to develop and promote the viable alternatives to mercury for gold mining and/or effective practices to recapture mercury during retorting has to date not been at all proportional to the scale of the global problem that mercury use and release in this sector represents. Experts in UNIDO have therefore recommended that countries of the world decrease the global supply of mercury, thereby increasing its price, so that miners have a natural reason to capture and reuse this toxic metal or to convert to non-mercury based production alternatives.

A recent report by the UNIDO Global Mercury Project, which finds that a 50% reduction in use of mercury in this sector is achievable by 2017 with existing alternative practices, highlights for emphasis to readers:

> **"The Global Mercury Project calls on nations around the world to achieve the [goal of reducing mercury use in ASM] by reducing mercury supply through export controls and other mechanisms that will encourage the transition to alternative technologies."** [11]

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[11] UNIDO Global Mercury Project. Global Impacts of Mercury Supply and Demand in Small Scale Gold Mining. A Report to UNEP Governing Council. February 2007.

The Mercury Export Ban of 2007

In November 2007, the House of Representatives responded to the global mercury crisis by passing on a voice vote the Mercury Export Ban Act of 2007 (H.R.1534), which prohibits the export of elemental mercury from the U.S. by 2010. The bill also directs the Secretary of Energy to designate a long-term storage facility to manage the excess mercury supply that will no longer be exported. This provision -- which was not in the introduced version in the House or Senate -- provides users and generators of mercury with a safe, legal way to manage their mercury once the ban goes into effect. Equally important to all U.S. taxpayers, the House-passed bill requires DOE to collect a fee from users of the storage facility, so that the cost of storage is appropriately borne by the users and generators of mercury, rather than by the U.S. government.

The House-passed bill specifies that the mercury long-term storage facility will be subject to federal and state permitting requirements under the Solid Waste Disposal Act. This state permitting authority will provide the relevant state government a clear role in establishing the parameters of the permit and in overseeing compliance, and will enable the public to monitor the operation of the facility.

The bill also establishes an indemnification mechanism for mercury generators who pay the fee to DOE for long-term storage, and don't otherwise do anything which contributes to a release from the DOE facility. This mechanism was sought by some of the industries

who currently sell their mercury for export, as a means of providing them with some certainty as to the cost of the export ban legislation to them, including the cost of storing the mercury. To achieve the compromise bill, NRDC agreed to the indemnification provision because first and foremost, commodity mercury storage is not technically challenging and has been accomplished by both DOD and DOE for many years without incident, thus the risk of release and triggering the indemnification provision is extremely small. Moreover, such indemnification provisions are often provided by commercial facilities in similar transactions. Finally, we note DOE is provided a great deal of discretion in assessing the storage fee, and we anticipate this fee will incorporate the costs associated with adequately preventing and responding to releases as needed, therefore users of the DOE facility will contributing their fair share of the facility's costs.

This storage solution represents a compromise negotiated among the major stakeholders with an interest in resolving the mercury issue, including NRDC, the American Chemistry Council, the Chlorine Institute, the National Mining Association and the Environmental Council of States (ECOS). Attached to this testimony is a letter signed by all of these groups, expressing support for the House-passed bill.

The House-passed bill also addresses several concerns raised about potential unintended consequences of an export ban. First, the bill requires DOE to study and report on any unanticipated impacts on mercury recycling associated with the export ban and with the long-term storage of excess mercury, including proposals to mitigate any negative impacts. The bill also contains a provision that authorizes exemptions from the ban in the

unlikely event mercury is required for "essential uses" in countries where the indigenous mercury supply is inadequate to meet these needs.

Finally, EPA is required to prepare a Report to Congress on the global supply and trade of elemental mercury at least three years after the ban, to evaluate the question of whether the mercury export ban has unexpectedly led to an increase in mercury mining elsewhere. As I discuss below, this is a very unlikely outcome, but the bill ensures that Congress will have adequate information on whether the mercury export ban is working as intended, to decrease the world supply of mercury.

Will there be unintended consequences of a U.S. mercury export ban?

Since the introduction of the Mercury Export Ban Act, questions have been raised whether a mercury export ban would be counter-productive, sparking an increase in mercury mining around the world, and/or decreasing mercury recycling domestically.

First, let me address the concern that a ban on U.S. exports will simply increase mining of mercury elsewhere. There is no evidence to support the allegation that a ban on mercury exports will lead new mercury mining. In fact, there is strong evidence to the contrary. Over the past seven years, for example, the price of mercury jumped from $140 per flask (in 2000-2003) to a peak of $800 per flask (in 2005) before falling back to

roughly $550-600 per ton at present.[12] No new mines exporting mercury opened during this period, and in fact several closed as discussed below.

There are at least two reasons why new mining is not likely to be sparked in the coming years either. First, most countries do not have viable mercury deposits; mercury occurs in economically recoverable deposits in only in a handful of countries around the globe. In each of these countries, there is limited remaining capacity to significantly expand output. Specifically, mercury mining for export in recent years has been dominated by only three nations with remaining rich mercury deposits: Spain, Algeria, and Kyrgyzstan. Only the mine in Kyrgyzstan remains in operation. (China mines considerable amounts of mercury but uses it only for its own robust home market.)

- The world's biggest mercury mine, in Almadén, Spain, stopped all mining and processing of primary mercury ores in 2003, and is not expected to restart. In fact, Spain has shuttered this mine as part of the EU's overall initiative to reduce global mercury supplies, which also includes an export ban similar to the Mercury Export Ban Act.
- Algeria's mine has suffered for years with poor operating conditions and closed at the end of 2004, in light of continuing technical problems, notwithstanding increased mercury prices that year.
- The last major mercury mine still in operation primarily for export is the Khaidarkan mining complex in Kyrgyzstan, which has not produced more than 500 tons of mercury per year since 2002. According to the World Bank, the

[12] Personal Communication with Peter Maxson, Concorde East/Wast Sprl, May 8, 2008. Mr. Maxson is a leading expert in the mercury trade and is responsible for analysis used both by the European Union and UNEP in their mercury deliberations. A flask = 34.5 kg of mercury.

quality of the deposit is low at this mine, and there are technical problems with the operation of the mine; as a result, the mine has historically required state subsidies to operate. Furthermore, the government of Kyrgyzstan has already recognized the desirability of phasing out mercury mining, and the Swiss government has recently funded the United Nations to conduct a feasibility study for closing the mine, in collaboration with the Kyrgyz government.

Other than Kyrgyzstan, China is the remaining virgin mercury mining location, where more than 1,000 tons per year have recently been produced. Significantly, however, China uses all of this mercury for its own internal market and therefore is not relevant to the supply-and-demand equation for the rest of the world. China has not historically exported much if any mercury into global commerce, and it is not expected to start now. To the contrary, China's largest mine was exhausted several years ago and closed. With its remaining deposits, China is mining mercury largely to service its chemical industry there, which uses a unique process to manufacture vinyl chloride for PVC with a mercury catalyst and for a few other smaller volume needs such as for manufacture of measuring equipment[13], batteries, and other products. It is thus very unlikely that China will begin to export any of its virgin mined mercury to supplement global supplies.

A second reason that the export ban will not lead to new mining is described in detail in my testimony above: mercury demand for most legal uses is on its way down in the world. The EU and other developed countries have a range of national initiatives

[13] Executive Finding of Mercury Investigation in Guizhou, Global Village of Beijing, Beijing, People's Republic of China, 2006 , found at :http://www.zeromercury.org/projects/Executive_Summary_of_Guizhou_Mercury_Investigation.pdf

proposed or in place to help curb mercury demand, including most notably a voluntary commitment from the chlor-alkali sector there to convert its plants to non-mercury production throughout Europe by 2020 at the latest. In the U.S., a combination of federal legislation, state legislation and industry initiatives will lead to reductions over time in use of mercury in products. India will be phasing out its mercury cell chlor-alkali plants by 2012. In light of these and other efforts, UNEP has predicted that the global demand for mercury will decline, even under a "status quo" scenario where governments take no additional steps to encourage the decline. This trend will clearly work against significant new investment in mining for a shrinking commodity sector. Indeed, international efforts to reduce mercury demand have already led Kyrgyzstan to examine alternative economic growth opportunities for its mercury mine area, as discussed above.

Finally, the UNEP Governing Council has established phasing out primary mining as a priority in order to control the global mercury pollution problem. If there is any uncertainty remaining about the potential for an expansion of primary mercury mining, the United States and other stakeholders truly interested in curbing mercury mining should work towards a binding international agreement to ban additional primary mining.

Questions have also been raised about whether the mercury export ban will discourage recycling. We believe this concern is unfounded for three reasons. First, the voluntary and mercury recycling programs run by state and local governments are driven by the desire to protect local communities from unnecessary mercury pollution that could result from mercury in local landfills and waste incinerators; the programs are not driven by the

monetary value of the recovered mercury. The amount of mercury collected from these programs is relatively small – enough to make a difference to the quality of the local environment, but, at $20-25 per kilogram on the commodity market, not enough to generate significant revenue.

Second, the cost of storing the mercury, when spread out over thousands of discarded mercury products will be extremely small. Both EPA and CBO have analyzed this issue, and the "high-end" storage fee estimated by CBO is $3.00 per pound of mercury. The added cost to store the mercury removed and collected from various switches, measuring devices, lamps, etc. is a fraction of a penny for each item even at the "high-range" estimate.

Third, if there is a disincentive to recycling at the present time, it is the knowledge that the recycled mercury now can find its way to the developing world where it will be released to the environment anyway. As described at length in this testimony, our responsibility does not end by simply recycling the mercury to prevents its release here. Our responsibility is to prevent its release globally.

Mercury pollution is a global problem that requires a global solution

In 2001, the UNEP Governing Council, a group of 58 countries empowered to make environmental decisions related to an international agenda, initiated a comprehensive global assessment of mercury. Two years later, the Governing Council concluded that

mercury had "caused a variety of documented, significant adverse impacts on human health and the environment throughout the world, and that further international action was required." Subsequently, UNEP has undertaken workshops and focused on capacity building in developing countries and formed voluntary partnerships to address mercury consumption in key industrial sectors where opportunities presented themselves. Most recently, and most importantly for our hearing today, at the February 2007 UNEP Governing Council meeting, governments including the United States unanimously agreed on the need to reduce supply and demand for mercury in commerce to address the mercury pollution problem.[14]

Concurrently during the past several years, the European Union has taken stock of the problem of mercury contamination in the food supply and developed its own aggressive mercury reduction strategy that reduces both supply and demand within the EU. Most notably, the EU is close to finalizing its own ban on the export of its surplus mercury by 2011, with legislation roughly parallel to what is being discussed here today. The EU has substantially completed its legislative work on this ban. To further reduce supply, they have shut down the world's largest virgin mercury mine, in Almadén, Spain. Meanwhile, to reduce demand, the EU has procured commitments from the chlor-alkali sector to phase out of mercury-based production, and has prohibited the use of mercury in other key products.

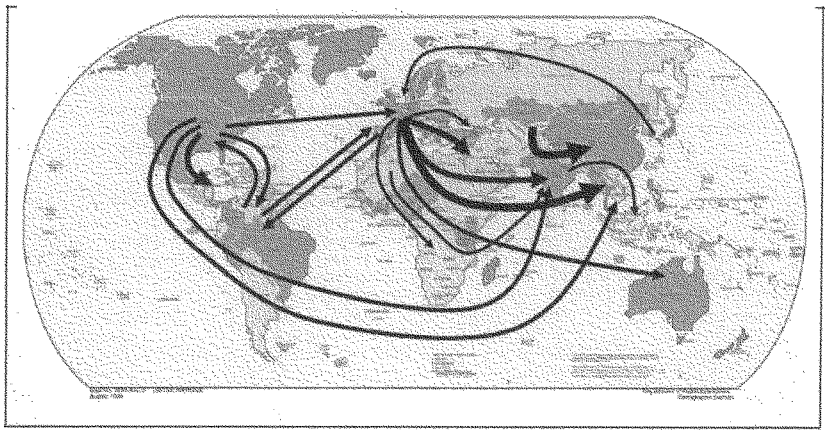
It is time for the U.S. to do its part. U.S. mercury demand within our own country is already declining. Thus, although the U.S. would benefit from additional regulations and

[14] UNEP Decision 24/3: Chemicals Management. Section IV item 19a and 19b.

policies to decrease our mercury consumption to zero, the benefit pales in comparison to the benefits of curtailing our contribution to global supply. The Mercury Export Ban Act will keep our mercury out of harm's way in the developing world and thereby keep it from coming right back at us from off the coasts of the developing world.

Thank you for the opportunity to testify today.

Figure 1: Commodity Mercury Shipments among World Regions, 2006.



Source: UNEP Chemicals. Summary of Supply, Trade and Demand Information on Mercury. November 2006.

Attachment 1. Letter of Support for HR 1534

November 8, 2007

Re: HR 1534

Dear Representative:

HR 1534, the "Mercury Export Ban Act of 2007", which bans the export of surplus elemental mercury into global commerce, was reported out of the House Energy & Commerce Committee on October 30, 2007, by an overwhelmingly bi-partisan vote of 45-2. The undersigned organizations support this negotiated version of HR 1534 and urge its passage under Suspension of the Rules.

Collectively, our organizations negotiated in good faith to produce the bill as reported, which addresses our individual concerns, advances our shared objective of reducing global mercury pollution, and reflects good public policy.

Specifically, the Committee-reported version of HR 1534 establishes a practical and workable domestic framework for sequestering the elemental mercury prohibited from export under the legislation. To develop this framework, our organizations worked diligently and collectively to reach consensus, each of us agreeing not to raise related mercury matters which may have prevented a successful outcome. Therefore we hope the full House of Representatives will acknowledge the compromises made and approve HR 1534 without further changes.

In closing, the undersigned organizations urge your "YES" vote on HR 1534 in the coming days.

Sincerely,

Frances G. Beinecke, President
Natural Resources Defense Council

Jack N. Gerard, President & CEO
American Chemistry Council

Kraig R. Naasz, President & CEO
National Mining Association

R. Steven Brown, Executive Director
Environmental Council of States

Arthur E. Dungan, President
The Chlorine Institute, Inc.

Senator CARPER. Dr. Greer, thank you so much.

Mr. Dungan, we are happy you are here. Your whole testimony will be part of our record. Please proceed.

STATEMENT OF ARTHUR E. DUNGAN, PRESIDENT, THE CHLORINE INSTITUTE, INC.

Mr. DUNGAN. Thank you, Mr. Chairman.

I am Art Dungan, President of the Chlorine Institute and I am here representing the Institute. I appreciate the opportunity to testify before you concerning mercury legislation.

My testimony will cover the Mercury Market Minimization Act of 2007, Senate Bill 906, and the Mercury Export Ban Act of 2007, House Bill 1534. In the United States, there are currently six facilities that produce chlorine using the mercury cell process. Of these six facilities, two have announced their intention to convert to another technology within the next 12 to 24 months. The remaining four plants, and possibly a plant scheduled for conversion, would be affected by this bill.

The Chlorine Institute and the chloralkali producers using the mercury cell process have worked aggressively and voluntarily to reduce mercury usage and releases to the environment, and have worked cooperatively with all agencies as they set regulatory standards limiting mercury releases.

In 1996, the Chlorine Institute and the mercury cell producers voluntarily agreed to reduce mercury use by 50 percent. As indicated in our most recent annual report to EPA, the overall reduction in annual mercury usage in the tenth year was 92 percent.

The Chlorine Institute wishes to comment on Sections 3 and 4 of Senate Bill 906. The Institute supports Section 3, which prohibits the sale or distribution or mercury by the Department of Defense or the Department of Energy. Mercury needed by the United States industries can amply be supplied by private mercury sources. Concerning Section 4 of the bill, the Institute is opposed to establishing a ban on mercury exports until the United States has a program established and in place for the permanent storage of mercury.

Implementation of an export ban will not only affect the remaining mercury cell plants but other sources of mercury. Over a 40-year period, other domestic sources of mercury, such as byproduct mining and recycling programs, will have a far greater contribution to the United States mercury supply than the chloralkali industry. It is estimated that the current quantity of net mercury exports is about 300 tons per year. With an export ban in place, this surplus mercury will have to be stored somewhere. Few options would have the safeguards that a permanent, federally managed storage site would have.

The Chlorine Institute respectfully asks the Committee to consider House Bill 1534. When originally proposed in March 2007, H.R. 1534 was very similar to S. 906. H.R. 1534 as passed is the result of several affected stakeholders working cooperatively to produce a bill. This coalition included the National Resources Defense Council, the Environmental Council of States, the American Chemistry Council, the National Mining Association and the Chlorine Institute.

The Coalition negotiated several important changes to House Bill 1534. Utmost were the mercury management and storage provisions which provide an important viable long-term storage solution if an export ban is enacted. The bill also provides several other important provisions, including performance criteria, indemnification and fees. We urge the Committee to adopt H.R. 1534.

In summary, the Institute is opposed to a prohibition of the export of mercury unless and until the United States has a program established and in place for the permanent storage of mercury. The Institute supports the establishment of a Federal stockpile for the permanent storage of surplus mercury. The Institute supports H.R. 1534 as passed by the House and urges the Senate to pass the same legislation.

I thank you again for the opportunity to appear before the Committee and share the Chlorine Institute's views.

[The prepared statement of Mr. Dungan follows:]

TESTIMONY OF ARTHUR E. DUNGAN

ON BEHALF OF

THE CHLORINE INSTITUTE, INC.
1300 WILSON BOULEVARD
ARLINGTON, VA 22209
703-741-5760

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

UNITED STATES SENATE

PERTAINING TO MERCURY LEGISLATION

MERCURY MARKET MINIMIZATION ACT OF 2007 (S. 906)

MERCURY EMISSIONS CONTROL ACT (S. 2643)

MERCURY EXPORT BAN ACT OF 2007 (H. R. 1534)

MAY 13, 2008

Introduction

Madam Chairman and Members of the Committee:

I am Art Dungan, President of the Chlorine Institute and I am here representing the Institute, the Chlorine Chemistry Division of the American Chemistry Council, and the mercury cell chlor-alkali producers in the United States. I appreciate the opportunity to testify before you concerning mercury legislation. My testimony will cover the Mercury Market Minimization Act of 2007 (S. 906) and the Mercury Export Ban Act of 2007 (H. R. 1534). While electricity is a major raw material in the manufacture of chlorine and co-product sodium hydroxide, the Chlorine Institute has not been involved in evaluating emission control technologies from electrical utility steam generating units. Accordingly, I will not be commenting upon S. 2643.

The Chlorine Institute, Inc., founded in 1924, is a 220-member, not-for-profit trade association of chlor-alkali producers worldwide, as well as packagers, distributors, users, and suppliers. The Institute's mission is the promotion of safety and the protection of human health and the environment in the manufacture, distribution and use of chlorine, sodium hydroxide, potassium hydroxide and sodium hypochlorite, plus the distribution and use of hydrogen chloride. The Institute's North American Producer members account for more than 98 percent of the total chlorine production capacity of the U.S., Canada, and Mexico.

Everyday life would be very different without the benefits of chlorine chemistry. Combined with the power of human innovation, chlorine chemistry plays an essential role in providing the indispensable products of modern life. From providing one of the most basic human needs — clean drinking water — to contributing to the production of high-tech first responder equipment,

sustainable building materials, food protection chemicals, computer microprocessor chips and more than 90 percent of prescription pharmaceuticals, chlorine chemistry is essential to everyday life in America.

In the United States, there are currently six facilities that produce chlorine using the mercury cell process accounting for approximately 6% of the annual chlorine production. All are members of the Chlorine Institute. Of these six facilities, two have announced their intention to convert to another technology. Both conversions are expected to occur within the next 12 -24 months. The remaining four plants, and possibly the plants scheduled for conversion, would be affected by S. 906 and H. R. 1534.

The Chlorine Institute and the Mercury Cell Producers' Commitment to Mercury Reduction

The Chlorine Institute and the chlor-alkali producers using the mercury cell technology have worked diligently to address mercury use and release issues since they first surfaced nearly 40 years ago. In the 1950s and 1960s, the mercury cell technology was the technology of choice because the sodium hydroxide co-product was felt by many customers to be superior in quality. Exhibit 1 provides a brief description of this technology. As a result, in the United States, mercury cell technology increased from less than 10% of chlorine capacity in the early 1950s to nearly 30% in the 1970s. In the early 1970s there were approximately 30 mercury cell plants in operation in the United States. It was at this time that environmental concerns about the effects of mercury releases became an issue. Since that time, no new mercury cell plants have been built in the United States. As chlor-alkali plants reached the end of their economic life, they

have either closed or converted to a different technology. In the last twenty years, all new chlor-alkali plants in the United States have utilized the membrane cell technology (which does not use mercury).

The mercury cell chlor-alkali producers individually and through the Chlorine Institute have worked aggressively and voluntarily to reduce mercury use and releases to the environment and have worked cooperatively with all agencies as they set regulatory standards limiting such releases. The Chlorine Institute established technical teams beginning more than forty years ago to address mercury issues. The first such teams focused on worker protection with the goal to minimize human exposure to mercury.

In the early 1970s, technical teams were established to reduce releases to the environment. Technologies were voluntarily shared between the mercury cell producers. These technologies first addressed emissions to water, then to air, and then to solid wastes. When EPA proposed the land disposal restrictions pertaining to solid wastes in the late 1980s, through the Chlorine Institute, the industry embarked on a nearly $4 million research program that would allow the mercury from these wastes to be recovered, prior to disposal, in a more environmentally friendly manner. The information that was developed enabled many mercury cell producers to utilize new methods to recover mercury utilizing equipment that allowed for reduced air emissions when compared with the traditional mercury retorting technology.

In 1996, the Chlorine Institute and the mercury cell producers voluntarily agreed to reduce mercury use by 50 percent by 2005 compared to the base years of 1990-1995. This commitment was made to help the United States achieve its mercury reduction goals as part of the United

States - Canada Binational Toxics Strategy Agreement (BTS). As part of its voluntary commitment, the Chlorine Institute agreed to issue annual reports highlighting the progress being made. The Tenth Annual Report was issued last year (Exhibit 2), and the eleventh report will be issued in the coming weeks. As indicated in the Tenth Annual Report, the overall reduction in annual mercury usage in the tenth year was 92%.

In order to meet this commitment, the Institute established several new technical teams to address a variety of issues. In addition to meeting numerous times, the teams held several workshops and developed additional guidance documents to address mercury issues (Exhibit 3).

When the commitment to the BTS was made, 14 mercury cell plants were operating. Today six plants continue in operation. Two of these plants are scheduled to convert within the next 24 months. The remaining four plants intend to operate until the end of their economic life. Exhibit 4 provides a list of the fourteen plants and their current status.

In addition, the Chlorine Institute and the Chlorine Chemistry Division of the American Chemistry Council are active participants in the World Chlorine Council (WCC). WCC has been an active supporter of the United Nations Environment Programme (UNEP) Global Mercury Program and has made a sustained effort to help mercury-based chlorine producers around the world reduce mercury uses and emissions. As part of this effort, WCC is supporting and contributing to the UNEP Global Mercury Partnership. The Global Mercury Partnership builds upon WCC's long-standing commitment to share best practices globally for reducing the use and release of mercury from mercury cell chlor-alkali facilities. WCC has contributed significant time, expertise and financial resources and has worked with governments, chlor-alkali

producers, and UNEP to help make this partnership a success. (See http://www.chem.unep.ch/mercury/partnerships/progress-reports/WCC%20Submission.pdf).

The Chlorine Institute's Position on S. 906

The Chlorine Institute wishes to comment on Sections 3 and 4 of the proposed bill.

The Institute supports Section 3 which prohibits the sale or distribution of mercury by the Department of Defense or the Department of Energy. Mercury needed by United States industries can amply be supplied by private mercury sources. The permanent storage of mercury may be an available option for the government. However, private industry can not permanently store such mercury and be in accordance with RCRA regulations regarding land disposal restrictions of mercury.

Concerning Section 4 of the bill, the Institute is opposed to establishing a ban on mercury exports until the United States has a program established and in place for the permanent storage of mercury.

Implementation of an export ban will not only affect the remaining mercury cell plants, but also other sources of mercury. Depending on the number of mercury cell plants affected by the bill, between 1,100 and 1,700 (short) tons of mercury from chlor-alkali plants would require permanent storage at some time in the future. When examined in a short time frame, this quantity is large when compared with other domestic mercury supplies. However, over a 40 year horizon, it is likely that other domestic sources of mercury (by-product mining and recycling programs) would have a far greater contribution to the US mercury supply. At the June 14, 2007

meeting of EPA's Advisory Committee on Commodity Mercury, it was stated that the current quantity of net mercury exports is about 300 tons per year. With an export ban in place, this surplus mercury will have to be stored somewhere. The generators might temporarily store the mercury, which is a commodity, at various sites in the hope that it could eventually be sold. While most of this mercury would be stored safely and without any adverse effects to the environment, few of the private sites would have the safeguards in place that a permanent federally managed storage site would have.

Establishment of a Federal Stockpile for the Permanent Storage of Surplus Mercury

For nearly six years the Institute has publicly supported the establishment of a federal stockpile for mercury. In the spring of 2002, the mercury cell producers through the Chlorine Institute endorsed six key principles pertaining to the retirement of mercury (Exhibit 5). These principles were first presented at a mercury conference co-sponsored by the USEPA and the Northeast Waste Management Officials' Association (NEWMOA). In July 2002, we reiterated our support of such a stockpile in a letter to your distinguished Committee (Exhibit 6).

The Institute believes that the principles it endorsed in 2002 are still sound today. We see no viable alternative other than a stockpile under the control of the federal government. We believe the mercury stockpile should be located at as few sites as possible. Because of the relatively small footprint involved (mercury is more than 13 times denser than water), it is very likely all the surplus mercury could be stored at a single site.

For example the Defense Logistics Agency (DLA) has stored mercury safely for more than 50 years. This mercury had been acquired as part of the U. S. government's policy to have a strategic reserve of essential materials, but it is no longer needed. Earlier this decade, the DLA undertook a very public process to examine how the long term storage of its surplus mercury should be addressed. The conclusion was that the mercury could continue to be safely stored for a long term period by the DLA, but that the multiple storage sites should be consolidated to store at a single site. The DLA is currently consolidating all of its nearly 5,000 tons of mercury to a single site. In addition, the Department of Energy has about 500 tons of surplus mercury that is being stored at a single site. Currently, there are no plans to consolidate this mercury to the DLA site.

While the Institute does not have verified data on mercury generated annually from recycling and by-product mining operations, it would appear that the US government would account for about 50% of the mercury which would need to be stored over the next 40 years. [Basis: 5,500 tons of mercury currently owned by the government; 1,100 - 1,700 tons of surplus mercury from the four to six chlor-alkali plants; and 100 tons per year of surplus mercury generated by the recycling and mining industries.] The contribution of the chlor-alkali industry is only about 15% of the total.

The Chlorine Institute recognizes that it is beyond the current mission of the DLA and the Department of Energy to manage the long term storage of all the surplus mercury generated in the United States. However, the Institute believes it is sound public policy for the United States government to provide for the long term management of surplus mercury in a safe and environmentally friendly way.

H. R. 1534

The Chlorine Institute respectfully asks the Committee on Environment and Public Works to consider H. R. 1534, The Mercury Export Ban Act of 2007. When originally proposed in March of 2007, H.R. 1534 was very similar to S. 906. H.R. 1534, as passed, is the result of several affected stakeholders working cooperatively to produce a bill. On November 8, 2007 in a joint letter (Exhibit 7) to members of the House of Representatives, the leading officials of the Natural Resources Defense Council, the Environmental Council of States, the American Chemistry Council, the National Mining Association, and the Chlorine Institute urged the House to pass the bill. On November 13, 2007 the House passed the bill by voice vote.

Our unique coalition negotiated several important changes to H.R. 1534 that we believe ultimately resulted in the bill's passage. Utmost was a long-term mercury management and storage solution. Section 5 of H.R. 1534 requires the Secretary of Energy to accept custody of surplus mercury for a reasonable fee, thereby providing an important, viable, long-term storage solution prior to an export ban. It is important to note that H.R. 1534 additionally allows for private, long-term storage options, should they ultimately be found viable.

Finally, H.R. 1534 importantly provides several provisions necessary for a safe and secure, long-term mercury storage and management solution, including performance criteria, indemnification, and fees for service. The Chlorine Institute therefore urges this honorable Committee to adopt this much improved and carefully crafted legislation

Conclusion

In summary:

1. The Institute is opposed to a prohibition on the export of mercury unless and until the United States has a program established and in place for the permanent storage of mercury.

2. The Institute supports the establishment of a federal stockpile for the permanent storage of surplus mercury.

3. The Institute supports H.R. 1534 as passed by the House and urges the Senate to pass the same legislation.

I thank you again for the opportunity to appear before the Committee and share the Chlorine Institute's views.

EXHIBITS 1 – 7 PERTAINING TO THE TESTIMONY OF ARTHUR E. DUNGAN

Exhibit 1

Chlorine Manufacture

Most chlorine is manufactured electrolytically by the mercury, the diaphragm or the membrane cell process. In each process, a salt (sodium chloride) solution is decomposed by the action of direct electric current in an electrolytic cell which converts the solution to elemental chlorine, and co-products sodium hydroxide and hydrogen. United States chlorine production is approximately 13 million short tons per year or about 30% of the global production.

In the mercury cell process recirculating mercury serves as the cathode. Chlorine is removed from the gas space above the anodes and elemental sodium is formed at the cathode. The sodium amalgamates with the mercury. The sodium-mercury amalgam then flows to a decomposer where it is reacted with purified water to produce sodium hydroxide and hydrogen with the mercury being recirculated. The mercury cell requires a relatively large amount of mercury inventory, but make-up to replenish losses is quite small. The typical mercury cell plant, depending on the size, may have 200 to 400 tons of mercury in inventory. A mercury cell plant may have between 25 and 100 of these electrolytic cells. Typically these cells are located in a cell room whose dimensions approximate a football field.

In the diaphragm cell process, sodium chloride brine is electrolyzed to produce chlorine at the positive electrode (anode) while sodium hydroxide and hydrogen are produced at the negative electrode (cathode). In order to prevent the reaction of sodium hydroxide and hydrogen with the chlorine, the anode and cathode chambers are separated by a porous diaphragm.

The membrane cell process electrolyzes sodium chloride brine to produce chlorine at the positive electrode (anode) while sodium hydroxide and hydrogen are produced at the negative electrode (cathode). An ion selective membrane prevents the reaction of sodium hydroxide and hydrogen with chlorine.

Chlorine is also produced in a number of other ways, for example, by electrolysis of potassium chloride brine in membrane and mercury cells with co-production of potassium hydroxide; by electrolysis of molten sodium or magnesium chloride to make elemental sodium or magnesium metal; by electrolysis of hydrochloric acid; and by non-electrolytic processes. A good reference for additional information is the Kirk-Othmer Encyclopedia of Chemical Technology which contains a section on chlorine and sodium hydroxide.

Exhibit 2

TENTH ANNUAL REPORT TO EPA

CHLOR-ALKALI INDUSTRY
MERCURY USE AND EMISSIONS
IN THE UNITED STATES
For the Year 2006

August 13, 2007

THE CHLORINE INSTITUTE, INC.
1300 Wilson Boulevard, Arlington, VA 22209
www.chlorineinstitute.org

TENTH ANNUAL REPORT TO EPA

CHLOR-ALKALI INDUSTRY
MERCURY USE AND EMISSIONS
IN THE UNITED STATES
For the Year 2006

INTRODUCTION and SUMMARY

The Chlorine Institute, Inc. ("Institute" or "CI") continues to be a proactive leader in the effort to reduce mercury use and emissions in the United States. This Tenth Annual Report to the U. S. Environmental Protection Agency ("EPA") illustrates the chlor-alkali industry's continuing progress in voluntarily reducing mercury use and emissions.

In 1996, the Chlorine Institute volunteered to reduce mercury use by 50 percent over the base years of 1990 through 1995. Since then the Institute and its members have worked cooperatively with federal and state authorities to meet and exceed that goal. Since 1995, an eleven-year period, total annual mercury used by the chlor-alkali industry has been reduced by over 92%.

CI's member companies that use mercury cell technology to manufacture chlorine are safe and perform above and beyond all applicable laws and regulations pertaining to mercury use and emissions. The chlor-alkali industry reaffirms its support for the sound management of mercury by committing to four action steps:

- Continue to account fully for mercury used;
- Further reduce the mercury used;
- Continue to improve methods to more accurately measure emissions from the cell rooms at each mercury cell chlor-alkali facility; and
- Further reduce air emissions by over 90% from facilities by implementing the extensive new work practice standards contained in and fully complying with EPA's new National Emission Standard for Hazardous Air Pollutants: Mercury Emissions from Mercury Cell Chlor-Alkali Plants ("NESHAP").

The remainder of this report will focus on the following:

- Status of chlor-alkali mercury cell facilities in the United States;
- Mercury purchases and use during the calendar year 2006;
- Reductions in mercury emissions to the environment; and
- Key initiatives by companies, the Chlorine Institute and the World Chlorine Council to further the industry's commitment to the safe use of mercury.

MERCURY CELL FACILITIES

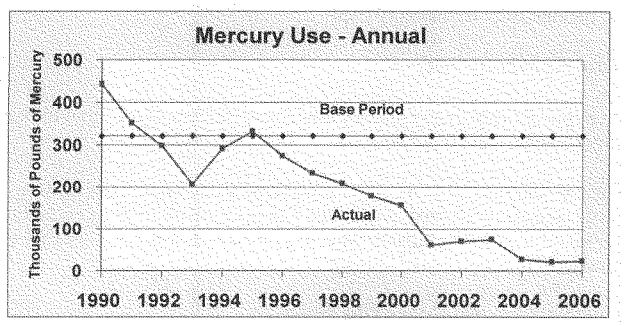
No mercury cell facilities closed in the calendar year 2006. As of the date of this report one facility will complete conversion to the membrane cell process by the end of August 2007. Two additional facilities have announced conversion to membrane technology by the end of 2008 and 2009. A fourth facility intends to close by the end of 2008. These actions will further reduce the chlor-alkali industry's mercury use and emissions. Based on the currently announced plans, only four mercury cell facilities will be in operation in the United States at the end of 2009.

In 1996, when the industry's original commitment to mercury reductions was made, there were 14 operating mercury cell plants. Of the nine facilities that have eliminated or plan to eliminate the use of mercury, three have or will have converted to membrane technology and six have or will have simply closed.

MERCURY USE AND PURCHASES

Using 1990 to 1995 as the baseline, the chlor-alkali industry has reduced its mercury usage by over 92% (see Figure 1 below). Mercury use in 2006 was 24,000 pounds. Mercury use is detailed in Table 1 found in Appendix A.

Figure 1



Chlor-alkali mercury use in the United States per ton of chlorine capacity for 2006 was 0.02 lb/ton chlorine capacity (see Figure 2 below).

Figure 2

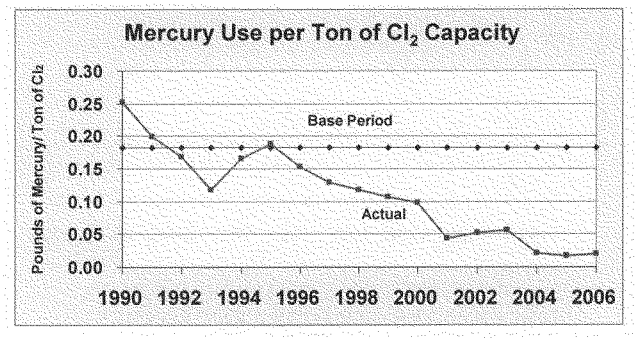
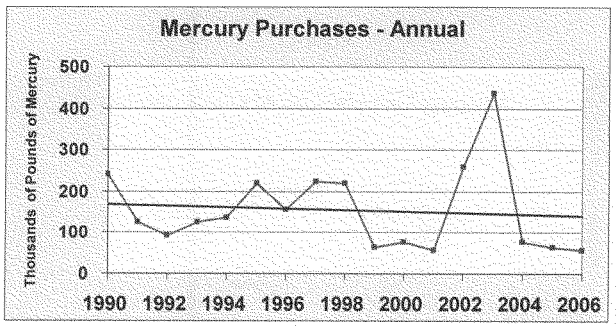


Figure 2 clearly shows that the chlor-alkali industry has significantly reduced its use of mercury, not just because of facility closures, but more importantly because of the more efficient utilization of mercury. This is reflected in an 89% reduction in the 2006 mercury used per ton of chlorine capacity when compared to the 1990 through 1995 baseline.

As is evident from both Figures 1 and 2, reductions in mercury use have slowed. This trend can be attributed to the effectiveness of past reduction efforts.

Mercury purchases in 2006 were 58,000 pounds (see Figure 3 next page). As explained in past reports, mercury purchases do not necessarily equate to mercury use. Process upgrades can necessitate the use of higher volume equipment and longer piping runs require that more mercury be added to the process. More mercury in the process does not equate to greater mercury emissions. In fact, most upgrades typically instituted as part of programs to upgrade cell room technology and improve system performance, also minimize mercury releases. Installation of new and better designed equipment minimizes fugitive emissions. Other upgrades allow the facilities to operate longer between cell maintenance. Less frequent cell maintenance means fewer openings of the cell and thus a reduction in mercury emissions. Annual mercury purchases rise or fall depending on the quantity of upgrades.

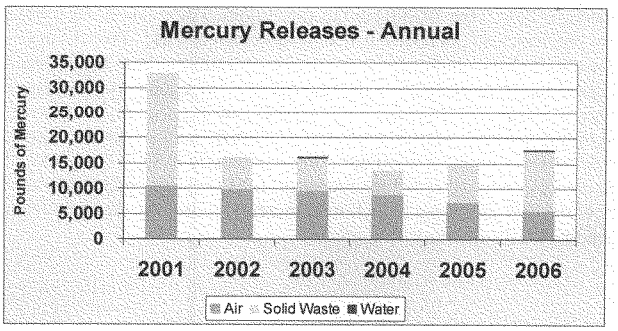
Figure 3



MERCURY RELEASES TO THE ENVIRONMENT

Mercury releases to the environment from the chlor-alkali industry were approximately 17,500 pounds (see Figure 4 below). Mercury emissions are detailed in Table 2 found in Appendix A. This latest information shows a 47% reduction in the chlor-alkali industry mercury emissions[1] since 2001. These emissions are a very small portion (approximately 8%) of the total mercury releases occurring in the United States[2] and have fallen at a greater rate than the overall decline.

Figure 4



[1] Mercury releases to water are not easily depicted in Figure 4 since these quantities are less than 0.1% of the total.
[2] 2002 U.S. mercury releases estimated at 111.4 tons (GLBTS 2006 Progress Report, February 2007).

KEY PROJECTS – NEW AND CONTINUING

Facility Specific Projects in 2006

Below is a summary of key projects completed and/or started at mercury cell facilities during the 2006 calendar year. These projects resulted in reduced mercury emissions but may have also resulted in a short term increase in mercury purchases since sometimes these projects require an increase in mercury process inventories. Process modifications resulted in an increase of process mercury inventory by 20 tons. Most of this mercury was added as virgin mercury obtained from existing corporate stockpiles or from purchases. Approximately 10% came from in-process recovery[3].

The following process modifications occurred in 2006:

- Plant A converted to larger decomposers which required the addition of mercury (approximately 37,000 pounds) into the process inventory;
- Plant B enlarged some decomposers resulting in the addition of 1,990 lbs of mercury to the process inventory; and
- Plant C added 1,900 pounds of mercury. The increase in mercury inventory was necessary when the volume of mercury residing in the cells was increased as part of an upgrade to raise the cell chlorine production efficiency. This also required the installation of larger impellers in the mercury pumps.

These process changes allow for reductions of mercury emissions in two ways. First, because much of the newer equipment being installed is larger than the previously installed equipment, operating cycles between maintenance activities are lengthened. Maintenance activities nearly always require equipment openings. Even though many improvements in techniques to reduce mercury emissions during equipment openings have been made, emissions can not be totally eliminated. Therefore, a lower number of openings results in reduced mercury emissions. Secondly, newer equipment is better designed to reduce fugitive emissions. Sealless mercury pumps, sealed end boxes, and improved hydrogen cooler design are examples of equipment changes that result in reduced fugitive emissions.

Industry-Wide Efforts

Besides aggressively pursuing specific facility-based opportunities for mercury use and emissions reductions, the U.S. chlor-alkali industry's voluntary efforts have also focused more broadly both domestically and worldwide. Since issuing its Ninth Annual Report to EPA, the Institute has continued to coordinate the industry's ongoing efforts to reduce mercury use and emissions. Specifically, CI and its member companies have worked on the following projects:

- Mercury NESHAP

[3] In-process recovery: Mercury can accumulate in filters, tanks, etc. When this mercury is recovered it is placed back in the facility's mercury inventory.

The new Mercury NESHAP (40 CFR Part 63) became effective on December 19, 2006. This new regulation replaces the old Part 61 NESHAP rule. The new regulation contains numerical emission limits for the three primary air sources of mercury at mercury cell facilities: 1) end-box ventilation system vents, 2) by-product hydrogen system vents, and 3) mercury thermal recovery unit vents. It also requires that the plants either install continuous mercury emission monitors or test each vent at least once per week.

The rule also contains a set of work practice standards (representing the best practices of the industry) that are considerably more stringent that the fugitive emissions limits or procedures required under the old Part 61 Mercury NESHAP. The new rule contains an alternative program that involves continuous mercury air concentration monitoring and problem correction when a fugitive emission action level is exceeded. All operating mercury cell facilities are in compliance with this new regulation[4].

- Chlorine Institute - 14th Annual Mercury Issues Workshop

Held at the Chlorine Institute's Annual Meeting in Houston, TX on March 18, 2007, session topics included:

  - Overview of Mercury Fugitive Emissions from Chlor-Alkali Facilities
  - Update from the U.S. EPA on the Mercury NESHAP
  - Fugitive Emissions Monitoring – Report on Side-by-Side Testing with EPA
  - Mercury NESHAP Compliance
  - United States Government Activities on Mercury
  - International Activities on Mercury
  - Working with NGOs

The event was well attended and continues to serve as a useful forum for both U.S. and international users of mercury cell technology.

- World Chlorine Council

The World Chlorine Council ("WCC") (www.worldchlorine.com) is a global network of national and regional chlor-alkali associations in over 27 countries and five continents, representing more than 80 percent of global chlorine and caustic-soda production. The WCC voluntarily engages in global programs to reduce mercury use, consumption and emissions from the mercury cell manufacturing process. CI is a WCC managing partner.

It is well understood that mercury in the environment is not entirely attributable to local sources. Mercury released in other parts of the world can be deposited in the United States. Mercury is a global pollutant and thus requires globally coordinated solutions. International efforts by CI (through the WCC) to reduce mercury emissions are a critical component of the industry's mercury reduction efforts.

[4] The US EPA has given ERCO Worldwide, Port Edwards, WI a one year deferral on compliance with the Mercury NESHAP to allow the facility to evaluate conversion to a non-mercury technology. The facility is on schedule to be in compliance by Dec 19, 2007.

WCC's global programs augment the programs and commitments made by regional WCC organizations. Emissions from this sector will continue to decline as the industry implements best available techniques and transitions to alternative, non-mercury technologies.

As part of these efforts, the WCC has been an active supporter of the United Nations Environmental Program ("UNEP") Global Mercury Program and has made a sustained effort to help mercury cell chlor-alkali producers around the world reduce mercury use and emissions. Furthermore, the WCC agreed to support and contribute to the *UNEP Global Partnership on Mercury Reduction in the Chlor-Alkali Sector*. The Global Mercury Partnership builds upon WCC's long-standing commitment to share best practices globally for reducing the use and release of mercury from mercury-cell chlor-alkali facilities. WCC has strived with governments, chlor-alkali producers, and the UNEP to help make this partnership a success.

Activities have included:

- Promotion & Implementation of Best Practices – WCC continues to encourage the adoption of best management practices to facilitate reductions in mercury releases and use from mercury-cell facilities around the globe. A key mechanism for sharing and implementing these best practices has been in-country workshops designed to allow industry experts and facility managers to share best practices and analyze how these practices could be applied to a specific facility so as to further reduce mercury use and emissions. Where appropriate, these workshops have included follow-up demonstration projects that when implemented are expected to result in tangible reductions in the amount of mercury used and released at specific mercury-cell chlor-alkali manufacturing facilities. To date workshops and technical exchange programs have been held in India, Russia and Mexico.

- Mercury Reporting & Measuring Progress – WCC supports the partnership objective to collect data concerning mercury use and emissions within the chlor-alkali industry. WCC has worked to catalogue, to the best of its knowledge, those facilities utilizing mercury-cell technology. WCC is also working to facilitate the collection on mercury use and emissions from chlor-alkali facilities worldwide. As part of its commitment to the Global Mercury Partnership, WCC submits an annual report to UNEP summarizing regional mercury use, consumption, and emission. The First Annual WCC Report was presented at the 2007 UNEP Governing Council meeting.[5]

[5] The document is available at: http://www.chem.unep.ch/mercury/Sector-Specific-Information/Chlor-alkali_facilities.htm

Update on 2004 Commitments

In its 2004 Annual Report to EPA, The Chlorine Institute discussed two new commitments made to the Binational Toxics Strategy. Specifically, the Chlorine Institute and its members committed to 1) enhancing cell room air monitoring, and 2) fully accounting for the industry's mercury inventory. The following summarizes the status of these commitments:

- Enhancing Cell Room Air Monitoring

Three facilities completed installation of cell room mercury monitoring systems[6] in 2005/early 2006. EPA has completed system evaluation and side-by-side testing for fugitive emissions and/or facility-wide emissions at these three chlor-alkali facilities. This three-part study will assist the Agency as it finalizes issues regarding the Mercury NESHAP.

One study addressed whether the fugitive air emissions from a mercury cell chlor-alkali plant are on the order of magnitude of the historical assumption of 1,300 grams per day (0.5 tons per year) or on the order of magnitude of the unaccounted for mercury. As part of this study, EPA performed two emission test series in 2006. One test series was performed outside and downwind from the plant, and theoretically measured all mercury air emissions from the process, both inside the cell room and outside the plant. The other test series was performed inside the cell room. These test series have been completed and EPA is in the process of evaluating the data. Both test series also will compare the EPA data to the plants' continuous mercury cell room monitoring systems (MMS) that were in place during the EPA tests.

In a second study, EPA performed tests at three facilities to validate continuous MMS and flow measuring systems. Two of the three facility tests were completed in 2005 and one was completed in 2006. Reports for the 2005 tests are currently available to the public on request to EPA. The two 2005 test series showed that the MMS and flow measurements at the facilities were in good agreement with the EPA measurements.

The third study will attempt to determine the process, maintenance, and other operational activities that most significantly impact fugitive mercury air emissions. The EPA will use these data to evaluate whether relationships exist between fugitive mercury air emissions and cell room activities (maintenance and other operational activities), which could be used to develop an emissions factor that could be applied industry-wide.

The final reports should be issued late in 2007.

[6] All of the remaining facilities have also installed systems as necessary to comply with the Mercury NESHAP.

- Fully Accounting for Mercury Inventory

The Chlorine Institute believes it has made outstanding progress in its efforts to fully account for the mercury the chlor-alkali industry uses. Nevertheless, CI continues to refine its data collection and analysis methodology. In 2004, in order to further clarify the facts, CI added a new table, Table 2 (Appendix A), to this report. Table 2 is a compilation of data for the calendar years 2002 through 2006 showing the differences between mercury purchases, mercury use, reported toxics release inventory (TRI) emissions, and mercury contained in chlor-alkali products. The key line item, "unaccounted for mercury", is near the bottom of the table.

The Chlorine Institute stated then that it was not satisfied with the unaccounted for mercury reported in 2002 and 2003 even though this unaccounted inventory represented only one percent of the total mercury inventory for the industry. The industry committed then to fully account for the mercury it uses. In 2005 and 2006 the unaccounted for mercury amounted to three tons; a reduction of nearly 90% from the prior years.

Mercury process inventory is typically measured using the radioactive isotope technique discussed in Chlorine Institute publication, *Guidelines for Conducting a Mercury Balance*, May 1999. The methodology has a variability of between 0.1 and 0.3 percent. Applying this variability to the 2006 year ending mercury inventory of 2,579 tons reveals the data to be accurate to within two to eight tons. The 2006 unaccounted for mercury equaled 2.9 tons or 0.1 percent of the total inventory.

Past Efforts Continue to Provide Environmental Benefits

Since the industry's commitment to mercury reductions, facilities have taken many steps to reduce mercury emissions. These changes have been detailed in prior reports but are summarized below because each historic process improvement continues to pay dividends in the form of mercury emissions reductions in every year that follows. Past activities have included the design, use and installation of:

- Improved collection devices to more effectively capture mercury during cell maintenance activities;
- New decomposer compression system design to improve efficiency of amalgam decomposition;
- New gasket materials to provide better seals on mercury containing equipment;
- Additional collection devices such as weirs to cell room trenches to more effectively recapture and reuse accumulated mercury;
- Process changes to reduce mercury carry-over with the water exiting the end boxes resulting in less mercury handling;

- More efficient electrical current distribution equipment; and
- Larger decomposers, thus lengthening the time between scheduled maintenance (i.e. reducing the need to open the equipment.)

CONCLUSION

The Chlorine Institute believes it has proactively addressed many of the concerns regarding the use and release of mercury into the environment by mercury cell chlor-alkali facilities. In addition, the Institute's commitment to the Binational Toxics Strategy is completed. CI and its members believe this voluntary effort, no matter how it is measured, has been a success. Nevertheless, the Chlorine Institute plans to continue its efforts to reduce mercury use and environmental releases in the chlor-alkali sector both in the United States and internationally through its participation in the WCC and UNEP Global Mercury Program.

ABOUT CI

The Chlorine Institute Inc., founded in 1924, is a non-profit trade association of companies and other entities involved or interested in the safe production, distribution and use of chlorine, sodium and potassium hydroxides, and sodium hypochlorite, and the distribution and use of hydrogen chloride.

Because of chlorine's nature and its widespread and varied applications, the promotion of its safe use and handling has long been an accepted responsibility of its producers, packagers, distributors and users. The Institute is the focal point for their joint efforts.

For more information on CI's mission, go to www.chlorineinstitute.org.

For more information concerning the content of this report please contact:

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APPENDIX A
Data Tables

Table 1
Mercury Purchase and Usage[1]
Chlor-Alkali Industry - Mercury Cell Process

	BASELINE (Average 1990 – 95)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005[2]	2006
Total Mercury Purchases, lb.	296,408	242,015	320,460	340,658	214,749	172,885	69,932	259,069	437,434	75,982	63,829	57,304
Total Mercury Purchases, tons	148	121	160	170	107	86	35	130	219	38	32	29
Total Mercury Used, lb.	319,715	273,659	232,056	210,213	177,968	156,403	61,506	71,052	75,309	28,637	20,660	24,210
Total Mercury Used, tons	160	137	116	105	89	79	30	36	38	14	10	12
Annual Chlorine Capacity, 1,000 tons	1,758	1,784	1,801	1,785	1,676	1,589	1436	1355	1,353	1,363	1,221	1,206
Total Number of Mercury Cells	762	762	762	762	706	682	646	594	594	594	506	506
Mercury Used, lb/ton of Chlorine Capacity	0.182	0.153	0.129	0.118	0.106	0.102	0.044	0.052	0.056	0.021	0.017	0.020

Notes:
1 ton = 2,000 lb
[1] Data was collected from those plants operating at the end of the calendar year.
[2] In 2005, the Occidental Chemical Company plant in Delaware City, DE closed. Beginning in 2005, data for this facility is no longer collected and included in the totals.

Table 2
Mercury Balance and Release[1, 2]
Chlor-Alkali Industry - Mercury Cell Process
(in tons)

		2002	2003	2004[3]	2005	2006
1	Mercury Virgin Inventory as of Jan 1	67	46	166	90	44
2	Mercury Process Inventory as of Jan 1	2,478	2,593	2,654	2,493	2,561
3	Total Mercury Inventory as of Jan 1 [3] = [1] + [2]	2,545	2,639	2,820	2,583	2,605
4	Mercury purchases during calendar year	130	219	38	32	29
5	Total Mercury Available [5] = [3] + [4]	2,675	2,858	2,858	2,615	2,634
6	Mercury Virgin Inventory at on site storage as of Dec 31	46	166	96	45	34
7	Mercury Process Inventory as of Dec 31	2,593	2,654	2,748	2,560	2,579
8	Total Mercury Inventory as of Dec 31 [8] = [6] + [7]	2,639	2,820	2,844	2,605	2,613
9	Mercury Transferred Out[4]	0	0	1	0	9.2
10	Total Mercury Used (Consumed) [10] = [5] – [8] - [9]	36	38	13	10	11.8
11	Mercury Released to the Environment (TRI)	8.2	8.1	6.8	6.7	8.8
12	Mercury Contained in Products	0.2	0.1	0.1	0.1	0.1
13	Total Mercury Losses to Environment and Products	8	8	7	7	8.9
14	Unaccounted for Mercury [14] = [10] – [13]	28	30	6	3	2.9
15	Number of Mercury Cell Facilities Operating at End of Year	9	9	9	8	8

Notes:
[1] For facilities operating at year end in the calendar year.
[2] Numbers may not add due to rounding.
[3] 2004 ending inventory and 2005 beginning inventory data adjusted to reflect shutdown of Delaware facility.
[4] Sent off-site for recovery, not returned during calendar year.

Exhibit 3

Documents Developed by the Institute's Technical Teams

- **Guidelines: Medical Surveillance and Hygiene Monitoring Practices for Control of Worker Exposure to Mercury in the Chlor-Alkali Industry**
- **Guidelines for the Handling of Rubber-Lined Cell Parts Potentially Contaminated with Mercury**
- **Guidelines for Conducting a Mercury Balance**
- **Guidelines for Technologies to Reduce Mercury in Sodium Hydroxide**
- **Guidelines for Mercury Cell Chlor-Alkali Plants Emission Control: Practices and Techniques**
- **Guidelines For The Optimization Of Mercury Wastewater Treatment (Sulfide Precipitation Process) Systems**

Exhibit 4

Mercury Cell Plants Operating in 1996 and Current Status

	Company	Location	Current Status
1	ASHTA Chemicals	Ashtabula, Ohio	In operation
2	Olin Corporation	Augusta, Georgia	In operation
3	Olin Corporation	Charleston, Tennessee	In operation
4	PPG Industries	New Martinsville, West Virginia	In operation
5	ERCO Worldwide	Port Edwards, Wisconsin	In operation; conversion in progress (completion expected within two years).
6	Olin Corporation	St. Gabriel, Louisiana	In operation; conversion in progress (completion expected within two years).
7	PPG Industries	Lake Charles, Louisiana	Converted
8	Westlake	Calvert City, Kentucky	Converted
9	Georgia Pacific	Bellingham, Washington	Closed
10	Holtra Chem	Orrington, Maine	Closed
11	Holtra Chem	Riegelwood, North Carolina	Closed
12	Occidental Chemical Corp.	Deer Park, Texas	Closed
13	Occidental Chemical Corp.	Delaware City, Delaware	Closed
14	Occidental Chemical Corp.	Muscle Shoals, Alabama	Closed (April 2008)

Exhibit 5

THE CHLORINE INSTITUTE, INC.
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Chlor-alkali Industry Principles Concerning the Retirement of Mercury

1. Mercury is a marketable commodity. It is not a hazardous waste. There are numerous beneficial uses for mercury that provide value to our society and which are likely to continue for the foreseeable future.

2. In the United States, the supply of mercury available from facilities (e.g., strategic reserve, converted/shutdown mercury cell plants) that no longer need it or that becomes available through reclamation processes exceeds the demand for such mercury. However, on a world wide basis, a net demand for additional mercury does exist. Currently, there is still at least one mine in operation for the express purpose of supplying virgin elemental mercury to meet this world demand.

3. Improper handling/use of mercury can lead to adverse environmental consequences (especially in countries where sufficient environmental restrictions are not in place). Therefore, it may be prudent for the United States to consider a national policy to identify which worldwide outlets are acceptable vs. the present free market approach. This restriction of outlets recognizes that the mining of fresh mercury will be encouraged to meet the demand for the identified unacceptable outlets outside of the US.

4. Any government policy related to the retirement of mercury must be predicated on the government's taking title to the mercury and assuming full responsibility for the permanent management of such mercury in a manner consistent with safety and environmental regulations and engineering standards.

5. In the event that recovery processes do not provide sufficient mercury to supply future needs, mercury from the permanent storage stockpile should be made available for the legitimate needs of users of mercury rather than the mining of virgin mercury.

6. Assuming that such a government policy regarding the retirement and storage of such mercury is developed, the chlor-alkali industry is willing to discuss options concerning how the chlor-alkali industry can best insure that any surplus mercury from idled or converted sites is placed into that permanent storage and is not allowed to enter poorly managed commercial markets.

Exhibit 6

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Stephen R. Fitzgerald, *Chair*
Carol A. Dudley, *Vice Chair*
Dr. Robert G. Smerko, *President*

June 26, 2002

The Honorable James M. Jeffords, Chairman
Environment and Public Works Committee
410 Dirksen Senate Office Building
Washington, DC 20510-6175

The Honorable Bob Smith, Ranking Member
Environment and Public Works Committee
456 Dirksen Senate Office Building
Washington, DC 20510-6175

Dear Senators Jeffords and Smith:

Reference: S. 351

The Chlorine Institute, Inc. supports Senate Bill 351 as presented in the version dated June 25, 2002 and identified by the file name DEC02.471. While we support the portion of the bill pertaining to fever thermometers, we believe the key part of the bill is that which addresses the retirement of surplus mercury.

The United States government has approximately 6,000 tons of surplus mercury within the Department of Defense and the Department of Energy. In addition, approximately 3,000 tons of surplus mercury may become available over the next several decades from mercury cell chlorine production plants as they reach the end of their economic life. Mercury recycling and recovery programs already make the supply of mercury greater in the USA than the demand. The excess supply will increase in the future, as legitimate mercury needs decline. All of these reasons combine to make it highly desirable for the United States to develop a policy to address the retirement of surplus mercury.

The Institute worked with EPA and the Northeast Waste Management Officials' Association (NEWMOA) in helping to plan the Mercury Workshop held in Boston on May 1 - 3, 2002. At this workshop, the Institute presented its views on issues associated with the retirement of surplus mercury in a formal presentation made by one of our members. Attached is a framework presenting the principles that we support and have provided to the Mercury Policy Project. We believe that the current draft of Senate bill 351 embodies the essence of these principles.

The Chlorine Institute, Inc., founded in 1924, is a 220-member, not-for-profit trade association of chlor-alkali producers worldwide, as well as packagers, distributors, users, and suppliers. The

A RESPONSIBLE CARE® PARTNER ASSOCIATION

Institute's mission is the promotion of safety and the protection of human health and the environment in the manufacture, distribution and use of chlorine, sodium hydroxide, potassium hydroxide and sodium hypochlorite, plus the distribution and use of hydrogen chloride. The Institute's North American Producer members account for more than 98 percent of the total chlorine production capacity of the U.S., Canada, and Mexico. In the United States, there are ten facilities that produce chlorine using the mercury cell process accounting for 10% of the annual chlorine production. All are members of the Chlorine Institute.

The Chlorine Institute has long worked on a cooperative basis with various federal, state, and local agencies and other groups to address issues associated with mercury use in chlorine production. We believe that production of chlorine with mercury cell technology continues to be a safe, environmentally sound way to manufacture chlorine and chlorine-based products. Mercury cell facilities can be operated in a manner that meets or exceeds environmental standards. However, we remain committed to voluntary mercury reduction strategies. For example, in April of this year, the Institute submitted its fifth annual report to the USEPA concerning the commitment the Institute and the mercury cell chlorine producers made to the Binational Toxics Strategy in 1996 to reduce mercury use by 50% or more by 2005 and to provide the agency with an annual report of progress. In the fifth year of the program, the goal has been achieved. The overall reduction to date is 81%. We will continue to provide these reports to the agency as we strive to make further reductions.

The Institute has worked with EPA and other entities on a variety of other issues. These include issues such as the currently pending MACT standard for further reductions in mercury emissions from mercury cell chlorine production plants and RCRA issues associated with mercury containing materials. The Institute has also worked on international issues such as the United Nations Economic Commission for Europe (UN/ECE) Convention on the Long Range Transboundary Air Pollution Protocol on Heavy Metals (includes mercury). The Institute formally supported this protocol and urged our government to sign it -- which it has.

We have been most privileged to work with your committee staff on this bill.

Very truly yours,

Robert G. Smerko

Robert G. Smerko

Senate Bill 351 Letter Final.doc

Exhibit 7

November 8, 2007

Re: HR 1534

Dear Representative:

HR 1534, the "Mercury Export Ban Act of 2007", which bans the export of surplus elemental mercury into global commerce, was reported out of the House Energy & Commerce Committee on October 30, 2007, by an overwhelmingly bi-partisan vote of 45-2. The undersigned organizations support this negotiated version of HR 1534 and urge its passage under Suspension of the Rules.

Collectively, our organizations negotiated in good faith to produce the bill as reported, which addresses our individual concerns, advances our shared objective of reducing global mercury pollution, and reflects good public policy.

Specifically, the Committee-reported version of HR 1534 establishes a practical and workable domestic framework for sequestering the elemental mercury prohibited from export under the legislation. To develop this framework, our organizations worked diligently and collectively to reach consensus, each of us agreeing not to raise related mercury matters which may have prevented a successful outcome. Therefore we hope the full House of Representatives will acknowledge the compromises made and approve HR 1534 without further changes.

In closing, the undersigned organizations urge your "YES" vote on HR 1534 in the coming days.

Sincerely,

Frances G. Beinecke, President
Natural Resources Defense Council

Jack N. Gerard, President & CEO
American Chemistry Council

Kraig R. Naasz, President & CEO
National Mining Association

R. Steven Brown, Executive Director
Environmental Council of States

Arthur E. Dungan, President
The Chlorine Institute, Inc.

CLEAN AIR COMPANIES

Commercial Electric Utility Mercury Control Technology Bookings

Air pollution control vendors are reporting booking new contracts for mercury control equipment for more than two dozen power plant boilers. The contracts for commercial systems are attributed to federal and state regulations, including new source permit requirements and consent decrees, which specify high levels of mercury capture. Below is a summary of the mercury control equipment that has been procured to date. **Last Update: 04-21-08**

	Plant Size (MW)	Location	Prime OEM Contractor	Coal	APC Configuration	Hg Control	New Plant or Retrofit	Regulatory Driver	Anticipated Startup Date
1	90 MW ea. 270 Total	**Midwest**	Siemens Envir. Sys. (Norit/ADA-ES)	PRB	TOXECON	ACI	Retrofit	Consent Decree	1st Qtr 2005
2	250	**East**	Siemens Envir. Sys.	Bituminous	SDA/FF	ACI	Retrofit	State Regulatory	2nd Qtr 2008
3	250	**East**	Siemens Envir. Sys.	Bituminous	SDA/FF	ACI	Retrofit	State Regulatory	2nd Qtr 2008
4	650	**East**	Siemens Envir. Sys.	Bituminous	ESP	ACI	Retrofit	State Regulatory	
5	740	**Midwest**	B&W (ADA-ES)	PRB	SDA/FF	ACI	New Plant	New Construction Permit	
6	550	**Midwest**	B&W (ADA-ES)	PRB	SDA/FF	ACI	New Plant	New Construction Permit	
7	350	**West**	B&W (ADA-ES)	PRB	SDA/FF	ACI	Retrofit	Consent Decree	
8	350	**West**	B&W (ADA-ES)	PRB	SDA/FF	ACI	Retrofit	Consent Decree	
9	800	**West**	B&W (ADA-ES)	PRB	SDA/FF	ACI	New Plant	New Construction Permit	
10	350	**East**	ADA-ES	Bituminous	ESP	ACI	Retrofit	Consent Decree	
11	350	**East**	ADA-ES	Bituminous	ESP	ACI	Retrofit	Consent Decree	
12	204	**Midwest**	Dustex	PRB	TOXECON	ACI	Retrofit	Consent Decree	
13	375	**East**	Siemens Envir. Sys.	Bituminous		ACI	Retrofit	Consent Decree	1st Qtr 2008
14	650	**Midwest**	Alstom (ADA-ES)	PRB	SDA/FF	ACI	New Plant	New Construction Permit	
15	156 MW ea. 315 Total	**Midwest**	Powerspan	Bituminous	Multi-pollutant	ECO	Retrofit	Construction Permit	
16	750	**Midwest**	Siemens Envir. Sys.	High Sul. Bit	ESP/WFGD/WESP	ACI	New Plant	Construction Permit	3rd Qtr 2009
17	680	**South**	Alstom (ADA-ES)	PRB	SDA/FF	ACI	New Plant	Construction Permit	

	Plant Size (MW)	Location	Prime OEM Contractor	Coal	APC Configuration	Hg Control	New Plant or Retrofit	Regulatory Driver	Anticipated Startup Date
18	107	**East**	BPI	Bit./Bio-Mass	FT-SNCR/CDS/FF	ACI	Retrofit	DOE Demo.	
19	860	**South**	BPI	Lignite	SCR/FF/WFGD	ACI	New Plant	Construction Permit	
20	860	**South**	BPI	Lignite	SCR/FF/WFGD	ACI	New Plant	Construction Permit	
21	220	**West**	B&W (ADA-ES)	PRB	SDA/FF	ACI	New	Construction Permit	
22	575	**Southwest**	B&W (STC)	West.Bit/Sub. Bit. Blend	HS-ESP/FF/WFGD	ACI	Retrofit	Construction Permit	
23	575	**Southwest**	B&W (STC)	West.Bit/Sub. Bit. Blend	HS-ESP/FF/WFGD	ACI	Retrofit	Construction Permit	
24	335	**Northeast**	ADA-ES	Bituminous	Cold-Side ESP	ACI	Retrofit	Voluntary Regional Emission Abatement Plan	
25	880	**South**	Siemens Envir. Sys.	PRB	ESP/FF (TOXECON)	ACI	Retrofit	Voluntary Regional Emission Abatement Plan	4th Qtr 2008
26	350	**Midwest**	Hamon (ADA-ES)	PRB	SCR/FF	ACI	Retrofit	State Regulatory	
27	650	**Southwest**	ADA-ES	PRB	ESP/FF	ACI	Retrofit	Voluntary Regional Emission Abatement Plan	
28	628	**Southwest**	ADA-ES	PRB	ESP/FF Parallel Flow	ACI	Retrofit	Voluntary Regional Emission Abatement Plan	
29	855	**Southwest**	ADA-ES	Lignite/PRB	ESP/WFGD	ACI	Retrofit	Voluntary Regional Emission Abatement Plan	
30	670	**Midwest**	Alstom/ADA-ES	PRB	SCR/FF/WFGD	ACI	Retrofit	Construction Permit of new unit	
31	850	**Midwest**	Alstom/ADA-ES	PRB	SCR/FF/WFGD	ACI	New	Construction Permit	
32	167	**East**	Sorbent Technologies	E- Bitum	ESP/WFGD	ACI	Retrofit	Consent Decree	
33	108	**Midwest**	Dustex	PRB	TOXECON	ACI	Retrofit	Consent Decree	
34	159	**Midwest**	NORIT	PRB	ESP	ACI	Retrofit	CAMR	1st Qtr 2010
35	348	**Midwest**	NORIT	PRB	ESP	ACI	Retrofit	State Regulatory	
36	237	**Midwest**	NORIT	PRB	ESP	ACI	Retrofit	State Regulatory	

	Plant Size (MW)	Location	Prime OEM Contractor	Coal	APC Configuration	Hg Control	New Plant or Retrofit	Regulatory Driver	Anticipated Startup Date
37	347	**Midwest**	NORIT	PRB	ESP	ACI	Retrofit	State Regulatory	
38	341	**Midwest**	NORIT	PRB	ESP	ACI	Retrofit	State Regulatory	
39	566	**Midwest**	NORIT	PRB	ESP	ACI	Retrofit	State Regulatory	
40	561	**Midwest**	NORIT	PRB	ESP	ACI	Retrofit	State Regulatory	
41	850	**Midwest**	NORIT	PRB	ESP	ACI	Retrofit	State Regulatory	
42	850	**Midwest**	NORIT	PRB	ESP	ACI	Retrofit	State Regulatory	
43	359	**Midwest**	NORIT	PRB	ESP	ACI	Retrofit	State Regulatory	
44	385	**Midwest**	NORIT	PRB	ESP	ACI	Retrofit	State Regulatory	
45	281	**Midwest**	NORIT	PRB	ESP	ACI	Retrofit	State Regulatory	
46	551	**Midwest**	NORIT	PRB	ESP	ACI	Retrofit	State Regulatory	
47	400	**Southwest**	Alstom/ADA-ES	PRB	SDA/FF	ACI	New	Construction Permit	
48	495	**Alberta Canada**	B&W/NORIT	Can. Sub-Bit.	SDA/FF	ACI	New	Construction Permit	
49	800	**Midwest**	Siemens Envir. Sys.	E. Bit	Lime Inj./ESP/ WFGD/WESP	ACI	New	Construction Permit	2 nd Qtr 2010
50	800	**Midwest**	Siemens Envir. Sys.	E. Bit	Lime Inj./ESP/WFGD/ WESP	ACI	New	Construction Permit	2nd Qtr 2011
51	350	**Midwest**	ADA-ES	PRB	ESP	ACI	Retrofit	Construction Permit	
52	568	**Southwest**	AESI/ADA-ES	Lignite	CFB Boilers/SNCR/A CI/CDS-DFGD/FF	ACI	New	Construction Permit	
53	248	**Midwest**	ADA-ES	PRB	ESP	ACI	Retrofit	State Regulatory	
54	590	**Midwest**	ADA-ES	PRB	ESP	ACI	Retrofit	State Regulatory	
55	608	**Midwest**	ADA-ES	PRB	ESP	ACI	Retrofit	State Regulatory	
56	110	**Midwest**	ADA-ES	PRB	ESP	ACI	Retrofit	State Regulatory	

	Plant Size (MW)	Location	Prime OEM Contractor	Coal	APC Configuration	Hg Control	New Plant or Retrofit	Regulatory Driver	Anticipated Startup Date
57	272	**Midwest**	ADA-ES	PRB	ESP	ACI	Retrofit	State Regulatory	
58	375	**Midwest**	ADA-ES	PRB	ESP	ACI	Retrofit	State Regulatory	
59	100 ea. 200 Total	**Northeast**	Clyde Bergemann EEC	PRB	Dry Injection/FF	ACI	Retrofit	State Regulatory	
60	200 ea. 400 Total	**Northeast**	Clyde Bergemann EEC	PRB	Dry Injection/FF	ACI	Retrofit	State Regulatory	
61	200 ea. 400 Total	**Northeast**	Clyde Bergemann EEC	PRB	Dry Injection/FF	ACI	Retrofit	State Regulatory	
62	300	**Midwest**	Allied/ADA-ES	PRB	CDS/FF	ACI	Retrofit	Construction Permit	
63	200	**Midwest**	Siemens Envir. Sys.	Ill Bit	FF/WFGD/ WESP	$Ca(OH)_2$ /ACI	Retrofit	State Regulatory	3rd Qtr 2009
64	680	**East**	Siemens Envir. Sys.	INR Bit & Pet Coke	FF/WFGD	$Ca(OH)_2$/ ACI	New	Construction Permit	4th Qtr 2009
65	680	**East**	Siemens Envir. Sys.	INR Bit & Pet Coke	FF/WFGD	$Ca(OH)_2$/ ACI	New	Construction Permit	1st Qtr 2010
66	493	**Midwest**	Siemens Envir. Sys.	PRB	SDA/FF	ACI	Retrofit	State Regulatory	3rd Qtr 2009
67	638	**Midwest**	Siemens Envir. Sys.	PRB	Initial ESP Later SDA/FF	ACI	Retrofit	State Regulatory	3rd Qtr 2009
68	637	**Midwest**	Siemens Envir. Sys.	PRB	Initial ESP Later SDA/FF	ACI	Retrofit	State Regulatory	3rd Qtr 2009
69	627	**Midwest**	Siemens Envir. Sys.	PRB	Initial ESP Later SDA/FF	ACI	Retrofit	State Regulatory	3rd Qtr 2009
70	382	**Midwest**	Siemens Envir. Sys.	PRB	ESP	ACI	Retrofit	State Regulatory	3rd Qtr 2009
71	880	**South**	Siemens Envir. Sys.	PRB	ESP/FF Toxecon	ACI	Retrofit	Voluntary Regional Emissions Abatement Plan	4th Qtr 2009
72	880	**South**	Siemens Envir. Sys.	PRB	ESP/FF Toxecon	ACI	Retrofit	Voluntary Regional Emissions Abatement Plan	2nd Qtr 2009
73	880	**South**	Siemens Envir. Sys.	PRB	ESP/FF Toxecon	ACI	Retrofit	Voluntary Regional Emissions Abatement Plan	1st Qtr 2010
74	620	**East**	Alstom/ADA-ES	E. Bit & Columbian	ESP/DFGD/PJFF	ACI	Retrofit	State Regulatory	
75	52 MW 73 MW	**West**	ADA-ES	PRB	ESP	ACI (Combined	Retrofit	CAMR Early Compliance	

	Plant Size (MW)	Location	Prime OEM Contractor	Coal	APC Configuration	Hg Control	New Plant or Retrofit	Regulatory Driver	Anticipated Startup Date
						Sys.)			
76	837	**Southwest**	NORIT	Lignite	ESP	ACI	Retrofit	CAMR	1st Qtr 2010
77	620	**East**	NORIT	Bituminous	ESP	ACI	Retrofit	State Regulatory	1st Qtr 2010
78	614	**East**	NORIT	Bituminous	ESP	ACI	Retrofit	State Regulatory	1st Qtr 2010
79	348	**Southwest**	Sorbent Technologies	W. Bit/Sub. Bit Blend	HS-ESP/FF/WFGD	ACI	Retrofit	Construction Permit	
80	329	**Southwest**	Sorbent Technologies	W. Bit/Sub. Bit Blend	HS-ESP/FF/WFGD	ACI	Retrofit	Construction Permit	
81	220	**West**	Allied/ADA-ES	PRB	CFB/FF	ACI	New	Construction Permit	
82	860	**Southwest**	NORIT Americas, Inc.	Lignite	ESP (cold)	ACI	Retrofit	CAMR	1st Qtr 2010
83	618	**Southwest**	NORIT Americas, Inc.	Subbituminous	ESP (cold)	ACI	Retrofit	CAMR	3rd Qtr 2010
84	183 ea. 366 Total	**Midwest**	NORIT Americas, Inc.	Subbituminous	ESP (cold)	ACI	Retrofit	State Regulatory	
85	183 ea. 366 Total	**Midwest**	NORIT Americas, Inc.	Subbituminous	ESP (cold)	ACI	Retrofit	State Regulatory	
86	183 ea. 366 Total	**Midwest**	NORIT Americas, Inc.	Subbituminous	ESP (cold)	ACI	Retrofit	State Regulatory	
87	305 ea. 610 Total	**Canada**	NORIT Americas, Inc.	Subbituminous	ESP (cold)	ACI	Retrofit	Provincial Regulatory	

Terminology:

- ESP – Electrostatic precipitators use electrical fields to remove pollutants such as particulates and mercury from boiler flue gases. The electric field drives particulates to the collecting electrodes where they are periodically dislodged using a mechanical process.
- Cold-Side ESP – Cold side electrostatic precipitators are ESPs located on the downstream side of the air preheater or heat exchanger (which transfers heat from the flue gas to the air to be fed into the furnace) and therefore operates at relatively low temperatures (i.e., temperatures of no more than about 200° C).
- HS-ESP – Hot side electrostatic precipitators are ESPs are located on the upstream side of the air preheater and therefore operate at relatively high temperatures (i.e., more than about 250° C).
- WESP – Wet electrostatic precipitators use electric fields to remove pollutants such as particulates and mercury from boiler flue gases. The electric field drives particulates to the collecting electrodes which are periodically washed off with a liquid.
- ACI – Activated carbon injection is a form of sorbent injection technology that injects powdered activated carbon into the flue gas where it mixes with the gas to contact the sorbent. The sorbent is then collected in the particulate control device where there is a second opportunity for sorbent to contact the mercury in the flue gas.
- FF – Fabric filter, commonly referred to as a baghouse, is a particulate control device that also captures mercury. Fabric filter collectors pass the flue gas through a tightly woven fabric where the particulates in the flue gas will be collected on the fabric by sieving and other mechanisms. The dust cake which forms on the filter is periodically removed from the fabric and collected in a hopper.
- TOXECON – TOXECON is an EPRI patented technology in which sorbents, including activated carbon is injected into a pulse-jet baghouse installed downstream of the existing particulate control device.
- WFGD – Wet flue gas desulfurization or wet scrubber is control system designed to remove SO_2 from flue gases and can also capture mercury. In a wet scrubber, a liquid sorbent is sprayed into the flue gas in an absorber vessel. The pollutant comes into direct contact with the sorbent and forms a wet slurry waste that is separated from the process stream.
- DFGD – Dry flue gas desulfurization or dry scrubber injects an alkaline sorbent into the flue gas to remove SO_2 and particulates but can also capture mercury. Dry flue gas desulfirization produces a dry solid by-product as the flue gas leaving the absorber is not saturated like in a WFGD.
- SDA – Spray dryer absorber is a form of dry flue gas desulfurization system.
- SCR – Selective catalytic reduction is a NO_x control device that can oxidize mercury. The basic principle of SCR is the reduction of NO_x to N_2 and H_2O by the reaction of NO_x and ammonia (NH_3) within a catalyst bed.
- SNCR – Selective non-catalytic reduction is a NO_x control device that utilizes a chemical process where a reducing agent, typically ammonia or urea, is injected into the process gases to convert nitrogen oxides into molecular nitrogen.
- CFB – Circulating fluidizied bed is a combustion process where crushed coal is mixed with limestone and fired in a process resembling a boiling fluid.
- APC Configuration – Air pollution control configuration refers to the emissions control technologies that are currently on the boiler or that contribute to mercury control.

ECOS

Approved February 27, 2001
Clearwater, Florida

As certified by
Robert E. Roberts
Executive Director

Reaffirmed on April 15, 2004
Washington, DC
Electronic Vote Tally

Reaffirmed on March 20, 2007
Alexandria, VA

As Certified by
R. Steven Brown
Executive Director

ON MULTI-POLLUTANT STRATEGIES FOR THE CONTROL OF AIR POLLUTION

WHEREAS, many sources of air pollution, including power plants, emit more than one pollutant subject to regulation under the Clean Air Act and under state laws;

WHEREAS, States and their citizens are concerned about electrical reliability, energy supply, and energy prices;

WHEREAS, the traditional approach to regulation of pollutants has proceeded independently for each pollutant in determining the level of regulation, the type of control requirements, and the timing of such regulatory requirements;

WHEREAS, the traditional approach to the regulation of these pollution sources may lead to control strategy decisions that might vary significantly in cost, efficiency, and type;

WHEREAS, a multi-pollutant strategy is defined as the coordinated consideration of multiple regulatory decisions for sources of environmental pollutants;

WHEREAS, a well-designed multi-pollutant strategy has the potential to improve the ability of the sources to control environmental pollutants in a manner that facilitates efficiency, competitiveness, and cost savings while significantly reducing environmental impacts and provides industry with the ability to plan for the future;

WHEREAS, it is in the public interest to protect and preserve the environment, while promoting more effective planning and rational, flexible regulation of sources and to limit the economic burden of environmental regulation wherever possible;

WHEREAS, the current concerns that have arisen with respect to electric reliability, energy supply, and energy prices increase the need of the States and their citizens to have the regulation of the power generation industry proceed in a manner that is as cost-effective and non-disruptive as possible;

WHEREAS, several States have adopted or are in the process of adopting multi-pollutant strategies for the power generation industry, some of which consider the simultaneous regulation of multiple pollutants including mercury, SO_2 and NO_X; such states being:

Connecticut	New Jersey
Delaware	New York
Illinois	North Carolina
Massachusetts	Tennessee
New Hampshire	

WHEREAS, this coordinated approach could lead to greater environmental gains than would be achieved under the existing provisions of the Clean Air Act and could create greater opportunities for pollution prevention and sustainability, as well as recognize the timing of installation, economic impact and co-benefits of controls;

WHEREAS, there are a number of bills before Congress and some proposals being developed that would establish multi-pollutant strategies for the regulation of pollutants from the power generation industry.

NOW, THEREFORE BE IT RESOLVED THAT:

The Environmental Council of States (ECOS) requests that EPA and Congress support research and incentives to allow the use of innovative multi-pollutant strategies for the control of air pollution under the federal Clean Air Act.

ECOS requests EPA to work with States to develop a cost-effective, efficient, and environmentally protective approach to implementing a multi-pollutant strategy for the regulation of the power industry.

In pursuing a multi-pollutant strategy, Congress, EPA and the States should proceed in a manner that protects the public health and environment, promotes efficient expenditure of resources, provides adequate and reliable energy, is scientifically sound and technically feasible and minimizes government impediments to the achievement of these goals and cost savings while significantly reducing environmental impacts and provides industry with the ability to plan for the future

Copies of this resolution be transmitted to the Administrator of EPA, the Director of the Office of Management and Budget, the President of the United States, and the United States Congress.

WHEREAS, large sources of mercury in the United States are becoming available from the dismantling of chlorine and caustic soda manufacturing systems and collection of discarded mercury-containing products, equipment, and devices; and

WHEREAS, state and federal governments are taking many actions to reduce mercury in the environment, which has led to a phasing out of mercury use and an increasing supply of mercury on the market; and

WHEREAS, large volume mercury sales depress world prices, increase world supply of mercury, and result in increased mercury use in countries with lesser or non-existent regulations concerning waste management, air emissions, and protection of worker safety and the environment; and

WHEREAS, mercury is a national and international concern because it is transported by air currents across political boundaries, and mercury exported by the U. S. returns to this country by atmospheric transport, through contaminated fish and in manufactured products.

NOW, THEREFORE, BE IT REOLVED THAT:

ECOS commends the DoD Defense National Stockpile Center for continuing the suspension of sales from the DOD mercury stockpile and for its identification of continued mercury storage as the preferable management option in the Mercury Management Environmental Impact Statement.

ECOS remains strongly opposed to U. S. mercury stockpile sales and recognizes that long-term storage of mercury is a federal responsibility.

ECOS requests that the President of the United States issue a directive to federal agencies, including the Department of Defense and the U.S. Environmental Protection Agency (US EPA), involved in the storage and management of mercury to work to recommend a plan to manage the long-term storage of excess mercury stocks in conformance with appropriate state and federal laws and regulations and to implement a plan by January 2008.

ECOS calls on the Department of Defense, the department of Energy, and the US EPA to research and evaluate long term management, retirement and substitution options in cooperation with interested parties.

ECOS urges all nations to end subsidies to mercury mining and sales and strongly encourages the federal government to provide resources sufficient to effectively implement and assess results of the international mercury partnerships and to further advance global strategies to reduce mercury use and pollution.

ECOS urges US EPA to develop retirement options for mercury so that waste generators and waste treatment facilities may choose recycling or retirement.

ECOS requests that large consumers of mercury, particularly the chlor-alkai industry, States, and especially those States where any repository of mercury may be sited, be included in the development of a recommended storage or retirement plan.

Copies of this resolution be transmitted to the Administrator of EPA, the Director of the Office of Management and Budget, the Secretary of Defense, and the Secretary of Department of Energy, the President of the United States, and the United States Congress.

Resolution Number 01-2

ECOS

Resolution Number 06-1
Approved March 21, 2006
Washington, DC

As Certified by
R. Steven Brown
Executive Director

MERCURY RETIREMENT AND STOCKPILING

WHEREAS, mercury is a persistent bio-accumulative toxic substance; and

WHEREAS, the United States government owns in excess of 10 million pounds of mercury in Department of Defense (DoD) and Department of Energy stockpiles, and U. S. government sales of stockpiled mercury were halted in 1994 so that environmental considerations could be assessed; and

WHEREAS, the entire United States mercury stockpile has been declared excess to U. S. needs and in 1996 was slated for sale on the world market through the Defense National Stockpile Center of the department of Defense; and

WHEREAS, the DoD's Defense National Stockpile Center has prepared an Environmental Impact Statement describing alternatives for managing its inventory of excess mercury; and

WHEREAS, the United States Consumption of mercury has declined about 75% since 1990 and will likely continue to decline; and

WHEREAS, the United States is meeting virtually all of its domestic needs via recycling; and

WHEREAS, mercury use and demand are similarly declining in developed countries due to increased awareness of health and environmental impacts, increased regulation, and increased use of non-mercury alternatives; and

WHEREAS, atmospheric deposition resulting from human activities, including area sources, waste disposal, chlorine and caustic soda manufacturing wastes, and fossil fuel burning contributes significantly to the global mercury loading in the environment; and

WHEREAS, global sources contribute significantly to mercury impacts in the US; and,

WHEREAS, ECOS has worked with the federal government on international issues since 2002 and the mercury partnership approach supported by the U.S. was adopted by the United Nations Environment Program in February 2005 as one approach to reducing mercury risks; and

ECOS

Resolution Number 06-8
Approved August 29, 2006
Portland, Oregon

As certified by
R. Steven Brown
Executive Director

ECOS Resolution on Encouraging Flexibility to Reduce Mercury and Achieve the Goals of The Clean Air Mercury Rule

WHEREAS, the United States Environmental Protection Agency (USEPA) adopted the Clean Air Mercury Rule to reduce mercury emission from coal-fired power plants that includes a national cap and trade program; and

WHEREAS, coal-fired electric generating units (EGUs) are the largest source of mercury in the US, representing approximately 43% of mercury emission from all US sources; and

WHEREAS, the States are pursuing varied initiative tailored to their own jurisdictional needs and priorities to reduce mercury emissions and

WHEREAS, state, in responding to their stakeholders in their rulemaking processes, may seek a variety of alternative compliance strategies, which may include emissions trading schemes not contemplated under Clean Air Mercury Rule but capable of achieving their state cap, or may pursue control programs and rulemaking that differ from the Clean Air Mercury Rule in order to address specific state issues and concerns; and

WHEREAS, states seek federal flexibility in approving state plans, which allow successful and efficient implementation of alternative state mercury reduction programs.

THEREFORE BE IT RESOLVED THAT THE ENVIRONMENTAL COUNCIL OF STATES

Urges USEPA to recognize the rights of states to address mercury emissions within their jurisdictions provided that the state programs reduce mercury emissions to levels that are at or below those contained in the Clean Air Mercury Rule; and

Requests that USEPA provide maximum flexibility to the states to pursue mercury emission reduction alternatives in order to comply with state mercury budgets pursuant to the Clean Air Mercury Rule.

emission reduction schedules; and in such a way that would preclude the creation of localized, adverse health or environmental impacts.

ECOS recommends that USEPA confirm that the federal program will not preempt the adoption of state or local mercury programs that are as stringent as or more stringent than that of the federal government.

ECOS urges the President of the United States and Congress to expand federal and state capacity for mercury-related environmental monitoring, pollution prevention programs, and health advisory efforts.

ECOS encourages the President and Congress to ensure that any mercury reduction program is, scientifically sound, cost-effective, and technically and feasibly designed to ensure flexibility in implementation.

Copies of this resolution will be transmitted to the Administrator of USEPA, the Director of the Office of Management and Budget, the President of the United States, and the United States Congress.

limited cost-effective, technically feasible options to reduce their mercury use, emissions or discharges; and

WHEREAS, coal-burning industrial and utility boilers represent the largest source of anthropogenic mercury emissions in the United States; and the largest source of mercury to water bodies is from air deposition in many states; and

WHEREAS, concerns have been raised about the Clean Air Mercury Rule's adequacy to protect public health and the environment; whether it satisfies the requirements, goals and intentions of the Clean Air Act; and whether it will result in adequate reductions of mercury deposition to water bodies to meet water quality standards and Total Maximum Daily Loads as required by the Clean Water Act.

NOW, THEREFORE, BE IT RESOLVED THAT:

ECOS calls on the President of the United States and Congress to pursue substantial reductions in mercury releases into the environment at the national and international levels.

ECOS requests that USEPA work with States and tribes as partners, as well as industry, environmental, and other groups, to develop appropriate strategies and initiatives to achieve substantial reductions.

ECOS requests that the federal government work cooperatively with the States and industry to collect comprehensive data on mercury uses so that short and long-term trends can be tracked; essential uses of mercury in the Unites States, including critical needs for the federal government, are identified; and those uses that can be eliminated are identified.

ECOS requests that the federal government, in cases where environmentally preferable alternatives to mercury use, or where effective technologies to control mercury releases to the environment do not currently exist, support research on alternatives and effective controls and ensure that mercury is properly managed at federal and federal-contractor facilities so that mercury discharges to the environment are prevented and collection and sequestration activities are performed to the maximum extent possible.

ECOS urges the federal government and other interested and affected parties to develop recommendations to eliminate mercury stockpiles in excess of essential national needs through the development of a safe long term storage plan, take all appropriate measures to prevent introduction of excess mercury supply from the US into the global marketplace, and exercise leadership in appropriate international forums to work toward substantial global reductions in mercury production, uses, and releases.

ECOS affirms USEPA's mercury research strategy, urges USEPA to develop an implementation plan for its Mercury Roadmap and urges USEPA to continue work to reduce mercury-related risks.

ECOS urges USEPA to take further necessary and appropriate actions to obtain the most aggressive mercury emissions reductions achievable, consistent with the provisions, intent and goals of the Clean Air Act; in as early a timeframe as possible in concert with other air pollutant

ECOS

Resolution Number 07-1
Approved March 20, 2007
Alexandria, VA

As certified by
R. Steven Brown
Executive Director

CREATING A PARTNERSHIP FOR A NATIONAL VISION FOR MERCURY

WHEREAS, mercury is a known potent neurotoxin, which is particularly damaging to the development of a human fetus, infant and young child. Children of women exposed to relatively high levels of methylmercury during pregnancy (e.g., those consuming large amounts of fish) have exhibited a variety of abnormalities, including delayed onset of walking and talking, cerebral palsy and reduced neurological test scores. Children exposed to far lower levels of methylmercury in the womb have exhibited delays and deficits in learning ability. In addition, children exposed after birth potentially are more sensitive to the toxic effects of methylmercury than adults, because their nervous systems are still developing; and

WHEREAS, the National Research Council's July 2000 report estimated that each year over 60,000 children may be born in the United States with permanent, irreversible neurological problems due to mercury exposure from the consumption of fish and data from the US Centers for Disease Control demonstrate that more than 300,000 newborns each year are being exposed to mercury above EPA's recommended safe level. This will result in an increase in the number of children who have to struggle to keep up in school and who might require remedial classes or special education -- leading to increased education and medical costs for these children; and

WHEREAS, mercury entering water can be transformed into methylmercury, a highly toxic form that *bioaccumulates* in fish and other animals. When a substance bioaccumulates, its concentration increases as it moves through the food chain. Mercury is known to bioaccumulate in the environment thereby creating a continuing and unacceptable public health risk; and

WHEREAS, releases of mercury to the environment have contaminated fresh and saltwater fisheries to such an extent that forty-five states and one U.S. territory have issued health advisories warning of the dangers of consuming fish caught in their waters due to elevated concentrations of mercury; and

WHEREAS, mercury pollution is both a local issue due to the creation of near-by hot spots and a global issue because it is transported by air currents across political and geographic boundaries and mercury exported from the United States returns to this country by atmospheric transport, through contaminated fish, and in manufactured products; and

WHEREAS, while the States and the United States Environmental Protection Agency (USEPA) are studying, monitoring, and reducing the discharge of mercury to the environment, a more concerted effort is required to eliminate the threat to humans and wildlife in the United States and throughout the globe; and

WHEREAS, some industries that use, emit or discharge mercury are important to the health, safety, and economies of the Unites States and other countries, and some of these industries may currently have

ECOS

Resolution Number 08-5
Approved April 15, 2008
New Orleans, LA

As certified by
R. Steven Brown
Executive Director

BEYOND EPA'S CLEAN AIR MERCURY RULE

WHEREAS, almost all U.S. states have public health advisories on elevated mercury concentrations in freshwater fish; and,

WHEREAS, coal-fired electric generating units (EGUs) are the largest source of mercury emissions in the nation; and,

WHEREAS, such emissions have been linked to elevated levels of mercury in fish, and some studies suggest that the reduction of mercury emissions has been shown to reduce mercury levels in fish; and,

WHEREAS, on February 8, 2008, the U.S. Court of Appeals for the District of Columbia Circuit vacated the U.S. EPA's Clean Air Mercury Rule (CAMR), which was based on emissions trading of mercury between coal-fired EGUs rather than Maximum Achievable Control Technology (MACT) which is required by section 112 of the Clean Air Act; and,

WHEREAS, air pollution control to reduce mercury emissions has been demonstrated on many coal-fired EGUs and achieves significantly more mercury reductions than assumed by U.S. EPA in its Clean Air Mercury Rule; and,

WHEREAS, U.S. EPA's vacated rule would have achieved about 70% mercury emission reductions by 2025 or later, according to EPA's projections, and regulating mercury emissions with MACT under section 112 of the Clean Air Act can achieve significantly more mercury emissions reductions, significantly sooner; and,

WHEREAS, coal-fired EGUs are also the largest industrial source of other hazardous air pollutants in the nation.

NOW, THEREFORE, BE IT RESOLVED THAT:

U.S. EPA should proceed expeditiously to set mercury emission performance standards for EGUs pursuant to section 112 of the Clean Air Act absent modification in the courts of the land.

U.S. EPA should also consider MACT performance standards for other hazardous air pollutant emissions from EGUs and multi-pollutant strategies advanced previously in ECOS resolutions number 06-8 and 01-2 at the same time it regulates mercury.

U.S. EPA should consider performance standards already adopted by states when setting national MACT performance standards.

U.S. EPA should not impinge upon the rights of states to be more stringent than the federal agency in the regulation of hazardous air pollutants from EGUs.

ECOS

THE
ENVIRONMENTAL
COUNCIL OF
THE STATES

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May 15, 2008

Honorable Thomas R. Carper
U.S. Senate Environment and Public Works Committee
513 Hart Building
Washington, DC 20510

Re: ECOS Support for Control of Mercury

Dear Senator Carper:

We understand that yesterday, the Senate Environment and Public Works Committee held a hearing on Mercury Legislation beginning at 10:00 am (Eastern). We understand that two (2) bills were discussed at this hearing: S.2643 and S.906.

ECOS is in substantive agreement with the provisions of S.2643 and believes that US EPA should proceed expeditiously to issue a mercury rule.

S.906 is similar to HR.1534. ECOS worked with other organizations to help draft HR.1534, which contains provisions consistent with our policy positions on the matter. To the extent that S.906 matches HR.1534, ECOS endorses its provisions.

Attached to this message, please find ECOS' policy positions on these matters, in the form of five (5) resolutions.

We request that you consider our positions on these matters, and we request that you include this letter and the attachments as part of the record of yesterday's hearing.

ECOS is the national non-profit, non-partisan association of state and territorial environmental agency leaders.

Sincerely,

R. Steven Brown
Executive Director

May 9, 2008

The Honorable Tom Carper
United States Senator
513 Hart Building
Washington DC 20510

Dear Senator Carper:

I would like to thank you again for inviting me to testify before the Committee on Environment and Public Works/Subcommittee on Clean Air and Nuclear Safety last May 2007, regarding Illinois' national leadership in reducing mercury and other harmful air pollutants from coal-fired power plants.

On behalf of Illinois Governor Rod Blagojevich, I would also like to express strong and enthusiastic support for your continued efforts to address the public health hazards posed by mercury in our environment, as contained in the Mercury Emissions Control Act (S. 2643) you introduced this February. Illinois supports the goals of the Mercury Emissions Control Act of requiring U.S. EPA to promulgate regulations no later than October 1, 2008, that would mandate a reduction of at least 90 percent in mercury emissions from new and existing coal-fired power plants. We also continue to enthusiastically support your companion legislation, the Clean Air Planning Act, which would require every coal-fired power plant to reduce mercury emissions by at least 90 percent no later than 2015, while also reducing emissions of nitrogen oxide, sulfur dioxide and carbon dioxide.

Because of the potential hazard to pregnant women and their unborn children, as well as young children, Illinois, like many other states, has issued advisory warnings to limit the consumption of certain species of fish caught in our state as a result of elevated levels of mercury found in some fish samples. Prompted by our disappointment in the weak Clean Air Mercury Rule (CAMR) promulgated by U.S. EPA (and struck down by the U.S. Circuit Court of Appeals for the District of Columbia in February), Illinois began to pursue our own state regulations mandating mercury power plant emission reductions to address these health risks.

As I described in my testimony before your subcommittee a year ago, our experience in Illinois has demonstrated that significant mercury reductions can be achieved with commercially available technology and at a reasonable cost while providing substantial benefits to public health.

Illinois Governor Rod Blagojevich's plan, announced in January 2006, to reduce mercury emissions from Illinois' coal-fired power plants by 90 percent beginning in mid – 2009 will be implemented through state regulations 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. These regulations, which became effective on December 21, 2006, were adopted after nearly a year of stakeholder meetings and hotly contested public hearings.

Equally significant, Governor Blagojevich's mercury plan prompted one of the power plant generators to approach the Illinois EPA, expressing 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 proposed mercury standards in exchange for commitments to also slash SO_2 and NO_x emissions. This initial agreement led to similar discussions and agreements with Illinois' other two large coal-burning power plant owners. These multi-pollutant agreements were memorialized in state regulations, and the power plant systems have already begun to take the necessary steps to comply with those agreements. .

This achievement is remarkable considering that Illinois obtains more than 40 percent of its electricity from 21 coal-fired power plants and sits on top of 38 billion tons of coal, giving it the third largest coal reserves in the nation. Coal-fired power plants constitute the largest source of man-made emissions of mercury in Illinois. The outcome is 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 mercury reductions obtained from Illinois' rule will be substantially greater than those once proposed under the now-vacated CAMR and will occur more quickly. Whereas CAMR would have capped Illinois' annual mercury emissions at 3,188 pounds by 2010 through 2017, the Illinois rule results in annual mercury emissions of around 770 pounds beginning mid-2009. CAMR would have required coal-fired power producers in Illinois to reduce their mercury emissions by approximately 47 percent in 2010 and approximately 78 percent by 2018, not the approximate 90 percent reduction by 2009 required by the Illinois rule. In addition, because of our concern with potential "hot-spots' for mercury deposition, trading mercury allowances is not permitted under our Illinois rule, and the rule ensures that mercury reductions actually occur in Illinois.

Passage of your legislation to require these same types of reductions at power plants nationwide would enhance and complement what we have done in Illinois. A national multi-pollutant reduction mandate will also help provide a level playing field for the increasingly deregulated and competitive electric energy industry, and will address the regional air quality impacts of the fossil-fuel fired electric generating facilities in neighboring states.

To quote Mr. Jack Darin, Director of the Sierra Club, Illinois Chapter, on the successful implementation of the Illinois regulations: "Governor Blagojevich's mercury cleanup plan will not only make Illinois children safer, it sets a bold example for America to follow in protecting our kids from this dangerous neurotoxin."

Again, thank you again for your outstanding leadership on this important environmental health issue.

Very truly yours,

Douglas P. Scott

Douglas P. Scott
Director

THE CHLORINE INSTITUTE, INC.
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July 8, 2008

Ms. Heather Majors
Senate Committee on Environment and Public Works
410 Dirksen Senate Office Building
Washington, DC 20510

Dear Ms. Majors:

Per your e-mail request of June 25, 2008, the below response to the questions from Senators Boxer and Inhofe is being submitted. This response has also been transmitted to you electronically per your request. Should you have any additional questions, please contact me at 703-741-5764, via e-mail at arthurdungan @CL2.com, or visa USPS at the address on the letterhead.

Questions from and responses to Chairman Barbara Boxer

Question #1: Facilities' Use of Mercury

Mr. Dungan, you have testified that members of the Chlorine Institute will continue to operate four plants that use mercury to produce chlorine until the end of their economic life. For how many years will these plants continue to operate using mercury?

The Institute is not aware of any plans these four plants have to close or convert to a different technology. Until such plans have been finalized, it is not possible to provide such an estimate. The Institute believes that these four plants will be operated indefinitely. At some time in the future, these plants will reach the end of their economic life and will convert to another technology or close. We wish to note that of the 14 plants that were operating in 1996 when the Institute and its members made the voluntary commitment to EPA to reduce mercury use by 50% within ten years and to report annually to EPA on mercury use and emission reduction activities, eight plants have closed or converted (six closed and two converted). Additionally, two more plants will have converted within the next 12 to 18 months.

Question #2: Unaccounted for Mercury

Mr. Dungan, in 2003, EPA admitted that "the fate of all the mercury consumed at mercury cell chlor-alkali plants remains somewhat of an enigma."

A. Have companies in the chlor alkali industry measured the amount of mercury that its facilities lose through cracks or holes in pipes, joints, and other sources of fugitive emissions?

The Institute does not have any data on such sources of fugitive emissions generated by its members except summary data publicly available on the USEPA TRI website. The Institute provides such data to the USEPA as part of its Annual Report on mercury use and emissions. This report has been provided annually for the past ten years to EPA as part of the Institute's voluntary commitment to EPA. A copy of the Tenth Annual Report is enclosed.

Nearly all the fugitive emissions from a mercury cell plant are from the cell room and are due to periodic maintenance of the equipment within the cell room. The typical mercury chlor-alkali plant has a cell room about the size of a football field. The cell room contains numerous pieces of process equipment and, literally, miles of piping. A cell room may have from 24 to 106 primary cells where the chlorine is produced. These plants also have an equivalent number of secondary cells (also called decomposers) where the sodium hydroxide and hydrogen are produced. In addition, a typical cell room contains numerous heat exchangers, pumps, and other specialized equipment. This equipment requires periodic maintenance. Even with the use of the best operating practices that these facilities do employ, it is impossible to avoid the emissions of fugitive mercury releases from these cell rooms. Such releases are not due to lax maintenance practices. Cracks or holes in pipes and joints are very infrequent occurrences. They constitute a miniscule portion of mercury released from mercury cell chlor-alkali plants.

The cell rooms of a mercury cell plant are typically very hot because it is within the cell room that large quantities of electricity are used to break down sodium chloride solution into its components, chlorine and sodium hydroxide, and hydrogen. Some of the electricity is lost as heat into the cell room. As a result, a cell room is designed to allow large quantities of air to be brought into the room for cooling purposes. The air will carry with it a minute amount of mercury that may be present in the cell room. This is the source of the fugitive emissions.

While not a part of your question, I wish to comment on the statement *"the fate of all the mercury consumed at mercury cell chlor-alkali plants remains somewhat of an enigma."* that appeared in the preamble of the EPA final rule in 2003.

When that statement appeared, the "unaccounted" for mercury in the chlor-alkali industry amounted to less than 2% of the total mercury in inventory in the facilities then operating. The Institute notes the following:

- **Mercury is a very dense material, more than 13 times denser than water. One ton of mercury occupies a volume the size of a typical kitchen trash can (approximately 2 ½ cubic feet).**
- **The typical mercury cell plant has about 300 tons of mercury in its inventory within the various primary and secondary cells at all times.**
- **As part of the reporting program to the Institute, members typically measured the mercury inventory in the cells using a radioactive isotope. The accuracy is within ¼ to ½ percent.**

Errors in reporting inventory can amount to as much as 2 tons per plant.

- **Additionally, mercury, because of its density, can accumulate in various pieces of equipment that are infrequently opened. Such mercury is available for use when recovered. However, it is not considered in inventory until recovered. Small volumes of mercury in such equipment can amount to relatively large tonnage and would increase the amount of unaccounted for mercury.**
- **Several facilities that have closed their mercury cell operations have reported anecdotally that they found significant amounts of mercury in places within their plants that were not accounted for in their reports to the Institute. These data are not reported in our annual reports to EPA because it was agreed to only consider facilities operating at the end of the current reporting year. The Institute felt that inclusion of facilities in the year of their closure would understate our mercury usage as some of the recovered mercury was most likely present before the Institute made its voluntary commitment and was not included in our initial mercury inventories.**
- **There is no evidence that would indicate that actual mercury emissions from mercury cell chlor-alkali plants are greater than that reported in the Institute's annual reports to the USEPA. The mercury cell chlor-alkali plants provide the Institute the same information that they provide to EPA per the TRI annual reporting requirements. All the studies undertaken by the USEPA (see response to next question) confirm that the emissions are not greater, and in most cases, significantly below the NESHAP/ MACT regulations in effect when the studies were undertaken.**
- **Nevertheless, as a result of this enigma statement, the Institute modified its method of reporting in its annual reports to the EPA, to explicitly account for all mercury used by the industry. Members took extra steps to measure mercury inventories and undertook steps to recover mercury from areas of the process where mercury was reported by others to be captured so that it could properly be accounted. With these steps taken, the amount of unaccounted for mercury has declined to less than 0.2% of the mercury inventory in these plants.**

In addition, the Institute notes since the new mercury emission requirements (MACT) were issued in 2003, U.S. mercury cell producers developed technology to monitor cell room mercury emissions on a nearly continuous basis. As a result of this technology development, the USEPA has proposed that such technology be required as part of the revised Mercury MACT when it is finalized next year. The Institute supports this requirement.

B. Provide all information that companies have collected concerning such measurements.

The Institute has no source documents generated by its member companies. However, the USEPA has done extensive studies of chlor-alkali plants as part of the original NESHAPs development in the 1970s, the chlor-alkali mercury MACT standard development that was finalized in 2003, and the currently proposed modification of the MACT undertaken as a result of a lawsuit challenging the 2003 final rule. Enclosed are the following reports that the Institute has as a result of work undertaken by the agency since 2000:

- **1 - Characterization of Mercury Cell Emissions at a Chlor-Alkali Plant, Jan 2002, Kinsey.**
- **2 - Characterization of Fugitive Mercury Emissions from a Cell Building at a Chlor-Alkali Plant, undated, Kinsey et al.**
- **3 - Fugitive Mercury Emissions from a Hg-cell Chlor-alkali Factory: Sources and fluxes to the Atmosphere, undated, Southworth et al. [*Journal article. May be copyright protected.*]**
- **3a - Fugitive Mercury Emissions from a Hg-cell Chlor-alkali Factory: Sources and fluxes to the Atmosphere, undated, Southworth et al.**
- **4 - Characterization of the Fugitive Mercury Cell Emissions at a Chlor-Alkali Plant: Overall Study Design, undated, Kinsey et al.**
- **5 - Divalent Inorganic Reactive Gaseous Mercury Emissions from a Mercury Cell Chlor-Alkali Plant and its Impact on Near Field Atmospheric Dry Deposition, undated, Landis, et al.**
- **6 - Assessment of Measurement Techniques for Fugitive Elemental Emissions from Chlor-Alkali Mercury Cell Room at Occidental Chemical Corporation, Delaware City, Delaware, Jan 13, 2006.**
- **7 -Assessment of Measurement Techniques for Fugitive Elemental Emissions from Chlor-Alkali Mercury Cell Room at Occidental Chemical Corporation, Muscle Shoals, Alabama, Jan 13, 2006.**
- **8 - Measurement and Evaluation of Fugitive Mercury Emissions at a Mercury Cell Chlor-Alkali Plant, Olin Chlor Alkali Products, Charleston, Tennessee, June 29, 2007.**
- **9 - Measurement of Total Site Mercury Emissions for a Chlor-alkali plant Using Open-Path UV-DOAS, July 2007.**
- **10 - Summary of Cell Room Mercury Emissions Data for Olin Mercury Cell Chlor-Alkali Plant: Charleston, Tennessee, August, 2007.**
- **11- Summary of Cell Room Mercury Emissions Data for Occidental Chemical Corporation's Mercury Cell Chlor-Alkali Plant: Muscle Shoals, Alabama August, 2007.**

Questions from and responses to Ranking Member James M. Inhofe

1. *Mr. Dungan, what impact would S. 906 have on the chlorine industry?*

S. 906 would affect the mercury cell chlor-alkali producers in two ways:

First and of most significance, the establishment of an export ban without the chlor-alkali industry having a place to store surplus mercury when it is no longer needed will put these facilities in a catch-22 position. In addition to the chlor-alkali industry, the mining industry and the recycling industry would face similar issues as the amount of mercury generated by these industries is on-going and the supply is greater than the U.S. demand. When examined over a 40 year horizon, it is likely that these other domestic sources of mercury would have a far greater contribution to the US mercury supply than the surplus mercury potentially contributed to by the chlor-alkali industry.

While the permanent storage of mercury may be an available option for the government, private industry can not permanently store such mercury and be in accordance with RCRA regulations regarding land disposal restrictions of mercury. When the remaining facilities close or convert to an alternate technology, these facilities (the four planning to operate after 2010, and possibly the two currently in the process of converting to a non- mercury technology) will have approximately 1,100 and 1,700 (short) tons of mercury that will have to be permanently managed. The passage of S. 906, as currently written, provides no viable options for industry to either sell this mercury to legitimate international mercury markets or to legally permanently store the mercury in accordance with current U.S. law and regulations.

With an export ban in place, this surplus mercury will have to be stored somewhere. The generators might temporarily store the mercury, which is a commodity, at various sites in the hope that it could eventually be sold. While most of this mercury would be stored safely and without any adverse effects to the environment, few of the private sites would have the safeguards in place that a permanent federally managed storage site would have.

The second adverse impact that S. 906 will have on, not only the mercury cell chlor-alkali industry, but also on other generators of surplus mercury is the loss of revenue from the sale of the commodity mercury to international markets. Assuming a market price of $6 - 7 per pound (Note - In a preliminary report, the USGS has estimated the market price of mercury in 2007 as ranging between $450 and $550 per 76 pound flask.), the current value of the mercury inventory is between $13 million and $21 million. The mercury cell producers have already agreed to forgo this potential revenue by supporting H. R. 1534. In addition, the chlor-alkali industry has agreed to pay the pro rata cost for the permanent storage on the mercury. The industry is willing to pay such costs in order to secure a legal means to permanently store surplus mercury which will some day become available. The Chlorine Institute, NRDC, the American Chemistry Council, ECOS, and NMA have all publicly supported and continue to support the passage of H.R. 1534. (Prototype of letter sent to House members last November is attached.)

2. *Mr. Dungan, why is permanent storage of mercury an important aspect of this issue?*

Legal experts, knowledgeable about RCRA requirements, have advised the Institute that, while the courts would have to make the final decision, it is most likely that storing large quantities of mercury, while selling only a very small portion to legitimate domestic users would most likely be held in violation of RCRA land disposal restrictions. An export ban, coupled with continuing declines in mercury use by U.S. industry will make the surplus grow. In addition, domestic users of mercury will most likely preferentially specify the purchase of mercury from recyclers which recover mercury from their discarded products. Accordingly, the domestic market for surplus mercury from the chlor-alkali industry will be very limited. Even in the unlikely event that this surplus mercury could be legally stored for long periods at the plant, long term storage of mercury at numerous sites throughout the United States does not appear to the Institute to be prudent public policy.

3. *Mr. Dungan, what products and benefits does chlorine chemistry contribute to everyday life?*

The chlor-alkali industry contributes over $46 billion to the North American economy annually and helps provide thousands of essential products that Americans depend on every day. The products of chlorine chemistry include disinfectants for safe drinking water; PVC pipe for delivering safe water safely; energy-efficient building materials; solar energy cells; glass fiber optics; 93 percent of pharmaceuticals; 86 percent of crop protection chemicals and 25 percent of medical plastics. Chlorine chemistry is even used to recycle aluminum beverage cans.

The products of chlorine chemistry help protect those who protect us. Much of the essential gear and life-saving equipment needed by the military and first-responders, such as bullet-resistant equipment, fighter jets, high-tech communications and surveillance equipment, all rely on chlorine chemistry.

Chlorine disinfectants are used by the food industry to sanitize foods and food preparation surfaces, food-processing equipment and food storage and transport containers. By killing germs, such as salmonella and E.coli, chlorine disinfectants help reduce the risk of foodborne illnesses. And chlorine disinfectants were used to disinfect public buildings that were contaminated with anthrax in bioterrorism incidents in 2001. Cipro®, the FDA-approved antibiotic for the treatment of exposure to inhaled anthrax, is a product of chlorine chemistry.

Two thousand and eight marks the 100th anniversary of the first use of chlorine to disinfect U.S. drinking water. Within a decade of its debut in Jersey City, New Jersey, on September 26, 1908, drinking water chlorination spread rapidly to nearly every large city in America. As a result, rates of waterborne diseases, including cholera and typhoid fever, plummeted and a drink of water no longer represented a risky proposition. The U.S. Centers for Disease Control and Prevention has called the chlorination of drinking water "one of the most important public health achievements in our country's history." One hundred years after its introduction, drinking water chlorination continues to play an important role in safeguarding public health in the U.S. and around the globe.

4. *Mr. Dungan, under H.R. 1534, what role would local stakeholders have in the selection of a permanent storage site by the Secretary of the Department of Energy?*

The Institute supports that local stakeholders have a say in the selection of a permanent site by the Secretary of the Department of Energy. It is our understanding that the Department of Energy has a long history of safely storing elemental mercury at the Oak Ridge site where the surplus mercury may potentially be stored. Within the U.S. Government, both the Department of Energy and the Department of Defense, have a long history of safely storing elemental mercury. It is my understanding that mercury has been safely stored by the Department of Energy for more than 50 years.

H.R. 1534 does not require storage at the Oak Ridge site. DOE should examine other sites for such storage as appropriate. We encourage the DOE to work with the Department of Defense Logistics to conduct technology transfer sessions so that each could learn from each other on suitable storage

techniques and locations. Nothing in H.R. 1534 prevents these two agencies from selecting a common site for the permanent storage of all the surplus mercury in the United States.

The Institute believes it is essential that the government assume this responsibility as it is unlikely that new uses for mercury will be found that will preclude the need for permanent storage. Unlike spent nuclear materials, and other wastes that typically decompose over time, mercury will remain as a pure element forever. If the storage site is not properly managed, it is a potential environmental liability. Our government is uniquely positioned to insure that the mercury is safely stored for the long term.

Very truly yours,

Arthur E. Dungan

Arthur E. Dungan
President

Senator CARPER. Mr. Dungan, thank you very much.

A couple of questions, if I could, for Dr. Greer and then one for you, Mr. Dungan. Dr. Greer, I think you mentioned in your testimony that the European Union has already adopted a similar mercury export ban, similar to that which we find in Senator Obama's bill. Have you seen or have they seen an impact on the mercury market as a result of these actions?

Ms. GREER. Actually, it is not in effect yet. They are in our equivalent of conference committee, resolving their two editions. So they are ahead of us, slightly. I have a case of beer bet on whether the United States gets there before the European Union.

Senator CARPER. Which side are you on?

Ms. GREER. I am definitely on our side.

[Laughter.]

Senator CARPER. All right. Mr. Dungan, I understand in the House legislation, which you endorse, the House provisions on the Mercury Export bill, the U.S. Government would charge a fee to cover all costs of mercury storage. First of all, is that true? And what are your thoughts about adding this provision to the Senate bill? I think you may have alluded to this. And would you be more inclined to support this bill with that provision added?

Mr. DUNGAN. Yes. The House bill does include a provision for costs. The Department of Energy is supposed to develop the actual long-term cost for the storage of mercury and whoever supplies mercury to the stockpile would pay that cost. This is the lifetime cost, which is basically forever, perpetual cost for storing of that mercury. EPA has estimated that would be about $3 a pound at a maximum level.

So industry, whoever puts mercury into that stockpile would pay that cost. So the cost to the Government should be zero.

Senator CARPER. All right, good. Thanks.

One last question, Dr. Greer. I believe, correct me if I am wrong, but I believe you stated that major sources of mercury contamination in our food come from quite a distance from our shores. Do you believe that we should still do nothing to regulate the major sources here in the United States from power utilities?

Ms. GREER. No, absolutely not. We really do have to look at both sources. Our imported ocean fish, for fish like tuna fish and some swordfish, swims very close to these international sources of mercury pollution. But for all of our freshwater fish and all of our hotspots of contamination, we have no choice but to also work on the coal-fired power plants.

Senator Carper, 15 of the 19 States represented on this Committee have mercury restrictions for fishing within their States. It is really quite critical for our own sports fish, our own health of the Great Lakes and our own coastlines for us to be regulating our largest source of pollution, which is coal-fired power plants. We need to do both.

Senator CARPER. Good. Thank you. I have other questions for each of you, I am not going to ask them now. Our caucus luncheon started 45 minutes ago, I am late. And I hope we haven't made you late for something as well. But we are really grateful to you for being here, for adding significantly to the value of this hearing.

We would ask that you give us another week or so to followup, if we have some questions, and if you get them, to please respond promptly.

Thank you again, and with that having been said, this hearing is at last adjourned.

[Whereupon, at 1:32 p.m., the committee was adjourned.]

Statement of Senator Barack Obama
Before the Senate Environment and Public Works Committee
Regarding S. 906, the Mercury Market Minimization Act
May 13, 2008

Thank you for conducting this hearing today on bills to reduce mercury in the environment. As a member of the Senate Environment and Public Works Committee during the 109th Congress, I am particularly pleased to discuss S. 906, a bill I introduced with Senator Murkowski.

Elemental mercury is a poisonous neurotoxin that can cause serious disability or death if ingested. Unfortunately, many people in the United States, and millions more worldwide, do ingest mercury, but unintentionally, as a result of industrial emissions or practices, or poor waste management and storage techniques. When mercury enters into the environment, it often manifests in plants and animals, and that means a major source of mercury ingestion in humans comes from eating certain types of fish. That, in turn, can cause serious developmental problems in children, adults, and women of childbearing age.

Experts tell us that fish is an excellent source of critical nutrients and other compounds indispensable for good health. Although circumstances may require advisories, labeling, or inspections, the real solution to addressing mercury in fish is reducing mercury in the environment. And given the ability of mercury emissions to settle anywhere around the globe, the strategy for mercury reductions cannot be limited to one state, or one nation, but rather requires states and nations to work together. S. 906 was created upon that premise.

The Mercury Market Minimization Act, or M3 Act, establishes a ban on U.S. exports of mercury by the year 2010. Such a ban, when coupled with the goal of the European Union to ban mercury exports by 2011, will result in a tightening of the global supply of commercially available elemental mercury and compel developing nations that still use mercury to switch to the affordable alternatives already widespread in industrialized nations. Consequently, the amount of elemental mercury contaminating the environment will be significantly reduced.

The M3 Act also requires federal agencies that now stockpile mercury to maintain those holdings. Both the Departments of Energy and Defense possess tons of mercury left over from various operations over the years. While it is the policy of these agencies not to sell, transfer or release the mercury from their possession, it is not the law. That can result in situations similar to what occurred in December of 2006, when the Department of Energy was reportedly considering the sale of its mercury stockpiles. After various inquiries into the matter, the Department ultimately chose not to sell those stockpiles. Codifying the prohibition of stockpile sales will ensure that mercury remains safely sequestered from the environment and overseas markets where tracking and waste disposal laws may be inadequate.

Finally, the M3 Act calls for the creation of a committee to explore and make recommendations on the development of a permanent repository of mercury collected as a result of an export prohibition. I understand our colleagues in the House of

Representatives, during committee consideration of the House companion measure, have expedited this "committee provision" by reaching an agreement among stakeholders as to the financing and liability issues associated with permanent storage. I believe that agreement is an appropriate foundation for inclusion into S. 906 and would urge my colleagues to consider a similar amendment.

I thank both Chairman Boxer and Subcommittee Chairman Carper for their attention to this important issue of mercury contamination in the environment, and I hope the Committee will provide its full support for S. 906.

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