THE AMERICAN ENERGY INITIATIVE, PART 15: WHAT EPA'S UTILITY MACT RULE WILL COST U.S. CONSUMERS

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY AND POWER

OF THE

COMMITTEE ON ENERGY AND COMMERCE

HOUSE OF REPRESENTATIVES

ONE HUNDRED TWELFTH CONGRESS

SECOND SESSION

FEBRUARY 8, 2012

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C O N T E N T S

Witnesses

Submitted Material

THE AMERICAN ENERGY INITIATIVE, PART 15: WHAT EPA'S UTILITY MACT RULE WILL COST U.S. CONSUMERS

WEDNESDAY, FEBRUARY 8, 2012

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY AND POWER,
COMMITTEE ON ENERGY AND COMMERCE,
Washington, DC.

The subcommittee met, pursuant to call, at 10:06 a.m., in room 2123 of the Rayburn House Office Building, Hon. Ed Whitfield (chairman of the subcommittee] presiding.

Members present: Representatives Whitfield, Sullivan, Shimkus, Terry, Burgess, Scalise, McMorris Rodgers, Olson, McKinley, Gardner, Pompeo, Griffith, Barton, Rush, Castor, Dingell, Markey, Green, Capps, Doyle, and Waxman (ex officio).

Staff present: Maryam Brown, Chief Counsel, Energy and Power; Allison Busbee, Legislative Clerk; Patrick Currier, Counsel, Energy and Power; Cory Hicks, Policy Coordinator, Energy and Power; Heidi King, Chief Economist; Ben Lieberman, Counsel, Energy and Power; Mary Neumayr, Senior Energy Counsel; Alison Cassady, Democratic Senior Professional Staff Member; Greg Dotson, Democratic Energy and Environment Staff Director; Caitlin Haberman, Democratic Policy Analyst; Elizabeth Letter, Democratic Assistant Press Secretary; and Alexandra Teitz, Democratic Senior Counsel, Environment and Energy.

Mr. WHITFIELD. Today's hearing will come to order.

OPENING STATEMENT OF HON. ED WHITFIELD, A REPRESENTATIVE IN CONGRESS FROM THE COMMONWEALTH OF KENTUCKY

Today we are going to focus on the cost and impact of the Utility MACT rule, or as EPA prefers to call it, the Mercury and Air Toxics Standard. When the President was a candidate for the office he now holds, he attended a meeting in San Francisco, a fundraiser, and at that fundraiser, he made the comment that we will bankrupt the coal industry in America. While his administration was unsuccessful in passing the cap and trade legislation, the President was quoted after that failure as saying that "there is more than one way to skin a cat." And he was right, because EPA did become the lead agency to significantly damage the coal industry in America, the industry that provides the base load for electricity in this country. When I talk about the coal industry, I am talking about the coal mining industry, yes, I am talking about utilities that burn coal as well. And with this new rule, EPA has made it very clear that in this area, they are not concerned about—they are not setting environmental policy, they are setting energy policy for America.

More than one expert in the field has said that the stringency of the new unit—electric generating units that use coal standard means that under this rule, not one new coal-fired plant can be built and meet these standards, because no one can get a warranty which is necessary to get the financing to build a unit because of the Frankenplant standard that EPA is using.

Now, the sad thing about it is when we asked about the cost of this regulation, EPA gives us no cost. In fact, they made the comment that that is not useful. But they did go out to the year 2016, they said that in 2016 that this would cost $9.6 billion that year. And of course, that is calculated by you borrow the money to meet these requirements, and the payment on that year will be $9.6 billion. We have repeatedly asked, we have sent questions, we have sent letters, we have called, asking for the total cost, and we still have no total cost. And we know that this is the most costly regulation relating to utilities that EPA has ever submitted.

And the sad thing about it is, they do not even look at the cost of lost jobs. They said that the total gigawatts lost as a result of this regulation would be 4.7 gigawatts, and one company, FirstEnergy, has announced in the last few days the closure of plants that equals 3.3 gigawatts from one company.

So I think EPA is misleading the American people and deliberately so, because when they talk about this regulation, all they talk about is mercury. The importance of reducing mercury and acid gases, and non-metallic components, and yet, when they did the benefit analysis of this rule, all of the benefits, with the exception of a very minute amount, comes from particulate matter, which was never even set out as a purpose of this regulation, to reduce particulate matter. Everyone you will hear today will talk about, oh, the mercury and how important it is we reduce that, and the benefits from that are minute. And I would just like to put on the slide real quick, the total global mercury emissions around the world are about 7,300 to 8,300 tons per year. About 70 percent of that is natural and U.S. utilities each year, out of that 8,300 tons per year worldwide, provides 29 tons of emissions of mercury. And the total benefit from this new regulation in reductions of mercury emissions in the U.S. will be about 20 tons per year, out of 8,300 worldwide.

So I am quite disappointed in this regulation is going to have profound impact in a negative way on the American people and their ability to compete in the global marketplace.

[The prepared statement of Mr. Whitfield follows:]

Opening Statement of the Honorable Ed Whitfield
Energy and Power Subcommittee
Hearing on "The American Energy Initiative: What EPA's Utility MACT Rule Will Cost U.S. Consumers"
February 8, 2012

This is the 15th day of our American Energy Initiative hearing, and today we will focus on the impact of EPA's recently finalized Utility MACT rule on consumers and the U.S. economy.

The Obama EPA's regulatory agenda continues to weigh heavily on the economy. Multiple costly new regulations impose significant new costs on job creators, and inject uncertainty into the regulatory process. It is simply unacceptable for this administration to continue to impose policies that are driving up energy prices and putting the economy and jobs at risk for speculative benefits.

The final Utility MACT rule is widely regarded as the most expensive power sector rule to date issued by the EPA, imposing billions of dollars of new costs and complex regulatory requirements on America's power sector and consumers.

While the Utility MACT rule is referred to by EPA as the "Mercury and Air Toxics Standards," EPA's projected health benefits for this expensive rule have almost nothing to do with reductions in mercury emissions. The benefits of the Utility MACT rule are 99.996 percent related to particulate matter, which is already regulated by other parts of the Clean Air Act. EPA attributes less than one percent of the benefits of the rule to reductions in mercury emissions.

According to an expert witness testifying today, the Utility MACT rule will make it impossible to build new coal-fired power plants in the U.S., and will also make it uneconomic for many existing coal-fired power plants to continue to operate. This is not EPA setting environmental policy, this is EPA setting energy policy and that was never supposed to be EPA's job, but it seems to be the focus of the Obama EPA.

Just last week, FirstEnergy announced that it would be retiring six plants in its fleet due to the Utility MACT rule and other environmental regulations. This decision directly affects over 500 employees and thousands of customers in Ohio, Pennsylvania, and Maryland who will be paying higher electricity rates.

This single company's retirements represents more than half of the 4.7 gigawatts EPA predicted would retire as a result of its Utility MACT rule. That leaves me with no option but to conclude that EPA's projections regarding cost are wrong.

Unfortunately, FirstEnergy's employees and customers are just one example of the consequences of the actions being taken by the Obama EPA.

- Last week Alpha Coal Company announced they are laying off 318 employees and closing 6 mines, in part due to EPA regulations.

- In May 2011, Louisville Gas and Electric Company and Kentucky Utilities Company announced that they planned to request approval to install environmental upgrades for their coal-fired plants along with the recovery of the expected $2.5 billion in costs, which will be passed onto consumers increasing electricity bills for an average home by over $16 per month by 2016. That's almost $200 per customer.

- In June, the American Electric Power company announced they would retire nearly 6,000 megawatts of coal-fueled power generation, while upgrading or switching to natural gas thousands more megawatts. The cost of AEP's compliance plan could range from $6 billion to $8 billion. This is on top of the already $7.2 billion AEP has invested since 1990.

- In August, Southern Company announced that they would spend $13 to 18 billion to comply with EPA's regulations and convert 8,700 megawatts from either coal or oil to natural gas.

Of course, let's not forget that EPA worked with environmental groups to force the Tennessee Valley Authority to shutdown 18 coal-fired electricity units at three power plants and spend $3 to 5 billion on other upgrades.

These are costs that will be passed on to consumers.

U.S. households are spending a greater share of their income on energy these days, meaning they have less money to spend on food, housing, or health care, and unfortunately, this has a disproportionate impact on lower income families. In 2001, families earning less than $50,000 spent an average of 12 percent of their after-tax income on energy. In 2012, these families are projected to spend 21 percent of their after-tax income on energy. One-fifth of their income on electricity? It doesn't have to be this way, energy can be affordable for everyone, but under EPA's regulations, it will only get worse.

Higher electricity prices will not only directly impact American households. It will increase the cost of doing business for our domestic manufacturers, especially those energy-intensive industries that rely on low-cost energy to produce affordable goods so that they can compete globally, as Mr. MacDonald from the steel manufacturer Gerdeau will testify to today on the second panel. If it becomes too expensive to operate in the U.S., these manufacturers – and their jobs – will be further forced outside the country.

Today's hearing continues this subcommittee's efforts to hold the Obama administration accountable for the significant costs and uncertainty its regulatory agenda continues to impose on the economy.

I thank the witnesses for being here today and look forward to the discussion.

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Mr. WHITFIELD. At this time, I would like to recognize for an opening statement the ranking member of the full committee, Mr. Waxman of California.

OPENING STATEMENT OF HON. HENRY A. WAXMAN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. WAXMAN. Thank you, Mr. Chairman.

In the first 20 years after the Clean Air Act was enacted in 1970, visible air pollution decreased substantially. But we made very little progress on reducing toxic air pollution, the invisible heavy metals and other chemicals that cause cancer, brain damage, birth defects, and other devastating health problems.

In the Clean Air Act amendments of 1990, adopted by an overwhelming bipartisan majority on this committee, we addressed this issue: The new law directed EPA to set standards requiring industrial sources to use available pollution control technology to reduce their emissions of mercury, arsenic, and other toxic air pollution.

Since 1990, EPA has adopted standards for almost every major industrial source of toxic air pollution. Every source, that is, except power plants, which emit more mercury than any other source.

Owners of the dirtiest power plants have used political and legal tactics to block standards requiring them to clean up their pollution. When forced to act, the Bush administration issued weak standards for power plants that were scientifically and legally indefensible. The courts ultimately threw them out, forcing EPA back to the drawing board.

Finally in December, after more than 20 years of study, litigation, and delay, EPA issued strong but achievable standards to cut toxic air pollution from America's dirtiest power plants.

These new standards will cut emissions of toxic mercury by 90 percent. This is a major step forward. Exposure to mercury can damage the nervous system of infants and children, which can impair their ability to think and learn.

We should be cheering this good news. But, instead, we are holding this hearing to criticize EPA for protecting the health of our children. Last year, the committee and House Republicans even voted to block EPA from acting.

I think this committee has its priorities exactly backwards. We should be standing up for the health of infants and children, not the powerful coal and utility industries.

These new standards will have tremendous health benefits. By cutting emissions of pollution that triggers asthma attacks and damages babies' brains, we could see up to $90 billion in health benefits every year. Ninety billion dollars in health benefits every year. These benefits far outweigh the costs of implementing these long overdue achievable pollution controls.

We will hear from members today that these health benefits aren't real. But as you evaluate these claims, remember that some of the members who voted to deny that climate chang is real will be making these claims.

We need to be guided by science. EPA's findings are supported by reams of peer-reviewed science on the health impacts of mercury and fine particles, including work by the independent EPA Science Advisory Board and the National Academy of Sciences.

I am concerned about what is happening in this committee. Science denial should have no place in Congress. It is reckless and it is dangerous.

If members have questions about our scientific understanding of air pollution and its health effects, bring in the researchers, bring in the experts and examine the peer-reviewed scientific literature.

The last 40 years prove we can have both economic growth and a cleaner environment. We do not have to choose between jobs and toxic mercury pollution that endangers our children's brains. In fact, requiring power plants to invest capital and install modern pollution controls will create jobs. Fabricators and factory workers build the pollution controls, construction workers install them on the site, and skilled employees operate them. EPA says its rule will create 46,000 short-term construction jobs, and 8,000 long-term utility jobs. The EPA—that is even more than the XL pipeline will create, in terms of jobs.

The EPA rule will save American lives, protect our children from brain damage, clean up all polluting power plants, and even create jobs.

I congratulate President Obama, Administrator Jackson, Assistant Administrator McCarthy, and the hardworking staff at EPA for finally getting the job done.

Thank you, Mr. Chairman.

Mr. WHITFIELD. Thank you.

At this time, I recognize the gentleman from Texas, Mr. Barton, for 5 minutes for an opening statement.

OPENING STATEMENT OF HON. JOE BARTON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TEXAS

Mr. BARTON. Thank you, Chairman Whitfield. Thank you, Ms. McCarthy, for once again coming before us.

I have a prepared statement, and it is a very good prepared statement. I am going to put it in the record, but I am going to speak a little bit extemporaneously because I think this is a very important hearing.

This Utility MACT rule is the most expensive regulation that has ever been proposed on the American economy, as far as I can tell. The annual estimated cost for the first 5 years is approximately $10 billion a year. It is estimated that by 2020 we are going to have a loss of about 1.5 million jobs, and the question is, what are the benefits?

As you know, myself and others have sent a number of letters to you and the administrator, Mrs. Jackson, asking to try to flesh out these so-called benefits, these avoidable deaths and things of that sort. Mr. Waxman alluded to that in his opening statement. I have a letter that you signed to me. We received it 3 days ago, and it is the most extensive effort yet to try to comply with our request, so I am going to give a pat on the back for that.

I have read it twice, and I honestly can tell you that I don't think you have told me anything. I think that we keep referring to these studies, these models. There is no real factual data in this response anywhere where they have gone out and done an emergency room study near a power plant and compared it to someone who lives in Yosemite National Park or something. I mean, you go from wherever you think the dirtiest area is to where you think the cleanest area is, compare those over time to get a base line for what the ambient environmental issues are, and then compare them. These are all models based on assumptions, and they are written in a way that the average person's eyes just glaze over it. I am going to keep trying. I am going to keep trying to understand it, and I am going to ask some people that are a lot smarter than me to take a look at it.

But when Mr. Waxman said in his opening statement that these regulations could create 46,000 jobs—that is in your report that you put out with the rule—and I looked at that and, when you delved down into it, it is because of the increased jobs created to comply with the rule. Now, the more regulation you have, the more compliance cost you are going to have, but you are going to have to hire people, but they don't produce anything. If I go out and hire a coal miner and he digs an additional ton of coal a day, and that coal is burned to create electricity, there is something—a product is developed that is salable and that somebody uses. If I hire another compliance officer, he sits there and shovels paperwork all day. Now if the answer to our economic problem is more regulation so that we get more people hired for compliance, we could go out and start hiring people to go rob banks, so they would have to hire more bank guards for—to protect against the bank robbers. You would create jobs, but you would shut the bank down.

Madam Administrator, I am afraid that is what we are doing right here. So I look forward to an honest debate. You are always honest in your answers. I appreciate that, but we have a fundamental disagreement about the result, and we hope to elaborate on that later.

[The prepared statement of Mr. Barton follows:]

Opening Statement of the Honorable Joe Barton
Chairman Emeritus, Committee on Energy and Commerce
Subcommittee on Energy & Power Hearing
"The American Energy Initiative" Day XV
EPA's Utility MACT Rule and Costs to U.S. Consumers

February 08, 2012

Thank you, Mr. Chairman for having this hearing today. Thank you, Ms. McCarthy for your testimony, and that of our other witnesses today. We are gathered here today to try to get an understanding of what the economic effects will be of the Utility MACT rule which was announced and made final December 22, 2011.

Currently, coal, powers about 45 percent of our country's electricity. A study conducted by the National Economic Research Associates (NERA) on the impact of EPA's Utility MACT and the Cross State Air Pollution Rule (CSAPR) found these regulations will cause a loss of 1.4 million jobs by the year 2020 and increase electricity prices up to 24 percent.

As estimated by the United States Department of Energy (DOE Fossil Energy division), "Coal-fired power plants contribute only a small part of the total worldwide emissions of mercury. The estimated 48 tons of mercury they emit annually is about one-third of the total amount of mercury released annually by human activities in the United States." That figure includes naturally occurring mercury as well, like that found in playing in the dirt.

But that is exactly the reason why you see the United States Environmental Protection Agency (EPA) admittedly only showing less than .01percent of the $33 billion to $89 billion being for mercury benefit, which was what this rule was supposed to be for.

Only somewhere between $5 hundred thousand and $6 million dollars a year come from mercury benefits. Over 99.99 percent, of the EPA acknowledged benefits of this rule, are from what they determine 'co-benefits' from the reductions in fine particles.

This shows that this rule is fraudulently attempting to fool the public into thinking that they are being good stewards of the law when in fact they are not. Instead of providing protection for the environment, they are mandating and creating their own environmental policy which is not in their agencies jurisdiction.

The co-benefits described in the EPA's own analysis show that over 99 percent of the 'alleged' avoided-mortality benefits, occur in areas that already comply with the EPA's ambient air quality standard for fine particles. The fine particles have been strictly regulated under other parts of the Clean Air Act (CAA) for 15 years.

Let's take a close look at this. The coal fueled electric industry has already invested over $95 billion dollars through 2010 for emission controls to meet clean air requirements. Sulfur dioxide, nitrogen oxides and particulate matter have been reduced by 90 percent per kilowatt hour over the period of 1970-2010. Mercury emissions nationwide have been reduced more than 60 percent. Now this industry that has invested billions of dollars to comply, are now closing their doors nationwide.

The EPA indicated that there would only be 4.7 GW of power retired as a result of their new rule. As Chairman Whitfield indicated, one company, just one company's retirements of 6 plants is over half of the total retirements indicated by the EPA. This tells me that, once again, their total costs numbers and entire speculation on health benefits etc. is suspect.

Bottom line, the huge costs of this rule are going to be passed on to hard working American families, small businesses and manufacturers. EPA's war on coal will result in huge increases in electric prices and millions of jobs lost from not only the coal industry but from companies who will have to cut back on their employees due to the increase in their electric bills. Many of the regulatory agencies in charge of reliability have very serious concerns as to whether or not we will be able to keep the lights on.

The press conference that Secretary Jackson held introducing this rule should have been done in front of the unemployment line instead of the children's hospital because this rule will only prove to increase the amount of working families looking for jobs and overall decrease the health of the entire family from the poverty. When is it good enough Ms. McCarthy? When we have lost all of our industry and jobs to other countries? Will it be good enough then? With that I yield back.

Mr. BARTON. With that, I want to yield to Mr. Pompeo the remainder of my time.

OPENING STATEMENT OF HON. MIKE POMPEO, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF KANSAS

Mr. POMPEO. Thank you, Mr. Barton. You know, we will learn a lot about studies and reports and data today, but we don't have to go very far from where I live to see the real world impact of this rule. In Kansas, we have been trying to build a coal-fired power plant called Holcomb II for an awfully long time. It has been stopped by our former governor, our secretary of HHS through litigation, and it is a clean coal-fired power plant. This is a power plant that I would think environmentalists would advocate. We will retire some older coal. This is a good step forward, and yet, under the existing Utility MACT, I am anxious to talk to Assistant Administrator McCarthy today about how we are going to build that plant. I don't think it is possible. The company certainly doesn't. It hasn't been able to move forward on this for many, many years now so I am anxious to learn how under this new set of rules we can begin to continue to build coal-fired power plants in America.

I think the Utility MACT rule is designed to create costs which prohibit that, and isn't about a good environmental policy but instead is about energy policy, trying to drive coal out as an affordable source for manufacturers and consumers all across the country.

Mr. POMPEO. With that, I yield back to Mr. Barton.

Mr. WHITFIELD. The gentleman's time is expired.

At this time, I recognize the gentleman from Illinois, Mr. Rush, for 5 minutes for his opening statement.

OPENING STATEMENT OF HON. BOBBY L. RUSH, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Mr. RUSH. Thank you, Mr. Chairman.

Mr. Chairman, we are here today to hold yet another debate in a long series of subcommittee hearings on the costs associated with implementing the EPA's Utility MACT rules. I am curious to see, will we hear anything new or different from what we have already learned from the numerous hearings on this issue in the past?

Mr. Chairman, I don't know, you know, I feel a sense of serious schizophrenia kind of settling in on this committee, because we have already passed the Train Act—to delay the rules and you know, with the majority's votes. Now we are saying well now, now that they are delayed, let us study them more. Let us look at the cost.

Mr. Chairman, in all the hearings that we have had in the past, we have heard industry say that implementing these new Utility MACT rules will raise prices for everyone involved, and they advocate stalling and they are delaying these rules for five or ten or twenty more years down the road in order to give themselves more time to plan and prepare for the new standards?

You know, Mr. Chairman, this schizophrenia in this committee, you know, yesterday we were saying let us hurry up and pass the legislation to force the administration to—within 30 days to approve the XL Keystone Pipeline. Another day, 24 hours later, we are saying let us stop, let us wait. Hold up. It reminds me of when I was in the service, you know, hurry up and wait. We were always running from here to there, running to the mess hall, running to this, running, and then you always had to wait in line. Hurry up and wait. So what we are doing here is yesterday we were hurrying up, and today we are saying let us wait. And those who subscribe from this horrific waiting and passing say that because many in the industry are not prepared for these new rules, they will have to shut down many old plants and spend money investing in retrofits and upgrades so they will be in compliance with the new MACT rules.

Mr. Chairman, these folks have had years and years and years to prepare for these new rules. I am sensitive to the issue hiring as much as anyone on this subcommittee. My constituents that I represent want something just as important—and energy bills eat up a larger share of their hard-earned paycheck.

But I believe it is a cop-out that we should scrap—to delay these new EPA rules, and give those who have been caught flat-footed more time to catch up, to get more forward thinking industry counterparts.

Again, Mr. Chairman, my utilities—Edison, Exelon, they have already retrofitted their plants. They invested over a billion dollars. They were out in front of this. Now you are telling them that they didn't have to invest all of that money and they didn't have to take a very progressive and forward view? You are telling my constituents that what has happened is meaningless? Mr. Chairman, I think that these companies who did not take—see the writing on the wall, did not take this Congress seriously, did not take the work of this committee seriously, and decided that at the end of the day, they were going to try to manipulate the American people and manipulate this committee so that they have even more time, 10, 20 years to do something that is common sense and that is in the interest of the American people?

I think, Mr. Chairman, that it is time for us now to try to deal—first of all, we have got to admit that we are a schizophrenic committee or subcommittee, and once we admit that we have got a problem, then we can get some help to try—an intervention to try to solve the problem. So let us—Mr. Chairman, I think this is a useless subcommittee, and I am glad that the administrator is here, but frankly, Ms. McCarthy, I think you have much more important work to do than to sit here and entertain us with the same old questions, the same old rigmarole, the same old game. You have got—the American people need you to be over doing your real work and not here entertaining us.

Thank you, and I yield back the balance of my time.

Mr. WHITFIELD. Thank you, Mr. Rush. Is there a psychiatrist in attendance this morning in the audience somewhere?

Well, we have one person on the first panel this morning, and that is the Honorable Gina McCarthy, who is the Assistant Administrator for Air and Radiation, U.S. Environmental Protection Agency. Ms. McCarthy, thank you for joining us again today. We appreciate your taking time to come and talk about Utility MACT, or Mercury—or MATS, as you all call it. You are recognized for a period of 5 minutes, and at the end of that time, then we will go into a question-and-answer period.

So you are recognized for 5 minutes.

STATEMENT OF GINA MCCARTHY, ASSISTANT ADMINISTRATOR FOR AIR AND RADIATION, ENVIRONMENTAL PROTECTION AGENCY

Ms. MCCARTHY. Thank you, Chairman Whitfield, Ranking Member Rush, members of the committee. I really appreciate the opportunity to testify before you today.

Last December, EPA finalized the Mercury and Air Toxic Standards, MATS. These standards required by the Clean Air Act are the first national standards to protect American families from power plant emissions of mercury and other toxic air pollutions, like arsenic, acid gases, nickel, selenium, and cyanide. These long overdue standards will help make our children and our communities healthier. MATS will eliminate 20 tons of mercury emissions and hundreds of thousands of tons of acid gas and toxic pollution each year. The control equipment that reduces these toxic emissions also will reduce fine particle pollution. As a result, MATS will help protect children and adults from the effects of exposure to toxic air pollution, saving thousands of lives and preventing more than 100,000 heart and asthma attacks each year. We project that the annual public health benefits from MATS are $37 billion to $90 billion, far outweighing the annual projected cost of $9.6 billion.

Technically, we know how to achieve these reductions. MATS relies on widely available, proven pollution controls that are already at use in more than half of the Nation's coal-fired power plants. These standards are affordable. EPA projects that electricity prices on average will rise only 3 percent as a result of MATS. With MATS and the cross-State rule combined, rates are projected to be well within the range of normal historic fluctuations, as this graph that is projected and as in my written comment shows.

In addition, the updated standard will support thousands of good jobs for American workers who will be hired to build, install, and then operate the pollution control equipment. Furthermore, the country can achieve these reductions while maintaining a strong and reliable electric grid. Several EPA and Department of Energy analyses conclude that MATS will not adversely affect capacity reserve margins in any region of the country. A January 2012 Congressional Research Service report reached similar conclusions.

The reliability concerns we heard were largely tied to concerns that 3 years was not enough time for compliance. We addressed those concerns. Sources would generally have over 4 years until the spring of 2016 to comply with MATS, and reliability critical units will have the opportunity for an additional year. All power plants will have at least 3 years. That is the compliance date that we established in the rules under the Clean Air Act. In addition, State or local permitting authorities can grant that additional year under certain circumstances. EPA recommends in its rule that this fourth year be broadly available to sources that require it for a wide range of activities, including constructing replacement power, upgrading transmission lines, maintaining reliability while other sources complete their compliance activities. My staff and I have already begun and we will continue to reach out to States to help develop clear, State-forward processes for requesting and granting these extensions.

Additionally, EPA is providing a well-defined pathway for reliability critical units to get up to an additional year beyond the 4 years mentioned above by obtaining a schedule to achieve compliance with an additional year. This pathway is set forth in a policy memorandum from EPA's Office of Enforcement and Compliance Assurance. While we don't foresee problems with the country maintaining a reliable electric grid as a result of our rules, we do believe that extra vigilance is appropriate to identify and address any potential localized reliability concerns that might arise. My staff and I have been and will continue to work with organizations that have the responsibility for maintaining the Nation's electricity reliability, including the Department of Energy, the Federal Energy Resource Commission, the National Association of Regulatory Utility Commissioners, and the Regional Transmission Organizations. We are working to help power plant owners understand their responsibilities, and remain confident that together, we do have the tools to address any challenges that may arise in connection with the implementation of the Mercury and Air Toxics Standard.

In summary, EPA's final MATS standard will reduce emissions of toxic air pollution from power plants. It will lead to healthier communities and a safer environment. For 40 years, we have been able to implement the Clean Air Act. We have been able to continue to grow the American economy, and we have kept the lights on. MATS will not change that.

Thank you for the opportunity to testify, and I look forward to answering your questions.

[The prepared statement of Ms. McCarthy follows:]

Opening Statement of Regina McCarthy
Assistant Administrator
U.S. Environmental Protection Agency

Committee on Energy and Commerce

Subcommittee on Energy and Power

February 8, 2012

Hearing Titled "The American Energy Initiative:

What EPA's Utility MACT Rule Will Cost U.S. Consumers"

Chairman Whitfield, Ranking Member Rush, and members of the Committee, I appreciate the opportunity to testify before you today on EPA's Mercury and Air Toxics Standards.

On December 16, 2011, EPA finalized the Mercury and Air Toxics Standards (MATS), the first national standards to protect American families from power plant emissions of mercury and other toxic air pollution like arsenic, acid gas, nickel, selenium, and cyanide. The standards will slash emissions of these dangerous pollutants by relying on widely available, proven pollution controls that are already in use at more than half of the nation's coal-fired power plants.

MATS will save thousands of lives and prevent more than 100,000 heart and asthma attacks each year while providing important health protections to the most vulnerable, such as children and older Americans. We do not have to choose between the significant public health benefits from reducing air pollution from power plants and a strong, reliable electric grid. Nor do we have to choose between clean, healthy air and robust economic growth and job creation. We can reduce harmful pollution while growing the U.S. economy and ensuring the reliable delivery of electricity to our families and businesses. As President Obama recently stated, "And because we acted, we're going to prevent thousands of premature deaths, thousands of heart attacks and cases of childhood asthma...We're creating healthier communities. But that's not all. Safeguarding our environment is also about strengthening our economy. I do not buy the notion that we have to make a choice between having clean air and clean water and growing this economy in a robust way. I think that is a false debate.[1]"

EPA received hundreds of thousands of public comments strongly supporting our Mercury and Air Toxics Standards to protect children and families from mercury and other toxic pollution. Some of the comments that EPA received during the public comment process allowed us to make changes to the standards that make them clearer, more flexible, and less expensive, while maintaining human health protections that will provide tangible benefits to American families for generations to come

Cleaning up the power sector is overdue

In 1990, three source categories made up approximately two-thirds of total U.S. mercury emissions: power plants, municipal waste combustors (MWCs), and medical waste incinerators (MWIs). Since then, MWCs have reduced their emissions by 96% and MWIs have reduced their emissions by over 98%. Many other major sources categories, such as cement plants and steel manufacturers, are also reducing their mercury emissions.

The power plant rules EPA has developed are necessary to protect public health and the environment from the pollution these plants produce – a need that both Republican and Democratic administrations have recognized for decades. For over 20 years, since President George H.W. Bush proposed what became the Clean Air Act Amendments of 1990, power plant clean-up has been the continuous policy of the U.S. government under two Democratic and two Republican presidents.

Over the years, many power plants have invested in modern pollution controls to reduce their emissions and have contributed to the significant progress this country has made in providing healthy air to our citizens. Many other power plants, however, have delayed investments in pollution control equipment that have been widely available for years – including equipment to reduce emissions of mercury and other toxic air pollutants. As a result, power plants remain the country's largest source of mercury and sulfur dioxide (SO_2) emissions, and the largest stationary source of nitrogen oxide (NO_X) emissions.[2] Power plant pollution contaminates the fish we eat; damages our nation's sensitive lakes, rivers, and streams; and is

[1] http://www.whitehouse.gov/the-press-office/2012/01/10/remarks-president-epa-staff
[2] EPA National Emissions Inventory (2008) http://www.epa.gov/air/emissions/index.htm

linked to tens of thousands of premature deaths and hundreds of thousands of asthma attacks each year.

MATS is needed to protect public health

In 2011, EPA issued two long-overdue rules to reduce air pollution from power plants – MATS and the Cross State Air Pollution Rule.[3] Both of these affordable, technologically achievable rules will provide enormous public health benefits for Americans that are significantly greater than the costs.

The Mercury and Air Toxics Standards, the topic of today's hearing, are required by the 1990 Clean Air Act Amendments. They are designed to reduce emissions of mercury, other toxic metals such as cadmium, nickel and arsenic, acid gases, and other toxic air pollutants. Mercury, depending on the form and dose, may cause neurological damage in children who are exposed before birth and is also associated with impacts on children's cognitive thinking, memory, attention, language, and fine motor and visual spatial skills. Metals such as arsenic, chromium, and nickel cause cancer and other health risks. Acid gases cause lung damage and contribute to asthma, bronchitis and other chronic respiratory diseases, especially in children and the elderly. Until these standards were finalized in December 2011, there were no national requirements to reduce mercury and other air toxic emissions from power plants.[4] These overdue national standards will level the playing field and help modernize the fleet of aging power plants.

The final MATS will eliminate 20 tons of mercury emissions and hundreds of thousands of tons of acid gases and toxic pollutants each year. The control equipment that reduces emissions of these toxics also will reduce fine particle pollution. Based on the reductions in fine particle pollution, we project that in 2016 these standards will prevent approximately:

- 4,200 to 11,000 premature deaths
- 4,700 heart attacks
- 130,000 cases of childhood asthma symptoms
- 6,300 cases of acute bronchitis among children
- 5,700 emergency room visits and hospital admissions

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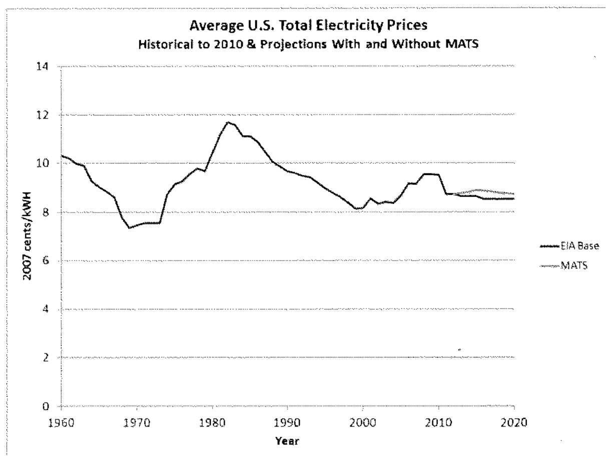
[3] This was called the "Transport Rule" when it was proposed.
[4] The last Administration's rule attempting to limit national mercury emissions from power plants was overturned in court in 2008 for failing to meet the requirements of the Clean Air Act.

• 540,000 days of work missed due to respiratory illness.[5]

In total, the annual public health benefits from MATS are estimated to be $37 to $90 billion. These benefits will continue each year after the control equipment is in place. In addition, there are many health effects associated with toxic air pollution (like mercury, chromium, nickel and arsenic) that EPA is unable to quantify. We also cannot yet quantify the benefits of MATS for outdoor recreational enthusiasts, or in preventing adverse effects on fish, birds, mammals and ecosystems. If we were able to quantify all of these effects, the benefits would potentially exceed the costs by an even larger margin than we currently estimate.



MATS is affordable

EPA's modeling indicates the annual cost of implementing MATS will be approximately $9.6 billion, significantly less than the estimated annual benefits of $37-90 billion. EPA's modeling for the final standards indicates that any change in retail electricity prices will be very small (approximately 3% on a national basis) and will not cause prices to rise even to 1990 levels. In fact, as shown in Figure 1, EPA's modeling shows that after both MATS and the Cross State Rule (in the base case) are implemented, electricity rates are projected to stay well within the range of normal historical fluctuations and below levels seen as recently as 2009. In addition, the updated standards will support thousands of good jobs for American workers who will be

[5] These benefits are from emissions reductions achieved solely by the final Mercury and Air Toxics Standards, and not from the Cross State Rule or any other emissions reduction regulation. When EPA estimated the benefits for MATS, we included the Cross State Air Pollution Rule (known then as the Transport Rule) in the baseline for our analysis, so these estimates represent the incremental benefits of MATS alone.

hired to build, install, and operate the equipment to reduce health-threatening emissions of mercury, acid gases, and other toxic air pollutants. EPA estimates that investments made to comply with MATS will provide 8,000 long term jobs in the power sector and 46,000 short term construction jobs.

MATS is achievable and will not "turn out the lights"

There were three primary concerns among the stakeholders who raised implementation concerns about MATS during the public comment period: a) the magnitude and technical feasibility of pollution control retrofits needed to comply with the standards; b) the time available to complete necessary installations and retrofits; and c) the effect of the standards on electric reliability before and after the compliance deadlines. Of these three related issues, the last one has received the greatest amount of public and Congressional attention.

In response to stakeholder comments EPA received on operational concerns related to the magnitude and technical feasibility of retrofits required by the standard, we made a number of substantive changes to the compliance requirements. These changes include switching to a filterable particulate matter (PM) emissions limit and providing sources the option to use a more flexible facility-wide averaging approach as long as it provides equivalent reductions in mercury. We are also providing separate sub-categories of standards for limited use and non-continental oil-fired units, as well as more achievable new source standards. These changes maintain reductions in air toxics while making implementation easier and less costly.

EPA also paid close attention to comments raised by stakeholders regarding the time available to achieve compliance with MATS, as well its impacts on electric reliability. Before MATS was finalized, EPA and the Department of Energy (DOE) conducted several analyses of its effects on electric generation resources.[6] EPA's and DOE's analyses demonstrate that the vast majority, if not all, sources will be able to meet the MATS requirements within the time frames provided under the Clean Air Act – which I discuss at greater length below.

EPA's resource adequacy analysis continues to demonstrate that only a modest amount of generating capacity will become uneconomic to operate under the MATS standards, and removal

[6] Environmental Protection Agency (2011). "Resource Adequacy and Reliability in the IPM Projections for the MATS Rule" http://www.epa.gov/ttn/atw/utility/revised_resource_adequacy_tsd.pdf
Department of Energy (2011). "Resource Adequacy Implications of Forthcoming EPA Air Quality Regulations" http://energy.gov/sites/prod/files/2011%20Air%20Quality%20Regulations%20Report_A_120911.pdf

of this capacity will not adversely affect capacity reserve margins in any region of the country. In addition, new capacity will be added between now and 2015. The analysis projects that, as a result of MATS, plant operators will choose to retire less than one half of one percent (4.7 gigawatts (GW)) of the more than 1,000 GW that make up the nation's electric generating capacity. This retiring generation capacity is an average of more than fifty years old, relatively inefficient, and does not have modern pollution controls installed. It should be noted that over the last few years low natural gas prices and an aging coal generation fleet have been pushing the industry towards less reliance on coal and greater reliance on natural gas. David Sandalow, DOE Assistant Secretary for Policy and International Affairs, summarized the DOE analysis as "demonstrat[ing] that new EPA rules – which will provide extensive public health protections from an array of harmful pollutants – should not create resource adequacy issues[7]." In addition, a recent Congressional Research Service report (January 2012)[8] reviewed industry data on planning reserve margins and potential retirement of units that do not currently meet the standards and concluded, based on these data "that, although the rule may lead to the retirement or derating of some facilities, almost all of the capacity reductions will occur in areas that have substantial reserve margins."

EPA took steps in the final MATS standards to address stakeholder concerns that compliance with MATS could not be achieved within the maximum three-year compliance date authorized under the statute. In the final rule, EPA described in detail the wide range of situations where we believe an additional year for compliance could be granted by permitting authorities. This fourth year - in addition to the three years provided to all sources - is provided by the Clean Air Act as needed to complete installation of control technologies. EPA suggests that permitting authorities make this fourth year broadly available to sources that require it to complete their compliance activities, including installing pollution control equipment, constructing on- or off-site replacement power, and upgrading transmission. EPA is also encouraging the fourth year to be available as needed to units that continue to operate for reliability purposes while other units are installing pollution controls. As described in more detail below, EPA will engage in outreach to states and permitting authorities to help ensure that the fourth year for compliance is broadly available and that the process for sources to request and

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[7] http://energy.gov/articles/energy-department-releases-study-electricity-system-ahead-proposed-epa-air-quality

[8] James E. McCarthy, January 9, 2012. "EPA's Utility MACT: Will the Lights Go Out?" http://www.eenews.net/assets/2012/01/19/document_gw_03.pdf

states to grant the extensions is clear and straightforward; if necessary we will issue guidance to accomplish that. As a result, EPA estimates that sources generally will have until spring of 2016 to comply – one year longer than our analysis indicates is necessary for most sources.

Although EPA's analysis indicates that most, if not all, sources can comply within three years, and that the fourth year should be available in the broad range of situations described above, EPA is also providing a clear pathway for units that are shown to be critical for electric reliability obtain a schedule to achieve compliance within up to an additional year beyond the four years mentioned above. This pathway is set forth in a policy memorandum from EPA's Office of Enforcement and Compliance Assurance.[9] As stated above, EPA believes there will be few, if any, situations in which this pathway will be needed. In addition, in the unlikely event that there are situations where sources cannot come into compliance on a timely basis that do not fall into any of these categories, EPA will address them on a case-by-case basis, at the appropriate time, to determine the appropriate response and resolution. This is consistent with its longstanding historical practice under the Clean Air Act.

As part of the Administration's commitment to maximize flexibilities under the law, MATS was accompanied by a Presidential Memorandum that directs EPA to take a number of steps to ensure continued electric reliability. These steps include: 1) working with State and local permitting authorities to make the additional year for compliance with MATS provided under section 112(i)(3)(B) of the Clean Air Act broadly available to sources; 2) working with the Department of Energy, the Federal Energy Regulatory Commission, State utility regulators, Regional Transmission Organizations, the North American Electric Reliability Corporation and regional electric reliability organizations, other grid planning authorities, electric utilities, and other stakeholders, as appropriate to promote early, coordinated, and orderly planning; and 3) making available to the public, including relevant stakeholders, information that describes the process for identifying circumstances where electric reliability concerns might justify allowing additional time to comply. EPA is in the process of taking a number of steps to implement the directives in this memo.

EPA is actively engaging power plants and other entities that will be involved in getting power plants retrofitted while maintaining the reliability of the electric grid. EPA has held, and

[9] EPA Memorandum December 16, 2011. "The Environmental Protection Agency's Enforcement Response Policy For Use of Clean Air Act Section 113(a) Administrative Orders in Relation To Electric Reliability and the Mercury and Air Toxics Standard" http://www.epa.gov/compliance/resources/policies/civil/erp/mats-erp.pdf

will continue to hold, a series of discussions with the Department of Energy, the Federal Energy Regulatory Commission, State utility regulators, Regional Transmission Organizations, the North American Electric Reliability Corporation, regional electric reliability organizations, and other grid planning authorities to promote early compliance planning, to support orderly implementation of the MATS standards, and to ensure that any potential, localized reliability concerns are identified and addressed. EPA has started and will continue discussions with power plant owners and operators to help them understand their responsibilities under the standards and their role in early, coordinated, and orderly planning. EPA is conducting specific outreach to stakeholders with unique concerns such as rural electric cooperatives, public power facilities, and investor-owned utilities. In addition, EPA will also engage in outreach to states and permitting authorities to help ensure that the fourth year for compliance is broadly available and that the process for sources to request and states to grant the extensions is clear and straightforward.

The nation's power grid is strong and resilient because numerous agencies and organizations fulfill their obligations to maintain the nation's electric reliability. As discussed above, EPA has already been working and will keep working with these organizations so that they can take the necessary steps to continue to fulfill this obligation while ensuring smooth implementation for MATS. Key steps include early planning and early notification of compliance plans by affected sources, system operators, and state and federal regulators. One regional transmission organization, PJM Interconnection, which operates a competitive wholesale electricity market and manages the high-voltage electricity grid to ensure reliability for more than 58 million people in the eastern U.S., has already begun asking its members for MATS compliance planning information. Over the 40 year history of the Clean Air Act, these stakeholders – working together with State and Federal regulators – have had an outstanding track record of substantially reducing pollution while maintaining reliability. We remain confident that, together, we have the tools to address any challenges that may arise in connection with the implementation of the MATS standards.

The Clean Air Act

The Cross State and MATS rules would continue the decades-long Clean Air Act success story. For 40 years, the Clean Air Act has fostered steady progress in reducing the threats posed by pollution and allowing us all to breathe easier. In the last year alone, programs implemented pursuant to the Clean Air Act Amendments of 1990 are estimated to have reduced premature mortality risks equivalent to saving over 160,000 lives; spared Americans more than 100,000 hospital visits; and prevented millions of cases of respiratory problems, including bronchitis and asthma attacks.[10] They also enhanced productivity by preventing 13 million lost workdays; and kept kids healthy and in school, avoiding 3.2 million lost school days due to respiratory illness and other diseases caused or exacerbated by air pollution.[11]

However, few of the emission control standards that gave us these huge gains in public health were uncontroversial at the time they were developed and promulgated. Most major rules have been adopted amidst claims that that they would be bad for the economy and bad for employment. In contrast to doomsday predictions, history has shown, again and again, that we can clean up pollution, create jobs, and grow our economy all at the same time. Over that same 40 years since the Act was passed, the Gross Domestic Product of the United States grew by more than 200 percent.[12] It is misleading to say that enforcement of the Clean Air Act is bad for the economy and employment. It isn't. Families should never have to choose between a job and healthy air. They are entitled to both.

Some may find it surprising that the Clean Air Act also has been a good economic investment for our country. A study led by Harvard economist Dale Jorgenson found that implementing the Clean Air Act actually increased the size of the US economy because the health benefits of the Clean Air Act lead to a lower demand for health care and a healthier, more productive workforce. According to that study, by 2030 the Clean Air Act will have prevented 3.3 million lost work days and avoided the cost of 20,000 hospitalizations every year.[13] Another study that examined four regulated industries (pulp and paper, refining, iron and steel, and

[10] USEPA (2011). The Benefits and Costs of the Clean Air Act from 1990 to 2020. Final Report. Prepared by the USEPA Office of Air and Radiation. February 2011. Table 5-6. This study is the third in a series of studies originally mandated by Congress in the Clean Air Act Amendments of 1990. It received extensive peer review and input from the Advisory Council on Clean Air Compliance Analysis, an independent panel of distinguished economists, scientists and public health experts.
[11] Ibid.
[12] Bureau of Economic Analysis, National Economic Accounts, "Table 1.1.5. Gross Domestic Product," http://bea.gov/national/index.htm#gdp
[13] Dale W. Jorgenson Associates (2002a). *An Economic Analysis of the Benefits and Costs of the Clean Air Act 1970-1990. Revised Report of Results and Findings.* Prepared for EPA. http://yosemite.epa.gov/ee/epa/eerm.nsf/vwAN/EE-0565-01.pdf/$file/EE-0565-01.pdf

plastic) concluded that, "We find that increased environmental spending generally does not cause a significant change in employment."[14]

The EPA's updated public health safeguards under the Clean Air Act will encourage investments in labor-intensive upgrades that can put current unemployed or under-employed Americans back to work. Environmental spending creates jobs in engineering, manufacturing, construction, materials, operation, and maintenance. For example, EPA vehicle emissions standards directly sparked the development and application of a huge range of automotive technologies that are now found throughout the global automobile market. The vehicle emissions control industry employs approximately 65,000 Americans with domestic annual sales of $26 billion.[15] Likewise, in 2008, the United States' environmental technologies and services industry of 1.7 million workers generated approximately $300 billion in revenues and led to exports of $44 billion of goods and services,[16] larger than exports of sectors such as plastics and rubber products.[17] The size of the world market for environmental goods and services is comparable to the aerospace and pharmaceutical industries and presents important opportunities for U.S. industry.[18]

Jobs also come from building and installing pollution control equipment. For example, the U.S. boilermaker workforce grew by approximately 35 percent, or 6,700 boilermakers, between 1999 and 2001 during the installation of controls to comply with EPA's regional nitrogen oxide reduction program.[19] Over the past seven years, the Institute for Clean Air Companies (ICAC) estimates that implementation of just one rule – the Clean Air Interstate Rule Phase 1 – resulted in 200,000 jobs in the air pollution control industry.[20]

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[14] Morgenstern, R. D., W. A. Pizer, and J. S. Shih. 2002. "Jobs versus the Environment: An Industry-Level Perspective." *Journal of Environmental Economics and Management* 43(3):412-436.
[15] Manufacturers of Emissions Control Technology (http://www.meca.org/cs/root/organization_info/who_we_are)
[16] DOC International Trade Administration. "Environmental Technologies Industries: FY2010 Industry Assessment. http://web.ita.doc.gov/ete/eteinfo.nsf/068f3801d047f26e85256883006ffa54/4878b7e2fc08ac6d85256883006c452c/$FILE/Full%20Environmental%20Industries%20Assessment%202010.pdf (accessed February 8, 2011)
[17] U.S. Census Bureau, Censtats Database, International Trade Data--NAICS, http://censtats.census.gov/naic3_6/naics3_6.shtml (accessed September 6, 2011)
[18] Network of Heads of the European Environment Protection Agencies, 2005. "The Contribution of Good Environmental Regulation to Competitiveness." http://www.eea.europa.eu/about-us/documents/prague_statement/prague_statement-en.pdf (accessed February 8, 2011).
[19] International Brotherhood of Boilermakers, *Boilermaker Labor Analysis and Installation Timing,* March 2005, EPA Docket OAR-2003-0053 (docket of the Clean Air Interstate Rule).
[20] November 3, 2010 letter from David C. Foerter, Executive Director of the Institute of Clean Air Companies, to Senator Thomas R. Carper (http://www.icac.com/files/public/ICAC_Carper_Response_110310.pdf (accessed February 8, 2011).

Conclusion

As we did more than two decades ago during debate of the Clean Air Act Amendments of 1990, we are hearing claims that our rules will lead to potential adverse impacts on electric reliability. Our analysis and past experience indicate that warnings of dire consequences of moving forward with these important rules are exaggerated at best. For example, during development of the 1990 Clean Air Act Amendments, one utility warned of unrealistic compliance dates and issues with electrical reliability. Industry estimated at the time that the cost of the new requirements for sulfur dioxide would be $7.5 billion per year; in reality, the cost of achieving the reductions was around $1.5 - 2 billion per year – a fraction of the costs estimated by those seeking to prevent enactment of that landmark legislation.[21] The resulting emission reductions are providing substantial health and ecosystem benefits with a monetized value of between $170 billion and $430 billion per year (2008$).[22] The dire predictions were not true then, and industry's remarkably similar claims about the current Clean Air Act regulations are not true now.

EPA's final MATS standards are data-driven, will reduce emissions of toxic air pollutants from power plants, and will lead to healthier communities and a safer environment. Public review and comment ensured that all interested stakeholders had an equal opportunity to look at the details of the standards and weigh in – ultimately helping EPA to write a better, more effective regulation. The adjustments between the proposed and final standards maintain reductions in air toxics while making implementation easier and less costly. For 40 years, we have been able to implement the Clean Air Act, grow the American economy, and keep the lights on. MATS will not change that.

Thank you for the opportunity to testify today. I look forward to your questions.

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[21] National Acid Precipitation Assessment Program Report to Congress 2011: An Integrated Assessment http://www.whitehouse.gov/sites/default/files/microsites/ostp/2011_napap_508.pdf . All costs reported in $2000

[22] Ibid

Mr. WHITFIELD. Thank you, Ms. McCarthy. We appreciate your testimony very much.

In the analysis that you provided the committee and that we have seen publically, you indicate that the annualized cost of this new regulation in the year 2015 will be $9.4 billion, and then you said that in 2020, it would be $8.6 billion, and in 2030 it will be 7.4 billion. How do you develop those annualized costs if you don't know what the total cost will be?

Ms. MCCARTHY. Well, EPA follows the best practices as well as OMB guidance to develop the costs and benefits information. We use a standard best management practice for understanding what those annualized costs are.

Mr. WHITFIELD. And what is the total cost?

Ms. MCCARTHY. I do not have—the figures that you are asking me for, actually, Congressman Upton asked us for as well. Those are costs that we don't establish or——

Mr. WHITFIELD. So you don't have a total cost for this regulation?

Ms. MCCARTHY. We have an annualized cost because the purpose of the cost——

Mr. WHITFIELD. Well, what is the annualized cost in 2016?

Ms. MCCARTHY [continuing]. Compare costs and benefits.

Mr. WHITFIELD. What is the annualized cost in 2016?

Ms. MCCARTHY. The 9.6 billion is the annualized cost in 2016. That is compared to——

Mr. WHITFIELD. Nine point four billion in 2015?

Ms. MCCARTHY. I am sorry?

Mr. WHITFIELD. Nine point four billion in 2015. What is 2016?

Ms. MCCARTHY. I believe it is 2016, but we can double-check.

Mr. WHITFIELD. Well what is 2017?

Ms. MCCARTHY. It would be less, but I don't have that exact figure.

Mr. WHITFIELD. Do you have 2018?

Ms. MCCARTHY. No, we used 2016 as the snapshot to compare both——

Mr. WHITFIELD. And when you look at these costs——

Ms. MCCARTHY [continuing]. Because it was the most conservative——

Mr. WHITFIELD [continuing]. Which you don't know the answer to, you don't know the total cost.

When you look at cost, we have a number of letters from companies that have already announced they are closing down various coal-fired plants as a result of these regulations. Do you look at the cost—do you include the cost of a person who loses their job because of this regulation?

Ms. MCCARTHY. We—in terms of our cost calculations, we look at the costs associated with the control equipment being purchased and installed, we look at the price of electricity and the changes——

Mr. WHITFIELD. But what about lost jobs? Do you look at that cost?

Ms. MCCARTHY. We actually estimate in our analysis that this will actually create both short-term and long-term jobs.

Mr. WHITFIELD. Do you look at the lost jobs, the cost of that?

Ms. MCCARTHY. We look at benefits associated with increased job growth.

Mr. WHITFIELD. Increased jobs, but do you look at lost jobs, the cost of that? Do you look at cost of a person who loses their health insurance and their family loses their health insurance? Do you consider that as a cost?

Ms. MCCARTHY. I understand what you are asking, Mr. Chairman, but in this rule, we estimated that it would increase jobs, both short-term and long-term.

Mr. WHITFIELD. OK. So you say it is going to increase jobs. We have plenty of experts who say it is going to lose jobs, but I find it rather appalling that this agency would issue a rule this widespread, this costly, and not even know what the total costs are. I mean, it is almost unbelievable that you would do this.

And then, you know, another thing that is quite disturbing is just the name that you give it, Mercury Air Toxic—the MATS, and every time we hear people talk about it, we talk about oh, we are reducing mercury, we are reducing the acid gas, we are reducing the non-metallic components, and yet, all of the analyses indicate that the dollar value of the benefits from the reductions of those are almost nil. That if you didn't have the co-benefit of the reduction of the particulate matter, that you wouldn't have any benefit of any size. I mean, it appears to me it is misleading the American people. I know we have Mr. Hescox from the Evangelical Group here who have been running ads in various members' districts about how dangerous it is about this mercury reduction, it is important that we reduce mercury. And yet, there is no calculated benefit or very minute, because this rule does not reduce mercury to any calculated benefit. So it is a total misleading of the American people. The only benefit is reduction in particulate matter.

So that is very disappointing to me, and at this time, I would like to recognize the gentleman from Massachusetts, Mr. Markey, for 5 minutes.

Mr. MARKEY. And I thank you, Mr. Chairman, and I thank the Ranking Member, Mr. Rush, for allowing me this courtesy.

In the movie "Groundhog Day" a weatherman named Phil Connors, played by Bill Murray, finds himself repeating the same day over and over and over again. And here we are in the same committee room for this committee's tenth hearing relating to EPA's regulations to remove toxic chemicals from power plants and other industrial sources. For the fifth time, Gina McCarthy has come to defend her agency against the specious claims that President Obama just doesn't want Americans to have jobs, and on the House floor, Republicans have already voted to weaken, delay, or repeal these regulations at least 40 times so far. It is Groundhog Day here in the House with the same hearings, the same bills, the same votes over and over again. Punxsutawney Phil saw his shadow, six more weeks of winter. Ms. McCarthy, you are just like Punxsutawney Phil, but you have eight more months of appearances before this committee to say the same thing over and over and over again. That is their plan.

Clearly, this a Republican majority that has run out of new bad ideas, so they have just decided to recycle all of their old bad ideas.

This may be the only type of recycling which the Republicans actually support.

Of course, at each of these hearings, Republicans claim over and over again that Americans must choose between air conditioning and air quality. They tell us that we have to choose between pollution and power plants. What the Republicans are giving us are false choice. We may not have to choose between manufacturing and mercury. We do not have to choose between concrete and cancer. We do not have to choose between the next generation and generators.

Just yesterday in this very committee during the debate on the Keystone pipeline, the Republicans said we should just ignore the environment, ignore pipeline safety, ignore public health, ignore the fact that none of the oil or fuel from this pipeline will stay in this country and benefit our citizens. And why do none of these things matter? Because of jobs, the majority says. Republicans even accused Democrats of not liking the blue-collar jobs they say the Keystone pipeline will create.

According to the EPA, the regulations that are subject to today's hearings will create 46,000 short-term construction jobs. That is nearly eight times the 6,000 temporary jobs that the State Department estimated for construction of the Keystone XL pipeline. An independent report from the Economic Policy Institute estimated that this rule could create between 28,000 and 158,000 jobs by 2015. That could be as many jobs as 26 Keystone pipelines would create. The Political Economy Research Institute at the University of Massachusetts found that EPA's Clean Air Act cross-State air pollution rule and the mercury rule would together create nearly 1.5 million jobs over 5 years. That is 250 Keystone pipelines.

Ms. McCarthy, the Clean Air Act is one of the reasons for tremendous growth in the U.S. environmental technologies industry, and has been estimated to support 1.6 million jobs over the past 40 years. Is that your understanding?

Ms. MCCARTHY. Yes, it is.

Mr. MARKEY. So assuming Keystone is able to create the 6,000 jobs State Department generously estimates it would, we would need 267 Keystone pipelines under that math to create the equivalent number of jobs as U.S. environmental technologies that have been created under the Clean Air Act, is that correct?

Ms. MCCARTHY. I will have to take your word for the math on this one.

Mr. MARKEY. But assuming that division is correct?

Ms. MCCARTHY. Yes.

Mr. MARKEY. Isn't it true that EPA's mercury rule will create 8,000 long-term utility jobs?

Ms. MCCARTHY. That is what our estimates project, yes.

Mr. MARKEY. Well, that again is more permanent jobs than the number of temporary construction jobs the State Department estimates the Keystone pipeline will create. So while the Republicans are crying crocodile tears over the 6,000 temporary jobs that the Keystone XL pipeline will create, they make us vote over and over and over again to kill tens of thousands of jobs that are created simply by ensuring that our air is clean to breathe.

This certainly would seem like a ridiculous comedy if the consequences weren't so serious. I can only wish when I rise and shine tomorrow morning this whole movie won't be repeated yet again here in this committee, because I like Bill Murray's version much better, how that movie turned out. I don't see a good ending to the way in which the Republicans want to deal with the environment and job creation in this country.

I yield back the balance of my time.

Mr. WHITFIELD. Thank you, Mr. Markey

At this time, I recognize the gentleman from Illinois, Mr. Shimkus, for 5 minutes.

Mr. SHIMKUS. Thank you, Mr. Chairman. Before Mr. Markey leaves, we have been debating pronunciations of bitumen and bitumen, so we did additional research, Mr. Markey, and if you go on the online Oxford Edition, unfortunately, we are both correct, because they will have a pronunciation of the words and I take the English version and you take the American. I have the old money version, you have the new money version.

Mr. MARKEY. You are taking the British version of how to speak it. You are so Southern Illinois, and I am taking the American version.

Mr. SHIMKUS. You know where the Industrial Revolution began, right? It was those old dirty coal packs in England that helped fuel their power.

Mr. MARKEY. And they came to America, they came to Boston. Ms. McCarthy and I, we took their language which is Irish, and we said no, let us use it correctly here. Let us put the——

Mr. SHIMKUS. I just wanted to put that on for record, for those who followed Keystone yesterday.

Mr. MARKEY. You said unfortunately we are both correct. That would be reconciliation, which is good.

Mr. SHIMKUS. Hard to believe it would happen here.

Mr. MARKEY. We hope that we can do the same thing with the EPA and the Clean Air Act, that we both——

Mr. SHIMKUS. All right, reclaiming my time.

Ms. McCarthy, thank you for coming. I do appreciate your time, and I do appreciate every time you appear. Even though it seems contentious, we have discussed and talked offline.

So a couple of questions. We do have concerns with this annualized impact analysis, 9.4 billion in 2015 and then we skipped to 2020 and say well that year, that annualized cost is going to be 8.6 billion, and then we skip to 2030 and you say then it is going to be 7.4 billion. You are testifying today that you cannot provide us with estimates for the intervening years, is that correct?

Ms. MCCARTHY. Yes, I am indicating that the way in which we do this is we compare an annualized cost very conservatively with the cost that would be the highest with the annualized benefits.

Mr. SHIMKUS. So I mean, I think we will have other folks on the second panel who say well, we can, and that is the problem. We are going to say—you are going to use these annualized numbers that industry will say it is just not in the ballpark.

Let me ask this question, and I will—how long past 2030 do you envision these annualized costs occurring?

Ms. MCCARTHY. Well we don't know. We can't project right now, and I certainly can't tell you how much lower they are going to go, nor can I tell you how much more increase in benefits will accrue through from this rule.

Mr. SHIMKUS. Let me then follow up, because again, with my friend Mr. Markey—you know, people from my district want me fighting for coal, and as the chairman of the recycling caucus, I take offense. We had a great bill moved through this committee to make sure we could recycle coal ash, which is an additional cost. This is one of the multitude of attacks on coal and electricity generation, Boiler MACT, Mercury MACT, coal ash, I mean, that is our problem.

So my folks send me here to fight for coal. My folks send me here to fight for low-cost power, because of jobs and incomes. There is—Atlantic Cities did an article, "What Happens to Small Town When Its Coal Plant Shuts Down?" The mayor of Eastlake was quoted as saying "It is a huge hit in terms of lost revenue for our town and school district."

In doing your analysis, did you consider what happens to small town America when they lose their coal-fired power plant? And we are losing three, based upon recent rules, in the State of Illinois.

Ms. MCCARTHY. I will tell you that the rule itself didn't project a significant amount of closures that were the result—as a result of——

Mr. SHIMKUS. But you can understand small town rural America, that is their only facility. Best wages, good benefits, good health care, what it does to the school system when that is no longer on the tax rolls, what it does to the local hospital when they no longer have a paying private-sector——

Ms. MCCARTHY. Yes.

Mr. SHIMKUS [continuing]. Industry. It kind of follows up to our next panel, we have a representative from the Navajo Nation who says this rule will be cataclysmic to the Navajo Nation. Do you consider these economic impacts in your consideration of the rule?

Ms. MCCARTHY. We certainly take a look and we are able to take a look nationally and regionally at what the impacts of the rule might be in terms of electricity capacity. We are also working really closely with local communities, with the Navajo in particular. I was there last week at the Navajo generating station. We are looking at these rules——

Mr. SHIMKUS. And if I can reclaim my time, I have 19 seconds. Their testimony will say you have not worked with them. So I would—we need to get a meeting of the minds.

And just to finalize, you know, Mr. Markey's tirade on the Keystone XL pipeline, remember, it is the plumbers and pipefitters who support the Keystone pipeline, Laborers International, the AFL–CIO, International Brotherhood of Teamsters, International Brotherhood of Electrical Workers, operating engineers, many who support me, I am a pro-labor, building construction trade guy, so they are barking up the wrong tree trying to stop the Keystone pipeline.

I yield back.

Mr. WHITFIELD. At this time, I recognize the gentleman from Michigan, Mr. Dingell, for 5 minutes of questions.

Mr. DINGELL. I thank you for your courtesy, and I commend you for this hearing.

Administrator McCarthy, first I would like to welcome you back to the subcommittee. I appreciate your willingness and patience to answer questions. I would also like to thank you for taking time last year to meet with two utilities from my home State of Michigan, DTE and CMS, and I am appreciative of the fact that you were able to take the time to listen to their concerns.

Administrator McCarthy, you may know I wrote a letter last December, along with Senators Levin and Stabenow to Administrator Jackson. We expressed our concern for sensible measures to reduce emissions of hazardous air pollutants in order to protect human health and the environment. However, we also pointed out that some utilities may not have enough time to comply with emissions standards. Can you inform us what steps EPA has taken to address that concern?

Ms. MCCARTHY. I can, Mr. Dingell, and thank you for your letter. We received a lot of comment concerning that timeline and the rule. As I indicated in my opening statement, we not only provided the 3 years that we are allowed to provide under the MATS rule for compliance, but we also directed States and provided guidance to them to be very forward leaning in terms of making available a fourth year for units that——

Mr. DINGELL. You actually have potential for 4 and perhaps for 5 years?

Ms. MCCARTHY. And we also developed an enforcement policy to utilize an Administrative Order that could provide a fifth year for reliability critical units.

Mr. DINGELL. Thank you, ma'am. Now in order for the utilities to request a one-year extension to comply with the new rule, what specific requirements or commitments will utilities have to meet in order to receive an extension? I won't object if you want to submit that to us for the record.

Ms. MCCARTHY. I am more than happy to do that.

Mr. DINGELL. Now I know that the final rule has not yet been published in the Federal Register, but have any utilities contacted you to discuss the process of requesting a one-year extension discussed in the final rule? In other words, could you submit for the record to us what the utilities will have to do to secure that extension?

Ms. MCCARTHY. We will.

Mr. DINGELL. Just submit that for the record, please.

Now, as utilities prepare to upgrade their larger facilities and meet the new rule, some of these facilities will have to be taken offline in order to install the new technologies. While these larger facilities are offline, utilities may have to depend on older facilities in order to meet the basic peak demand. These older facilities will not likely be upgraded to meet the new rules. Now here comes the rub. As utilities are going to go through this retrofitting process, can they apply for a waiver for the older facilities to operate beyond the 3 years to ensure reliability during the transitioning? Yes or no.

Ms. MCCARTHY. Yes.

Mr. DINGELL. Would you submit for the record how that would be done, please?

Ms. MCCARTHY. We will.

Mr. DINGELL. Now, Madam Administrator, I understand that there have been two instances where the Department of Energy required utilities to reactivate generation facilities in order to meet reliability requirements. These facilities were not in compliance with Clean Air requirements, and it is my understanding that they were subsequently fined by EPA. Do you believe that the new Mercury and Air Toxics Standards provide room and flexibility to ensure that reliability is not jeopardized?

Ms. MCCARTHY. We will work together, Mr. Dingell, and I will provide you information on the case that you referenced. I do not believe that EPA fined that facility, but there certainly is a concern that those issues raise and we will address those to you in written comments.

Mr. DINGELL. I thank you for that. I would also like to see sufficient attention given to that, if we could have a good answer to those questions in the record, and if you would submit that for the record, it would be much appreciated because there is a great deal of concern amongst the utilities on this particular matter.

Now, Madam Administrator, should this situation occur again, that is, what I have been referring to earlier, will the EPA explore ways to work with utilities so that the utilities are not fined?

Ms. MCCARTHY. We are exploring with them the issues that they are facing and how to face those challenges together right now. We are raising these issues. We are working with the regional transmission organizations, we are working with each of the States and with individual utilities right now to ensure that there is a pathway forward where we will absolutely be able to provide reliable, cost effective electricity and achieve compliance with these rules.

Mr. DINGELL. Madam Administrator, I note that you have a number of agencies, Federal, State, EPA, and also, you have to address the concerns of the Department of Energy, which has its reliability responsibilities. You had said—and this is comforting to me—that you are working with the utilities, but it appears to me to be very necessary that you should also be working, for example, with the Department of Energy, with the several State agencies, perhaps with the reliability councils, and others so that you can achieve the necessary purposes of avoiding fining utilities behaving in good faith but trying to serve a number of different masters.

Can EPA give us assurance that you will be working with these other agencies as well as the utilities to avoid this kind of situation?

Ms. MCCARTHY. I can provide that assurance, and the President directed the agencies to work together and we are doing that.

Mr. DINGELL. Thank you, Madam Administrator.

Mr. Chairman, you have been most courteous. I am 1 minute over time, and I thank you.

Mr. WHITFIELD. Thank you.

At this time, I recognize the gentleman from Texas, Dr. Burgess, for 5 minutes.

Mr. BURGESS. Thank you, Mr. Chairman, and thank Ms. McCarthy for being here again.

Could we talk for just a minute about the energy policy that is being followed by this administration? Of course, we got some clues 4 years ago when President Obama was running for president and he said so, if somebody wants to build a coal-fired power plant they can, it is just that we will bankrupt them. So could a new coal-fired power plant be built today that meets the new Utility MACT rule, or has the EPA effectively taken coal off the table for our future energy portfolio, consistent with what President Obama said when he was running for president?

Ms. MCCARTHY. Let me just say that we believe that you can not only construct a new coal facility that meets the new coal standards, but we believe there is an existing facility that already does achieve the toxic standards in this rule.

Mr. BURGESS. No surprise that not everyone agrees with that. We may hear some testimony in the second panel that provides some additional insight into that.

Let me ask you this. I come from a part of the country that does not produce coal. We do produce a fair amount of natural gas through a procedure known as hydraulic fracturing. Is the EPA planning further restrictions on the production of natural gas?

Ms. MCCARTHY. Are you asking are we looking at additional emissions rules relative to oil and gas? I am just trying to——

Mr. BURGESS. Correct, are there going to be further restrictions placed on the production of natural gas through hydraulic fracturing that the EPA is now contemplating?

Ms. MCCARTHY. Well, we—I can speak for the air program, and we are finalizing an oil and gas new source performance standard that does relate to oil and gas development that looks at emissions associated with that.

Mr. BURGESS. And when will that appear?

Ms. MCCARTHY. It is due to be finalized this spring.

Mr. BURGESS. Well is there—you just worry that—you take coal out of the equation, a lot of people feel nuclear no longer belongs in our portfolio—natural gas is under assault as well. Where do we get our energy? We heard testimony in this committee last session of Congress when the Waxman-Markey bill was being debated that without energy, life is cold, brutal, and short. I think that is still true. So where are we going to get our energy if we take all of these sources off the table?

Ms. MCCARTHY. I believe that the MATS rule that we are discussing today allows existing coal to continue to run. I believe it allows new coal to be sited and constructed. I believe that the rules we are contemplating on the oil and gas industry, on natural gas will continue to allow natural gas to be utilized. The only thing we are doing in this rule in particular is using available cost effective controls to minimize harmful emissions of toxic chemicals that are impacting American families. That does not mean that we are precluding any type of energy from being utilized or constructed.

Mr. BURGESS. But on the one hand, it seems like you are eliminating other sources of energy, driving electrical suppliers to natural gas and on the other hand, there are going to be new regulations that make this problematic as well, not just in your department, but also on the studies of groundwater. We want it to be safe, but at the same time, we know we have to have energy available.

You know, we have talked before and it doesn't take long in your testimony where you refer to asthmatics whose lives will be improved because of the things that you are doing. You didn't disappoint. It was in your third paragraph, prevent 100,000 heart and asthma attacks each year.

I just got to tell you, I do not believe that the EPA is serious about reducing asthma in this country because as someone who suffers from asthma, I can no longer buy an over-the-counter asthma inhaler as of January 1 to remove it. You said that the CFCs were not permitted because there is going to be a hole in the ozone, and as a consequence Primatene Mist, which I relied upon for years and years and years, is now gone. Many of us are inconsistent asthmatics, that is, we are not asthmatic all the time so we may move away from our maintenance medications, but then at 2 o'clock in the morning, something happens, mountain cedar, someone goes by on a horse and carriage, triggers our asthma and we are in trouble. And at 2 o'clock in the morning, it used to be you could go down to the all-night pharmacy and buy a Primatene inhaler. You can't do that anymore. The only option you have is to go to the hospital emergency room and spend $800 to $1,500 getting a breathing treatment. How is that enhancing the life of asthmatics in this country?

Ms. MCCARTHY. Mr. Burgess, as you know, there has been much review of the issue of Primatene Mist, not only at EPA but primarily at FDA in concert with many medical associations. The decision was made that the Primatene Mist did not—was available to be phased out because of concerns with the ozone layer without impacting the treatment that is medically available and that is useful for individuals——

Mr. BURGESS. It didn't work. It didn't work, and as a consequence, we cannot buy the leftover Primatene in the pharmacy any longer, and we are left to find much more expensive solutions to those problems that occur. This is something that could be fixed, and people frankly do not understand why it cannot be fixed. We had Margaret Hamburg in here from the FDA at the Health subcommittee the other day, and she said that it wasn't their problem, it was the EPA's problem.

Mr. WHITFIELD. The gentleman——

Mr. BURGESS. I am asking you, fix this problem. People want it——

Mr. WHITFIELD. The gentleman's time is expired.

Mr. BURGESS. Thank you, Mr. Chairman.

Mr. WHITFIELD. Recognize the gentleman from Illinois, Mr. Rush, for 5 minutes.

Mr. RUSH. Thank you, Mr. Chairman, and I do share in your concerns, and I think the problems need to be fixed. Asthma is a very, very—high incidents of asthma and asthma-related illnesses in my district, and so I want you to know, I empathize with and I share your concern.

But along those lines, Ms. McCarthy, I know that this has been kind of a protracting struggle that you have been engaged in here with us, and—but we are here today and I welcome you again, you know. I feel for you.

The second panel—there are witnesses on the second panel who will allege that the EPA has enslaved the health benefits of the air toxics rule. In particular, they argue that EPA has over-estimated the value of reducing emissions of deadly fine particles which are linked to asthma, stroke, heart attacks, and premature deaths.

Ms. McCarthy, do you have a response to these allegations, and could you share your responses?

Ms. MCCARTHY. Thank you. I would respond by saying that EPA did its best job working with congressional panels who did a peer-reviewed study of how we do our cost and benefits approach. There are clearly benefits associated with the reduction of toxic emissions of mercury, arsenic, cyanide. Many of those toxic emissions and those benefits cannot be specifically calculated because of data and methodology problems. It doesn't mean that mercury doesn't cause neurological challenges for our children. We calculate those as best we can. But we also identify that the control technologies that are going to be put in place as a result of this rule also bring benefits associated with reductions in particulate matter. We counted those reductions. We used the best available science, both the science that is being driven by peer review, by our guidance with our Office of Management and Budget. We used the exact, most transparent way of calculating those, and we included them in benefits.

There is no reason to deny the public the numbers associated with the full suite of public health benefits that are accrued as a result of this rule, just because the rule itself isn't targeting those reductions. It is coming with the rule itself, and that is what is driving significant public health benefits, as well as those benefits we just can't calculate that stem from reduction of toxic pollution that is impacting children and adults in this country.

Mr. RUSH. I think that should put to rest this fallacy that is being perpetuated, you know, at each one of these hearings, each one of your appearances that——

Ms. MCCARTHY. Mr. Chairman, these are all real benefits to real people. People should know about them and we are telling them about the benefits. Thank you.

Mr. RUSH. Thank you.

Last year in September, the committee and the full House passed the TRAIN Act that nullified the EPA's Mercury Air Standards or Air Toxics rules, requiring EPA to start from scratch. This prohibits the EPA from issuing a new rule for at least 2 years and bars implementation for at least 5 years. I can't—it doesn't make sense. I can't see the rhyme or the reason that this committee, this subcommittee never, ever had a hearing on the public health implications of nullifying these rules before passing the bill. So Ms. McCarthy, just for the record, how will nullifying the Mercury and Air Toxics rules affect public health?

Ms. MCCARTHY. The Mercury and Air Toxics rules are now 20 years overdue. If we are denied the ability to move this rule forward and implement it, you are denying significant public health improvements that Congress anticipated that EPA would produce for the American public. You are denying the ability for us to move forward with cost effective rules that will actually provide healthier families and healthier communities across the entire United States.

Mr. RUSH. Thank you. I yield back.

Mr. WHITFIELD. Thank you.

At this time, I recognize the gentleman from Texas, Mr. Barton, for 5 minutes.

Mr. BARTON. Mr. Chairman, could I defer at this point in time and let one of the other members who has been here ask questions? I do want to ask questions, but I still have some studying to do, so if you could go to somebody else who has sat here.

Mr. WHITFIELD. At this time, I recognize the gentleman from Texas, Mr. Olson, for 5 minutes.

Mr. OLSON. I thank the chairman, and good morning, Ms. McCarthy.

Ms. MCCARTHY. Good morning.

Mr. OLSON. Thanks for coming today, and the people I represent back home in Texas 22 have a lot of questions they want me to ask you this morning. It is going to center on costs for the Utility MACT bill and greater liability.

And just starting out, everyone in this room is entitled to their own opinion, but no one is entitled to their own facts, and that is why we are here today, ma'am, is the facts.

My home State is still experiencing severe drought conditions. We just went through the hottest August in record. My district, the Houston district, we were over 100 degrees the entire month of August. While most people here don't think that is unique, that is. We will go over 100 maybe 10 times a year normally. We have 100 percent humidity a lot longer than that, but experts are going to predict that this pattern is going to continue. And so reliability of the grid is particularly important. And ERCOT, the entity that regulates our grid in Texas, expects capacity shortages. If we are going to have rolling blackouts in the soaring heat, young and elderly lives are going to be in danger, the very people that this supposed rule is going to protect. These aren't projected lives saved, but real lives lost.

And the people in Texas 22, I have got to be honest with you, ma'am, are skeptical about the administration's motive. They remember then-candidate Obama's statements to a San Francisco editorial board that under his policies, energy prices will "necessarily skyrocket", basically making the cost of fossil fuels too expensive and making the other fuels, the alternative fuels, economically viable. I share their concerns.

EPA claims that the benefits of this bill are $90 billion, but the experts say the benefits to the mercury are much, much lower, $500,000 a year. In this chart here, just to focus on the mercury issue, as you can see on this chart, blood levels are significantly low exposure levels. Look at this. This is the World Health Organization up here, and there are 20 micrograms per liter. The European Food Safety Authority down here, U.S. Environmental Protection Agency down here. Obviously, we have got the lowest mercury standards in the entire world. And we are above the limits in blood mercury levels of women ages 16 to 49, 95th percentile from 1999 to 2000. President Bush takes office, we go below for the first time, 4.6 milligrams per liter, 4.4 in 2003–2004, 4.5 2005 to 2006, 3.8

2007 to 2008. So this chart shows that EPA—we are below EPA's own standards right here, and yet you are calling this thing the Mercury and Air Toxics Standards rule. It can't be mercury, looking at this chart.

So the question I have for you, and this is what my people back home want me to ask, are these numbers being used, the mercury being used, to get it to the miniscule mercury exposure to actually get reductions in particulate matter? Yes or no. Again, are you using mercury to get another target, particulate matter?

Ms. MCCARTHY. This standard is about reducing toxic pollution. It has the co-benefit of reducing particulate matter.

Mr. OLSON. Total benefit. Ma'am, you are below the levels right now, and again, people are skeptical. We are over 95 percent. This is from, again—we will get you all the information.

Ms. MCCARTHY. I am sorry, I don't know what—are those numbers reflective of what, the blood level mercury?

Mr. OLSON. Blood level mercury, yes, ma'am, the Y axis going up is the blood level mercury, and that is micrograms per liter, and then the level, the number here on just the—what has decreased, what has happened over a number of years. As you can see, this is the World Health Organization, European Food Safety Authority, U.S. Environmental Protection Agency, your agency. We were above, EPA only, 1999 to 2000, and then since that point forward, from 2001 to 2008, we have had significant decreases. We have been below EPA's own levels. So I am very skeptical about this thing being called some sort of mercury bill, and not being used to get into particulate matter. But I have got to move on, ma'am, I have got a lot more questions from my people.

The other thing I have got, in questions from our chairman here, he talked about jobs gained and jobs lost. You kept just talking about the jobs gained, jobs gained, jobs gained. That is only half the equation. I mean, we need to know about how many jobs are lost as well, because it is the net that is important. Not just the jobs gained, but the net of jobs gained versus jobs lost. I have got a bill, H.R. 1341, the Establishing Public Accountability Act, that is going to require EPA to do a study of the job impact overall, jobs they have lost, jobs gained, jobs sent overseas, and to do it before the public comment period so the public has the ability to determine whether or not they will get some of that information. Would you support that bill?

Ms. MCCARTHY. Our job numbers are net, so I would be happy to have any additional information and participate.

Mr. OLSON. OK, thank you, because you just kept talking about jobs gained, so thank you very much. I appreciate that.

Mr. WHITFIELD. Thank you very much, Mr. Olson.

At this time, I recognize the gentlelady from Florida, Ms. Castor, for 5 minutes.

Ms. CASTOR. Thank you, Mr. Chairman, and good morning, Administrator McCarthy.

Ms. MCCARTHY. Good morning.

Ms. CASTOR. And really to everyone that values clean air across America, I want to thank you for your perseverance, because after all, it has been 20 years—21 years since the passage of the Clean Air Act amendments, and we finally have a proposed air toxics standard that will regulate mercury and other toxic air pollutants that is based on the best science and technology.

These substances are some of the most toxic, carcinogenic, and dangerous pollutants. Mercury is known to cause devastating damage to the brain. Mercury is of particular concern to women of childbearing age, infants, and children, because mercury exposure damages the nervous system, which can impair children's ability to think and learn.

So I guess it is no surprise that a lot of public health groups see this as a great victory, like the American Lung Association, the Academy—American Academy of Pediatrics, but I think people across the country would also be interested in knowing that religious organizations, sportsman's organizations like hunters and anglers, also support the rule, but they may be particularly surprised to understand how many utilities support this rule. Thirty-six energy businesses and business associations, including Calpine, Constellation Energy, Entergy, Exelon, NRG Systems, Pacific Gas and Electric, and Public Service Enterprise Group have expressed their support. And in fact, in my home State of Florida, a number of utilities that operate coal-fired power plants have expressed their commitment to coming into compliance. I think that is very telling. See, many of those utilities over the years have invested in the technology. They have continued to make good profits, but part of that has been being responsible businesses. They have invested in technology to reduce their emissions. The technology is in widespread use all across the country, but the dirtiest power plants have put off installing pollution controls for decades.

So hopefully this is going to spur everyone to come up to the best science, use the best technology. It will create jobs, but Madam Administrator, I understand that there will be some that are going to be affected. They have kind of stared in the face of the evolution of technology and haven't gone down that road, and now they are going to have to. But explain that compliance period. How long will businesses, utilities, have to come into compliance?

Ms. MCCARTHY. We are generally talking about the ability for companies to have a 3- to 4-year window, which brings us to the spring of 2016. Units that are necessary for reliability purposes will have a defined pathway that they can come to the agency and get a fifth year added on to that, which brings us to 2017. We do not even anticipate that most will need a 4-year window, never mind a fifth year, but we are fully prepared to address those issues to ensure that we meet the President's clear directive that we keep the lights on while we address issues that are so critical to the health of American families related to toxic air pollution.

Ms. CASTOR. I mean, 3 to 4 to 5 years? Some, I bet, have argued that that is too lenient. What is that compliance timeframe of 3 to 4 to 5 years based upon? What study went into that time period?

Ms. MCCARTHY. Well, it is a statutory requirement that we look at what kinds of technologies are in the marketplace that are cost effective and available, and then we give sufficient time under the statute to be able to allow those to be constructed. We have looked at in detail with the Department of Energy and others have looked at this as to whether it is sufficient time. We know the types of control technologies that will be required. We understand the time it takes to construct those, to engineer them, to put them in place, and we believe that the timeline that is being provided with this rule and with the other pathways available to us will be more than sufficient to address the challenges associated with compliance and keeping the lights on.

Ms. CASTOR. Thank you very much. I yield back.

Mr. WHITFIELD. Thank you.

At this time, I recognize the gentleman from West Virginia, Mr. McKinley, for 5 minutes.

Mr. MCKINLEY. Thank you, Mr. Chairman.

Unfortunately, my colleague from Massachusetts left, and he made an interesting analogy about Groundhog Day, but unfortunately he missed the point. Groundhog Day, by repeating the message, the actor of the story got the message finally and he became a better person. That is what we are trying to do here. We are going to repeat it and repeat and repeat it until America understands that these rules—what effect these rules are going to have, because what we have said to you and your predecessors and others is that just because you can doesn't mean you should. It is a business lesson. And for those of us that have come from the business community, we understand just because you can doesn't mean you should, because of your consequences of what you do.

So for example, powerhouses all across America are shutting down because of the onslaught of EPA rules. If I could just show you, here is a visual for people to understand, here are the plants that are going to be closing across America, because of the short timeframe and the rules are simply too severe to comply.

Just this morning a company announced three more powerhouses are going to close, in addition to the six they already—hundreds of jobs are going to be lost, health care benefits. Nationally, you can see the drama that will play out.

But curiously, last December in your own testimony and then today again, you said that you only think the loss of gigawatts will only be in the neighborhood of 4.7 gigawatts. But yet, every other group in America that has studied this has said that you are grossly misleading the American public and concealing information apparently from Congress, because your number is down here, while all the others are up in a much higher level. I think there is a real question about your capability of doing your own mathematics. Some have said it could be as high as 75 gigawatts, not 4.7. Just in the last 48 hours, we have had one power company reduce 3.3 gigawatts. Earlier this year, AEP came out and said 6 gigawatts. Between the two of them are 10. That is twice the number that you suggested. It is so blatantly false what you are representing to us in this. What you are doing is this war on coal. It is not just a war on coal in the industry, but just a war on the miners and the families and the communities. You are devastating them with these kinds of threats.

But more importantly, what you have to understand, and we have heard it throughout this whole thing, has been the increased cost of electricity. You say 3 percent. Utility companies are saying 13 to 15 percent. Again, what are we supposed to believe? Your numbers that you keep giving us are flawed, and they are proven out time and time again as being unreliable. Just in the last 10 years, half of the American families have seen their energy costs double, and you are saying it is only going to increase 3 percent?

Now, I wish what you would do is the EPA—all of you, would take some of your resources and look at where possibly the real culprit is, that cost, and bear that in mind. All the quotes that we keep hearing coming from the other side of the aisle talk about asthma, heart, but no one differentiates between outdoor air and indoor air quality. You look surprised. Have you considered indoor air quality? Do you understand that 90 percent of our hours that we are on this planet, 90 percent of our day is spent in a building? Only 10 percent in that outdoor air quality, 90 percent—60 percent of it is in our homes. We have 56 million children and families that go into a school building every day and deal with bad air quality. Indoor air quality is one of the biggest issues we should be addressing, and when we talk about the asthma conditions that occur, why don't we look at the fact that historically, with all the drops in all of the contaminants that are occurring across America, asthma is increasing. All of this, all this money that is being spent by the powerhouses to reduce a particular matter, whether it is NOX, SOX, or whatever is going to be in the air to contribute to that, has not been offset the fact that asthma has actually increased across America. I would like to see you spend some time to do the research to find out what that is about, instead of spending—we have 700 powerhouses in America that need to be upgraded, and for you to say $9.4 billion annually is just patently preposterous. Everyone in this room that has any sense of engineering and facts knows that you can't do it for that amount of time.

Unfortunately, my time has run out, but—so I didn't get a chance, but I hope that—I hope you can respond finally to some questions, issues that we have raised, because I have asked you for questions in the past—for answers—and you have not gotten back to me. Thank you.

Mr. WHITFIELD. At this time, I would like to recognize the gentleman from California, Mr. Waxman, for 5 minutes.

Mr. WAXMAN. Thank you, Mr. Chairman.

The idea that EPA requirements to clean up air pollution will hurt the economy and kill jobs is now Republican economic dogma, but these are the same doom and gloom scenarios we have heard from industry since the Clean Air Act was first adopted in 1970, and none of them have come true. The truth is, it takes workers to install new pollution controls and construct cleaner power plants. That is why groups representing over 125,000 U.S. businesses support the air toxics standards.

Mr. Chairman, I would like to make a unanimous consent request to insert this letter of support into the record.

Mr. WHITFIELD. Without objection.

[The information follows:]

December 21, 2011

President Barack Obama
The White House
1600 Pennsylvania Ave NW
Washington, DC 20005

Dear President Obama,

As leaders in the business community collectively representing over 125,000 businesses from across the U.S., we wish to thank you for sticking to strong standards and a clear compliance timeframe for the implementation of EPA's proposed Mercury and Air Toxics Standards (MATS) for power plants.

We represent a diverse set of business interests ranging in size from Fortune 500 companies to small businesses that support timely implementation of EPA's clean air rules. We believe that failure to implement MATS would create significant uncertainty for the business community and delay investment. Companies that make up the diverse pollution control industry's supply chain, consisting of businesses involved in engineering, design, construction, maintenance, transportation, and manufacturing of air pollution control systems and technologies stand ready to supply their services but needed a final rule with a clear compliance schedule in order to begin hiring more workers to meet expected demand. In addition, MATS will yield up to $90 billion in annual air quality improvements for human health alone, leading to a healthier and more productive workforce and reducing pollution-related health care costs for businesses across the economy.

Our experience has shown that the Clean Air Act yields substantial benefits to the economy and to businesses, and that these benefits consistently outweigh the costs of pollution reductions. We believe the finalization of MATS is a meaningful step towards economic recovery and growth.

On behalf of the signatories below, we thank you for reducing the burden of air pollution on businesses by supporting the timely finalization and implementation of MATS. We hope that you will continue to support Clean Air Act pollution standards and recognize the benefits they provide to the business community.

Sincerely,

American Businesses for Clean Energy
American Sustainable Business Council
Ceres
Environmental Entrepreneurs

Main Street Alliance
Small Business Majority

cc: Lisa Jackson, Administrator, Environmental Protection Agency
Cass R. Sunstein, Administrator, Office of Information and Regulatory Affairs

American Businesses for Clean Energy (ABCE) with over 5,200 supporters nationwide is an initiative to demonstrate large and small business support for EPA's clean air rules and Congressional enactment of clean energy and climate legislation. www.americanbusinessesforcleanenergy.org

The American Sustainable Business Council (ASBC) is a growing coalition of business networks and businesses committed to advancing a new vision, framework and policies that support a vibrant, equitable and sustainable economy. The Council brings together the business perspective, experience and political will and strength to stimulate our economy, benefit our communities, and preserve our environment. Today, the organizations that have joined in this partnership represent over 100,000 businesses and more than 200,000 entrepreneurs, owners, executives, investors and business professionals. www.asbcouncil.org

Ceres is a national coalition of major investors, businesses and public interest organizations working with companies to address sustainability challenges such as climate change and water scarcity. www.ceres.org

Environmental Entrepreneurs (E2) is the independent business voice for the environment. E2 is a national community of individual business leaders who advocate for good environmental policy while building economic prosperity. E2 takes a reasoned, economically sound approach to environmental issues by relying on fact-based policy expertise. As the independent business voice in the debate, E2 is effective and delivers results at both the state and national levels through its bipartisan efforts. www.e2.org

The Main Street Alliance is a national network of state-based small business coalitions. The Alliance creates opportunities for small business owners to speak for ourselves, advancing public policies that are good for our businesses, our employees, and the communities we serve. www.mainstreetalliance.org

Small Business Majority is a national nonpartisan small business advocacy organization founded and run by small business owners and focused on solving the biggest problems facing small businesses today. We speak for the nearly 28 million Americans who are self-employed or own businesses of up to 100 employees. Our organization sponsors scientific research that guides us to understand and advocate on behalf of the interests of small businesses across the country. www.smallbusinessmajority.org

Mr. WAXMAN. The—during a recent call with investors and discussing the effects of the Mercury and Air Toxics rule, American Electric Power CEO Michael Morris even stated "Once you put capital money to work, jobs are created." EPA has come to the same conclusion. The Agency estimates that compliance with the new air toxics standards will be a net job creator, not a job killer.

Ms. McCarthy, how many jobs could be created as power companies comply with the new standards?

Ms. MCCARTHY. We estimate that as many as 46,000 jobs will be created on a temporary basis to assist with the construction and installation, and 8,000 permanent jobs will be created.

Mr. WAXMAN. Can you explain how complying with these new air toxics standards will create jobs?

Ms. MCCARTHY. Yes, because the standards will require, in particular, some of the small inefficient coal-fired facilities to make a choice between continuing to run and investing. There are a number of facilities that will need to install control equipment. That will mean engineering jobs, that will mean construction jobs. We estimate that there will be investments made, as we indicated, up to 9.6 million in 2016 alone. That means that we will have construction jobs, and in the long-term, we will have permanent jobs at those facilities to manage that control equipment, and it, of course, will allow us significant health improvements that will really be of benefit to American families in terms of lower health care costs, and improved health of particularly our children.

Mr. WAXMAN. Thank you. As economist Josh Bivens will point out in the second panel, these regulations are expected to have particularly positive effects under current economic conditions. American industry isn't short of cash, it is short of demand for its products, and spending capital to hire workers and buy equipment injects desperately needed cash into the economy, stimulating demand. The record bears this out. Over the last 40 years, the economy has continued to grow as EPA has set new standards to cut air pollution from every industrial sector. Can you discuss some other examples of how implementing the Clean Air Act has created jobs in engineering, manufacturing, construction, and other highly skilled areas?

Ms. MCCARTHY. I certainly can, and there have been studies done of this which we are happy to provide to the committee.

But you look at everything from our car rules, including the ones that we are contemplating now that are leading to new cost effective cars available to people that save them money. We are looking at the installation of catalytic converters that actually significantly helped to reduce emissions from cars that led to the growth of industries in the United States that are now exporting to other countries. There is great documentation about our rules initiating expertise in innovation and technology improvement that is bringing world-class industries developing in the United States that then export to other countries. Control technologies in the air pollution sector are, for the most part, have been designed in the United States, manufactured in the United States. A lot of that has been driven by the requirements under the Clean Air Act.

Mr. WAXMAN. In addition to the overblown rhetoric about the impact of this rule on jobs, some have warned that this rule will cause electricity prices to skyrocket. EPA estimates that the rule will cause electricity prices to increase by just 3 percent on average by 2015, falling to 2 percent by 2020, and less than 1 percent by 2030. Can you put this 3 percent increase in context for us?

Ms. MCCARTHY. I can. It is well within the normal fluctuations that we have seen, and it is—the increase that we would estimate as a result of this rule is less than what folks would have paid in 2009 for electricity. It translates into about $3 per household per month.

Mr. WAXMAN. Thank you, Mr. Chairman.

Mr. WHITFIELD. Thank you.

At this time, I recognize the gentleman from Kansas, Mr. Pompeo, for 5 minutes.

Mr. POMPEO. Thank you, Mr. Chairman. Thank you, Ms. McCarthy, for being here today.

Do any existing units currently meet the new unit standards?

Ms. MCCARTHY. One.

Mr. POMPEO. One? What plant is that?

Ms. MCCARTHY. It is a plant in New Jersey. I think it is called Logan.

Mr. POMPEO. Is this Logan 1? So there is a single—of all the plants in the United States today, there is a single existing plant that meets these new requirements. Did I ask the question correctly to get the answer I got, ma'am?

Ms. MCCARTHY. Let me just indicate that we don't have all the information on all the plants in terms of whether or not they would comply. We are aware of one plant that I indicated that would meet this new——

Mr. POMPEO. So to the best of your knowledge with all the data that you have there, it is single plant that you are aware of that currently would comply with the new rule——

Ms. MCCARTHY. That we have data to verify, that is correct.

Mr. POMPEO. Great, I appreciate that. That is not very many. That is a far cry from what you have described as a process that can be accomplished in 3 to 5 years.

Ms. MCCARTHY. Well, the good news is for the existing plants and those standards, there are many dozens and dozens actually that will comply out of the gate.

Mr. POMPEO. Sure, I understand. In Kansas, we have got a plant we have been trying to build that has an existing air permit, it has been granted the permit, but because it was unable to break ground to begin construction, it is now going to be trapped under the new regulatory regime. Your rule as issued, I understand, made no exception for plants that already had existing permits granted, but because the Sierra Club and other folks took them to task for years, they were unable to proceed. Am I—have I got that correct as well?

Ms. MCCARTHY. I would be happy to look into it in detail, but generally, if you are constructing a new facility and you haven't broken ground, you are obligated to meet new source facility standards.

Mr. POMPEO. Right, that is their understanding as well, so—we talked—Mr. Waxman asked you a question about cost. Testimony today—and I have heard from folks back in the district about increasing costs of a penny a kilowatt hour, 3 cents a kilowatt hour. You talked about 3 percent as if it was nothing. I will tell you that when I was in business, we tried to take costs out everywhere. We had to require—when your energy costs go up by any amount, it enormously impacts your business and causes you to consider seriously about whether to continue to manufacture or produce chemicals here in the United States.

Did you consider the economic impacts to all of those businesses that will be affected by the cost increase for electricity when you promulgated the rules?

Ms. MCCARTHY. We did, to the extent that methodology allows, look at the cascading impact on other sectors, yes. And that impact was negligible.

Mr. POMPEO. Do you think that there will be new coal-fired power plants built in the United States following the implementation of this rule?

Ms. MCCARTHY. Actually, I don't make those predictions, so I would hesitate to do that based on my personal knowledge.

Mr. POMPEO. If there are no new coal-fired power plants built in America following this rule, would you be willing to at least consider the possibility that it was a direct result of this rule, that no such plants were ever built?

Ms. MCCARTHY. Well actually, our analysis did take a look at whether or not the MATS rule, in and of itself, would change the dynamic in terms of decisions about building new coal, and we do not believe that it will.

Mr. POMPEO. Mr. McKinley showed you some data that refuted your assessment that only 4.7 gigawatts of energy will be lost as a result of this. Do you think that data is just wrong? We have already got FirstEnergy's announcement. What is it about the data that Mr. McKinley presented you that you think causes that to be at such a wide variance from your very low prediction about the impact of the rule on retiring facilities?

Ms. MCCARTHY. I think that we have to acknowledge that there is a transition in the energy world. We have to acknowledge that low natural gas prices is causing a transition, and when these issues come up, and I am sure they will consistently come up, you have to take a look at it and see what is actually happening. Whether it is the MATS rule or it is an overall business decision, that is reflective of that transition, and we could walk through what happened with FirstEnergy, but it appears to us on looking at this that FirstEnergy is making a business decision. And what we are attempting to do is work with the RTOs, with the energy world, to understand these dynamics so that we can be informed by this and ensure that the MATS rule can be complied with, but it is not changing the direction in which the industry is heading.

Mr. POMPEO. I will tell you that FirstEnergy disagrees with you. I mean, their public statements, the folks who know the business best tell us that you are wrong about that, so their assessment is very different. So while you said you can't predict about what someone will do about a coal plant, apparently you can predict inside of a company's own business why it is making their own business decision better than the leaders of that business.

Ms. McCARTHY. Well, the units that they have announced that they are closing, they are closing now, 3 or 4 years in advance of being required to do it under the rule, and they are also an average of 53 years old.

Mr. POMPEO. I have got one last question. The new coal-fired power plants, have you talked to any of the contractors about whether their permit to issue—they are prepared to issue certifications saying that they can meet these new rules? That is what a new—a company needs. If they are going to build a plant, they have got to get financing. They need the contractors to confirm that, in fact, when it is built it will be in compliance. Have you talked to any of the contractors who have assured you that they can provide that guarantee?

Ms. McCARTHY. I have not, but clearly, we expect that there will be concerns raised about many aspects of these rules, and we will take a look at it if people submit data and have concerns.

Mr. POMPEO. Thank you. Thank you, Mr. Chairman.

Mr. WHITFIELD. At this time, I would like to recognize the gentleman from Texas, Mr. Green, for 5 minutes.

Mr. GREEN. Thank you, Mr. Chairman. Ms. McCarthy, welcome back. It is good to see you again.

Ms. McCARTHY. You, too.

Mr. GREEN. I want to start like my colleague, Congressman Olson, we share East and Southeast Harris County together, and we are concerned about the reliability issues.

Last year, Texas suffered two major reliability problems, and we actually experienced rolling blackouts throughout the State. Since that time, EPA has issued the Cross State Air Pollution rule, which is something that our utilities had not anticipated having to comply with, and now the Utility MACT rule on top of that. The North American Reliability Corporation recently looked at the reserve margins in 18 regions covering the 48 mainland U.S. States, and found that two regions, ERCOT in Texas, the Texas grid, and New England would experience margin—planning margins below the NERC reference level of 15 percent in 2015. According to the Congressional Research Service, the data suggests that ERCOT may experience reliability problems, but the Utility MACT would play a minor role. Of course, industry has different conclusions.

Did you or EPA work with our regional grid, ERCOT, during the rulemaking process on the reliability issue, and if so, what were their concerns and how were they addressed?

Ms. McCARTHY. Actually, we did and we continue to work with them. I think I would just point out that I believe the study that you identified was on the basis of the proposed rule, and because of the comments that we received, we made significant adjustments in that rule because of the data we received. Recent analysis does indicate, we believe, that the MATS rule will not impact resource capacity in any region. So I think the issues that were raised for ERCOT and the New England States are no longer considered in the same framework, because of the changes that we made.

Mr. GREEN. Does ERCOT agree with you on that?

Ms. McCARTHY. We actually had them on a phone call last week with a number of the RTOs. We are working hand in hand with them. I do not know exactly what their comments might be on the final rule, but if they have concerns, we are certainly open and we will be working with them.

Mr. GREEN. OK. One of my concerns is that if we—because of the coal plants and in central Texas and in east Texas, if those are required to shut down, I know some companies are bringing natural gas facilities out of mothballs, but they are having—going through the permitting process. Is there any way that EPA could look at some of those—some of them are in Harris County, in fact, in Congressman Olson and I's district—to look at bringing those back on in time? Hopefully we won't have 100 degree temperatures for, you know, 200 days or whatever it was last year, but is there an effort to make sure, whether it be ERCOT or even New England, that there are some additional power that will be coming online? And like I said, we have no shortage of natural gases, we know, in our country, but the permitting process may be longer through EPA to get those plants back up, those mothballed——

Ms. MCCARTHY. We will be working with those, Congressman. One of the things that I indicated is that we have developed an enforcement policy that would utilize and Administrative Order to allow up to 5 years for those types of issues to be addressed. But we will address those issues and we are working to identify them now so that there is more than sufficient time to look at what other generation will be constructed and how to address these issues.

Mr. GREEN. I have a number of questions, Mr. Chairman. I would like to submit them in writing, but let me get to another one.

In response to the stakeholder comments EPA received and operational concerns related to the magnitude in facilities the retrofit required by the standard, you are now providing sources the option to use more flexible facility-wide averaging approach, as long as it provides the equivalent reduction in mercury, for example. Can you elaborate on this, and if the facility-wide averaging program is something that has been pushed in the past, especially during the cap and trade debate, but would have often—would we hear often push back from EPA on looking at a system instead of per unit?

Ms. MCCARTHY. Actually, we proposed an averaging system at the facility, not across facilities, that could be utilized under the rule. What we did in the final rule is to allow that averaging to be a little longer period of time with a little tighter standard to provide more flexibility to those facilities. We believe it is consistent with the law. It is not trading among facilities or within regions that would result in different exposure patents for communities. So we believe it is consistent and it is good under the law, and that it will provide opportunities for very cost effective methods to achieve compliance with the rule.

Mr. GREEN. Mr. Chairman, I know I am out of time, and I just hope we will invite Ms. McCarthy to come enjoy our hospitality more often, because obviously we have a lot of questions that would, you know, I think it would help with Members of Congress on both sides of the aisle. So I thank you for you time.

Mr. WHITFIELD. And I am sure that she would like to come back more often, too.

At this time, I recognize the gentleman from Texas, Mr. Barton, for 5 minutes.

Mr. BARTON. Thank you, and I appreciate the courtesy of being allowed to defer initially so that I could become somewhat better prepared.

It is obvious that everybody in this room wants the best health environment we possibly can here in the United States. It is also, I think, a given that we want the best economic opportunity for people here in the United States. You are in an unenviable position of having to make decisions that, to some extent, trade off between those two noteworthy goals. I have really tried to understand this MACT rule, and I have really tried to look at the justification for it and tried to be able to substantiate that, and I just can't do it. I want to talk about health benefits briefly, and then I want to talk about costs.

In your—not your rule, but the EPA rule, this is the statistical report that accompanies the rule. It was put out in December. It is, gosh, who knows, 500 pages long. On Table E5, it talks about the reduction in ES3, estimated reduction of incidents of adverse health effects of the Mercury and Air Toxics Standard at a 95 percent confidence level. And basically, it says that 99.98 percent of the total benefits are going to be because of reductions in PM2.5, I think, that only .02 percent of the total benefits are with reductions in mercury. And yet, all the press is about mercury reduction. Isn't it true that you get almost no health benefit from the reduction—the new standards for mercury reduction, according to your own statistical analysis?

Ms. MCCARTHY. I do not believe that that is an accurate statement. What I will——

Mr. BARTON. That is what you say.

Ms. MCCARTHY. No, we actually identify the benefits that we can count. We certainly know the toxic impacts associated with mercury. We know that other toxins——

Mr. BARTON. I stipulate that mercury is toxic.

Ms. MCCARTHY [continuing]. Cause cancer, we are just not able to quantify those sufficiently because of data, resource methodology.

Mr. BARTON. When you talk in your—I don't know if you talked in your testimony, but you gave us in an answer to a question, you just said that—you used the phrase "real people."

Ms. MCCARTHY. Yes.

Mr. BARTON. "Real people." Is there a verified incidence of a real person in the United States either dying or being hospitalized because of mercury poisoning that results from a power plant emission?

Ms. MCCARTHY. I don't think I can address that specificity.

Mr. BARTON. You just talked about "real people," OK, I am asking you a straight question——

Ms. MCCARTHY. When we look at it on——

Mr. BARTON [continuing]. About "real people."

Ms. MCCARTHY [continuing]. Populations, I can't name an individual——

Mr. BARTON. Well, you can't name it because it doesn't exist.

Ms. MCCARTHY. Well, I can tell you that power plants are the single largest source of mercury emissions. I can tell you that that mercury enters into the food chain. I can tell you that——

Mr. BARTON. If you cannot tell me that somebody has gotten sick and died and gone to the hospital in the United States because of exposure to mercury from a power plant smokestack. You can't do it.

Now, let me read you something. This is from your report. This isn't me making it up. Down in the sub-footnotes of this table ES3, and this is your table—not you personally, but the EPA's table. "The negative estimates for certain endpoints are the result of the weak statistical power of the study used to calculate the health impacts and do not suggest that increases in air pollution exposure result in decreased health impacts." The weak statistical power of the study. Now, if you read this, these tables, and they have an estimated midpoint and then they have—on the downside and on the upside, and it turns out that they are all over the map. But the most negative impact, when you go through all of these, non-fatal heart attacks, hospital admissions, respiratory admissions, cardiovascular, emergency room, acute bronchitis, lower respiratory, upper respiratory, asthma exacerbation, it turns out that most of the impact is minor restricted activity days. Minor restricted activity days. From 2.5 million to 3.7 million in the eastern United States from 99,000 to 150,000 in the western United States, and from 2.6 million to 3.8 million nationwide. Minor restricted activity days.

Now, minor restricted activity days is going to cost them probably—in your own numbers at least $10 billion a year for 10 years, but you estimate even in the out years it is about $7 billion a year. That is going to cost real jobs and real negative economic impact, and your own tables don't back it up.

Mr. WHITFIELD. Thank you, Mr. Barton.

At this time, I recognize the gentleman from Pennsylvania, Mr. Doyle, for 5 minutes.

Mr. DOYLE. Well, that is quite a hard act to follow.

Mr. Chairman, thank you for putting the hearing together today and Ms. McCarthy, thanks for your testimony.

Mr. Chairman, we are here today to have another hearing on EPA's Utility MACT rule that was finalized in December of last year, and it seems to me that one thing that is often missing from the conversation is that these rules are finally being implemented after years and years of delay, so we shouldn't sit here and pretend like this has just sprung up on our utility and manufacturing sectors in the last year. In fact, EPA has been tasked with regulating mercury since the passage of the 1990 Clean Air Act, and efforts to issue a mercury rule that treated mercury as non-hazardous were thrown out by the courts and now after 24 years, we are finally seeing a rule from the EPA that will regulate mercury and other toxins. And yet, we sit here trying to sort through these claims that, in fact, 24 years wasn't long enough for the power sector to prepare, and a potential 5 additional years of compliance time provided by the rule, totaling a full 29 years since the power sector knew controlling mercury would be required. We are saying that that is simply too onerous.

The fact is, the time has come and the time is now, so let us see what we can do to make sure that the rule has the least negative impact possible on those people who matter the most, American consumers.

Administrator McCarthy, in your written testimony, you tell us that though the rule will cause the retirement of some older coal plants, you don't expect that any of these retirements will affect the capacity reserve margins in any region of the country. Is that correct?

Ms. MCCARTHY. That is correct.

Mr. DOYLE. Can you tell us why that is?

Ms. MCCARTHY. Because the estimated retirements are basically primarily small coal-fired facilities that are highly inefficient and fairly non-competitive. We believe that this 4.7 percent is less than 1 percent of the capacity of generation across the U.S., and we have analyses from a resource capacity perspective, and we believe that the uneconomic units that will decide not to continue to operate, because they don't want to invest in modern pollution control equipment will be replaced by new capacity, cleaner capacity, and there is sufficient capacity in the system to be able to allow this transition to happen over the next 3 to 4 to 5 years.

Mr. DOYLE. Now, can you tell us, do you expect capacity reserve prices to increase in power markets where there will be or have been retirements?

Ms. MCCARTHY. That could very well be the case. We are seeing at least claim of that, but I want to indicate that the increase in capacity reserve market prices are only one factor that impact the retail cost of electricity. We actually calculated where we thought that capacity increase might happen. That was factored into our estimate that retail prices are only likely to, at its maximum, average to 3 percent across the U.S. to increase. And again, that needs to balance against the American families being able to accrue the benefits, which are 9 to 1, against the costs. The benefits associated with lower health costs, being able to make it to work, being able to send your kids to school, that result from the health benefits associated with this rule.

Mr. DOYLE. So you are saying that those potential increases were included in EPA's assessment of regional cost impacts?

Ms. MCCARTHY. That is correct.

Mr. DOYLE. That was part of your assessment?

Ms. MCCARTHY. Retail cost impacts, that is correct.

Mr. DOYLE. OK. Thank you, Mr. Chairman. That is all I have.

Mr. WHITFIELD. At this time, I recognize the gentleman from Virginia, Mr. Griffith, for 5 minutes.

Mr. GRIFFITH. Hi, thanks for being here, and I am going to ask you for some yes or no answers. If you can't do that, just submit them to me later because I just have a little bit of time allotted to me.

Isn't it correct that the vast majority of mercury emissions in our air come from natural sources, such as volcanoes and forest fires, or from foreign sources?

Second, isn't it also correct that the EPA's proposed rule cites the estimates of global mercury emissions that range from 7,300 to 8,300 tons per year and between 50 and 70 percent of that is from natural sources, less than 50 percent of which would be from manmade sources? Yes or no.

Ms. McCARTHY. I will provide you——

Mr. GRIFFITH. You will provide me with an answer? I appreciate that.

It is also—seems that the EPA has published that the mercury coming from U.S. power plants of about 29 tons per year under this proposed rule, and isn't it true that that is about 1/3 of a percent of the total global mercury air emissions? You will give me an answer later?

Ms. McCARTHY. And I will, yes.

Mr. GRIFFITH. And I appreciate that.

And I question, as others have, how you can estimate and then build from that estimate other projections of what is going to happen to the coal-fired power plants when FirstEnergy alone has closed or has eliminated 3.3 of your 4.7 gigawatts of power alone, that doesn't count the other folks. And here is the concern that I have. AEP estimated in a meeting that I was in earlier this year that with the new rules, they were going to have to expend money that—to clean up another 12 percent of the air, and there is no question that that is a good thing to clean up, but for the consumers and the AEP footprint in my area of Virginia would be—they would pay an additional 10 to 15 percent.

I asked Lisa Jackson earlier this year and she didn't have an answer for me, and if you have got one, please submit it later. What is the impact—when I have got a district where the median household income is $36,000 a year, you raise the electric costs, what is the health impact on my constituents when they can't afford to heat their homes, and doesn't that have a negative impact? And I don't believe that was considered in your estimates of the health benefits, and so I would ask that you submit that to me as well. And I would submit to you also that having people out of work also affects their health. I think every statistic shows that, and I pick up Mr. McKinley's chart and he showed you the coal power plants that are closing down, and we have got a dot right here. That is the same spot in a small county that Boiler MACT might very well put 700 jobs out of business at. So we are double whammying with different EPA rules the rural communities of this country. And I would have to ask you, do you know if the new Dominion plant being built in Virginia City area is going to meet the new standards that you all have come out with? Do you know that?

Ms. McCARTHY. I do not. I am not familiar.

Mr. GRIFFITH. If you could find out for me, I appreciate it because that is just south of this dot right here, and so what we are talking about is from one regulation after another, the Ninth District of Virginia and all the parts of the country are being hammered on jobs, and I submit to you that the United States has got a job problem, if you all haven't figured that out by now, and that we shouldn't be piling on regulations that are killing jobs. We want to move in the right direction, but we can't be killing our economy. And I would have to ask you that if we had a regulation that we could eliminate, an instrumentality or something, we were going to get rid of power and we were going to get rid of those jobs, if we could save from 1990 to the present—I am looking at page 9 of your report where you said that the current regs have saved 167,000 lives. What if in that same time period we could have eliminated direct, not indirect, but direct, about 700,000 premature deaths? Would that be a good thing, and should we have regulations that would prohibit and make it clear that those deaths wouldn't occur?

Ms. MCCARTHY. I am sorry, I am not sure I followed the question.

Mr. GRIFFITH. The question is if there were a regulation that could save directly 700,000—forget the job impact—700,000 lives, would you all be recommending that to the President?

Ms. MCCARTHY. I would have to tell you what—I would have to decide whether it was consistent with the law and my authority. That is all I am doing here, that is all I would speak to.

Mr. GRIFFITH. OK. So you wouldn't be—notwithstanding the fact that we could save all those lives, it wouldn't matter? Is that what you are saying?

Ms. MCCARTHY. I would be happy to save every life we could save, obviously.

Mr. GRIFFITH. But you understand that there's always a tradeoff, and that sometimes it is—you know, you can't make the world perfect. You understand that? EPA can't make the world perfect. You don't control the Chinese, you don't control a lot of parts of the world. You can't even make the United States perfect, can you?

Ms. MCCARTHY. Right. Hopefully that is not the mission of the Agency.

Mr. GRIFFITH. Well, it sure seems like you all want to make it perfect, because you want to wipe out everything related to coal, as far as those of us in the coal industry and areas are concerned, and you are killing jobs left and right with no regard to what is going to happen to the people in those areas, and when you raise the cost of electricity, it doesn't appear to me that you have any regard for the cost to the people who have to pay those heat bills and those electric bills who cannot afford to do so. I had a manufacturer in my district here this morning. I stepped out to talk to him, and I said that that is what we were looking at and that is what we were talking about today, and they said please don't let that happen. We can't afford to be any less competitive than we are right now with our foreign competitors, et cetera.

So this is why you are getting so much concern from this committee today, and I appreciate your testimony, and I yield back, Mr. Chairman.

Mr. WHITFIELD. At this time, I recognize the gentleman from Nebraska, Mr. Terry, for 5 minutes.

Mr. TERRY. Thank you, Mr. Chairman. I appreciate you being up here. It is always interesting.

I have a public power in my district, and they have, for the metropolitan area, two different coal-fired plants, both of which will have to be upgraded for the MACT rule, and then of course later on, the inclusion in CASPER, but I just want to talk about the MACT rule right now.

They estimate—again, they are just guessing a range of $450 to $500 million per unit, two units, so we are talking about $1 billion. They estimate in their published documents that they have given both the press and me, that would relate to about a 12 percent or little over 12 percent rate increase. So I just lay that out because it is completely—I mean, from 3 percent to 12 percent rate increase is a huge difference in swing between the EPA's estimates.

The other issue that seems—from them and other utility companies that they have expressed to me is the 3 years. Not only in the fact that there is a limited number of companies that have the expertise and the trades people necessary to do that, but now they have to compete against each other and that drives up the cost of the bids. Have you taken that into account at all, that by trying to compact all of the construction into a 3-year period that you are actually driving up the costs, and if we extended it out maybe 3 or 4 years or 4 or 5 years that we could eliminate some of the angst and anxiety?

Ms. MCCARTHY. We looked at—actually at both issues. We looked at costs associated with the rule, and what impact that might have on retail electricity prices. We are more than happy to work with—through the APPA, which we have met with and with those companies in that region. We provided a lot more flexibility in the final rule because of comments that we received in the proposal. We think there is a lot more flexibility in terms of controls and compliance strategies that should significantly lower the costs associated with compliance.

We also looked at the timing. We are forward-leaning in the fourth year for States. We have also provided an additional fifth year opportunity for reliability critical units. We know that this is a challenge, and we will work with the regions as well as the local communities to make sure that we can get this done well.

Mr. TERRY. Yes, and on the reliability critical units, which are the only ones that are eligible for the fifth year, as I understand, is that right?

Ms. MCCARTHY. Yes.

Mr. TERRY. OK, and the EPA issues an Administrative Order that the plant can operate for a fifth year. Can EPA guarantee that the plant will not be subject to citizen suits?

Ms. MCCARTHY. No, you are asking a very complicated question. We cannot guarantee that; however, this is an administrative vehicle that we have used many thousands of times, and we believe that because it is a year that—the process that we are going through for the Administrative Order will be transparent and will be rigorous, that we believe that there would be limited opportunity or likelihood of civil suits that would follow.

Mr. TERRY. When could these companies that are requesting a fourth year or a fifth year if it is a reliability critical unit, when will they know that they have got that extra time?

Ms. MCCARTHY. That is a very good question as well, and what we tried to signal in the enforcement policy was that the sooner we have these discussions, the better. We are working with the RTOs and the planning agencies to gather the compliance plans and to assess what will be necessary for reliability. The agency has indicated that we will provide a signal to that company about the eligibility of that Administrative Order so that they would be able to rely on it with certainty to make their investments as soon as possible, while in advance——

Mr. TERRY. Would that be this year?

Ms. McCARTHY. Well, it will take a while for the compliance plans to be done and for the reliability assessments, but as soon as they are ready, we are ready and working with DoE and FERC to assess those applications and make those decisions quickly.

Mr. TERRY. All right. Again, on getting some extra time, there is also a phrase in the rule or the order that said that—disclaims that anything can change at any time. And so if somebody is even granted an extra year or a fifth year if it is a reliability critical unit, they already know that anything can change without even public notice. I don't think that provides a level of certainty, and I would like the EPA to go back and look at that disclaimer.

Ms. McCARTHY. Let me look at that qualification. I think we are trying to make sure that we communicate effectively and we work with folks to provide a certain investment path forward. We will do everything we can to be able to do that.

Mr. WHITFIELD. Thank you, Mr. Terry, and I think we have concluded with questions. Ms. McCarthy, thank you very much for taking time to join us, and we look forward to seeing you again real soon.

Ms. McCARTHY. Thank you, Mr. Chairman.

Mr. WHITFIELD. As soon as possible.

Ms. McCARTHY. Thank you, members.

Mr. WHITFIELD. And now I would like to call up the second panel. We have seven witnesses on the second panel. First, Dr.—Mr. Darren MacDonald, Director of Energy, Gerdau Long Steel North America; Mr. Harrison Tsosie, Attorney General, Navajo Nation; Dr. Julie Goodman from Harvard School of Public Health; Dr. Anne Smith, Ph.D., Economist with NERA Economic Consulting; Mr. Ralph Roberson, President of RMB Consulting and Research; Reverend Michael Hescox, President and CEO, Evangelical Environmental Network; and Dr. Josh Bivens, Acting Research and Policy Director of the Economic Policy Institute.

So we appreciate all of you being with us this afternoon, and I will recognize—I am going to recognize each one of you for the period of 5 minutes for you to give your opening statements, and then at the end of that time we will have questions for you or some of you.

So once again, thanks for being with us, and Mr. MacDonald, we will begin with you, so I will recognize you for a period of 5 minutes for an opening statement, and I would just remind all of you to be sure and pull the microphone close and push the button to make sure that it is on, because the transcriber has difficulty hearing if it is not on.

So Mr. MacDonald, you are recognized for 5 minutes.

STATEMENTS OF DARREN MACDONALD, DIRECTOR OF ENERGY, GERDAU LONG STEEL NORTH AMERICA; RALPH E. ROBERSON, PRESIDENT, RMB CONSULTING AND RESEARCH, INC.; HARRISON TSOSIE, ATTORNEY GENERAL, NAVAJO NATION; THE REVEREND MITCHELL C. HESCOX, PRESIDENT AND CEO, EVANGELICAL ENVIRONMENTAL NETWORK; JULIE E. GOODMAN, PRINCIPAL, GRADIENT, AND ADJUNCT LECTURER, HARVARD SCHOOL OF PUBLIC HEALTH; JOSH BIVENS, ACTING RESEARCH AND POLICY DIRECTOR, ECONOMIC POLICY INSTITUTE; AND ANNE E. SMITH, SENIOR VICE PRESIDENT, NERA ECONOMIC CONSULTING

STATEMENT OF DARREN MACDONALD

Mr. MACDONALD. Thank you. I would like to thank the chairman of the subcommittee, Mr. Whitfield, for the opportunity to testify here regarding EPA's Utility MACT rule and its impact on our company, the steel sector, and the manufacturing sector in general as we all attempt to recover from the great recession.

I ask that my full written statement be placed in the record.

My name is Darren MacDonald. I am the Director of Energy for Gerdau's 17 steelmaking facilities in the U.S. Gerdau employs 10,000 people in the U.S. and is the second-largest steel recycler in North America. My responsibility at Gerdau is to secure a reliable, cost effective energy supply, and manage the company's energy efficiency strategy. Like all energy intensive manufacturers, energy is a significant input cost for Gerdau, and a key consideration when making investment decisions.

The steel sector is concerned about the tremendous disagreement regarding the increased costs and reliability impacts that may result from the Utility MACT. The simple fact is that all of the reliability risks and all of the compliance costs will be ultimately passed on to us, the consumers.

Let me be clear. The U.S. manufacturing sector is doing everything that we can to be energy efficient and reduce our costs. In fact, in a recent DoE study, they concluded the U.S. steel industry was the most energy efficient in the world, and only a new breakthrough technology could make a significant improvement in energy intensity. So there is no silver bullet for us to address increased energy costs or reliability impacts associated with the rule.

Although the EPA has projected the Utility MACT will not have a significant impact on reliability and only have a modest impact on the price of electricity, other reputable organizations disagree with these estimates. NERA has looked at the full suite of EPA's proposed regs on the utility sector, and have estimated that electricity prices in some regions will increase by double digits. Others, such as Credit Swiss and NERC, have found that there will be significant costs and reliability issues.

To give you some idea of the sensitivity of the manufacturing sector to an increase in electricity costs, a 1 cent per kilowatt hour increase in the cost of electricity imposes an additional cost of approximately $9 billion per year on the manufacturing sector.

Reliability is also a significant concern. Please recognize that large manufacturers with interruptible contracts are the first to be called upon if there is a reduction in reliability. There was a case in February of 2012—2011 when Texas had an ice storm and our operations in Texas were curtailed far beyond our contracted limits to provide reliability so hospitals and residential consumers could maintain reliability. So if reliability is impacted, there will be direct costs on—and those will have an impact on our bottom line, our ability to meet our customer orders, but also our ability to operate safely.

From the private sector perspective, we wonder if the pace of change makes sense. The timeline required by the Utility MACT rule will put a significant demand on suppliers and installers of pollution control equipment, and utilities will have no choice but to pay these heightened market rates, and these extraordinary costs will simply be passed through to rate payers.

We believe that it is in the best interest of the manufacturing sector for the EPA to phase in the Utility MACT rule over a longer period of time to alleviate the combined impact that regulations will have on electricity costs, and on reliability. A delay will also give time for utilities to avoid what appears to be an over-reliance on natural gas. Natural gas has had a history of volatility, but itself is the subject of potential new regulation that could drive up those costs.

So let me be clear. I am not here today to say that the EPA should do nothing with respect to improving environmental regulations. We share the environmental goals involved in many of the regulatory efforts, but the timeline is too tight and the potential extensions for utility compliance are too uncertain. If the regulation is implemented in a thoughtful and systematic way with sufficient time, then compliance and environmental gains will impose less of a concentrated impact on reliability and on the economy.

Policymakers must understand that we are exposed to global competition. Risks of higher prices and reliability impacts will inevitably affect the economy, investment decisions, and the levels of employment that are sustainable in the U.S. If our customers can't afford the products made here in the U.S., the replacement products will come from somewhere else with a larger emissions footprint.

Thank you for the opportunity to testify.

[The prepared statement of Mr. MacDonald follows:]

Subcommittee on Energy and Power
House Energy and Commerce Committee
February 8, 2012

Darren MacDonald - Summary of Testimony

- The steel sector is concerned about increased electricity costs and reliability issues that may result from this regulation. This is for the simple fact that all of the compliance costs and reliability risks will ultimately be passed on to us, the consumers. Our concern is that a confluence of new EPA regulations on the utility sector over the next 5 years – capped by the Utility MACT Rule – will have a substantial impact on our direct cost of doing business. We believe that it is in the best interest of the manufacturing sector for EPA to phase-in the Utility MACT Rule over a longer period of time to alleviate the combined impact the regulations will have on electricity costs and reliability.
- If the Utility MACT Rule goes into effect as currently finalized, billions of dollars of investment will be required in upgrades to existing electricity production facilities, new generation facilities and transmission upgrades. In 2015 alone, EPA estimates that the rule will cost consumers $9.6 billion annually (in 2007 dollars). Others in the electric power industry have estimated that that costs will be much higher. While we don't know for certain who is right regarding the different cost estimates, we do know that additional costs for electricity will directly impact our bottom line, reducing competitiveness and potentially putting jobs in jeopardy.
- I am also concerned that the short timeframe for compliance in combination with planned retirements, conversions to natural gas, and outages required to install control technologies will create significant reliability issues. The pace of change required by the Utility MACT Rule and other EPA utility regulations will put a significant demand on the suppliers and installers of pollution control equipment and could further drive up costs.
- If electricity prices do not remain affordable and if electric supply is not reliable, the economic recovery can be put at risk along with it manufacturing jobs. We have heard from various stakeholders that the utilities prime concern is the aggressive pace of required compliance, and its impact on cost and reliability.
- Gerdau strongly recommends that the Committee seriously consider legislative alternatives so that compliance witb utility sector rules and other rules affecting the manufacturing sector can be phased in over a longer period of time. We share the environmental goals involved in many of the regulatory efforts, but if the regulation is implemented in a thoughtful, systematic way, compliance and environmental gains will impose less concentrated economic impacts. Policymakers must understand that not all of our international competition are exposed to these costs. Any product that is displaced in the U.S. will be made in a country with less air regulations.

Testimony of Darren MacDonald

Subcommittee on Energy and Power

House Energy and Commerce Committee

February 8, 2012

I would like to thank the Chairman of the Subcommittee, Mr. Whitfield, for the opportunity to testify regarding the Environmental Protection Agency ("EPA's") Mercury and Air Toxics Standards Rule (known as the "MATS" or "Utility MACT" Rule). This Subcommittee and the full Energy and Commerce Committee have a long history of conducting in-depth hearings into major Clean Air Act ("CAA") rulemakings, in particular, regulations that have large economic consequences.

By way of introduction, I am the Director of Energy for Gerdau's steel making facilities in the U.S. It is my responsibility to secure a cost effective and reliable supply of electricity, natural gas, oxygen, and industrial gases that are necessary to meet the needs of our steel-making operations. I am also responsible for the company's Energy Efficiency Strategy. I appreciate the opportunity to share information on the impact of this regulation on our company, the steel industry and the manufacturing sector in general as we attempt to recover from the "great" recession.

In particular, the steel sector is concerned about increased electricity costs and reliability issues that may result from this regulation. This is for the simple fact that all of the compliance costs and reliability risks will ultimately be passed on to us, the consumers. Our concern is that a confluence of new EPA regulations on the utility sector over the next 5 years – capped by the

Utility MACT Rule – will have a substantial impact on our direct cost of doing business. We believe that it is in the best interest of the manufacturing sector for EPA to phase-in the Utility MACT Rule over a longer period of time to alleviate the combined impact the regulations will have on electricity costs and reliability. To give you some sense of the impact on the manufacturing sector, a 1 cent/kWh increase in the cost of electricity imposes additional costs of approximately $9 billion per year on factories and manufacturing plants. This will inevitably affect investment decisions and the levels of employment that are sustainable in the U.S. Don't forget that it is the electricity customers – and energy-intensive and internationally trade exposed manufacturers – who will be writing the checks while competing with companies who are located in countries with less air regulations.

Gerdau Operations in the United States

Gerdau is the second largest steel mini-mill producer and steel recycler in North America. We have an annual manufacturing capacity of over 10 million tons of finished steel product and we employ approximately 10,000 people in the U.S. Steel mini-mills produce steel products from melting and refining recycled scrap metal. We offer a diverse product mix of merchant steel, special bar quality, rebar, flat rolled steel, and wire rod.

With 20 facilities in the U.S., Gerdau's business operations occur in many different regulated and deregulated energy markets. Wherever we are located, however, my job is to take advantage of every opportunity to minimize the cost of energy. This is essential in order for us to remain competitive in the international marketplace for steel. Therefore, we seek wherever possible to be a highly "demand responsive" load; we frequently participate in programs aimed at reducing system peaks. We also do what we can to work with our electricity suppliers to obtain reliable energy at the lowest possible cost. This is a core part of our business planning and our profit or loss.

It should be understood that we are not simply passive consumers of energy that depend on electricity producers to hold costs down. We also intensively review our own operations to save energy. In this regard, Gerdau is the second largest recycler of steel in North America (in an industry which uses the most recycled material on the planet). Recycling steel makes business and energy sense for us; indeed our industry is built around it.

Gerdau has taken every opportunity to improve energy and environmental performance through "bench marking" and sharing best practices throughout its operations. But we are not alone. The steel industry in North America has effectively set the bar for energy efficiency internationally. A recent Department of Energy ("DOE") study concluded the U.S. steel industry was the most energy efficient in the world and only a new breakthrough technology could make any significant improvement in energy intensity. And, as DOE noted in the same report, "Since 1990, the U.S. steel industry reduced its carbon emissions by 35%, achieving one of the lowest carbon dioxide emission intensities among steel-producing countries worldwide

Economic Impact of the Utility MACT Rule on the Manufacturing Sector

Gerdau is extremely concerned about the impact the Utility MACT Rule will have on electricity prices. If this regulation goes into effect as currently finalized, billions of dollars of investment will be required in upgrades to existing electricity production facilities, new generation facilities and transmission upgrades. In 2015 alone, EPA estimates that the rule will cost consumers $9.6 billion annually (in 2007 dollars). Others in the electric power industry have estimated that the costs will be much higher. While we don't know for certain who is right regarding the different cost estimates, we do know that additional costs for electricity will directly impact our bottom line, reducing competitiveness and potentially putting jobs in jeopardy.

There is always a certain amount of finger-pointing with regard to the costs estimated for environmental compliance. EPA, I am sure, defends its cost analysis as based on its best estimate of the amount of new scrubbers, fabric filters, and dry sorbent injection ("DSI") that will be required to control mercury emissions and other hazardous air pollutants. Industry and private forecasters take issue with the assumptions, asserting, for example, that EPA's assumptions concerning the efficacy of DSI are too optimistic. We certainly look at both sides. But regardless of which projections ultimately prove to be most accurate, in the interim large electricity consumers will experience fundamental uncertainty and dramatic increase in future electric costs.

The Energy Information Administration ("EIA") has recently estimated that coal's share of electric generation will drop considerably over the next 25 years. EIA's Annual Energy Outlook 2012 Early Release estimates that by 2035, coal will represent about 39% of electric generation in the U.S., down from approximately 50% in recent years. Natural gas and electric generation using renewable sources of energy are projected to increase to a total of 43% of the U.S. electric generation in the same period. Gerdau has conducted an internal analysis on our fleet of mills, and our exposure to coal generation ranges from 8 percent to 80 percent with an average of 49 percent. This regional disparity will cause cost impacts in some states to be more significant than others, impacting state economics. A slower transition would allow time for adjustment

Although EIA's analysis includes consideration of EPA's Cross-State Air Pollution Rule ("CSAPR"), it does not yet include the Utility MACT Rule, and it is likely that another rule, related to cooling water which imposes additional costs on coal-fired electricity will result in further pressures on this sector. Although we do not know the full extent of all the costs involved, they will likely be very significant and inevitably passed on to consumers. As a result, the manufacturing sector will experience greater challenges in maintaining our business in the U.S. and sustaining related employment.

EPA has projected that the Utility MACT Rule will not affect reliability and have only a modest impact on the price of electricity. EPA's Regulatory Impact Analysis estimates that average U.S. retail rates will increase 3.1% by 2015 and between 1% and 6%, depending on the region. But such estimates are based on assumptions concerning the types of controls that will meet the new standards and how quickly sources can receive necessary permits and install controls. As a large electric energy consumer we ask a fundamental question: what if these government projections are wrong or even partially wrong?

EPA economic projections on the Utility MACT Rule are also constrained by the practice of just focusing on the effects of the rule that is being finalized. The business world, however, cannot afford to look at different rulemakings in isolation. The manufacturing sector must look at the full impact of EPA regulations on the utility sector and the resulting increase to our electricity costs.

Some analyses have attempted to do this. The National Economic Research Associates ("NERA") reviewed the combined energy and economic impact of four EPA rules: (1) the final

CSAPR and the proposed rules for (2) Utility MACT, (3) coal combustion residuals, and (4) Clean Water Act section 316(b) cooling water intake structures. NERA used three models to conduct its analysis and relied on cost and other data from EPA and EIA for most of the modeling assumptions. The results of the analysis show substantial economic impacts. Costs for the electric sector to comply with the four rules are projected to be $21 billion per year, which includes $104 billion (present value) in capital spending. Combined, the rules that EPA has finalized and will finalize shortly constitute the most expensive suite of rules that EPA has ever promulgated for coal-fueled power plants. Retail electricity prices in regions of the U.S. covering all or portions of 30 states plus the District of Columbia are projected to increase by double digits in the peak years, with some regions experiencing increases as high as 19 percent with an average exceeding 10 percent. The manufacturing sector is in recovery mode and if NERA's analysis is accurate, recovery and growth will certainly be at risk.

Again, we are aware of certain criticisms and limitations in such studies. It was not possible, for example, for NERA to know precisely what would be included within the final Utility MACT Rule which wasn't released to the public until December 21st. Rules regarding coal combustion residuals and cooling water intake are also not final. But put yourself in my position. I must operate in the current business and regulatory environment and look at the available data and analysis. And I can tell you that we are already seeing the effect of the regulations faced by utilities. For example, PJM Interconnection, which coordinates buying, selling and delivery of wholesale electricity throughout its energy market, has been able to discern that the addition of pollution control retrofit costs contributed approximately $60-$80/MW-day to the price increase in their capacity market auction. This means that a customer with a 100 MW peak load would see an increase in capacity costs of between $2.2 and 2.9 million dollars per year in increased costs directly related to compliance with EPA regulations.

Capacity prices are not the only cost impact in PJM, long term energy prices are also impacted. The Regulatory Impact Analysis which accompanied the Utility MACT Rule projects that about 4% of pulverized coal units will be retired. Many of these units naturally are older and smaller units. But as these lower cost units are retired early, prices will almost inevitably rise despite EPA's projections concerning excess capacity.

In addition, the new capacity which is installed may not afford the same long-term cost-profile as the capacity which was retired. EPA has predicted that "most new capacity is projected as a mix of wind and natural gas." Although the price of gas is historically low right now, in the past gas has been a volatile commodity. EPA and states are also considering additional regulations regarding hydraulic fracturing, the technology which is behind the recent surge in natural gas production. Increased use of natural gas as base load for transportation, and other uses, could have a significant impact on available supply. To the less than casual observer, it appears that we are over relying on natural gas for both our electricity production and environmental compliance needs.

Private industry must look to not only government estimates but other forecasts of the future energy mix. In 2010, for example, Credit Suisse predicted that 50 gigawatts of coal plant closures could be "realistic" within the next few years. More recently, Credit Suisse indicated that "we forecast new generation construction to meet some lost capacity needs, although replacements will likely be well below retirements as 20%+ reserve margins are inevitably tightened." These reports stress that we cannot look at the Utility MACT Rule in isolation, but need to consider other EPA rules regarding pollution transport and new national ambient air quality standards.

This brings me to the next significant and largely misunderstood cost impact. Manufacturers are very concerned about how these combined costs resulting from a wave of environmental regulation are allocated to customers. This is particularly true in my industry since steel makers are generally one of the largest and most interruptible customers. Traditionally, large interruptible loads would pay for capital additions in the utility sector through a capacity charge in base rates, but recent utility practice in many regions has been to spread the cost through a volumetric charge to all ratepayers, shifting the lion share of the cost burden onto users with high load factors such as large energy intensive manufacturers. I can tell you from personal experience that this may lead to plant closures. In the state of New Jersey, Gerdau was forced to close a steel mill in part due to mounting kWh base charges.

Reliability Impact of the Utility MACT Rule on the Manufacturing Sector

I am also concerned that the short timeframe for compliance in combination with planned retirements, conversions to natural gas, and outages required to install control technologies will create significant reliability issues. The pace of change required by the Utility MACT Rule and other EPA utility regulations will put a significant demand on the suppliers and installers of pollution control equipment and could further drive up costs. In this situation, utilities may have no choice but to pay heightened "market rates" for intensified construction projects. These "extraordinary" costs will simply be passed through to ratepayers.

Gerdau strongly recommends that the Committee seriously consider legislative alternatives so that compliance with utility sector rules and other rules affecting the manufacturing sector can be phased in over a longer period of time. We share the environmental goals involved in many of the regulatory efforts, but if the regulation is implemented in a thoughtful, systematic way, compliance and environmental gains will impose less concentrated economic impacts. Policymakers must understand that not all of our international competition are exposed to these costs. Any product that is displaced in the U.S. will be made in a country with less air regulations.

Comprehensive assessments, like the November 2011 North American Electric Reliability Corporation ("NERC") report, have cautioned that the Utility MACT Rule could cause "significant generator retirements." NERC believes that "the future state of reliability is still undetermined" and that the greatest risks to reliability lie with the potential impact of environmental regulations.

Even without the Utility MACT Rule we are already seeing substantial cost and reliability impacts, and we believe that this rule will exacerbate the problem. For example, energy prices in the State of Texas were low throughout the recent recession and little new generation was built. Last summer, however, prices in the on-peak period for the entire month of August averaged 26 cents/kWh, more than 5 times above 2010 annual rates, because the supply/demand balance was very tight. According to assessments by the state and its regulatory bodies, the 2011 CSAPR will result in further tightening of the available electric supply in Texas. And no new generation has been announced which, in any event, would require considerable time to obtain permits and begin operation. This is just an example of an area where the Utility MACT Rule will have a significant impact despite the overall average numbers in the country looking acceptable.

Implementation of the Utility MACT Rule

In general, there has been much debate on the concerns over electric price and reliability, and EPA has disputed contrary analysis, and pointed to "flexibility" contained in the final Utility MACT Rule. EPA indicates in the final rule that utilities can seek another year for compliance from state permitting agencies in addition to the three years allowed by the CAA. In addition, EPA has indicated that they might be willing to grant "enforcement discretion" thereafter to address issues related to reliability. Neither one of these options provide the manufacturing sector with the certainty we need to make business decisions to maximize our growth potential.

Another issue that has not been discussed extensively is that utilities will have to rely on their state regulators to get approval to make the investments in new control technology and reflect those costs in the rates. To ensure the cost allocation issue is addressed appropriately manufacturers will need to be involved in multiple regulatory proceedings in every state in which they operate. This is a time consuming process and the current timeline does not take this into account.

We look at the short window provided by EPA for comments on the Utility MACT Rule and cannot help but wonder if additional consultation time would have helped to clarify the impacts of the rule and allow for better planning so that these issues could be addressed upfront.

Conclusion

Let me be clear that I am not here today to say that EPA should "do nothing" with respect to improving environmental regulations or implementing new controls on electric powerplants. Although substantial progress has been made under the CAA, we understand there is more to be done and economic progress and environmental progress can indeed coincide. But many utilities have stated that in the past, success was achieved in reducing criteria pollutants like NO_x and SO_2 by executing a very well thought out plan that provided ample time for a planned response to compliance, balancing the availability of pollution control equipment and labor, and using flexible implementation to decrease costs. This system of regulation allowed the most favorable investments to be made while achieving the desired environmental results. Thus, to the extent that additional time and flexibility can be implemented under existing law, or perhaps through additional legislative authority, I believe this could be greatly beneficial.

Altogether, I am not expert on all EPA rules or all the public and private projections regarding EPA regulations – but I do understand business and from a manufacturing sector perspective, additional costs will have significant impacts on investments and jobs. Simply not knowing who is right about the price of electricity over the next five to ten years – EPA or other forecasters – creates too much uncertainty with respect to large capital investments. We must be able to operate a profitable business while we transition to a cleaner generation fleet.

The economic recovery is fragile and the year over year step changes in electricity prices that have been forecasted are not tolerable against the backdrop of global competition. If electricity prices do not remain affordable and if electric supply is not reliable, the economic recovery can be put at risk along with it manufacturing jobs. We have heard from various stakeholders that the utilities prime concern is the aggressive pace of required compliance, and its impact on cost and reliability. This, in my opinion, is what needs to change.

Thank you for providing me the opportunity to testify. I look forward to answering any questions that you may have.

Mr. WHITFIELD. Thank you, Mr. MacDonald.

At this time, I recognize Mr. Ralph Roberson, President of RMB Consulting, for 5 minutes.

STATEMENT OF RALPH E. ROBERSON

Mr. ROBERSON. Thank you. Chairman Whitfield, Ranking Member Rush, and members of the committee, thank you for the opportunity to appear before you and speak to you about the American Energy Initiative. My name is Ralph Roberson and I am President of RMB Consulting and Research. I personally have over 40 years of experience in measuring air pollution and evaluating the ability of pollution control technologies to meet emission limits.

Let me begin by saying that I am not representing any of RMB's clients today, and the views that I express are mine and not necessarily indicative of any of my clients, and I am not receiving any compensation for this testimony.

My testimony addresses EPA's recently promulgated by now we know MATS rule. That rule addresses emissions of hazardous air pollutants from electric generating units. My testimony is that the emissions limits in the MATS rule, which EPA developed under the Maximum Achievable Control Technology provisions, or MACT provisions of the Clean Air Act, are so stringent that no new coal-fired generating unit can be built. The stringency of these new unit standards means that no generating unit can built in this country. In effect, EPA has adopted standards that prevent our country from building any new coal units; thus, coal-fired units will no longer be an option for the utility industry's generation portfolio.

Note that my comments and testimony do not include the category of facilities called integrated gasification combined cycle, as they are regulated under a different rule. I am addressing conventional coal-fired units.

Power companies have always relied on a diverse set of resources in order to ensure that the industry can provide electricity to their customers at stable prices. Coal has always played a role in that because it is a domestic fuel, and over the long-term, it has always been available at predictable cost. Banning new coal generating units would represent a significant shift in U.S. energy policy and the way that utilities have planned their portfolios, with potential significant consequences for us, the electric consumers.

As I explained in my comments on the proposed rule, there are several reasons why I believe what I am telling you. First, no unit actually achieves all of the emission—all of the new unit emission limits. Second, EPA based its new unit limits on selected short-term stacked tests that are not representative of long-term performance, and are inconsistent with the 30-day rolling average provisions that the rule requires. Third, some of the emission limits in the final rules are so low that they are below our ability to measure them accurately. In the final rule and in response to comments on the proposed rule that no existing unit met all of the new unit limits, EPA said it has identified a source that did meet all the limits, even though that source was not identified in the preamble of the final rule. We have heard Ms. McCarthy say it today, and my testimony is that that unit is Logan Generating Unit 1. EPA used Logan 1 to set the new unit limits for HCl and mercury, and EPA now says that Logan can, in fact, meet all the new unit limits.

But please consider the following facts. Publicly available data show the results of six separate HCL tests for Logan. In only one of those tests did Logan meet the limits that EPA has set for HCl. It failed the other five times. In other words, EPA is requiring all new units to meet an HCL standard based solely on the performance of Unit 1, when that unit itself failed to meet the standard in five out of six tests.

An identical situation exists for the Chambers Cogeneration Unit 2. Unit 2 was selected by EPA to support the final filterable PM limit, or particulate matter. However, six publicly available stacked test results for Chambers exist, and only one out of those six meet the limits. EPA's selective use of these test results undermines EPA's conclusion that new units can meet the new unit limits.

If the best performing unit for HCl fails the test five out of six times and the best performing filterable limit—unit fails the filterable limit five out of six times, how can it be concluded that these standards are achievable?

Taking all of these problems together, I am convinced that no air pollution control vendor will provide guarantees that its equipment can meet these stringent limits. Absent those guarantees, developers will not be able to obtain the huge amount of financing that it takes to build one of these projects, and absent such financing, no units will go forward.

In sum, the standard set forth for new coal units in the MATS rule are so stringent that new units, even using the best technology available on the market, cannot comply. These standards therefore prevent new coal-fired units from coming into existence.

Thank you.

[The prepared statement of Mr. Roberson follows:]

Testimony of Ralph E. Roberson
Subcommittee on Energy and Power of the House Committee on Energy and Commerce
"The American Energy Initiative"
February 8, 2012

Chairman Whitfield, Ranking Member Rush, members of the Committee, thank you for the opportunity to provide testimony to you on the American Energy Initiative. My name is Ralph E. Roberson, and I am President of RMB Consulting & Research, Inc. RMB is a multi-disciplinary air quality consulting company providing services to electric utilities and a wide range of industrial sources. We specialize in regulatory analysis, evaluating air pollution control technology, continuous emissions monitoring systems, quantifying hazardous air pollutants emissions, evaluating predictive emissions monitoring systems and developing compliance assurance monitoring plans. I personally have over 40 years of experience in measuring air pollution emissions and evaluating the ability of pollution control technologies to meet air emission standards. My curriculum vitae is attached. More information on my company can be found at http://www.rmb-consulting.com.

Let me begin by saying that I am not representing any of RMB's clients in my testimony today and that the views I express are my own views and do not necessarily reflect the views of any of our clients. I am not being compensated for my testimony today.

My testimony addresses EPA's recently promulgated Mercury and Air Toxics Standards (MATS) rule. The MATS rule addresses the emission of hazardous air pollutants (HAPs) from Electric Generating Units (EGUs). My testimony is that the Maximum Achievable Control Technology, or MACT, standards that EPA has issued for new coal-fired EGUs are so stringent that no technology is available that can meet them. The stringency of the new-unit standards means that no new coal-fired EGU can be built under these standards. In essence, EPA has adopted standards that prevent the country from building new coal-fueled units.[1] Thus, new coal-fired electric generating units in the United States will no longer be an option for the utility industry's generation portfolio.

Electric utilities have always relied on a diverse set of resources as a means of insuring against the uncertainty of the future. Coal has always played a prominent role in utility resource portfolios because it is a domestic fuel and, over the long term, has proved to be reliably available at stable and predictable prices. Banning new coal-fired EGUs would represent a significant shift in U.S. energy policy and the way utilities have planned their portfolios, with potentially significant consequences for electric ratepayers.

As I explained in my comments on the proposed rule, there are several reasons why I believe EPA's new-unit standards will prevent the construction of new coal-fired EGUs. First is what has become known as EPA's "Franken-Plant" approach to setting MACT standards. The Clean Air Act requires that EPA establish MACT standards that reflect "the emission control that is achieved in practice by the best controlled similar source." In applying this standard, EPA has

[1] My conclusion and reference to new coal-fired units does not include IGCC units, which are regulated in a different subcategory from coal-fired units in EPA's final MACT rule.

set emission limits for each HAP based on the best performance achieved in practice by an existing unit for that particular HAP. The problem is that no single existing unit meets all of these standards, just as Dr. Frankenstein's fictitious monster bore no resemblance to an actual human being. It is as if a scholarship is available for the best individual student, and the school based its criteria on the student with the highest spelling score, the student with the highest math score and the student with the highest reading score. If different students had the highest scores on all three tests, no student could win the scholarship.

Second, as EPA recognizes, emissions from any unit can vary over time. EPA based its new-unit standards on the performance of selected units whose emissions were determined by performing short-term stack tests, but these short-term test results are not representative of emissions over time because of process and operating variability.

EPA attempted to address this variability by calculating and applying what is known as the upper prediction limit (UPL). But EPA's UPL approach is fundamentally flawed. EPA used a simple statistical formula to estimate the UPL for the best performing unit. The problem with EPA's approach is that the Agency is applying the UPL formula to very incomplete data. For each HAP, EPA typically has three sampling runs that were performed very close in time (i.e., at a maximum, over 3 consecutive days) for the single, best performing unit. The variance that EPA calculates using its formula is only representative of a very limited set of operating conditions and probably little, if any, fuel variability. Thus, EPA is only predicting the 99th percentile of a very limited range of operation and not a level that can definitely be complied with at all times and under all operating conditions. This is a critical flaw because EPA's standards require compliance on a rolling 30-day averaging period. Because the standards are set at such a low level based on short-term stack tests, and because the variability that will occur over a typical 30-day averaging period is not properly accounted for, the new-unit emission standards are simply not achievable.

In effort to put my concern with EPA's treatment of variability into an everyday example, consider the following questions. Who would claim that the child who makes the highest score on a single test is the smartest or best performing student in the class -- much less in the U.S.? What are the chances the same student will make the highest score on the next test?

A third problem is EPA's handling of measurements below the method detection limits (MDLs), which exacerbates the variability flaws discussed above. Specifically, the final emission limits for at least two pollutants (hydrogen chloride and filterable particulate matter) for new coal-fired units are based on measurements below the respective MDLs. This means that the concentration of the emissions required to comply with these new-unit limits cannot be accurately measured. The HCl emission limit is based on three test runs conducted on a unit for which all three test runs are reported to be less the MDL – in other words, the results are below the HCl level that can be reliably detected by the measurement method. EPA's MACT emission limit for HCl was determined by multiplying the highest method detection limit for the three sampling runs times by a factor equal to 3. In other words, the HCl floor is based on one constant (3) multiplied by another constant (MDL). Thus, the proposed HCl limit is not only based on non-detected concentrations, but also fails to account for any process variability. In the final rule, EPA followed a very similar procedure is setting the filterable PM emission limit for new units.

Basing an emission limit on some multiple of an MDL is not justified, especially when one stops to think literally what the MDL is. The universally accepted definition of MDL is the concentration at which we are 99 percent certain the analyte is actually present (i.e., greater than zero). However, the potential measurement error or measurement uncertainty at the MDL is huge. That measurement uncertainty is reduced but not eliminated by multiplying the MDL by a factor of 3. In my view, the concentration of HCl that can be reliably and accurately measured exceeds the level of EPA's new-unit HCl emission limit.

In the final rule, in response to comments on the proposed rule that no existing source met all of EPA's new-source MACT standards, EPA said it had identified a source that did meet all of the standards, even though that source had not been identified in the proposed rule. In my opinion, EPA can only be referring to Unit 1 at the Logan Generating Station because, if for no other reason, Unit 1 is the basis for two of three of the final primary emission limits (HCl and Hg). But EPA's assertion as to the Logan unit is untrue.

In order to collect data on which to base the MACT standards, EPA mandated utilities to conduct short-term stack tests. These short-term data were the basis for EPA's determination of the level of emission control that EPA believes has been achieved in practice by the best-performing units. As noted, however, EPA set standards that must be met on a rolling 30-day average basis. What a unit achieved during a short-term stack test does not represent what a unit can achieve over every rolling 30-day period in the year. Stack testing results are snapshots and cannot be guaranteed to be representative of long-term performance. If the same units undertook the same stack tests again, it is likely that they would yield different results.

This is exactly the case as to the Logan unit (which EPA used to support the new unit HCl emission limit). Logan submitted data pursuant to EPA's information collection request (ICR) demonstrating non-compliance with that very same emission limit. The Logan unit was used by EPA to support the final HCl emission limit of 0.40 lb/GWh. However, within publically available data posted by EPA, there exist five separate HCl test results for the very same Logan unit that report emissions well in excess of the new-unit HCl emission limit. Unfortunately for EPA, there exist no other publically available dataset for the Logan unit that demonstrates compliance with the new unit HCl emission limit. In other words, there are six publicly available stack test results for the Logan unit, and EPA chose to base the new-unit HCl emission limit on the lowest result of the six tests. EPA elected to ignore the other five test results for the Logan unit, all of which show non-compliance with the new-unit emission limit.

An identical situation exists for Chambers Cogeneration Unit 2. Unit 2 was used by EPA to support the final filterable PM emission limit of 0.0070 lb/MWh. However, within publically available data posted by EPA, there exist five separate emission test results well in excess of this filterable PM emission limit. There exist no publically available dataset for the Chambers Cogeneration unit that demonstrates compliance with the new unit filterable PM emission limit other than the single test result used by EPA to set the new-unit PM limit. In sum, EPA falls far short of having a unit that meets all of the new unit emission limits, because this unit does not even achieve compliance with the emission limit for which EPA used it to support. While I disagree with EPA's premise that finding an individual unit that meets all of the new unit emission limits would mean that EPA's emissions limits are achievable, I think it is particularly telling that EPA's claim is simply not true.

Taking all of these problems together, I am convinced that no pollution equipment vendor will offer guarantees that their equipment will meet these standards. Absent those guarantees, developers will be unable to obtain financing of the hundreds of millions of dollars that this equipment will cost. And absent that financing, new units will not get constructed.

In sum, the standards EPA has set forth for new coal-fired EGUs in the MATS rule are so stringent that new units, even using the best technology available in the market, cannot comply. These standards therefore will prevent new coal-fired EGUs from being built.

Thank you.

Mr. WHITFIELD. Thank you.

At this time, Mr. Tsosie, Attorney General for the Navajo Nation, you are recognized for 5 minutes.

STATEMENT OF HARRISON TSOSIE

Mr. TSOSIE. Ya'at'eeh, Chairman Whitfield, Ranking Member Rush, and distinguished members of the committee. Thank you for allowing the Navajo Nation an opportunity to present its views concerning the recent EPA Utility MACT rule pertaining to mercury emissions from electric generating facilities.

My name is Harrison Tsosie, and I am the Attorney General for the Navajo Nation. As the Chief Legal Officer for the Navajo Nation, I have an extensive background in matters pertaining to the implementation of various Federal laws and regulations on the Navajo Nation.

In order to fully understand the effects of the MACT rule on the economy and its impact on consumers, I will provide a brief history of the Navajo Generating Station to illustrate how complex these issues can be.

NGS was authorized by Congress to provide power for the pumps of the Central Arizona Project. Congress authorized the Central Arizona Project in 1968 through the Colorado River Basin Project Act. The purpose of the CAP is to provide the State of Arizona with access to the annual 2.8 million acre feed of entitlement to the Colorado River. Simultaneously, the Act authorized the Department of Interior to enter into cooperative agreements with non-Federal entities to build a power plant to provide power to the Central Arizona Project and to augment the lower Colorado River Basin Development Fund, which is used to fund Indian Water rights settlement claims. The result is a 24.3 percent ownership in the Navajo Generating Station by the U.S. Government.

NGS is unique because of its Federal ownership stake and the plant being sited on Indian lands and uses Indian resource as a fuel source. Therefore, the Federal Government has certain trust responsibilities to safeguard the economy of the Navajo Nation. The U.S. EPA held no tribal consultation prior to ruling on the MACT as required by the administration's Executive Order on tribal consultations. Further, there are no health studies on the Navajo Nation regarding mercury. There are no mercury-based land studies to determine if there will be health improvements by the rule.

The cost of compliance with the regulations has a cumulative impact. While the U.S. EPA says the MACT rule will not force closure of power plants, it is the sum of all its regulations that could do just that. The Navajo Nation has already experienced impact of the Mojave Generating Station closure, resulting in job and revenue loss to the Navajo Nation. Roughshod regulatory policies and implementation without full analysis and tribal consultation will result in the possible closure of other facilities. Closures mean massive job losses on the Navajo Nation, which is already faced with an unemployment rate of 50 percent. A closure of NGS would also mean the forfeiture of $20.5 billion in gross State products to the Arizona economy, and just under $680 million in adjusted State tax revenues during the years 2011 to 2044, according to recent studies.

The U.S. Federal Government set up the Navajo Nation economy as a natural resource economy. The Federal Government holds title to Indian lands, therefore, they control the economy of the Navajo Nation. As a result of the Federal over-regulation and control of Indian lands, there is no economy existing on hardly any Indian lands. Indian nations are often cited as being pockets of poverty throughout this great Nation, and the one common denominator is the pervasive Federal control. The United States EPA MACT ruling is no exception, and adds yet another regulatory burden tribes are left to contend with.

While some testifying today might espouse the affordability of the MACT rule implementation and the net job creation following EPA's regulatory action, the facts on the ground do not support these assertions and provide little comfort for the 1,000 plus workers employed by the various plants and the mines, in addition to the over 7,000 Navajo Nation employees that are funded in part by the revenues created by these operations. When the barrage of regulatory burdens hits home, the Navajo Nation is left with little recourse but to investigate the exportation of our abundant coal reserves to outside interests like China and India. This will only be—be the only method by which the Navajo Nation in the short-term can maintain its economy.

The Navajo Nation supports the goal of reducing hazardous emissions. We recommend a tailored implementation of any environmental rule. In the case of the MACT ruling, appropriate analysis and consideration of the economic impacts to the Navajo Nation did not occur. The MACT implementation should be fair and reasonable, taking into account compliance timelines, and must consider impacts on the Navajo economy, Indian water rights settlements, and the overall price tag that will be passed on to the electric utility consumers in the Southwest and the CAP water users throughout the State of Arizona.

[The prepared statement of Mr. Tsosie follows:]

Opening Statement of Harrison Tsosie
Attorney General
Navajo Nation

Committee on Energy and Commerce
Subcommittee on Energy and Power
February 8, 2012
Hearing Titled "The American Energy Initiative: What EPA's Utility MACT Rule will Cost U.S. Consumers

The Navajo Nation appreciates the opportunity to present its views on the U.S. EPA Utility MACT rule (also referred to as the Mercury and Air Toxics Standards or MATS rule). The Navajo Nation ("Nation") is a primarily coal-based resource tribe that is the landlord for two large coal-fired plants and associated mines located directly on its tribal lands. The final MACT Rule directly affects the Nation's existing natural resource economy and its government revenue sources. Moreover, because of the Nation's substantial coal reserves, the MACT Rule will have long reaching impacts on the Nation's sovereignty, including the Nation's ability to independently develop its natural resource economy and provide economic security for its tribal members.

I. INTRODUCTION

EPA recently issued a final MACT rule on December 21, 2011, that establishes national emission limits and monitoring, reporting, recordkeeping and testing requirements for mercury ("Hg"), non-Hg-metals such as arsenic (As), nickel (Ni), cadmium (Cd), chromium (Cr), lead (Pb) and selenium (Se), and acid gases such as hydrogen chloride (HCl), hydrogen fluoride (HF) and hydrogen cyanide (HCN), at new or existing coal- and oil-fired electric utility generating units ("EGUs"). The compliance deadline is three years from the effective date of the final rule. The final rule impacts three coal-fired power plants, comprised of 12 EGUs, currently located on or near the Navajo Nation, as well as future coal-fired power plants to be located on the Nation. The Navajo Generating Station ("NGS")[1] and Four Corners Power Plant ("FCPP")[2] are both located on Navajo Nation trust land pursuant to lease agreements with the Navajo Nation and burn Navajo coal, as well as employ Navajo tribal members and sustain local economies. San Juan Generating Station ("SJGS") is located adjacent to the Navajo Nation and is a significant employer of Navajo tribal members and is a major contributor to the local economy.

The Navajo Reservation, or Diné'tah, is the permanent homelands of the Navajo people as reserved in the Treaty of 1868 between the United States and the Navajo Nation. The health and well being of the natural environment and the Navajo people are of utmost importance to the Navajo government. As a tribal nation and a small government landlord of affected EGUs and associated mines, appropriate analysis and consideration in the MACT Rulemaking should have been given to the critical economic interests of the Navajo Nation and the Navajo people in the continued operation of NGS and FCPP, as well as additional potential adverse impacts to the regional economy and Navajo tribal

[1] NGS is comprised of three EGUs with a total generating capacity of 2,250 megawatts.
[2] FCPP is comprised of five EGUs with a total generating capacity of 2,060 megawatts.

employment for compliance by SJGS with the MACT Rule. So far, EPA has completely failed to meet its consultation obligations to the Navajo Nation and to appropriately analyze the economic impacts to the Nation in promulgating the MACT Rule. The MACT Rule was not tailored so that costs of compliance for plants on the Navajo Nation are achievable within a reasonable timeframe, taking into consideration the simultaneous challenges each of the plants faces under the Regional Haze Rule ("RHR") in meeting Best Available Retrofit Technology ("BART"), as well as compliance requirements under other Clean Air Act ("CAA") programs.

In accordance with Section 112(d)(1) of the CAA, the MACT rule did not take into account differences among classes, types, and sizes of sources as well as differences in types/classes of fuels in determining emissions standards for existing sources, and which differ substantially on a regional and site specific basis. Based on the Treaty derived government-to-government relationship of the Navajo Nation and the United States government, and consistent with the right of sovereignty and self-determination of the Navajo Nation, it was appropriate for EPA to consider classifying EGUs on tribal lands in a different subcategory from those on non-Indian lands. Instead, EPA has promulgated a "one size fits all" rule that fails to acknowledge the efficacy of certain technologies based on boiler type and coal qualities or the impracticability of coal blending for many plants.[3]

II. EPA MUST CONSULT WITH THE NAVAJO NATION AND MUST AMEND ITS REGULATORY IMPACT ANALYSIS (RIA) TO CONSIDER THE ECONOMIC IMPACTS TO THE NAVAJO NATION AND NAVAJO PEOPLE FROM THE FINAL MACT RULEMAKING.

A. There are Substantial Economic Interests of the Navajo Nation and Navajo People at Stake.

The 2009-2010 Comprehensive Economic Development Strategy of the Navajo Nation ("CEDS") summarizes Navajo Nation economic data including budget figures, primary sources of revenue, major employers, and poverty, employment and unemployment figures.[4] According to the CEDS, in 2007 the unemployment rate for the Navajo Nation was five times higher than the unemployment rate of the highest ranked U.S. State (Rhode Island at 10%), increasing from 42.16% in 2001 to 50.52% in 2007.[5]

The percentage of Navajo people on the Navajo Nation living below the federal poverty level in 2007 was 36.76%.[6]

Based on the CEDS, the Power Plants are listed among the largest employers within the Nation. During the period covered by the CEDS, FCPP employed 586 people, 72% of whom were members of the Nation, with an annual payroll of $41 million.[7] Additionally, the plants are linked inextricably with the coal mines that supply fuel to them and the additional economic benefits to the Navajo Nation

[3] For example, SJGS, NGS and FCPP are captive to their associated mines, and cannot blend. *See* EPA Base Case v.4.10, Ch. 9, Tables 9-1 and 9-2, and Sections 9.1.2 and 9.2.9.
[4] 2009-2010 Comprehensive Economic Development Strategy of the Navajo Nation ("CEDS"), *available at* http://www.navajobusiness.com/pdf/CEDS/CED_NN_Final_09_10.pdf.
[5] CEDS at 20.
[6] *Id.* at 23.
[7] *Id.* at 35.

attributable to the plants include mine employment, payroll and royalty revenue for the Nation. For example, FCPP burns approximately 10 million tons of coal annually from the BHP Navajo Mine.[8] Revenues to the Nation in the form of royalties and taxes paid by the Navajo Mine into the Navajo Nation's general revenue were $69 million in 2007 alone.[9] The Navajo Mine is also a major employer on the Navajo Nation, with 427 employees, 87% of whom are Navajo tribal members. Salary and benefits paid by the Navajo Mine exceeded $46 million in 2007.[10]

A February 2012 Economic Impact Study prepared by the Arizona State University W.P. Carey School of Business concerning the Navajo Generating Station and Kayenta Mine finds the following in this grave economic environment; NGS provides 538 permanent jobs, with 83% of those filled by Navajos. Numerous seasonal employees are also hired by the plant of which large percentages are Native American. The plant's annual payroll is more than $50.0 million.[11] The Peabody Kayenta Mine delivers approximately 8.3 million tons of coal to NGS and employs 320 union represented and 110 non-represented company workers a large percentage of whom are Native American.[12] The general revenues attributable to the Navajo Nation government from FCPP, NGS, and the mines that supply them, make up a third of the general operating budget of the Navajo Nation. In part utilizing its general operating budget, the Navajo Nation itself employs 7,316 individuals, 98% of which are Navajo.[13]

The CEDS provides the following commentary on the impacts of the closure of the Mohave Generating Station on the Navajo Nation:

> Because of EPA regulations, the Mohave Generating Station near Laughlin, Nevada, closed its operations. As this power plant was the sole buyer of coal from Black Mesa Mine, it had to close its operation on January 1, 2006. Closure of this mine has had very adverse economic impact not only on the 160 or so people laid-off from the mine, but also on the Navajo Nation coffers.[14]

The Nation has already suffered the ripple effects of one EPA rulemaking that, through the imposition of financially untenable emissions controls, resulted in the closure of the Mohave Generating Station, and as a consequence, the closure of the Black Mesa Mine, which until then had supplied 30% of the Nation's general revenues.[15] If FCPP or NGS were to close as the result of the imposition of cost-prohibitive emission controls, the mine supplying coal to that plant would also close. Revenue and job losses of that magnitude would be cataclysmic for the Navajo Nation and its People, and would certainly impugn the very solvency of the Navajo Nation government.

B. EPA Has So Far Failed to Consult with the Navajo Nation As Required by Law.

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[8] *Id.*
[9] *Id.* at 37.
[10] *Id.*
[11] *Id.* at 36.

[13] *Id.* at 140.
[14] *Id.* at 37.
[15] *Id.*

As recognized in E.O. 13175, "the United States has a unique legal relationship with Indian tribal governments as set forth in the Constitution of the United States, treaties, statutes, Executive Orders, and court decisions."[16] Accordingly, every federal agency "shall have an accountable process to ensure *meaningful and timely* input by tribal officials in the development of regulatory policies that have tribal implications."[17] As the EPA recognizes, EPA shares "the federal government's trust responsibility, which derives from the historical relationship between the federal government and Indian tribes . . . ."[18] It is therefore extremely surprising that in a February 28, 2011 Memorandum regarding consultation with Indian tribes on the proposed MACT Rule, EPA states the following:

> The EPA has concluded that this action may have tribal implications. However, it will neither impose substantial direct compliance costs on tribal governments, nor preempt tribal law. This proposed rule would impose requirements on owners and operators of EGUs. EPA is aware of three coal-fired EGUs located in Indian country. EPA is not aware of any EGUs owned or operated by tribal entities.[19]

For purposes of the required tribal consultation, the standard for determining whether a regulation has tribal implications is not whether it "impose[s] substantial *direct compliance costs* on tribal governments," but rather whether a proposed regulation has "substantial *direct effects* on one or more Indian tribes."[20] As discussed above, the final MACT Rule will have substantial direct effects on the Navajo Nation, which relies on two of the three coal-fired plants identified in the Tribal Outreach Memo, and their supporting mines, for one third of its general operating fund, in addition to the significant Navajo jobs provided by all three plants and their associated mines. Where the Nation's tribal trust assets are so implicated, EPA has a unique trust responsibility to the Navajo Nation in this circumstance.

Nonetheless, despite recognizing the unique impact of the MACT Rulemaking in Navajo Indian Country,[21] EPA's sole "outreach" to the Nation was apparently a generic letter to the Navajo Nation President that was also sent out to 583 other tribes, none of which has coal-fired plants on their lands.[22] The EPA can and must do better to engage with the Navajo Nation in meaningful government-to-government consultation in this and other rulemakings, which have the potential to so catastrophically impact the Navajo Nation through EPA regulation.[23]

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[16] E.O. 13175, 65 Fed. Reg. at 67249.
[17] *Id.* at 67250 (emphasis added).
[18] USEPA Tribal Consultation Policy, Section IV.

[19] February 28, 2011 Memorandum, *Summary of Outreach and Consultation with Tribal Governments*, from Laura McKelvey, EPA Community & Tribal Programs Group, to NESHAP (hereinafter "Tribal Outreach Memo").
[20] E.O. 13175 §§ 1(a) and 5(a), 65 Fed. Reg. at 67249-50 (emphasis added). Where there are direct compliance costs placed on tribes by agency regulation, a further process beyond meaningful consultation is generally required. *See id.* at § 5(b).
[21] Surely EPA knew where the three coal fired power plants in Indian country were located.
[22] Tribal Outreach Memo.
[23] It is especially troubling to have to remind USEPA of its consultation obligations to the Nation where three other air-quality rulemakings for the Nation's power plants are current or pending, where the Nation has had to request consultation on those rulemakings, and where USEPA has just finalized its Tribal Consultation Policy purportedly to better implement E.O. 13175 and its 1984 Indian Policy.

C. EPA Failed to Analyze Impacts to the Navajo Nation as Part of Its Regulatory Impact Analysis.

Moreover, in addition to its failure to meaningfully consult with the Nation, the EPA failed entirely to analyze the potentially catastrophic economic effects of the MACT Rulemaking on the Navajo Nation in its March 2011 Regulatory Impact Analysis of the Proposed Toxics Rule ("RIA"),[24] or to consult with the Navajo Nation as a government that would be "uniquely" affected by the proposed rule.[25] Although the Navajo Nation is not the "owner" or "operator" of the FCPP or NGS, it is the landlord for those plants, and owns the coal that supplies both plants, and consequently is directly impacted by the MACT Rule's compliance costs. As a coal fired power plant landlord and coal owner, EPA should have analyzed the effects of compliance on the future solvency of the Navajo Nation government.

Additionally, in the proposed MACT Rule, EPA provides the facile conclusion that "more jobs will be created in the air pollution control technology production field than may be lost as the result of compliance with these proposed rules."[26] This is not an accurate analysis of the potential social costs to the Navajo people, where unemployment runs at over 50%, and where no skilled labor force, or industry, exists in the pollution control technology field. On the contrary, should the final MACT Rule result in closure of NGS, as apparently predicted by the EPA,[27] thousands of jobs will be lost, not only in the coal and power industry on the Nation, but in the service support industry and public sector as well. Such devastation to the local Navajo economy would likely force migration of many Navajo workers from their native homeland in search of jobs, a "social cost" never analyzed or considered by EPA in its RIA.[28]

III. THE MACT RULE FAILS TO PROVIDE AN APPROPRIATE LEVEL OF FLEXIBILITY REDUCE IMPLEMENTATION COSTS

A. The MACT Rule Compliance Timeline Is Overly Stringent and Will Increase the Cost of Compliance and Uncertainty in Continued Operation of EGUs.

Given site specific constraints and the likely inability of the control technology industry to meet industry demands for compliance technology within the statutorily mandated maximum three year period for compliance established pursuant to CAA § 112(i)(3)(A), EPA can reduce the impact of the MACT Rule compliance timeline by seekingthe available 2-year Presidential extension.[29] Alternatively, EPA could still seek a legislative fix that would allow compliance timelines for the MACT Rule to be incorporated into other rulemakings affecting sources.[30]

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[24] *See, generally*, RIA, Chapters 8-10.
[25] *See* 2 U.S.C. § 1534, E.O. 12866, 58 Fed. Reg. 51735 (Oct. 4, 1993).
[26] 76 Fed. Reg. at 24979.
[27] RIA, Figure 8-8.
[28] Other shortcomings in the RIA are discussed in further detail, *infra*.
[29] *See* CAA § 112(i)(4).
[30] *See* discussion, *infra*.

Pursuant to CAA §112, existing sources are required to comply with the final MACT Rule within 3 years.[31] However, as EPA itself acknowledges, coming into compliance within the three year statutory period will depend on the control technology industry being able to ramp up quickly.[32] Additionally, EPA should consider that existing sources would have to design and procure appropriate control technology to meet the new standards, obtain necessary permits, and schedule outages to install the required technology. Timelines should also take into consideration site-specific constraints, which may include materials and labor costs, pending lease approvals,[33] future CAA rulemaking, changes in business structure, etc. Moreover, this rule is effective nationally. Indeed, EPA estimates that there are approximately 1,400 EGUs located at 550 facilities covered by this proposed MACT Rule.[34] Without appropriate extensions, site-specific constraints and demand on the control technology industry have the potential to lead to premature shutdown of the some sources.

B. EPA Must Incorporate All Other Current and Pending Rulemakings into its MACT Rulemaking and Provide Flexibility for Industry to Comply.

EPA acknowledges that EGUs are subject to several rulemaking efforts such as NESHAP standards under § 112, New Source Performance Standards ("NSPS") under §111, interstate transport of emissions contributing to ozone and PM air quality problems under § 110(a)(2)(D) and greenhouse gases ("GHG") standards.[35] However, all current and pending EPA rulemakings for EGUs should have been considered in establishing a compliance schedule for meeting Hg and other HAP emission limits under this current rulemaking. In the case of FCPP and NGS on the Navajo Nation, costs for compliance and scheduling to meet the MACT Rule requirements will be in addition to the exorbitant costs and other uncertainties faced by FCPP, NGS, and SJGS as they strive to meet BART under the CAA.

NGS and the FCPP are subject to proposed BART determinations under the RHR of the CAA, with the goal of restoration of visibility in mandatory Class I federal areas ("Class I Areas") (42 USC § 7491(a); 40 CFR §51.308). Upon a final determination for BART, the power plants will have five years to comply with installation of the determined emissions control technology. Compliance costs and compliance scheduling in meeting BART already have the potential to significantly impact the Navajo Nation economy. Including another level of costs for compliance and compliance scheduling to meet the MACT Rule would be in addition to the exorbitant costs faced by the power plants on Navajo Nation to meet BART, and the stringent timeframes for MACT emissions controls. The Navajo Nation economy will be confronted with the recurring threat of severe reductions in the revenue received from the power plants and their supplying mines.

On February 25, 2011, EPA, Region IX, proposed an Alternative Emission Control Strategy ("AECS"), a better-than-BART determination to its previous October 19, 2010 proposal for FCPP. The AECS takes into account the FCPP proposal to shutdown Units 1, 2 and 3. The loss of this total net

[31] CAA § 112(i)(3)(A).
[32] *Id.* at 25055.
[33] Land use approvals on Indian trust lands require significantly longer time periods, as many as several years, and hence add to regulatory uncertainty in the context of ongoing, and multiple, rulemakings.
[34] *Id.* at 25088.
[35] 76 Fed. Reg. at 25057.

capacity of 560 MW by 2014 would result in 100% control of NO_x, SO_2, PM, Hg and other hazardous pollutants from these EGUs, which would significantly reduce emissions from FCPP.

Currently, EPA, Region IX, has delayed proposing BART for NGS pending crucial consultations with stakeholder tribes. After publication of the Advance Notice of Proposed Rulemaking ("ANPRM"), the Navajo Nation recommended a phased approach to emissions controls for FCPP and NGS, and suggested that the EPA consider the multiple interests at stake, including the significant economic interests of the Navajo Nation. EPA should have explicitly analyzed the impact of the MACT rule in conjunction with these other rulemakings and provide flexibility for compliance scheduling so that FCPP and NGS, upon which the Navajo Nation economy is almost entirely reliant, can continue their operations. The EPA should also analyze the impact of future rulemakings, such as greenhouse gas regulation, which have the potential to insert another layer of compliance costs and compliance scheduling for coal-fired power plants to meet, and may add another layer of severe challenges to the Navajo Nation economy.

IV. THE RIA'S MODELING AND ANALYSIS IS FLAWED AND INCOMPLETE.

The RIA presents the health and welfare benefits, costs, and other impacts of the MACT Rule by 2016.

A. Projected Retirements Are Troubling.

EPA used the Integrated Planning Model (IPM), developed by ICF Consulting, to conduct its analysis. IPM is a dynamic linear programming model that can be used to examine air pollution control policies for SO2, NOx, Hg, HCl, and other air pollutants throughout the United States for the entire power system.[36] Relative to the base case, the RIA states that 9.9 GW of coal-fired capacity is projected to be uneconomical to maintain by 2015. The RIA further defines uneconomic EGUs as "older, smaller, and less frequently used generating units that are dispersed throughout the country."[37] In fact, the RIA projects that NGS will have to retire by 2015 as a result of the proposed MACT Rule.[38] The Navajo Nation is particularly concerned how EPA in its RIA categorizes NGS as "uneconomic". In the policy case, EPA assumes that most eoal fired EGUs will require a fabric filter (baghouse) to meet the total PM standard.[39] However, EPA acknowledges that for non-Hg controls, a number of the units that were in the MACT floor for non-Hg HAP metals in fact had electrostatic precipitator ("ESP") installed.[40] NGS should not have to install baghouses to comply with the MACT Rule.

In addition to failing to consider the direct economic impacts on the Navajo Nation, the RIA fails to account for the fact that NGS is owned in part by the United States acting through the Bureau of Reclamation ("BOR"). Energy generated by NGS and attributed to BOR's ownership share is used in multiple ways to subsidize the Central Arizona Project ("CAP"), which delivers Colorado River water for domestic, municipal, industrial and agricultural uses throughout central and southern Arizona. Pursuant to the Arizona Water Settlements Act of 2004, P.L. 108-451, revenues generated by the sale of power

[36] RIA at 8-1.
[37] RIA at 8-17.
[38] RIA at Figure 8-8.
[39] RIA at 8-5.
[40] 76 Fed. Reg. at 25055.

exceeding that needed to deliver CAP water may be used to fund the costs of Indian water rights settlements in Arizona. The Nation is currently engaged in negotiations to settle its water rights claims in the Lower Colorado River Basin, and will look to these funds should it reach a settlement of these water rights claims in the state. Further, any settlement of the Nation's water rights claims in Arizona would likely also involve delivery of CAP water, and the Nation has an interest in keeping energy rates for delivery of CAP water at an economical level. None of these tribal interests, or federal and state interests, were analyzed or even considered in the RIA.

The RIA projection of NGS as uneconomic and retiring based on the MACT Rule is alarming. EPA needs to explain how it predicted the closure of NGS, and if that prediction is correct, EPA must consider the impacts to the Navajo Nation and consult with the Navajo Nation. EPA must also evaluate closure of larger EGUs such as NGS on a regional economic basis rather than on a Nation-wide basis considering only electric reliability and costs to ratepayers.

V. CONCLUSION

The Nation generally supports the goal of the final MACT to reduce HAP emissions from stationary sources. However, as a tribal nation and a small government landlord of affected EGUs and associated mines, appropriate analysis and consideration in the MACT Rule should have been given to the critical economic interests of the Navajo Nation and the Navajo people in the continued operation of power plants in Navajo Indian Country. So far, EPA has failed to meet its consultation obligations to the Navajo Nation and explicitly analyze the economic impacts to the Nation in promulgating the MACT Rule. The MACT Rule must be tailored so that costs of compliance for plants on the Navajo Nation are achievable within a reasonable timeframe, taking into consideration the unique challenges each of the plants faces in meeting BART, other compliance requirements under CAA, as well as compliance costs for future rulemakings.

Based on the government-to-government relationship of the Navajo Nation and the United States government, and consistent with the right of sovereignty and self-determination of the Navajo Nation, EPA should also consider classifying EGUs on tribal lands in a different subcategory from those on non-Indian lands. In any case, EPA should not promulgate a "one size fits all" rule that fails to acknowledge the efficacy of certain technologies based on boiler type and coal qualities or the impracticability of coal blending for many plants. Additionally, given the likelihood that the control technology industry will be unable to meet industry demands for compliance with the MACT Rule within the statutorily mandated three year period, and site specific realities, the EPA should seek to utilize all extension measures available under the CAA. EPA should also consider seeking amendments to the CAA which would allow for extension of the compliance period for the MACT Rule where necessary to coordinate compliance timelines for plants involved in other rulemakings.

Harrison Tsosie
Attorney General
THE NAVAJO NATION

Mr. WHITFIELD. Thank you.

At this time, Reverend Hescox, who is President of the Evangelical Environmental Network, you are recognized for 5 minutes.

STATEMENT OF MITCHELL C. HESCOX

Mr. HESCOX. Thank you, Chairman Whitfield and Ranking Member Rush, and all the members of the committee. I must say, my biggest challenge here this morning, being an old preacher, is to keep this to 5 minutes.

"Life, especially protecting our unborn children and infants, should not be a matter of party or economic commodity." Speaker Boehner spoke those words just a couple of weeks ago in my hearing at the March for Life rally. He suggested protecting life and providing the opportunity for abundant life must be a matter of principle and morality. Children are a precious gift from God. They are among the most vulnerable members of our society, and our scripture demands that we protect the vulnerable. And yet, we gather here today to choose if protecting our unborn children and newborns from mercury emitted from coal-burning power plants is in our national interest in keeping with our national character.

Are we, as a Nation, willing to protect our children or hinder them? Mercury is an neurotoxin whose impacts on the unborn and newborn children pose significant costs to both them and society. A recent medical paper states that mercury is a highly toxic element, and there is no known safe level of exposure.

In the past year, the National Association of Evangelicals, the United Conference of—United States Conference of Catholic Bishops, and us, the EEN, Evangelical Environmental Network, have joined together to support a Federal mercury standard that would protect our unborn children and infants across the country. Two different Christian traditions united to protect a sacred gift from God, a gift before and after birth, and anything that threatens or impedes life or unborn infants is contrary to our common belief an exacts a moral cost on the Nation's character.

Approximately one in six children in the United States are born with threatening levels of mercury. Mercury impairs neurological development, lowers IQ, and has a potential list of other health impacts. There are over 1,000 documented published medical journals that support these conclusions. These conditions result from eating food containing methyl mercury, primarily contaminated fish, and the source of 50 percent of our domestic mercury emissions remain coal-fired utilities.

Unborn children and infants are at risk. Pregnant women who consume fish contaminated with mercury transmit such mercury to their unborn children. They also give it to them in their breast milk. Unlike adults, unborn children have no way to excrete mercury. The toxin keeps circulating inside their mother's womb, increasing their exposure. Medical research indicates that mercury cord blood is twice that of the mother's blood. Therefore, even if a mother's blood remains below toxic levels, risk levels, the unborn child may not.

Right now, according to the latest survey, over 50 percent of our fresh waters in the United States have mercury fish eating advisories. It is simply not safe to eat freshwater codfish in most of the United States. An example of that is one of my employees, one of my staff, Ben Lowe who lives in Illinois, many of his neighbors fish regularly to provide protein for their families. Ben tells a story of one day he was fishing in the Chicago River. He knew it was polluted, knew it was filled with mercury, and he was about ready to throw his catch back in when a man came up to him and asked him if he could have it. Ben tried to explain to him that it was full of mercury and other toxins, but the man said I need to feed my family. They are hungry. Ben gave him the fish, but it is not right. Nowhere in America should a man have to choose to feed his family or to feed them poison.

Our children pay the greatest cost to mercury pollution, but such costs also accrue to society. One study estimate that the cost of methyl mercury alone was $5.1 billion in 2008. The authors of that study compare the economic benefits of eliminating mercury pollution to the benefits gained from past lead regulation.

We have heard today over and over again that MATS will cost $9.6 billion a year, but I believe with these kinds of benefits that aren't even included in the EPA studies that for every $1 spent, we will see 5 to $10 in return. It is going to be expensive. We estimate in an internal EEN Study that it could cost in the high area $7 a month to electricity bills. You have heard the averages here before. But I think that $84 a year is worth protecting our families.

I know I am probably running out of time, so I would just like to say and conclude by as this stance bill was released earlier this year. We stood together with the U.S. Catholic Conference. Bishop Blair stated upon the MATS release that the U.S. Catholic bishops welcome this important move by the administration to adopt long-awaited standards to reduce mercury and air toxic pollution from power plants and to protect our children's health. We believe together that this is a fair and uniform standard to address a powerful threat. We can take 90 percent of the mercury out away from coal-burning power plants without the fear of diminished electricity reliability or job loss, and with great economic ability.

It is well past time to act. No more delays, no more special treatment of one industry over another. Not caring for our children simply diminishes our Nation. And as the Psalmist says, give justice to the weak, and maintain the rights of the afflicted.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Hescox follows:]

TESTIMONY OF
THE REVEREND MITCHELL C. HESCOX
President and CEO
Evangelical Environmental Network

"A CHRISTIAN PERSPECTIVE ON THE COSTS OF MERCURY TO HUMAN HEALTH AND WELLBEING"
Before the
ENERGY AND POWER SUBCOMMITTTEE
of
ENERGY AND COMMERCE COMMITTEE
U.S. HOUSE OF REPRESENTATIVES
FEBRUARY 8, 2012

"Because human life is not a political or economic commodity. And defending life is not a matter of party ... it's about standing on principle.

"These two founding principles, life and liberty, are intertwined. Together, they form the core of our national character. They comprise the standard by which the world looks to us. When we affirm the dignity of life, we affirm our commitment to freedom. When we don't affirm life ... when life is cheapened or weakened, here or abroad, freedom itself is diminished.

– The Honorable John Boehner,
Speaker of The House of Representatives,
March for Life Rally
January 23, 2012

The Honorable Speaker of The House John Boehner's words just two weeks ago at the March for Life rally express values I hold dear, values that help bring me here today. Life, especially protecting our unborn children and infants, should not be a "matter of party or economic commodity." Protecting life and providing the opportunity for abundant life must be a matter of principal and morality.

Luke 18:15-16 (ESV)
15 Now they were bringing even infants to him that he might touch them. And when the disciples saw it, they rebuked them. 16 But Jesus called them to him, saying, "Let the children come to me, and do not hinder them, for to such belongs the kingdom of God.

Children are a precious gift from God and are among the most vulnerable members of our society. Christian Scripture demands we protect the vulnerable, and yet we gather here today to choose in effect if protecting our unborn children and newborns from mercury pollution from the largest domestic source, coal-burning power plants, is in our national interest and in keeping with our national character. Are we as a nation willing to protect our children or hinder them? Mercury is a neurotoxin whose impacts on unborn and newborn children pose significant costs to them and society. A recent medical paper from the National Institutes of Health states:

> **Mercury is a highly toxic element; there is no known safe level of exposure. Ideally, neither children nor adults should have any mercury in their bodies because it provides no physiological benefit.[1]**

Even slight increases in environmental exposure to mercury may lead to adverse effects on nervous system development.[2] In addition, the American Academy of Pediatrics stated:

> **We agree with the strong evidence the EPA provides to support their decision that the proposed rule is both appropriate and necessary to protect public health ...[3]**

In the past year, the National Association of Evangelicals (NAE), The United States Conference of Catholic Bishops (USCCB), and the Evangelical Environmental Network (EEN), have joined together to support a federal mercury standard that would protect our unborn children and infants across the country. Affirming our positions are several documents, including a statement from senior evangelical leaders entitled ***An Evangelical Call To Stop The Poisoning of Our Unborn***, and a letter from the Catholic Bishops' Conference to Environmental Protection Agency (EPA) Administrator Jackson. In the letter, Bishop Blaire stated,

> **While there are short-term costs involved in implementing this standard, the health benefits of such a rule outweigh these costs. Therefore, we welcome the EPA's proposal of a national standard to significantly reduce**

> **toxic air pollution and call upon our leaders in government and industry to act responsibly, justly, and rapidly to implement such a standard.**

We represent two different Christian traditions; however, we are united to protect life, a sacred gift from God, both before and after birth.

> ***Psalm 139:13 (ESV)***
> [13]***For you formed my inward parts;***
> ***you knitted* me together in my mother's womb.**

Anything that threatens and impedes life, especially impacts on the unborn and young children, is contrary to our common beliefs and values and exacts a moral toll on the nation's character.

According to data from the Centers for Disease Control, approximately 1 in 6 children in the United States are born with threatening levels of mercury.[4] Another medical research study places the number on children affected at roughly fifteen (15) percent.[5] Mercury impairs neurological development, lowers IQ, and is linked to cardiovascular disease and a host of other potential adverse health impacts. Over 1000 published medical journal articles verify mercury's heath impacts.[6] These adverse conditions result from eating foods containing methylmercury, primarily contaminated fish. Mercury deposition and entrance into the food chain is also well documented, as is the fact that 50% of our domestic mercury sources remain coal-fired utilities.

The most at risk and vulnerable are unborn children and infants, mainly because the body's natural defense, the blood brain barrier, is not yet fully developed. Pregnant women who consume fish and shellfish contaminated with mercury transmit such mercury to their developing unborn child, and infants can ingest mercury in breast milk. Unlike adults, unborn children have no way to excrete mercury. The toxin just keeps circulating inside their mother's womb increasing their exposure. Medical research indicates that mercury cord blood is twice that of their mothers' blood.[7] Therefore, even if a mother's blood remains below "risk level" doses, the unborn child's may not. Mercury poisoning of our children is just not a statistic; it's our children.

The threat of mercury is present across our country. According to the latest EPA Toxic Release Inventory, Texas produces approximately 17 % of the United States mercury emissions from coal-fired utilities, over 11,000 pounds in 2010, an increase over 2009.[8] Using EPA guidelines, fifty-one percent of North Texas reservoirs had largemouth bass above the recommended mercury limits.[9] Texas is not alone. The 2010 ***Biannual National Listing of Fish Advisories*** states that approximately 17 million acres of lakes and 1.3 million miles of rivers, over 40% of our fresh waters, have mercury advisories, an increase of 1.1% (lakes) and 0.2% (rivers) from 2008.[10] All fifty (50) states have at least one mercury fish consumption advisories. It's simply not safe to eat locally caught fish in much of the United States, especially if you are a woman who is pregnant or nursing.

As part of his Christian witness, EEN staff member Ben Lowe chooses to live in a low-income community in DuPage County, IL. Many of his neighbors fish regularly to provide protein for their families. Ben, an avid angler, reports an event while fishing in the Chicago River. Knowing the river had fish consumption advisories, Ben was about to release his catch, when a man walked up and asked for it, to feed his family. Ben attempted to explain that the fish was full of toxins such as mercury, which would hurt his children. It's ok, the man said, they need the food. Ben ended up giving him the fish, but no, it is not ok. Nowhere in America should a family have to choose between eating poison and going hungry.

Ben's story is not unique. Last spring, we had a family outing to Valley Forge National Park. My daughter-in-law is a photographer, and as we passed the covered bridge, she asked for a photo. We walked around the bridge and right there was a sign posted, "Attention All

Fishermen – No Fish May be Killed or Held in Possession From This Stream." Just 30 feet away, a man was fishing. Returning home, we went to the Pennsylvania Fish Advisory Website and learned mercury and PCB's poisoned the stream. A colleague, Hispanic Pastor Frank Machado, shared how his family once depended on locally caught fish for a source of protein. Now he is afraid of even taking his sons fishing in Pennsylvania because of the mercury warnings.

Our children pay the greatest cost of mercury pollution. But such costs also accrue to society. One study estimates the base cost for methylmercury toxicity of $5.1 billion in 2008 between a range of $3.2 of $8.4 billion.[11] The authors compare the economic benefits of eliminating mercury pollution to the benefits gained from lead regulation:

> **Similarly [to lead], great economic savings can be achieved by preventing methylmercury contamination of fish, which is the major source of human exposure to this chemical.[12]**

The EPA's Mercury and Air Toxics Standard, the so-called "utility-MACT" rule, will cost some $9.6 billion per year according to the agency[13]. However, the EPA also estimates that for every $1 spent complying with this rule, society will reap between $5-9 in return.[14]

Some may point out that the poor will be most affected in higher electric rates. In certain areas, it could add $7.00[15] per month to electric bills, with the national average increase $3 to $4 per month.[16] Considering that the average electric bill has declined over twenty (20%) in real terms since 1980[17], most Americans, we suggest, would agree that it is worth $84.00 per year to protect our children. Nevertheless, for those for whom this might prove a hardship, we are happy to work with private parties and government to ensure that the poor are helped through energy efficiency, public policy, or any number of possibilities.

Small business owners' understand the value of health benefits provided by environmental protection. In a recently released study, "79% of small business owners support having clean air and water in their community in order to keep their family, employees, and customers healthy, and 61% support standards that move the country towards energy efficiency and clean energy".[18]

Our Network and those we work with in the faith community, including the National Association of Evangelicals and the United States Conference of Catholic Bishops, are thankful for recently finalized National Mercury and Air Toxics Standards and their life-saving benefits from mercury, particulates, and acid gases. In a public release after the MATS' promulgation Bishop Stephen Blaire of USCCB stated:

> **The U.S. Catholic bishops welcome this important move by the Administration to adopt long-awaited standards to reduce mercury and toxic air pollution from power plants and to protect children's health. In the end it just makes good sense to want to have clean air for our children and families to breathe and for future generations.**

This regulation is a fair and uniform standard to address a powerful threat to our children.

As a father and now a grandfather, this is personal. It is also central to the Evangelical Environmental Network's ministry of creation care, because for us creation care is a matter of life. We understand the gift of creation as a sustainable gift empowering and providing for human life.

Exposing children to mercury poisoning in their mother's womb, a poisoning that will last a lifetime, is simply wrong. We have it within our means to reduce 90% of the mercury emitted from coal-burning power plants without the fear of diminished electric reliability or job loss, and with economic benefits at least five times greater than the cost.

We've waited since the 1990 Clean Air Act for our country to clean up mercury from the burning of fossil fuels. It is well past time to act –no more delays or special treatment of one industry over another[19]. Let us live up to our nation's character and protect the vulnerable from mercury pollution emitted by coal-burning power plants. We urge this Subcommittee and the entire Congress to protect our children by supporting this regulation. Today's world provides enough threats to our children's future. Let's not endanger our children with a substance we can control. We must protect the weakest in our society, the unborn, from mercury poisoning. As the Psalmist says:

Psalm 82:3 (ESV)

Give justice to the weak and the fatherless;
maintain the right of the afflicted and the destitute.

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[12] Ibid.
[13] EPA FACT SHEET: Mercury and Air Toxics Standards -BENEFITS AND COSTS OF CLEANING UP TOXIC AIR POLLUTION FROM POWER PLANTS, downloaded from: http://www.epa.gov/mats/pdfs/20111221MATSimpactsfs.pdf
[14] Ibid.
[15] Evangelical Environmental Network internal estimate of monthly consumer cost in highest abatement areas.
[16] EPA Proposed Rule Factsheet: http://www.epa.gov/airquality/powerplanttoxics/pdfs/overviewfactsheet.pdf
[17] McCarthy, James E., EPA's Utility MACT: Will the Lights Go Out?, Congressional Research Service, January 9, 2012, 7-5700.

[18] Small Business Owners' Opinions on Regulations and Job Creation, February 1, 2012; downloaded from http://www.asbcouncil.org/uploads/Regulations_Poll_Report_FINAL.pdf
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An Evangelical Call to Stop the Mercury Exposure of the Unborn

Our commitment to Jesus Christ compels us to do all we can to protect unborn children from mercury poisoning.

> *"Jesus said, 'Let the little children come to me, and do not hinder them, for the kingdom of heaven belongs to such as these.'" (Matthew 19:14)*

> *"For you created my inmost being; you knit me together in my mother's womb." (Psalm 139:13)*

As evangelical Christians, we believe that all human life is sacred; that each person conceived is of equal and innate value and dignity, and that all human life is worthy of protection.

We are thankful for the many benefits provided by our modern, advanced economy, including vastly improved health care. We recognize, however, that our economic progress has been accompanied by considerable environmental degradation. For example, approximately half of our electricity is generated in coal-fired power plants that emit many toxic pollutants, including mercury. Such power plants are the largest domestic source of mercury pollution, helping to create a situation where one out of six babies born in the U.S. has harmful levels of mercury in their blood.1

The Clean Air Act was signed into law over 40 years ago by President Richard Nixon, with significant amendments signed by President George H. W. Bush in 1990. The law as amended provides, among other things, for the protection of all people, and especially pregnant mothers and unborn children, from mercury pollution generated by power plants. Yet until recently, court challenges have tied the hands of those charged with protecting our air quality.

Mercury emitted from power plants drops from air to earth and presently contaminates over 6 million acres of freshwater lakes, 46,000 miles of streams, and 225,000 wetland acres across the U.S. Every state has a fish consumption advisory. Mercury contaminated fish are often eaten by pregnant women. Mercury and other heavy metal toxins pass across the mother's placenta and enter the bloodstream of her unborn child. A protective shield around the developing child's brain is not fully formed until the first year of life. Mercury easily crosses into the developing child's brain causing brain damage, developmental disabilities, neurological disorders, lowered intelligence, and learning difficulties.

On March 16, 2011, the Environmental Protection Agency (EPA) issued the proposed Mercury and Air Toxics Standards. Finally, more than 20 years after the 1990 Clean Air Act amendments were passed, the courts have cleared the way for the issuance of regulations protecting our communities from mercury pollution. These standards when applied are expected to reduce emissions of mercury from power plants by 91 percent.

Opponents of the mercury standards are seeking to weaken or delay the regulations. They argue that the cost of cleaning up our air (about $3-7 per month per family) is too expensive. We welcome an honest debate about how much our children's health is worth. We believe that our families, and particularly the unborn who are most at risk, deserve protection. We support efforts to safeguard pregnant mothers and our unborn and newborn children from the neurological health risks associated with mercury poisoning.

As an essential step in protecting the vulnerable from mercury pollution, we call upon our leaders in government and industry to act responsibly and humanely, and to implement effective regulations that reduce at least 90% of mercury emissions from power plants without further delay. Our children have already waited far too long for this protection.

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[1] See Kathryn R. Mahaffey et al., "Blood Organic Mercury and Dietary Mercury Intake: National Health and Nutrition Examination Survey, 1999 and 2000," *Environmental Health Perspectives*, 112, No. 5 (April 2004): http://ehp.niehs.nih.gov/members/2003/6587/6587.html, and Leonardo Trasande, et al., Public Health and Economic Consequences of Methyl Mercury Toxicity to the Developing Brain, *Environmental Health Perspectives*, Vol. 113, No. 5 (May 2005): p. 593; http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1257552/pdf/ehp0113-000590.pdf. The 1-in-6 figure, taken from her peer-reviewed research, was used by Mahaffey in a presentation she made while she was the EPA's top mercury scientist. See http://www.epa.gov/waterscience/fish/forum/2004/presentations/monday/mahaffey.pdf.

An Evangelical Call to Stop the Mercury Poisoning of the Unborn Signatories

All signatories do so as individuals expressing their personal opinions and not as representatives of their organizations unless indicated.

Rev. James Amadon, Pastor, Highland Covenant College Bellevue, WA

Rev. Dr. Leith Anderson, President, National Association of Evangelicals (NAE), Washington, DC

Vincent Bacote, Ph.D., Associate Professor of Theology and Director of Center for Applied Christian Ethics, Wheaton College, Wheaton, IL

Corey Beals, Ph.D., Associate Professor of Philosophy & Religion, George Fox University, Newburg, OR

Rev. Gary Bergel, Director, Community Peace International, Charles Town, WV

Alexandria Bennett, Sustainability Coordinator, Point Loma Nazarene University, San Diego, CA

David Black, Ph.D., President, Eastern University, St. Davids, PA

Dr. Negiel Bigpond, Co-Founder, Two Rivers Native American Training Center, Bixby, OK

Steven Bouma-Prediger, Ph.D., Professor of Religion, Hope College, MI

Kathleen Braden, Ph.D., Professor of Geography, Seattle Pacific University, WA

Bettie Ann Brigham, Vice President for Student Development, Eastern University St. Davids, PA

Bob Brower, Ph.D., President, Point Loma Nazarene University, San Diego, CA

Rev. Edward R. Brown, Director, Care of Creation Inc., Madison, WI

Rev. Dave Butts, Chair, National Prayer Committee; President, Harvest Prayer Ministries, Terre Haute, IN

Rev. Dr. Clive Calver, Senior Pastor, Walnut Hill Community Church Bethel, CT,

Rev. Mae Cannon, Executive Director, El Karma Ministries, Concord, CA

Rev. Dr. Paul Cedar, Executive Director, Mission America Coalition, Palm Desert, CA

Rev. Pat Chen, Founder & President, Love Ministries International; The White House & Capitol Hill Prayer Initiative, San Ramon, CA

Rev. Richard Cizik, President, New Evangelical Partnership for the Common Good, Fredericksburg, VA

Shane Claiborne, A Founding Partner of The Simple Way, Philadelphia, PA

David Clark, Ph.D., Past President, Palm Beach Atlantic University, Palm Beach, FL

Anna Clark, Author, *Green American Style*, Dallas, TX

Rev. Luis Cortes, President & CEO, Esperanza USA; Host, National Hispanic Prayer Breakfast, Philadelphia, PA

Phil Covert, Lead Pastor, Asbury Church, York, PA

Paul R. Corts Ph.D., President, Council for Christian Colleges and Universities (CCCU), Washington DC

Andy Crouch, Christianity Today International, Swarthmore, PA

Kelly R. Cupples, Senior Pastor, Life Fellowship Fort Morgan, CO,

Janel Curry Ph.D., Professor of Geography & Environmental Studies, Calvin College Grand Rapids, MI

Dharius Daniels, Senior Pastor, Kingdom Church, Ewing, NJ

Rev. Daniel Delgado, Senior Pastor, Third Day Missions Church; Board of Directors, National Hispanic Christian Leadership Conference, Staten Island, NY

Dr. Wesley Duewelm, President Emeritus, One Mission Society, Greenwood, IN

Rev. Michael Doerr, Pastor, Mt. Healthy Christian Church, Cincinnati, OH

Rev. Dick Eastman, International President, Every Home for Christ, Colorado Springs, CO

Chris Elisara, Ph.D., Executive Director, Center for Environmental Leadership, Julian, CA

Susan Emmerich Ph.D., Emmerich Environmental Consulting, Palos Heights, IL

Merrill Ewert, Ph.D., President, Fresno Pacific University, Fresno, CA

Dr. Michael Ferber, Director of Environmental Studies and Assistant Professor of Geography, The King's University College Edmonton, AB

Dr. Daniel F. Flores, President, The Hispanic Wesleyan Society, Fort Worth, Texas,

Rev. Steve Fortenberry, Board Chair & Founder Goodness Grows; Pastor, Common Ground Church, North Lima, OH

Steven Garber, Director, The Washington Institute, Falls Church, VA

Luke A. Gascho, Ed.D., Executive Director, Merry Lea Environmental Learning Center of Goshen College, Wolf Lake, IN

Aaron Graham, Lead Pastor, The District Church, Washington DC

Jeffrey Greenberg Ph.D., Professor of Geology, Wheaton College, Wheaton, IL

Rev. David Gushee, Professor of Christian Ethics and Director of the Center for Theology and Public Life, Mercer University, Atlanta, GA

Dr. Norval Hadley, Chaplin, Evangelical Friends Mission, Stanton, CA

Dai Sup Han, Coordinator, Prayer Surge Now!; Coordinator, Californians for Jesus, Chino, CA

Greg Harris, Executive President, Apostolic Initiative, Batesville, MS

Rev. Abiel Hernandez, Pastor and Associate for Urban Ministries, Stillmeadow Church of the Nazarene, York, PA

Rev. Mitchel C. Hescox, President & CEO, Evangelical Environmental Network, New Freedom, PA

Mike Higgs, President, Sondance, Canby, OR

Rev. Gordon P. Hugenberger Ph.D., Senior Minister, Park Street Church, Boston, MA

Rev. Dr. Joel Hunter, Senior Pastor, Northland, A Church Distributed, Longwood, FL

+Peter Illyn, Executive Director, Restoring Eden, La Center, WA

Rev. Scott Johnson, Director, Over the Wall Ministries, Herndon, VA

Rick Joyner, Founder, Morning Star Ministries & Oak Initiative, Ft. Mill, SC

Brian Kammerzelt, Chair and Assistant Professor of Communication, Moody Bible Institute, Chicago, IL

Susan Karr, Instructor of Biology, Carson-Newman Newman, Jefferson City, TN

Dr. John Jorstad, Professor of Biology, Oral Roberts University, Tulsa, OK

Matthew Kennedy, Youth Pastor, North Park Covenant Church, Chicago, IL

Rev. William Lee, Senior Pastor, Christ Fellowship, Purcellville, VA

Jennifer Letherer, Affiliate Professor of Communications & Media, Spring Arbor University, Spring Arbor, MI

Ellen Livingood, President, Catalyst Services, Newton, PA

Peter Mayer, Senior Pastor, Freedom Community Church, Shrewsbury, PA

Gordon MacDonald, Chancellor, Denver Seminary, Littleton, CO

David McCullough, Lead Pastor, Wesley Church, Middletown, PA

Bishop George D. McKinney, Ph.D., D.D., St. Stephens Church Of God In Christ, San Diego, CA

Rev. James McNally, Pastor, Harvest Christian Fellowship, Stafford, VA

Rev. Jonathan Merritt, Author and Spokesperson, Southern Baptist Environment and Climate Initiative, Duluth, GA

Richard Mouw, Ph.D., President, Fuller Theological Seminary, Pasadena, CA

David Neff, Editor in Chief, *Christianity Today*, Carol Stream, IL

Rev. Jeff Noel, Lead Pastor, Grace Heartland Church, Elizabethtown, KY

Bruce Norquist, Ph.D., Associate Dean of Residence Life, Moody Bible Institute, Chicago, IL

Suzii Paynter, Director, Christian Life Commission, Advocacy Care Center, Austin, TX

Gretchen Peck, National Coordinator, Renewal: Student Caring for Creation, Minneapolis, MN

Terrell Permenter, Pastor, Pinedale Church of the Lord Jesus Christ, Pontotoc, MS

Lowell (Rusty) Pritchard, Ph.D., President and Co-Founder, Flourish: Reviving Lives and Landscapes, Atlanta, GA

Rev. Dr. Elizabeth Rios, Executive Pastor/President Save The Nations/Center for Emerging Female Leadership, Orlando, FL

Tri Robinson, Senior Pastor, Vineyard Boise, Boise, ID

Rev. Samuel Rodriguez, President, National Hispanic Christian Leadership Conference, Sacramento, CA

Joel Roman, Senior Pastor, Ministerio Casa de Oracion, San Francisco, CA

Aaron Routhe, Assistant Professor of Sociology & the Environment, Houghton College, Houghton NY

Scott C. Sabin, Executive Director, Plant with Purpose, San Deigo, CA

Rev. Gabriel Salguero, President, National Latino Evangelical Coalition, New York, NY

Rev. Kim Sandelin, Executive Director, Love in the Name of Christ of Kalamazoo County, Kalamazoo, MI

Rev. Ruth Schofield, Founding President, Embassy for World Peace, Washington, DC

Luke Schrock-Hurst, Mennonite Central Committee; Co-Pastor, Immanuel Mennonite Churchl; East Coast Bishop and Overseer of Potomac District; Virginia Representative, Virginia Mennonite Conference, Harrisonburg, VA

Peter Shinn, President, Pro-Life Unity / Cherish Life, Sterling, VA

Rev. Ron Sider, Ph.D., President, Evangelicals for Social Action, Wynnewood, PA

Matthew Sleeth, MD, Executive Director, Blessed Earth, Wilmore, KY

Nancy Sleeth, Co-Founder, Blessed Earth Wilmore, KY

Matthew Soerens, U.S. Church Training Specialist, World Relief, Chicago, IL

Rev. Dr. Paul V. Sorrentino, Director Religious Life, Amherst College, South Deerfield, MA

Jeremy Story, President, Campus Renewal Ministries, Austin, TX

Rev. Bradley Stuart, Founder, Yada International, Moses Lake, WA

Rev. Dr. Loren Swartzendruber, President, Eastern Mennonite University, Harrisonburg, VA

Steve Timmermans, Ph.D., President, Trinity Christian College, Palos Hieghts, IL

Judy Turpen, Contributing Editor, Christian Educators Association International, Anaheim, CA

C. Pat Taylor, Ph.D., President, Southwestern Baptist University, Bolivar, MO

Noah Toly, Ph.D., Associate Professor of Urban Studies and Director of the Urban Studies Program, Wheaton College, Carol Stream, IL

Dr. Fred Van Dyke, Executive Director, Au Sable Institute, Mancelona, MI

Peter Vander Mulen, Coordinator, Office of Social Justice, Christian Reform Church in North America, Grand Rapids, MI

Rev. Stanley Wachtstetter, The Amos Project, Charleston, MS

Dr. Richard Waldrop, Church of God World Missions, Cleveland, TN

Harry S. Watkins, Ph.D., Professor, Fermanian School of Business, Pt. Loma Nazarene University San Diego, CA

Rev. Dr. Thomas D. Wenig, Senior Pastor, Lutheran Church of Our Redeemer, Evansville, IN

Rev. Tyler Wigg-Stevenson, Founder & Director, Two Futures Project, Nashville, TN

Rev. Dr. Cecelia Williams-Bryant, Senior Episcopal Supervisor, Fourth Episcopal District, African Methodist Episcopal Church, Chicago, IL

Nancy Wilson, Global Ambassador, Campus Crusade for Christ, Orlando, FL

Dr. L. Daniel Wolfe, Director, Oakbrook Translocal Ministries, Oakbrook Church, Reston, VA

Committee on Domestic Justice and Human Development
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June 20, 2011

Lisa P. Jackson
Administrator
U.S. Environmental Protection Agency
Washington, DC 20460

Subj: Docket ID No. EPA-HQ-OAR-2011-0044
Docket ID No. EPA-HQ-OAR-2009-0234

Dear Administrator Jackson:

I write on behalf of the United States Conference of Catholic Bishops ("Conference") to welcome and comment on recently proposed Mercury and Air Toxics Standards that would reduce hazardous air pollution from power plants. The Conference supports a national standard to reduce such pollution. Such standards should protect the health and welfare of all people, especially the most vulnerable members of our society, including unborn and other young children, from harmful exposure to toxic air pollution emitted from power plants.

While we are not experts on air pollution, our general support for a national standard to reduce hazardous air pollution from power plants is guided by Catholic teaching, which calls us to care for God's creation and protect the common good and the life and dignity of human persons, especially the poor and vulnerable, from conception until natural death. As we articulated in *Putting Children and Families First:* "For generations, the Catholic community has reached out to children… We have defended their right to life itself and their right to live with dignity, to realize the bright promise and opportunity of childhood."

Children, inside and outside the womb, are uniquely vulnerable to environmental hazards and exposure to toxic pollutants in the environment. Their bodies, behaviors and size leave them more exposed than adults to such health hazards. Furthermore, since children are exposed to environmental hazards at an early age, they have more extended time to develop slowly-progressing environmentally triggered illnesses.

It is well known that power plants are the largest source of mercury and other toxic air pollution in the United States. In addition to mercury and arsenic, power plants emit lead, other heavy metals, dioxins and acid gases. It is reported that even in small amounts these harmful air pollutants in the environment are linked to health problems, particularly in children before and after birth, the poor and the elderly. These problems apparently include asthma, cancer, heart disease, learning disabilities, brain damage, and other illnesses that adversely affect childhood development.

Toxic air pollution from power plants causes great harm to the environment, to the food chain, and to humans. Scientists tell us mercury emitted from power plants contaminates our lakes, streams, rivers and fish. People are primarily exposed to mercury by eating contaminated fish. This is of particular concern for pregnant women and their unborn and newborn children since mercury exposure can interfere with children's developing nervous systems, impairing their ability to think and learn. According to research, one out of six babies born in the U.S. has harmful levels of mercury in his or her blood.[i] Fish advisories have been issued across the United States warning against fish consumption from local waters as a result of mercury contamination.[ii]

A national standard limiting mercury and other toxic air pollution represents an important opportunity to protect the health and welfare of all people, especially our children and poor and vulnerable communities. Applying such a standard would reduce emissions of mercury from power plants by 91 percent marking a significant step forward. Some may attempt to weaken this proposed standard. However, we believe we ought to take prudent and responsible action to protect our children.

We do not make these comments unaware of the broad economic reality. Our country continues to struggle with persistently high unemployment and stagnant economic growth that is not nearly sufficient to meet the needs of vulnerable workers and families. EPA's analysis finds that the employment impacts of this rule are expected to be small.[iii] Implementation of such a rule should attempt to mitigate the potential effects on the workforce and protect poor and vulnerable communities while maintaining a clear priority for health and well-being. EPA and others involved in implementing this rule should work to ensure that any additional costs generated by implementation of the rule are allocated according to capacity to bear such burdens. Poor and vulnerable people and their communities must not be asked to bear a disproportionate share of the effects of toxic air pollution or the cost burden of implementing such a rule.

While there are short-term costs involved in implementing this standard, the health benefits of such a rule outweigh these costs.[iv] Therefore, we welcome the EPA's proposal of a national standard to significantly reduce toxic air pollution and call upon our leaders in government and industry to act responsibly, justly, and rapidly to implement such a standard.

Sincerely,

Stephen E. Blaire

Most Reverend Stephen E. Blaire
Bishop of Stockton
Chairman, Committee on Domestic Justice and Human Development

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[i] See Kathryn R. Mahaffey et al., "Blood Organic Mercury and Dietary Mercury Intake: National Health and Nutrition Examination Survey, 1999 and 2000," *Environmental Health Perspectives*, 112, #5 (April 2004): http://ehp.niehs.nih.gov/members/2003/6587/6587.html, and Leonardo Trasande, et al., Public Health and Economic Consequences of Methyl Mercury Toxicity to the Developing Brain, *Environmental Health Perspectives*, Vol. 113, No. 5 (May 2005): p. 593; http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1257552/pdf/ehp0113-000590.pdf. The 1-in-6 figure, taken from her peer-reviewed research, was used by Mahaffey in a presentation she made while she was the EPA's top mercury scientist. See http://www.epa.gov/waterscience/fish/forum/2004/presentations/monday/mahaffey.pdf.

[ii] American Lung Association, Emissions of Hazardous Air Pollutants from Coal-Fired Power Plants. Prepared by Environmental Health & Engineering, Inc., March 7, 2011, p.18. Available at: http://www.lungusa.org/assets/documents/healthy-air/coal-fired-plant-bazards.pdf

[iii] U.S. Environmental Protection Agency, Regulatory Impact Analysis for the Utility Air Toxics Rule, Final Report, March 29, 2010, p. 9-15. Available at: http://www.epa.gov/ttn/atw/utility/ria_toxics_rule.pdf

[iv] U.S. EPA ibid, p. 1-1

UNITED STATES CONFERENCE OF CATHOLIC BISHOPS

USCCB> Media > News Releases >

Bishops Welcome New Mercury And Air Toxics Standards To Protect Human Life And God's Creation

December 21, 2011

WASHINGTON—"A new national standard to reduce mercury and toxic air pollution from power plants is an important step forward to protect the health of all people, especially unborn babies and young children, from harmful exposure to dangerous air pollutants," said the U.S. bishops' domestic policy chairman in response to the Environmental Protection Agency's (EPA) announcement of a new rule limiting hazardous air pollution.

Recently finalized Mercury and Air Toxics Standards will reduce toxic air pollution from coal- and oil-fired power plants that are the largest source of mercury pollution in the United States. Many of these pollutants are linked to health problems, particularly in children before and after birth, the poor and the elderly.

"The bishops welcome this important move by the Administration to adopt long-awaited standards to reduce hazardous air pollution and protect children's health," said Bishop Blaire. "In the end it just makes good sense to want to have clean air for our children and families to breathe and for future generations."

Bishop Blaire is chairman of the Committee on Domestic Justice and Human Development of the U.S. Conference of Catholic Bishops (USCCB). He also cited Catholic teaching on the protection of the environment and the need to protect human life and dignity at all stages.

"Children, inside and outside the womb, are uniquely vulnerable to environmental hazards and exposure to toxic pollutants in the environment," he said. "Their bodies, behaviors and size leave them more exposed than adults to such health hazards."

Bishop Blaire had earlier commented on the proposed rule in a June 20 letter to the EPA. The text of the letter can be found at http://www.usccb.org/about/general-counsel/rulemaking/upload/comments-to-epa-on-mercury-2011-06.pdf

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Keywords: children's health, environmental justice, stewardship, creation, natural resources, pollution, mercury, standards, EPA, Environmental Protection Agency, standard, rule, reduction, pro-life, Domestic Justice and Human Development, Bishop Stephen E. Blaire, USCCB, U.S. bishops, U.S. Conference of Catholic Bishops, Catholic Church:

# # # # #

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Mr. WHITFIELD. At this time, we recognize Dr. Julie Goodman from the Harvard School of Public Health, and you are recognized for 5 minutes for your opening statement.

STATEMENT OF JULIE E. GOODMAN

Ms. GOODMAN. Good afternoon, Mr. Chairman and members of the subcommittee, and thank you for the opportunity to testify. I am Dr. Julie Goodman, a board-certified toxicologist and Principal at Gradient, which is——

Mr. WHITFIELD. Is your microphone on?

Ms. GOODMAN. Is it—can you—should I start again?

Mr. WHITFIELD. Yes.

Ms. GOODMAN. Thanks. All right. Good afternoon, Mr. Chairman and members of the subcommittee, and thank you for the opportunity to testify. I am Dr. Julie Goodman, a board-certified toxicologist and Principal at Gradient, which is an environmental consulting firm in Cambridge, Massachusetts. I also teach a graduate level epidemiology class at the Harvard School of Public Health. I am presenting testimony this morning on my own behalf, and as an independent scientist.

I want to start by stressing how important clean air is. there is no doubt that high levels of pollution can be detrimental to human health and the environment. But considering everything from infant mortality to life expectancy, negative impacts from air pollution are at their lowest levels in recent history in the United States.

EPA has estimated that the Mercury and Air Toxics Standards, also known as the Utility MACT, will lead to benefits from reductions in health effects ranging from bronchitis to mortality, and that these benefits translate to tens of billions of American dollars saved. But the methods use to derive these benefits are fraught with large uncertainties, which will likely result in a large overestimation of benefits.

Despite its name, the vast majority of the benefits from the Mercury and Air Toxics Standards reported by EPA are not from mercury reductions, but rather, from highly imprecise estimates of mortality reductions from decreasing emissions of fine particulate matter, or PM2.5. Importantly, these estimates are not based on an evaluation of all available relevant science. Rather, EPA relied on two observational epidemiology studies conducted when air pollution levels were generally above current standards.

Epidemiology studies investigate statistical associations or correlations between estimated levels of air pollutants and health outcomes in human populations. The two studies on which EPA relied report statistical associations between PM2.5 reductions and health benefits and assumed a causal relationship, but dozens of other epidemiology studies are available, and many report no such correlations.

The fact that EPA only considered studies that suggested an association means that it conducted a biased assessment of the available data. And even if it were appropriate to rely only on these two studies, just because two factors are correlated does not mean that one caused the other. Study outcomes can depend on many factors. For example, health risk factors such as smoking, exercise, and diet may have contributed to the increased mortality some studies attributed to PM2.5. In addition, most epidemiology studies, including the two on which EPA relied, estimated personal exposure for monitors at central sites, even though most people spend the majority of their time indoors. These monitors do not accurately capture daily variations in PM2.5 concentrations or composition that are experienced by individuals, particularly indoors. This also leads to inaccurate results in epidemiology analyses.

Finally, in addition to ignoring much of the epidemiology evidence, EPA did not consider other lines of evidence in its benefits estimations. Experimental studies have demonstrated that the physiological impacts of inhaling PM2.5 are only observed when very high doses overwhelm the lungs natural defense mechanisms. In other words, the body's natural defenses can effectively deal with a certain level of PM2.5. Above that level, called the threshold, additional PM2.5 can perturb normal function. Indeed, some level of PM2.5 in ambient air is unavoidable and has been present on Earth for eons, but humans have evolved the means to cope with these exposures without major health consequences.

Despite this, EPA assumed that there is no level of PM2.5 below which health effects, including mortality, would not be observed. Although EPA acknowledged that the benefits estimate would be significantly overestimated if a threshold was incorporated in its analysis, it nonetheless calculated benefits without one. If a threshold were accounted for, mortality estimates would be much less and could be zero.

In conclusion, the largest benefits from the Mercury and Air Toxics Standards are derived not from reducing mercury, but from reducing PM2.5. Despite the vast array of peer reviewed scientific literature on the topic, EPA based its calculations on only two epidemiology studies. These two studies had several methodological limitations, including the inability to assess alternative causes of the observed health effects and the reliance on central monitors to estimate personal exposures. These studies were not consistent with many epidemiology studies, indicating no correlation between reducing PM2.5 in health benefits, nor experimental studies indicating an exposure threshold below which PM2.5 is not likely to overwhelm the body's natural defenses.

All of these factors indicate that the benefits estimates from the Mercury and Air Toxics Standards are grossly inflated and not realistic. Because there is arguably very limited evidence that these standards would reduce the disease burden more than pollution standards already in place, resources should be used towards other measures that would more clearly benefit society..

Thank you again for the opportunity to testify, and I look forward to answering your questions.

[The prepared statement of Ms. Goodman follows:]

EPA's Assessment of Health Benefits Associated with $PM_{2.5}$ Reductions for the Final Mercury and Air Toxics Standards

Prepared for

The American Energy Initiative Hearing

Congress of the United States
House of Representatives
Committee on Energy and Commerce
Subcommittee on Energy and Power
2125 Rayburn House Office Building
Washington, DC 20515-6115

Prepared by
Julie E. Goodman, Ph.D., DABT

February 8, 2012

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Overview

EPA estimated that the Mercury and Air Toxics Standards will reduce the disease burden in America to such an extent that it will translate to tens of billions of dollars saved. The largest benefits from the Mercury and Air Toxics Standards are derived not from reducing mercury, but from reducing fine particulate matter ($PM_{2.5}$). Despite the vast array of peer-reviewed scientific literature on the topic, EPA based its calculations on only two $PM_{2.5}$ epidemiology studies that reported statistical associations between $PM_{2.5}$ reductions and health benefits and assumed a causal relationship. These studies had methodological limitations and were not consistent with many epidemiology studies indicating no correlation between reducing $PM_{2.5}$ and health benefits or experimental studies indicating an exposure threshold below which $PM_{2.5}$ is not likely to overwhelm the body's natural defenses. Thus, EPA's analysis led to grossly inflated estimates of benefits.

My biographical summary is included at the end of this testimony, followed by an Appendix that further details the uncertainties associated with estimations of health benefits from $PM_{2.5}$ reductions.

Testimony

Good morning, Mr. Chairman and members of the subcommittee, and thank you for the opportunity to testify. I am Dr. Julie Goodman, a board-certified toxicologist and Principal at Gradient, an environmental consulting firm in Cambridge, Massachusetts. I also teach a graduate-level epidemiology course at the Harvard School of Public Health. I am presenting testimony this morning on my own behalf as an independent scientist.

I want to start by stressing how important clean air is. There is no doubt that high levels of pollution can be detrimental to human health and the environment. Considering everything from infant mortality to life expectancy, negative impacts from air pollution are at their lowest levels in recent history in the United States.

EPA has estimated that the Mercury and Air Toxics Standards, also known as the Utility MACT, will lead to benefits from reductions in health impacts ranging from bronchitis to mortality, and that these benefits translate to tens of billions of American dollars saved. But the methods used to derive these benefits are fraught with large uncertainties, which likely resulted in a large overestimation of benefits.

Despite its name, the vast majority of the benefits from the Mercury and Air Toxics Standards reported by EPA are not from mercury reductions, but rather from highly imprecise estimates of mortality reductions from decreasing emissions of fine particulate matter, or $PM_{2.5}$. Importantly, these estimates are not based on an evaluation of all available relevant science; rather, EPA relied on two observational epidemiology studies conducted when air pollution levels were generally above current standards.

Epidemiology studies investigate statistical associations or correlations between estimated levels of air pollutants and health outcomes in human populations. The two studies on which EPA relied reported statistical associations between $PM_{2.5}$ reductions and health benefits and assumed a causal relationship, but dozens of other epidemiology studies are available and many report no such correlations. The fact that EPA only considered studies that suggested an association means that it conducted a biased assessment of the available data.

Even if it were appropriate to rely only on these two studies, just because two factors are correlated does not mean that one caused the other; study outcomes can depend on many factors besides pollution. For example, health risk factors – such as smoking, exercise, and diet – may have contributed to the increased mortality some studies attributed to $PM_{2.5}$. In addition, most epidemiology studies, including the two on which EPA relied, estimated personal exposure from monitors at central sites, even though most people spend a majority of their time indoors. These monitors do not accurately capture daily variations in $PM_{2.5}$ concentrations or composition that may differ from what is experienced by individuals, particularly indoors. This leads to inaccurate results in epidemiology analyses.

Finally, in addition to ignoring much of the epidemiology evidence, EPA did not consider other lines of evidence in its benefits estimations. Experimental studies have demonstrated that the physiological impacts of inhaling $PM_{2.5}$ are only observed when very high doses overwhelm the lungs' natural defense mechanisms. In other words, the body's natural defenses can effectively deal with a certain level of $PM_{2.5}$. Above that level, called a threshold, additional $PM_{2.5}$ can perturb normal function. Indeed, some level of $PM_{2.5}$ in ambient air is unavoidable and has been present on earth for eons, but humans have evolved the means to cope with these exposures without major health consequences.

Despite this, EPA assumed that there is no level of $PM_{2.5}$ below which health effects, including mortality, would not be observed. Although EPA acknowledged that the benefits estimates would be significantly overestimated if a threshold was incorporated in its analyses, it nonetheless calculated benefits without one. If a threshold were accounted for, mortality estimates would be much less – and could be zero.

In conclusion, the largest benefits from the Mercury and Air Toxics Standards are derived not from reducing mercury, but from reducing $PM_{2.5}$. Despite the vast array of peer-reviewed scientific literature on the topic, EPA based its calculations on only two epidemiology studies. These two studies had several methodological limitations, including the inability to assess alternative causes of the observed health effects and the reliance on central monitors to estimate personal exposures. These studies were not consistent with many epidemiology studies indicating no correlation between reducing $PM_{2.5}$ and health benefits, nor experimental studies indicating an exposure threshold below which $PM_{2.5}$ is not likely to overwhelm the body's natural defenses.

All of these factors indicate that the benefits estimates from the Mercury and Air Toxics Standards are grossly inflated and not realistic. Because there is arguably very limited evidence that these standards would reduce the disease burden more than pollution standards already in place, resources should be used towards other measures that would more clearly benefit society.

Thank you again for the opportunity to testify today and I look forward to answering your questions.

Biographical Summary

Julie E. Goodman, Ph.D., DABT
Principal

Dr. Goodman is an expert in toxicology, epidemiology, and assessing human health risks from chemicals in consumer products and the environment. Her primary responsibilities at Gradient include the design, oversight, analysis, and interpretation of epidemiology studies as well as the evaluation of chemical toxicology data, apparent disease clusters, and chemical exposures. Before joining Gradient, Dr. Goodman was a Cancer Prevention Fellow at the National Cancer Institute. Dr. Goodman has authored original research articles, review articles, and book chapters on a wide variety of topics related to epidemiology and toxicology, including weight-of-evidence analyses of several chemicals. She also has presented scientific findings and analyses to community groups and regulatory and legislative bodies. She is currently an adjunct faculty member in the Department of Epidemiology at the Harvard School of Public Health.

Representative Projects

Cancer Cluster Analysis: At the request of a municipality and in response to citizens' concerns, investigated whether there was an increased incidence rate of cancer in residents living near a municipal landfill. Communicated findings to city officials and residents at public meetings.

Cross-Sectional Study: Critically reviewed cancer and noncancer trichloroethylene and perchloroethylene toxicity data. Conducted quantitative analysis of exposure to these solvents in groundwater *via* ingestion and showering. Determined whether health effects in an allegedly exposed community were comparable to those in communities with no known solvent exposures based on questionnaire data.

Efficacy and Toxicity Analysis: For a pharmaceutical company whose patent was being challenged, performed an independent analysis of efficacy and toxicity data to determine whether claims in the patent could be challenged.

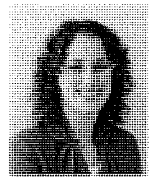
Regulatory Comment: Provided written and oral comments to the Clean Air Scientific Advisory Committee (CASAC) on clinical and epidemiological studies and their bearing on US EPA's development of National Ambient Air Quality Standards (NAAQS) for ozone, particulate matter, nitrogen oxides, and sulfur oxides.

Weight-of-Evidence Analysis: Conducted a comprehensive critical weight-of-evidence review of studies bearing on the ability of very low exposures to bisphenol A to affect reproduction and development *via* endocrine disruption. Testified before several state legislative committees regarding potential restrictions on bisphenol A.

Benchmark Dose Calculations: Analyzed US EPA's use of the lower confidence limit on the BMD_1 ($BMDL_1$) to determine a point of departure for cancer risk of dimethylarsenic acid in humans in a white paper submitted to US EPA.

Product Safety Analysis: Determined whether a toxicological evaluation of a toy was sufficient for determining children's health risks. Conducted an independent analysis of potential routes of exposure to and toxicity of a chemical found in the toy.

Meta-analysis: Conducted meta-analyses and meta-regressions of airway hyper-responsiveness data from clinical studies of asthmatic volunteers exposed to NO_2 while exercising or at rest.



Practice Areas & Expertise

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Education

Ph.D., Toxicology, Johns Hopkins University

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Selected Publications

Rhomberg, LR; Bailey, LA; Goodman, JE; Hamade, AK; Mayfield, DB. 2011. "Is exposure to formaldehyde in air causally associated with leukemia? – A hypothesis-based weight-of-evidence analysis." *Crit. Rev. Toxicol.* (In Press).

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Appendix to the Testimony of
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Regarding
EPA's Assessment of Health Benefits
Associated with $PM_{2.5}$ Reductions
for the Final Mercury and Air Toxics Standards

Prepared for

The American Energy Initiative Hearing

Congress of the United States
House of Representatives
Committee on Energy and Commerce
Subcommittee on Energy and Power
2125 Rayburn House Office Building
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Estimation of Health Benefits from Reductions of PM

The US Environmental Protection Agency (EPA) recently released "Benefits and Costs of the Clean Air Act Report from 1990 to 2020" (US EPA, 2011a) and several associated documents that present the underlying methodology (Industrial Economics, Inc. (IEc), 2006, 2010, 2011). This report, also called the "Second Prospective Study," is the third in a series of EPA studies that evaluated programs related to the implementation of the Clean Air Act (CAA) and its 1990 Amendments (CAAA).

Approximately 90% of the economic benefits reported in the Second Prospective Study relate to reductions in mortality associated with particulate matter (PM) and ozone (O_3); the remaining benefits are divided between reductions in illness (morbidity) and visibility improvements. The majority of the issues discussed below are also relevant to analyses conducted for the Mercury and Air Toxics Standards.

The likely largest source of uncertainty in the CAAA benefits estimation is the choice of the concentration-response function[1] (CRF) that relates the reduction in $PM_{2.5}$ air concentrations to reductions in adverse health outcomes. Underlying this choice is the assumption that statistically significant associations reported in the epidemiology literature are causal. Although EPA acknowledged that "[i]f the PM/mortality relationship is not causal, it would lead to a significant overestimation of net benefits" (US EPA, 2011a, Table 5-11), it did not consider any non-causal scenarios. There are many epidemiology studies that find no association between PM and mortality.

EPA relied heavily on the epidemiology literature in its evaluation of the health impacts from air pollutants and in selecting appropriate CRFs, even though studies report mixed results in the case of PM-associated mortality. While the two studies on which EPA relied report positive statistically significant effects (*e.g.*, Pope *et al.*, 2002 and Laden *et al.*, 2006), other studies show no effect (*e.g.*, Beelen *et al.*, 2008; Brunekreef *et al.*, 2009; Enstrom, 2005; McDonnell *et al.*, 2000; Lipfert *et al.*, 2006; Zeger *et al.*, 2008). EPA placed no weight on these latter studies, and thus did not consider a possible null or no-effect association in the Second Prospective Study.

The first study on which EPA relied to quantify the deaths avoided from $PM_{2.5}$ is a re-analysis of the American Cancer Society (ACS) cohort by Pope *et al.* (2002); the second is a re-analysis of the Harvard Six Cities (HSC) Study by Laden *et al.* (2006). Although these studies have undergone a limited

[1] The concentration-response function describes the change in effect on an organism caused by differing levels of exposure to a stressor after a certain exposure time.

amount of reanalysis, there are remaining limitations that make them unreliable in a quantitative analyses, particularly if considered in isolation from the results from other epidemiology studies.

These two studies reported different mortality estimates. Pope *et al.* (2002) found a 0.6% increase in all-cause mortality per $\mu g/m^3$ of $PM_{2.5}$, while Laden *et al.* (2006) found a 1.5% increase in all-cause mortality. EPA used the mid-point between these two estimates in its benefits analysis (*i.e.*, 1% per $\mu g/m^3$ of $PM_{2.5}$), and gave two bases for its choice: Its assumption that the ACS study underestimated responses because this cohort had a greater percentage of white, educated, higher income participants that are less representative of the susceptible population compared to the HSC study; and its assumption that the ACS study had more exposure measurement error because it relied on a single central monitor in each large city compared to the HSC study, which used monitors that were specifically located for the study. As discussed below in Sections 1.2 and 1.3, neither of these reasons is scientifically sound and raise questions about the magnitude of the estimated mortality effects.

Additional sources of uncertainty discussed in greater detail in Section 1 include the reliability of statistical models used and how effectively the models can control for confounding factors. In Section 2, significant uncertainty in the shape of the CRF is discussed amid mounting evidence that a threshold for PM-related effects exists. In Section 3, EPA's assumption that all PM is similarly toxic is discussed.

1 Uncertainty in the Magnitude of the Mortality Estimate for Particulate Matter

Not only is the question of causality unresolved, but questions remain as to the magnitude of the effects reported in the epidemiology literature. In the Second Prospective Study, EPA relies on two studies as the basis for the CRFs for PM mortality (Pope *et al*, 2002; Laden *et al.*, 2006), although there are a number of other long-term mortality studies that should have been considered. Several studies report no association between PM and mortality, yet EPA does not acknowledge them. EPA's justification for inclusion of the HSC and ACS studies is flawed, and a number of uncertainties in the epidemiology findings raise questions about their use in quantitative benefits assessments. Some of the key uncertainties include exposure measurement error, confounding, and model specification.

1.1 Choice of Concentration-Response Function

EPA limited its choice of CRFs to those from only two studies, not considering the full range of studies available. Importantly, several recent long-term mortality studies have reported no association between $PM_{2.5}$ and mortality, and EPA does not include the possibility of no causal association between PM and mortality in its estimated benefits analyses.

For example, analyses of a large Netherlands Cohort (the NLCS-Air) have reported consistently null results in investigations of PM-related mortality (*e.g.*, Beelen *et al.*, 2008; Brunekreef *et al.*, 2009). Similarly, McDonnell *et al.* (2000) reported no association between $PM_{2.5}$ concentrations and mortality in a large cohort of Seven Day Adventists in California. In another study, Zeger *et al.* (2008) found a lack of association between $PM_{2.5}$ concentrations and mortality for the western US regions, whereas a statistically significant association was reported for the eastern and central regions of the country. Similarly, Lipfert *et al.* (2006) reported a weak association between mortality and $PM_{2.5}$ in single-pollutant models, but no association was noted when they included traffic density in the analyses of a large veterans cohort. Also, Enstrom (2005) reported no association between fine PM and chronic mortality in elderly Californians.

Instead of considering the full range of potential CRFs from the available epidemiology literature, including those that show no or "beneficial" effects of PM, EPA relied on expert elicitation to support its choice of a CRF, asking 12 experts to propose mortality estimate distributions associated with long-term PM exposures (Roman *et al.*, 2008; IEc, 2006).

EPA used expert judgment elicitation as a means of capturing the uncertainty in the CRF. The use of experts to attain this information opens the question of bias in the choice of expert judgments, particularly since the group was not a random sample of experts representing the range of scientific opinions on the subject. For example, six of the 12 experts were co-authors of the ACS and HSC studies, which EPA ultimately relied on to quantify PM mortality. Also, the opinions of experts should not be a substitute for empirical data. In fact, as discussed by Roman *et al.* (2008), one of the challenges in the elicitation study was how to reconcile expert opinion on the likelihood of a causal relationship with the CRF function uncertainty distribution. For example, one expert opined that the likelihood of a causal association was 35%, yet his uncertainty distribution did not include a 0% decrease in mortality per $1 \mu g/m^3$ $PM_{2.5}$.

Skepticism that expert elicitation is appropriate for use in quantitative risk assessment is shared by the NRC Committee on Improving Risk Assessment Approaches (CIRAA), commissioned by EPA to provide advice on improving its risk assessment process (NRC, 2009). This committee was concerned with both the methodology and use of expert elicitation.

Regardless of adequacy of expert elicitation, results of the EPA expert elicitation distributions varied widely by expert, although all were positive. Overall, eight out of 12 experts estimated a PM-associated mortality that was lower than the primary estimate that EPA used (mean of 27% over a 1-80% range). This is consistent with benefits from the CAAA being overestimated.

In summary, EPA did not consider the available epidemiology research fully in developing the CRF for use in its quantitative assessment of mortality reductions associated with reduced $PM_{2.5}$ levels. In addition, because it did not consider a lower bound to the estimates inclusive of a null or non-causal association between PM and mortality, the estimates provided in its Second Prospective Study are likely biased high with significant uncertainties understated.

1.2 Effects on Susceptible Population Groups

The ACS study by Pope *et al.* (2002) included a cohort of over 1 million adults in over 50 US cities, but was a more homogenous population than the general US population. EPA concluded that the authors likely underestimated any mortality effects because the study did not sufficiently represent potentially susceptible population groups, such as people with a lower socioeconomic status (SES). EPA cited the re-analysis of the ACS study conducted by Krewski *et al.* (2000) as evidence of potential effect modification based on SES.[2] There is little evidence to support that soeioeconomic factors modify mortality estimates as the data regarding effects of SES on PM mortality associations are inconclusive at best. EPA actually noted in the Second Prospective Study that the direction of the bias associated with this source of uncertainty cannot be determined based on available data (US EPA, 2011a, Table 5-11).

As part of a sensitivity analysis, Krewski *et al.* (2000) identified potentially "susceptible" subgroups and conducted analyses for each subgroup. The only modifying factor that was found to have a significant effect on PM-associated mortality was education (chosen as a surrogate of SES). In the ACS cohort, Krewski *et al.* (2000) found larger risks of mortality in a subpopulation of people with less than a

[2] An effect modifier is a factor that results in a change in the magnitude of an association between an exposure and an outcome when data are stratified by that factor (Last, 2001).

high school education than in the full cohort. Conflicting results were reported in the most recent analysis of the ACS cohort, which extended the follow-up time to 18 years, from 1982-2000 (Krewski *et al.*, 2009). As in the previous analyses, the most current evaluation featured sensitivity analyses that assessed effect modification by education. For this follow-up, however, a trend of effect modification by education was more difficult to discern and for some health outcomes (*e.g.*, ischemic heart disease), there was a reverse trend such that greater risks were observed for the more educated. It is unknown whether the SES risk gradient observed indicates a higher risk in those with lower SES, or alternatively, as Krewski *et al.* (2009) reported, that there may be inadequate control for socioeconomic factors in the study.

Few studies are available that specifically address SES modification by $PM_{2.5}$ exposures, but several studies have assessed the modifying effects of other PM fractions. Overall, the evidence is mixed. Laurent *et al.* (2007) recently reviewed epidemiology studies of the interaction between SES and air pollution-related mortality (including PM). The authors were not able to make formal comparisons between studies due to the large variety of SES indicators used across the studies. One important finding was that no effect modification by SES was found in studies that used SES indicators at coarse geographic resolutions (city or county level), whereas mixed results were reported for studies that used SES measures at finer geographic resolutions. Overall, the authors noted that there is not enough information to conclude that SES modifies the relationship between air pollution and mortality outcomes.

Although each community in the HSC cohort included a more heterogeneous population than the ACS cohort, the study was much smaller and limited to six cities in the midwestern and northeastern US that are unlikely to be representative of the overall US population or the mix of air pollutants and other factors across the US.

Overall, EPA provided weak justification for focusing on the much higher reported mortality estimates from the Laden *et al.* (2006) analysis, as the literature is not supportive of a "larger" mortality effect from $PM_{2.5}$ exposures in lower SES populations. In addition, EPA does not provide justification for not considering the full range of possible CRF functions available in the literature, which are not limited to the results from these two studies.

1.3 Exposure Measurement Error

As EPA notes, the Pope *et al.* (2002) and Laden *et al.* (2006) studies are also limited in that both studies had to estimate $PM_{2.5}$ concentrations for a large part of the follow-up period (1980s & 1990s) because there were no $PM_{2.5}$ measurements available. Even if these data were available for all years, these studies relied on central monitors to estimate personal exposure, which led to exposure measurement error.

In the ACS study, researchers used average $PM_{2.5}$ concentrations based on the early and later study periods, whereas, in the HSC study, Laden *et al.* (2006) used city-specific regression equations based on extinction coefficients, collected PM_{10} concentrations from monitors within 80 km of study subjects' homes, and indicators for season to estimate $PM_{2.5}$ concentrations for years when measurements were not available. This also introduced uncertainty into the association between $PM_{2.5}$ and mortality. The amount and direction of the bias in both studies are uncertain, but likely overestimated risk associated with exposures to $PM_{2.5}$ (Rhomberg *et al.*, 2011).

Exposure assessment studies have shown that central site data do not adequately represent personal exposure, in part because most people spend a large portion of their time indoors (Lioy *et al.*, 1990; Mage and Buckley, 1995; Janssen *et al.*, 1997, 1998; Ozkaynak *et al.*, 1996; Dominici *et al.*, 2003). Exposure measurement error occurs because central-site monitors may not accurately capture population mobility, the uneven distribution of PM exposure attributable to local sources, pollution patterns that can be affected by terrain features and weatber, and daily variations in PM concentrations or composition that may differ from variations experienced by individuals. These factors may bias the results of an epidemiology analysis in either direction, and are particularly relevant for long-term studies for which these factors likely also vary over time. The direction and magnitude of the bias depends on the type of measurement error and spatial variability of air pollutant concentrations is likely to result in effects being overestimated (Goldman *et al.*, 2011).

Exposure measurement error also affects the interpretation of the CRF for air pollution effects. EPA has often dismissed this important source of uncertainty assuming that the bias is likely to be towards the null. In Second Prospective Study, EPA indeed stated that this bias likely underestimated the benefits (US EPA, 2011a, Table 5-11). Recent studies have shown that this bias can be in either direction but the type of bias typically associated with spatially variable pollutants usually overestimates effects.

1.4 Confounding Bias

A large source of uncertainty that is common to all air pollution epidemiology studies is confounding. A confounder is a factor associated with both the exposure and the health outcome, but is not causal. For example, individual risk factors (*e.g.*, smoking, diet, *etc.*) may contribute to or even fully explain the deaths attributed to PM. The main challenge is the large number of potential confounders which include co-pollutants, temporal trends, individual factors, and meteorological factors.

The study by Pope *et al.* (2002) analyzed potential confounding factors. The researchers tested confounding by smoking, education, body mass index (BMI), diet, alcohol consumption, and occupational/other exposures. Although mortality risk reductions were observed when controlling for these individual factors, the reductions were not statistically significant. While it is plausible that these factors did not play a role in the observed association, it is also likely that they were not accurately estimated in the study because these risk factors were assessed only at the time of enrollment, nearly thirty years ago, and changes in these risk factors were not assessed during follow-up. Furthermore, the SES factors in this study were collected using a self-administered questionnaire, an approach that is well known to result in under-reporting of key potential confounding risk factors for mortality (*e.g.* smoking).

In the Pope *et al.* (2002) study, spatial confounding (effects that may be due to regional or other spatial differences across cities) was explored by applying complex statistical modeling (*i.e.*, random effects models). The results indicated that for all-cause mortality, effect estimates were reduced to statistical insignificance when regional differences were included in the model. This indicates that confounding was likely not fully accounted for in the study.

In addition, Pope *et al.* (2002) assessed mortality associations with alternative PM metrics [*e.g.*, coarse particulate matter (PM_{10}) and total suspended particles (TSP)], sulfates, and various gaseous pollutants (*e.g.*, SO_2, NO_2, CO, and O_3). The mortality estimates associated with sulfates and SO_2 were of the same magnitude as the $PM_{2.5}$-related estimates, but the researchers found no association for other PM metrics and no association with O_3. Interestingly, the authors did not assess potential confounding of the $PM_{2.5}$ mortality association by SO_2 and sulfate in two-pollutant models, even though a reanalysis of the original study indicated these pollutants significantly confounded the PM mortality associations (*e.g.*, Krewski *et al.*, 2000). This is a very critical omission. The ambient levels of SO_2 have decreased markedly since the initiation of the ACS study. It is possible that at the current levels of SO_2, researchers would find no significant association between ambient PM and mortality.

The bias associated with confounding effects is particularly difficult to address in epidemiology studies because it is often difficult to account for all potential confounding factors. In PM mortality studies there is evidence that co-pollutants can confound the PM mortality association, particularly strongly correlated pollutants such as SO_2. Even if potential confounders are accounted for in studies, there may still be issues of how well the confounding variables are measured and, as with the Pope *et al.*, (2002) study, whether confounders were re-evaluated over the follow up study period. The issue of confounding relates to both the assumption of causality, where another factor may actually be the causal agent, and to the magnitude of the association, where a co-factor may account for some of the observed risk. In the Second Prospective Study, EPA did not address the potential bias associated with confounding either quantitatively or qualitatively.

1.5 Model Selection Bias

A remaining large source of uncertainty in the PM mortality association involves how different statistical models impact epidemiology findings. To address this question, researchers conduct extensive sensitivity analyses, including tests of the effects of various model assumptions (*e.g.*, lags and smoothing functions for time trends), to assess the impacts on mortality estimates. There have been questions raised on the appropriateness of the standard Cox Proportional Hazards Model that was used by the two studies EPA relied on for the PM CRFs (Pope *et al.*, 2002; Laden *et al.*, 2006).

A risk estimate is dependent on the statistical model from which it is calculated. If a model is based on assumptions that are not met, risk estimates are likely biased. For example, Moolgavkar (2005) notes that the assumptions of the Cox proportional hazards model are violated in ecological studies of pollution health effects. This is likely for several long-term $PM_{2.5}$ exposure studies, including the study by Laden *et al.* (2006). As Abrahamowicz *et al.* (2003) noted:

> [T]he proportional hazards (PH) assumption…implies that the impact of each covariate on hazard remains constant during the entire follow-up time. While testing the PH assumption is interesting in its own right, simultaneous modeling of nonlinear and time-dependent effects of the exposure of interest may be necessary to avoid biased estimates and incorrect conclusions.

This means that not only the impacts of exposure, but also those of all potential confounders, must be proportional over time to prevent a biased risk estimate. Abrahamowicz *et al.* (2003) actually tested whether this held for a subset of the ACS, which included 50 cities with $PM_{2.5}$ data, and 151 cities with sulfate data. They found a statistically significant deviation from the traditional linearity assumption for both $PM_{2.5}$ and sulfate. They also found that risk estimates for both $PM_{2.5}$ and sulfate differed from those based on models using the traditional assumptions, with $PM_{2.5}$ risks inflated at low doses, and sulfate showing a threshold. These results illustrate that the Cox PH models give inaccurate risk estimates, particularly at low doses.

Koop and Tole (2004) also emphasized that by neglecting the important issue of model uncertainty, or the choice of a specific model among the many options assessors have, "most studies overstate confidence in their chosen model and underestimate the evidence from other models," and can result in "uncertain and inaccurate results." Furthermore, the authors found that when model uncertainty is incorporated into the estimation of air pollution effects, it is so large that the plausibility of effects become questionable. These authors argue that such estimates not be used in policy decision-making, which excludes their use in quantifying impacts of regulations.

In summary, recently conducted analyses to test how model choice impacts mortality estimates find a significant impact on results for one of the most commonly used models for long-term mortality effects analyses, the Cox-PH mode. Model uncertainty has generally not been incorporated in the estimates of air pollution effects and if it is considered, it would likely result in many non-statistically significant results. As with confounding bias, EPA does not address the impact of model uncertainty in its selected CRF function.

2 Uncertainty in the Shape of the CRF for PM Mortality

As noted above, questions remain regarding the shape of the CRF. EPA assumed that the PM-mortality relationship is linear at low concentrations with mortality directly proportional to the ambient particle concentration. The uncertainty of the linear coefficient describing the relationship is considered, but the possibility that the function is nonlinear is not given the same consideration. EPA qualitatively discussed this potentially large source of uncertainty, noting that the bias would overestimate the benefits, but concluded that the effects would be minor. The sensitivity analyses conducted in the First Prospective Study, however, demonstrated that considering a threshold had significant effects on mortality estimates. Several studies provide evidence that the PM-mortality association is non-linear and that a threshold exists. For example, Smith *et al.* (2000) reported PM mortality thresholds at 20-25 $\mu g/m^3$. As shown in Figure 2.1, based on the EPA sensitivity analysis, a threshold at 20 $\mu g/m^3$ would decrease avoided deaths from ~20,000 to 5,000 or fewer (US EPA, 1999).

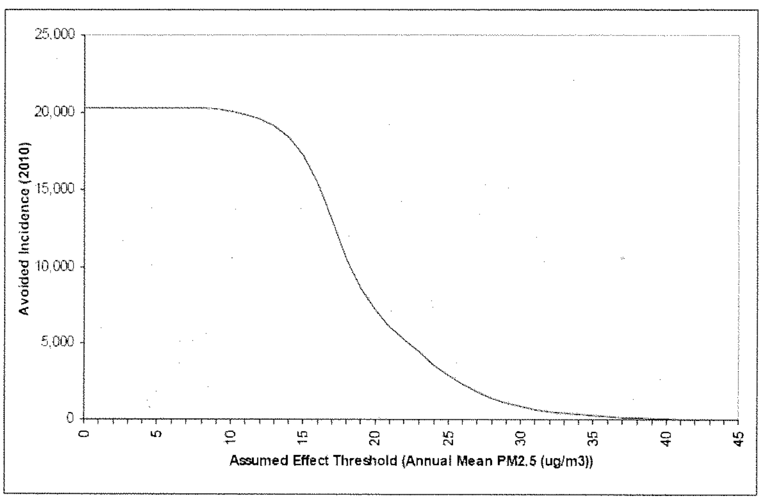

Figure 2.1 **Long-term Mortality Incidence Avoided Assuming Different $PM_{2.5}$ Thresholds.** Based on the CRF from Pope *et al.* (1995). Source: US EPA, 1999, Figure D-2.

A threshold for PM health effects is supported by toxicological, occupational, and human exposure evidence. Toxicological studies demonstrate that the physiological impact and biological mechanism of inhaled PM effects comes from overwhelming the natural defense mechanisms from the mass of particles deposited locally onto tissues (*e.g.*, Oberdorster, 1996, 2002; Pauluhn, 2011; Valberg *et al.*, 2009). Therefore, one would expect to see thresholds and/or nonlinear behavior with higher doses. Indeed, animal studies using carbon black and titanium dioxide (TiO_2) particles show that a threshold for PM-related effects exists (Oberdorster, 1996, 2002). Furthermore, the EPA Health Assessment Document for Diesel Exhaust (US EPA, 2002) reports a no observable adverse effect level (NOAEL) for chronic diesel exhaust particulate (DEP) exposures of 460 $\mu g/m^3$. This NOAEL is based on EPA's comprehensive review of the large numbers of laboratory-animal studies with exposures up to high levels of diesel exhaust (100-7,800 $\mu g/m^3$). Similarly, the development of occupational standard threshold limit values show that other government agencies have been able to derive threshold level of effects for many types of particles (Oller and Oberdörster, 2010). Lastly, human exposure studies using DEP suggest a threshold for inflammatory responses (*e.g.*, Mudway *et al.*, 2004; Behndig *et al.*, 2006; Peretz *et al.*, 2008a,b).

Assuming a linear relationship has significant impacts on health effects benefits estimates because, when a linear function is used to describe health impact for an effect that is truly nonlinear with exposure, then the effect on health is overestimated at lower concentrations and may be (depending on the range of concentrations) underestimated at high concentrations. This is because the change in estimated effect brought about by a reduction in exposure levels depends heavily on how those reductions are distributed over the range of exposure (Rhomberg *et al.*, 2011).

For example, benefits of a control program that knocks down the upper end of the exposure range, but leaves the lower end largely unchanged will tend to be undervalued because the assumed linear function fails to attribute most of the original mortality impact to high-end exposures. Further, this method fails to note that most of the exposure reduction occurs at the high end, where it is most effective.

In contrast, a program that generally lowers all exposure levels but does not disproportionally lower high-end exposures will tend to be overvalued, because it ascribes illusory benefits to the reductions of the already low exposures experienced by much of the population. Indeed, because most of the population exposure occurs at the lower parts of the distribution of exposures even small overestimates of the benefits can, when collected over such a large fraction of the population, dominate the population benefit.

Observed linear relationships between PM exposures and mortality may be artificial due to exposure measurement error. That is, in addition to affecting the magnitude of the effect estimate, exposure measurement error also influences the shape of the CRF. This is because some individuals in the population have greater exposures than others for any given central-site ambient concentration. This will artificially flatten apparently linear CRFs and make concentration-related effects (even those that are truly threshold in nature) look linear, masking what may in fact be a steeper curve (Brauer *et al.*, 2002; Rhomberg *et al.*, 2011).

For example, Meng *et al.* (2005) hypothesized that biases arise in $PM_{2.5}$–health effects associations because of seasonal variations in infiltration behavior. Their data showed that seasonal differences in infiltration behavior coincide with fluctuations in ambient PM concentrations and vary with location. In particular, they found that during the summer, when $PM_{2.5}$ concentrations are generally higher, there was an increase in infiltration factors in New Jersey homes from opening of windows for ventilation, whereas in Texas there was a reduction in infiltration factors because of the use of air conditioners. The researchers concluded that exposure measurement error from differences in infiltration behavior bias health estimates in chronic studies. The magnitude of the error can differ between communities and differentially impact personal-ambient relationships – *e.g.*, mean ambient $PM_{2.5}$ concentrations could be higher in City A *vs.* City B, but due to differences in particle infiltration behavior in the two cities, mean exposures to ambient $PM_{2.5}$ could be reversed. Dominici *et al.* (2002) also reported nonlinear C-R curves when analyzing data at the regional level and noted that nonlinearities are likely averaged out in multi-city studies that present national CRFs.

In conclusion, EPA assumed a linear relationship in its calculation of health impacts from exposure to PM. Evidence is growing in the epidemiology literature that this relationship is in fact nonlinear, and that factors such as exposure measurement error and pooling multi-city effect estimates lead to the appearance of a linear relationship. A threshold for PM effects is also supported by toxicological, occupational, and human chamber studies. A threshold was assumed in the sensitivity analysis conducted for the First Prospective Study, showing much lower mortality incidence when a threshold is assumed.

3 Differential Toxicity of PM Size fractions and PM Components

An additional important source of uncertainty in the CRFs is the regional and seasonal heterogeneity in $PM_{2.5}$ concentrations, population characteristics, and risk estimates that introduce additional bias to overall effect estimates in epidemiology studies (US EPA, 2010, 2011b). For example, in multi-city studies that employ a common model specification, risk estimates may be biased due to differences in $PM_{2.5}$ sources, $PM_{2.5}$ composition, $PM_{2.5}$ concentrations, the adequacy of central monitors to measure personal exposures, and/or population characteristics (*e.g.*, personal behaviors or susceptibilities). Researchers have found significant differences in effect estimates across cities and regions that are unexplained despite recent efforts to evaluate modifying effects that could account for these differences (US EPA, 2011b).

The $PM_{2.5}$ NAAQS makes no distinction between components of $PM_{2.5}$, treating all $PM_{2.5}$ as equally toxic. However, the spatial, temporal, and toxicological composition of $PM_{2.5}$ can vary greatly. The uncertainty associated with differential toxicity of $PM_{2.5}$ components can be significant, as discussed in the IEc uncertainty analyses report (IEc, 2010). Control strategies that reduce specific $PM_{2.5}$ components also affect other components, adding to the complexity of the issue.

For example, regulations that specifically reduces sulfates and nitrates also affect ammonia. In certain parts of the country, these three $PM_{2.5}$ components make up about 40-50% of the PM mass, mostly derived from gas to aerosol conversion from large point sources (such as utilities and industrial combustors) (Green *et al.*, 2002). There is no evidence either from human exposure studies or animal studies, however, to suggest that sulfates, nitrates, or ammonia at current ambient levels are associated with mortality or morbidity outcomes (Green *et al.*, 2002; Utell *et al.*, 1983; US EPA, 1996).[3] Therefore, if controls are focused on particulate components that are highly unlikely to contribute to mortality, and if these PM reductions are counted as contributors to the avoided mortality, then these controlled benefits would be exaggerated and misleading. In the Second Prospective Study, because EPA assumed that all PM is of equal toxicity, the benefits estimates are thus likely biased high.

Although the particulate composition and differential toxicity issue is currently being investigated as noted in the Uncertainty report (IEc, 2010), there is no clear resolution. This issue remains a

[3] Airborne sulfate is widely used in medicine. It is a common ingredient in bronchodilators used to treat asthma. If fact, one puff of an albuterol sulfate inhaler delivers sulfate at a concentration of about 10,000 μg of sulfate per m^3 of inhaled air (Green *et al.*, 2002) and is not only considered safe, but beneficial.

potentially significant source of uncertainty in both the assumption of a causal relationship between PM and health effects (particularly mortality) and if a causal relationship exists at low levels, in the magnitude of these effects.

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Mr. WHITFIELD. Thank you, Dr. Goodman.

At this time, I recognize Dr. Josh Bivens, who is Acting Director at the Economic Policy Institute, for 5 minutes.

STATEMENT OF JOSH BIVENS

Mr. BIVENS. I thank the House subcommittee, and especially the chairman and ranking member for the invitation to testify today. I am Josh Bivens, an economist at the Economic Policies Institute in Washington, D.C. I am going to focus on a relatively narrow slice of the issue, which is the short run job impacts of the toxics rule.

This is the narrowest part of the issue, but it has started to become a major part of the debate. And this is understandable. Far too many Americans remain jobless nearly 4 years after the bursting housing bubble led to what is now known as the Great Recession. Further, I think it is—the entangling of this debate of the toxics rule with this current crisis of joblessness is why I actually began writing about this rule. On the topic of job creation and economic performance, especially in the short run, this is my area of expertise.

Further, I think it is safe to say that no other research institute in Washington, D.C. has worried more loudly and publicly about the current crisis of joblessness than the Economic Policy Institute. Nobody has stronger bonafides in demanding the policymakers address the unacceptably high unemployment rates in the past couple years. So in short, I take very seriously any claim that economic policy could actually inflict some harm in the labor market.

But looking at the toxics rule with an eye towards making sure that the current crisis of joblessness is not exacerbated, I found nothing to concern me on the jobs front. In fact, I found that the jobs impact of the toxics rule in the next couple of years is going to be modest positive. It is not a jobs bill, it is a bill to improve health and quality of life. It also happens to have modest positive job impacts.

In my testimony, my written testimony which I request be submitted into the record, draws heavily on research I authored for EPI. I sketch out how regulatory changes in general and the toxics rule specifically can impact unemployment.

I concluded a couple of things. One, the air toxics rule, like almost all regulated regulatory changes, will have only negligible impacts on job growth over the longer run, and that in the shorter run, especially in an economy plagued by too high rates of unemployment like the American economy today, its impact is very likely to be positive. The major findings in my research is I do a couple different methodologies. My best estimate is that the impact of the rule will be to create about 100,000 jobs between now and 2015. And so for the rest of my testimony, I am just going to briefly describe some of the economic mechanisms that I take into account in making this, and then, of course, I am happy to take questions.

So basically, if you want to think about the effect of regulatory changes on job creation, you really want to separate two things, you know, the long run when the economy is functioning pretty well, versus the short run, when the economy is not functioning well. Employment over the long run and in a well-functioning economy, basically regulatory changes are going to have no impact on unemployment in that case. The reason is pretty simple. When the economy is functioning well, the Federal Reserve has a great ability to neutralize any boost or reduction in job growth through its conventional monetary policy. We may criticize the Fed for their specific unemployment or inflation targets, but when the economy is functioning well, they hit them. So whatever the effective regulation does to the unemployment rate when the economy is functioning well, the Fed can just push back on it, either way.

Further, the impact of the regulatory changes on the first round impacts even before the Fed gets involved, they are going to be pretty modest because they are cross-cutting. Basically you are going to see some job growth because of the investments, the need to be undertaken to install the pollution abatement and control equipment that is going to clean the air, and then on the other side, you are going to see a slight rise in the overall price level as energy costs are then perhaps passed on in the form of higher prices to consumers. But they are cross-cutting effects, they are going to be modest. It isn't even going to be that hard for the Fed to push back against them. In a well-functioning economy, the Fed will be able to do so.

We know that is not the case of the economy today. The Fed is unable to push the unemployment rate lower. It has been trying for a long time and it can't. And so that means, you know, in the jargon we call it the economy is stuck in a liquidity trap. We have very high rates of unemployment, even with short-term interest rates absolutely stuck at zero. The Federal Reserve has essentially disarmed its conventional policy and that changes the analysis of regulatory changes.

So basically you have got, I would say, a positive, a negative, and a neutral effect of this rule on unemployment. The positive is jobs gained through investments and pollution abatement and control equipment. The roughly neutral is jobs in the utility sector themselves, and then the negative is the job impacts of higher energy costs being passed on to higher prices, and that is reducing consumer demand.

I am just going to tell you a couple reasons why in an economy with a very large unemployment rate and large output gaps, that that last negative factor is not going to be as strong. I mean, first the bulk of cost impacts of the toxics rule and electricity prices are temporary, reflecting the need for utilities to make up for investments and cleaner generation. The vast body of economic research says households don't respond very much to temporary price increases. Second, it is likely that any upward price pressure stemming from regulatory changes in the current environment are going to be very blunted because of the very large output gap in the economy. Basically, firms don't have pricing power. When they are not running factories full bore, when they are not selling enough stuff, they just don't have much pricing power to pass on the higher cost to consumers. We know that they have very large profit margins today, pre- and post-tax profit margins are at their highest rates in over 40 years. They have a very large buffer with which they can absorb any cost increase, especially when it is modest as that stemming from the toxics rule.

And lastly, even if prices do rise slightly in response to the toxics rule, this could actually be of benefit in the current economy. What we have right now is nominal interest rates that the Fed controls, they are stuck at zero, and so as prices fall, that actually makes real interest rates rise. That is the last thing we want in the economy right now. We don't want to increase borrowing costs for firms, and so anything that pushes back against disinflationary pressures could actually be good for the economy.

I would just conclude by saying the claim that regulatory changes in general are responsible for today's continued economic weakness don't have an empirical foundation. The claim that regulatory changes should be expected to slow economic and employment growth in the future lacks any basis in economic theory or evidence, and normally, regulatory changes are pretty neutral in their impacts on employment. Actually, the poor performance of the economy today is a reason to make sure that the toxics rule is actually implemented as planned.

[The prepared statement of Mr. Bivens follows:]

Oral testimony of Josh Bivens, Ph.D.
Subcommittee on Energy and Power,U.S. House of Representatives
February 8, 2012

I thank the House Subcommittee on Energy and Power, especially Chairman Whitfield and Ranking Member Rush, for the invitation to testify today on the topic of the Environmental Protection Agency's (EPA) rules governing the emission of mercury, arsenic and other toxic air pollution from power plants, which I'll refer to henceforth as the "toxics rule".

I am Josh Bivens, an economist at the Economic Policy Institute in Washington, DC. For the kind of professional, peer-reviewed cost/benefit analysis that *should be* the clear criterion upon which judgments about the toxics rule – and all other regulatory changes – are made, I'm at best just one in a long list of economists that could be testifying in front of your committee. Further, it's not just modesty that compels me to say that for this sort of cost/benefit analysis, there are plenty of economists and other experts that could be even better choices.

However, the debate over the toxics rule has often become a debate about jobs – and this is partly understandable, given that far too many Americans remain jobless nearly four years after the bursting housing bubble led to what is now known as the Great Recession – the steepest and longest economic contraction we've seen since the Great Depression.

This entangling of the debate regarding the toxics rule with the current crisis of joblessness is why I began writing about this rule – because on the topic of job-creation and economic performance, I actually am an expert. I know what does and what does not materially affect unemployment and employment growth in the U.S. economy; and regulatory change is something that generally does *not* affect these. Put simply, what drives changes in the unemployment rate is just the macroeconomic performance of the economy. So unless one can tie a given regulatory change to a major shift in macroeconomic performance, it will be very hard indeed to say that the change has any major effect on unemployment.

Further, it is safe to say that no other research institute or think tank in DC has worried more loudly and publicly about the current crisis of joblessness than has EPI. Nobody has stronger bona fides in demanding that policymakers address the unacceptably-high unemployment rates of the past couple of years. So, in short, we take very seriously any claim that a given policy will harm the labor market. But, looking at the toxics rule with an eye towards making sure that our current crisis of joblessness is not exacerbated, I found absolutely nothing to concern me on the jobs-front.

In my testimony, which draws heavily on research that I authored for EPI, I will sketch out how regulatory change in general, and the air toxics rule specifically, can impact unemployment. I conclude that the air toxics rule – like almost all related regulatory changes – can have only trivial effects on job-growth over the longer-run, and that in the shorter- run (over the next couple of years – particularly if the unemployment rate remains high) its effects on job-growth will be clearly positive.

In fact, it is *precisely because* the economy has so much unused capacity today that the impact of the air toxics rule, if implemented as planned, would have positive impacts on job-creation and would lead to a lower unemployment rate. In short, calls to delay implementation of the rule based on vague appeals to wider economic weakness have the case entirely backward – there is no better time than now, from a job-creation perspective, to move forward with these rules.

The major findings of my research on the employment effects of the toxics rule are as follows:

- The rule will have a modest, but positive, impact on overall employment, leading to the creation of roughly 100,000 jobs between now and 2015. I use two methodologies to generate the estimates of the toxics rule unemployment impacts – one indicates that 84,500 jobs will be created while the other indicates that the number will be 117,000.

- This net job impact is the result of "cross-cutting" effects. New investments in pollution abatement and control (PAC) will generate jobs in the environmental protection sector. The need to switch to more labor-intensive activities within the utility sector itself will generate a small increase in jobs within the sector itself. One potential downward pressure on job-growth stemming from the rule is the possibility of energy cost increases feeding through to higher prices in energy-using industries and slowing consumer demand for their output. Lastly, any net change from these first-round impacts is amplified through re-spending effects as those who gain jobs increase their consumption thereby generating jobs throughout the economy. More specifically, using the more-conservative methodology of Bivens (2011) applied to the final rule RIA:

  -8,000 would be gained in the utility industry itself.
  -80,500 jobs would be created through PAC investments.
  -32,500 jobs would be lost due to higher energy prices leading to reductions in output.
  -Assuming a re-spending multiplier of .5, and since the net impact of the above impacts is positive, another 28,000 jobs would be created through respending.

  If, however, the more-realistic assumptions of Bivens (2012, forthcoming) are adopted, the jobs lost due to higher energy prices would be reduced to 10,600, leading to 117,000 net new jobs created due to the toxics rule.

Again, the clearest take-away point from the EPA's regulatory impact analysis (RIA) and other analyses of pollution standards is that the *primary* economic impact these rules will have is on health and quality-of-life outcomes. The improvements to health and quality-of-life stemming from the rule changes would be very large and make the regulatory change worthy of support in and of itself. Specifically, the EPA estimates (based on the state-of-the-art research) that the final rule would annually lead to:

-4,200 to 11,000 lives saved (which the EPA describes as "avoiding premature mortality")
-4,700 fewer heart attacks
-5,700 fewer hospital and emergency room visists
-140,000 fewer cases of respiratory symptoms
-540,000 fewer days of work lost to sickness

The 'monetized' value of these and certain other health benefits would amount to $33-90 billion per year, dramatically exceeding the $9.6 billion annual cost of the program (figures in 2007 dollars). Again, it is these substantial benefits to health and quality of life that should be the main criterion for judging the worth of passing the toxics rule. But, since we're here today to talk about jobs – I will pivot for the rest of the report to this.

The effect of regulatory change on job-creation: long vs short run and healthy vs sick economy

At the outset, we should note that the job impacts of regulatory changes are very different depending both on the time-horizon examined as well as the macroeconomic context. Below, the differing employment effects that occur over these different time-horizons and macroeconomic contexts are sketched out.

Employment over the long-run in well-functioning economies

In the long-run and during times when the economy is functioning well, the job impacts from these regulations would likely to be quite small, for two main reasons.

The most important reason is simply that in a well-functioning economy, the Federal Reserve has great ability to neutralize any boost or reduction in job-growth through conventional monetary policy. We may (and I often do) criticize the Fed for their specific unemployment and employment targets – but in a well-functioning economy, they will, by definition, be able to hit these targets so the first-round effects of regulatory change on job-growth are likely to be swamped by the Fed's management of the overall economy.

Further, in a well-functioning economy the Fed actually won't have to do too much to offset the direct, first-round impacts of regulatory change on employment-growth, because these first-round effects will be very modest because they have offsetting influences. On the one-hand, regulatory change may well boost employment because of the extra investments needed to be undertaken to bring producers into compliance – powerplants purchasing and installing scrubbers to clean their emissions, for example. On the other hand, a bump in the price-level of energy may be transmitted to the overall economy by causing a slight rise in *overall* prices – and this rise in the price-level may cause a reduction of spending. What this means is that the first-round effects of regulatory changes are more likely to be positive than negative.

Hence, in the long-run in a well-functioning economy, it is accurate to say that there are *no aggregate job losses at all* stemming from regulatory actions like the toxics rule. The fact that there are no *aggregate* job-losses does not mean, of course, that each and every industry escapes job losses. The degree to which job-losing industries should be aided with complementary policies is an important question, but it should remain clear that in the long-run regulatory action like the toxics rule does not lead to overall involuntary job loss.

Employment effects in the short-run in economies with excess capacity

The analysis is very different in the short-run, especially one characterized by chronic excess capacity and historically high rates of unemployment even as the short-term policy interest rates controlled by the Fed sit at zero. Under these conditions (often labeled a "liquidity trap"), the job impacts of regulatory changes can be substantial, mostly because the Federal Reserve has lost the ability to counter-balance any significant first-round effect of regulatory change on employment.

Of the primary (ie, before re-spending) effects of the toxics rule on employment specified in this report, one is essentially neutral (employment changes within utilities), one is clearly positive (effects of PAC investment) and one is negative (effects of price changes due to higher energy costs).

However, given the current situation of the U.S. economy – caught in a "liquidity trap" – it's actually unclear that the negative impacts of higher product prices caused by more-expensive energy generation would actually have any negative bite at all on the economy. A forthcoming paper by Bivens (2012) explains this point in some detail. But, the intuitive reasons for this judgment are as follows.

First, the bulk of the cost impacts of the toxics rule on electricity prices are temporary, reflecting the need for utilities to make up-front investments in cleaner generation. Given that these price increases are largely temporary, households are not likely to change their behavior much in response. Buitier (2000) has perhaps the clearest exposition of what an increase in a sector's relative price will do for overall economic growth. His overall assessment is that any relative price change not associated with a permanent change to economy-wide productivity growth will

Second, it is likely that any upward price-pressure stemming from the regulatory changes will be extremely blunted in the current economic environment. Research on inflation in the face of "prolonged large output gaps" (PLOGs) show clearly that these gaps exert great downward force on price-growth (see, for example, Meier 2010). The figure below makes the point – very large PLOGS are associated with great downward price pressure.

Third , firms currently have very large profit margins – the highest pre- and post-tax margins in 43 and 45 years, respectively. This gives them a very large buffer against cost-increases pushing up prices (on the role of profit margins as buffers against future price increases, see Rich and Rissmiller (2000). In addition, unit labor costs in nominal terms remain lower at the end of 2011 than they were at the beginning of the Great Recession. All in all, slack in labor and product markets means that there is severe disinflationary pressure on firms that would make it less likely that anything as small as the compliance costs associated with EPA regulations could possibly register as overall price increases. The figure below shows these profit rates.

Lastly, even if prices do rise slightly in response to the toxics rule, recent research (see Chung et al. (2012)) has indicated that this could actually be *expansionory*. This is because nominal interest rates are as low as they can go today, but the economy actually "needs" lower inflation-adjusted rates to move closer to full-employment. Anything that generates some inflationary pressure in a severely disinflationary environment actually helps these real interest rates to fall – which is just what the economy needs to generate more jobs.

Conclusion

The claim that regulatory changes in general are responsible for today's continued economic weakness lacks any empirical foundation. The claim that regulatory changes should be expected to slow economic and employment growth in the future lacks any basis in economic theory or evidence. Normally regulatory changes are neutral in their impacts on employment. Given the specifics of today's economic environment - specifically the very large output gaps that have persisted even in the face of extraordinarily low interest rates – it seems clear that the air toxics rule will provide a modest positive benefit to employment to with it's very large benefits to the nation's health and quality of life.

Testimony before the Subcommittee on Energy and Power of the U.S. House of Representatives Committee on Energy and Commerce, for a hearing on "The American Energy Initiative"

February 8, 2012

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I thank the House Subcommittee on Energy and Power, especially Chairman Whitfield and Ranking Member Rush, for the invitation to testify today on the topic of the Environmental Protection Agency's (EPA) final rules governing the emission of mercury, arsenic and other toxic air pollution from power plants, which I'll refer to henceforth as the "toxics rule".

I am Josh Bivens, an economist at the Economic Policy Institute in Washington, DC. For the kind of professional, peer-reviewed cost/benefit analysis that *should be* the clear criterion upon which judgments about the toxics rule – and all other proposed regulatory changes – are made, I'm at best just one in a long list of economists that could be testifying in front of your committee. Further, it's not just modesty that compels me to say that for this sort of cost/benefit analysis, there are plenty of economists and other experts that could be even better choices.

However, the debate over the toxics rule has often become a debate about jobs – and this is partly understandable, given that far too many Americans remain jobless nearly four years after the bursting housing bubble led to what is now known as the Great Recession – the steepest and longest economic contraction we've seen since the Great Depression.

This entangling of the debate regarding the toxics rule with the current crisis of joblessness is why I began writing about this rule – because on the topic of job-creation and economic performance, I actually am an expert. I know what does and what does not materially affect unemployment and employment growth in the U.S. economy; and regulatory change is something that generally does *not* affect these. Put simply, what drives changes in the unemployment rate is just the macroeconomic performance of the economy. So unless one can tie a given regulatory change to a major shift in macroeconomic performance, it will be very hard indeed to say that the change has any major effect on unemployment.

In my testimony, which draws heavily on a series of papers that I have authored for EPI as well as some work-in-progress, I will sketch out how regulatory change in general, and the air toxics rule specifically, can impact unemployment. I conclude that the air toxics rule – like almost all related regulatory changes – can have only trivial effects on job-growth over the longer-run, and that in the shorter- run (over the next couple of years – particularly if the unemployment rate remains well above normal) its effects on unemployment will be clearly ameliorative (if modest). In fact, it is *precisely because* the economy has so much unused capacity today that the impact of the air toxics rule, if implemented as planned, would have positive impacts on job-creation and would lead to a lower unemployment rate. In short, calls to delay implementation of the rule based on vague appeals to wider economic weakness have the case entirely backward – there is no better time than now, from a job-creation perspective, to move forward with these rules.

The major findings of my research on the employment effects of the toxics rule are as follows:

- The rule will have a modest, but positive, impact on overall employment, leading to the creation of roughly 100,000 jobs between now and 2015. I use two methodologies to generate the estimates of the toxics rule unemployment impacts – one indicates that 84,500 jobs will be created while the other indicates that the number will be 117,000.

- This net job impact is the result of "cross-cutting" effects. New investments in pollution abatement and control (PAC) will generate jobs in the environmental protection sector.

> The need to switch to more labor-intensive activities within the utility sector itself will generate a small increase in jobs within the sector itself. One potential downward pressure on job-growth stemming from the rule is the possibility of energy cost increases feeding through to higher prices in energy-using industries and slowing consumer demand for their output. Lastly, any net change from these first-round impacts is amplified through re-spending effects as those who gain jobs increase their consumption thereby generating jobs throughout the economy. More specifically, using the more-conservative methodology of Bivens (2011) applied to the final rule RIA:
>
> -8,000 would be gained in the utility industry itself.
> -80,500 jobs would be created through PAC investments.
> -32,500 jobs would be lost due to higher energy prices leading to reductions in output.
> -Assuming a re-spending multiplier of .5, and since the net impact of the above impacts is positive, another 28,000 jobs would be created through respending.
>
> If, however, the more-realistic assumptions of Bivens (2012, forthcoming) are adopted, the jobs lost due to higher energy prices would be reduced to 10,600, leading to 117,000 net new jobs created due to the toxics rule.

Again, the clearest take-away point from the EPA's regulatory impact analysis (RIA) and other analyses of pollution standards is that the *primary* economic impact these rules will have is on health and quality-of-life outcomes. The improvements to health and quality-of-life stemming from the proposed rule changes would be very large and make the regulatory change worthy of support in and of itself. Specifically, the EPA estimates (based on the state-of-the-art research) that the final rule would annually lead to:

-4,200 to 11,000 lives saved (which the EPA describes as "avoiding premature mortality")
-4,700 fewer heart attacks
-5,700 fewer hospital and emergency room visists
-140,000 fewer cases of respiratory symptoms
-540,000 fewer days of work lost to sickness

The 'monetized' value of these and certain other health benefits would amount to $33-90 billion per year, dramatically exceeding the $9.6 billion annual cost of the program (figures in 2007 dollars). Again, it is these substantial benefits to health and quality of life that should be the main criterion for judging the worth of passing the toxics rule. But, since we're here today to talk about jobs – I will pivot for the rest of the report to this.

Overview of how economists think about regulatory changes and employment

Given that regulations are often reflexively opposed on the grounds that they inevitably lead to job loss (generally, very large job-losses are implied), and given as well that huge damage inflicted by the Great Recession remains very much with us even two-plus years after its end, insecurity over jobs remains front-and-center in American political debates. Hence, it is useful to take a rigorous and comprehensive look at how these regulatory changes are likely to affect job-creation and unemployment. Again, it should be noted that this testimony and the research it is based upon assesses the job impacts of the economic projections provided by the EPA in their rigorous RIA. If their estimates of key economic parameters (the number of coal plant retirements, the price impacts of regulation, or the amount of capital spending induced by the rule) are changed, the job impacts in this analysis would change as well. That said, past research (see Shapiro and Irons (2011), for example) shows that EPA estimates of the costs of regulations tend to, if anything, generally be too pessimistic about how difficult they will be for businesses to comply with.

It should also be noted at the outset that the job impacts of regulatory changes are very different depending both on the time-horizon examined as well as the macroeconomic context. Below, the differing employment effects that occur over these different time-horizons and macroeconomic contexts are sketched out.

Employment over the long-run in well-functioning economies
In the long-run and during times when the economy is functioning well, the job impacts from these regulations would likely to be quite small, for two main reasons.

In the long-run, industries have time to adjust inputs to reflect changing relative prices (say, substituting more capital and labor for energy inputs as regulatory changes make energy more expensive), and job *losses* in energy-intensive industries that see demand for their output fall due to rising energy prices will be substantially counter-balanced by job *gains* in industries that are not energy-intensive and that benefit from the changed consumption patterns induced by the regulatory change.

Furthermore, in a well-functioning economy any depressing effect on aggregate demand stemming from regulatory changes (declines in consumers' purchasing power driven by increased energy prices, for example) can be offset with other macroeconomic policy levers—reducing interest rates to spur business investment, for example.

Hence, in the long-run in a well-functioning economy, it is accurate to say that there are *no aggregate job losses at all* stemming from regulatory actions like the toxics rule. Instead, because regulations may slightly raise the price of energy and this cuts the purchasing power of workers' wages, there may be very small voluntary reductions in hours supplied to the labor market by American workers. By all accounts, however, the price increase spurred by the toxics rule as well as the labor-supply response stemming from them will be vanishingly small.

The fact that there are no *aggregate* job-losses does not mean, of course, that each and every industry escapes job losses. Some industries will see job losses (energy-producing and heavily energy-using industries) and some will see job gains (light energy-using industries and some that provide alternative sources of energy-generation that do not emit the regulated toxics). The degree to which job-losing industries should be aided with complementary policies is an important question, but it should remain clear that in the long-run regulatory action like the toxics rule does not lead to overall involuntary job loss.

Employment effects in the short-run in economies with excess capacity
The analysis is very different in the short-run, especially a short-run characterized by chronic excess capacity and historically high rates of unemployment. Under these conditions, the job impacts of regulatory changes can be substantial.

On the negative side, any depressing effect these regulatory changes have on aggregate demand are harder to counter-balance with traditional macroeconomic policy levers (for example, the "policy" interest rates controlled by the Federal Reserve are sitting essentially at zero today, so lowering these is not a viable option – though fiscal stimulus could still be used to counter-balance any declines in demand stemming from regulatory changes), and job losses in energy-intensive industries are not likely to be recouped quickly through job gains in less energy-intensive sectors. In fact, these job losses may well just be amplified through multiplier effects.

On the positive side, capital investments made in order to bring power plants into compliance with new rules also spur multiplier effects, and may well represent net new spending in an economy where both businesses and households are extremely reluctant to make new purchases.

Given the actual context in the U.S. economy today as these rules are being debated, this briefing paper mostly focuses on the short-run impacts of regulatory change occurring in an economy with chronic excess capacity. Furthermore, economists and policymakers should be mindful of a key lesson of both the Great Recession but also the Japanese lost decade of the 1990s: while in theory it is easy to imagine ways to keep aggregate demand shortfalls from being problematic for economies, in practice this demand-management might be considerably harder. Given these historical episodes and given academic research on the positive externality benefits of spurs to aggregate demand, economists and policy makers should not be too quick in assuming a long-run horizon where problems of excess capacity have been solved.

The role of complementary policies

Another issue that is made even more salient by today's context of high rates of joblessness and economic under-performance is the role of complementary policies to aid the adjustments that will be needed should the proposed rule become law.

Some industries will see job losses (even as overall job changes are positive), and workers will need to find alternative employment in a very tough labor market. Complementary policies should cushion the amount of industry loss and help those workers who must change jobs. Most importantly, complementary policies that help to achieve both the explicit goals of the regulation (reduced emissions from power plants) as well as minimizing the labor-market adjustments needed should be front and center in the policy debate.

The specific impact of the air toxics rule

In this section, I quickly sketch out the different channels that are relevant to the debate over the effect of the final toxics-rule regulation and jobs given the context of a U.S. economy still facing clear shortfalls in aggregate demand. I would note that an analysis that attempts to capture the incremental employment effects stemming from the rule through all of these channels has not yet, to our knowledge, been undertaken. As mentioned before (and documented below), the EPA technical analysis released with the proposed and final rules quantified the employment implications of some channels of the rule, but was far from exhaustive. And other studies (see Heintz el al. (2010), for example) have looked at the likely activities of the utility sector in light of a set of assumptions regarding the combined effects of the final toxics rule as well as other regulations, but have not isolated the incremental job-effects of the toxics rule alone, apart from other regulatory changes and (importantly) apart from the presumed baseline path of employment and investment in the utility sector. This testimony reports results from my research that quantify solely the incremental employment changes to be expected from the final toxics rule.

The channels that link the rule-change to employment changes are as follows:

Impact on directly-regulated utilities themselves

The most obvious effect of regulations is on the industries that are directly regulated. In the case of the toxics-rule, this means utilities. The toxics rule RIA provides a very good assessment of the likely employment effects of the rule on the utilities themselves, following the approach of Morgenstern, Pizer, and Shih (MPS, 2002), which provided an empirically rigorous examination of the employment effects of regulation on four industries (none of them utilities). MPS identify three separate channels through which regulatory change can impact an industry that is being directly regulated:

-***The output effect***. This is simply the reduction in demand for industries' output that can occur if regulatory changes raise the price of this output.

-***The cost effect***. The cost-effect reflects the fact that if production costs rise due to regulatory change, more inputs (including labor) are needed to produce the same amount of output.

-***The factor-shift effect***. The factor-shift effect reflects the fact that environmental activities *within* a given sector may be more labor intensive than conventional production.

The toxics rule RIA essentially uses the overall averages from the MPS (2002) study to estimate the likely impact on employment in the utilities sector. While none of the four industries studied by MPS (2002) are utilities, there is still a strong case to be made that the study's results can provide a useful benchmark and, if anything, actually paint a too-pessimistic picture in regards to the likely impact of regulations on job trends in the utility sector.

This is because the average output effect measured for the industries studied by MPS (2002) is likely to be far larger (in the negative direction) than that faced by the utility sector, for two reasons.

First, the price elasticity of demand for utility sector output is much lower (by a factor of four) than that facing three of the four industries examined in MPS (2002). This means that a change in the prices of the output of the utility industry has much less effect on demand for its output (and consequently on employment) than do changes in prices of the products of the other industries.

Second, the utility sector is much less exposed to international competition than the four industries examined by MPS (2002). The relevant elasticities and import shares are displayed in the table below, drawn from my briefing paper.

TABLE 1

Price elasticities of demand and import shares, utilities vs. Morgenstern et al. industries

	Utilities	Pulp and paper	Plastics	Steel	Petroleum
Elasticity	-0.16	-0.698	-0.987	-0.953	-0.071
Import share of domestic consumption	0.5%	33.2%	15.3%	22.1%	10.0%

SOURCE: Morgenstern, Pizer, and Shih (2002) and Ho, Morgenstern, and Shih (2008).

Given that the output effect is by far the largest negative contributor to employment growth in the directly regulated industries studied by MPS (2002), and given that this effect is sure to be much smaller for the utility sector than for the average of the industries they studied, it seems clear that the MPS (2002) results are likely to be quite pessimistic in regards to the jobs impact of the toxics rule.

Impact on the environmental protection (EP) sector

Meeting the new standards will, according to the EPA RIA, lead to substantial investments in pollution abatement and control (PAC) – and these investments will spur output in what Bezdek, Wendling, and DiPerna (2008) call the "environmental protection" (EP) sector of the economy. For example, utilities are forecast to purchase and install scrubbers and filters and other equipment meant to capture pollutants before they are released into the atmosphere. These PAC investments will lead to job-growth – scrubbers must be manufactured and installed.

It is important to note as well that a given amount of final demand in the EP sector does not just create jobs *within* that sector; it also creates jobs in industries that *supply* this sector. For example, if steel is a key intermediate good used in the production of scrubbers, then increased demand for scrubbers will lead to employment gains in the steel sector as well.

The toxics rule RIA assumes that utilities will respond to the new standards in part by undertaking significant investments in PAC construction and installation. While investments made by firms as a result of tougher environmental standards are often thrown under the rubric of "compliance costs," it is important to realize that these are *not* simply foregone economic activity, but instead are largely a *re-orientation* of activity.[1] In short, spending on goods and services that are needed to reduce pollution is an activity every bit as capable of creating jobs as spending on anything else.

The RIA forecasts that $8 billion will be spent in the construction and installation of PAC equipment between now and 2015 as a result of the proposed rules. The RIA further estimates that this $8 billion results in roughly 31,000 job-years supported directly in the EP sector. A technical supporting document (TSD) to the RIA breaks out these jobs and allocates them to

1 While there are portions of the social costs identified in the RIA that are indeed purely foregone economic activity, costs dedicated to purchase of PAC equipment are not part of them.

installation of pollution control equipment and jobs spurred by the need to hire operators and materials used in the PAC processes. **Table 3** replicates their job break-outs below.

TABLE 3

Employment effects using the environmental sector approach

Jobs associated with PAC construction and installation	Number of jobs
Construction jobs	30,440
Steel jobs	430
Subtotal	30,870
Jobs associated with new operational needs	**Number of jobs**
Increased resource use[1]	5,230
Increased operational needs[2]	5,500
Subtotal	10,730
Total	41,600

(1) These jobs are supplier jobs.
(2) These jobs are probably already estimated in the "effects on directly regulated industry" methodology following Morgenstern et al. (2002).
SOURCE: EPA (2011a).

On balance, the toxics rule technical supporting document likely undercounts EP jobs
The EPA's analysis of the jobs generated by the toxics rule is likely actually too conservative, leading to an undercount of the employment generated by these EP investments, for two reasons.

First, the implied direct job-multiplier of one job-year created for every $259,000 in spending seems low when compared to other data sources. When data sources like the employment requirements matrix (ERM) of the Bureau of Labor Statistics (BLS) or the Census of Construction are consulted, one gets a much higher direct job-multiplier (between roughly one job per $134,000 to $158,000; see Table 3).

Second, the RIA identifies only the jobs *directly* related to the construction and installation of PAC equipment—mostly missing in this analysis are the jobs supported by final demand for the construction and installation of PAC equipment in *supplier* industries, like those that manufacture the PAC components that are installed. The toxics rule RIA *does* show jobs supported in the steel industry stemming from PAC construction and installation, but these jobs are likely far too small a fraction of the direct jobs to fully reflect the impact of increased PAC construction and installation on supplier industries.

To get a rough sense of how many supplier jobs are being missed in the toxics rule RIA, one can consult the BLS ERM and examine the employment vector in the overall construction industry associated with each $1 million in final demand in that sector. The construction vector in the ERM indicates that each $1 million is associated with roughly 11 jobs in the overall economy, with just fewer than seven of these jobs being accounted for directly in construction. This means that four of the 11 overall jobs (or about 37% of the total) associated with each $1 million in construction spending is actually a supplier job. Of the supplier jobs associated with a given level of spending in the overall construction sector, over a *quarter* come from the manufacturing sector.

In short, the toxics rule RIA, by not accounting fully for supplier jobs supported by spending on installation and construction of PAC equipment, could well be undercounting jobs through this channel by almost 40%, and manufacturing jobs are some of the most significantly undercounted jobs. Counting the steel jobs alone does not nearly give one a good order of magnitude of the supplier jobs supported through the construction and installation of PAC equipment.

A more complete number on PAC investments and jobs
The safest method to use to estimate the number of jobs (including both direct and supplier jobs) that are supported by a given amount of spending on PAC construction and installation is to use the BLS ERM and plug-in the forecasted amount of induced PAC investment as the input. This approach will be the preferred estimate used in this testimony and the research supporting it for identifying the overall job effects; this approach indicates that 80,500 jobs are created through the PAC spending induced by the rule in 2015.

Is counting job gains stemming from compliance costs like the "broken windows" fallacy?
Often in regulatory debates, counting jobs gained through business spending meant to meet new regulatory standards is subject to the accusation that this calculation is an example of the "broken windows" fallacy. This alleged fallacy is the notion that replacing a shopkeeper's window that has been broken by a stray baseball does not generate net new productive employment because the money spent to replace the broken window would have been spent somewhere else (and more productively) had it not been necessary to make the repair – and this foregone spending is destroying jobs as surely as replacing the broken window creates them.

The "broken windows" fallacy is useful to remind policymakers that each use of resources has opportunity costs that must be kept in mind when making cost/benefit analyses, but it surely does not say that the jobs gained through investments made to meet regulatory standards can never constitute net new additions to overall employment. There are essentially two ways that such induced capital compliance costs can spur net new job growth.

The first way—and the way most relevant to today's debate—is if these compliance costs mobilize currently idle financial savings into productive investment flows. This seems extremely likely in today's economy. For one, U.S. corporations sit on massive amounts of liquid cash-holdings that are not being mobilized to finance job-creating investments. For another, the economic channel that is supposed to mobilize these cash holdings into investment is declines in interest rates—yet these rates sit at historic lows today with little prospect that they can be pushed lower through regulatory inaction that will spur non-compliance investments. In the jargon, the U.S. economy is in a liquidity trap that keeps financial savings from being channeled into job-creating investments. Regulatory changes that mobilize this financial savings will indeed create jobs in this economic situation.

Second, even in a well-functioning economy, it is far from clear that the investments undertaken in the name of meeting new regulatory standards cannot add to total employment *even if the financial resources that financed them would have spent elsewhere*. If the construction and installation of PAC equipment, for example, is significantly more labor intensive than the same amount of spending deployed in alternative economic activities, for example, then even just switching from these other activities to PAC investments would yield an increase in labor demand) This scenario actually seems quite likely, especially when one considers the likely alternative uses of the financial resources used to undertake these investments.

Remember, the economic mechanism that channels financial savings into productive investments is interest rate changes. So, if not spending $8 billion on PAC construction and installation boosts financial savings of utilities by this amount, and if the economy is functioning well and seamlessly translates this money into alternative job-creating investments, it will do so by lowering interest rates. This means that the alternative job-creating investments will take place in *interest-sensitive* industries. Interest-sensitive industries are essentially construction or durable goods manufacturing. Since the PAC investments are largely construction, and typically labor-intensive forms of construction at that, it is hard to see why alternative ways of spending this $8 billion would obviously lead to more jobs created through increased non-PAC construction spending. Durable goods manufacturing, additionally, is some of the least labor-intensive production in the entire economy, so spending directed there as an alternative to PAC construction and installation is very unlikely to prove a better job creator.

Given the large amounts of excess capacity and the failure of interest rates to mediate the savings and investments relationships in the U.S. economy today, it seems very likely that the investments mobilized through the need to meet the new standards would represent a nearly pure net new addition to economy-wide employment. And even if these investments happened in an already well-functioning economy, there is still little reason to believe that they would be anything but a plus to job creation.

It should be noted that this macroeconomic reasoning carries through to the utilities sector as well. Even if the utilities sector had concrete plans to spend the $8 billion that will now have to be dedicated to compliance costs on some other investment project, today's historically low interest rates mean that they are free to do both at minimal cost. Furthermore, as most analysts agree that the financial health of the utilities sector is even more connected to interest rates than most (because of their significant infrastructure needs, utilities tend to have high debt load and benefit greatly from low interest rates), it is hard to imagine that the utilities sector is currently more cash-constrained than the overall corporate sector today.

Impact on energy-using industries

If the rules lead to increases in the price of energy, industries that are intensive *users* of energy could see noticeable increases in their own production costs. These price increases could lead to reduced demand for their output, harming employment in these sectors.

The RIA estimated that the new toxics standards would raise prices of electricity by 3.1%. To estimate the effect on demand for industrial output (and then employment) in energy-using sectors, one only needs an estimate of each industry's electricity intensity (the share of electricity costs in total production costs) and an estimate of the elasticity of demand for final output. As energy prices rise, one can assume that overall costs in a sector rise in proportion to energy's share of total costs. Then, the increase in total costs can be multiplied by the elasticity of demand for final output to yield the output losses in each industry stemming from rising energy prices.

A study by Ho, Morgenstern and Shih (HMS, 2007) provides the parameters needed to make this calculation. Allowing the full value of electricity cost increase to be passed through to final prices in a sector (a perhaps-dubious assumption – see discussion below) leads to the finding that the total job loss stemming from lost output in energy-using industries is 32,000.

It is important to realize, however, that much of the discussion regarding economic counter-factuals that informed our estimates of jobs gained through PAC construction and installation (i.e., concerns over the "broken windows" fallacy) apply to the jobs displaced by rising energy prices, but in reverse . This means that while demand for industrial output falls as the price of this output rises in response to rising energy prices, in the longer-run and in a better-functioning economy, much of this decline in demand can (and would) be neutralized by using other macroeconomic policy tools: lowering policy interest rates to spur business investment, for example. In short, if one decided that it was utterly inappropriate to look at short-run employment gains that might be counter-balanced by larger macroeconomic policy levers, then it must also be inappropriate to examine short-run employment losses that could also be so counter-balanced.

Impact stemming from re-spending effects of net job creation outcomes from other channels
The net impact of the previous channels will, given the vast amounts of unused capacity in today's U.S. economy, be amplified by "re-spending" effects. As workers are, on net, either hired or displaced through the channels sketched out previously, this will either increase or decrease overall purchasing power in the economy and this initial change in spending will be subject to a re-spending "multiplier" as it ripples through the economy. So, if net job creation stemming from the other channels is positive, then newly-hired workers will buy more food and clothes and other goods and their spending will add to incomes in these other sectors. If the net job-creation from other channels is negative, the reduced spending on food and clothes and other goods will subtract to incomes in these other sectors.

In the short-run in an economy characterized by excess capacity, if the previous channels all sum to a net job-gain stemming from the implementation of the toxics-rule, then these extra jobs should be multiplied by the "re-spending" effects of newly employed workers to get a total jobs impact.

The intuition is simply that construction workers newly hired to install PAC equipment and manufacturing workers newly hired to produce the intermediate inputs for this construction will have extra income, a portion of which they will spend. This additional spending in the economy will support production (and jobs) in sectors of the economy wholly unrelated to the activities associated with conforming to the toxics rule. For example, waitstaff will be hired by diners that are serving more lunches because the newly hired construction workers come through the door, and clerks will be hired by retail clothing stores that will sell more back-to-school clothes to newly hired manufacturing workers.

These re-spending effects are likely to be particularly large in the present economic moment, when the U.S. economy is characterized by a severe shortfall of aggregate demand for goods and services relative to what is needed to ensure low rates of unemployment.

Of course, if the combined job impacts of the previous channels sum to less than zero, then the negative shock to employment would also be amplified by the re-spending effects (waitstaff would be laid-off as diners served fewer lunches because workers in energy-using industries lost their jobs and these effects dominated others).

The estimates of re-spending effects (or, "re-spending multipliers") stemming from job-creation are rather varied. Bivens (2006) uses an estimate of 0.5, noting that the literature provides estimates of the re-spending multiplier that run from 0.25 to 1.7. Given that there's very little objective criterion to judge what is the best value within this range, the re-spending effects are presented spanning the full-range of these estimates, with 0.5 being the preferred estimate. With this estimate, and using the mid-point of estimates of job changes from each of the other channels, re-spending effects will add 28,000 jobs stemming from adoption of the toxics rule.

Again, in the longer-run and in a better-functioning economy, the boost or decline to aggregate demand stemming from these re-spending multipliers can and will be offset with other macroeconomic policy tools. But in today's economy, characterized by lots of excess capacity, these re-spending effects will be powerful indeed.

The table below sums the effects from the previously mentioned channels, being careful to not double-count any effects. It then applies various re-spending multipliers to the results to get a final number on job creation stemming from the toxics rule (see table below).

A note on the fundamental conservatism of these estimates

Of the primary (ie, before re-spending) effects of the toxics rule on employment specified in this testimony, one is essentially neutral (employment changes within utilities), one is clearly positive (effects of PAC investment) and one is negative (effects of price changes due to higher energy costs).

However, given the current situation of the U.S. economy – caught in a "liquidity trap" – it's actually unclear that the negative impacts of higher product prices caused by more-expensive energy generation would actually have any negative bite at all on the economy. A forthcoming paper by Bivens (2012) explains this point in some detail. But, the intuitive reasons for this judgment are as follows.

First, the bulk of the cost impacts of the toxics rule on electricity prices are temporary, reflecting the need for utilities to make up-front investments in cleaner generation. Given that these price increases are largely temporary, households are not likely to change their behavior much in response. Buitier (2000) has perhaps the clearest exposition of what an increase in a sector's relative price will do for overall economic growth. His overall assessment is that any relative price change not associated with a permanent change to economy-wide productivity growth will

Table 1: Employment effects from each channel

	Channel	High	Low	Average
	Replication of Bivens (2011) methodology with final RIA parameters			
(1)	**Directly-regulated utility effects, MPS approach**[a]	30,000	-15,000	8,000
(2)	**Effects from PAC investments, direct + supplier jobs**[b]	89,000	71,000	80,500
(3)	**Effects from higher prices in energy-using sectors**[c]	-26,000	-38,200	-32,000
(4)	**Sub-totals**	93,000	17,800	56,500
	Re-spending effects[d]			
(6)	***Re-spending multiplier = .5***	46,500	9,000	28,000
	Totals, replicating Bivens (2011) methodology			
(9)	***Re-spending multiplier = .5***	139,500	26,500	84,500
	Using more-realistic assumptions of Bivens (2012)			
	Alternative price impacts from Bivens (2012)[e]			
(11)	***Price increases buffered by PLOGs and profit margins***	-15,600	-22,920	-19,300
(12)	***Price increases lower real interest rates***	-1,625	-2,388	-2,000
(13)	***Average of alternative effects***	-8,613	-12,654	-10,600
	Totals including alternative price impacts			
(15)	***Re-spending multiplier = .5***	165,500	65,000	117,000

Source: Author's calculations, as explained in text and in Bivens (2011) and Bivens (2012), using data from th Bureau of Labor Statistics employment requirements matrix, and Mun, Ho, and Morgenstern (2008).

a Range of effects estimated by EPA

b See Bivens (2011) for explanation of range of effects - stems from slight difference in estimates of labor intensity of construction effort

c See Bivens (2011) for explanation of range of effects - stems from estimates of substitutability between electricity and other energy sources

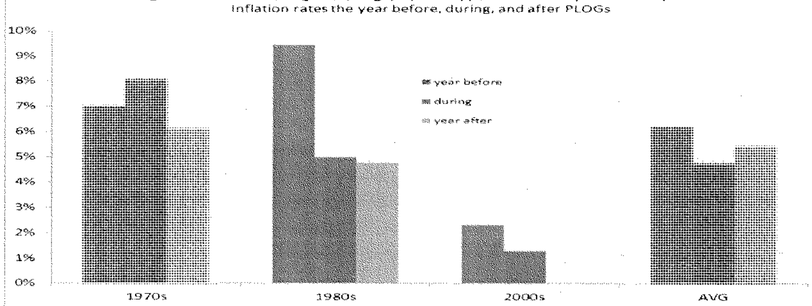
d See Bivens (2011) for explanation of range of effects - stems for different estimates of respending

e See Bivens (2012) for explanation of range - stems from differeing estimates as to how much firms will be able to pass on higher energy costs into higher prices and how much higher prices will translate into lower demand

not affect the degree of economic slack – this is an uncontroversial position. Moreover, he argues that if a relative price increase in one sector is generated through a slight increase in the overall price level, the only way this increases economic slack in the short-run is by spurring a response from the Federal Reserve in the form of higher interest rates. But, we know that the Federal Reserve has no plans in the next couple of years to respond excessively to what would be clearly a very small and very transitory rise in the overall price level spurred by the toxics rule (or actually any degree of regulatory change currently on the table).

Second, it is likely that any upward price-pressure stemming from the regulatory changes will be extremely blunted in the current economic environment. Research on inflation in the face of "prolonged large output gaps" (PLOGs) show clearly that these gaps exert great downward force on price-growth (see, for example, Meier 2010). The figure below makes the point – very large PLOGS are associated with great downward price pressure.

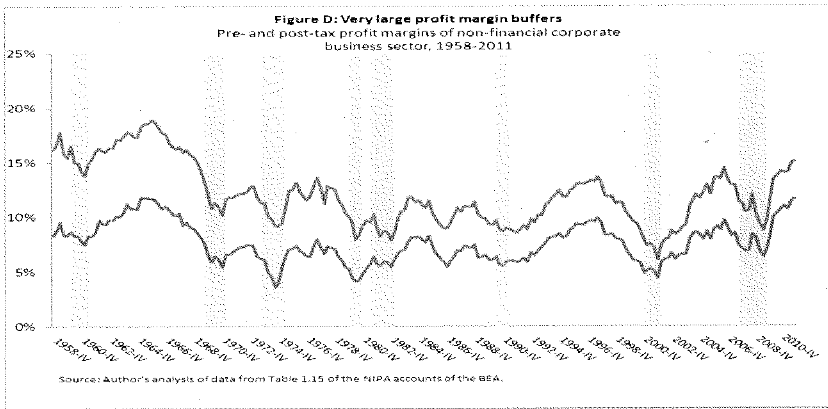
Figure C: Persistent, large output gaps (PLOGs) put downward pressure on prices
Inflation rates the year before, during, and after PLOGs



Source: Author's analysis of the core CPI-U from the Bureau of Labor Statistics (BLS) inflation and prices programs. PLOG espisodes identified by Maier (2010). 1970s episode runs from 1974:3-1976:4, 1980s episode runs from 1981:4-1983:4, while 2000s episode began in 2008:4 and is currently ongoing.

Third , firms currently have very large profit margins – the highest pre- and post-tax margins in 43 and 45 years, respectively. This gives them a very large buffer against cost-increases pushing up prices (on the role of profit margins as buffers against future price increases, see Rich and Rissmiller (2000). In addition, unit labor costs in nominal terms remain lower at the end of 2011 than they were at the beginning of the Great Recession. All in all, slack in labor and product markets means that there is severe disinflationary pressure on firms that would make it less likely that anything as small as the compliance costs associated with EPA regulations could possibly register as overall price increases. The figure below shows these profit rates.

Lastly, even if prices do rise slightly in response to the toxics rule, recent research (see Chung et al. (2012)) has indicated that this could actually be *expansionary*. This is because nominal interest rates are as low as they can go today, but the economy actually "needs" lower inflation-adjusted rates to move closer to full-employment. Anything that generates some inflationary pressure in a severely disinflationary environment actually helps these real interest rates to fall – which is just what the economy needs to generate more jobs.



In Bivens (2012) I provide rough estimates as to how much these considerations blunt the demand-depressing effects of higher prices spurred by electricity price increases stemming from the toxics rule. I find that they blunt these demand depressing effects by roughly 40-100%. This boosts the net number of jobs likely created by the rule from roughly 84,500 to 117,000.

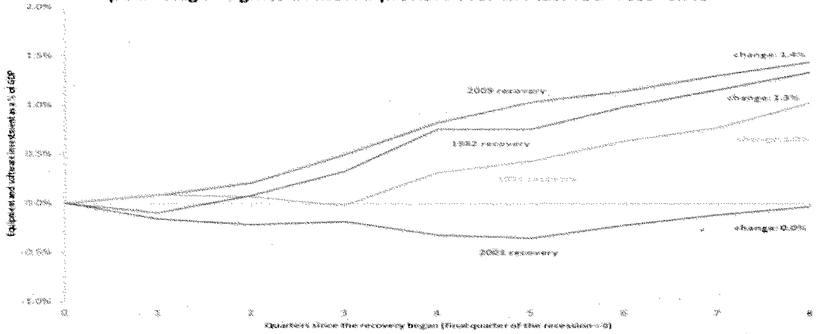
General observations on the generic argument that regulatory changes are damaging growth

Recently, many observers have tried to make the case that regulatory changes – either implemented or proposed – are causing uncertainty that is keeping businesses from spending money and hiring new employees. In my own research I have tried my mightiest to fairly assess this claim. The first difficulty lies in the fact that the vast majority of people making it fail to specify any evidence that could even test the proposition. So, I have tried to figure out what a testable proposition of this might be.

The first thing to look at is the growth of business investment. If firms really are reluctant to make commitments to future production, it should show up in depressed rates of investment relative to previous episodes of recovery from recession. The figure below shows that business investment is actually quite strong in the current recovery.

Another obvious place to look for regulatory burdens (or any other) that are strangling businesses ability to be profitable is profits per unit sold. As noted before, these profit margins are at their highest levels in over 40 years. Given that businesses are making record profits on every unit shipped today, it seems odd indeed to think that regulatory changes now or in the future would keep them from shipping as much as possible. Of course, what would keep them from shipping all they can today is the real cause of the economy's poor performance – slack demand for goods and services.

Figure A. **Growth in equipment and software investment as a percentage of gross domestic product over the last four recoveries**



Source: EPI analysis of Bureau of Economic Analysis data.

Lastly, even if firms were reluctant to commit to *permanent* acquisitions of capital or labor, if this reluctance was all that was holding back production than we should expect to see them using their *incumbent* factories and staff at peak capacity. They're not. Average hours per employee still have not recovered their pre-recession peak, and capacity utilization rates remain very, very low relative to other non-recessionary periods.

In short, there is nothing to suggest in the macroeconomic data that regulatory change or uncertainty about it is holding back the economy's performance. It's worth noting that the opposition to regulatory changes based on claims of its "job-killing" characteristics has been consistently overblown for decades – Irons and Shapiro (2011) have provided an excellent overview of the hyperbolic claims and review of the economic evidence.

Conclusion

In normal times, regulatory changes have an almost totally neutral impact on employment growth. Any economist who tells you otherwise is lying or misinformed. In times like today – with very high rates of unemployment, regulatory change that induces job-creating investments from corporations that are sitting on plenty of savings but finding no other incentive to make these investments – such regulatory changes can boost job-growth.

Both the macroeconomic data and the review of the air toxics rule argue strongly that regulatory change, while not a jobs-program per se, would only nudge up the level of job-creation in the US economy.

To be clear, the most relevant debate about any regulation – and the air toxics rule specifically – would focus simply on the cost/benefit analyses. On this measure, the air toxics rule is a no-brainer, with benefits to health and quality of life dwarfing the compliance costs of meeting its mandates. But since opponents of the rule have demanded to fight on the much less-relevant ground of jobs, it is worth highlighting that even on this their arguments are wrong. First, it is a modest job-creation strategy, and, second, the best time to undertake these regulatory changes are precisely times like today, when the economy is starved of job-creating investments like the ones this rule would induce.

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Mr. WHITFIELD. I let you go over a minute, so next our witness is Dr. Julie—Dr. Anne Smith, I am sorry, Anne Smith, from the NERA Consulting Group, economic consulting, and you are recognized for 5 minutes.

STATEMENT OF ANNE E. SMITH

Ms. SMITH. Mr. Chairman, members of the committee, thank you for inviting me. I am Anne Smith. My statements today are my own opinions and do not reflect the views of my company, NERA Economic Consulting.

The MATS rule is costly and will create net harm to the economy without providing any meaningful reduction of risk from the hazardous air pollutants, or HAPs, that are its sole purpose. No matter how costly, EPA must set MACT rules based on the assessed risks from the HAPs. However, EPA lacks evidence that the utility HAPs pose meaningful risks. EPA is masking that fact in its regulatory impact analysis, or RIA, with estimates of so-called co-benefits from coincidental reductions of PM2.5, which is not a HAP, and which EPA is already required to regulate to safe levels.

EPA estimates the MATS rule will void up to 11,000 premature deaths and many other respiratory and heart ailments, creating benefits of 33 billion to 90 billion per year, which compared to EPA's cost estimate of about 10 billion per year.

First, those benefits have nothing to do with the HAPs at all. All of the lives saved and virtually all of the dollar benefits are from coincidental reductions of already save levels of PM2.5. The estimated benefits from HAP reductions are 10,000 times smaller than the PM2.5 co-benefits, lost to rounding error. It is solely due to the mercury reductions under this complex rule as well. The mercury related benefit is so low because EPA estimates the rule will improve IQ of exposed children by an average of only 0.002 IQ points. That change is not even measurable in actual IQ testing. EPA nevertheless assumes it reduces their lifetime earnings to generate those tiny mercury benefits.

The story is even worse for requiring MACT on acid gases from utilities. This rule—this part of the rule accounts for about half of the $10 billion price tag, and EPA has not identified any actual health risk associated with current emissions of acid gases from power stations.

That leaves only co-benefits. In a report I completed last December, I explained why EPA's practice of justifying new rules using co-benefits is wrong, and showed how the PM2.5 co-benefits are overstated to the point of implausibility. For example, EPA's estimates of 11,000 lives saved under the MATS rule from coincidental PM2.5 reductions is based on assumptions that also imply that about 25 percent of all deaths nationwide were due to PM2.5 back in 1980. Those assumptions stretch the bounds of credibility.

Further, as I said, EPA must identify the safe level of PM2.5 when setting the PM2.5 national ambient air quality standard. EPA's MATS RIA shows that all of its estimated lives saved are in areas where PM2.5 is already below that safe level.

Even if EPA tightened its PM2.5 standard to a lower level, given the range it is willing to consider for that new standard right now, 94 percent to nearly 100 percent of those 11,000 lives will still be from areas where EPA deems the PM2.5 levels to be safe. If EPA considers those PM levels unsafe, it would have to set an even lower standard for PM2.5. It is thus not valid to use those risk estimates to instead justify non-PM regulations, such as the MATS rule.

Without any meaningful risks from the HAPs themselves and with the co-benefits both non-credible and inappropriate to consider, the economic impact of the MATS rule becomes relevant. EPA does not fully analyze the implications of spending $10 billion per year for MATS compliance. I have. Using NERA's new era model, I project that EPA's $10 billion costs per year implies a net loss in worker income, GDP, and consumption. Even accounting for spending on workers who will install the controls, the NERA analysis projects a reduction in worker income that is equivalent to about 200,000 full-time jobs in 2015.

RIAs are intended to provide transparency about the impacts and merits of regulations. Even when a benefit cost justification is not the legal basis for setting the standard, the MATS RIA fails to serve that purpose. EPA's use of highly dubious co-benefits in its RIA for the MATS give it a shield to justify a costly rule that it cannot justify on its own risk merits.

[The prepared statement of Ms. Smith follows:]

Prepared Statement of
Anne E. Smith, Ph.D.
at a Hearing on
The American Energy Initiative
– A Focus on What EPA's Utility MACT Rule Will Cost U.S. Consumers –
by the
Subcommittee on Energy and Power
Energy and Commerce Committee
United States House of Representatives
Washington, DC

February 8, 2012

Mr. Chairman and Members of the Committee:

Thank you for your invitation to participate in today's hearing. I am Anne E. Smith, and I am a Senior Vice President of NERA Economic Consulting. I am a specialist in environmental risk assessment and integrated assessment to support environmental policy decisions, which was a core element of my Ph.D. thesis at Stanford University in economics, with a minor concentration in decision sciences. I have performed work in the area of air quality cost and benefits analysis and risk assessment over the past thirty years, including as an economist in the USEPA's Office of Policy, Planning, and Evaluation, as a consultant to the USEPA Air Office, and in many consulting engagements since then for government and private sector clients globally. I have also served as a member of several committees of the National Academy of Sciences focusing on risk assessment and risk-based decision making. I have analyzed costs, risks and benefits of many U.S. air policies, including mercury, fine particulate matter ($PM_{2.5}$), ozone, regional haze, NO_2, SO_2, and greenhouse gases. I have been extensively involved in assessment of the evidence on risks from ambient $PM_{2.5}$ since EPA first turned to the task of identifying an appropriate National Ambient Air Quality

Standard (NAAQS) for $PM_{2.5}$ over fifteen years ago. I thank you for the opportunity to share my perspective today on the costs, economic impacts, and benefits of EPA's Utility MACT Rule. My written and oral testimonies reflect my own opinions, and do not represent any position of my company, NERA Economic Consulting.

The focus of this hearing is "What EPA's Utility MACT rule will cost U.S. consumers." (Because EPA calls this rule the "Mercury and Air Toxics Standards" (MATS) Rule, I will also refer to it as the "MATS Rule" in my testimony.) The MATS Rule's purpose is to control risks from hazardous air pollutants (HAPs) emitted by coal- and oil-fired electricity generating units (EGUs). I will address the cost issue directly, but wish to point out that if a source category is listed for HAP regulation, and the Administrator decides EPA must control the HAP using maximum achievable control technology (MACT), the Clean Air Act (CAA) requires EPA establish a MACT for existing sources that is determined without consideration of the cost. The threshold set of decisions to apply MACT to EGUs in the first place (*i.e.*, listing EGUs or whether any alternatives to the MACT standard are feasible) are what push EPA into a position of imposing a MACT, however costly the MACT may be. Those decisions are based on assessed risks from the HAPs. Much of my testimony is therefore focused on the lack of evidence of benefits from HAPs under the MATS Rule. I will explain how EPA is masking its lack of evidence of risks from EGU HAPs emissions with non-credible and inappropriately-attributed estimates of "co-benefits" from a non-HAP that EPA already is required to regulate to safe levels under separate provisions of the CAA. I will then describe some of the economic impacts of the MATS Rule that EPA has not reported.

I. Overview of the Cost and Benefits Estimated by EPA for the MATS Rule

By Executive Order of the President, a "Regulatory Impact Analysis" (RIA) is required for each major new rulemaking to provide the regulating agency's estimates of the benefits and costs of the rule. EPA's RIA for the MATS Rule (EPA, 2011b) reports costs and benefits only for a "snapshot" year, 2016, apparently selected because it is the first year when the MATS Rule may be fully implemented. The RIA reports that the annual costs in 2016 of the MATS Rule is $9.6 billion (stated in 2007 dollars, "2007$"), . These are incremental costs above and beyond a baseline of other emissions regulations that includes the Cross-State Air Pollution Rule (CSAPR). This is an extremely large cost for a single regulation, but the RIA contrasts this cost to an estimate of quantified benefits that ranges from $33 billion to $90 billion per year in that same snapshot year (also 2007$). Over 90% of those benefits are based on RIA estimates that between 4,200 and 11,000 premature deaths will be avoided per year (in 2016) as a result of the MATS Rule. Using these RIA estimates, EPA has made some misleading public statements, such as the following two bullets from its "Fact Sheet" for the MATS Rule:

> "The Mercury and Air Toxics Standards (MATS) will save thousands of lives and prevent more than 100,000 heart and asthma attacks each year while providing important health protections to the most vulnerable, such as children and older Americans" and,
>
> "The updated standards will create thousands of good jobs for American workers who will be hired to build, install, and operate the equipment to

reduce health threatening emissions of mercury, acid gases, and other toxic air pollutants. "[1]

Many in the public who read or hear only these misleading summaries of EPA's analyses may consider the MATS Rule's high cost of approximately $10 billion per year to be worth undertaking. When the onion layers are peeled back on both the benefits and costs estimates, however, a very different picture emerges. First, the reported benefits have nothing to do with HAPs at all. In fact, the total benefits EPA has quantified for reductions in the HAPs that are the purpose of the MATS Rule are only between $0.0005 billion and $0.006 billion (*i.e.*, between $500,000 and $6 million per year). In light of this fact, the Rule's large cost of $9.6 billion per year begins to appear quite disproportionate. That cost may appear larger still when one learns that it is likely to destroy hundreds of thousands more jobs than the several thousand jobs that EPA's Fact Sheet states will be created.

A closer read of the RIA reveals that *all* the "saved lives" and virtually all of the $33 billion to $90 billion of estimated benefits EPA has attributed to the MATS Rule are for purported coincidental reductions of a non-HAP – fine particulate matter ($PM_{2.5}$) – that is already regulated to safe levels separately under the CAA. Allowing such co-benefits to dominate RIAs detracts from RIAs' most valuable practical role, which is to help guide us toward regulations that provide cost-effective, minimally-complex management of societal resources. Moreover, the estimate of up to 11,000 lives saved is not a scientifically-credible estimate, for reasons I will explain later in my testimony.

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[1] EPA Fact Sheet: Mercury and Air Toxics Standard, "Benefits and Costs of Cleaning Up Toxic Air Pollution from Power Plants," (http://www.epa.gov/mats/pdfs/20111221MATSimpactsfs.pdf.)

II. No Cost-Benefit Case Exists for Any of the HAPs Groupings Regulated by the MATS Rule

A key feature of the MATS Rule is that it sets different MACT standards for three groupings of HAPs:

(1) for Hg,

(2) for the entire group of acid gases (using hydrogen chloride (HCl) as a surrogate),[2] and

(3) for the entire group of non-mercury metallic HAPs (using particulate matter emissions as a surrogate).[3]

EPA grouped the HAPs in this manner because the Agency found that the HAPs within each group can be most effectively controlled by a single type of technology that differs for each group. For example, control of non-Hg metal HAPs occurs primarily through particulate control devices, while control of acid gases is generally achieved using some form of flue gas desulfurization technology. Hg is more complex because several types of technology may be effective, but the most cost-effective on a stand-alone basis is activated carbon injection (ACI), which is uniquely targeted to capturing Hg.

Thus, EPA has performed a separate MACT analysis for each of these three groups of HAPs. Estimates of benefits and benefit-cost comparisons therefore must vary for each of the MACT provisions, and this information is needed to obtain insights about the merits of the three separate MACT provisions. Such insights can be useful because, under the CAA, regulation of listed HAPs does not necessarily have to be based on

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[2] The acid gas of greatest concern as a risk driver in the MATS Rule is HCl (Strum *et al.*, 2011, Table 5, p. 15).

[3] The metallic HAPs of greatest concern as risk drivers in this MATS Rule are chromium VI (Cr^{+6}), arsenic (As), and nickel (Ni) (Strum *et al.*, 2011, Table 5, p. 15).

MACT.[4] Although EPA has not provided such MACT-specific cost and benefit information, I have been able to develop an approximate disaggregation of the benefits and co-benefits using information in the RIA. I have also been able to approximately disaggregate EPA's estimate of the cost of the rule using the N_{ew}ERA Model.[5] The results are presented in Table 1 below.

Table 1. Approximate Attribution of Costs, Benefits, and Co-Benefits by Individual MACT Provision in the MATS Rule (2007$, rounded to nearest billion. Negative numbers are in red font.)

	(a) Benefits from HAPs reductions (billions/yr)	(b) Co-benefits from non-HAPs[*] (billions/yr)	(c) Costs (billions/yr)	(d) Net Benefits without co-benefits (billions/yr)	(e) Net Benefits including co-benefits (billions/yr)
Mercury MACT	< $0.1	$1 to $2	$3	-$3	-$2 to -$1
Acid Gases MACT	$0	$32 to $87	$5	-$5	$27 to $82
Non-Hg Metals MACT	$0	$1 to $2	$1	-$1	-$1 to $0
Total[**]	< $0.1	$33 to $90	$10	-$10	$23 to 80

(*) The range for co-benefits shown in this table spans from the lower end of the lower set of estimates (*i.e.*, based on a 3% discount rate) to the upper end of the higher set of estimates (*i.e.*, based on a 7% discount rate).

(**) Totals may not add up exactly due to rounding.

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4 In fact, the MATS Rule regulates organic HAPs (*e.g.*, formaldehyde) with a work practice standard rather than a MACT-based standard (MATS Final Rule, p. 353 of 1117, available at http://www.epa.gov/mats/pdfs/20111216MATSfinal.pdf).

5 NERA's N_{ew}ERA Model is designed to be able to assess, on an integrated basis, system costs to the power sector to meet any specified policy scenario, and the overall macroeconomic impacts of that policy scenario. N_{ew}ERA produces estimates of the power sector costs of the MATS Rule that are comparable to EPA's estimate of $9.6 billion per year for 2015. I also ran scenarios with the N_{ew}ERA Model for each of the individual MACT provisions on its own. Doing so identified the share of EPA's total cost that can be attributed to each of the three separate MACTs in the MATS Rule for Table 1 above. (There are synergies in the costs, such that the sum of the costs of the individual MACT provisions is about 10% higher than the cost when all three are imposed together. Since these synergies are shared in all of the two-way combinations of the MACTs, I reduced the model-estimated cost of each individual MACT by one-third of the savings from the three-way synergies to get the shares of the total cost due to each provision.) Technical information on the N_{ew}ERA Model is available at http://www.nera.com/67_7607.htm.

Column (a) of Table 1 shows that the only quantified HAP-reduction benefits of the MATS Rule are due to the Hg MACT, and that estimated benefit is so small that it is lost in the rounding errors of the rest of the numbers in the table. Thus, as Column (b) of Table 1 shows (and which one can confirm by looking at the RIA's Table ES-4[6]), effectively all of the $33 billion to $90 billion of benefits that EPA predicts would result from the MATS Rule are actually "co-benefits" from reductions of pollutants *that are not HAPs at all* but which EPA estimates also will be reduced in the course of efforts to control the HAPs to their MACT levels. <u>Of this total, fully $32.6 billion to $89.6 billion is due to co-benefits from a single ambient pollutant – $PM_{2.5}$ – which is already the subject of health-protective regulation by EPA.</u> (The remaining $0.4 billion of co-benefits is an estimate of the social benefit of reduced greenhouse gases, or "carbon," which comes from reduced coal-fired generation under the MATS Rule.)

Thus, as computed in Column (d) of Table 1, each of the three MACT provisions in the MATS Rule has *negative* net benefits (*i.e.*, their costs are greater than their benefits) if only the HAP-related benefits are counted. That net negative benefit is billions of dollars per year for each of the three MACT groups, and it is about negative $10 billion per year for the MATS Rule as a whole. However, it is also very interesting that even if co-benefits are included, as shown in Column (e), only the acid gases MACT group obtains a positive net benefit, while the MACTs for Hg and for the non-Hg metallic HAPs still have negative net benefits. As for the acid gases, if co-benefits *are* included, this group of HAPs is in the remarkable position of being viewed as passing a

[6] EPA (2011b), pp. ES-6 to ES-7.

cost-benefit test by a vast margin, despite billions of dollars of cost and zero dollars of identified direct benefits from the acid gas reductions.

The huge co-benefits that are estimated for the acid gases MACT group occur because almost all of the $PM_{2.5}$ co-benefits that EPA has projected are due to reductions in the *sulfate* component of ambient $PM_{2.5}$. This, in turn, is almost entirely attributable to the requirement to reduce acid gases through installation of some form of flue gas desulfurization technology, which also reduces SO_2.[7] Incremental reductions of primary $PM_{2.5}$ emissions reductions due to the MATS Rule are only about 5% of the $PM_{2.5}$ reductions.[8]

Thus, inclusion in the MATS RIA of co-benefits from projected coincidental reductions in $PM_{2.5}$ – a non-HAP pollutant that is not the purpose or justification for a HAPs rule *and* which is regulated to safe levels under other provisions of the CAA (CAA) – is helping generate an inappropriate justification for costly controls of hazardous air pollutants from electric generating units. Furthermore, those $PM_{2.5}$ co-benefits only help build a cost-benefit case for the acid gases MACT category, which is notably the one MACT grouping for which EPA has not offered any evidence of direct health effects, as I will explain next.

There are many reasons why the $PM_{2.5}$ co-benefits should not be included in the MATS RIA, and why they are overstated and unreliable. I will explain those reasons in

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7 The SO_2 reductions must be beyond what existing standards (such as CSAPR but also the $PM_{2.5}$ NAAQS and the SO_2 NAAQS) will require in order to be appropriate to consider as co-benefits. Otherwise they are merely being double-counted.

8 EPA (2011b), p. 5C-7. EPA also reports that nitrate $PM_{2.5}$ actually increases, but has not included this negative co-benefit in its co-benefits calculation.

Section IV of my testimony. First, however, given that the quantified benefits cited above are not due to HAPs, it is instructive to ask the question: *What risk reductions has EPA identified for the MATS Rule's reductions of the HAPs themselves?* .

III. Lack of Quantified Benefits from HAPs in the RIA Reflects Lack of Identifiable Current Health Risks from those HAPs.

Quantified estimates of benefits for reducing the HAPs that are the target of the MATS Rule (*i.e.*, the Rule's "direct benefits") are less than 0.02% of the total benefits that EPA has quantified for this rule. The RIA states that EPA believes there are substantial *unquantified* benefits, "including the overall value associated with HAP reductions" and points to the RIA's Tables ES-5 and ES-6 for a list of these unquantified HAP reduction benefits.[9] However, those tables list only PM health, PM welfare, ozone health, ozone welfare, NO_2 health, NO_x and SO_2 welfare, mercury health, and mercury wildlife effects.[10] Of these, only mercury is a HAP. The rest of the unquantified benefits listed are still co-benefits from non-HAP pollutants. Not one unquantified benefit is listed for acid gases, non-Hg metallic HAPs or organic HAPs. Perhaps the most telling fact of all is that discussion of risks from non-Hg HAPs consumes only 6.5 pages of the 510 pages of the RIA.[11] Below is a summary of EPA's estimates of benefits for mercury controls under the MATS Rule (which is discussed at length in the RIA), and a summary of what EPA has reported about the risks of acid gases and non-Hg metallic HAPs in technical support documents other than the RIA.

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9 EPA (2011b), p. ES-9.

10 EPA (2011b), pp. ES-10 to ES-13.

11 EPA (2011b), pp. 73-79.

a) Mercury

As noted above, EPA does quantify Hg-related risks and benefits from the Hg MACT provision, but despite exhaustive and comprehensive evaluation of the Hg risks to the most sensitive population (*i.e.*, children exposed *in utero* to high methylmercury concentrations), the final estimate of that benefit is miniscule: $500,000 to $6 million per year. This is so low because EPA estimates that the imposition of the MATS Rule would improve the IQ of those highly-exposed children by an average of only 0.00209 IQ points.[12] Such a change would not even be measurable in actual IQ testing (the average person's IQ score being 100). The RIA's Table ES-3, which summarizes the physical effects that lie beneath the monetized benefits estimates, does not report this tiny change per child, but instead provides a meaningless "sum of total lost IQ points" of 510.8 IQ points.[13] But even when aggregated in this way, the impact still appears small, given that the comparable sum of total IQ points among all children born each year is about 425 million.[14] It is small even compared to the total IQ points among the 244,000 children born each year that EPA estimates are exposed to methylmercury originating from freshwater fish caught from U.S. lakes and streams; they would have over 24 million IQ points in aggregate.

Although the RIA does not report it, one can infer the more extreme IQ change in a child born to a mother who eats recreationally-caught freshwater fish in quantities at the

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[12] EPA (2011b), Table 4-7, p. 56.

[13] EPA (2011b), Table ES-3, p. ES-5.

[14] This is calculated by multiplying the number of births in the US each year (about 4.25 million) by the average of 100 IQ points per person.

95th percentile level. It is 0.007 IQ points.[15] Thus, even the 95th percentile IQ loss estimate is smaller than anything that can be detected in IQ testing.

As small as the average IQ change per exposed child appears to be, EPA nevertheless assigns projected earnings losses to that change. The resulting estimate of the benefits that would result from the Hg reductions predicted under the MATS Rule is an aggregate present value improvement in that at-risk group's lifetime earning power of between $500,000 and $6 million.

Even these small Hg benefit estimates are clearly overstated, because EPA assumes that the entire reduction in fish tissue will occur instantaneously with the abatement of EGU emissions, and hence that the IQ benefits will occur in full by 2016. EPA's RIA acknowledges this is not a sound assumption, saying that its mercury benefits modeling:

> "does not account for a calculation of the time lag between a reduction in mercury deposition and a reduction in the MeHg concentrations in fish and, as noted earlier, depending on the nature of the watersheds and waterbodies involved, the temporal response time for fish tissue MeHg levels following a change in mercury deposition can range from years to decades depending on the attributes of the watershed and waterbody involved."[16]

The footnote EPA attaches to the above statement adds:

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[15] On p. 45 of the RIA (EPA, 2011b) EPA states that 25 gm/day is the fish consumption for the 95th percentile consumption level of recreational fishers, compared to its estimate of 8 gm/day for that population's average consumption level. The 95th percentile of IQ loss within the sensitive population is thus easily computed because increased fish consumption affects the estimated maternal Hg intake linearly (see RIA, equation 4.4, p. 44). Since 25 gm/day is about 3.13 times 8 gm/day, the 95th percentile child's IQ loss would be about 3.13 times .00209, or 0.007 IQ points.

[16] EPA (2011b), p. 4-18.

> "If a lag in the response of MeHg levels in fish were assumed, the monetized benefits could be significantly lower, depending on the length of the lag and the discount rate used." [17]

This means that any alternative, more realistic assumptions would have produced even lower monetized benefits for Hg.

b) Acid gases

Mercury benefits may be small even with their overstatement, but the RIA was unable to quantify any benefits at all for any of the acid gas, metallic, or organic HAPs reductions. EPA has not even identified any actual health risk associated with current levels of the acid gases.

None of the acid gases is listed as carcinogenic. "Hazard quotients" (HQs) are calculated to assess risk for HAPs that pose non-cancer health risks from chronic exposure. EPA states that if an HQ is 1.0, estimated exposures are at a level "that is likely to be without an appreciable risk of deleterious effects during a lifetime,"[18] but above that point, EPA considers the margin of safety against toxic effects to be too uncertain to be acceptable. EPA reported in its Preamble to the Proposed MATS Rule that the HQ for the key acid gas, HCl, never exceeded 0.05 in any of its inhalation risk estimates,[19] meaning that for EGUs, the predominant HAP in the acid gas MACT group

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[17] EPA (2011b), p. 4-18.

[18] Strum *et al.* (2011), p. 13.

[19] 76 *Fed. Reg.* 24976, footnote 170, at p. 25051. Although EPA notes that other acid gases (Cl_2, HF and HCN) were not included in the risk calculations "because of uncertainties in their emission rates," it is hardly likely that any of these other gases would involve a HQ so much closer to 1.0 than HCl, given that their total EGU emissions are less than 15% of total EGU HCl emissions (see Table 4 at p. 25005).

has a maximum risk that is 95% below a level that EPA deems protective of health with a safety factor included.

Neither has EPA presented any firm evidence that further controls of acid gases would benefit ecosystems:

> "In areas where the deposition of acids derived from emissions of sulfur and NO_x are causing aquatic and/or terrestrial acidification, with accompanying ecological impacts, the deposition of hydrochloric acid could exacerbate these impacts. Recent research has suggested that deposition of airborne HCl has had a greater impact on ecosystem acidification than previously thought, although direct quantification of these impacts remains an uncertain process."[20]

Thus, the reason EPA has not been able to quantify any direct benefits from controlling the acid gas HAPs is because it could not find any evidence of current acute or chronic health risks from EGU emissions of these gases. Section 112(d)(4) of the CAA gives EPA discretion to consider setting a "health-based" standard for a HAP that has an HQ below 1.0. A health-based standard can be less stringent (and less costly) than MACT, provided that it protects health with an ample margin of safety (for example, by ensuring HQs will be lower than 1.0). EPA has applied health-based standards for HCl under Section 112(d)(4) in other HAP rulemakings.[21]

c) Non-Hg Metallic HAPs

EPA performed an integrated analysis of cancer risks from non-Hg metallic HAPs at 16 power plants. EPA's updated analysis finds risks of about 1-in-a-million lifetime risk to an hypothetical, maximally-exposed individual at five of those power plants that

[20] 76 *Fed. Reg.* 24976, at p. 25050, footnote omitted, emphasis added.

[21] 76 *Fed. Reg.* 24976, at, p. 25050.

had coal-fired units. At one of the five plants, the risk was 5-in-a-million.[22] The power sector submitted its own study during the Rule's comment period finding that none of the U.S. coal-fired plants have risk above 1-in-a-million. In the Final Rule, EPA dismisses that analysis, suggesting reasons its estimates may be biased low.[23] Regardless of which analysis is more correct (and the statutory implication for listing if a single plant is found to impose a maximal risk at the level of 1-in-a-million), it is apparent that even the highest of the assessed cancer risk levels that EPA has estimated from current EGU emissions of non-Hg metallic HAPs is very low, and would be lower still for the average person. Thus, it is no surprise that the RIA made no attempt to quantify benefits from these small risks. The result probably would have been even smaller than the benefits estimate EPA calculated for Hg.

IV. $PM_{2.5}$ Co-Benefits Estimates Should Not Be Included in RIAs for Non-PM Rulemakings Such as the MATS Rule

Thus, the RIA's benefit-cost justification for the MATS Rule is based solely on co-benefits from a non-HAP pollutant – $PM_{2.5}$ – that is already regulated under the CAA separately from HAPs. EPA's RIA for the MATS Rule is not unusual in this regard. I recently reviewed EPA's use of co-benefits in CAA-related RIAs that EPA has released since 1997 (the year that EPA first started to quantify public health risks from ambient $PM_{2.5}$). Among the full set of such RIAs, there were 27 finalized or still-proposed rules whose RIAs did quantify at least some benefits, and which were not directly targeting ambient $PM_{2.5}$. In 22 of those 27 (which are listed in Table 2 below), $PM_{2.5}$ *co*-benefits

[22] MATS Final Rule, p. 323 of 1117.

[23] MATS Final Rule, pp. 332-333 of 1117.

Table 2. Summary of Degree of Reliance on $PM_{2.5}$-Related Co-Benefits in RIAs Since 1997 for Major Non-$PM_{2.5}$ Rnlemakings under the CAA
(RIAs with no quantified benefits at all are not in this table. Where ranges of benefit and/or cost estimates are provided, percentages are based on upper bound of both the benefits and cost estimates. Estimates using the 7% discount rates are used in all cases.)

Year	RIAs for Rules NOT Based on Legal Authority to Regulate Ambient $PM_{2.5}$	$PM_{2.5}$ Co-Benefits Are >50% of Total	$PM_{2.5}$ Co-Benefits Are Only Benefits Quantified
1997	Ozone NAAQS (.12 1hr=>.08 8hr)	×	
1997	Pulp&Paper NESHAP		
1998	NOx SIP Call & Section 126 Petitions		
1999	Regional Haze Rule	×	
1999	Final Section 126 Petition Rule	×	
2004	Stationary Reciprocating Internal Combustion Engine	×	
2004	Industrial Boilers & Process Heaters NESHAP	×	×
2005	Clean Air Mercury Rule	×	
2005	Clean Air Visibility Rule/BART Guidelines	×	
2006	Stationary Compression Ignition Internal Combustion		
2007	Control of HAP from mobile sources	×	×
2008	Ozone NAAQS (.08 8hr =>.075 8hr)	×	
2008	Lead (Pb) NAAQS	×	
2009	New Marine Compress'n-Ign Engines >30 L per	×	
2010	Reciprocating Internal Combustion Engines NESHAP	×	×
2010	EPA/NHTSA Joint Light-Duty GHG & CAFES		
2010	SO2 NAAQS (1-hr, 75 ppb)	×	> 99.9%
2010	Existing Stationary Compression Ignition Engines	×	×
2011	Industrial, Comm, and Institutional Boilers NESHAP	×	×
2011	Indus'l, Comm'l, and Institutional Boilers & Process	×	×
2011	Comm'l & Indus'l Solid Waste Incin. Units NSPS &	×	×
2011	Control of GHG from Medium & Heavy-Duty		
2011	Ozone Reconsideration NAAQS	×	
2011	Utility Boiler MACT NESHAP (Final Rule's RIA)	×	≥ 99%
2011	Mercury Cell Chlor Alkali Plant Mercury Emissions	×	
2011	Sewage Sludge Incineration Units NSPS & Emission	×	×
2011	Ferroalloys Production NESHAP Amendments	×	×

accounted for more than 50% of the quantified benefits. None of those rules would have had benefits greater than their costs but for the inclusion of those $PM_{2.5}$ co-benefits. The trend towards EPA's reliance on $PM_{2.5}$ co-benefits has become more pronounced with time. $PM_{2.5}$ co-benefits accounted for 99% to 100% of the total benefits in 8 of the 12 non-$PM_{2.5}$ RIAs released during 2010-2011. The RIA for the MATS Rule is thus just part of a co-benefits habit that EPA has come to rely on.

I released a report in December 2011 in which I evaluate EPA's practice of relying on co-benefits in non-PM RIAs from theoretical, practical, scientific, and analytical perspectives (Smith, 2011b). In that report I show how the theoretical formulation of benefit-cost analysis (BCA) – a key underpinning of RIAs – does not support inclusion of co-benefits from pollutants subject to their own, separate regulation. I also explain how allowing such co-benefits to dominate RIAs detracts from RIAs' most valuable practical role, which is to help guide us toward regulations that provide cost-effective, minimally-complex management of societal resources. In addition, my report explains how EPA's estimates of the risks of $PM_{2.5}$ have become less and less credible as EPA has come to rely more and more heavily on them to justify regulation of other pollutants.

The primary reason EPA's $PM_{2.5}$ co-benefits estimates have become less credible is that EPA is now extrapolating $PM_{2.5}$ risk estimates far below the lowest level of $PM_{2.5}$

for which risks have ever been estimated in the epidemiological literature.[24] Figure 1 below, which is copied from the MATS RIA,[25] helps illustrate the inflationary effect of extrapolation to levels below the lowest measured levels (LML) in the underlying statistical studies. The vertical axis of this figure shows the percentage of EPA's estimate of the MATS Rule's $PM_{2.5}$ mortality co-benefits (*i.e.*, the 11,000 lives saved) that is attributable to ambient $PM_{2.5}$ concentrations at or below each level on the horizontal axis. It shows that nearly all (*i.e.*, 100% on the vertical axis) of those 11,000 deaths are in populations that are in areas that are already in attainment with the current $PM_{2.5}$ annual NAAQS of 15 $\mu g/m^3$. Under current EPA policy, all of those estimated deaths would be deaths of people living in areas that are protected with an "adequate margin of safety" from $PM_{2.5}$ risks.

Figure 1 also shows that if EPA had not extrapolated below LMLs, about 89% of the estimated upper bound of MATS co-benefits would have been estimated as zero.[26] This is confirmed in the RIA, which reports that of the 11,000 estimated avoided

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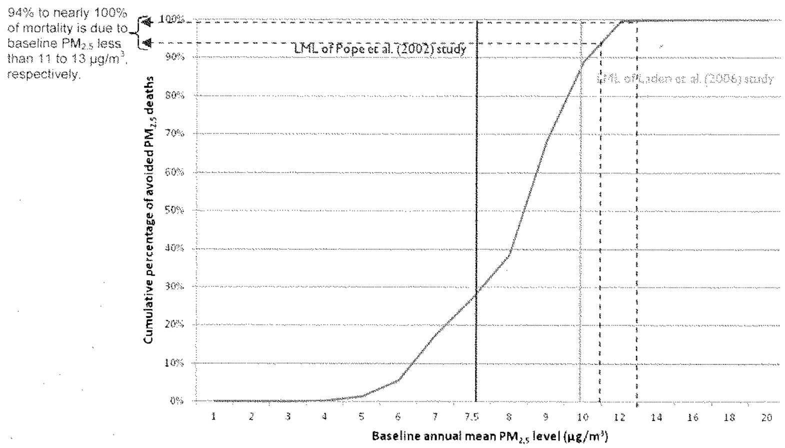
[24] Readers unfamiliar with the literature on $PM_{2.5}$ health risks should be aware that the estimates of $PM_{2.5}$-attributed deaths (such as the 4.200 to 11,000 that EPA is attributing to the MATS Rule) are based entirely on statistical associations between total mortality rates in various locations of the US and their respective monitored, region-wide ambient $PM_{2.5}$ concentrations. These mortality estimates are merely inferences drawn after making a host of assumptions about how to convert a statistical association into a concentration-response function, and all of the risk estimates that the RIA attributes to $PM_{2.5}$ are based on a *presumption* that the associations in the epidemiological literature are causal in nature – a presumption that remains under debate. A much more extensive explanation of the uncertainties and difficulties with this statistical body of evidence is provided in my recent report, as well as a more detailed explanation of what is meant by "extrapolation." (See Smith, 2011b, available at http://www.nera.com/67_7587.htm.)

[25] EPA (2011b), Figure 5-15, p. 5-102.

[26] The epidemiological study that generates the upper bound co-benefits estimate is the Laden et al (2006) study, whose LML is show at the green vertical line in the figure. That green line intercepts the blue curve at 89%, indicating that 89% of the total mortality is based on people in locations where the average ambient $PM_{2.5}$ concentration is less than the LML of 10 $\mu g/m^3$.

premature deaths, only 1,200 are in areas where to baseline $PM_{2.5}$ concentrations are above the LML.[27]

Figure 1. Copy of Figure 5-15 from EPA's RIA for the Final EGU MACT Rule Showing that 94% to Nearly 100% of the $PM_{2.5}$ Co-Benefits in that RIA Are Due to Changes in Exposures to Annual Average Ambient $PM_{2.5}$ that Will Still Be Deemed Safe by EPA after Revising the $PM_{2.5}$ NAAQS.



The 15 µg/m³ annual $PM_{2.5}$ NAAQS is under review now, and EPA staff (with CASAC's concurrence) has stated that it will consider revising the annual $PM_{2.5}$ NAAQS to somewhere in the range of 11 to 13 µg/m³.[28] EPA's reluctance to set the annual $PM_{2.5}$ NAAQS anywhere below 11 to 13 µg/m³ would appear to reveal the extent to which EPA does not itself feel that risk estimates below that range are credible; if it did view them as credible estimates, surely EPA and CASAC would be compelled to propose a lower

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[27] EPA (2011b), Table 5-20, p. 5-101.

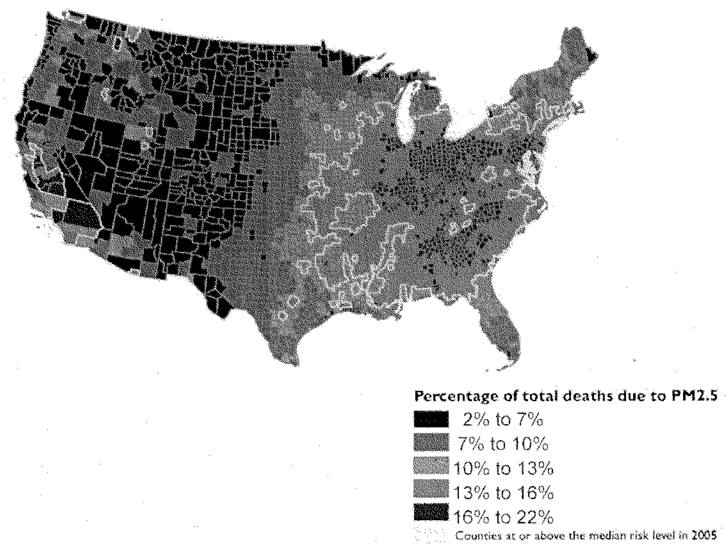
[28] EPA (2010), p. 2-106.

$PM_{2.5}$ NAAQS. The figure above also shows how extrapolation below the LML has created large estimates of benefits at levels of average ambient $PM_{2.5}$ concentrations for which EPA and CASAC reveal a reluctance to declare that risks exist with strong probability. That is, dotted red lines have been added to Figure 1 to show that between 94% and nearly 100% of the 11,000 $PM_{2.5}$ mortality benefits that EPA has estimated from the Final EGU MACT are attributed to estimated $PM_{2.5}$ concentrations below levels that the Administrator will still deem protective of the public health with an adequate margin of safety even if EPA revises the annual $PM_{2.5}$ NAAQS to a level within its recommended range of 11 $\mu g/m^3$ to 13 $\mu g/m^3$.

If those concentrations are safe, then it is not appropriate for EPA to be calculating them as co-benefits justifying non-PM regulations such as the EGU MACT rule. However, my report (Smith, 2011b) also explains why those co-benefits estimates are non-credible from a scientific standpoint, which I recap here in the rest of this section.

Most scientists consider estimates that involve extensive extrapolation such as EPA is making to be very uncertain and generally lacking in credibility. However, the inflationary impact of this specific extrapolation reveals a true credibility deficit. Figure 2 below shows the percent of all mortality in the U.S. in 2005 on which the EPA's upper bound $PM_{2.5}$ co-benefits estimate for the MATS Rule is based. (Each colored zone on the map is a county.) This figure shows that, according to EPA, as recently as 2005 up to 22% of all deaths in many parts of the U.S. (*i.e.,* all of those counties colored dark red on the map) were "due to $PM_{2.5}$."

Figure 2. EPA-Produced Map Showing Percentage of Total Deaths due to $PM_{2.5}$ in the Year 2005, with Legend Adjusted by Author to Represent the $PM_{2.5}$ Risk Slope that EPA Uses for its Upper Bound $PM_{2.5}$ Risk Calculations. [29]



The absurdity of this estimate should be apparent from some basic statistics. EPA has never been able to identify the particular types of causes of death that account for its $PM_{2.5}$-mortality associations, but usually argues that cardiovascular deaths are the most likely candidate. In 2005, 35% of deaths in the U.S. were due to major cardiovascular

[29] Figure copied from EPA (2011a), Figure C-2. However, the figure in the RIA is presented for a $PM_{2.5}$ concentration-response slope that is not the one EPA uses to calculate its upper bound estimate of lives saved from the EGU MACT due to $PM_{2.5}$ co-benefits. That is, the text in EPA (2011a) explaining the derivation of the figure indicates that it is based on a $PM_{2.5}$ concentration-response slope from Krewski *et al.* (2009). EPA's current upper bound estimates of lives saved from $PM_{2.5}$ is based a concentration-response slope from Laden *et al.* (2006). Since the 2005 $PM_{2.5}$ levels in each county in the map would not change (they are historical data), the risk range for the scale can readily be recalculated for the Laden *et al.* slope, as done in this paper. An explanation of how this adjustment is made can be found in Smith (2011a).

diseases.[30] If the predicted $PM_{2.5}$-related deaths are indeed cardiovascular in nature, 22% of all deaths being "due to $PM_{2.5}$" would mean that nearly *two-thirds* of all cardiovascular deaths in 2005 were "due to" $PM_{2.5}$. Given all of the other risk factors that are known to be major contributors to cardiovascular mortality, such as smoking and weight, it is not credible to have a $PM_{2.5}$ co-benefit estimate that is implicitly assuming almost two-thirds of those types of deaths are due to $PM_{2.5}$. EPA's co-benefits estimates should be viewed as highly overstated just from these statistical implications.

Another inference can be made from EPA's post-2009 method of extrapolating $PM_{2.5}$-related mortality risks below the LML. It implies that about 25% of all deaths *nationwide* were due to $PM_{2.5}$ as recently as 1980.[31] These assumptions, which underpin EPA's co-benefits calculations, stretch the bounds of credibility, and thus undercut the credibility of all of EPA's $PM_{2.5}$-related mortality benefits estimates.

EPA's post-2009 baseline risks are so large because EPA now assumes that there is no tapering off of relative risk as $PM_{2.5}$ exposure approaches zero. For years there has been a debate about whether the concentration-response relationship can truly be linear down to zero, but this debate has been focused on questions of statistical power and on basic principles of toxicology. The linear-to-zero/no-threshold assumption has never been debated in terms of its implication that an implausible proportion of total deaths in the US would be due to $PM_{2.5}$ – but perhaps now it should be debated that way too.

[30] According to national death statistics, 856,030 U.S. deaths were due to "major cardiovascular diseases" out of 2,448,017 total U.S. deaths, which is 35%. (See http://www.disastercenter.com/cdc/Number%20of%20Deaths%2013%20Causes%202005.html.)

[31] See Smith (2011a), pp. 14-16 for how this calculation is done.

The facts summarized above, and explained in more detail in my recent report (Smith, 2011b) make it clear that the vast majority of the co-benefits in EPA's MATS Rule are not credible. And without those co-benefits estimates, there is simply no benefits basis for the MATS Rule.

V. Given that the MATS Rule Has No Credible Identifiable Benefits, Costs of the MAT Rule Do Become a Relevant Topic

Once one strips away the non-credible and inappropriate façade of coincidental co-benefits from reducing an already-regulated non-HAP pollutant, the MATS Rule is left with almost nothing to justify its costs. There are no identifiable risks from reducing the non-Hg HAPs emissions under the acid gases and non-Hg metallic HAP MACT provisions. EPA has identified some potential benefits from reducing Hg, but when quantified as the benefits from the Hg MACT provision, those benefits are miniscule. In this situation, it does indeed become a valid question whether the costs of the MATS Rule, which even EPA estimates will be on the order of $10 billion per year, are warranted.

EPA's Fact Sheet for the MATS Rule refers only to positive aspects of that huge incremental spending rate: it mentions "thousands of good jobs" that will be created by the extensive spending on power sector retrofits.[32] It is important that the public also be informed about the economic downsides of that spending, but that is not provided by EPA. The facts not reported by EPA are that compliance with the MATS Rule will

[32] EPA Fact Sheet: Mercury and Air Toxics Standard, "Benefits and Costs of Cleaning Up Toxic Air Pollution from Power Plants," (http://www.epa.gov/mats/pdfs/20111221MATSimpactsfs.pdf.)

impose significant capital demands on the power sector, and net losses of job income and consumption on U.S. consumers.

Although EPA does not provide insight about the overall magnitude and impact of the MATS Rule, I can fill in some of those blanks based on close examination of the IPM inputs and outputs, supplemented by my own analyses using NERA's model, the N_{ew}ERA Model.[33] When I have run NERA's N_{ew}ERA model for the same baseline and MATS scenario, and the same assumptions about retrofit options and costs, [34] I have projected 2015 incremental annualized costs of $10.4 billion (2010$).[35] Working from this scenario, I have inferred other aspects of the EPA's electric sector costs. Also, because the electricity sector in the N_{ew}ERA Model is embedded in a macroeconomic model of the full U.S. economy, I can provide insights about the overall macroeconomic impacts that are associated with the estimated costs of the MATS Rule.

I find that to finance the costs to fully comply with the MATS Rule that are, when stated in annualized form, in the range of $10 billion per year by 2015, the U.S. electricity sector will have to raise about $84 billion (2010$) of additional capital between 2012 and 2015. This is a 30% increase over the capital spending projected within the U.S. electricity sector through 2015 under baseline spending (*i.e.*, including

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[33] The N_{ew}ERA Model simulates the optimized operations and investments of the U.S. electric sector over a long-term horizon in a manner very similar to the IPM model on which EPA's cost analysis has been based. N_{ew}ERA, however, also embeds that electricity sector in a full equilibrium model of the entire U.S. economy, so that the macroeconomic impacts of changes in electric sector costs are simultaneously estimated. More information on the N_{ew}ERA Model is available at http://www.nera.com/67_7607.htm.

[34] The only difference in assumptions about retrofit options in the N_{ew}ERA runs was to limit Dry Sorbent Injection (DSI) to units burning subbituminous coals and that have capacity less than 300 MW.

[35] I consider this to be a reasonable approximation of EPA's own equivalent cost estimate, which is $9.8 billion when also stated in 2010$.

CAIR). This is a large increment for businesses in a single sector to absorb, and might create financing challenges that would drive up the cost of capital to these companies – a potential cost escalation that is not incorporated into either EPA's or my analyses.

Another important insight is that the added spending to comply with the MATS Rule will drive income for workers in a net downwards direction. Although the spending by the electricity sector will create jobs in some segments of the economy during the investment phase (*e.g.*, in construction), that same spending will also drive up costs of electricity and natural gas, and produce a net drag on the economy. For example, my analysis indicates that the net impact to U.S. workers in 2015 will be a reduction in worker income that is equivalent to about 200,000 full-time jobs. The net impacts are largest in the period around 2015, but remain a net negative through 2035.

These estimates of total worker income impacts are net of (*i.e.*, include) the increases in demand for labor to implement the electric sector's compliance projects. The vast majority of the reduction occurs in the services and non-energy manufacturing sectors, which have to absorb the higher natural gas and electricity prices induced by the MATS Rule.

Net negative impacts to the macroeconomy and to U.S. consumers appear in other common economic metrics as well. For example, present value (2012 through 2035) of GDP (relative to a baseline with CAIR only) is lower by about $100 billion and the present value (2012 through 2035) of consumption by U.S. consumers is reduced by about $70 billion.

VI. Conclusion

EPA's sole benefit-cost case for the MATS Rule is founded on non-credible, overstated estimates of coincidental reductions of a non-HAP that is already regulated. Even if those estimates could be viewed as credible, they have no place in the RIA for a rule that has the sole purpose of controlling HAPs. The use of $PM_{2.5}$ co-benefits to justify non-$PM_{2.5}$ rulemakings undercuts the practical purpose and value of RIAs. RIAs are intended to provide transparency about the impacts and merits of regulations, even when a benefit-cost justification is not the legal basis for setting the standard. One important purpose of RIAs (as stated in President Barack Obama's Executive Order 13563) is to help identify ways to reduce regulatory requirements that are "redundant, inconsistent, or overlapping."[36] The inclusion of $PM_{2.5}$ co-benefits in non-$PM_{2.5}$ regulations is lending an apparent benefit-cost justification to rules for which EPA actually has no such justification. Thus, the use of such co-benefits in non-$PM_{2.5}$ RIAs is only serving to enable costly redundancy in regulations, while also relieving EPA from the more pressing and scientifically challenging task of making the requisite cost-effectiveness demonstration for new regulations on pollutants such as HAPs. The MATS Rule is a perfect example of this problem.

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[36] Executive Order 13563. "Improving Regulation and Regulatory Review." 76 *Fed. Reg.* 3821, January 18, 2011, Section 3. Available at: http://www.regulations.gov/exchange/sites/default/files/doc_files/President%27s%20Executive%20Order%2013563_0.pdf.

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Mr. WHITFIELD. Thank you, Dr. Smith, and I thank all of your for your testimony.

Mr. Tsosie, Dr. Bivens in his testimony indicated that he would anticipate maybe 100,000 jobs gained in the U.S. as a result of this regulation, maybe more, maybe a little less. What did you tell me the unemployment rate was in the Navajo Nation right now?

Mr. TSOSIE. Based on our studies——

Mr. WHITFIELD. Turn your microphone on, please.

Mr. TSOSIE. Based on our studies in 2009, the unemployment rate on the Navajo Nation hovers about 50 percent unemployment.

Mr. WHITFIELD. And do you anticipate from the analysis that you all conducted and from your own personal knowledge working with others, that your unemployment rate is going to go down as a result of this regulation?

Mr. TSOSIE. No, we anticipate there may be some preliminary jobs during the installation of the technology; however, there may be, at the most, eight jobs that are created as far as operating the technology. But the offset is not only with the MACT but with the BART, there will be substantial costs on the generating facility, which in my mind, will force the owners to shut down the plant.

Mr. WHITFIELD. And if that happens, how many jobs do you lose?

Mr. TSOSIE. If that happens at the Navajo Generating Station, I believe we estimated 438 jobs at the plant. There is also an associated mine that employs close to 400 people also, and that also will have a devastating effect. So we are talking approximately 1,000 jobs, in addition to the additional jobs that it creates by——

Mr. WHITFIELD. So you are potentially really going to be hurt economically?

Mr. TSOSIE. That is correct. We also have two facilities. The Navajo Generating Station is one example that I used. We have the Four Corners Power Plant located near Farmington and the San Juan Generating Station also right across the river from that that are going to be impacted by these regulations.

Mr. WHITFIELD. Now Ms. McCarthy testified that EPA has been working very closely with the Navajo Nation to try to address your concerns. Are you all satisfied with the assistance you are getting from EPA?

Mr. TSOSIE. Not on this particular rule.

Mr. WHITFIELD. OK. Now Dr. Goodman in her testimony and Dr. Smith in her testimony and others had indicated that in all the analyses, even the EPA's analysis, shows that the benefit from mercury reduction is almost nil, and yet, the advocates of this regulation, that is all they talk about is the benefits of mercury reductions. From your perspective as the Attorney General of the Navajo Nation, are you—do you feel like the benefit of the mercury reduction from this bill will outweigh the negative impacts of losing jobs, or are you more concerned about mercury reduction or the jobs in the Navajo Nation?

Mr. TSOSIE. We are concerned about both, and the difficulty in the MACT rule is there is no data available that we can analyze to make an assessment. That is the ongoing difficulty. We have studied the impacts of the BART, the Best Available Retrofit Technology, on the power plants that exist, but as far as the MACT implications, we haven't generated any data, so we can't make a determination as to whether or not it is going to be good or bad.

Mr. WHITFIELD. Well Dr. Goodman, in your analysis, did you—you did a pretty thorough analysis on this. Did you find any dollar value in the reduction of the mercury emissions as a result of this rule?

Ms. GOODMAN. I am not an economist—but I can tell you that—sorry about that. I am not an economist, so I can't speak too much to the dollar value, but what I can say is that the science used to evaluate the mercury benefits, the evaluation had similar issues as the PM analysis in that there were many steps getting from the beginning to the ultimate calculation of risks and each step had uncertainties and these uncertainties were compounded, so by the very end, this ended up being a large overestimate, even though it is still on the accounts for whatever it is, .01 percent of the benefits.

Mr. WHITFIELD. Well my understanding, Dr. Smith, and you can tell me if you disagree, and Dr. Goodman, that the benefits certainly did not come from mercury reduction, the primary benefits were coming from reduction of PM2.5. Is that correct?

Ms. GOODMAN. Oh, absolutely.

Mr. WHITFIELD. OK. So I think they are very misleading about focusing on the mercury, because there is no benefit in the mercury reduction.

Mr. Roberson, you made some quite startling comments, and I know that you have worked with electric generating utilities for a long time. Are you saying that conventional coal plants cannot really be built in this country as a result of this rule because of guarantees and financing issues? Did I understand you correctly?

Mr. ROBERSON. Yes, that is my testimony. The emission limits, the numerical emission limits in the final rule for new coal-fired units are so low that an equipment vendor could not possibly guarantee that they could meet those numbers on a consistent basis.

Mr. WHITFIELD. Yes. Well, that is really a concern because we expect electricity demand to go up by 2035 by maybe 50 percent, and we are reducing our base load, and I am concerned about our ability to compete in the global marketplace.

My time is expired, and at this time I recognize the gentleman from Illinois, Mr. Rush, for 5 minutes.

Mr. RUSH. I want to thank you, Mr. Chairman.

Reverend Hescox, I am glad that you are here. It is really refreshing for me. I am a pastor of a church on the south side of Chicago, so it is so refreshing to me to hear the voice of the priests on this particular issue. I want to thank you for being here.

Why did you decide to get involved on this particular issue?

Mr. HESCOX. I am an Evangelical, and I am concerned about life. To me, the threat of 600,000, 15 percent of our unborn children, suffering IQ brain damage from the result of mercury is a significant problem to me. I mean, I believe that we should stand up and protect our unborn, the least of these, and we know that mercury is a problem. You know, it has been going on for a long time, this amount of IQ damage and other things. Our waters are filled with it. I have pastors in Pennsylvania where I live. I live in the State that produces the third amount most of mercury who used to fish for their children who won't even take their children fishing anymore because they are scared of the mercury poisoning.

So I am here because it is a life issue. For us, creation, care—I mean, I am not an environmentalist. I am a Christian who believes that God gave us a planet, the Creation, for sustainable life, and things like mercury pollution are making the planet not sustainable. It especially impacts those we can't protect at all.

Mr. RUSH. Well, your organization is not the only religious organization that is involved on this issue. Can you talk about the other organizations?

Mr. HESCOX. Sure, and with us together, I have a representative from the U.S. Catholic Conference of Bishops is right behind me, at least I hope she is still here. Also the National Association of Evangelicals have joined us, and there are probably other Christian groups involved. We happen to be two groups that are pro-life groups, and so it is very easy for the NAE and the Catholic Bishops to join together with us to stand up for the rights of the unborn.

Mr. RUSH. Now, you have been very patient with us, and you have been here from the beginning and I am sure you probably pay attention to the discourse, the debate on both sides over a number of months, if not years. We seem to be going back and forth, never moving forward, just going back and forth in what I may call a firing squad. We just look forward and—what do you think we are missing here in terms of the point? Why can't we move forward? What is the element that we are missing here, in your opinion, that we are failing to appreciate that we have lives that don't see and ears that don't hear? What are we missing here?

Mr. HESCOX. I mean, the flippant answer would be a miracle, but I think the reality is that we—I know—I live in southern York County, Pennsylvania. I am a Republican. I have been a Republican since I was born. York County is a Republican place. But we talk about what we need to come together as a people to solve these problems. I think that is what I would urge us all to do. It is why the Catholics—Catholics and Evangelicals don't agree on everything, but we have this common issue of protecting unborn that is very important to us. And so I guess how do we solve it? I would like to get you and Mr. Whitfield in a room together and say let us work it out and not go forward until we agree. There has to be a way to find a common interest to go forward on all these issues, and quite honestly, our country needs it. Our country needs the men and women of this Congress to really—to find a way to work together. I mean, that is my prayer every day that we could—I mean, Speaker Boehner put it right. I was at the March for Life rally and walked up the Hill. When he said those words that, you know, life should not be a party or an economic issue, I stood up and cheered. Somehow we found that in 1990 when the Clean Air Act was first put into place, and I am just asking let us find a way to come back together again to find that. Let us find a way to work together to solve these problems.

Mr. RUSH. I just want to, you know, as a pastor and a believer—7:14, would that have meaning for us here?

Mr. HESCOX. I think that we just need to come together to be people to recognize that there are problems. We need to solve the problems, we need to get on with it, and really establish America as a great place again. I think we can do that by working together.

Mr. WHITFIELD. Thank you, Mr. Rush.

At this time, I recognize the gentleman from Texas, Mr. Barton, for 5 minutes.

Mr. BARTON. Thank you. Amen. We all want to work together. Brother Rush and myself want to work together. We just have differences of opinion on what the problem is, but we definitely want to work together. I hope someday that I come to your church and get to sit out in the congregation, if I am allowed in the door.

Mr. RUSH. No, you are allowed in the door.

Mr. BARTON. I hope so.

Mr. RUSH. Not only allowed, but you will be welcome.

Mr. BARTON. I will help the collection plate a little bit.

Mr. RUSH. No, you will be welcome.

Mr. BARTON. I want to ask Dr. Goodman some questions. I think you were in the audience when I questioned the Deputy Administrator. I am going to read you the sentence that I read her that is in the footnotes of their ruling that says "The negative estimates for certain endpoints are the result of the weak statistical power of the study used to calculate the health impacts, and do not suggest that increases in air pollution exposure result in decreased health impacts." Is that sentence basically stating in one sentence what your testimony stated, that these—that their conclusions really can't be confirmed by the true facts of the case?

Ms. GOODMAN. Yes, I think if you look at the science as a whole, so it is epidemiology, toxicology, mechanistic studies, they don't support that reducing PM2.5 levels, when you are already starting with low levels, reducing them even more is going to necessarily have any health benefits.

Mr. BARTON. And I know that—I mean, you are the only toxicologist on the panel here. The gentleman next to you on your right, who I have great respect for because of his right to life beliefs, which I am about a 96 percent right to life lifetime voting record Congressman, he is concerned about mercury poisoning in the unborn. Is it your belief as a toxicologist that the exposure levels resulting from smokestack emissions of power plants in terms of mercury does impact the unborn?

Ms. GOODMAN. I would say that the—in terms of this rule, the impact on mercury emissions is going to be so negligible that it will not have a measurable impact.

Mr. BARTON. A measurable impact, OK.

I am going to ask the Attorney General for the Navajo Nation, you seem to be a pretty level-headed guy and you seem to understand the real world and the impacts on your tribe. Dr. Bivens, if I understood him correctly, I was listening in my office, says that higher electricity prices are good for the economy because it has a deflationary impact and since factories aren't working anyway, they can't raise prices so we ought to just go with it. I am paraphrasing, but I think that is a pretty close paraphrase. What is your reaction to that?

Mr. TSOSIE. For us, for the Navajo Nation, the reaction is that it is a little different than what he is stating. The Navajo Nation is generally not the end customer for electric utility facilities.

First of all, most of our people lived without electricity for a long time, and we just recently made an effort to get electricity into our households, so that is not a luxury that we have enjoyed for a long time. In addition to that, we site the facilities on Navajo lands. Our coal is used to fuel the power plants, and historically, the Federal Government has taken the initiative to negotiate deals on behalf of the Navajo Nation. So in essence, we have always subsidized the Southwest with the low rate prices for our resources, our water, our air shed, and exemptions from our taxes.

Now it has come to a point where the leases are expiring and we are renegotiating our leases. So we have come to a timeframe where we will enjoy greater benefits than we have in the past. And the very economy that was established for us by the Federal Government is now under threat by the Federal Government.

Mr. BARTON. My time is expiring and I want to go back to Dr. Goodman.

Can I paraphrase your testimony to say that you don't think these new rules when implemented will have a measurable positive impact on public health?

Ms. GOODMAN. I think that is a definite possibility.

Mr. BARTON. Thank you, Mr. Chairman.

Mr. WHITFIELD. At this time, I recognize the gentleman from Michigan, Mr. Dingell, for a period of 5 minutes.

Mr. DINGELL. Mr. Chairman, I thank you for your courtesy. My questions are to Darren MacDonald, Director of Energy at Gerdau Long Steel in North America.

Mr. MacDonald, you have a fine manufacturing facility in Monroe, Michigan, which is in my district. I have been there and seen it. Now, what have the Michigan utilities told you about the potential effects of the new rules on the rates that they will charge your company in Monroe for electricity?

Mr. MACDONALD. I don't have an exact impact on the cost for—from Detroit Edison or from consumers. One of the challenges is to understand what the cost will be and what technical solution they are going to be able to implement to meet the compliance deadlines, so——

Mr. DINGELL. Let us take a quick look at this, though. Electricity costs go up and they are going to have significant problems, are you not?

Mr. MACDONALD. Well yes. Yes, we will.

Mr. DINGELL. That is very clear. And if these matters are handled improperly by the regulatory agencies, the practical result will be that the rates for electricity sold to your company will go up, is that not so?

Mr. MACDONALD. That is correct.

Mr. DINGELL. Would you have your rate people take a look at these matters and give us an answer as to how these things are going to affect you under the different possible scenarios? If the EPA hurries matters unduly, or if it treats the utilities in a proper fashion, we would like to see how you are projecting your electrical utility costs.

Now, next question. What steps will you take if rates for your Monroe facility rise excessively?

Mr. MACDONALD. What we do on a regular basis, routine monthly basis is look at the costs——

Mr. DINGELL. You buy your electricity in bulk, is that right?

Mr. MACDONALD. Well, we are a regulated utility in the State of Michigan, both locations, so we buy it from the utility under a contracted rate. However, if the rates go up, what we do is look at the cost—our cost structure at each of those mills, 20 in North America, and we decide where it is least cost——

Mr. DINGELL. So you are going to go build somewhere else where the rates are cheaper?

Mr. MACDONALD. Lowest cost, yes, sir.

Mr. DINGELL. Is that a danger to us in Monroe?

Mr. MACDONALD. Oh, it is a decision that is made for every State that we operate in.

Mr. DINGELL. OK. Now in your testimony, you recommend that legislative action be taken to phase in the requirements of the new rule over a period of time, is that correct?

Mr. MACDONALD. That is correct.

Mr. DINGELL. Do you—what do you think an appropriate period of time would be for phasing in these regs?

Mr. MACDONALD. Well, we have been told that 3 years is too quick and that the fourth and fifth year are subject to some application process at that time, so you get to the fourth year, you need to apply, you get to the fifth year, you need to apply. So we are looking for—utilities have told us that they were looking for a much longer window in order to properly plan and avoid the——

Mr. DINGELL. You are looking for them to phase it in over 4 or 5 years and hoping that that would be so, is that right?

Mr. MACDONALD. Could you repeat the question?

Mr. DINGELL. I am sorry?

Mr. MACDONALD. Could you repeat your question? I didn't hear it.

Mr. DINGELL. I said you are looking for them to phase in the new rules over 4 or 5 years as opposed to doing it in 3, is that right?

Mr. MACDONALD. At least 5 years.

Mr. DINGELL. All right, and the consequences of phasing in over 3 years would be a rapid and difficult rate increase for you, is that right?

Mr. MACDONALD. That is right, plus unnecessary costs because of the rush for the same resources and the same suppliers.

Mr. DINGELL. Now, how many people do you have at your Monroe plant?

Mr. MACDONALD. Roughly in the 300 range.

Mr. DINGELL. OK. Do you have any plans for expansion?

Mr. MACDONALD. Yes, we are currently planning an expansion at Monroe.

Mr. DINGELL. Now what would that order of magnitude be?

Mr. MACDONALD. From a capacity perspective? We are looking to nearly double it.

Mr. DINGELL. OK. And if the rate increases go up too fast, you might find that you are going to have to rethink those plans, is that right?

Mr. MACDONALD. We always consider the price of electricity. Is it one of the key investment decisions.

Mr. DINGELL. All right. Now, are there other recommendations you would make besides a longer period of time for the utilities to be able to comply with the changes that EPA is suggesting?

Mr. MACDONALD. Yes, we would like to see more consideration given to alternatives for fuel diversity. We are concerned about all the eggs in a single natural gas basket.

Mr. DINGELL. Thank you. Mr. Chairman, you have been very gracious. Thank you.

Mr. WHITFIELD. Thank you, sir. At this time, I recognize the gentleman from Illinois, Mr. Shimkus, for 5 minutes.

Mr. SHIMKUS. Thank you, Mr. Chairman. I want to direct most of my questions and comments to Reverend Hescox. It is interesting how in this profession and in this committee that I am always drawn to theological debates and discourse, which I think my friends on the other side like to draw me into. But I am not afraid, and so with that, let us—Dr. Hescox, the phrase "conceived and bore" is used repeatedly in Genesis 4:1 and Genesis 4:17, and the individual has the same identity before and as after birth, "in sin my mother conceived me," the repentant Psalmist says in Psalm 51:7. The same word is used for the child before and after birth, that word is "brethos," that is infant. It is used in Luke 1:41 and Luke 18:15. The—do you agree with that?

Mr. HESCOX. Yes.

Mr. SHIMKUS. Thank you. God knows the preborn child—I also quote—"You knit me in my mother's womb ... nor was my frame unknown to you when I was made in secret," Psalm 139:13–15. God also helps and calls the preborn child, and I quote, "You have been my guide since I was first formed from my mother's womb. You are my God." Psalm 22:10–11. And I also quote, "God, from my mother's womb, had set me apart and called me through His grace." And that is from Saint Paul to the Church Ecclesia 1:15.

Now, the term—"the pro-life community"—well, first of all, there is one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen pieces of legislation promoted by the pro-life community in this Congress. Has your organization endorsed any of them?

Mr. HESCOX. We endorse the whole effort and do that as part of the right to life——

Mr. SHIMKUS. So you have officially endorsed H.R. 3?

Mr. HESCOX. Not officially.

Mr. SHIMKUS. H.R. 374? Have you officially endorsed any defined pro-life legislation in this Congress? I mean, it is a simple yes or no. Have you or have you not?

Mr. HESCOX. No.

Mr. SHIMKUS. OK, that is not unexpected. Why do I ask that question?

Mr. HESCOX. Yes, why do you?

Mr. SHIMKUS. The "life" in "pro-life" denotes not the quality of life, but life itself. The term denotes opposition to a procedure that intentionally results in dead babies. So that is why we in the pro-life community take great offense when an Evangelical movement tries to usurp the meaning of "pro-life" when it is defined. Those in the pro-life community believe life is distinct, unique, at conception to natural death. That is what the pro-life community stands for, and in—and I would like to submit for the record testimony of Dr. Timothy D. Terrell, Associate Professor of Economics, Wofford College, and Senior Fellow at Cornwall, and I would also like to submit a statement—I have quoted some of it—"Protecting the Unborn and the Pro-Life Movement from Misleading Environmentalist Tactic," a joint statement by pro-life leaders. I would like to submit that into the record.

Mr. WHITFIELD. Without objection.

[The information follows:]

TESTIMONY OF
DR. TIMOTHY D. TERRELL
Associate Professor of Economics
Wofford College
and
Senior Fellow
Cornwall Alliance for the Stewardship of Creation

"A CALL TO TRUTH ON THE COST OF NEW MERCURY REGULATIONS"
for the
ENERGY AND POWER SUBCOMMITTEE
of the
ENERGY AND COMMERCE COMMITTEE
U.S. HOUSE OF REPRESENTATIVES
FEBRUARY 8, 2012

The principle of preserving life should be a powerful ethical force behind public policy, both in our intentions and in evaluating the actual results of any government action. Our collective efforts should be particularly concerned with the lives and well-being of the poorest among us. The God who "will maintain the cause of the afflicted and justice for the poor" (Psalm 140:12) expects just rulers to have this priority as well. But the "cause of the afflicted" is not well-served by regulations which target exaggerated or sensationalized risks while adding other burdens on the poor. It is vital that policies enacted on behalf of the poor have not only virtuous motivations, but also beneficial outcomes for the weakest and most vulnerable among us.

Last October, at a press conference in Washington in the same Rayburn building in which this American Energy Initiative hearing is being held, the Cornwall Alliance released a report on the ethical problems and economic costs of the Utility MACT rule. I wrote that report, entitled "The Cost of Good Intentions" (included for the record as Appendix 1 to this testimony), with the help of fifteen highly qualified reviewers from the fields of theology, ethics, law, economics, and science, all listed at the end of this testimony. My own doctoral work on environmental regulation and my academic background prepared me to carefully examine both sides of the controversy and objectively handle the competing claims. The Cornwall Alliance is concerned that the proposed Utility MACT regulation is likely to do more harm than good, and that the "pro-life" banner is being misused by some proponents of the new rule. When we are called to "count the cost" as a part of wise decision making (Luke 14:28), we must use honest analysis to evaluate the question: does the new rule preserve human life, or does it compromise human flourishing?

We have several concerns with the new mercury rule.

First, the link between the regulation and the likely reduction in U.S. mercury exposure is weak. Only a minority of the mercury deposited in the United States comes from sources inside the U.S. The EPA itself estimated that only 16 percent of the mercury deposited in the continental United States came from the U.S. and Canada.[i] Location matters: west of the Mississippi, almost all comes from outside the United States. US power plants contribute less than 1 percent of the global atmospheric mercury,[ii] with a huge fraction of mercury produced from natural sources. Yellowstone National Park produces more mercury emissions than all eight of Wyoming's coal-fired power plants, and forest fires in the U.S. emit roughly the same amount of mercury each year as all U.S. power plants.[iii] And the connection between atmospheric mercury and mercury in fish is not as tight a connection as has been implied. In oceanic fish, methylmercury concentrations do not appear to have increased over time, even though global mercury emissions have. A study in

Hawaii found that yellowfin tuna had the same methylmercury levels in 1998 as they had almost thirty years before,[iv] even though the mercury levels in the atmosphere nearly tripled over that period of time. Non-human sources of mercury were thought likely to be responsible.[v] Another study that looked at concentrations of mercury in striped bass in the San Francisco Bay area over the period from 1970 to 2000 found no clear evidence that mercury levels were increasing, despite a general increase in mercury in the environment over that period of time.[vi]

Since oceanic fish have a trivial connection to mercury emissions by U.S. power plants, and since farm-raised freshwater fish have low mercury levels because of how they are fed, the closest connection between mercury emissions by U.S. power plants and U.S. mercury consumption would be for wild freshwater fish, which make up only about 10 percent of U.S. fish consumption.

Second, mercury reductions in fish may have even less benefit when one considers the impact selenium content has on methylmercury toxicity. Some research indicates that the vast majority of freshwater fish in the continental United States has sufficient selenium content to protect fish consumers against methylmercury. A 2009 EPA-funded study analyzing 40 species of freshwater fish at 137 sites in the western U.S. found that while 56 percent of the fish had quantities of mercury above what has been considered a "safe" threshold, 97.5 percent of the fish had enough selenium to counteract the effects of the mercury.[vii] All but one of the fish in the 468-fish sample that had an insufficient ratio of selenium to mercury were pikeminnows (also called squawfish), which are commonly considered a "trash" fish and are not normally consumed as food. And erring on the side of caution can be a serious error indeed. Alarmism about mercury in fish could discourage people from consuming this valuable but inexpensive source of protein, which can make up an important part of good maternal nutrition and aid cardiac and brain function in adults.[viii] Unwarranted concern about mercury could cause Americans to back into a more threatening problem from the loss of nutrition.

Third, the costs of the new regulations could easily exceed any benefits. Common perceptions of the benefits rely on dubious statistics. Advocates of the mercury rule have used a "1 in 6" estimate of the number of children in the United States born with excessive levels of methylmercury (the biologically active form of mercury). However, there are multiple problems with this statistic. It relies on an EPA reference dose established from a long-term study in the Faroe Islands,[ix] among a population that contained important differences from the population of the US. Another long-term study in the Seychelles found no indication that methylmercury from a high-fish diet caused neurological damage in children.[x] Adding to the magnified damage estimate is another misconception: exceeding a reference level of mercury does not mean that health problems have occurred. The EPA's reference dose was obtained by calculating one tenth of a lower-bound estimate of when one neurological test in the Faroe study indicated the onset of detectable problems. This is a conservative lower limit, not an indication of when detectable harm occurs. Furthermore, the 1-in-6 figure ignores the fact that mercury accumulates in the human body over many years, so that the younger women who are more likely to be giving birth are also likely to be on the lower end of mercury levels. We believe that a commitment to honesty requires far greater caution when using statistics to support an important policy position.

Estimates of the economic gains from avoiding mercury-related health problems have also been overstated. At least one group advocating for the regulation has cited a 2005 study[xi] warning that brain damage from mercury emitted by U.S. power plants causes "around $1.3 billion"[xii] in annual losses. However, a 2007 study,[xiii] based on EPA's assumptions, showed that the earlier study overstated losses by well over 600 percent. The 2007 study shows that Cross-State Air Pollution regulation would reduce actual damage by at most $210 million, or, if borne evenly by the 700,000 babies the advocacy group claims are affected, $300 per person per lifetime. With 80-year life expectancy, that equals $3.75 per person per year (0.009% of 2010 U.S. per capita income). The later study also found that "U.S. EPA assumptions ... decrease the estimated impact of U.S. sources (including power plants) by almost 97%."[xiv]

In exchange for this negligible benefit, imposing the Utility MACT and Cross-State Air Pollution Rule (a.k.a. Clean Air Transport or Clean Air Interstate Rule) could force electricity costs to increase substantially for many families. According to a study by National Economic Research Associates (NERA), their combined impact would be to increase electricity costs while inducing the closing of some 48 gigawatts of installed generating capacity of coal power—enough to power about seven New York Cities. NERA projects an increase in national average retail electricity prices of about 11.5 percent by 2016. Some regions would see even higher increases. For Michigan and Wisconsin, prices are expected to rise around 21 percent, and for southern Illinois and eastern Missouri, around 23 percent. Kentucky and Tennessee are projected to see increases of 23.5 percent. Natural gas prices also would be higher than otherwise as electric utilities shift from coal to natural gas, driving up demand. NERA projects increases in natural gas prices of 17 to 18 percent by about 2015. This not only affects households directly as they pay more in utility bills. Any product that requires electricity to produce could become more expensive.[xv]

Many people may not perceive the connection between their reduced living standards, their health problems, and the regulation that caused them. Economists have estimated the relationship between a decline in income and the loss of life that will result. One study indicates that a life is lost, on average, for an income decline of $10 million to $15 million.[xvi] Another approach indicates that it takes a $17 million income decline to result in one lost life.[xvii] Systems engineer Ralph Keeney commented on still another study:

> Regulatory costs are paid by individuals, which leaves them with less disposable income. Since individuals on average use additional income to make their lives safer and healthier, the regulatory costs lead to higher mortality risks and fatalities. Based on data from the National Longitudinal Mortality Study relating income to the risk of dying, approximately each $5 million of regulatory cost induces a fatality if costs are borne equally among the public. If costs are borne proportional to income, approximately $11.5 million in regulatory costs induces a fatality.[xviii]

This means that some regulations may cost more lives through reduced income than they save by avoiding the risk they regulate against.[xix] In a way, the regulation backs us away from one risk into another risk that may be far larger. For example, the 1990 EPA regulation placing a hazardous waste designation on wood-preserving chemicals costs three lives for every one it saves.

These effects may not always be obvious to the victims. But in some cases, the environmental regulation can lead to job losses that are clearly damaging, both to a local area and to the economy as a whole. While MACT regulations can result in some people being employed to build and install the technology, industries subjected to MACT regulations can face job losses and reduced overall productivity. In addition, just as households will struggle with higher energy prices, many firms will see their financial situation worsen, and reducing employment will be among the means they use to adjust. The EPA projects some job gains from complying with the new regulations. However, the NERA study found that the U.S. labor market from 2013 to 2020 can be expected to see a net *loss* of 1.44 million job-years (1.88 million lost, partially offset by 0.45 million gained). Most of that impact, NERA projects, would be felt up front, from about 2013 to about 2015.[xx]

Fourth, the reliability of the electric grid could also be reduced, leading to brownouts and blackouts during periods of high demand. The unrealistic timeline for compliance with the new regulation could force retirement of generating capacity without replacements sufficient to ensure a constant flow of power.[xxi] With regard to the possible effects of the new regulation on the reliability of the grid, the head of the Federal Energy Regulatory Commission, Philip D. Moeller, argued that while the EPA was considering aggregate electricity generation in its reliability analysis, it did not take into account problems of transmission. Even if electricity generation remains adequate in total, the transmission network could be unable to fill gaps left when local generating facilities are forced into retirement by the new EPA rules.[xxii] We are concerned that the costs of making changes to the transmission network may also be passed on to American households.

In summary, we believe that the risks posed by mercury emissions from U.S. coal-fired power plants have been overstated, and that it is difficult to justify the hardships the Utility MACT rule will cause for American families. The *Cornwall Declaration on Environmental Stewardship*, endorsed by 1,500 individuals from Catholic, Jewish, and Protestant communities, states,

> Public policies to combat exaggerated risks can dangerously delay or reverse the economic development necessary to improve not only human life but also human stewardship of the environment. The poor... are often forced to suffer longer in poverty with its attendant high rates of malnutrition, disease, and mortality; as a consequence, they are often the most injured by such misguided, though well-intended, policies.[xxiii]

We are concerned that the Utility MACT rule is an example of this. We believe that this policy, perhaps well-intended but misconstrued as an instrument of justice in the pro-life cause, will in fact place unnecessary burdens on an energy sector that is responsible for the livelihoods of many thousands of Americans. We further assert that any claim that mercury exposure is a "pro-life" issue must use the term honestly. The conventional use of the term has to do not with a concern for accidentally compromised health, but with intentional deaths. Mercury exposure at the levels sparking the concern of Utility MACT proponents does not kill babies—and applying the "pro-life" label to this regulation is highly inappropriate. We urge this Subcommittee to remember those poor—born and unborn—for whom the risk of mercury from U.S. power plants is far less significant than the health hazards that accompany unemployment, higher costs of living, and a stagnant economy.

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[i] The "EPA estimated that 144 tons of mercury was deposited in the continental United States in 2001, and that 121 (or 84%) came from sources outside of the United States and Canada." Charles Griffiths, Al McGartland, and Maggie Miller, "A Comparison of the Monetized Impact of IQ Decrements from Mercury Emissions," *Environmental Health Perspectives* 115, no. 6: 844 (2007). See Environmental Protection Agency, *Mercury Deposition in the U.S. Washington, D.C.* 2005. Available at http://www.epa.gov/air/mercuryrule/pdfs/slide2rev1.pdf, also Gail Charnley, "Assessing and Managing Methylmercury Risks Associated with Power Plant Emissions in the United States," *Medscape General Medicine* 8, no. 1: 64 (2006). Available at http://www.medscape.com/viewarticle/522270?src=search.

[ii] Sandy Szwarc, "Fishy Advice—Risk-Free at What Cost?" In *Energy, Environment, and Economics*. Washington, D.C.: American Legislative Exchange Council, 2004, p. 35.

[iii] Willie Soon, *A Scientific Reply to Specific Claims and Statements in EPA's Proposed NESHAP Rule, Focusing on Mercury Emission Issues*. Science and Public Policy Institute Reprint Series, June 25, 2011, p. 1. Available at http://scienceandpublicpolicy.org/images/stories/papers/reprint/scientific_reply.pdf.

[iv] Anne M. L. Kraepiel, Klaus Keller, Henry B. Chin, Elizabeth G. Malcolm, and Francois M. M. Morel, "Sources and Variations of Mercury in Tuna," *Environmental Science & Technology* f37, no. 24 (2003): 5551–5558.

[v] A similar study found no difference in mercury concentrations in tuna caught between 1878 and 1909 and tuna caught in 1972. G. E. Miller, F. S. Steinkru, P. M. Grant, V. P. Guinn, and R. Kishore, "Mercury Concentrations in Museum Specimens of Tuna and Swordfish," *Science* 175, no. 26 (1972): 1121–1122.

[vi] B. K. Greenfield, J. A. Davis, R. Fairey, C. Roberts, D. Crane, and G. Ichikawa, "Seasonal, Interannual, and Long-Term Variation in Sport Fish Contamination, San Francisco Bay," *The Science of the Total Environment* 336, nos. 1–3 (2005): 25–43.

[vii] Spencer A. Peterson, Nicholas V. C. Ralston, David V. Peck, John Van Sickle, J. David Robertson, Vickie L. Spate, and J. Steven Morris, "How Might Selenium Moderate the Toxic Effects of Mercury in Stream Fish of the Western U.S.?" *Environmental Science and Technology* 43, no. 10 (2009): 3919–3925.

[viii] G. Myers, P. Davidson, C. Cox, C. Shamlaye, D. Palumbo, E. Cimichiari, J. Sloane-Reeves, G. Wilding, L. Huang, and T. Clarkson, Statement by the University of Rochester Research Team Studying the Developmental Effects of Methylmercury before the U.S. Senate Committee on the Environment and Public Works, July 29, 2003. Available at http://epw.senate.gov/hearing_statements.cfm?id=212851.

[ix] Katsuyuki Murata, Pal Weihe, Esben Budtz-Jorgensen, Poul J. Jorgensen, and Philippe Grandjean. "Delayed Brainstem Auditory Evoked Potential Latencies in 14-Year-Old Children Exposed to Methylmercury," *Journal of Pediatrics* 144, no. 2 (2004): 177–183.

[x] Faroe Islanders consume pilot whale meat and blubber, known to have higher levels of methylmercury than fish, but also other contaminants like polychlorinated biphenyls (PCBs) and cadmium that have also been linked to neurological disorders. Perhaps more important, pilot whales do not contain as much selenium as ocean fish, while Seychelles fish diets were more selenium-rich. See G. Myers, P. Davidson, C. Cox, C. Shamlaye, D. Palumbo, E. Cimichiari, J. Sloane-Reeves, G. Wilding, L. Huang, and T. Clarkson, Statement by the University of Rochester Research Team Studying the Developmental Effects of Methylmercury before the U.S. Senate Committee on the Environment and Public Works, July 29, 2003. Available at http://epw.senate.gov/hearing_statements.cfm?id=212851.

[xi] Leonardo Trasande, Philip J. Landrigan, and Clyde Schechter, "Public Health and Economic Consequences of Methyl Mercury Toxicity to the Developing Brain," *Environmental Health Perspectives* 113, no. 5 (2005): 590–596.

[xii] Evangelical Environmental Network, *Protecting the Unborn from Mercury*. Washington, D.C.: Evangelical Environmental Network, 2011, p. 3.

[xiii] Charles Griffiths, Al McGartland, and Maggie Miller, "A Comparison of the Monetized Impact of IQ Decrements from Mercury Emissions," *Environmental Health Perspectives* 115, no. 6 (2007): 841–847.

[xiv] *Ibid.*, p. 841. Also see subsequent correspondence: Leonardo Trasande, Philip J. Landrigan, Clyde Schechter, and Richard F. Bopp, "Methylmercury and the Developing Brain," *Environmental Health Perspectives* 115, no. 8 (2007): A396–A397, and Charles Griffiths, Al McGartland, and Maggie Miller, "Methylmercury and the Brain: Griffiths et al. Respond," *Environmental Health Perspectives* 115, no. 8 (2007): A397–398.

[xv] National Economic Research Associates. "Proposed CATR + MACT," unpublished draft, 2011. Retrieved from http://www.globalwarming.org/2011/06/09/nera-economic-consulting-estimates-combined-impacts-of-epa-utility-mact-clean-air-transport-rules/

[xvi] Randall Lutter and John F. Morrall III, "Health-Health Analysis: A New Way to Evaluate Health and Safety Regulation," *Journal of Risk and Uncertainty* 8, no. 1 (1994): 43–66.

[xvii] Randall Lutter, John F. Morrall III, and W. Kip Viscusi, "The Cost-Per-Life-Saved Cutoff for Safety-Enhancing Regulations," *Economic Inquiry* 37, no. 4 (1999): 599–608.

[xviii] Ralph L. Keeney, "Estimating Fatalities Induced by the Economic Costs of Regulations," *Journal of Risk and Uncertainty* 14 (1997): 5–23.

[xix] Kenneth Green applies this reasoning to the Kyoto Protocol. *Evaluating the Kyoto Approach to Climate Change.* RPPI Policy Brief. Los Angeles: Reason Foundation, 1998.

[xx] National Economic Research Associates. "Proposed CATR + MACT," unpublished draft, 2011. Retrieved from http://www.globalwarming.org/2011/06/09/nera-economic-consulting-estimates-combined-impacts-of-epa-utility-mact-clean-air-transport-rules/

[xxi] The production and distribution of electric power is complex, and problems extend beyond the simple reduction of capacity that could result from costly environmental regulations. Even a power grid that has sufficient generating capacity can become unreliable if a generating facility that was responsible for "jump-starting" a local area of the grid shuts down due to regulatory costs.

[xxii] Philip D. Moeller, Letter to Senator Lisa Murkowski, August 1, 2011. Available at http://energy.senate.gov/public/files/FERCMoellerResponse.pdf.

[xxiii] Acton Institute. *Environmental Stewardship in the Judeo-Christian Tradition.* Grand Rapids, Mich.: Acton Institute, 2007, p. 9.

Appendix 2

Protecting the Unborn and the Pro-Life Movement from a Misleading Environmentalist Tactic

A Joint Statement by Pro-Life Leaders

Recently some environmentalists have portrayed certain of their causes as intrinsic to the pro-life movement. The tactic often involves appealing to a "seamless garment" of support for life, or to being "consistently pro-life" or "completely pro-life."

As leaders of the pro-life movement, we reject that portrayal as disingenuous and dangerous to our efforts to protect the lives of unborn children.

The term *pro-life* originated historically in the struggle to end abortion on demand and continues to be used in public discourse overwhelmingly in that sense. To ignore that is at best sloppy communication and at worst intentional deception. **The *life* in *pro-life* denotes not quality of life but life itself. The term denotes opposition to a procedure that intentionally results in dead babies.**

In stark contrast, most environmental causes promoted as pro-life involve little threat to human life itself, and no intent to kill anyone. For example, even if one grants the exaggerated numbers and harms claimed by the Evangelical Environmental Network (EEN) in its recent quarter-million-dollar advertising campaign that claimed, "being pro-life means protecting the unborn from mercury pollution," mercury exposure due to power-plant emissions does not kill infants.

Consequently, calling mercury pollution and similar environmental causes pro-life obscures the meaning of *pro-life*. And thanking politicians with 100% pro-abortion voting records (even some who support partial-birth abortion) for their "pro-life" position because they supported restrictions on mercury emissions, while rebuking some with 100% pro-life voting records because they opposed or didn't support the new restrictions, as EEN's campaign did, will confuse voters, divide the pro-life vote, and postpone the end of abortion on demand in America.

This doesn't mean we should ignore environmental risks. It does mean they should not be portrayed as pro-life. Genuinely pro-life people will usually desire to reduce other risks as well—guided by cost/benefit analysis. But to call those issues "pro-life" is to obscure the meaning of the term.

Two fundamental principles distinguish truly pro-life issues (like abortion, euthanasia, and embryonic stem cell research) from

environmental issues. First and foremost, truly pro-life issues are issues of actual life and death, while environmental issues tend to be matters of health. **Second, truly pro-life issues address actual intent to kill innocent people,** whether the unborn, the gravely ill, or the aged, while environmental issues do not.

If environmental advocates still want to support mercury-emission reductions or other environmental causes, let them do so honestly and above board. But they should not promote those causes under the pro-life banner. That is at best badly misinformed, at worst dishonest.

We call on environmentalists to cease portraying such causes as pro-life and join us in working diligently to reduce and end abortion on demand in the United States, which every year kills about 1.2 million babies, amounting to over 54 million in the 39 years since the Supreme Court's *Roe v. Wade* decision.

The statement had been endorsed by the following pro-life leaders as of Monday, February 6, 2012. The organizations they lead represent over 16 million Americans.

- Sara L. Anderson, Executive Vice President, Bristol House, LTD
- Dr. Herman Bailey and Dr. Sharron Bailey, Hosts, Herman & Sharron Television Ministry, Christian Television Network
- J. Matt Barber, Vice President, Liberty Counsel Action
- Gary L. Bauer, President, American Values
- E. Calvin Beisner, Ph.D., Founder and National Spokesman, Cornwall Alliance for the Stewardship of Creation
- Rev. Pierre Bynum, Founder, Pro-Life Action Churches of Maryland, Inc, Chaplain, Family Research Council
- Nancy Clark, Director of Women's Ministries, Elim Fellowship; President, Evangelical Women Leaders of the National Association of Evangelicals
- Janice Shaw Crouse, Ph.D., Executive Director and Senior Fellow, The Beverly LaHaye Institute
- Marjorie Dannenfelser, President, Susan B Anthony List
- Rev. Barrett Duke, Ph.D., Vice President for Public Policy and Research, Southern Baptist Ethics and Religious Liberty Commission
- Rev. Bryan Fischer, Director of Issues Analysis, American Family Association
- Tim S. Goeglein, Vice President for External Relations, Focus on the Family
- Rev. Wayne A. Grudem, Ph.D., Research Professor of Theology and Biblical Studies, Phoenix Seminary; Board Member, Council on Biblical Manhood and Womanhood
- Donna Hearne, Convener, Educational Policy Conference
- Rev. Peter Jones, Ph.D., Director, truthXchange, and Adjunct Professor and Scholar in Residence, Westminster Theological Seminary, Escondido, CA
- Rev. Richard Land, Ph.D., President, Southern Baptist Ethics & Religious Liberty Commission
- Jan Markell, Founder, Olive Tree Ministries
- Tom Minnery, Senior Vice President, Focus on the Family

- Marilyn Musgrave, Vice President for Government Affairs, Susan B Anthony List
- Penny Young Nance, Chief Executive Officer and President, Concerned Women for America
- Tony Perkins, President, Family Research Council
- Rev. Joey Pipa, Ph.D., President, Greenville Presbyterian Theological Seminary
- Kelly Shackelford, President & CEO, Liberty Institute
- Robert F. Schwarzwalder, Jr., Senior Vice President, Family Research Council
- Eunie Smith, President, Eagle Forum of Alabama
- Mat Staver, Founder and Chairman, Liberty Counsel
- Mark Tooley, President, Institute on Religion and Democracy
- Kelley Wesley, Pregnancy Center Advisor, former Chief Executive Officer of Sanctity of Life Ministries
- Tim Wildmon, President, American Family Association

(Institutional affiliations are listed for identification only and do not imply institutional endorsement.)

Signers' quotes:

Gary Bauer, President, American Values: "As a veteran leader in the pro-life movement, I am disturbed at the audacity of those trying to intentionally disguise a left-wing environmental agenda under the rubric of being 'pro-life.' Being pro-life is about ending the intentional killing of 1.2 million by abortion. While preventing mercury pollution is a laudable goal, those concerned about the sanctity of life should not be misled by deceptive efforts that could ultimately be counterproductive to economic growth and prosperity."

E. Calvin Beisner, Founder and National Spokesman of The Cornwall Alliance for the Stewardship of Creation: "Whatever mercury emissions from U.S. power plants might do, it's plain as the noonday sun that they don't kill babies—and 1.2 million dead babies every year are what the pro-life movement labors to prevent."

Barrett Duke, Vice President of the Southern Baptist Ethics and Religious Liberty Commission: "We sympathize with parents whose children are adversely affected in any way by human impact on the environment, and we support responsible efforts to try to alleviate this impact, but we oppose the appropriation of the pro-life cause in the effort to alleviate the impact of human mercury emissions on children as though it is in the same class as the outright destruction of more than 1.2 million unborn babies every year in our country."

Wayne Grudem, Research Professor of Theology and Biblical Studies, Phoenix Seminary: "The excessive and unreasonable pollution standards advocated by the 'Evangelical Environmental Network' will just serve to raise the cost of living through higher energy costs, especially for the poor, and thus they will hinder everyone's quality of life in the United States. They want to prevent human beings from wisely using the abundant carbon-based energy resources that God has placed in the earth for our benefit. I think that genuine evangelicals should oppose, rather than support, these misguided standards."

Peter Jones, Director of truthXchange, Adjunct Professor of New Testament, Westminster Theological Seminary, Escondido, CA: "Confusing the at best dubious science of mercury pollution's effect on unborn children with the real murder of babies in the womb will neither save babies nor promote good science."

Marilyn Musgrave, Vice President for Government Affairs, Susan B Anthony List: "As a pro-life leader I am amazed that some in the far left environmentalist movement would try to hijack the term 'pro-life' and use it to further their agenda. It is my life's call to speak for those who cannot speak for themselves and work to end abortion in this country. The term pro-life has profound meaning and should not be used deceitfully in this way."

Mat Staver, Founder and Chairman, Liberty Counsel: "There is nothing 'pro-life' about the radical environmentalist movement. Oppressive 'green' regulations, particularly in the third world, have been linked to millions of deaths. This is just a cheap political shell game."

Mark Tooley, President, Institute on Religion and Democracy: "It's disingenuous and simply wrong to dilute 'pro-life' for any trendy cause. Most evangelicals rightly understand 'pro-life' to mean stopping the senseless destruction of the unborn by abortion. And most evangelicals will not be fooled by EEN's advertising gimmick."

Mr. SHIMKUS. Because as has been testified here by the toxicologist, you are basing your religious movement and assuming the pro-life mantle when even a toxicologist testifies that there is little to no harm. Little to no harm. Now the pro-life community is about life. It is not about levels of harm or no harm. We are there to protect the life of the unborn child.

Mr. HESCOX. Mr. Shimkus, are you going to allow me to respond?

Mr. SHIMKUS. I think I am doing pretty good right now, thank you.

Mr. HESCOX. I figured as much.

Mr. SHIMKUS. First and foremost, truly pro-life issues are issues of actual life and death. That is the pro-life community, which you are masquerading for an environmental cause which I reject and which many in the pro-life community—and I am sorry that I have had to take this time to set the record straight.

And with that, I yield back my time.

Mr. HESCOX. I feel that you have just attacked my—and I really——

Mr. SHIMKUS. Mr. Chairman? Mr. Chairman? Regular order.

Mr. WHITFIELD. Just a minute. What did the gentleman say?

Mr. SHIMKUS. I just called for regular order.

Mr. WHITFIELD. OK.

Mr. RUSH. Mr. Chairman?

Mr. WHITFIELD. Yes.

Mr. RUSH. These are some very heated words here and some accusations that I think that this witness has come from far and he is sitting there very patient. Unfortunately, my friend from Illinois threw some real harsh charges at him that goes to the core of what he believes in and what he works for. So I think this heated—the committee should, out of common courtesy, allow him to respond.

Mr. WHITFIELD. Well, I am not going to allow him to respond because we ask questions all the time. Sometimes we give people an opportunity to respond, sometimes we don't.

Mr. RUSH. Mr. Chairman——

Mr. WHITFIELD. We have five or six members that are here. I recognize Mr. Waxman——

Mr. RUSH. Mr. Chairman, a point of order. I would like to then officially request that we have a second round of questioning.

Mr. WHITFIELD. I don't—no, OK. I don't have any objection to that. That is fine.

Mr. Waxman, you are recognized for 5 minutes.

Mr. WAXMAN. Thank you, Mr. Chairman.

According to EPA, the Mercury Air Toxics Standards will generate up to $90 billion in health benefits each year, far outweighing the costs of compliance. EPA estimates that this rule will create jobs as well.

Dr. Bivens, in your testimony, you state that "There is no better time than now from a job creating perspective to move forward with these rules." Can you explain to us in layman's terms what you mean by this?

Mr. BIVENS. Yes. I think in the longer run, in economies that are working well, regulatory changes are going to have essentially no impact on employment, because basically the Federal Reserve has unemployment targets that in normal, well-functioning times they can hit so they can neutralize any change to employment coming from regulatory changes. That is not true right now. We have got the Federal Reserve—its conventional monetary policy is maxed out, and yet we still have very high rates of unemployment. What that means is the economy needs more spending, more investment, more consumer spending, more government spending, anything to increase spending will increase jobs. These regulatory changes will actually kick out some corporate investment. It will make them undertake some pollution abatement and control investments they wouldn't have otherwise.

Mr. WAXMAN. Well, many of my Republican colleagues talk about the cost of complying with EPA's rules as if the money spent on pollution controls and upgrades goes into a black hole. That is simply not the case, is it?

Mr. BIVENS. That is right. I mean, one person's cost is another person's income, and so what is compliance costs from the perspective of the industry is incomes and jobs from the perspective of people installing the pollution abatement and control equipment.

Mr. WAXMAN. How does spending on pollution control activities create jobs, both at a power plant and up the supply chain?

Mr. BIVENS. Basically, it is investments that firms would not have undertaken, absent the mandates to the regulatory change, and so in order to make sure that they are emitting less of the hazardous air pollutions, they install things like filters and scrubbers and bag houses. These are additions to the capacity they have. They have to hire construction workers and skilled workers to install them onsite. That creates jobs down in supplier industries and steel in order to make the bag houses and the scrubbers, and so it creates jobs that way. It just basically makes a lot of economic activity that wouldn't have happened because now it is mandated.

Mr. WAXMAN. EPA estimated that the Mercury and Air Toxics Standards will create 46,000 short-term construction jobs and 8,000 long-term utility jobs. You argue that this a conservative estimate and likely undercounts the job creation benefits of the new rule. How does EPA underestimate the employment benefits of the air toxics rule?

Mr. BIVENS. I think the biggest underestimate is that when they looked at jobs created through the pollution abatement and control investments, they didn't capture anywhere near all of the supplier jobs. So basically, you have the equipment that needs to be installed, they capture the jobs that install the equipment, but the supplier jobs, the steel that goes into the equipment, the drivers that are needed to bring it to site, the accountants that work for the firms that supply the equipment, they missed a lot of those supplier jobs and I think that is the biggest source of understatement.

Mr. WAXMAN. This committee has had numerous hearings to examine the question—the big picture question of whether new regulations harm economic growth, and what we have heard from the Republicans is that regulations are slowing down the economic recovery. You conclude that this argument has not merit. Can you briefly describe why regulations are not a drag on the economy?

Mr. BIVENS. Sure. I would first urge people—the president of my institute had a very good paper on this about regulatory change not being the source of slow job growth. People should look for that on our Web site.

The biggest evidence are if you look at profit margins for firms today, they are highest in 45 years, and so it is really hard to make the case that anything, regulatory change or anything else, is sort of destroying the cost structure of firms and making them unprofitable. Yet with very high profit margins, you don't see them producing a lot. Why don't they produce a lot? Because there is just not that many customers coming in the door. And so to me, that says when you have got very high profit margins and let some out, you cannot exploit those and sell more stuff. That is not the sign that something has ruined your cost structure, the way the argument the regulatory change would be, it is a sign that the economy lacks demand.

Mr. WAXMAN. Reverend Hescox, I just came in in the middle of your questioning by my colleague. How do you—and I don't know how much we can get into this, but—or whether we want to or whether I want to—but how do the real people you talkS to feel about exposing children or unborn children to mercury and other toxic air pollution?

Mr. HESCOX. They are scared. They want to protect their children. How many people in this room want to have their children or grandchildren have two or three points lower on their IQ? I don't. I have a 9-year-old—9-month-old grandson who was born in Pennsylvania. We won't know for 48 months whether his IQ will be normal or not. We stand a good chance because of my work in mercury and—I mean, who hasn't gone to their physician when pregnant and told what fish not to eat and to watch your fish consumption.

So I think he stands a pretty good chance, but there are a lot of people that don't stand that chance in protecting their kids. And for me, it is a pro-life issue, along with many Evangelicals, that we are totally pro-life. Pro-life against poverty, pro-life against air pollution. Certainly first pro-life against abortion. Number one, won't deny that in a bit, but we are totally whole life, and there is a growing, growing number of Evangelicals and Roman Catholics, and that is why we are sitting here together.

Mr. WAXMAN. I think the Catholic Bishops—Catholic Council of Bishops has endorsed the EPA rule. That is my understanding, Mr. Chairman. I just wanted to put that on the record. I yield back my time.

Mr. WHITFIELD. Gentleman's time is expired. At this time, I recognize the gentleman from Texas, Dr. Burgess, for 5 minutes.

Mr. BURGESS. Thank you, Mr. Chairman.

Mr. Roberson, you were in the audience when I was questioning Administrator McCarthy and brought up to her that under the new rule, that the EPA was effectively taking coal of the table for our future energy portfolio. She was very dismissive of me in her answer. It seems like you offered additional information that perhaps that question was not one that should be so easily dismissed.

Mr. ROBERSON. Well, it is certainly my opinion that it is not easy to dismiss. I think EPA was looking——

Mr. WHITFIELD. Is your microphone on?

Mr. ROBERSON. Is that better?

Mr. BURGESS. Much better.

Mr. ROBERSON. I don't think that is a very easy issue to dismiss at all. I think EPA was looking for a simple answer that they had found a unit that meets the new unit limits and therefore everything is fine. I think they failed to look much—as far as they should have, because it is their own data of the tests that I am talking about. It is not five or six tests that I have in my attic, it is in the EPA's own spreadsheets that shows that the Logan unit fails the HCl limit five out of six tests. The Chambers Co-Gen unit fails the particulate test five out of six times.

Mr. BURGESS. And these were the units that she was referencing in her answer to me, that we already have new plants that meet the standard?

Mr. ROBERSON. The Logan unit is the one she claims meets all of the new unit limits, and I am saying the Logan unit is the basis for the HCl limit, but it itself doesn't even meet that limit when you look at multiple tests.

Mr. BURGESS. Very well. Thank you. Thank you for that answer.

Reverend Hescox, let me ask you a question. It says on my information sheet about the witnesses that your group is called the Evangelical Environmental Network, is that correct?

Mr. HESCOX. That is correct.

Mr. BURGESS. And currently, are you all involved in any sort of media campaign or advertising campaign?

Mr. HESCOX. We have done some important—not currently, we did last year.

Mr. BURGESS. And what was your budget for that advertising?

Mr. HESCOX. We had a total of around $250,000.

Mr. BURGESS. Do you have—is it—would it be available to the committee who has provided you the funding for that advertising?

Mr. HESCOX. Sure, the money came from—I mean, it will be filed on whatever the right form is this year.

Mr. BURGESS. Maybe you could provide that to the committee?

Mr. HESCOX. I would be happy to provide that.

[The information follows:]

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February 17, 2012

Dear Members of the Subcommittee on Energy and Power,

I am writing in response to a verbal request to provide the source of EEN's funding for our recent public information campaign on mercury and the unborn. The request was received during the question and answer period of my testimony delivered on February 8, 2012 before the Subcommittee.

The source of all funding came from the National Religious Partnership for the Environment.

Sincerely,

The Rev. Mitchell C. Hescox
President
Evangelical Environmental Network

Mr. BURGESS. All right, I have got up on the screen a slide, because Mr. Barton asked a question of Administrator McCarthy about the contribution of the United States to the global mercury emissions, and this slide is from the EPA from their reference on the Federal Register, and they referenced this source from this paper from the atmospheric—the Journal of Atmospheric Chemistry and Physics, which is the global mercury emissions to the atmosphere from anthropogenic and natural sources, manmade and natural sources.

[Slide]

Mr. BURGESS. If you look at that slide, it looks like we could cut out of all mercury production in the United States, and we have made a miniscule effect upon global mercury production. So I would also suggest from hearing from the other witnesses that knocking out the entire United States contribution of mercury, which means shuttering all coal-fired power plants, could have a devastating effect upon certainly Mr. Tsosie's constituents. Mr. Roberson has implied that it would be hard on people in his area, certainly the people in Texas last winter who had the gas-fired plant shut down for a brief period of time during an ice storm would argue that there were some health effects of that.

But you keep referencing the effects of mercury. I have a brief film clip that I would like to play. It is not from a right-wing group, it is from NOAA, the National Oceanic and Atmospheric Association. Perhaps we could key that up and play that. Let us just take a listen here. This is from NOAA.

[Video]

Mr. BURGESS. Go ahead and stop that. Mr. Chairman, this is an excepted portion from the NOAA film, and if it is OK with the committee, I would like to put a link to the entire 25-minute segment on the committee's Web site so people can view that for themselves.

Mr. WHITFIELD. Absolutely.

Mr. BURGESS. And I yield back the balance of my time.

Mr. WHITFIELD. At this time, the Chair recognizes the gentleman from Texas, Mr. Olson, for 5 minutes.

Mr. OLSON. I thank the chairman, and welcome to all the witnesses. Thank you all for testifying today. Unfortunately with such a large panel, I will have to ask my questions in a form that requires a yes or no answer. I ask you as a former Naval aviator, so please cover your buddy. If they are not hitting the microphone button, just reach over there and tap it for them.

And as I mentioned the first panel, my home State of Texas is still suffering a significant drought. The district I represent, Texas 22, went through the hottest August in history, over 100 degrees every single day in August, and still we had 100 percent humidity that makes people love Houston weather in the summer. Experts predict that we are going to have the same conditions recurring this summer. ERCOT, which is the company, the organization that controls our grid for most of the State, is worried about capacity shortages if the weather reoccurs as expected. If it does happen, real lives will be lost if we have blackouts. Not projected lives saved that EPA uses. Real lives, real people, disproportionally impacting the young and elderly if they lose power in this excessive heat.

EPA calls the proposed rule we are talking about today the "Mercury and Air Toxics Standard," and I want to make clear that I realize that mercury is a dangerous toxin. As a 6-year-old, I broke a thermometer with mercury in it in the bathroom. We almost moved out of the house because of my carelessness. EPA claims that there is going to be $90 billion per year in health benefits, and yet the benefits from decreased mercury standards is going to be $500,000. One half of 1 percent of the total health benefits come from the reduction of mercury.

Here is the question the people in Texas 22 want me to ask you all. If the EPA is using miniscule benefits—mercury benefits from—I apologize. If the EPA is using miniscule benefits from reduction of mercury to increase reductions in particulate matter, PM2.5, is that what they are doing? I will start at the right there. Mr. MacDonald. Yes or no?

Mr. MACDONALD. Was the question——

Mr. OLSON. The question basically is EPA—as I said, EPA says it is going to be $90 billion in health benefits, but the benefits from mercury reduction—I have got a chart here I can go into, but the benefits of mercury production are going to be $500,000. So one-half of 1 percent of all EPA benefits are going to come from mercury reduction, so the other benefits have to be coming from, in my opinion, particulate matter reductions. That is what the people at home want me to ask you. Do you think this is coming—these mercury reductions seem as a guise to get to particulate matter reduction, yes or no.

Mr. MACDONALD. Yes.

Mr. OLSON. And Mr. Roberson, yes or no?

Mr. ROBERSON. Yes, I do.

Mr. OLSON. OK, Mr. Tsosie?

Mr. TSOSIE. Yes, it appears that way.

Mr. OLSON. Reverend Hescox?

Mr. HESCOX. No.

Mr. OLSON. And Dr. Goodman?

Ms. GOODMAN. Yes.

Mr. OLSON. Mr. Bivens?

Mr. BIVENS. No.

Mr. OLSON. And finally, Dr. Smith?

Ms. SMITH. Yes.

Mr. OLSON. OK, five yeses and two nos.

Another question. This chart, just so you understand this, have you seen—and another yes or no, real quickly, did you see this chart or have this information before you came here today? First Mr. MacDonald, have you seen this before, these numbers?

Mr. MACDONALD. I haven't seen it.

Mr. OLSON. Haven't seen it before. How about you, Mr. Roberson?

Mr. ROBERSON. I have not seen the chart, but I am very familiar with the numbers.

Mr. OLSON. There we go. Mr. Tsosie?

Mr. TSOSIE. No, I haven't.

Mr. OLSON. Reverend Hescox?

Mr. HESCOX. Not seen your particular chart, but seen many numbers.

Mr. OLSON. OK, Dr. Goodman?

Ms. GOODMAN. The same.

Mr. OLSON. The same numbers, OK, you guys got the information. Mr. Bivens—Dr. Bivens?

Mr. BIVENS. No.

Mr. OLSON. And Dr. Smith?

Ms. SMITH. I have not seen the chart, but I have seen the data.

Mr. OLSON. And just—OK. Basically just to show you, these are three organizations and this is their level of mercury exposure, and I apologize to my colleague from Washington for trashing APEC, but the bottom line is here. Here is the World Health Organization and the vertical axis there, the Y axis, is the blood mercury levels at micrograms per liter. European Food Safety Authority and Environmental Protection Agency, you can see that over a 10-year period, we have been under the EPA's limit set the standards here, 3.8 milliliters in blood level mercury.

One final question. I want to talk to the one representative here who actually works in the manufacturing industry. This is for you, Mr. Gerdau. Has the affordability of energy in the United States been a factor in attracting manufacturing in the United States, and will increases in electricity costs due to EPA regulation potentially deter new investment in U.S. manufacturing? Yes or no.

Mr. MACDONALD. Yes, it will.

Mr. OLSON. Yes, OK. One more. Are higher energy costs for manufacturers passed on to consumers in the form of higher costs for goods and services?

Mr. MACDONALD. Absolutely.

Mr. OLSON. Absolutely. And one final question. You said, and this is a quote, "With a 1 cent kilowatt increase in the cost of electricity imposes additional costs of approximately $9 billion per year on factories and manufacturing plants." Will those costs—will you swallow those costs, or will you pass them on to families and individuals?

Mr. MACDONALD. Oh, those will be passed on.

Mr. OLSON. Pass them on, OK. I am out of time. Thank you all. Yield back.

Mr. WHITFIELD. Thank you, Mr. Olson.

At this time, I recognize the gentleman from West Virginia, Mr. McKinley, for 5 minutes.

Mr. MCKINLEY. Thank you, Mr. Chairman.

I would like to begin by—there has been some testimony throughout the day and from—comments from the other side that the companies shutting down these plants are doing so to enhance their bottom line, rather than facing up to the reality, so I would like to introduce into the record some reports that have come from the Brattle Group and others about the costs, the actual costs of energy.

Mr. WHITFIELD. Without objection.

[The information follows:]

The Brattle Group

Potential Coal Plant Retirements Under Emerging Environmental Regulations

Metin Celebi, Frank Graves, Gunjan Bathla, and Lucas Bressan

The Brattle Group

December 8, 2010

www.brattle.com

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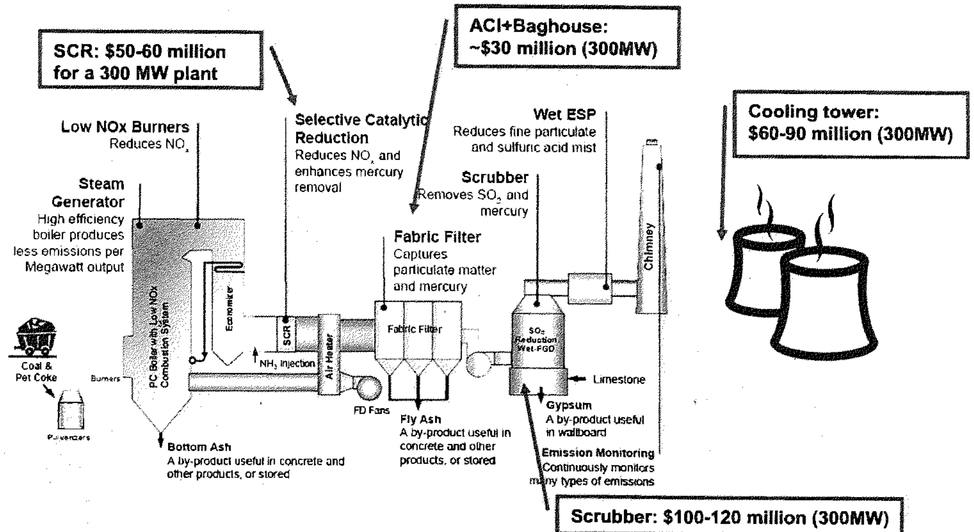
EPA regulations – implications

Potential technology-based environmental restrictions in air (SO_2, NOx, Mercury), water and coal ash disposal in lieu of market-based approaches.



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219

Costs of compliance

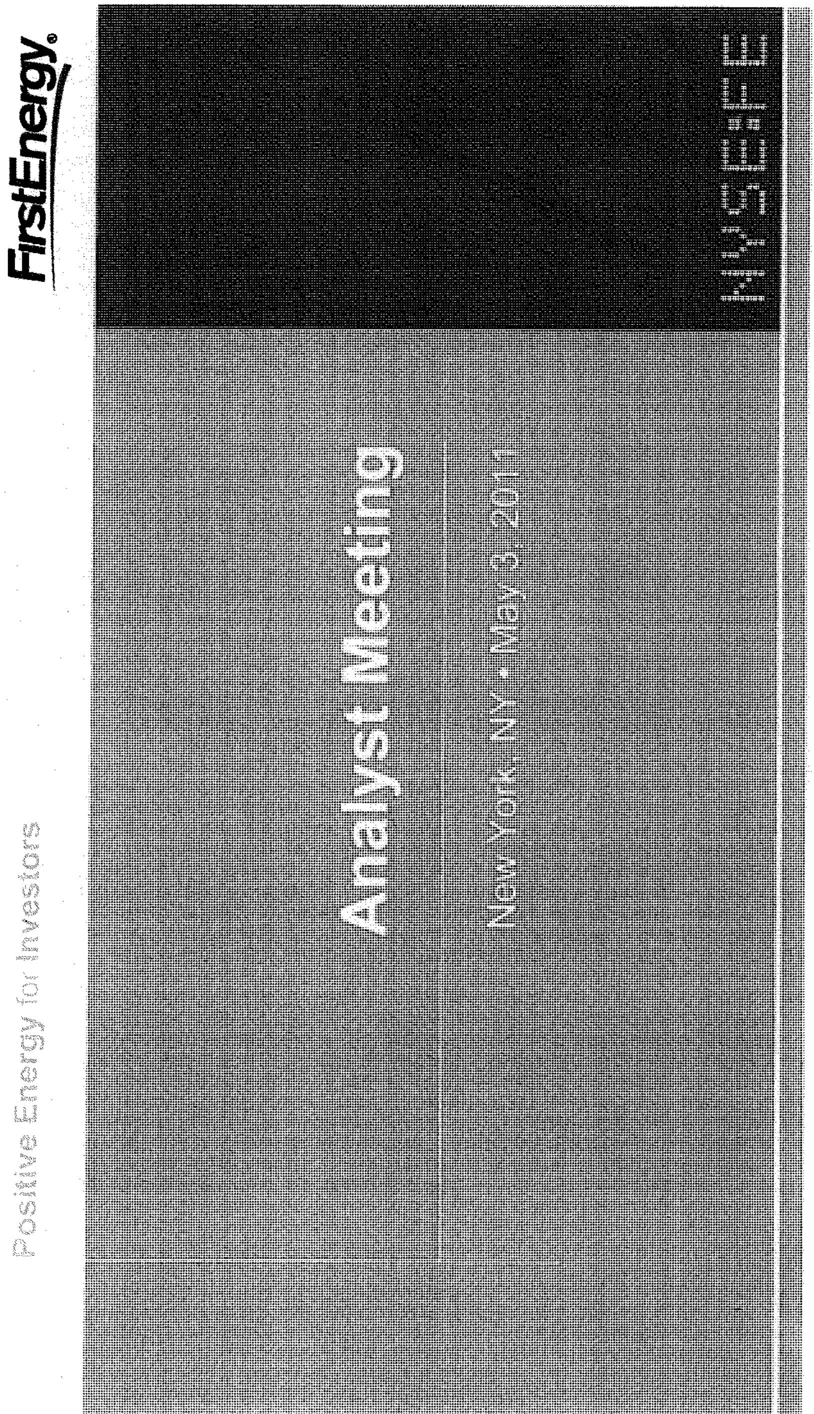
A new regulation that requires scrubbers would add $8-34/MWh (in O&M and carrying costs) to the existing costs of coal plants. If NOx controls (SCR) and/or mercury controls (ACI) are also required, this would bring the total increase in levelized costs to $12-46/MWh.

COST OF ENVIRONMENTAL CONTROL EQUIPMENT FOR COAL PLANTS

Controls			Scenario I	Scenario II	Scenario III
FGD			x	x	x
SCR				x	
ACI (No Existing Baghouse)					x
Total Cost			*Million 2009 $'s*		
600 MW unit at 70% CF			$153	$233	$199
600 MW unit at 30% CF			$149	$227	$194
300 MW unit at 70% CF			$118	$168	$149
300 MW unit at 30% CF			$116	$165	$147
Economic Life	*Size (MW)*	*Capacity Factor*	*Levelized Cost in 2009 $/MWh*		
10	600	30%	22.36	32.22	30.38
		70%	10.63	15.31	14.31
	300	30%	34.02	46.40	45.02
		70%	15.61	21.42	20.57
15	600	30%	18.49	26.23	25.43
		70%	8.97	12.75	12.19
	300	30%	27.99	37.69	37.48
		70%	13.03	17.69	17.34
20	600	30%	16.64	23.36	23.06
		70%	8.18	11.52	11.17
	300	30%	25.10	33.51	33.86
		70%	11.79	15.90	15.79

Current energy margins (excluding capacity revenues) already low for merchant coal plants due to low gas prices, low demand growth, and new renewables

- Current dispatch costs for an existing coal plant ~$20-35/MWh
- Low wholesale power prices in 2009
  - PJM West: ~$40/MWh
  - Midwest (Illinois/Michigan): ~$25-39/MWh
  - Southeast: ~$30/MWh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Fossil Generation Fleet

Plant	Capacity	IS Dates	Type
Mansfield 1-3	2,490	1976-1980	Super-Critical
Harrison 1-3 (Part Reg)	1,984	1971-1973	Super-Critical
Hatfield 1-3	1,710	1969-1971	Super-Critical
Pleasants 1 & 2 (Part Reg)	1,300	1979-1980	Super-Critical
Sammis 6 & 7	1,200	1969-1971	Super-Critical
Fort Martin 1 & 2 (Reg)	1,107	1967-1968	Super-Critical
Eastlake 5	597	1972	Super-Critical
Total Super-Critical Fleet	10,388		
Sammis 1-5	1,020	1959-1967	Sub-Critical
Eastlake 1-4	636	1953-1956	Sub-Critical
Bay Shore 1	136	1955	CFB
Bay Shore 2-4	495	1959-1968	Sub-Critical
Armstrong 1 & 2	356	1958-1959	Sub-Critical
Albright 1-3 (Reg)	292	1951-1953	Sub-Critical
Mitchell 3	288	1963	Sub-Critical
Lake Shore	245	1962	Sub-Critical
Ashtabula 5	244	1958	Sub-Critical
Willow Island 1 & 2 (Reg)	242	1949 - 1960	Sub-Critical
Rivesville 5 & 6 (Reg)	126	1942-1951	Sub-Critical
R. Paul Smith 3 & 4	116	1947 – 1958	Sub-Critical
Burger 3	94	1950	Sub-Critical
Total Sub-Critical Fleet	4,290		
Total Coal Fleet	14,678		

222

Environmental Controls

Plant	NOx Controls		SO_2 Controls		Particulate		Cooling Towers
	SCR	Other[1]	Scrubbers	Other[2]	Baghouse	ESP/Other[3]	
Mansfield 1-3	✓	✓	✓			✓	✓
Harrison 1-3 (Part Reg)	✓	✓	✓	✓		✓	✓
Hatfield 1-3		✓	✓	✓		✓	✓
Pleasants 1 & 2 (Part Reg)	✓	✓	✓	✓		✓	✓
Sammis 6 & 7	✓	✓	✓			✓	
Fort Martin 1 & 2 (Reg)		✓	✓	✓		✓	✓
Eastlake 5		✓		✓		✓	
Sammis 1-4		✓	✓		✓		
Sammis 5		✓	✓			✓	
Eastlake 1-4		✓		✓		✓	
Bay Shore 1*		✓		✓	✓		
Bay Shore 2-4		✓		✓		✓	
Armstrong 1 & 2		✓				✓	
Albright 1-3 (Reg)		✓		✓		✓	✓
Mitchell 3			✓			✓	
Lake Shore				✓		✓	
Ashtabula 5		✓		✓		✓	
Willow Island 1 & 2 (Reg)		✓				✓	
Rivesville 5 & 6 (Reg)						✓	
R. Paul Smith 3		✓				✓	
R. Paul Smith 4		✓			✓		
Burger 3						✓	

[1]Other NOx Controls can include: Selective Non-Catalytic Reduction (SNCR), Low NOx Burners (LNB) & Over-Fire Air (OFA) and/or the Circulating Fluidized Bed (CFB) Boiler
[2]Other SO_2 Controls include Low-Sulfur Fuel and the CFB Boiler
[3]Particulate Controls can include Venturi Scrubber, Baghouse or Electrostatic Precipitator (ESP)
*Circulating Fluidized bed boiler is the advance control mechanism for NOx and SO_2
As of March 1, 2011

IEc

MEMORANDUM | 31 March 2011

TO Ellen Kurlansky

FROM Jason Price, Nadav Tanners, and Jim Neumann (IEc) and Roy Oommen (ERG)

SUBJECT Employment Impacts Associated with the Manufacture, Installation, and Operation of Scrubbers

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INTRODUCTION

EPA expects that a wide range of current and upcoming regulatory actions pursued under the authority of the Clean Air Act (CAA) could significantly increase the demand for flue gas desulfurization (FGD, commonly referred to as scrubbers). Under the combined requirements of more stringent NAAQS standards, regional haze requirements, a revised Clean Air Interstate Rule, and Section 112 MACT rules, FGD may be the most cost-effective compliance strategy for affected emissions sources. Therefore, a full understanding of the economic impacts associated with the manufacture, installation, and operation of scrubbers is critical to an assessment of the impacts of these rules. Among these impacts is the employment effect associated with the production, installation, and operation of scrubbers in response to CAA requirements.

The purpose of this memorandum is to present the average employment impacts associated with the manufacture, installation, and operation of a scrubber. These per-scrubber employment impacts may inform the assessment of regulatory impacts for upcoming CAA regulations. The employment impacts estimated in this memorandum include both direct and indirect impacts. Direct employment impacts include labor used by scrubber manufacturers, fabricators, and users, whereas indirect impacts include labor employed in the production of inputs to scrubber production, as well as labor employed by vendors that support scrubber operations.

We estimate employment impacts for a series of model scrubber installations, defined in terms of their size and application (e.g., electric utilities versus industrial boilers). Exhibit 1 summarizes our employment estimates for each model scrubber. As indicated in the exhibit, employment impacts are most significant for large scrubbers installed at electric utilities.

In the sections that follow, we provide a detailed specification of the model scrubbers that we used for this analysis, summarize our methods for estimating the direct and indirect employment impacts for each model scrubber, and present recommendations for applying our results in a regulatory setting.

EXHIBIT 1. SUMMARY OF EMPLOYMENT IMPACTS PER MODEL SCRUBBER

MODEL SCRUBBER	MODEL SCRUBBER DESCRIPTION	ONE-TIME EMPLOYMENT IMPACTS (ANNUAL EQUIVALENT FTEs)[2]	RECURRING ANNUAL EMPLOYMENT IMPACTS (FTEs PER YEAR)[3]
Model Scrubber 1	Medium/Large Utility Boilers	848 - 1,001	103
Model Scrubber 2	Small Utility Boilers	409 - 493	39
Model Scrubber 3A[1]	Large Industrial/ Institutional Boilers (method 1)	333 - 400	29
Model Scrubber 3B[1]	Large Industrial/ Institutional Boilers (method 2)	77 - 91	16
Model Scrubber 4	Small- and Medium-Sized Industrial/Institutional Boilers	40 - 48	6

Notes:

1. As described in later sections of this document, Model Scrubbers 3A and 3B are different analytic variants of the same model scrubber. Both represent scrubbers at large industrial boilers, but we estimate employment impacts for Model Scrubber 3A based on one methodology and Model Scrubber 3B based on another.
2. One-time employment impacts reflect the labor required for the manufacturing and installation of each model scrubber, including the labor required to produce scrubber components (e.g., the absorber vessel) that scrubber makers purchase from other firms.
3. Recurring employment impacts include labor required for the operation, maintenance, and administrative support for each scrubber over its full lifetime of operation.

MODEL SCRUBBERS

The guiding principles that informed the specification of model scrubbers for this analysis were to (1) capture the range of scrubbers likely to be installed in response to various emissions control requirements and (2) reflect significant per-scrubber employment impact variation. To that end, we define the model scrubbers for this analysis in terms of their size (i.e., capacity of the controlled combustion unit) and the type of boiler to which each scrubber is applied for acid gas control. We distinguish between scrubbers at electric utilities and scrubbers installed on industrial/ institutional boilers because of the significant differences between the two in terms of construction and labor requirements.[1] The scrubber market is similarly segmented along these lines, such that many companies that manufacture large scrubber units for utilities do not manufacture scrubbers for smaller industrial sources and *vice versa*.

[1] In addition, as indicated below, installation represents most of the direct one-time labor associated with EGU scrubbers, whereas manufacturing makes up most of the direct one-time labor associated with industrial boiler scrubbers.

MODEL SCRUBBERS FOR ELECTRIC UTILITIES

We define the model scrubbers for electric utilities based on a prior ERG analysis. For Alberta's Clean Air Strategic Alliance, ERG conducted a review of the USEPA Clean Air Market Division's database and specified three model units defined in terms of their size: small (25-100 MW), medium (100-500 MW), and large (> 500 MW).[2] ERG's analysis of wet FGD systems for these units identified a clear difference in the capital cost per energy output ($/MW) between wet FGD systems applied to small utility units (25 - 100 MW) and those applied to medium to larger units (100 – 1,000 MW). Assuming that this difference in capital costs is indicative of differences in labor requirements, we specify two model scrubbers consistent with these capacity ranges, as indicated in Exhibit 2.

MODEL SCRUBBERS FOR INDUSTRIAL BOILERS

The model scrubbers for industrial boilers are based on EPA's previous analysis of the costs associated with the MACT standards for these sources. To estimate the costs of the industrial boiler MACT, EPA specified a series of model units based on Federal and state databases and survey data compiled by the Agency for these units.[3] These model units were differentiated by size (as well as other factors not relevant to this analysis) into the following categories: < 10 million Btu per hour (MMBtu/hr), 10-100 MMBtu/hr, 100-250 MMBtu/hr, and > 250 MMBtu/hr. EPA's assessment of the scrubber-related costs for these model units found a significant difference in total annualized cost between units with capacity greater than 250 MMBtu/hr—most of which burned coal as their primary fuel—and those with capacity less than 250 MMBtu/hr—most of which used residual fuel oil or process gas as their primary fuel. This difference in costs reflects: (1) higher flue gas flow rates from larger units that will require larger control devices, and (2) high pollutant concentrations in coal relative to residual fuel oil or process gas, requiring more expensive controls with higher reduction efficiencies. Assuming that this difference in costs is indicative of differences in labor requirements, we specify two model scrubbers for units installed at industrial/institutional boilers: one for scrubbers installed at small- and medium-sized industrial boilers (50-250 MMBtu/hr) and a second for scrubbers at large industrial boilers (250-500 MMBtu/hr), as shown in Exhibit 2.

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[2] ERG, Electricity Framework 5 Year Review - Control Technologies Review. Final Report. Prepared for Clean Air Strategic Alliance of Alberta, Canada. January 21, 2009.

[3] A summary of these units is available in Jeanette Alvis Christy Burlew, and Roy Oommen, Eastern Research Group. "Development of Model Units for the Industrial/ Commercial/ Institutional Boilers and Process Heaters National Emission Standards for Hazardous Air Pollutants". Memorandum to Jim Eddinger, U.S. EPA. October 2002.

EXHIBIT 2. SUMMARY OF MODEL SCRUBBERS

MODEL NO.	BOILER TYPE/APPLICATION	BOILER SIZE (IN TYPICAL UNITS FOR APPLICATION)	BOILER SIZE (STANDARDIZED TO MMBTU/HR)
1	Utility Boilers (Medium and Large)	100-1,000 MW	980-9,800 MMBtu/hr
2	Utility Boilers (Small)	25-100 MW	245 -980 MMBtu/hr
3	Industrial/Institutional Boilers (Large)	250-500 MMBtu/hr	250-500 MMBtu/hr
4	Industrial/Institutional Boilers (Small- and Medium-Sized)	50-250 MMBtu/hr	50-250 MMBtu/hr

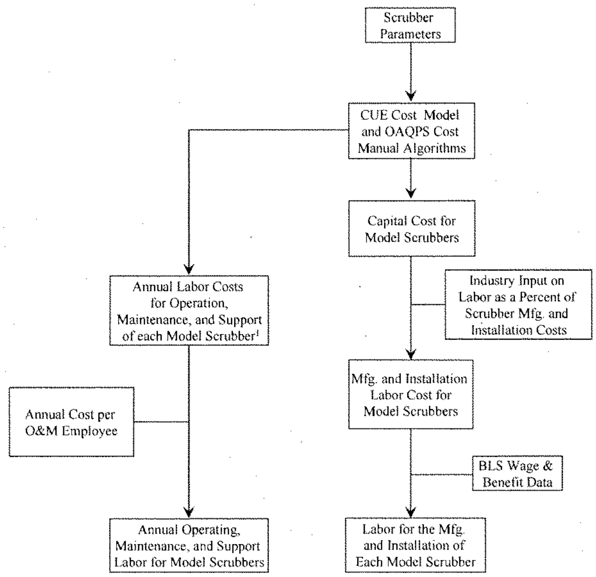
DIRECT EMPLOYMENT IMPACTS

In this section, we present our analysis of the direct employment impacts associated with scrubber manufacturing, installation, and operation. These direct impacts include labor expended by scrubber producers for the manufacturing and installation of scrubbers and the labor required (on an annual basis) for the operation of a scrubber. We note that these direct employment impacts do not include labor associated with the production of material inputs used (purchased) by scrubber manufacturers or labor employed by vendors that support scrubber operations (e.g., firms that assist with FGD gypsum disposal).

As indicated above, the model scrubbers specified for this analysis distinguish between scrubbers at electric utilities and scrubbers at industrial boilers. Because electric generating units (EGUs) are typically much larger than industrial boilers and can more easily realize economies of scale, electric utilities often construct scrubber support systems on-site, such as more complex waste handing and disposal systems, reagent handling systems, and limestone grinding systems. Industrial sources generally rely upon external vendors for these support functions. Large industrial boilers, which are similar in size to small utility units, may use either method depending on the cost over the lifetime of the equipment. To address this uncertainty, we estimate employment impacts for large industrial boilers (Model Scrubber 3) using two methodologies: one in which we assume that large industrial units construct scrubber support systems onsite and another in which we assume that these units rely on external vendors for this support. For reporting purposes, we designate the former as Model Scrubber 3A and the latter as Model Scrubber 3B.

Exhibit 3 summarizes the approach that we employed to estimate the direct employment impacts associated with the manufacture, installation, and operation of each model scrubber. As indicated in the exhibit, the main steps of our approach are as follows:

EXHIBIT 3. SCHEMATIC OF METHODOLOGY FOR ESTIMATING DIRECT SCRUBBER LABOR REQUIREMENTS



1. For the operator labor associated with EGU model scrubbers, the CUECost program directly estimates the annual number of FTEs. Maintenance and administrative support labor for EGU model scrubbers is estimated based on the approach depicted in this exhibit.

1. Input model scrubber parameters into EPA's CUECost Program (for scrubbers at EGUs) and the cost algorithms included in the OAQPS control cost manual (for industrial boiler scrubbers) to estimate the capital costs associated with each model scrubber.[4],[5]
2. Based on industry input on the labor costs reflected in the total cost of a scrubber, estimate the labor costs associated with the manufacture and installation of each model scrubber.
3. Using wage and fringe benefit data from the Bureau of Labor Statistics (BLS), translate manufacturing and installation labor costs for each model scrubber into estimates of the labor required for manufacturing and installation, measured as full-time equivalents (FTEs).
4. Estimate operating and maintenance labor based on O&M data generated by CUECost and the OAQPS cost manual algorithms. We generate separate estimates for operator labor, maintenance labor, and administrative support labor.

We discuss each component of the analysis in greater detail below.

ESTIMATION OF SCRUBBER CAPITAL COSTS

The first step in our assessment of direct labor requirements is to estimate the total investment cost (i.e., upfront capital cost) for each model scrubber. For scrubbers at electric utilities, we generate these estimates with EPA's CUECost program, whereas our estimates for industrial boiler scrubbers are based on the cost algorithms contained in the OAQPS control cost manual. The CUECost program was developed by EPA for analysis of the costs associated with nitrous oxide (NO_x), sulfur dioxide (SO_2), and particulate matter (PM) controls at coal-fired utility boilers. The OAQPS control cost manual provides detailed information on point source and stationary area source air pollution controls for volatile organic compounds (VOCs), PM, NO_x, SO_2, and other acid gases.

Estimation of the capital costs for each model scrubber requires the specification of data inputs for the CUECost Program and the algorithms contained in the OAQPS control cost manual. In particular, representative capacity and SO_2 control efficiency values were necessary for each model scrubber. Based on our previous experience with electric utility and industrial boilers scrubbers, we selected the representative capacity values included in Exhibit 4. The control efficiency for scrubbers may range from 90 to 99 percent. For this analysis, we assumed a control efficiency of 95 percent. For other data inputs required by CUECost (e.g., coal type and properties, flue gas temperature, etc.), we used the default values included in the program. Similarly, for other data inputs required by

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[4] Detailed information on the CUECost Program is available in R. Keeth, R. Blagg, C. Burklin, B. Kosmicki, D. Rhodes, and T. Waddell, *Coal Utility Environmental Cost (CUECost) Workbook User's Manual Version 1.0*, prepared for U.S. EPA. Information on the OAQPS cost algorithms is available in U.S. EPA, OAQPS, *EPA Air Pollution Control Cost Manual*, Sixth Edition, January 2002.

[5] Capital costs for Model Scrubber were estimated with both CUECost and the OAQPS cost algorithms.

the cost algorithms contained in the OAQPS cost manual (e.g., temperature, inlet sulfur loading, etc.), we used default inputs previously developed by ERG for another analysis.[6]

EXHIBIT 4. REPRESENTATIVE CAPACITY FOR EACH MODEL SCRUBBER

MODEL NUMBER	SIZE RANGE	TYPICAL SIZE (IN TYPICAL UNITS FOR APPLICATION)	TYPICAL SIZE (STANDARDIZED TO MMBTU/HR)
1	100 MW - 1,000 MW	750 MW	7,350 MMBtu/hr
2	25-100 MW	100 MW	980 MMBtu/hr[a]
3A and 3B	250 - 500 MMBtu/hr	500 MMBtu/hr	500 MMBtu/hr
4	50 - 250 MMBtu/hr	100 MMBtu/hr	100 MMBtu/hr

Based on the inputs entered into CUECost and the OAQPS cost manual algorithms, we estimate that the capital costs for the model scrubbers range from $7.1 million for small scrubbers installed on industrial boilers to $116 million for scrubbers fitted to large EGU boilers, as indicated in Exhibit 5.

ESTIMATION OF DIRECT LABOR COSTS FOR THE MANUFACTURE AND INSTALLATION OF EACH MODEL SCRUBBER

A key step in our assessment of direct scrubber employment impacts is estimation of the labor costs reflected in the total capital cost associated with each model scrubber. These labor costs reflect the cost of employing engineers, iron and steel workers, and boilermakers to manufacture and install each scrubber. Based on input from various industry sources, we estimate these labor costs as a percentage of the total investment costs for each model scrubber. Exhibit 6 summarizes the estimates that we obtained from these sources. As the exhibit indicates, the estimates that we obtained vary significantly, ranging from 25 percent of capital costs to 50 percent. However, most of the scrubber manufacturers and installers included in Exhibit 6 indicated that labor represents 40 to 50 percent of capital costs. Moreover, Babcock and Wilcox, which manufactures *and* installs scrubbers for both utilities and industrial boilers, specified that precise range and provided the most detailed information on scrubber costs.[7] Accordingly, this analysis reports labor costs associated with scrubber manufacturing and installation (and the associated employment impacts) as a range, based on the 40 to 50 percent range that we obtained from industry.

[6] Roy Oommen, Eastern Research Group. "Methodology for Estimating Control Costs for the Industrial, Commercial, and Institutional Boilers and Process Heaters National Emission Standards for Hazardous Air Pollutants." Memorandum to Jim Eddinger, U.S. Environmental Protection Agency, OAQPS. October 2002.

[7] Personal communication with Phil Blazer, Babcock and Wilcox, January 5, 2010.

EXHIBIT 5. MODEL SCRUBBER COSTS AND DIRECT LABOR REQUIREMENTS

		MODEL SCRUBBER 1	MODEL SCRUBBER 2	MODEL SCRUBBER 3A	MODEL SCRUBBER 3B	MODEL SCRUBBER 4
	SIZE RANGE	980-9,800 MMBtu/hr	245 -980 MMBtu/hr	250-500 MMBtu/hr	250-500 MMBtu/hr	50-250 MMBtu/hr
COST ESTIMATES	CAPITAL COST (MILLION $)	$116	$56.7	$45.9	$13.5	$7.13
	LABOR COST - FABRICATION (MILLION $)	$15.5 - $19.3	$7.6 - $9.5	$6.1 - $7.7	$3.6 - $4.5	$1.9 - $2.4
	LABOR COST - INSTALLATION (MILLION $)	$30.9 - $38.7	$15.1 - $18.9	$12.2 - $15.3	$1.8 - $2.3	$1.0 - $1.2
	ANNUAL LABOR COST - O&M (MILLION $)	$9.7	$4.0	$3.1	$0.45	$0.19
DIRECT LABOR ESTIMATES	FABRICATION LABOR (ANNUAL EQUIVALENT FTES)	128 - 160	63 - 78	51 - 63	30 - 37	16 - 20
	INSTALLATION LABOR (ANNUAL EQUIVALENT FTES)	510 - 638	249 - 312	202 - 252	30 - 37	16 - 20
	O&M AND ADMINISTRATIVE SUPPORT LABOR (FTE PER YEAR)	103	39	29	11	5

Mr. McKINLEY. Thank you, Mr. Chairman.

Please understand, where I am coming from is a coal-fired State. We create coal, we mine coal in West Virginia. Ninety-nine or 98 percent of the power generated in West Virginia is produced by coal, so when the EPA goes after the coal industry, you are attacking the very fabric—much like your Navajo Nation, you are coming at the very fabric of our community. So I am very sensitive to it. I take it very personally. But I think because the EPA is truly a group that we have to rely on, how sensible are they going to approach things? I have learned here in my first year that there is a real credibility gap, and I heard that in the overall discussion here. The numbers that they have been presenting are really subject to question pretty seriously, and if we are making decisions based on false information, it is only going to hurt a State like West Virginia and this Nation that is relying on coal fired gemeratopm.

So I—do any of you agree, given the fact that FirstEnergy just spent $1.8 billion on a facility to bring it into compliance? For one facility, is it reasonable to suggest that with the 700 we have across the country that we are going to be able to do this for 9.4 billion annually? I mean, if any of you think that we can do it for 9.4, let me know. Do any of you agree? I am not—do you think they can do it for 9.4?

Ms. SMITH. If I can explain, that 9.4 billion is annualized. It is incurred over many, many, many years, and so, in fact, the cost that needs to be spent prior to 2015 to come into compliance is more like $100 billion.

Mr. McKINLEY. That is going to put a real strain, I think, if we are going to be spending that on all 700, or whatever number that they are going to have with it.

And another question, do you agree with the idea that the only reductions—although I showed you that chart, we are only going to reduce less than half of 1 percent of our energy capacity? Is that reasonable to suggest? That is what they are representing to us and that is what we are making decisions, based on that information. Do any of you agree that it is not going to have an impact on our energy production? And last, Dr. Goodman, let me go to you on a very direct question, because I raised it during the earlier testimony against—with Ms. McCarthy. What about indoor air quality, because what the Reverend is talking about is providing help for the unborn. What about the indoor air quality? Is that—do you agree that the indoor air quality, being our homes and our offices, is worse than in our playgrounds and parks? Our workplace environment, is that—testimony seems to show that, but I would like to hear it from you, from a toxicologist.

Ms. GOODMAN. Well really, my point was more that——

Mr. McKINLEY. Can you speak closer?

Ms. GOODMAN. Sorry. My point was really that in estimating health benefits, the estimates were only based on outdoor concentrations at a fixed point, whereas people don't stand at a fixed point and they spend most of their time indoors. So this—these calculations don't take into account indoor exposures at all, so we have no——

Mr. MCKINLEY. But that is what they keep testifying to. What are we missing? How can we get them to separate the two so that we can deal with the real problem, where we are spending 90 percent of our life is indoors? How do we deal with that?

Ms. GOODMAN. Well, we need to put the money into conducting studies where we actually measure the indoor exposures, and then look at health effects based on people's actual exposures, rather than these surrogates for exposure that aren't very precise.

Mr. MCKINLEY. Thank you. I yield back my time.

Mr. WHITFIELD. Thank you. At this time, Mr. Pompeo of Kansas is recognized for 5 minutes.

Mr. POMPEO. Thank you, Mr. Chairman.

Mr. Roberson, I heard your testimony. Isn't it fair to say that this new rule is a ban on new coal-fired power plants, in effect?

Mr. ROBERSON. In my view it is a ban because I don't see how anyone can go forward with a new coal-fired project.

Mr. POMPEO. And we talked to—I think you were here when I spoke to Ms. McCarthy about the existing plants. We talked about Logan 1. In fact, there is really no power plant in existence today that can consistently meet the requirements that the new rule would require.

Mr. ROBERSON. I believe that is correct.

Mr. POMPEO. Thank you.

Mr. MacDonald, when you talk about your electricity rates going up, where—if rates go up to the level that you have hypothesized, that your data suggests, and that folks have told you, what does that mean on a relative basis to other countries?

Mr. MACDONALD. Well, we are already seeing imports of steel into the U.S. economy, so what it means is that we will undoubtedly have a competitive pressure against our own domestic production. We will lose production, which is going to be a loss of jobs. It is a direct interaction.

Mr. POMPEO. And electricity costs are a very relevant, very significant portion of the cost of goods sold for those businesses?

Mr. MACDONALD. That is correct.

Mr. POMPEO. Thank you.

Mr. Bivens, I am fascinated by your testimony. I want to make sure I have got it right before I ask you questions. You said that regulatory policy in the long run has no net impact on jobs.

Mr. BIVENS. Yes.

Mr. POMPEO. And then you also said that one person's costs are someone else's income.

Mr. BIVENS. Yes.

Mr. POMPEO. So if we had a regulation that costs someone to take a stack of dollar bills, a million bucks, and burn them, that would be a cost to that business, correct?

Mr. BIVENS. Sure.

Mr. POMPEO. And would that—whose income would that be?

Mr. BIVENS. Whoever set them on fire, if they got paid for it. It is a weird——

Mr. POMPEO. OK, they got paid a dollar, so there would be a net loss to the—if they got paid a dollar to burn them. But the million dollars that was burned, that regulation, it is not true that regulations have a one-to-one correlation between costs and income. That regulation would——

Mr. BIVENS. That is right.

Mr. POMPEO [continuing]. Generate a million dollars of cost, and if we paid them $3 an hour and it took them hour to do it, it would generate $3 of income, so there would be a net loss associated with that regulation. Is that not right?

Mr. BIVENS. That is right, but——

Mr. POMPEO. So it is—so that is right, so——

Mr. BIVENS. But every bit of compliance costs are somebody else's income.

Mr. POMPEO. Excuse me?

Mr. BIVENS. Every bit of compliance costs is somebody else's income.

Mr. POMPEO. That was a compliance——

Mr. BIVENS. The EPA separates them out, compliance costs versus social costs, and the difference between the two is economic activity foregone, that is what you are talking about, and the vast majority of the total social class is in compliance——

Mr. POMPEO. So where did this money go? This regulation required them to—that was a compliance cost. They were forced to burn the million dollars.

Mr. BIVENS. That hypothetical on the ratio would be different.

Mr. POMPEO. OK, so if we made somebody build a building and we said no power tools could be used, your answer is no impact on jobs whatsoever?

Mr. BIVENS. Actually that would create jobs, because that would be a very inefficient way to do it and it would take a lot more manpower.

Mr. POMPEO. So the costs would far exceed the benefits associated with that.

It is fascinating. Your experience set in running a manufacturing business that has profit and loss responsibility is exactly what?

Mr. BIVENS. None.

Mr. POMPEO. So your views of this are—come from books?

Mr. BIVENS. Looking at actual economic data.

Mr. POMPEO. And data, but you, unlike some of the other folks who are testifying today, haven't actually had responsibility for hiring people and making sure at the end of the day that those checks cleared the bank and you could grow your business and keep all your stakeholders, your shareholders, your employees, your community—keeping all of them happy. Your sum total experience there is precisely zero.

Mr. BIVENS. Manufacturing, that is correct.

Mr. POMPEO. Ms. Smith, I want to ask you your views of this notion that regulatory policy has no impact on jobs.

Ms. SMITH. It is simply not possible to spend money on investments that don't increase the productivity of the economy and expect to get a net increase in the economy, or even a net zero. It will always have a net drag on the economy if the investment that is somebody's income and somebody's spending also doesn't increase the productivity, and that is really what is happening with investments in retrofit controls, or more expensive energy.

Mr. POMPEO. Indeed, another way to look at Mr. Bivens's economic error is if I sell something for $5, it is not a zero sum gained, right?

Ms. SMITH. Yes.

Mr. POMPEO. You are happier with the $5 and I am happier with the product. We both gained from that. It is not the case that there was just an exchange, we created value through trade in that process. Mr. Bivens suggests it is a zero sum deal and we are stuck in the new school of research beliefs about economic processes.

Ms. SMITH. Correct.

Mr. POMPEO. Thank you. I yield back the balance of my time.

Mr. WHITFIELD. Thank you, Mr. Pompeo.

Mr. Griffith of Virginia is recognized for 5 minutes.

Mr. GRIFFITH. I guess my thoughts on the comments of Mr. Pompeo are that, you know, one of the problems that we have in my area where we have lost a lot of jobs is that even if we accept some of the policies of Dr. Bivens, the people who are gaining are not Americans. They are foreign countries that are gaining at our expense because we can no longer make the goods here. We are shipping coal to China and other places so they can make the products that we used to make. So even if I accept some of your principles, it seems to me that what is happening is the gainers are not people who are producing jobs in the United States, they are people in other countries. And one of the concerns I have, and when we look at this chart and you have got, you know, 3 percent—it looks like .3 percent of global mercury air emissions—and we had this chart up earlier—come from U.S. power plants, according to the EPA. One of the concerns I have is that the facilities that use a lot of electricity to provide jobs in my district and in other districts, Mr. McKinley's district, lots of places, where we are heavily dependent on coal, you raise that price and the estimate from AEP itself, which is a major supplier, although there are others in my district, is 10 to 15 percent for the consumers. When those jobs go away, there are health impacts on people in my district who no longer have jobs. When that increase in the electricity rate goes up 10 to 15 percent, there are health impacts on the folks who can't afford to heat their home at the level they want to, who isolate themselves during the wintertime because unlike—and I am going to mispronounce the name—Tsosie—Mr. Tsosie, a lot of my folks have been on electricity for quite a while, but they can't afford to pay the bill. They isolate themselves in one room and try to keep the heat to a minimum. Not to a healthy level, but to keep the pipes from freezing and to keep themselves from freezing at night. That has a negative impact on health.

And when we look at this mercury, I would submit when we ship jobs because we have made electricity so expensive in this country, we ship jobs to other countries where they will make the goods with the products that we are not—with the coal that we are not willing to use any longer, we actually increase, in my opinion, and I don't have a study to back it up but it is—common sense tells me if we are shipping that coal to be burned in places where they don't even have the reasonable regulations that we currently have where they don't have anything to clean up the mercury and it is in the Northern Hemisphere, that air is coming back to us, and a NASA study has actually shown us that it takes 10 days for the air from the central part of the Gobi Desert to reach the eastern shore of Virginia. That means that it is a significant part and part of the reason you look at this, and you are saying wait a minute, what are we doing? It looks like to me that while we may be trying to positively affect health, we are making some decisions that don't look at the world as a whole, that only look at what is happening in a particular neighborhood.

I guess I would ask, would you agree that we need to look at the whole world situation and make sure that we are not destroying American jobs, which also, by killing those jobs, has a negative health impact? Would you agree with that, Mr. MacDonald, that if we are going to make these decisions, we have to do them in a global sense and not just look at the United States?

Mr. MACDONALD. Absolutely. The term leakage, which was abundantly used during the cap and trade discussions, isn't brought up now but it is just as important.

Mr. GRIFFITH. And would you explain that to me? I wasn't here for the cap and trade discussion, but I clearly talk about cap and trade all the time.

Mr. MACDONALD. Leakage is exactly what you are suggesting if our costs go up here and force the product to be made in a less regulated jurisdiction. The emissions will be higher net globally, and the product production won't happen here, it will happen somewhere else.

Mr. GRIFFITH. All right. Regrettably, I would probably prefer and I would probably have time to get each one of you to answer that, but I am going to decline because I also don't like to miss votes on the floor. If you heard those bells going off about—I don't know how much time we have left, but about 5 minutes ago they called for votes on the floor, so I am going to yield back my time, Mr. Chairman.

Mr. WHITFIELD. Thank you very much, Mr. Griffith.

Mr. Rush, you wanted to ask a second round, so as you——

Mr. RUSH. Yes, I am going to be quite brief, Mr. Chairman. I know we have got to go for a vote.

But I want to—Reverend Hescox, there is a pretty popular spiritual song around that says in effect, "Please be patient with me. He is not finished with me yet." And I just—I am sorry that my friend from Illinois is not here, but I kind of have to apologize. You are our invited witness, and so therefore I feel some responsibility for the fact that he threw out some charges and you didn't have a chance to refute the charges or to address the charges. And there is a record, so my only—I am going to offer you an opportunity, either verbally on the record now, to address the charges or you—in writing in the future. You can do—you can choose your option, how you want to deal with that. But I just think that you should have an opportunity to respond to those, I think, pretty unfair characterizations of you and your motivations and your understanding of this issue.

Mr. HESCOX. Well, I can share it in about 1 minute or less.

First up, the reason we don't take formal actions on pro-life bills is we are members of the National Association of Evangelicals. We don't take up policy issues on everything because they are not our expertise, so we leave that with our partner, the larger agency, the National Association of Evangelicals, number one.

Number two, you know, for me, and I wish I would have brought my sign from this year's pro-life walk, it just says, you know, pro-life is anti-abortion and a whole lot more about environmental things. So we have a consistent stream of being life. I think what I mentioned to Congressman Waxman was true. There is a tremendous growing movement of Evangelicals and Roman Catholics across this country who support us, that understand that being pro-life is totally pro-life, environmental health, anti-poverty, and all those issues.

So I thank you, Mr. Rush, for your comments, but I also know that I have been a man of God and have had lots of parking lot conversations as a pastor for 20 years, so I know how it goes. Thank you.

Mr. RUSH. I yield back.

Mr. WHITFIELD. That concludes today's hearing. The record will be kept open for 10 days, and I am also going to ask that we submit into the record an analysis by David Guinnup, who is with the Air Toxics Assessment Group at EPA, in which they looked at specifically two electric utility steam-generating units and the impact that those units had on mercury emissions into a nearby lake, and its impact on fish. They concluded that based on their analysis, that the risks associated with those mercury exposures were insignificant. So I will put that in the record.

[The information follows:]

MEMORANDUM

SUBJECT: Case Study Analyses of Potential Local-scale Human Health Risks Associated with Mercury Emissions from Electric Utility Steam-generating Units

FROM: Dave Guinnup, Air Toxics Assessment Group (C539-02)

TO: Docket EPA-HQ-OAR-2009-0234

DATE: March 16, 2011

The attached document consists of two site-specific case study risk assessments that were conducted to assess the potential near-field (i.e., local) exposures and health risks associated with mercury emissions from an individual electric utility steam generating unit (EGU) facility as a result of consuming fish caught in a nearby lake. Ingestion of fish is the exposure pathway likely to pose the highest near-field health risks associated with mercury emissions from individual facilities. We selected the case study facilities based on data the Agency had collected as the result of an information collection request (ICR). In the ICR, we collected mercury emissions data from about 330 of the 1,100 units. Because the ICR data were collected for the purposes of developing maximum achievable control technology (MACT) standards, the ICR was targeted toward better performing sources, with a small set of other randomly selected sources. In selecting the case study locations, we considered proximity of the facilities to fishable lakes, magnitude of mercury emissions, and other criteria. The local-scale assessments captured mercury deposition impacts within 50 km of each of the case study facilities.

Results from the two case studies suggest that for these two facilities, risks associated with local mercury exposures may be relatively low, and there may be several reasons for this. Because elemental mercury does not readily deposit, local deposition of elemental mercury is low. Divalent and particle-bound mercury more readily deposit locally. Since not all of the mercury emitted by EGUs is in the divalent and particle bound forms, not all is expected to deposit locally. Further, the emissions from EGUs are generally released from very tall stacks and are buoyant because of the high temperatures of the releases. This can result in significant dispersion of pollutants and low local deposition, even for the divalent and particle bound mercury (i.e., much of the deposition likely occurs outside the 50 km modeling domain). As a result, we are not certain that the near-field deposition captures the majority of the risk associated with the case-study facilities. Further consideration of the design of the case-studies has also called into question our ability to draw any conclusions regarding the mercury risks posed by these facilities, and as a result, these case studies are not being used to support any aspect of rulemaking.

Specifically, there is the potential that the two case studies do not actually capture facilities with some of the highest near- field impacts (this issue is already discussed in the attached document). Another critical limitation is the fact that each case study only considered emissions and impacts from that particular facility (i.e., single-facility near-field impacts). The case studies do not cover the potential for combined deposition over specific watersheds from multiple facilities located in the same region, or the combination of mercury deposition from

U.S. EGU sources with mercury deposition from domestic non-EGU sources and non-US sources. Analysis completed in support of other elements of the Toxics Rule (specifically the national-scale mercury risk assessment completed in support of the appropriate and necessary determination USEPA, 2011), have demonstrated the importance of mercury deposition from multiple US EGUs acting in concert with each other, and with deposition from other sources within and outside the US. Specifically, air quality modeling completed for these analyses has shown that there are regions of the country (e.g., the Ohio River Valley) where US EGU-sourced mercury deposition can be substantially elevated over general national trends (see Section 2.3 of the Mercury Risk TSD, USEPA, 2011). This increased deposition occurs due to a number of factors including meteorology and topography, but it also reflects the combined impacts of multiple US EGUs. The potentially important role of multiple facility impacts on driving risk needs to be considered when interpreting the risk estimates generated for these two case studies. Although risk estimates for each facility when considered in isolation may be relatively low, the combined impact of multiple facilities on regional watersheds can be substantially greater, as shown in our national-scale analyses.

Although the attached document was not used to determine whether it is appropriate and necessary to regulate coal- and oil-fired EGUs under CAA section 112, it is being included in the docket for completeness to present all the recent analyses that were performed for EGUs.

Attachment

Technical Support Document:

Case Study Analyses of Potential Local-scale Human Health Risks Associated with Mercury Emissions from Electric Utility Steam-generating Units

DRAFT
March 16, 2011

Prepared for:
Terri Hollingsworth, Work Assignment Manager
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

Contract No. EP-D-06-115
Work Assignment No. 4-02

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TABLE OF CONTENTS

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LIST OF TABLES

[This page intentionally left blank.]

LIST OF FIGURES

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1 Introduction

This technical report documents the approach and results of two case study analyses conducted for EPA by ICF to evaluate the potential for near-field human health risks resulting from mercury emissions from electric utility steam-generating units (EGUs). Section 112(a)(8) of the Clean Air Act defines an EGU as: (1) any fossil-fuel-fired combustion unit of more than 25 megawatts electric (MWe) that serves a generator that produces electricity for sale; or (2) a unit that cogenerates steam and electricity and supplies more than one-third of its potential electric output capacity and more than 25 MWe output to any utility power distribution system for sale.

The analysis consisted of two site-specific case-study risk assessments that assessed the potential near-field (i.e., local) exposures to mercury emissions from an EGU source via ingestion of fish caught in a nearby lake. This exposure pathway is believed a *priori* to pose the highest near-field health risks associated with mercury emissions from such a facility. The facilities subject to evaluation in this analysis were selected by EPA based on (a) relatively high divalent Hg emissions from facilities with available ICR test data, (b) presence of waterbodies (preferably moderate-sized stationary lakes) and, (c) the potential for subsistence fishing activity at those lakes.

There is the potential that the two case studies, selected for this analysis, do not actually capture facilities with some of the highest near- field impacts. Another critical limitation is the fact that each case study only considered emissions and impacts from that particular facility (i.e., single-facility near-field impacts). The case studies do not cover the potential for combined deposition over specific watersheds from multiple facilities located in the same region, or the combination of mercury deposition from U.S. EGU sources with mercury deposition from domestic non-EGU sources and non-US sources. Analysis completed in support of other elements of the Toxics Rule (specifically the Technical Support Document: National-scale Mercury Risk Assessment Supporting the Appropriate and Necessary Finding for Coal- and Oil-fired Electric Generating Units – DRAFT (USEPA, 2011)) have demonstrated the importance of mercury deposition from multiple US EGUs acting in concert with each other, and with deposition from other sources within and outside the US. Specifically, air quality modeling completed for these analyses has shown that there are regions of the country (e.g., the Ohio River Valley) where US EGU-sourced mercury deposition can be substantially elevated over general national trends (see Section 2.3 of the Mercury Risk TSD, USEPA, 2011). This increased deposition occurs due to a number of factors including meteorology and topography, but it also reflects the combined impacts of multiple US EGUs. The potentially important role of multiple facility impacts on driving risk needs to be considered when interpreting the risk estimates generated for these two case studies. Although risk estimates for each facility when considered in isolation may be relatively low, the combined impact of multiple facilities on regional watersheds can be substantially greater, as shown in our national-scale analyses (USEPA, 2011).

This report presents the approach, assumptions, model inputs, and results of the assessments. Section 2 describes the conceptual approach, defines the exposure scenario evaluated, and provides an overview of the modeling approach. Section 3 provides a detailed description of the assessment methodology, including the modeling approach used to simulate the fate and transport of emitted mercury in the environment and estimate human exposure levels and the associated heath risks. Results of the assessment are presented in Section 4, along with a discussion of sources of uncertainty in the data and methods. Appendix A provides parameter values input to TRIM.FaTE for the model applications.

2 Overall Approach and Scope of the Assessment

These case studies evaluated the incremental risks from near-field human exposure to methyl mercury via consumption of fish contaminated with mercury emitted from EGUs. In other words, only EGU source-attributable exposures and the associated risks were evaluated. Exposures to mercury from any other sources, including background mercury present in the environment, were not included in the assessment. The chemical and exposure modeling approach used for these risk assessments was generally consistent with the methods EPA uses to evaluate residual risks for source categories under the Risk and Technology Review (RTR) program, with the notable exception of using AERMOD to estimate air-to-surface deposition of emitted mercury (see Section 3.1.1).

The remainder of this section provides a general overview of the conceptual approach and the exposure scenarios that were evaluated. Detailed discussions of the modeling efforts are provided in Section 3.

2.1 Conceptual Approach

Because mercury has a relatively long half-life in the atmosphere, the majority of mercury emitted to the air by EGUs and other sources contributes primarily to the regional/global burden. Some forms of mercury, however, can readily deposit to land areas and surface water bodies located near a source. Consequently, the contamination of ecosystems in the vicinity of major sources of mercury emissions is a concern. In particular, the accumulation of mercury in water bodies derived from near-field sources is a concern because inorganic mercury deposited to a water body (and the surrounding watershed) can be transformed to methyl mercury via biologically-mediated processes. Methyl mercury, which has been demonstrated to cause adverse effects in humans, readily bioaccumulates in aquatic organisms. As a consequence, elevated methyl mercury concentrations can result in game fish residing at the top of the food chain. Consumption of fish contaminated with methyl mercury is believed to be a primary route of exposure to methyl mercury for humans and can be a particular concern for individuals that consume large quantities of fish.

The objective of these case studies was to estimate the potential for near-field adverse impacts on human health via this exposure pathway (i.e., through the consumption of fish that have accumulated methyl mercury derived from local EGU emissions). This was accomplished by conducting scenario-based exposure assessments that estimated potential exposures and the resulting hazard quotients (HQs) for individuals consuming fish caught in a lake in the vicinity of an EGU source. The modeling approach for the analyses used AERMOD to model the dispersion and transport of mercury emissions in the atmosphere and subsequent deposition to land and water surfaces. These deposition rates were input into TRIM.FaTE, which was used to model the subsequent fate and transport within the environment, including transformation to methyl mercury and bioaccumulation in an aquatic food web. Exposures for individuals consuming fish were estimated based on assumptions regarding quantity and type of fish (i.e., carnivorous or omnivorous) caught locally and consumed. The resulting individual exposure estimates were used to calculate incremental HQs for exposure to methyl mercury.

Two facilities were selected by EPA for evaluation in the near-field case studies conducted by ICF:

- TVA Gallatin, near Gallatin, TN (NEI facility ID NEI8373); and

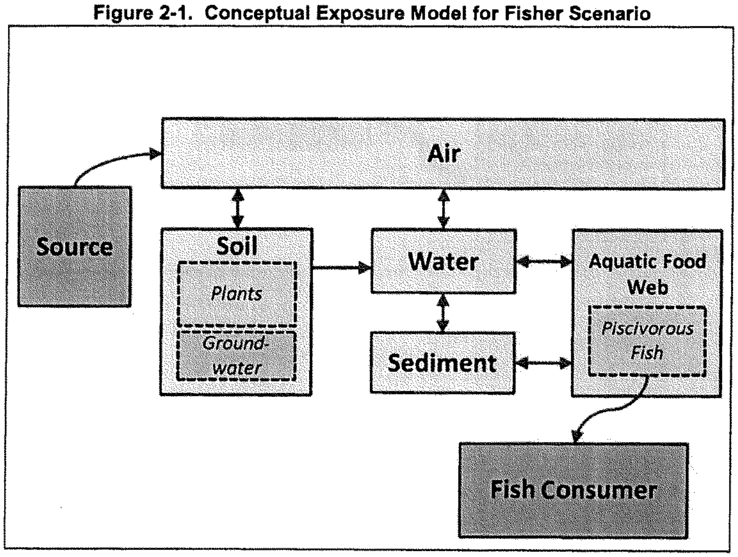
- Santee Cooper Jefferies, near Moncks Corner, SC (NEI38327).

Both of these facilities have water bodies located nearby that are of sufficient size to support populations of upper-trophic-level fish.

2.2 Exposure Scenarios

In a scenario-based exposure assessment, one or more plausible scenarios are evaluated for the exposure situation of interest. The assessment usually focuses on those scenarios that are assumed *a priori* to lead to the highest individual exposure and risks. Risk metrics, such as incremental lifetime cancer risk and chronic non-cancer hazard quotient, are then calculated for potentially exposed individuals for each scenario. As appropriate, information regarding the likelihood of a specific exposure scenario actually occurring can be used to develop estimates of uncertainty for each scenario and the variations thereof. For the mercury case studies described in this report, exposure estimates and risks were calculated for scenarios involving individuals who regularly consume fish caught in freshwater lakes in the vicinity of the source of interest. Figure 2-1 presents the conceptual exposure model for this scenario. The exposed individual consumes fish from a water body impacted by a near-field source of mercury emissions (i.e., one of the two EGUs evaluated). This scenario is expected to cover the highest possible individual exposures and human health risks associated with mercury emissions from an EGU.

Figure 2-1. Conceptual Exposure Model for Fisher Scenario



Variations of this basic fish consumption scenario were evaluated using different assumptions about the water body from which fish were caught, the age of the individual exposed, and the fish ingestion rate. Exposures were calculated for five age groups for a fish consumer in the

U.S. ingestion scenario (identified as a "recreational angler"), with fish consumption rates representing members of the U.S. population who consume some fish. Additionally, exposures were calculated for five populations of adults who are culturally or economically disposed to higher rates of fish consumption, including African American, female, and individuals of Hispanic, Laotian, and Vietnamese descent. HQs were then calculated for each of the populations evaluated.

3 Methodology

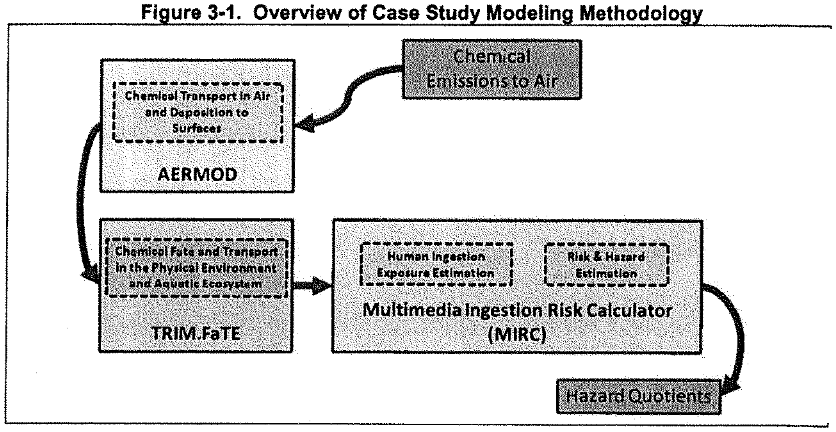
Figure 3-1 provides an overview of the three-step methodology used to assess multipathway risks from EGU emissions of mercury.

1. Modeling of transport in air of emitted elemental and divalent mercury and subsequent dry and wet deposition to soil and water using AERMOD;

2. Modeling of mercury fate and transport in the physical environment and biological ecosystem subsequent to deposition, including chemical transformations (e.g., methylation) and uptake and cycling in the aquatic food web using TRIM.FaTE; and

3. Estimating the resulting source-attributable ingestion exposures for individuals consuming fish from a local lake and calculating the associated HQs using MIRC.

Figure 3-1. Overview of Case Study Modeling Methodology



This specific combination of models was used per EPA recommendation to estimate exposures and HQs for the scenarios included in the EGU case studies. The overall modeling approach is based on the risk assessment methodology applied to evaluate multipathway exposures for EPA's residual risk assessments of emissions of air toxics, but with the use of AERMOD (rather than TRIM.FaTE) to estimate air-to-surface deposition. A brief description of each of these three models is presented in this introductory section. The configuration and application of these models for the EGU case studies are then described in the remainder of Section 3.

AERMOD

The deposition fluxes from air to surfaces were estimated by EPA using the AMS/EPA Regulatory Model, or AERMOD (Version 09292) (U.S. EPA 2010a), for a selected modeling zone around each facility. In 2005, AERMOD became the preferred model for near-field (less than 50 km) dispersion. Because these case studies were designed to evaluate near-field impacts associated with facility emissions of mercury, AERMOD was the appropriate model for these studies.

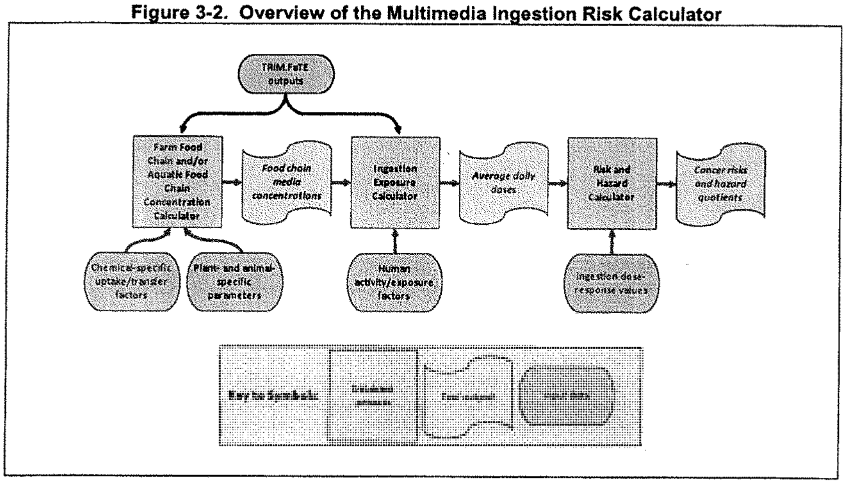
TRIM.FaTE

ICF then used the AERMOD outputs to develop chemical source terms for input into the Fate, Transport, and Ecological Exposure module of the TRIM modeling system (TRIM.FaTE, Version 3.6.2). TRIM.FaTE is a spatially explicit, compartmental mass balance model that describes the movement and transformation of pollutants over time, through a user-defined, bounded system that includes both biotic and abiotic compartments. Outputs include pollutant concentrations in multiple environmental media and biota, which provide exposure estimates for ecological receptors (i.e., plants and animals). Significant features of TRIM.FaTE include: (1) a fully coupled multimedia model; (2) user flexibility in defining scenarios in terms of the links among compartments and number and types of compartments, as appropriate, for the application spatial and temporal scale; (3) a transparent, user-accessible algorithm and input library that allows the user to review and modify how environmental transfer and transformation processes are modeled; (4) a full accounting of emitted pollutant mass as it moves among environmental compartments during a simulation; (5) an embedded procedure to characterize uncertainty and variability; and (6) the capability to provide exposure estimates for ecological receptors. Additional information about TRIM.FaTE, including support documentation, software, and the TRIM.FaTE public reference library, is available on EPA's Technology Transfer Network (TTN) (U.S. EPA 2010b). The fate and transport modeling conducted for the EGU case studies is discussed in Section 3.2.

MIRC

The Multimedia Ingestion Risk Calculator (MIRC), a Microsoft Access-based computer framework developed by ICF primarily for use in EPA's residual risk assessments, was used to complete the calculations required for estimating mercury concentrations in aquatic media, average daily ingestion doses, and chronic non-cancer HQs. The algorithms included in MIRC are based largely on the exposure equations presented by EPA in the Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (HHRAP; EPA 2005) (U.S. EPA 2005a). The implementation of these algorithms in MIRC is described in detail in Appendix C (Attachment C-2) to EPA's report to SAB on the risk assessment methods used in the RTR program (U.S. EPA 2009). These algorithms, and the required exposure factors and other parameter values, were compiled into a database. An overview of the computational processes this tool carries out and the types of input data it requires is presented in Figure 3-2. This figure demonstrates the general relationships between the relevant TRIM.FaTE outputs (i.e., chemical concentrations in environmental media and fish) and the ingestion exposure and risk calculations carried out using MIRC. A description of the exposure and risk calculations for this screening scenario is presented in Section 3.3.

Figure 3-2. Overview of the Multimedia Ingestion Risk Calculator



3.1 Air Modeling (AERMOD)

The AERMOD steady-state plume model was used to model deposition for this analysis. This section describes the AERMOD modeling conducted and the method used to incorporate AERMOD results into site applications of TRIM.FaTE.

3.1.1 *AERMOD Deposition Modeling*

For each of the two facilities selected for the case study analyses, EPA used AERMOD to estimate deposition fluxes for input to TRIM.FaTE. EPA relied on guidance included in the Guideline on Air Quality Models, also published as Appendix W of 40 CFR Part 51, to determine model set-up and application (40 U.S. Code of Federal Regulations [CFR] Part 51. Appendix W, Guideline on Air Quality Models. [Current through 2/11/2011]). Appendix W is the primary source of information on the regulatory application of air quality models for State Implementation Plan (SIP) revisions for existing sources and to new source reviews (NSR), including prevention of significant deterioration (PSD).

EPA conducted the AERMOD deposition modeling with input from ICF. Although the case studies' modeling are not regulatory applications of AERMOD, much of the guidance in the Guideline are still applicable and were applied to this modeling, including: (1) use of five years of representative meteorological data (years 2005 through 2009), (2) inclusion of terrain elevations for sources and receptors, (3) use of urban dispersion where appropriate, and (4) inclusion of building downwash where applicable. AERMOD emissions inputs were hourly emissions based on information collection request (ICR) emissions data provided for each boiler for elemental mercury, divalent particulate mercury (Santee Cooper Jefferies only), and gaseous divalent mercury.

Deposition fluxes were calculated for a grid of receptors around the facilities that encompassed nearby water bodies of interest. Nested square grids with resolutions of 250 m and 1000 m between points were used. The 250 m resolution grid encompassed the water bodies parameterized for TRIM.FaTE modeling (and small buffer areas surrounding them) and for all areas within 5 km of the TRIM.FaTE source parcel surrounding the EGU facilities. This ensured that even the smallest surface parcels of approximately 500 m by 500 m had at least two receptors. The 1000 m resolution was used for all other areas within the TRIM.FaTE modeling extent. The receptor grids for the TVA Gallatin and the Santee Cooper Jefferies facilities are shown in Figures 3-3 and 3-4, respectively.

There were two exceptions to this receptor grid setup. First, at the time that the AERMOD receptor grid was designed, Lake Marion had not been selected to be included in the TRIM.FaTE model scenario, and therefore the grid spacing over Lake Marion was 1000 m rather than the 250 m used for other water bodies. Lake Marion contained dozens of receptors, however, and this resolution was deemed acceptable for the modeling application. Second, because the receptor setup was designed before the TRIM.FaTE modeling extent was finalized, some areas near the outside border did not have receptors. However, the outer-extent TRIM.FaTE surface parcels still contained dozens to hundreds of receptor grid points. This second exception was also considered acceptable because the deposition fluxes were small at these distances from the facility (compared to areas nearby the facility) and because it was expected to lead to very small (and likely health conservative) impacts on multipathway modeling results.

Figure 3-3. AERMOD Receptor Grid and TRIM.FaTE Air and Surface Parcels for TVA Gallatin

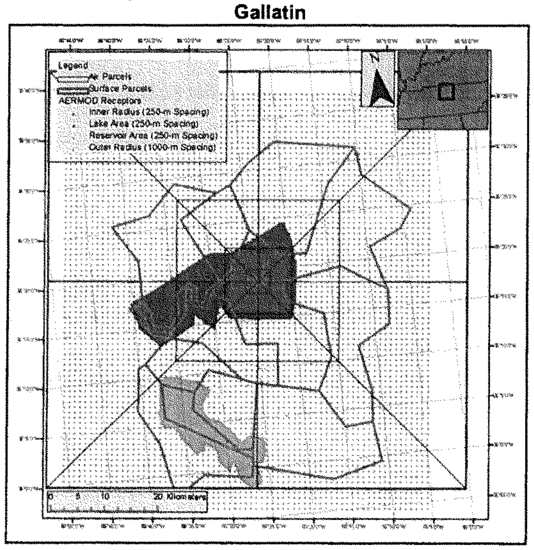
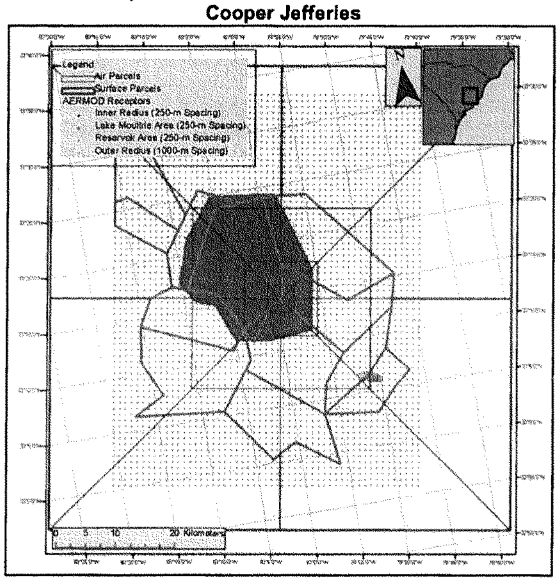


Figure 3-4. AERMOD Receptor Grid and TRIM.FaTE Air and Surface Parcels for Santee Cooper Jefferies



3.1.2 *Incorporating AERMOD Results into TRIM.FaTE*

Using the receptor grid described in Section 3.1.1, AERMOD produced hundreds of deposition estimates for each TRIM.FaTE surface compartment. To aggregate these outputs for input to TRIM.FaTE, an average deposition flux for each TRIM.FaTE surface parcel was computed from the point estimates within each parcel (where each receptor represented an area dictated by its receptor grid spacing). Area-weighted averages were used to ensure that varying receptor densities between and within parcels were properly accounted for. For a surface parcel that had an area without receptors, the parcel's area-weighted deposition flux was calculated by ignoring the area without receptors; this is expected to result in a small overestimation of parcel deposition flux, compared to if receptors had covered the whole parcel.

AERMOD deposition fluxes were calculated on an hourly basis by the model. These outputs were averaged across the entire five-year simulation period to produce a long-term overall average deposition for each modeled grid point.

In order to insert AERMOD average deposition values in place of TRIM.FaTE-modeled deposition fluxes, several modifications to the model scenarios and libraries were required. A pseudo-source was created to represent the AERMOD-derived deposition rate for each parcel, with an emission rate equal to the product of the parcel surface area and the spatially averaged deposition flux. Because the deposition fluxes are mass per unit area per unit time, the pseudo-source emission rates were set equal to the total chemical mass deposited onto the surface of each parcel each time period. Separate pseudo-sources were created for each deposition type: wet and dry, vapor phase and particulate. In this way, the TRIM.FaTE processes of air transport and deposition were replaced by "emissions" directly into surface soil, plant, and surface water compartments.

Pseudo-sources were assigned to placeholder volume elements and linked to transfer mass to the appropriate surface compartments. For water parcels, the entire mass is transferred to the surface water compartment. For land parcels, algorithms apportioning mass between surface soil and leaves were derived from the existing FaTE algorithms for air-soil and air-plant transfers. The placeholder volume elements were designed to prevent transfer to any compartment other than those prescribed, and each contained only one pseudo-source.

Once the pseudo-source set-up was designed and tested, the process of making necessary revisions to the FaTE scenarios and libraries was automated to reduce the likelihood of error. With four pseudo-sources (representing dry/wet and vapor/particle deposition) for each parcel, along with the corresponding placeholder compartments, links, and algorithms, each scenario required input files several thousand lines long. Automation allowed the following process to be consistently applied across multiple scenarios:

1. Create a volume elements file by evaluating the scenario layout and defining the coordinates of four placeholder volume elements for each surface parcel, with one each for dry particle, dry vapor, wet particle, and wet vapor deposition.

2. Create a library import file with supplemental compartment types, property types, and algorithms used in linking placeholder volume elements to targeted surface compartments. This file also includes the definitions and locations of pseudo-sources with emission rate formulas accounting for parcel surface area.

3. Create a properties import file defining the actual links that connect the placeholder compartments to their surface targets. This includes determining which water, soil, and/or plant compartments are present on the surface of each parcel.

To complete the process, deposition rates (averaged as described above) were specified for each pseudo-source. At each time step of the TRIM.FaTE simulation, this system multiplies deposition by area and transfers the resulting mass to the appropriate surface compartments. In this assessment, constant, long-term average deposition rates were used. The mass transfer rates for output from pseudo-sources were time-varying because they rely on factors such as daylight and leaf coverage.

3.2 Fate and Transport Modeling (TRIM.FaTE)

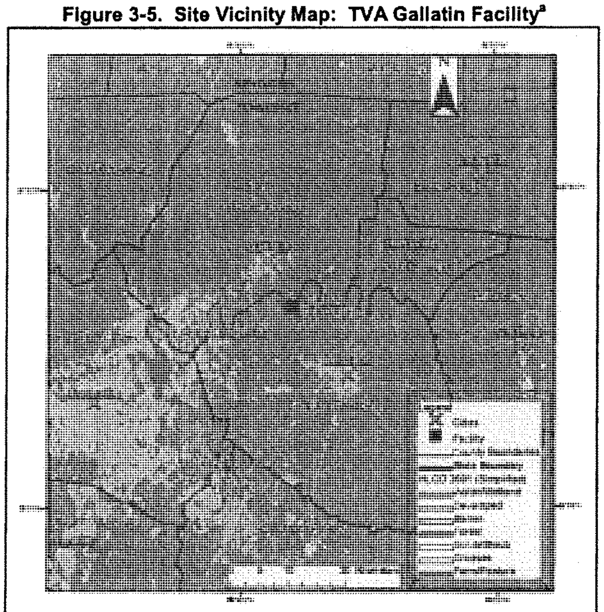
This section describes the TRIM.FaTE modeling conducted for this assessment. Most of the material presented here describes the assumptions and data sources used to set TRIM.FaTE inputs and settings related to meteorological inputs used by the model, the spatial aspects of the modeled regions for each site, characteristics of abiotic environmental compartments and plants included in the analyses, and the aquatic ecosystems setup in each water body of interest. All of the user-supplied parameter values input to TRIM.FaTE for these model applications are documented in Appendix A to this report.

3.2.1 *Facility and Site Descriptions*

The TVA facility near Gallatin, TN (hereafter referred to as the TVA Gallatin facility) is located on the border of Wilson and Sumner Counties (est. 2009 populations 112,377 and 158,759, respectively [U.S. Census Bureau 2010]), about 9 km southeast of Gallatin and about 38 km northeast of Nashville-Davidson (est. 2009 populations 30,504 and 605,473, respectively [U.S. Census Bureau 2010]). As illustrated in Figure 3-5, two large water bodies are located near the facility, including Old Hickory Lake (which meanders east to west past the facility, from 42 km east of the facility to 22 km west of the facility) and J. Percy Priest Reservoir (which is about 28 km southwest of the facility).

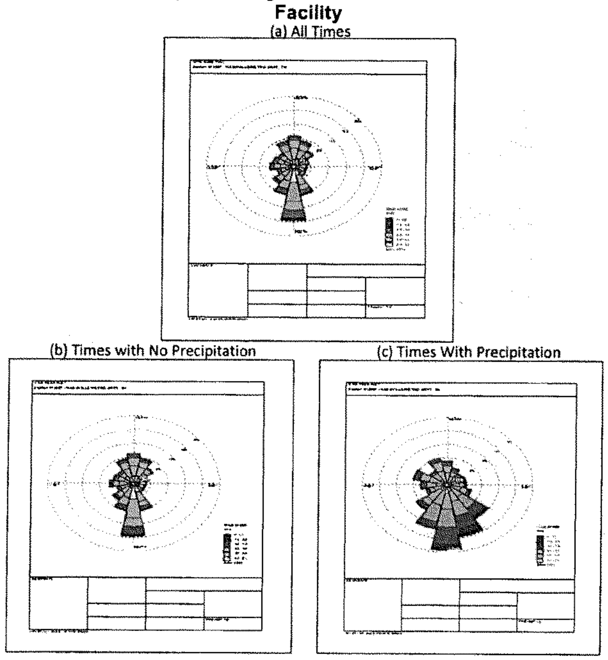
The Gallatin area is not arid, and the terrain nearby the facility ranges from about 140 m to 350 m above sea level. Based on the representative meteorological data used in the TRIM.FaTE modeling, the portion of Old Hickory Lake adjacent to the facility is downwind from the facility close to 50 percent of the modeled hours, while the J. Percy Priest Reservoir is downwind from the facility about 27 percent of the modeled hours (see Figure 3-6a). The parts of Old Hickory Lake further west and east of the facility are downwind from the facility about 14 and 20 percent of the time, respectively.

Figure 3-5. Site Vicinity Map: TVA Gallatin Facility[a]



[a] Shading indicates land use type in 2001 (with simplified categories); data from USGS 2001.

Figure 3-6. Wind Roses Representing Wind Flow Conditions Near the TVA Gallatin Facility

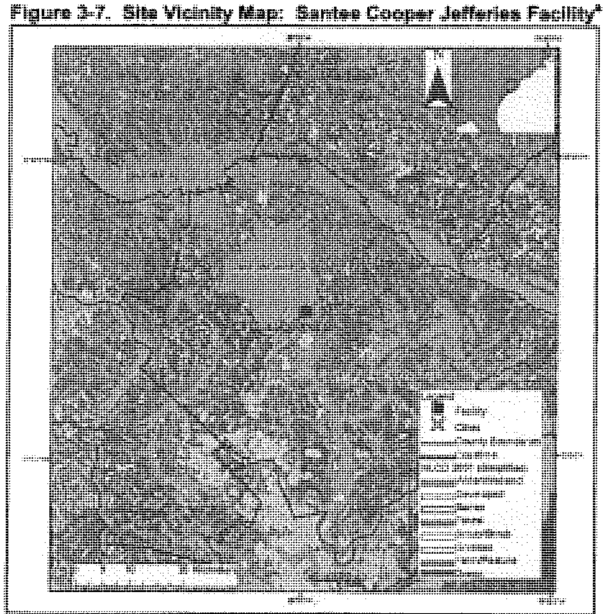


Wind roses reflect surface hourly meteorological data used for AERMOD modeling from the Nashville International Airport (WBAN ID 13897) for years 2005-2008.

The area map for the Santee Cooper Jefferies facility near Moncks Corner, SC, is presented in Figure 3-7. The facility is located in Berkeley County (est. 2009 population 173,498 [U.S. Census Bureau 2010]) approximately 5 km north of the town of Moncks Corner (est. 2009 population 7,266 [U.S. Census Bureau 2010]). Two large water bodies are located near the facility. Lake Moultrie is directly adjacent to the facility to the west and extends to 17 km west and north of the facility. Lake Marion is further to the northwest of Lake Moultrie and extends out to approximately 75 km northwest of the facility. The Upper and Lower Reservoirs are also nearby the facility (about 20 km southwest of the facility). Figure 3-7 shows these water bodies.

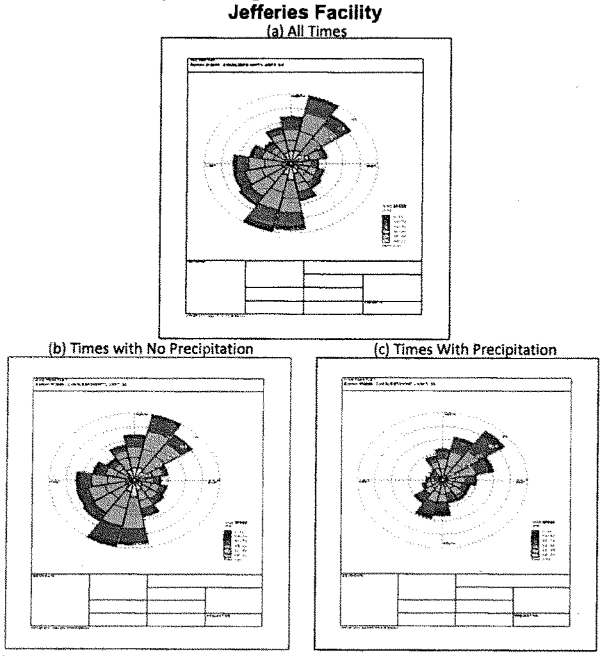
The Moncks Corner area is not arid. The terrain near the facility ranges from 0 m to 50 m above sea level. Lake Moultrie was downwind from the facility about 35 percent of modeled hours, while Lake Marion and the Upper and Lower Reservoirs were each downwind from the facility about 9 percent of the time (see Figure 3-8a).

Figure 3-7. Site Vicinity Map: Santee Cooper Jefferies Facility[a]



[a] Shading indicates land use type in 2001 (with simplified categories); data from USGS 2001.

Figure 3-8. Wind Roses Representing Wind Flow Conditions Near the Santee Cooper Jefferies Facility



[a] From the surface hourly meteorological data from the Charleston International Airport (WBAN ID 13880) for years 2005-2008.

Facility emissions for the two facilities included in the case studies are presented in Table 3-1. These emissions were not used as inputs to TRIM.FaTE (emissions to air and subsequent deposition were modeled using AERMOD) but are presented here for informational purposes.

Table 3-1. Mercury Emissions for Modeled EGUs

Facility	Stack ID	Emissions of Divalent Mercury (tons/yr)	Emissions of Elemental Mercury (tons/yr)
TVA Gallatin	STK1	3.45E-02	5.38E-02
	STK2	1.38E-02	3.88E-02
Santee Cooper Jefferies[a]	STK1	1.42E-02	4.93E-03
	STK2	1.43E-02	4.93E-03

[a] Particulate and vapor-phase divalent mercury emissions were modeled separately for this facility by EPA in the AERMOD portion of modeling. The divalent mercury emissions included in this table represent total emissions of divalent mercury (particulate+vapor).

Emission screening thresholds have been developed for divalent mercury for use in conducting multipathway residual risk assessments for EPA; these thresholds were compared to facility emissions to provide a point of comparison. Total reported emissions of divalent mercury used in AERMOD modeling for this facility exceed EPA's current RTR divalent mercury screening level by a modest margin, as illustrated in Table 3-2.

Table 3-2. Divalent Mercury Emissions Compared with RTR PB-HAP Screening Thresholds

Facility	Total Divalent Mercury Emissions from EGU (tons/yr)	RTR Screening Level (tons/yr)	Screening Results
TVA Gallatin	4.83E-02	1.946E-03	Exceeds threshold by ~25x
Santee Cooper Jefferies	2.85E-02	1.946E-03	Exceeds threshold by ~15x

3.2.2 *Chemical Properties*

Chemical/physical properties required by TRIM.FaTE, such as Henry's law constant and molecular weight, were obtained from peer-reviewed and standard reference sources. Numerous other chemical-specific properties that are related to a particular abiotic or biotic compartment type are discussed in later sections.

3.2.3 *Meteorological Data*

TRIM.FaTE uses several meteorological parameters to determine chemical transfers among the air compartments in a modeling scenario via advective transport (i.e., wind-driven physical movement through the atmosphere) and from air to underlying soil or water surfaces via deposition transfers. In a typical TRIM.FaTE application, these processes determine the long-term spatial patterns of chemical distribution in air within the modeling analysis, and modeled concentrations are highly sensitive to the meteorological inputs used in TRIM.FaTE. For the current analyses, however, AERMOD was used to model air transport and subsequent deposition to soil and water surfaces. As a result, the algorithms that determine transport and fate in air (which were kept on in the current applications) only affected mercury re-emitted to air from soil, water, and plant surfaces.

An initial step in developing the TRIM.FaTE applications for these case studies was the collection of meteorological data for the modeled regions. The long-term trends in these data were used to inform the development of the modeling layouts that were the bases of these modeling analyses. To maintain consistency with the development of the TRIM.FaTE application, we present in this section the specifications of the meteorological data and a summary of the long-term temporal trends.

The meteorological inputs that TRIM.FaTE requires include wind speed, wind direction, precipitation, ambient air temperature, and mixing height. EPA modeled mercury deposition near these two sites using AERMOD with 2005-2009 meteorology data. Because the AERMOD deposition amounts were incorporated into this multipathway analysis (see Section 3.1), this multipathway analysis also used the same meteorology data as the AERMOD modeling. There was one exception to this – the AERMOD analyses used five years of meteorological data, but because the data must be repeated to create a 50-year record for modeling, and because leap years occur every four years, the meteorological data were reduced to four years (2005-2008) to make it simpler to repeat. The meteorological data for the TVA Gallatin facility were the 2005-2008 hourly surface data and twice-daily upper-air data from the Nashville International Airport (WBAN ID 13897; 34 km southwest of the facility) (NOAA 2009a, 2009b). The meteorological data for the Santee Cooper Jefferies facility were the 2005-2008 hourly surface data and twice-daily upper-air data from the Charleston International Airport (WBAN ID 13880; 38 km south of the facility) (NOAA 2009a, 2009b).

These meteorological data deviated from the 1971-2000 historical 30-year normal values (Table 3-3) in ways that are similar to or smaller than those of the Ravena Portland Cement analysis for the 2009 EPA Science Advisory Board (SAB) review (U.S. EPA 2009). In the natural environment, rainfall amounts that are smaller than climatologically typical quantities in the TVA Gallatin and Santee Cooper Jefferies areas can have the effect of decreasing modeled wet deposition. Decreased rainfall may also increase chemical concentrations in water bodies by decreasing their volumes and flush rates, although the water bodies would also collect decreased amounts of chemicals from their tributaries. The relatively small deviations from normal (warmer and slightly drier for Nashville, drier and slightly warmer for Charleston) intrinsic in the data used for modeling were assumed to be acceptable for this assessment.

Table 3-3. Average Meteorological Conditions Near TVA Gallatin and Santee Cooper Jefferies

	TVA Gallatin Nashville International Airport (WBAN 13897)				**Santee Cooper Jefferies Charleston International Airport (WBAN ID 13880)**			
	Daily Max. Temp. (°C)	**Daily Min. Temp. (°C)**	**Daily Mean Temp. (°C)[a]**	**Total Precip. (mm)**	**Daily Max. Temp. (°C)**	**Daily Min. Temp. (°C)**	**Daily Mean Temp. (°C)[a]**	**Total Precip. (mm)**
Annual 1971-2000 Climate Normal Averages[b]	20.6	9.3	14.9	1222	24.4	12.6	18.5	1,309
Annual Averages from Data Used in This Analysis	21.5	10.6	16.1	1058	24.5	13.7	19.1	871
Deviation from Normal Averages	**+0.9** (+4.4%)	**+1.3** (+14.0%)	**+1.2** (+8.1%)	**-164** (-13.4%)	**+0.1** (+0.4%)	**+1.1** (+8.7%)	**+0.6** (+3.2%)	**-438** (-33.5%)

[a] The daily mean temperature is calculated as the average of the daily maximum and minimum temperatures.
[b] 1971-2000 Climate Normals (NOAA 2005).

Calm winds occurred for about 15 percent of the modeled hours for the TVA Gallatin facility and about 13 percent of the modeled hours for the Santee Cooper Jefferies facility. In TRIM.FaTE modeling, calm winds cause chemical mass to build up in the source compartment and stagnate over the rest of the modeling region until the next positive wind speed. As such, all calm wind values were set to 0.75 m s^{-1} for modeling.

As shown in Figures 3-6b and 3-6c for the TVA Gallatin facility, wind speeds during modeled precipitation events tended to be larger than during times without precipitation. The frequency distribution of wind directions was similar between times with precipitation and times without precipitation. Southerly winds dominated during modeled times without and with precipitation (37 and 46 percent of the time, respectively), so areas north of the facility should experience the greatest dry and wet deposition. Irrespective of precipitation status, easterly winds occurred least frequently (14 percent of the time overall), so areas west of the facility should experience the least total deposition.

As shown in Figures 3-8b and 3-8c for the Santee Cooper Jefferies facility, wind speeds during modeled precipitation events tended to be larger than during times without precipitation. The frequency distribution of wind directions was somewhat different depending on modeled precipitation status. During times with no precipitation, winds from the north and northeast and from the south and west occurred with about the same frequency (between 13 and 18 percent of the time), so areas northwest and southeast of the facility should experience the least dry deposition. During modeled precipitation events, northeasterly winds occurred most frequently and northwesterly winds occur least frequently (23 and 6 percent of the time, respectively), so areas southwest of the facility should experience the greatest wet deposition and areas southeast of the facility should experience the least wet deposition.

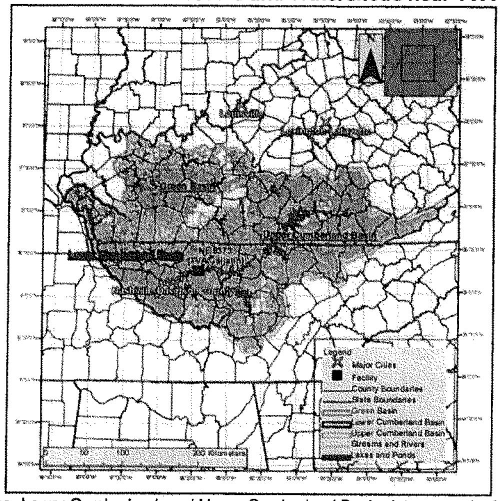
3.2.4 *Extent and Dimensions of Modeled Environment*

This section describes the environment for which media concentrations were estimated using TRIM.FaTE and the geographic characteristics of the modeled environment (e.g., layout of the modeled domain and geometry of the constituents included). The design of the modeling layout was developed based primarily on the physical and geographic characteristics of the watersheds in the area and the land use data for the region. This section provides a brief overview of the features present in the vicinity of the modeled facilities.

As illustrated in Figure 3-9, the TVA Gallatin facility is located within the Lower Cumberland Basin (HUC-051302), although the TRIM.FaTE modeling analysis for this facility also extends into the Upper Cumberland Basin (HUC-051301) and the Green Basin (HUC-051100). Rivers and streams in these basins drain northwestward or westward into the Ohio and Mississippi Rivers. Large and small lakes and reservoirs are located throughout these basins, including Old Hickory Lake (79.4 km^2 surface area; meanders east-to-west past the facility, from 42 km east of the facility to 22 km west of the facility) and the J. Percy Priest Reservoir (57.6 km^2 surface area; about 28 km southwest of the facility).

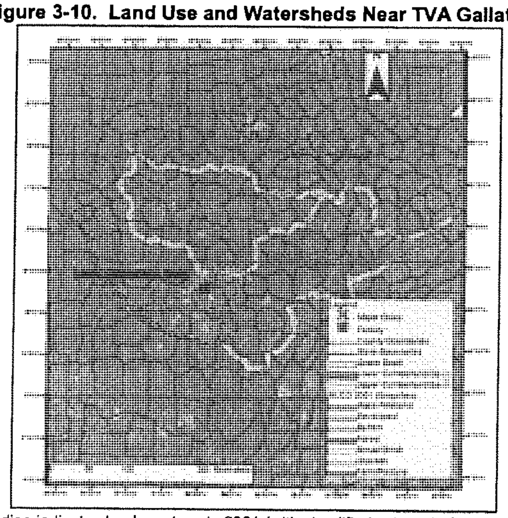
Based on the 2001 National Land Cover Database (NLCD) (USGS 2001) from the US Geological Survey (USGS), land use in the immediate vicinity of the TVA Gallatin facility is classified as a mix of forest (mostly deciduous), land in agricultural use (for pasture and cropland), and commercial and residential uses, with small amounts of water (see Figures 3-5 and 3-10). Land use becomes more urban proceeding southwest from the facility towards the Nashville-Davidson County metropolitan area. Nashville-Davidson County is the only major metropolitan area in the basins, but otherwise the land use patterns in the basins are similar to the area immediately around the facility, with more forestland towards the western Lower Cumberland Basin, eastern Upper Cumberland Basin, and northern Green Basin.

Figure 3-9. Surface Water Bodies and Watersheds near TVA Gallatin[a]



[a] Green, Lower Cumberland, and Upper Cumberland Basin data were obtained from the US Geological Survey (USGS) National Hydrography Dataset (NHD) (USGS 2011). These data are based on the content of USGS 1:100,000-scale data.

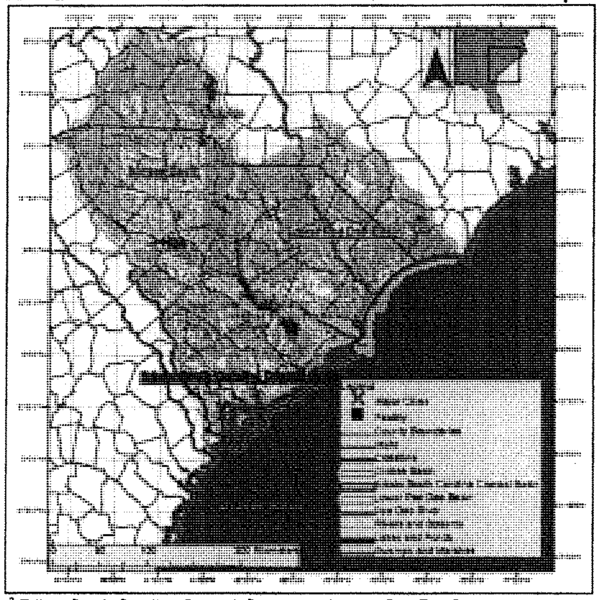
Figure 3-10. Land Use and Watersheds Near TVA Gallatin[a]



[a] Shading indicates land use type in 2001 (with simplified categories); data from USGS 2001.

As illustrated in Figure 3-11, the Santee Cooper Jefferies facility is located within the Edisto-South Carolina Coastal Basin (HUC-030502), though the TRIM.FaTE modeling analysis for this facility also extends into the Lower Pee Dee (HUC-030402) and Santee (HUC-030501) Basins. Rivers and streams within the Santee Basin drain into Lake Marion (and eventually into the Atlantic Ocean), while rivers and streams within the Edisto-South Carolina Coastal and Lower Pee Dee Basins drain into the Atlantic Ocean. Relatively small lakes and reservoirs are located throughout the basins, including the Upper and Lower Reservoirs nearby the facility (0.801 km^2, 20 km southwest of the facility) as well as Lake Moultrie (229.5 km^2, extends to 17 km west and north of the facility) and Lake Marion (356.1 km^2, extends 23 to 75 km northwest of the facility). Lake Marion is the largest water body among these basins.

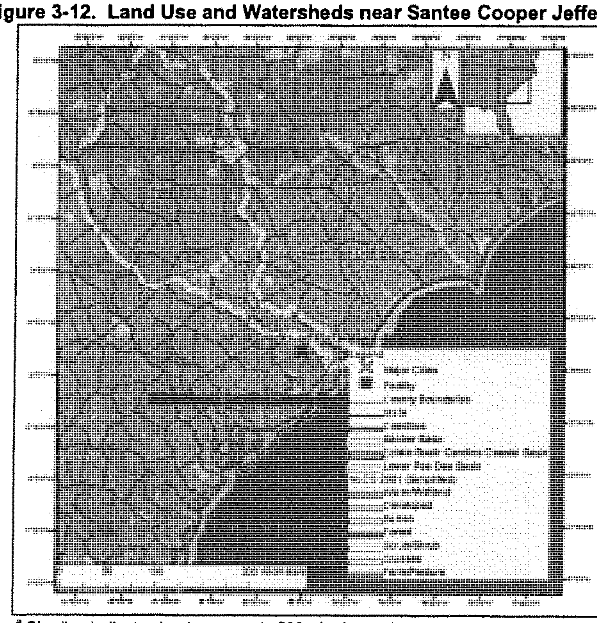
Figure 3-11. Surface Water Bodies and Watersheds near Santee Cooper Jefferies[a]



[a] Edisto-South Carolina Coastal, Santee, and Lower Pee Dee Basin data were obtained from the US Geological Survey (USGS) National Hydrography Dataset (NHD) (USGS 2011). These data are based on the content of USGS 1:100,000-scale data. The Pee Dee River is highlighted in the figure using a water bodies file provided by Environmental Systems Research Institute, Inc. (ESRI 2011) and based on the US National Atlas Water Feature Areas (U.S. National Atlas 2011).

Based on the 2001 National Land Cover Database (NLCD) from the US Geological Survey (USGS) (USGS 2001), land use in the immediate vicinity of the Santee Cooper Jefferies facility is classified as a mix of forest (mostly coniferous), land in agricultural use (for pasture and cropland), water (including wetlands), and commercial and residential uses, and small amounts of shrub/scrub (see Figures 3-7 and 3-12). Land use becomes more urban proceeding southward from the facility towards Charleston. The Charleston metropolitan area is the lies about 55 km south of the facility within the Edisto-South Carolina Coastal Basin, but otherwise the Edisto-South Carolina Coastal Basin's land use patterns are similar to the area immediately around the facility, with fewer wetlands to the west.

Figure 3-12. Land Use and Watersheds near Santee Cooper Jefferies[a]



[a] Shading indicates land use type in 2001 (with simplified categories); data from USGS 2001.

3.2.5 *TRIM.FaTE Parcel Design*

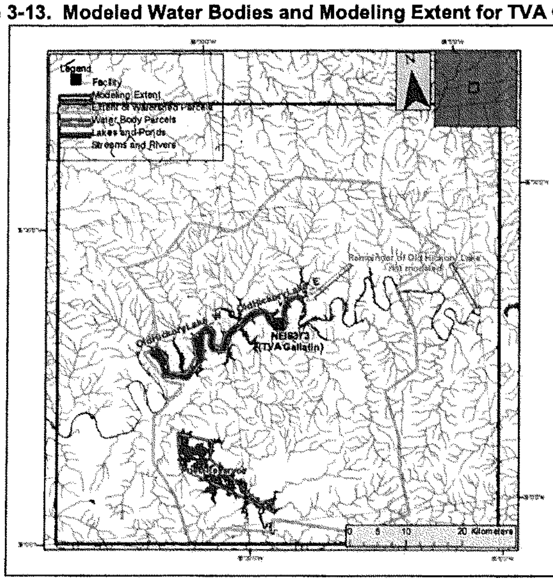
The TRIM.FaTE surface parcel layout is the two-dimensional configuration of soil and water regions included in the modeled domain. The air parcel layout is then superimposed over the surface layout. These layouts provide the spatial references for three-dimensional compartments that contain the modeled chemical mass.

3.2.5.1 Modeling Spatial Extent and Modeled Water Bodies

The spatial extent of previous TRIM.FaTE modeling analyses, such as those conducted for evaluative purposes and initial modeling runs performed in support of RTR risk assessments, has typically covered at least a 15-km radius around the facility and has extended out as far as 35 km This proximity is derived from an internal study using the ISCST3 model (*Summary of ISC Analysis at the NY TRIM Site*, prepared by ICF International, Draft, May 6, 2002). The results of this study suggest that increasing the modeling domain beyond a 15-km radius of the facility generally does not capture enough additional chemical deposition to counterbalance the added computational resources needed to model the larger analysis. However, increasing the proximity somewhat (e.g., to 25 or 35 km) in at least one direction may be desired in order to model a certain water body and its watershed or to accommodate location-specific wind patterns.

The modeling extent has typically been square or rectangular in shape and is constructed to encompass water bodies of interest for the assessment. For the TVA Gallatin facility, Old Hickory Lake and J. Percy Priest Reservoir were included in the modeled area for the purposes of modeling fish concentrations for the risk assessment. Figure 3-13 shows these lakes and the surface parcels created to represent them. Both lakes are large enough to support large populations of fish. J. Percy Priest Reservoir and the part of Old Hickory Lake nearby the TVA Gallatin facility were downwind from the facility about 27 and 50 percent of modeled hours, respectively. The parts of Old Hickory Lake further west and east of the facility were downwind from the facility about 14 and 20 percent of modeled hours, respectively (see Figure 3-6 for the wind roses). Figure 3-13 also shows the extent of the surface parcels that were based on watershed data (the surface parcels themselves are not shown here; see Section 3.2.5.3 for more detail). Because the air parcel layout is square and has a predetermined extent irrespective of the site (see Section 3.2.5.5 for more detail), it extended beyond the extent of the watershed surface parcels. "Outer" surface parcels were added beyond the extent of the watershed surface parcels (out to the extent of the air parcels) so that every air parcel had a surface parcel(s) underneath it. As such, Figure 3-13 also shows the resulting full modeling extent. Any watersheds or water bodies in these outer surface parcels were not specifically modeled (i.e., outer surface parcels were not drawn specific to the watersheds or water bodies).

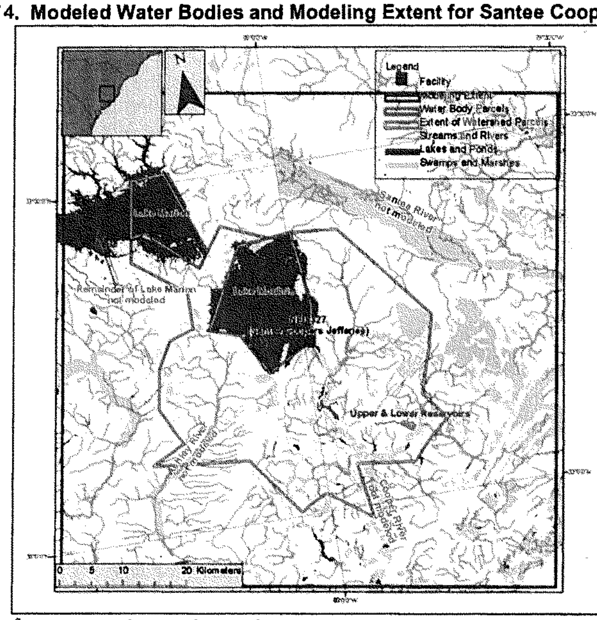
Figure 3-13. Modeled Water Bodies and Modeling Extent for TVA Gallatin[a]



[a] Green, Lower Cumberland, and Upper Cumberland Basin data were obtained from the US Geological Survey (USGS) National Hydrography Dataset (NHD) (USGS 2011).

For the Santee Cooper Jefferies facility, three water bodies were included in the modeled area: Lake Moultrie and Lake Marion to the northwest, and Upper and Lower Reservoirs to the southeast. Figure 3-14 shows these lakes and the surface parcels created to represent them. These water bodies are large enough to support a fish population of reasonable size for sustenance fishing. They were not often downwind from the facility during modeled hours, but Lake Moultrie is directly adjacent to the source (see Figure 3-8 for the wind roses). Figure 3-14 also shows the extent of the surface parcels that were based on watershed data (the surface parcels themselves are not shown here; see Section 3.2.5.3 for more detail). Since the air parcel layout is square and has a predetermined extent irrespective of the site (see Section 3.2.5.5 for more detail), it extended beyond the extent of the watershed surface parcels. "Outer" surface parcels were added beyond the extent of the watershed surface parcels, out to the extent of the air parcels, so that every air parcel had surface parcel(s) underneath it. As such, Figure 3-14 also shows the resulting full modeling extent. Any watersheds or water bodies in these outer surface parcels were not specifically modeled (i.e., outer surface parcels were not drawn specific to the watersheds or water bodies).

Figure 3-14. Modeled Water Bodies and Modeling Extent for Santee Cooper Jefferies[a]



[a] Edisto-South Carolina Coastal, Santee, and Lower Pee Dee Basin data were obtained from the US Geological Survey (USGS) National Hydrography Dataset (NHD) (USGS 2011). These data are based on the content of USGS 1:100,000-scale data.

The surface parcels created to represent the water bodies were developed as simplified shapes with the goal of representing the actual water body surface areas as accurately as possible. For the TVA Gallatin facility, the actual extent of Old Hickory Lake is significantly longer than the two surface parcels that represent it. Old Hickory Lake is widest (about 1,500 m wide) at the Old Hickory Lock and Dam in the west, and its width decreases going eastward to about 375 m wide near the facility and about 150 m wide a few kilometers upstream of the facility. Because the width of the lake is rather small just east of the facility, the parcels used to represent it were extended from the dam to about 8.5 km upstream from the facility. This portion of Old Hickory Lake was divided into two adjacent surface parcels, with a division located where Spencer and Station Camp Creeks feed into the lake (roughly where the width of the lake becomes smaller than about 500 m). Also, for the Santee Cooper Jefferies facility, note that Lake Marion extends westward far beyond the extent of modeling. Because Lake Marion feeds into Lake Moultrie (which was the primary reason why Lake Marion was included in the modeling scenario), the section of Lake Marion nearest Lake Moultrie was included in the modeling. This approach was assumed to be a reasonable compromise between including the entirety of Lake Marion (which would have required the modeling domain to be extremely large) and excluding Lake Marion from the layout (which would fail to account for chemical mass deposited to Lake Marion and subsequently transported to Lake Moultrie via the connecting canal).

Table 3-4 indicates the actual surface areas of these water bodies compared to the surface areas of the parcels representing them (USGS 2011). Note that the "actual surface areas" shown for Old Hickory Lake and Lake Marion are only for the portions of the lakes that were parameterized for modeling. The two Old Hickory Lake surface parcels together were about 26 percent smaller than the actual surface area because many of the small appendages of the lake were not captured by the parcel design. The surface area of J. Percy Priest Reservoir was within 4 percent of the actual water body surface area. The Lake Marion surface parcel was about 15 percent smaller than the actual surface area because some of the small appendages of the lake were not captured by the parcel design. The surface areas of Lake Moultrie and the Upper and Lower Reservoirs were within about 3 percent of the actual surface areas.

Table 3-4. Water Bodies Included in the Modeled Regions of the TVA Gallatin and Santee Cooper Jefferies Facilities

Facility	Water Body Name	Actual Surface Area (km^2)[a]	Surface Parcel Name	Modeled Surface Area of TRIM.FaTE Parcel (km^2)
TVA Gallatin	Old Hickory Lake (portion)	58.665	OldHickoryLake_W	31.983
			OldHickoryLake_E	11.568
			(Total)	*(43.551)*
	J. Percy Priest Reservoir	57.604	PercyReservoir	60.000
Santee Cooper Jefferies	Lake Marion (portion)	113.877	LakeMarion	97.064
	Lake Moultrie	229.5	LakeMoultrie	229.747
	Upper and Lower Reservoirs	0.801	Upper&LowerReservoirs	0.821

[a] Actual surface areas are from the USGS NHD (USGS 2011).

3.2.5.2 Source Parcel

Although mercury emissions from the sources were not included in the TRIM.FaTE modeling, source parcels were included in each of the site applications for consistency with a typical TRIM.FaTE application. The source parcel for TRIM.FaTE applications was calibrated to roughly capture the actual locations of all emissions sources considered in the application. The source parcels for the TVA Gallatin and Santee Cooper Jefferies facilities were approximately 500 m on a side, (Figures 3-15 and 3-16, respectively).

Figure 3-15. Location of Source Parcel for TVA Gallatin

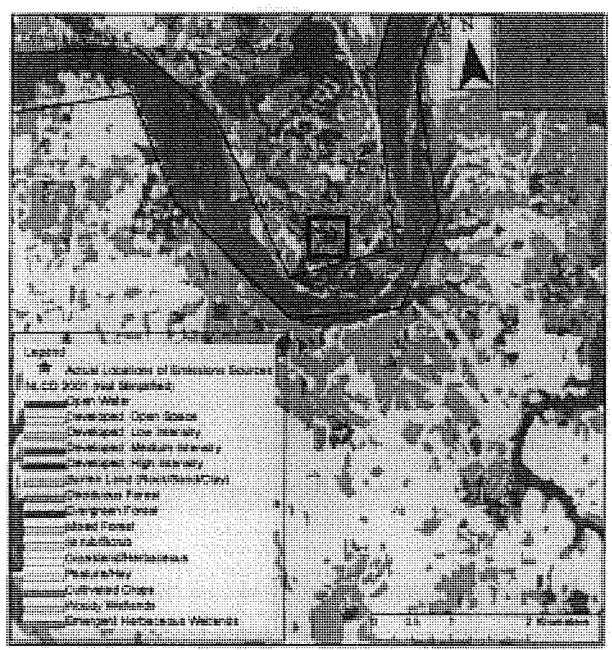
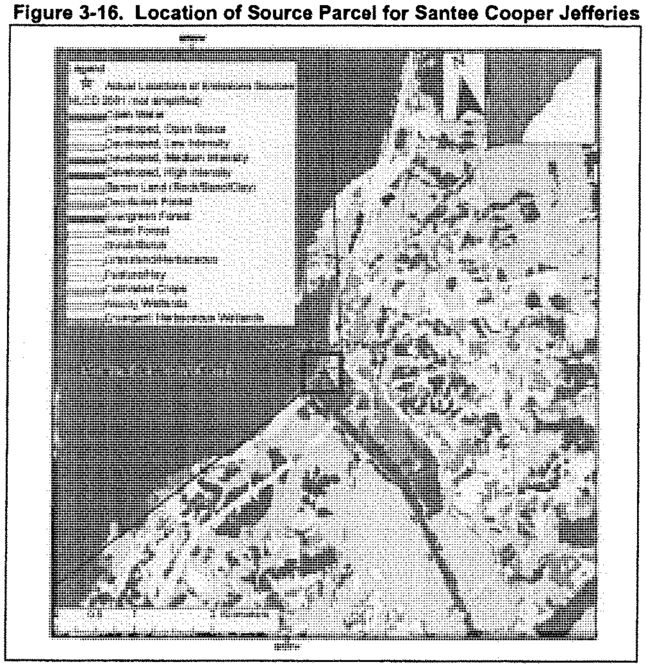


Figure 3-16. Location of Source Parcel for Santee Cooper Jefferies



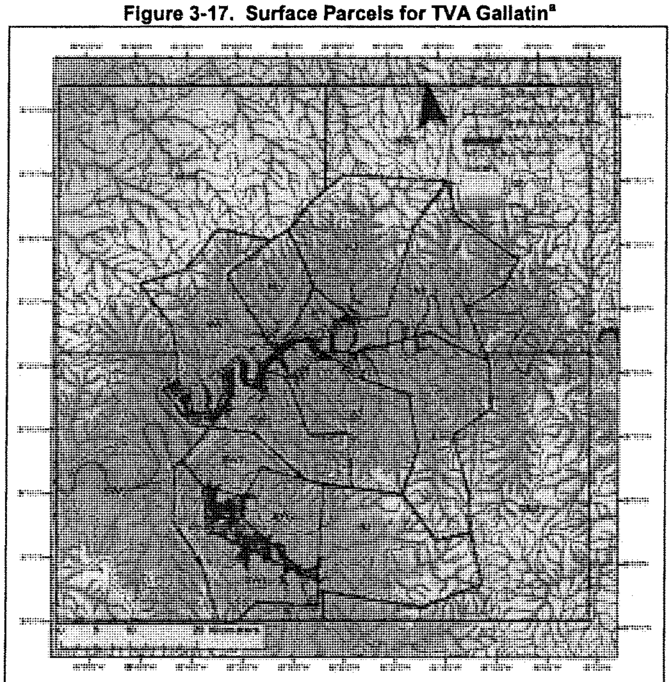
3.2.5.3 Layout of Watershed Surface Parcels and Outer Surface Parcels

The chief goal in designing the surface parcel layout was to accurately capture the watersheds surrounding the water bodies selected for modeling (i.e., those that contain fish that people are assumed to eat). In pursuing this goal, surface parcels were generally drawn following subwatershed boundaries while also considering topographic data (USGS 2006) and wind flow data. Some surface parcels contained multiple subwatersheds. The shapes of surface parcels were kept as simple as possible to reduce complexity in the layout and corresponding model run time. As required by TRIM.FaTE, no surface parcel was fully contained within any other surface parcel; all surface parcels shared at least one side or corner with another parcel.

The air parcel layout was square with an extent that extended beyond the extent of the surface parcels that were drawn to subwatershed boundaries (hereafter referred to as "watershed surface parcels"). "Outer" surface parcels were added beyond the extent of the watershed surface parcels, out to the extent of the air parcels, so that every air parcel had a surface parcel underneath it. These outer surface parcels were not drawn to watershed boundaries; instead, their inside boundaries were shared with the watershed surface parcels and their outside boundaries were shared with the outer extent of the air parcels.

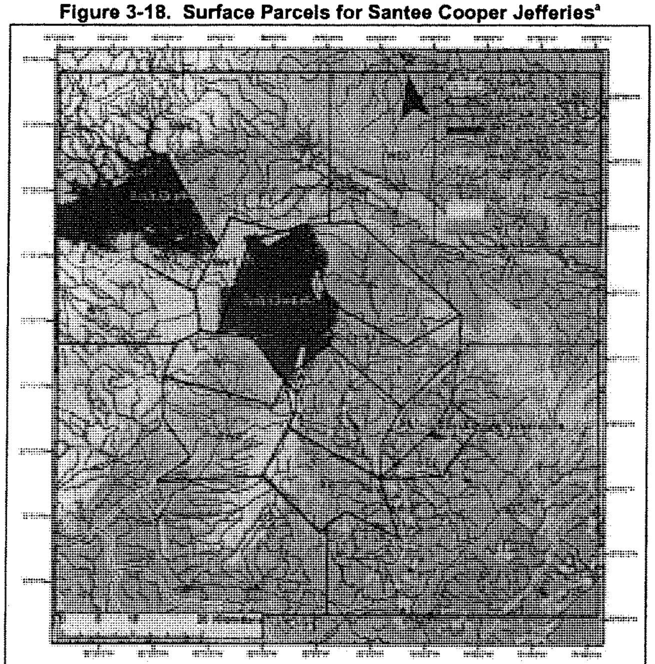
The watershed surface parcels are shown as the polygons inside the full modeling extent square in Figure 3-17 for TVA Gallatin and Figure 3-18 for Santee Cooper Jefferies. The full TRIM.FaTE modeling extent of each facility analysis was about 79 km square. For the TVA Gallatin facility, the watershed surface parcels extended as close as about 18 km from the facility (towards the north-northwest) and as far away as about 42 km from the facility (towards the southwest). For the Santee Cooper Jefferies facility, the watershed surface parcels extended as close as about 17 km from the facility (towards the north) and as far away as about 38 km from the facility (towards the northwest).

Figure 3-17. Surface Parcels for TVA Gallatin[a]



[a] Elevation data from USGS National Elevation Dataset (USGS 2006).

Figure 3-18. Surface Parcels for Santee Cooper Jefferies[a]



[a] Elevation data from USGS National Elevation Dataset (USGS 2006).

3.2.5.4 Surface Parcel Vegetation Types

Calculations of the areal coverage of each land use type (using the 2001 NLCD [USGS 2001]) within each surface soil (i.e., not water body) parcel were used to set each parcel's dominant vegetation type. This strategy results in some simplification because most parcels were at least several square kilometers in area and contained a variety of land use types.

The vegetation type determines which algorithms and inputs will be used to model terrestrial plants. Table 3-5 summarizes the vegetation types used in this analysis and the corresponding inputs and algorithms that vary by land use type. In the current TRIM.FaTE library, only one vegetation type can be assigned per surface soil parcel. The four vegetation types that are in the current TRIM.FaTE library are:

- **Deciduous Forest**: Deciduous tree plant cover (leaf and leaf particle), "regular" surface soil depth (i.e., 0.01 m surface soil depth, 0.79 m root zone depth), standard site-specific soil erosion parameters, relatively small coverage management (i.e., 0.039);

- **Coniferous Forest**: Same as "Deciduous Forest" except with coniferous tree plant cover and a larger coverage management factor (i.e., 0.1);

- **Grasses/Herbs (and Untilled Farmland)**: Same as "Deciduous Forest" except with grasses/herbs plant cover (leaf, leaf particle, root, and stem) and a smaller coverage management factor (i.e., 0.003); and

- **Agriculture**: Currently not used.

There are also two surface parcel types that do not have vegetation during TRIM.FaTE modeling:

- **Untilled Soil (and No Vegetation)**: Same as "Deciduous Forest" except with no plants. "No vegetation" is used in situations where the area is highly developed/paved or where the user wants to omit terrestrial plants for a model run; and

- **Tilled Soil (and Tilled Farmland)**: Same "Untilled Soil" and "No Vegetation" except with thicker surface soil (i.e., 0.2 m) and thinner root zone depth (i.e., 0.6 m). If "tilled farmland" is used, the tilled soil concentrations are used in the exposure assessment methodology to approximate concentrations in produce and animal feed, and the untilled soil concentrations are used for where animals graze and people live.

Table 3-5. TRIM.FaTE Properties that Vary by Vegetation Type

Vegetation Type	Litterfall	Allow Exchange	Coverage Management Factor[a]	Plants Included in Parcel	Surface Soil Depth (m)	Root Zone Depth (m)
Deciduous Forest	15 percent of leaves fall each day for 30 days after first autumn freeze	Off after first autumn freeze; On after last spring freeze	0.039	Leaf and Leaf Particle: Deciduous Forest	0.01	0.79
Coniferous Forest	99 percent of leaves fall over 6 years	Always On	0.1	Leaf and Leaf Particle: Coniferous Forest	0.01	0.79
Grasses/Herbs and Untilled Farmland	15 percent of leaves fall each day for 30 days after first autumn freeze	Off after first autumn freeze; On after last spring freeze	0.003	Leaf, Leaf Particle, Root, and Stem: Grasses/Herbs	0.01	0.79
Tilled Soil and Tilled Farmland	N/A	N/A	0.2	N/A	0.01	0.79
Untilled Soil and No Vegetation	N/A	N/A	0.2	N/A	0.20	0.60

The vegetation type for each surface parcel was determined by calculating the most common land use type (using the 2001 NLCD [USGS 2001]) in each parcel. Below are further details on these processes:

- **"Deciduous Forest" and "Coniferous Forest"** TRIM vegetation types:
  - The 2001 NLCD contains a "mixed forest" category (in addition to the coniferous and deciduous categories), so if deciduous forest was more common than

coniferous forest in a given parcel, then mixed forest was considered to be entirely deciduous; likewise, if coniferous forest was more common than deciduous forest, then mixed forest was considered to be entirely coniferous.

- **"Grasses/Herbs"** TRIM vegetation type:
  - This was defined as a combination of the "grassland/herbaceous" and "shrub/scrub" 2001 NLCD types.
- **"Untilled Soil," "Untilled Farmland," "Tilled Soil," and "Tilled Farmland"** TRIM vegetation types:
  - The untilled and tilled TRIM land use types were defined as the "pasture/hay" and "cultivated crops" 2001 NLCD types, respectively.
- **"No Vegetation"** TRIM vegetation type:
  - The "no vegetation" TRIM vegetation type was defined as a combination of the four developed and the "barren land" 2001 NLCD types.
  - Because it was rare for a surface parcel to be truly devoid of vegetation, a surface parcel could not be described as "no vegetation" unless at least a majority of the parcel qualified as "no vegetation." If "no vegetation" was the most frequent land use type of a parcel but it did not make up a majority, then the next most frequent vegetation type was assigned to the parcel.
- **Special "Wetlands"** TRIM vegetation type:
  - TRIM.FaTE is not currently set up to model the various properties of wetlands, marshes, and swamps.
  - For a parcel that was not intended to be modeled as a water body, it was possible for its most frequent land use type to be water-related. For example, the "open water," "woody wetlands," and "emergent herbaceous wetlands" 2001 NLCD types together could have been the most frequent land use type. If these three types together made up a majority of the parcel, then the TRIM vegetation type of the parcel was set as the next most frequent vegetation type, but some specific parcel properties were modified to reflect the fact that the soil was often saturated. For example, the run-off should be larger than for non-saturated soil, and the erosion should be smaller. The parameters in the Universal Soil Loss Equation were selected specifically to account for a wetlands floor (see Section 3.2.6.1 for more information on soil properties).

Figure 3-19 shows the TRIM vegetation type assigned to each surface parcel for the TVA Gallatin facility. Most surface parcels were set as either untilled soil (not meant to be treated as farm/pasture for exposure purposes) or deciduous forest. Because of the heavier urbanization to the south and southwest of the facility, some parcels were set as no vegetation.

Figure 3-20 shows the TRIM vegetation type assigned to each surface parcel for the Santee Cooper Jefferies facility. The majority of surface parcels were set as coniferous forest. For two parcels (i.e., parcels NW0 and SE0), the majority land use type was wetlands, and the most frequent vegetation type was coniferous forest, so they were set as wetlands/coniferous forest. Specific parameters in the Universal Soil Loss Equation were modified to account for the coniferous forest canopy and wetlands floor.

Figure 3-19. TRIM Vegetation Types for the TVA Gallatin Facility

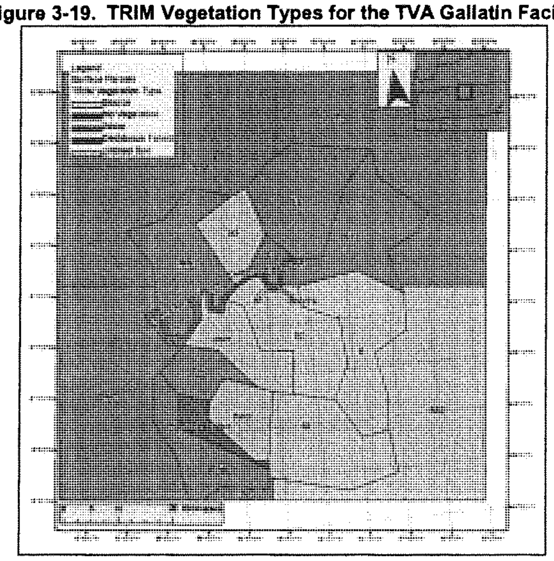
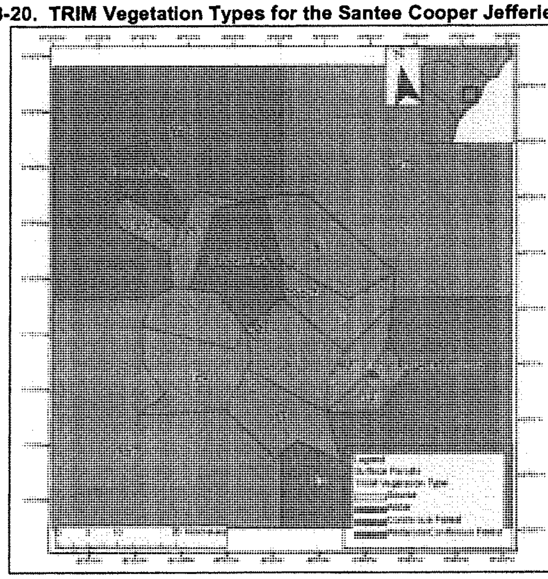


Figure 3-20. TRIM Vegetation Types for the Santee Cooper Jefferies Facility



3.2.5.5 Air Parcel Layout

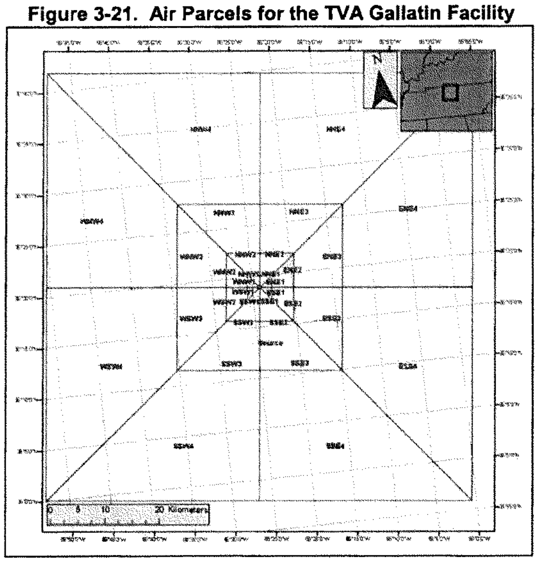
The design of the air parcel layout for the TRIM.FaTE analysis was simpler to construct than for the surface parcel layout because watersheds, terrain, and land use are not taken into account in the design. The air parcel layout consists of concentric squares around the source overlaid onto lines emanating radially in a regular 45-degree pattern. The distance from the side of a given square to the side of the next outward square increases with increasing distance from the source, in much the same way that modeled pollutant air concentrations and depositions generally decrease rapidly with increasing distance from the source. Radial lines divide each concentric square such that eight parcels of equal area can be formed. This radial layout minimizes the TRIM.FaTE bias for over-accumulation of mass along the axes of the grid (refer to the TRIM.FaTE User's Guide (U.S. EPA 2005b) for additional discussion of this design).

The sizes of the concentric air parcel squares were derived from an internal ICF case study of the deposition of mercury and PAHs using the ISCST3 model (U.S. EPA 2005c). Part of that analysis involved examining the cumulative sum of the modeled deposition of divalent mercury (as a ratio of divalent mercury emissions) with increasing distance from the source. Results from this analysis were used as a guide to determining the sizes of the air parcel squares, keeping in mind the predetermined criteria that (1) the concentric squares should increase exponentially in size going outward from the facility, (2) the number of concentric squares should be "reasonable" (i.e., less than about 6), and (3) the outward-most square should fully encompass all of the watershed surface parcels. Four concentric air parcel squares were constructed at 2 km from the side of the source (containing 4 percent deposition of emitted mercury), at 6 km (8 percent), at 15 km (12 percent), and at 39 km (16 percent). The 39-km square should be large enough to encompass all reasonable surface parcel layouts for

TRIM.FaTE analyses. If a surface parcel layout was fully contained within one of the smaller air parcel squares (e.g., the 15-km square), then the larger air parcel square(s) (e.g., the 39-km square) should not be used.

Overall, 33 air parcels, including the source parcel, were included in the air parcel layout for the TVA Gallatin analysis and for the Santee Cooper Jefferies analysis. Figure 3-21 shows the air parcel layout for the TVA Gallatin analysis, and Figure 3-22 shows the air parcel and surface parcel layouts overlaid. Likewise, Figure 3-23 shows the air parcel layout for the Santee Cooper Jefferies analysis, and Figure 3-24 shows the air parcel and surface parcel layouts overlaid.

Figure 3-21. Air Parcels for the TVA Gallatin Facility



The source parcel at the center is not labeled.

Figure 3-22. Air Parcels for the TVA Gallatin Facility, Overlaid with the Surface Parcels

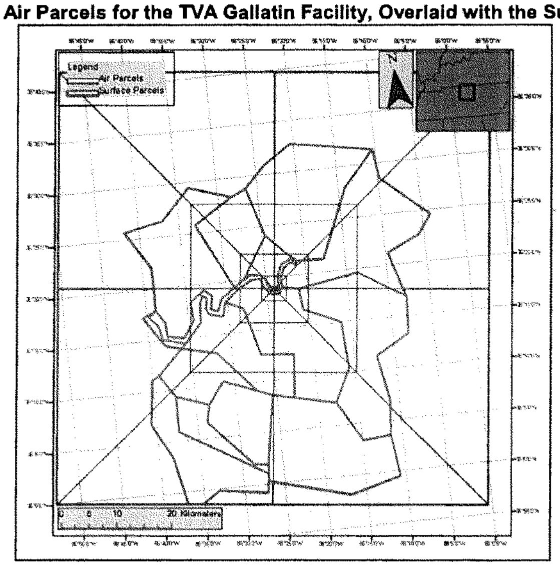
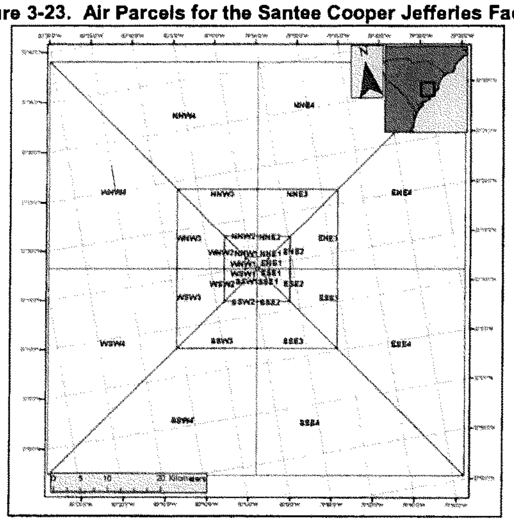
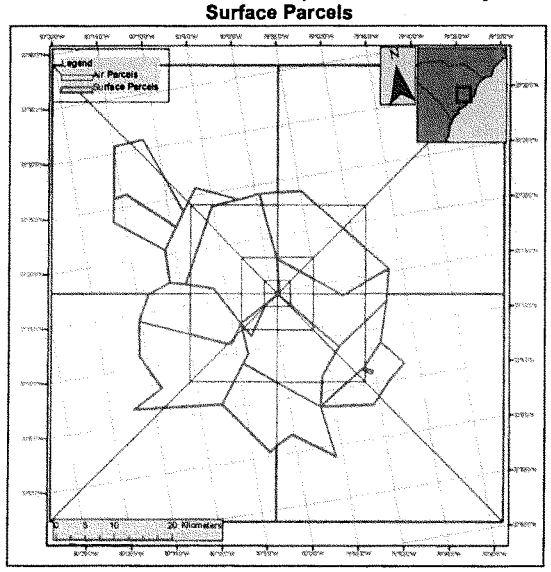


Figure 3-23. Air Parcels for the Santee Cooper Jefferies Facility



The source parcel at the center is not labeled.

Figure 3-24. Air Parcels for the Santee Cooper Jefferies Facility, Overlaid with the Surface Parcels



3.2.6 *Abiotic Environment*

TRIM.FaTE requires various environmental properties for each abiotic compartment included in a scenario. Examples of abiotic environmental properties include the depth of surface soil, soil porosity and water content, erosion and runoff rates for surface soil compartments, and suspended sediment concentrations in surface water. Site-specific inputs were used for this assessment where data supporting such a value were readily available. Regional or national defaults identified by ICF were used in some instances, especially for those parameters that are not expected to strongly influence chemical concentrations. This section lists some of the important values used for this application. A complete list of all TRIM.FaTE inputs used for abiotic compartments is provided in Appendix A.

3.2.6.1 Soil Properties

For both sites, soils were modeled as three stacked soil layers (surface, root zone, and vadose zone soil) over ground water. The surface soil layer that receives deposited mercury was assumed to be 1 centimeter (cm) deep. Depths for subsurface soil layers were based on "typical" state values for multimedia modeling and are presented in Table 3-6 (McKone et al. 2001).

Table 3-6. Soil and Groundwater Compartment Depths

Zone	Compartment Depth (m from surface)	
	TVA Gallatin	Santee Cooper Jefferies
Root soil	0.01 – 0.80	0.01 – 0.80
Vadose soil	0.80 – 2.30	0.80 – 2.50
Groundwater	2.30 – 5.30	2.50 – 5.50

For most of the basic surface soil properties, values also were defined using typical regional or state values compiled by McKone et al. (2001). Selected soil and groundwater properties are shown in Table 3-7.

Table 3-7. Selected Properties of Soil and Groundwater Compartments[a]

Property	Surface Soil	Root Zone Soil	Vadose Soil	Groundwater
TVA Gallatin				
pH	6.8	6.8	6.8	6.8
Organic carbon content	0.005	0.005	0.002	0.004
Volume fraction, vapor (air content)	0.26	0.23	0.19	NA
Volume fraction, liquid (water content)	0.2	0.22	0.25	NA
Average downwind vertical velocity of water infiltrating the soil (m day^{-1})	5.75E-4	5.75E-4	5.75E-4	NA
Santee Cooper Jefferies				
pH	6.8	6.8	6.8	6.8
Organic carbon content	0.006	0.006	0.003	0.004
Volume fraction, vapor (air content)	0.29	0.24	0.22	NA
Volume fraction, liquid (water content)	0.15	0.2	0.21	NA
Average downwind vertical velocity of water infiltrating the soil (m day^{-1})	7.17E-4	7.17E-4	7.17E-4	NA

[a] All values from McKone et al. (2001) NA: Not applicable.

3.2.6.2 Erosion

Erosion rates for each surface parcel for all facilities were estimated using a modified Universal Soil Loss Equation (USLE), with a sediment delivery (SD) ratio adjustment. The USLE was developed to predict the long-term average soil losses from individual field areas (Wischmeier and Smith 1978) and represents the sheet and rill erosion from a small plot or agricultural field. Application of the USLE to an entire watershed requires modification of the equation to account for subsequent re-deposition of eroded soil before it reaches the water body. The SD ratio was developed for this purpose: it estimates the fraction of sediment that reaches a water body based on the size of the watershed.

Representative site-specific values were used in the USLE and SD equations to estimate erosion for the case study applications. Rainfall/erosivity values were estimated from the isoerodent gradient map of the continental U.S. developed by Wischmeier and Smith (1978). In cases where the facility location fell between lines of equal erosivity, linear interpolation was used. Soils data were obtained from the Soil Survey Geographic (SSURGO 2.2) database for the counties of interest (obtained from the USDA Natural Resources Conservation Service) to calculate site-specific soil erodibility factors. ESRI ArcInfo (ESRI 2011b) was used to generate soil erodility factors (K values) for each parcel with the same vegetation type (see Section 3.2.5.4 for vegetation types). Different cover management factors were used for natural forests and wetlands. Calculated erosion rates for modeled surface soil parcel ranged from 7.39E-5 to

8.59E-4 kg m^{-2} day^{-1} for the TVA Gallatin facility and from 6.78E-6 to 2.99E-5 kg m^{-2} day^{-1} for the Santee Cooper Jefferies facility.

The USLE is an empirical model, and therefore modeled conditions should be similar to conditions for which the model has been calibrated to yield useful results. In particular, the USLE was developed for application to a single slope or field, rather than to an entire watershed. Using average values across a watershed parcel introduces uncertainty in the prediction; predictions are improved when individual analyses of the slopes within the watershed are conducted. EPA's HHRAP documentation states that using the USLE to calculate sediment load to a lake from the surrounding watershed can sometimes lead to overestimates (U.S. EPA 2005a). The use of area-weighted averages for some of the USLE variables helps to avoid under- or over-estimating by assuming uniformity across the watershed. The area-weighted soil erodibility factor (K) and cover management factor (C) are not expected to contribute significantly to inaccurate soil erosion estimates.

Estimating the length-slope (LS) factor is more challenging than any other factor for the USLE (Moore and Wilson 1992), especially for complex watersheds. Values for LS were estimated following the approach developed by Moore and Wilson (1992). In actual watersheds, the entire watershed has neither uniform slope length nor uniform slope steepness. Also, due to nonlinearities in the equation to calculate the LS factor, the assumption of uniformity can result in underestimates or overestimates of the LS factor. The use of average slope likely would underpredict the LS factor. A representative slope-length was selected for each scenario using Google Terrain software (Google Inc. 2010). Finally, uncertainty was introduced when using the SD ratio to account for the re-deposition of soil before it reaches the water body. The degree to which the SD ratio underpredicts or overpredicts actual sediment delivery is unknown.

3.2.6.3 Runoff

Runoff from surface parcels into water bodies was calculated by subtracting the annual evaporation (0.9855 and 1.314 m/yr for TVA Gallatin and Santee Cooper Jefferies, respectively) from the annual precipitation (1.05 and 1.31 m/yr for TVA Gallatin and Santee Cooper Jefferies, respectively) (NOAA 2009a). The resulting total runoff values include interflow and ground water recharge in addition to surface runoff. To estimate surface runoff only, total runoff was reduced by the amount expected to infiltrate the groundwater based on information compiled by USGS (USGS 1985). Total runoff for all surface parcels into each lake is reported below in Table 3-9 (source parcel excluded). The source parcels were not included in runoff because the facilities are assumed to have different containment configurations than the rest of the modeled areas.

3.2.6.4 Surface Water and Sediment Properties

Selected surface water and sediment properties for all lakes are shown in Table 3-8 (all other TRIM.FaTE surface water and sediment properties are listed in Appendix A).

Table 3-8. Selected Surface Water and Sediment Properties

Property	TVA Gallatin[a]	Santee Cooper Jefferies[b]
Temperature (K)	298	298
Suspended sediment concentration (kg[sediment]/kg[water])	0.05	0.05

Table 3-8. Selected Surface Water and Sediment Properties

Property	TVA Gallatin[a]	Santee Cooper Jefferies[b]
Water column and sediment organic carbon content (kg[organic carbon]/kg[solid wet weight])	0.02	0.02
Water column pH	7.9	7.6[c]
Sediment pH	7.3	7.3
Chlorophyll concentration (mg/L)	0.0029	0.0029
Chloride concentration (mg/L)	8	8
Algae density in water column (g/L)	0.007038	0.0095

[a] Data for lakes near TVA Gallatin from Tennessee Valley Authority (2002). Environmental Assessment and Finding of No Significant Impact: Hartsville Nuclear Plant Site Trousdale and Smith Counties, Tennessee-Transfer of TVA Property for Industrial Park.
[b] Data for Santee Cooper Jefferies from Santee Cooper (2004).
[c] Multiple sources were available for pH in the lakes near Santee Cooper Jefferies, including Santee Cooper (2004) and Bowers, J.A. (1992). Value for modeling was selected based on the most reliable and, when available, site-specific sources.

3.2.6.5 Water Transfers

To estimate annual flush (turnover) rates and other properties for each modeled lake, a volumetric water balance was assumed. Estimated water inputs to each water body included runoff from the surrounding watershed and direct precipitation to the lake. Outputs (i.e., water removal) from each water body included outflow through the lake outlet and evaporation from the lake surface.

Long-term average precipitation rates used to calculate water balances for each lake were obtained from nearby meteorological stations identified in Section 3.2.3. For each water body, this precipitation was added as a water input, based on surface area of the water body. Runoff from the watershed was calculated by subtracting annual average evapotranspiration and groundwater infiltration from annual average precipitation and multiplying the difference by the total watershed area. Evapotranspiration data for each state were obtained from the USGS Water Summary Table (USGS 1985).

Evaporation from each water body was subtracted from the water inputs to estimate the volumetric flow of water leaving the water bodies. Using surface areas and mean depths to calculate lake volumes, turnover rates in flushes per year were calculated. The values of these turnover rates are presented in Table 3-9. For the TVA Gallatin facility, Old Hickory Lake was split into an eastern and western section. Table 3-9 presents the results for each of these sections.

Table 3-9. Lake Parameter Values for Modeled Water Bodies

Water Body Name	Area (km^2)	Average Depth (m)	Surface Runoff from Land (km^3/yr)	Discharge Rate (m^3/s)	Turnover Rate (flushes/ yr)	Sediment Re-suspension Rate (m[sediment]/ day)
TVA Gallatin						
Old Hickory Lake West	31.96	5.69[a]	0.16	35.96	6.24	9.46E-5
Old Hickory Lake East	11.56	5.69[a]	0.50	27.04	12.96	9.91E-5

Table 3-9. Lake Parameter Values for Modeled Water Bodies

Water Body Name	Area (km^2)	Average Depth (m)	Surface Runoff from Land (km^3/yr)	Discharge Rate (m^3/s)	Turnover Rate (flushes/ yr)	Sediment Re-suspension Rate (m[sediment]/ day)
Priest Reservoir	59.96	8.74[a]	0.19	10.66	0.64	9.56E-5
Santee Cooper Jefferies						
Lake Moultrie	229.6	5.7[b]	0.02	8.37	0.20	9.62E-5
Upper and Lower Reservoirs	0.82	5.7[b]	0.01	0.57	3.83	9.87E-5
Lake Marion	97.0	4[b]	0.15	7.34	0.60	9.64E-5

[a] Depth data for lakes near TVA Gallatin from Tennessee Valley Authority (2002).
[b] Multiple sources were available for lake depth in the lakes near Santee Cooper Jefferies, including Santee Cooper (2004), Bowers (1992), Tufford and McKellar (1999). Value for modeling was selected based on the most reliable and, when available, site-specific sources.

3.2.6.6 Sediment

The sediment mass balance of each watershed/water body system modeled was estimated by accounting for sediment inputs to the water body based on the erosion calculations and the removal of sediment from the modeled system via benthic burial and outflow of suspended sediment in the water column. In this scenario, assumptions about the physical environment were used to calculate sediment input through erosion and sediment removal through suspended sediment flushing. All sediment inputs to a lake are estimated based on the calculated erosion inputs from the surrounding watershed.

For this assessment, all sediment that was not flushed out as suspended sediment was assumed to be buried (i.e., removed from the modeled system by transfer to the consolidated benthic sediment layer, where it was assumed to no longer interact with the overlying water column). Suspended sediment depositional velocity was used to calculate total deposition to the lake bottom, and the difference between deposition and burial was then used to calculate the sediment that was resuspended. The suspended sediment concentration for all water bodies was assumed to be 0.05 kg[sediment]/m^3[water].

3.2.7 *Biotic Environment*

3.2.7.1 Terrestrial Plants

For most plant compartment properties required by TRIM.FaTE, the default values included in the TRIM.FaTE public reference library were used for the EGU case studies. In addition, two site-specific, seasonally-varying plant properties were set: (1) an "allow exchange" property that dictates whether plants are actively growing, and thus able to exchange chemical mass to and from the ambient air and take up chemical mass from soil; and (2) a litterfall rate property that dictates when and how fast chemical mass accumulated by a leaf is transferred to underlying surface soil (to account for chemical transfers to soil from leaves dropped by deciduous trees and plants in the autumn). For this assessment, the dates at which these seasonal events occur were based on the dates of the first and last frosts reported for the regions in which the two facilities are located (Koss et al. 1988). The "allow exchange" property was set to enable chemical exchange between plants and air/soil compartments in the period between these frost dates (i.e., the spring, summer, and autumn). Litterfall was assumed to begin on the first day of frost and to end 30 days later, with a litterfall rate of 15 percent of the remaining detritus falling per day (this rate assures that essentially all mass is transferred to the soil within 30 days).

Modeling terrestrial plants also requires an assigned vegetation type for each surface parcel. See Section 3.2.5.4 for details on how each parcel was assigned a vegetation type.

3.2.7.2 Aquatic Ecosystems

The aquatic food web was an important part of the EGU case studies because the chemical concentrations modeled by TRIM.FaTE in fish are used to calculate human ingestion exposure and risks associated with eating contaminated fish. A biokinetic approach to modeling bioaccumulation in fish was used in the assessment. The primary producers (first trophic level) in the TRIM.FaTE aquatic ecosystems for the lakes at these two sites are algae. The scenario used for all aquatic food webs in this assessment includes a benthic invertebrate compartment to represent the primary invertebrate consumers (second trophic level) in the benthic environment and zooplankton to represent the primary invertebrate consumers in the water column. The benthic and water column fish compartments represent the higher trophic levels in the aquatic system. For TRIM.FaTE to provide reasonable predictions of the distribution of a chemical across biotic and abiotic compartments in aquatic systems, the biomass of the aquatic biotic compartments and the distribution of biomass among the trophic levels must be as realistic as possible.

To support the development of a representative freshwater aquatic ecosystem in which to model bioaccumulation in fish, a literature search, review, and analysis was conducted in support of developing and parameterizing aquatic biotic compartments for TRIM.FaTE. This research demonstrated that the diversity of species and food webs across U.S. aquatic ecosystems is substantial, reflecting the wide range of sizes, locations, and physical/chemical attributes of both flowing (rivers, streams) and low-flow (ponds, lakes, reservoirs) water bodies. In general, lentic bodies of water (lakes and ponds) are at a higher risk of accumulating contaminants in both sediments and biota than are lotic systems (rivers, streams). Also, the literature suggested that a lake of 60 hectares (ha) or larger would likely be sufficient to support higher trophic level predatory fish, with some fraction of their diet comprising smaller fish.

For the TVA Gallatin facility, the modeling zone encompassed Old Hickory Lake and J. Percy Priest Reservoir. The exposure and risk assessment focused on Old Hickory Lake because it was closer to the emission source and was therefore assumed to have higher concentrations of source-attributable mercury. Literature confirmed that Old Hickory Lake supported a range of biotic components consistent with the default aquatic biota compartments in the TRIM.FaTE model (Tennessee Valley Authority 1995). These components included macrophytes, algae, zooplankton, benthic invertebrates, benthic omnivores, benthic carnivores, water column planktivores, water column omnivores, and water column carnivores. However, site-specific data on the precise biomass densities of these biotic components in the Old Hickory Lake were not located. Empirical equations were used to predict the biomass densities of the modeled biotic compartments on the basis of the annual average total phosphorus levels in the lake (Peters 1986). The relative biomass densities of different types of fish were calibrated within the observed empirical ranges to reflect the appropriate level of bioaccumulation and biomagnification in the food chain. The biomass densities for the various aquatic biota compartments included in TRIM.FaTE for the Old Hickory Lake are presented in Table 3-10.

Table 3-10. Biomass Parameters for Old Hickory Lake near TVA Gallatin Facility

Biotic Compartment	Biomass Density	Units
Macrophytes	0.5	kg[ww]/m^2
Algae	0.007038	g[ww]/L
Zooplankton	0.02811	kg[ww]/m^2
Benthic Invertebrates	0.009723	kg[ww]/m^2
Benthic Omnivores	0.00249	kg[ww]/m^2
Benthic Carnivores	0.00124	kg[ww]/m^2
Water Column Planktivores	0.00249	kg[ww]/m^2
Water Column Omnivores	0.000623	kg[ww]/m^2
Water Column Carnivores	0.000248	kg[ww]/m^2
Annual Average Total Phosphorus Level = 33.13 µg/L (Tennessee Department of Environment and Conservation 2004)		

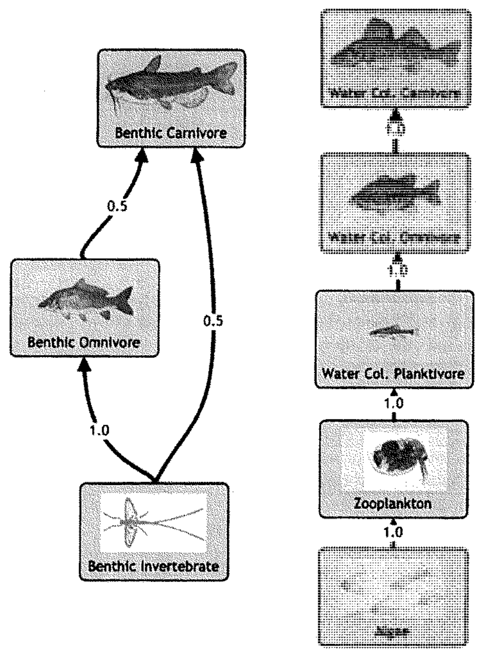
For the Santee Cooper Jefferies facility, the modeling zone encompassed Lake Moultrie, Lake Marion, and the Upper and Lower Reservoirs. The exposure and risk assessment focused on Lake Moultrie because it was closest to the emission source. A literature search indicated that Lake Moultrie supported a healthy aquatic ecosystem consistent with the default aquatic biota compartments in the TRIM.FaTE model (Santee Cooper Green 2007). An online search of fishing reports confirmed the occurrence of higher trophic level game fish in Lake Moultrie (South Carolina Fishing Report 2009). In the absence of site-specific data on biomass densities and total phosphorus levels in Lake Moultrie, total phosphorus data from Lake Marion were used to predict biotic densities in Lake Moultrie using empirical relationships (Tufford and McKellar 1999). The biomass densities for the various aquatic biota compartments in TRIM.FaTE for Lake Moultrie are presented in Table 3-11.

Table 3-11. Biomass Parameters for Lake Moultrie near Santee Cooper Jefferies

Biotic Compartment	Biomass Value	Units
Macrophytes	0.5	kg[ww]/m^2
Algae	0.0095	g[ww]/L
Zooplankton	0.0304	kg[ww]/m^2
Benthic Invertebrates	0.0115	kg[ww]/m^2
Benthic Omnivores	0.00294	kg[ww]/m^2
Benthic Carnivores	0.00147	kg[ww]/m^2
Water Column Planktivores	0.00294	kg[ww]/m^2
Water Column Omnivores	0.000737	kg[ww]/m^2
Water Column Carnivores	0.000292	kg[ww]/m^2
Annual Average Total Phosphorus Level = 41.92 ug/L		

For both facilities, the aquatic food web (predator-prey) relationships between the biotic components were conservatively structured to simulate elevated exposure for human consumers of fish. In the water column, each trophic level exclusively consumed prey from the trophic level directly below it, thus favoring higher bioaccumulation by upper trophic levels of bioaccumulative contaminants. Figure 3-25 illustrates the structure and diet fractions of the aquatic food web modeled for both facilities.

Figure 3-25. Aquatic Food Web and Diet Fractions



3.3 Exposure and Risk Calculations

This section describes the approach for estimating human exposures and risks associated with consumption of fish. All exposure and risk calculations conducted for the EGU case studies were performed using the Multimedia Ingestion Risk Calculator (MIRC). MIRC is a computational, computer-based framework developed by ICF for conducting multipathway risk assessments for EPA's residual risk program and similar initiatives.

3.3.1 *Ingestion Exposure Assessment*

MIRC was used to estimate body weight-normalized long-term average daily doses (ADDs) for methyl mercury via the fish ingestion pathway. The following two subsections describe the parameterization of the ingestion exposure scenario and the exposure estimates for the individual scenarios of interest.

3.3.1.1 Exposure Scenarios and Corresponding Inputs

To assess exposure from fish ingestion, specific individual scenarios were developed for a range of ingestion patterns (i.e., how much fish was consumed) and the associated characteristics of the hypothetical exposed human receptor (e.g., age and body weight). Data related to exposure factors and characteristics of the receptor were obtained primarily from EPA's *Exposure Factors Handbook* and *Child-Specific Exposure Factors Handbook* (U.S. EPA 1997a, 2008).

For this assessment, ICF evaluated individuals who were assumed to eat fresh-water game fish caught in a local lake within the modeled domain. It was assumed that fish intake consisted of 50% omnivorous fish and 50% carnivorous fish. Exposures were estimated for U.S. populations that have been identified as eating a large amount of self-caught fish. Specifically, for these case studies, exposures were estimated for recreational anglers as a whole (for an adult and child receptor), and for adult African American and female anglers and adult anglers of Hispanic, Laotian, and Vietnamese descent who are culturally or economically disposed to higher rates of fish consumption.

Two variants of each of the individual exposure scenarios were modeled to provide information on the range of possible exposures. In keeping with nomenclature and precedent set by risk analyses performed under the purview of the Superfund programs, these two variants are referenced as follows:

- a central tendency estimate (CTE), representative of a "typical" member of the population of interest, represented in this assessment by the mean value from a distribution of ingestion rates; and
- an estimate representative of a "reasonable maximum exposure" (RME), represented in this assessment by the 90^{th} percentile value from a distribution of ingestion rates.

The range of exposures for these two variants for the specific populations evaluated was estimated by varying only the individual fish ingestion rates; other exposure values, including body weight and exposure frequency remained the same. An overview of the exposure factors selected for the fish ingestion scenario is summarized in Table 3-12. Specific exposure factors are presented in more detail in Tables 3-13 through 3-15.

Table 3-12. Overview of Exposure Factors used for Fish Ingestion Exposure Scenarios

Exposure Factor	Selection for Screening Assessment
Age group evaluated	Children 1 to 2 years of age Children 3 to 5 years of age Children 6 to 11 years of age Children 12 to 19 years of age Adult (20 to 70 years)
Body weight (BW; varies by age)	Weighted mean of national distribution
Ingestion rate for fish (IR; varies by age and subpopulation)	RME Scenarios: 90th percentile of distribution of population of interest[a] CTE Scenarios: mean of distribution of population of interest[a]
Cooking conversion factor (CCF)	1.5[b]
Exposure frequency (EF)	365 days/year
Exposure duration (ED)	Varies (see Table 3-13)

[a] U.S. EPA (2002), Burger (2010), Shilling et al. (2010).

[b] EPA-recommended CCF which accounts for the difference between ingestion rates for cooked fish and calculated mercury concentrations in whole fish. Cooking fish tends to reduce the overall weight of fish, and volatilization of mercury is unlikely to occur during cooking, thereby increasing the concentration of mercury by a factor of roughly 1.5 (Morgan et al. 1997).

Default body weights (BWs) in MIRC are the mean values for adults and the four children's age groups. The BW values are listed in Table 3-13. For adults, BW represents the weighted average of male and female mean body-weights for all races, ages 18-74 years, from EPA's EFH (U.S. EPA 1997a,b). In general, BW values for the five children's age groups were calculated from the summary data provided in EPA's *Child-Specific Exposure Factors Handbook* (U.S. EPA 2008) (see below).

Table 3-13. Exposure Duration and Mean Body Weight Estimates for Adults and Children

Life stage (years)	Duration (years)	Mean Body Weight (kg)
Adult[a] (20-70)	50	71.4
Child 1-2[b]	2	12.6
Child 3-5[c]	3	18.6
Child 6-11[d]	6	31.8
Child 12-19[e]	8	64.2

[a] BW represents the sample-size weighted average of male and female mean body weights (all races, 18-74 years) from EPA (Tables 7-4 for males and 7-5 for females). Note that these weights include the weight of clothing, estimated to range from 0.09 to 0.28 kg. Although the 18 to 74 year age category in EPA's EFH does not match exactly the age 20 to 70 year categorization of adults in MIRC, the magnitude of error in the mean and percentile body weights is likely to be very small (i.e., less than 1%).

[b] Each BW represents a time-weighted average of body weights for age groups 1 to <2 years and 2 to <3 years from Table 8-3 of the 2008 CSEFH (U.S. EPA 2008). Original sample sizes for each of these age groups can also be found in Table 8-3.

[c] BWs obtained directly from Table 8-3 of the 2008 CSEFH (U.S. EPA 2008) (age group 3 to <6 years).

[d] BWs obtained directly from Table 8-3 of the 2008 CSEFH (U.S. EPA 2008) (age group 6 to <11 years). This value represents a conservative (i.e., slightly low) estimate of BW for ages 6 through 11 years since 11-year olds are not included in this CSEFH age group.

[e] Mean BW estimated using Table 8-22 of the 2008 CSEFH (U.S. EPA 2008), which is based on NHANES IV data as presented in Portier et al. (2007). This estimate was calculated as the average of the 8 single-year age groups from 12 to 13 years through 19 to 20 years.

MIRC includes built-in, age-specific, fish ingestion rates (IRs). All default IRs in MIRC are 90th percentile values. In addition to the default 90th percentile ingestion rates, MIRC includes values for the mean and the 95th and 99th percentile fish ingestion rates (freshwater and estuarine fish only) based on EPA's analysis of 1994-96 and 1998 Continuing Survey of Food Intakes by Individuals (CSFII) (U.S. EPA 2002, 2008), part of USDA's Nationwide Food Consumption Survey (NFCS) (USDA 1994). Due to limitations of the available data, ICF analyzed the survey data to estimate child fish ingestion rates. The details of ICF's approach are presented in U.S. EPA (2009). Table 3-14 presents the age-specific mean and 90th percentile fish ingestion rates.

Table 3-14. 90th Percentile and Mean Fish Ingestion Rates Representative of Individuals in U.S. Population Consuming Fish

Product	Age Group					
	Units	Child 1-2 Years	Child 3-5 Years	Child 6-11 Years	Child 12-19 Years	Adult 20 - 70 years
Mean	g/day	1.37	2.03	2.71	3.9	6.9
90th Percentile	g/day	3.24	4.79	6.9	8.95	17

Source: U.S. EPA (2002)

MIRC also includes values for the mean and the 90th percentile fish ingestion rates for select populations that exhibit higher rates of fish ingestion than the general population. Table 3-15 presents the mean and 90th percentile fish ingestion rates for these additional high-end fish consumption populations.

Table 3-15. 90th Percentile and Mean Fish Ingestion Rates for Additional Fish Consumers Evaluated

Product	Population					
	Units	African American Angler[a]	Female Angler[a]	Hispanic Angler[b]	Laotian Angler[b]	Vietnamese Angler[b]
Mean	g/day	171	39.1	25.8	47.2	27.1
90th Percentile	g/day	446	123	98	144.8	99.1

[a] Burger et al. (2010)
[b] Shilling et al. (2010)

3.3.1.2 Calculating Average Daily Doses

MIRC calculates human chemical intake rates from the ingestion of locally caught fish as average daily doses (ADDs) normalized to body weight for each receptor. ADDs, calculated using Equation 3-1, are expressed in milligrams of chemical per kilogram of body weight per day (mg/kg-day). The ADD accounts for ingestion of both carnivorous and omnivorous fish.

Equation 3-1. Average Daily Dose

$$ADD_{(y,i)} = \left(\frac{C_{(i)} \times IR_{(y,i)} \times FC_{(i)} \times ED_{(y)}}{BW_{(y)} \times AT_{(y)}} \right) \left(\frac{EF_{(y)}}{365\ \text{days}} \right)$$

where:

$ADD_{(y,i)}$	=	Average daily dose for receptor *y* from fish type *i* (mg chemical/kg body weight-day)
$C_{(i)}$	=	Concentration of chemical in prepared fish type *i* harvested from the contaminated area (mg chemical/kg food)
$IR_{(y,i)}$	=	Ingestion rate for receptor *y* of fish type *i* (kg/day)
$FC_{(i)}$	=	Fraction of fish type *i* that was caught in contaminated area (unitless)
$ED_{(y)}$	=	Exposure duration for receptor *y* (years)
$BW_{(y)}$	=	Body weight for receptor *y* (kg)
$AT_{(y)}$	=	Averaging time for calculation of daily dose (years) for receptor *y*, set equal to ED in MIRC
$EF_{(y)}$	=	Annual exposure frequency for receptor *y* (days)

ADD values, expressed as intakes, not absorbed doses, are appropriate for comparison with oral reference dose (RfD) values to estimate risk, as discussed in Section 3.3.2. All components of this equation are assumed to remain constant for consumers in a given population over time (e.g., seasonal and annual variations in diet are not explicitly taken into account). To calculate an $ADD_{(y,i)}$ from the contaminated area for food group *i* (in this case, fish) over an entire lifetime of exposure, age-group-specific ingestion rates and body weights are used. In MIRC, the averaging time used to calculate the daily dose for an age group (AT_y) is equal to the exposure duration for that group (ED_y); therefore these variables drop out of Equation 3-1.

3.3.2 *Calculation of the Hazard Quotient*

MIRC was used to calculate a non-cancer hazard quotient (HQ) for each individual exposure scenario using the ratio of the calculated ADDs to the ingestion dose-response value for methyl mercury. Specifically, EPA's RfD of 1×10^{-4} mg/kg-day for chronic exposure to methyl mercury was used. This value was obtained from EPA's Integrated Risk Information System (IRIS), and it is also the value included by OAQPS in tabulated dose-response values typically used for risk assessments of hazardous air pollutants (more information on these values is included on EPA's Fate, Exposure, and Risk Assessment (FERA) website (U.S. EPA 2007). The critical effect on which this RfD is based is developmental neuropsychological impairment, although data suggest that other adverse effects, including cardiovascular, persistent and delayed neurotoxicity, and reproductive effects, might also be associated with exposures to mercury.

If the HQ for a chemical is equal to or less than 1, EPA believes that there is no appreciable risk that non-cancer health effects will occur. If the HQ is greater than 1, however, EPA cautions that adverse health effects are possible, although an HQ above 1 does not indicate an effect will definitely occur. This is because of the margin of safety inherent in the derivation of all RfD values. The larger the HQ value, the more likely it is that an adverse effect may occur.

Equation 3-2. Hazard Quotient for Chemicals with a Chronic RfD

$$HQ = \frac{ADD}{RfD}$$

where:

HQ	=	Hazard quotient for chemical (unitless)
ADD	=	Average daily ingested dose of chemical (mg/kg-day)
RfD	=	Chronic oral reference dose for chemical (mg/kg-day)

For chemicals for which the toxicity reference value is an RfD based on developmental effects in infants, children, or young animals, a shorter exposure duration (ED) and averaging time (AT) may be required. For methyl mercury, the appropriate ED/AT and sensitive lifestage for exposure may need to be estimated from the information provided in the critical developmental study(ies) from which the RfD was derived (e.g., in consultation with the RfD documentation in EPA's IRIS or in a toxicological profile developed for the chemical). For the type of assessment presented here, however, comparing the highest ADD from among the child age categories provided in MIRC to the RfD is considered a conservative approach.

4 Modeling Results and Risk Characterization

The results presented and discussed in this section include estimated concentrations of mercury in environmental media and biota (Section 4.1) and estimates of mercury exposures and associated non-cancer human health risks (Section 4.2). The presentation of results is followed by a discussion of the major sources of uncertainty (Section 4.3).

Results are presented for one lake at each of the two facilities included in the assessment. As previously noted the results do not consider risks associated with any other source of mercury, (i.e., long-range transport from other utilities) just the subject facilities in isolation. A more detailed analysis and discussion of media concentration trends for the Santee Cooper Jefferies facility is included to provide some additional insight on how mercury concentrations and exposures were estimated using the models applied for these case studies. This discussion includes a brief comparison of the modeled biota-surface water mercury partitioning behavior with data found in literature.

4.1 Estimated Media Concentrations

For each of the abiotic and biotic compartments described in Section 3.2, TRIM.FaTE was used to estimate annual average mercury concentrations for each year in the 50-year modeling period. To simplify the presentation of the estimated media concentrations, this section focuses primarily on results for the 50^{th} (i.e., final) year of the modeling period. Methyl mercury concentrations in fish from this year were used to estimate human exposures via fish consumption for this assessment.

Table 4-1 presents media concentrations of divalent, elemental, and methyl mercury for the 50^{th} year of the modeling period for the Santee Cooper Jefferies site. The aquatic media concentrations are from Lake Moultrie, which was the closest water body to the emission source. The surface soil concentrations are from a surface soil compartment representative of the immediate watershed of Lake Moultrie.

Table 4-1. Modeled Mercury Concentrations and Speciation for Lake Moultrie, SC, near Santee Cooper Jefferies

TRIM.FaTE Compartment	Concentration					Speciation		
	Units	Total Hg	Hg^0	Hg^2	MeHg	% Hg^0	% Hg^2	% MeHg
Surface water	mg/L	3.4E-08	1.0E-08	2.3E-08	1.0E-09	29.98%	67.03%	3.00%
Algae	mg/kg wet weight	4.4E-05	0	3.3E-05	1.2E-05	<0.01%	73.72%	26.28%
Macrophyte	mg/kg wet weight	1.2E-08	1.4E-18	1.2E-08	6.7E-10	<0.01%	94.66%	5.34%
Zooplankton	mg/kg wet weight	8.5E-05	0	2.4E-05	6.0E-05	<0.01%	28.66%	71.34%
Water Column Carnivore	mg/kg wet weight	5.8E-03	0	2.1E-06	5.8E-03	<0.01%	0.04%	99.96%
Water Column Herbivore	mg/kg wet weight	2.3E-04	0	9.6E-06	2.2E-04	<0.01%	4.14%	95.86%
Water Column Omnivore	mg/kg wet weight	1.1E-03	0	4.0E-06	1.1E-03	<0.01%	0.36%	99.64%
Sediment	ug/g dry weight	3.9E-04	9.7E-06	3.7E-04	1.5E-05	2.47%	93.78%	3.75%
Benthic Invertebrate	mg/kg wet weight	6.3E-05	5.0E-07	1.9E-05	4.4E-05	0.80%	30.27%	68.93%
Benthic Omnivore	mg/kg wet weight	1.7E-04	3.7E-15	8.6E-06	1.6E-04	<0.01%	5.03%	94.97%
Benthic Carnivore	mg/kg wet weight	1.4E-03	1.3E-15	7.5E-06	1.4E-03	<0.01%	0.55%	99.45%
Surface Soil	ug/g dry weight	4.5E-04	1.1E-07	4.4E-04	7.4E-06	0.02%	98.34%	1.64%

Table 4-2 presents the analogous TRIM.FaTE results for the TVA Gallatin site. The aquatic media concentrations are from the eastern branch of Old Hickory Lake, which was the closest water body to the emission source. The surface soil concentrations are from a surface soil compartment representative of part of watershed of Old Hickory Lake.

Table 4-2. Modeled Mercury Concentrations and Speciation for Eastern Branch of Old Hickory Lake, TN, near TVA Gallatin

TRIM.FaTE Compartment	Concentration					Speciation		
	Units	Total Hg	Hg^0	Hg^2	MeHg	% Hg^0	Hg^2%	% MeHg
Surface water	mg/L	2.3E-08	2.8E-09	2.0E-08	8.5E-10	12.02%	84.35%	3.63%
Algae	mg/kg wet weight	3.9E-05	0	2.8E-05	1.0E-05	<0.01%	73.99%	26.01%
Macrophyte	mg/kg wet weight	5.8E-09	3.9E-19	5.2E-09	5.7E-10	<0.01%	90.15%	9.85%

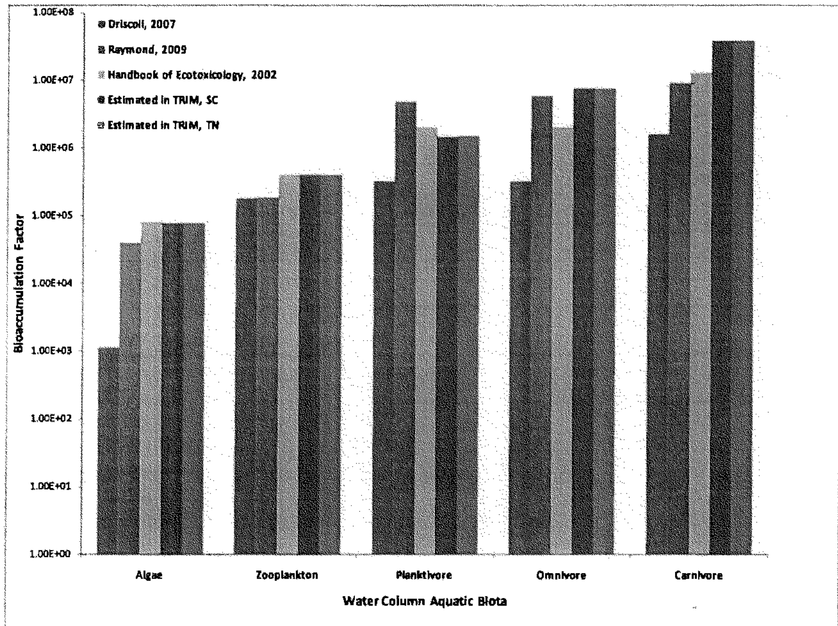
Table 4-2. Modeled Mercury Concentrations and Speciation for Eastern Branch of Old Hickory Lake, TN, near TVA Gallatin

TRIM.FaTE Compartment	Concentration					Speciation		
	Units	Total Hg	Hg^0	Hg^2	MeHg	% Hg^0	Hg^2%	% MeHg
Zooplankton	mg/kg wet weight	7.3E-05	0	2.1E-05	5.2E-05	<0.01%	28.83%	71.17%
Water Column Carnivore	mg/kg wet weight	5.0E-03	0	1.8E-06	5.0E-03	<0.01%	0.04%	99.96%
Water Column Herbivore	mg/kg wet weight	2.0E-04	0	8.4E-06	1.9E-04	<0.01%	4.17%	95.83%
Water Column Omnivore	mg/kg wet weight	9.6E-04	0	3.5E-06	9.6E-04	<0.01%	0.37%	99.63%
Sediment	ug/g dry weight	3.2E-04	2.7E-06	3.1E-04	1.2E-05	0.85%	95.34%	3.81%
Benthic Invertebrate	mg/kg wet weight	5.2E-05	1.4E-07	1.6E-05	3.6E-05	0.27%	30.43%	69.30%
Benthic Omnivore	mg/kg wet weight	1.4E-04	1.0E-15	7.1E-06	1.4E-04	<0.01%	4.93%	95.07%
Benthic Carnivore	mg/kg wet weight	1.1E-03	3.8E-16	6.1E-06	1.1E-03	<0.01%	0.54%	99.46%
Surface Soil	ug/g dry weight	2.5E-06	3.6E-09	2.4E-06	4.0E-08	0.15%	98.22%	1.64%

For both facilities, the model results suggest divalent mercury is the dominant species in surface water, sediment, and surface soil. Methyl mercury is the dominant species in the higher trophic levels of the aquatic biota, progressively bioaccumulating up the food chain until it represents over 95 percent of total mercury in game fish. These speciation trends are broadly consistent with the literature (see, for example, Driscoll et al. 2007).

Mercury partitioning between surface water and sediment, surface water and the various biotic compartments, and between the biota themselves are also consistent with a range of empirical data (Raymond and Rossman 2009). To evaluate TRIM.FaTE's performance with respect to methyl mercury, modeled concentrations in aquatic biota were divided by modeled concentrations in surface water to derive a bioaccumulation factor based on outputs of the bioenergetic food web included in TRIM.FaTE. Figure 4-1 presents the results of these calculations and comparisons for Lake Moultrie in SC and Old Hickory Lake in TN to each other and to values found in literature (Hoffman et al. 2002, Driscoll et al. 2007, Raymond and Rossman 2009).

Figure 4-1. Comparison of Calculated Bioaccumulation Factors Based on Model Outputs to Literature



A detailed analysis of deposition and media concentration trends was performed for the Santee Cooper Jefferies facility in SC because it presented the higher risk of the two facilities. The highlights of this analysis are presented below:

- The average mercury deposition rates (dry and wet, gaseous and particulate, divalent and elemental) based on the 5 years of AERMOD output are somewhat low compared to background deposition in remote locations. The mean deposition in the entire modeling domain was 0.197 ug/m^2-yr, while the mean for Lake Moultrie was 0.64 ug/m^2-yr. By comparison, background deposition in remote locations ranged from <5-30 ug/m^2-yr (Miller et al. 2005).

- The percentage of divalent mercury emissions that are estimated to deposit in the 30-km radius modeling zone was about 5 percent. This is a somewhat smaller percentage than has been observed in previous mercury modeling exercises. (Emissions at the Santee Cooper Jefferies facility were 74 percent divalent mercury, however, compared to 100 percent divalent mercury in the ISC study.)

- Dry deposition was substantially larger than wet deposition and made up 99.9 percent of total deposition (aggregate of all mercury species). Gaseous deposition was larger than particulate deposition and made up about 93.9 percent of total deposition (aggregate of all mercury species). Gaseous divalent mercury deposition made up 85 percent of total deposition of all mercury species.

- Modeled surface water concentrations of total mercury in Lake Moultrie (0.034 ng [total Hg]/L) appeared low relative to levels (0.3 to 8 ng [total Hg]/L) in lakes and streams lacking substantive on-site anthropogenic or geologic sources (Hoffman, 2002). However, surface water concentrations were consistent with lake deposition rates, based on previous TRIM modeling. Partitioning between benthic sediment and surface water also seemed reasonable.
- Modeled methyl mercury concentration in carnivorous game fish (the uppermost trophic level in the lake, representative of the water column carnivore compartment) at 0.006 mg/kg ww was at the low end of the range of mean concentrations (0.001-8.94 mg/kg ww) found in game fish in lakes in a national study (U.S. EPA 1999). As illustrated above in Figure 4-1, the modeled biomagnification and bioaccumulation estimates reflected well-established literature trends.

4.2 Human Health Risk Assessment Results

This section presents the human health risk assessment results of the case study analysis. Section 4.2.1 provides an overview of the results and Section 4.2.2 provides further details about the risk estimates for methyl mercury exposure.

The annually-averaged concentrations estimated by TRIM.FaTE for the 50th year of the modeling period were used to calculate chronic non-cancer hazard quotients (HQs) for methyl mercury exposures estimated to be attributed to source emissions. As described in Section 3, for methyl mercury, an EPA-recommended cooking conversion factor (CCF) of 1.5 was utilized to account for the fact that cooking fish reduces the overall mass of the fish without a reduction in the mercury level, which effectively increases the mercury concentration in the cooked fish (Morgan et al. 1997). Separate HQs were then calculated for different individual variations of the fisher scenario evaluated by ICF. As described in Section 3.3, for the recreational angler, these variations were modeled using fish ingestion rates that varied by age for individuals in the general U.S. population who eat fish. Exposures were also calculated for five additional adult populations of anglers (African American and female anglers and anglers of Hispanic, Laotian, and Vietnamese descent) who are culturally or economically disposed to higher rates of fish consumption.

HQs were below one for all scenarios modeled at both facilities. Non-cancer HQs for methyl mercury are presented in Figures 4-2 and 4-3 for the fisher scenarios evaluated. Results are presented for the RME ingestion rates representative of the upper end (i.e., 90th percentile) of the distribution of ingestion rates for each type of individual fish consumer evaluated. The HQs calculated using CTE ingestion rates are approximately half of the RME HQs. HQs for all populations at both CTE and RME ingestion rates are presented in Table 4-3. The majority of HQs are well below 1.0. The highest HQ was calculated for African American anglers, where an HQ of 0.32 was estimated. This result reflects the higher rate of fish ingestion assumed for this population.

Figure 4-2. Source-attributable Hazard Quotients for Exposure to Methyl Mercury for Recreational Angler Scenarios, RME Ingestion Rate

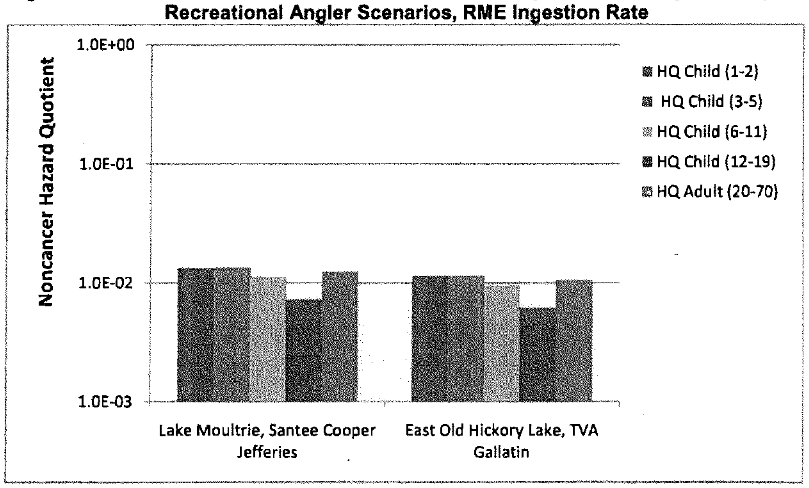


Figure 4-3. Source-attributable Hazard Quotients for Exposure to Methyl Mercury for Other Angler Populations, RME Ingestion Rate

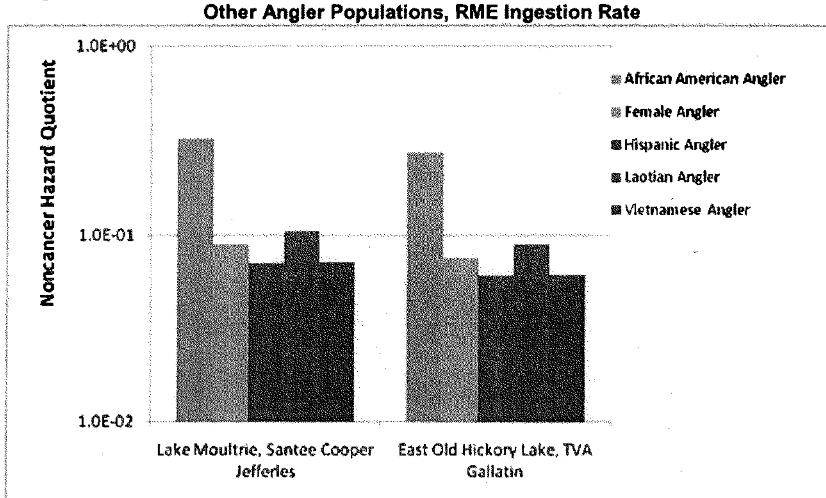


Table 4-3. Hazard Quotients for Exposure to Methyl Mercury via Fish Ingestion

	Non-Cancer Hazard Quotients			
	Lake Moultrie (Santee Cooper Jefferies)		East Old Hickory Lake (TV Gallatin)	
	CTE Ingestion	RME Ingestion	CTE Ingestion	RME Ingestion
Recreational Angler				
Child 1-2	5.63E-03	1.33E-02	4.79E-03	1.13E-02
Child 3-5	5.65E-03	1.33E-02	4.81E-03	1.14E-02
Child 6-11	4.41E-03	1.12E-02	3.76E-03	9.57E-03
Child 12-19	3.14E-03	7.22E-03	2.68E-03	6.15E-03
Adult	5.00E-03	1.23E-02	4.26E-03	1.05E-02
African American Adult	1.24E-01	3.23E-01	1.06E-01	2.75E-01
Female Adult	2.83E-02	8.92E-02	2.41E-02	7.59E-02
Hispanic Adult	1.87E-02	7.10E-02	1.59E-02	6.05E-02
Laotian Adult	1.96E-02	1.05E-01	1.67E-02	8.94E-02
Vietnamese Adult	1.96E-02	7.18E-02	1.67E-02	6.12E-02

4.3 Discussion of Uncertainties and Limitations

The exposure and risk modeling process attempts to describe naturally occurring physical, chemical and biological processes in terms of mathematical algorithms. In a risk assessment, the modeling process generally involves a relatively simplistic representation of highly complex processes for computational tractability. This simplification introduces uncertainty that must be considered when evaluating the risk assessment results and the intermediate values calculated by models over the course of the risk assessment. Furthermore, algorithms that describe the movement of pollutants in the natural environment depend on a large number of environmental parameters whose values may be inherently variable and whose variability may not be well characterized in the literature for the specific sites being modeled. While these unavoidable issues do not invalidate the integrity of the modeling process, the evaluation of model results must be informed by consideration of model uncertainties, parameter variability, and related issues.

The media concentration and risk results presented above must be interpreted in light of the uncertainties associated with both the model inputs and the modeling results. The behavior of mercury in the environment is highly complex, and a range of natural processes are represented in a relatively simplistic manner by AERMOD and TRIM.FaTE, including, but not limited to:

- gaseous and particulate deposition from air;
- mercury biogeochemical cycling in the aquatic environment, and especially mercury transformation through methylation and demethylation at the sediment-surface interface;
- mixing processes and suspended and benthic sediment dynamics in lakes; and
- biotic processes such as growth, reproduction, and predation.

In addition, the toxicology of methyl mercury is complex and uncertain, as are the empirical estimates of human exposure from which the health benchmark (RfD) is based.

Examples of parameters and model inputs for which there is variability and uncertainty include aquatic food web parameters (such as assimilation efficiencies and elimination rates), topographic parameters (such as lake depth, runoff rates, and erosion rates), meteorological parameters (such as evaporation and precipitation rates), chemical transformation parameters (such as methylation and demethylation rates), human exposure parameters (especially fish consumption rates), and the reference dose used to assess potential adverse effects.

Given restrictions inherent to the modeling approach and the parameters of this evaluation, this assessment did not attempt to quantitatively estimate the full range of uncertainty associated with results (such as might be obtained in a probabilistic analysis). Instead, this analysis depended on central tendency and reasonable maximum exposures to bound risk estimates.

The omission of any background mercury from the estimation of potential health impacts must also be considered when interpreting the results of this assessment. The scope of this analysis encompassed only facility-attributable exposures and the resulting incremental HQ as a risk assessment endpoint. No quantitative health impact of the number or fraction of people potentially affected in the modeling zones was estimated, and no estimates of specific impacts like IQ decrements or cardio-vascular effects were made. This does not represent a source of uncertainty affecting the modeling results presented here, but it is an important consideration that must be taken into account when interpreting the results of this analysis.

This section describes the key uncertainties in the modeling process for risks from EGUs. Table 4-4 presents major sources of uncertainty affecting model and risk results; describes the sensitivity of model results, in general, to the uncertainty factor; offers a brief comment on the treatment of the issue in the current assessment; and provides a qualitative assessment of the level of uncertainty in the current results attributable to the various factors. Each of the uncertainty factors is also discussed further below: Section 4.3.1 provides additional information on the major sources of uncertainty in the fate and transport modeling and Section 4.3.2 provides additional detail on the uncertainty related to exposure modeling and risk calculations.

Table 4-4. Uncertainty Factors in the Multipathway Residual Risk Assessment for EGUs

Uncertainty Factor	Sensitivity of Risk Results	Comment	Estimated Impact of Uncertainty on Results
Methylation and demethylation rates in sediment and surface water	High	Model uses fixed rate constants for methylation and demethylation in abiotic media. Model does not capture complex dependence of rate constants on environmental conditions.	Medium-High
Aquatic food web parameters	High	Limited data on chemical and species-specific parameters such as assimilation efficiency, elimination rates, etc. Conservative assumptions used.	Medium
Depth of lakes	High	Based on limited data. Averaged over lake area and time. Perfect mixing assumed in estimating concentrations.	Medium

Table 4-4. Uncertainty Factors in the Multipathway Residual Risk Assessment for EGUs

Uncertainty Factor	Sensitivity of Risk Results	Comment	Estimated Impact of Uncertainty on Results
Toxicity reference value (RfD) for methyl mercury	High	Used EPA recommended value, but estimate includes inherent variability and uncertainty.	Low-Medium
Fate and transport modeling process	High	TRIM.FaTE model may not capture all natural processes or describe them precisely for particular sites.	Low-Medium
Ingestion exposure parameters	High	Used EPA recommended values, but high-end ingestion rates may be based on extrapolation from survey data with small sample sizes.	Low-Medium
Retention time/flush rate	Medium-High	Calculated from depth. Site-specific data would help validate inflows and runoff fractions.	Medium
Modeling resolution and lay out	Medium	Resolution of compartments in modeling zone is relatively coarse. Higher area averaging may dilute exposure point concentrations.	Low-Medium
Runoff rates	Medium	Based on judgment in absence of scientific method. Could not validate owing to lack of data.	Low-Medium
Erosion rates	Medium	Based on USLEs. State-specific erosion data may differ.	Low-Medium
Precipitation rate	Medium	Data for four year period may not represent true average. Affects deposition quantity and type.	Low-Medium
Evaporation rate	Medium	Limited site specific data. Impacts lake flush rates and concentrations.	Low-Medium
Wind speed and direction	Medium	Data for four year period may not represent average conditions. Excessive dispersion may underestimate risk.	Low-Medium
Sediment dynamics	Medium	Model uses simplistic algorithms to describe deposition and resuspension of sediment.	Low-Medium
Other soil, surface water, air & vegetation physico-chemical parameters	Medium	Limited site-specific data. Default assumptions often used.	Low-Medium

4.3.1 *Uncertainties Related to Fate and Transport Modeling (AERMOD and TRIM.FaTE)*

The algorithms representing the transport and eventual fate of mercury in air, surface water, sediment and biotic media are simplified representations of complex natural processes. Estimated deposition rates and concentrations may vary across different environmental models and may be most accurate in specific conditions that meet restrictive assumptions. The

AERMOD model assumes steady-state conditions, which may not exist at the modeled sites. The TRIM.FaTE model represents all fate and transport processes in terms of first-order differential equations; however, some processes like chemical diffusion are known to follow second-order dynamics. Other algorithms, like those dealing with methylation and demethylation, do not consider all the factors known to affect these processes, or the processes may not be well understood (as is the case with mercury methylation and demethylation). As noted in Section 4.1, the deposition rates and media concentrations predicted in the current model are at the low end of the range found at remote sites; these results should be viewed in light of model uncertainty.

This section expands on some of the major uncertainties included in the previous table that are specific to the fate and transport modeling conducted for the case studies.

Methylation and Demethylation Rates. Methylation and demethylation in sediment and surface water are key processes governing biogeochemical cycling of mercury in the aquatic environment. The rate of occurrence of these processes has a great influence on sensitivity of an aquatic ecosystem to mercury inputs and specifically influences the amount of methyl mercury available for bioaccumulation. Some water bodies that are efficient at methylating inorganic mercury can show significant methyl mercury concentrations in biota despite a relatively small mercury input into the system. The representation of these processes in the TRIM.FaTE model does not explicitly account for known dependencies of transformation rates on redox potential, pH, sulfite concentration, dissolved organic carbon content, and hydrodynamics at the sediment-surface water interface. Both methylation and demethylation can occur either biotically or abiotically. Certain conditions, like specific ranges of chloride, sulfide and dissolved organic matter concentrations, can increase the bioavailability of divalent mercury for methylation. Redox conditions can influence the rate of abiotic demethylation. These process mechanics, potentially antagonistic interactions with heavy metals like selenium, and the potential for photodegradation of methyl mercury are not captured in the TRIM.FaTE model. Instead, user-supplied first-order rate constants are used to model methylation and demethylation in surface water and sediment. Site-specific data are limited and the regional default rate constants used may not represent conditions at the modeled lakes.

Aquatic Food Web Parameters. Estimates of methyl mercury concentrations in fish consumed by people are extremely sensitive to aquatic food web parameters. Limited site- and species-specific data were available on a range of aquatic food web parameters, including biomass, food web structure, assimilation efficiencies, elimination rates, ingestion rates, and gill absorption rates. Site-specific data were used when feasible, but conservative assumptions based on literature review and professional judgment were used in the absence of specific data.

Depth of Lakes. The concentration of pollutants transported into lakes (and thereafter up the aquatic food chain) has a sharp dependence on the depth of lake assumed in the model. Site-specific, average depth data were used for all lakes, but there were limited data available for cross-verification. Averaging concentrations over space and time implies perfect mixing in the water body and may not account for local pockets or periods of high concentration.

Fate and Transport Modeling Process. The TRIM.FaTE model represents all fate and transport processes in terms of first-order differential equations. However, some processes like diffusion are known to follow second-order dynamics. TRIM.FaTE also does not explicitly account for lateral or vertical dispersion in the air compartments. As noted earlier, some algorithms like methylation do not consider all the factors known to affect the process. While the model's algorithms have been validated and are based on professional judgment, some level of uncertainty may result from such simplifications.

Surface Water Retention Time/Flush Rate. Retention time, which is inversely proportional to flush rate, determines how quickly pollutants are passed out of a lake. A flush rate that is too high (or retention time that is too low) could result in an underestimate of pollutant concentrations in surface water and in the aquatic food chain. For the current case study, retention time was calculated based on information and assumptions regarding inflow into the lake, evaporation, and depth. Lack of data prevented cross-verification of the computed retention time/flush rates.

Modeling Resolution and Lay Out. In a compartmental box model like TRIM.FaTE, if the size of the compartments is large relative to the rate at which concentrations change with distance from the emission source, high concentration areas would be averaged with low concentration areas resulting in a potential risk dilution for some areas. Furthermore, lateral diffusion in air compartments in TRIM.FaTE is sensitive to the size and shape of air compartments. We attempted to minimize the potential for underestimation of risk by selecting smaller compartment areas close to the source and gradually increasing the compartment dimensions away from the source.

Runoff Rates. For pollutants whose risks are transmitted chiefly by the fish consumption pathway, the amount of pollutant entering lakes is a significant variable. Because runoff can account for a significant portion of the pollutant transported into the lake in some locations, runoff rate from the watershed is a potentially sensitive parameter in the model. ICF estimated these runoff rates based on information about the surrounding topography and local precipitation data.

Erosion Rates. Similar to runoff rates, erosion rates can affect the quantity of pollutants transported into a water body. ICF estimated erosion rates using the universal soil loss equation, which is a generalized estimate that is dependent on local topography, land use and climate. It is possible that local erosion rates may differ from the USLE estimate.

Precipitation Rate. The precipitation rate in the model potentially affects the rate at which pollutants are transported between surface soil compartments and water bodies and also the rate at which pollutants are flushed out of water bodies. ICF used rainfall data for a four-year period, which may not represent average or future conditions.

Evaporation Rate. The evaporation rate affects flush rate computation in the model, and consequently lake concentration and aquatic biota concentration estimates. Limited site-specific data were available and regional estimates had to be used in the model.

Wind Speed and Direction. Wind speed and direction affect dispersion of the pollutant in the model. Because these data were derived from a single-four period, they may not be representative of average or future conditions.

Sediment Dynamics. The suspension and burial of sediment can have a significant impact on surface water concentration and speciation by influencing the methylation and demethylation process. Suspended solid concentrations also affect the amount of mercury transported out of the water body during flushing. Resuspension of buried sediment could remobilize previously deposited mercury into the water body. In the TRIM.FaTE model, these processes are simplistically represented by default sediment deposition rates and suspended solids concentrations, which do not account for hydrodynamic sediment cycling processes. These parameters were not based on site-specific data.

Other Soil, Surface Water, Air & Vegetation Physico-Chemical Parameters. Because of a lack of easy accessible site-specific data, default or national-average values were used for a number of other soil, surface water, air, and vegetation physical and chemical parameters.

4.3.2 *Uncertainties Related to Exposure Modeling and Risk Calculation*

Toxicity Reference Value. HQs were calculated using EPA's recommended RfD for methyl mercury. Reference doses are typically estimated after building in uncertainty factors for pharmacokinetic variability and uncertainty, pharmacodynamic variability and uncertainty, inter- or intra-species variability, and potentially other factors. An awareness of the values and ranges of these uncertainty factors (documented in EPA's IRIS data base) can help inform risk management decisions. For methyl mercury, EPA has reported a high confidence in the oral reference dose assessment.

Ingestion Exposure Parameters. Although the fish ingestion rates used in this analysis for recreational anglers were obtained from recommended EPA exposure factors and additional data that were provided by EPA for high-exposure populations, there is associated uncertainty. This is especially true for the upper percentile estimates that were derived using statistical inferences from limited survey data. To evaluate the sensitivity of risk results to the selected fish ingestion rates, HQs were calculated for the mean, 90th, 95th, and, where available, the 99th percentile ingestion rates for each of the populations assessed. These results, as well as the ingestion rates and the relative percentage increases from the mean for each of the ingestion rates, are provided in Table 4-5. (Note that because HQs are linearly proportionate with the ingestion rate, the relative percentage increase from the mean for the ingestion rate is equal to the relative percentage increase from the mean for the associated HQ.)

As can be seen in Table 4-5, the sample size for many of the populations is relatively low. The African American population has the highest ingestion rates and associated HQs with a maximum HQ of 4.3E-1. However, the ingestion rates for this population are based on only 39 data points, which leads to high uncertainties, particularly near the edges of the distribution. The Vietnamese population is the only group whose ingestion rates are based on a smaller sample size (33). Overall, the increase in ingestion rate, and subsequently, HQ, from the mean to the 95th percentile is fairly small across populations (from 226% to 504%). However, much greater variability can be seen when looking at the increase in HQ from the mean to the 99th percentile ingestion rate (from 245% to 1,614%). Larger sample sizes would reduce some of the uncertainty related to ingestion rates, especially for higher-end rates.

For the populations other than the recreational angler scenario, taken from the EFH (U.S. EPA 1997a), data was collected at one geographical location. Regional differences in ingestion rates may not be captured with the data that were used in these analyses. There also could be highly exposed populations that have not been identified that could reside within the modeled area. It also is possible that not all of the populations assessed in this analysis are present in the modeling zone of the two facilities considered. All of these issues provide some level of uncertainty to the results of this analysis.

Table 4-5. Sensitivity Analysis for Fish Ingestion Rate

	Ingestion Rate[a] (g/day)	HQ Lake Moultrie	HQ East Old Hickory	Relative % Increase from Mean
Recreational Angler Adult				
Mean	6.9	5.0E-03	4.3E-03	NA
90th percentile Ingestion	17	1.2E-02	1.0E-02	146%
95th percentile Ingestion	25	1.8E-02	1.5E-02	262%
99th percentile Ingestion	118.3	8.6E-02	7.3E-02	1,614%
African American Adult				
Mean	171	1.2E-01	1.1E-01	NA
90th percentile Ingestion	446	3.2E-01	2.8E-01	161%
95th percentile Ingestion	557	4.0E-01	3.4E-01	226%
99th percentile Ingestion	590	4.3E-01	3.6E-01	245%
Female Adult				
Mean	39.1	2.8E-02	2.4E-02	NA
90th percentile Ingestion	123	8.9E-02	7.6E-02	215%
95th percentile Ingestion	173	1.3E-01	1.1E-01	342%
99th percentile Ingestion	373	2.7E-01	2.3E-01	854%
Hispanic Adult				
Mean	25.8	2.2E-03	1.6E-02	NA
90th percentile Ingestion	98	8.3E-03	6.1E-02	280%
95th percentile Ingestion	155.9	1.1E-01	9.6E-02	504%
99th percentile Ingestion	NA	NA	NA	NA
Laotian Adult				
Mean	47.2	4.0E-03	1.7E-02	NA
90th percentile Ingestion	144.8	1.2E-02	8.9E-02	207%
95th percentile Ingestion	265.8	1.9E-01	1.6E-01	463%
99th percentile Ingestion	NA	NA	NA	NA
Vietnamese Adult				
Mean	27.1	2.3E-03	1.7E-02	NA
90th percentile Ingestion	99.1	8.4E-03	6.1E-02	266%
95th percentile Ingestion	152.4	1.1E-01	9.4E-02	462%
99th percentile Ingestion	NA	NA	NA	NA

[a] Sample size = 1,633 for recreational angler, 39 for African American, 149 for female, 45 for Hispanic, for 54 for Laotian, and for 33 for Vietnamese.

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Appendix A. TRIM.FaTE Inputs for Utilities Scenario
TVA Gallatin and Santee Cooper Jefferies

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LIST OF TABLES

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Table A-1. TRIM.FaTE Simulation Parameters

Parameter Name	Units	Value Used	Reference
Start of simulation	date/time	1/1/1990, midnight	Consistent with met data.
End of simulation	date/time	1/1/2040, midnight	Consistent with met data set; selected to provide a 50-year modeling period.
Simulation time step	hr	1	Selected value.
Output time step[a]	hr	4	Selected value.

[a] Output time step is set in TRIM.FaTE using the scenario properties "simulationStepsPerOutputStep" and "simulationTimeStep."

Table A-2. Meteorological Inputs

Parameter Name	Units	Value Used	Reference
Meteorological Inputs (all TRIM.FaTE scenario properties, except mixing height)			
Air temperature	degrees K	Varies by hour	NCDC Hourly Surface Hourly Meteorological Data (NCDC 2010)
Horizontal wind speed	m/s	Varies by hour	NCDC Hourly Surface Hourly Meteorological Data (NCDC 2010)
Vertical wind speed	m/s	0.0	Professional judgment; vertical wind speed not used by any of the algorithms in the version of the TRIM.FaTE library used for secondary lead
Wind direction	degrees clockwise from N (blowing from)	Varies by hour	NCDC Hourly Surface Hourly Meteorological Data (NCDC 2010)
Rainfall Rate	m^3[rain]/m^2[surface area]/day	Varies by hour	NCDC Hourly Surface Hourly Meteorological Data (NCDC 2010)
Mixing height (used to set air VE property named "top")	m	800	5[th] percentile annual average mixing heights (calculated from daily morning and afternoon values), for all stations in SCRAM Surface Archived Data (40 state, 70 stations U.S. EPA 2010). Calculated by met data. This value is not used in TRIM.FaTE,
isDay_SteadyState_for Air	unitless	--	Value not used in current dynamic runs (would need to be reevaluated if steady-state runs are needed).
isDay_SteadyState_for Other	unitless	--	

Table A-3. Air Parameters

Parameter Name	Units	Value Used	Reference
Atmospheric dust load	kg[dust]/m^3[air]	6.15E-08	Bidleman 1988
Density of air	g/cm^3	0.0012	U.S. EPA 1997
Dust density	kg[dust]/m^3[dust]	1,400	Bidleman 1988
Fraction organic matter on particulates	unitless	0.2	Harner and Bidleman 1998
Height	m	800	5^{th} percentile annual average mixing heights (calculated from daily morning and afternoon values), for all stations in SCRAM Surface Archived Data (40 state, 70 stations; U.S. EPA 2010). Calculated by met data. This value is not used in TRIM.FaTE,

Table A-4. Soil and Groundwater Parameters

Parameter Name	Units	TVA Gallatin	Santee Cooper Jefferies	Reference
Surface Soil Compartment Type				
Air content	volume[air]/volume[compartment]	0.26	0.29	McKone et al. 2001. (Table A-2)
Average vertical velocity of water (percolation)	m/day	5.75E-04	7.17E-04	Assumed to be 0.2 times the average precipitation for the site.
Boundary layer thickness above surface soil	m	0.005	0.005	Thibodeaux 1996; McKone et al. 2001 (Table 3).
Density of soil solids (dry weight)	kg[soil]/m^3[soil]	2600	2600	McKone et al. 2001 (Default in Table 3)
Thickness - untilled[a]	m	0.01	0.01	McKone et al. 2001 (p. 30).
Thickness - tilled[a]	m	0.20	0.20	U.S. EPA 2005.
Erosion fraction	unitless	varies[b]	varies[b]	See Erosion and Runoff Fraction table.
Fraction of area available for erosion	m^2[area available]/m^2[total]	1	1	Professional judgment; area assumed rural.
Fraction of area available for runoff	m^2[area available]/m^2[total]	1	1	Professional judgment; area assumed rural.
Fraction of area available for vertical diffusion	m^2[area available]/m^2[total]	1	1	Professional judgment; area assumed rural.
Fraction sand	unitless	0.25	0.25	Professional judgment.
Organic carbon fraction	unitless	0.005	0.006	McKone et al. 2001 (U.S. average in Table A-3).
pH	unitless	6.8	6.8	Professional judgment.
Runoff fraction	unitless	varies[b]	varies[b]	See Erosion and Runoff Fraction table.
Total erosion rate	kg[soil]/m^2/day	varies[b]	varies[b]	See Total Erosion Rates table.
Total runoff rate	m^3[water]/m^2/day	8.05E-04	7.17E-04	Calculated using scenario-specific precipitation rate and assumptions associated with water balance.
Water content	volume[water]/volume[compartment]	0.2	0.15	McKone et al 2001 (Table A-2).
Root Zone Soil Compartment Type				
Air content	volume[air]/volume[compartment]	0.23	0.24	McKone et al 2001 (Table A-3).
Average vertical velocity of water (percolation)	m/day	5.75E-04	7.17E-04	Assumed to be 0.2 times the average precipitation for the site.
Density of soil solids (dry weight)	kg[soil]/m^3[soil]	2,600	2,600	McKone et al. 2001 (Table 3).

Table A-4 (cont.). Soil and Groundwater parameters

Parameter Name	Units	TVA Gallatin	Santee Cooper Jefferies	Reference
Fraction sand	unitless	0.25	0.25	Professional judgment.
Thickness - untilled[a]	m	0.79	0.79	McKone et al. 2001 (U.S. average in Table 16).
Thickness - tilled[a]	m	0.6	0.6	McKone et al. 2001 (Adjusted from Table 16).
Organic carbon fraction	unitless	0.005	0.006	McKone et al. 2001 (Table A-3).
pH	unitless	6.8	6.8	Professional judgment.
Water content	volume[water]/volume[compartment]	0.22	0.2	McKone et al. 2001 (Table A-3).
Vadose Zone Soil Compartment Type				
Air content	volume[air]/volume[compartment]	0.19	0.22	McKone et al. 2001 (Table A-4).
Average vertical velocity of water (percolation)	m/day	6.8	6.8	Assumed as 0.2 times the average precipitation for the site
Density of soil solids (dry weight)	kg[soil]/m^3[soil]	2,600	2,600	McKone et al. 2001 (Default in Table A-3).
Fraction sand	unitless	0.35	0.35	Professional judgment.
Thickness[a]	m	1.5	1.7	McKone et al. 2001 (Table A-4).
Organic carbon fraction	unitless	0.002	0.003	McKone et al. 2001 (Table A-4).
pH	unitless	6.8	6.8	Professional judgment.
Water content	volume[water]/volume[compartment]	0.25	0.21	McKone et al. 2001 (Table A-4).
Ground Water Compartment Type				
Thickness[a]	m	3	3	McKone et al. 2001 (Table 3).
Fraction sand	unitless	0.4	0.4	Professional judgment.
Organic carbon fraction	unitless	0.004	0.004	Professional judgment.
pH	unitless	6.8	6.8	Professional judgment.
Porosity	volume[total pore space]/volume[compartment]	0.2	0.2	McKone et al. 2001 (Default in Table 3).
Density of Solid material in aquifer	kg[soil]/m^3[soil]	2,600	2,600	McKone et al. 2001 (Default in Table 3).

[a] Set using the volume element properties file

[b] See separate tables for erosion/runoff fractions and total erosion rates.

Table A-5.1. Runoff Fractions – TVA Gallatin[a]

Sending Compartment	Receiving Compartment: Old Hickory Lake W	Old Hickory Lake E	Priest Reservoir	Source	S1	N2	N3	NW	W	SW4	E	S3	SW1	S2	NE	SW2	N1	SW3	SW0	SE0	S0	NE0	NW0
Old Hickory Lake West	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OldHickory Lake East	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Priest Reservoir	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Source	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW4	0	0	0	0.75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.25	0	0	0
E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
S3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S2	0	0	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0.6	0	0	0	0	0	0	0
NE	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A-5.1 (cont.). Runoff Fractions – TVA Gallatin[a]

Sending Compartment	Receiving Compartment																						
	Old Hickory Lake W	Old Hickory Lake E	Priest Reservoir	Source	S1	N2	N3	NW	W	SW4	E	S3	SW1	S2	NE	SW2	N1	SW3	SW0	SE0	S0	NE0	NW0
SW2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
N1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SW0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SE0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4
S0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
NE0	0.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0	0	0	0	0	0
NW0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0

[a] Values estimated from analysis of the National Elevation Data (USGS 2010)

Table A-5.2. Runoff fractions – Santee Cooper Jefferies[a]

Sending Compartment	Old Hickory Lake W	Old Hickory Lake E	Priest Reservoir	Source	S1	N2	N3	NW	W	SW4	E	S3	SW1	S2	NE	SW2	N1	SW3	SW0	SE0	S0	NE0	NW0
	Receiving Compartment																						
Old Hickory Lake West	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
OldHickory Lake East	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Priest Reservoir	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Source	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
S1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
N3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
NW	0	0	0	0	0	0	0	0.25	0	0.25	0	0	0	0	0	0	0	0	0.5	0	0	0	0
W	0	0	0	0.1	0	0	0	0	0	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0
SW4	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9	0	0	0	0
E	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
SW1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
S2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

320

Table A-5.2 (cont.). Runoff Fractions –Santee Cooper Jefferies[a]

Sending Compartment	Receiving Compartment																						
	Old Hickory Lake W	Old Hickory Lake E	Priest Reservoir	Source	S1	N2	N3	NW	W	SW4	E	S3	SW1	S2	NE	SW2	N1	SW3	SW0	SE0	S0	NE0	NW0
NE	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
SW2	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0.5	0	0	0	0	0
N1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
SW3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
SW0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
SE0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
S0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
NE0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

[a] Values estimated from analysis of the National Elevation Data (USGS 2010)

321

Table A-6. USLE Parameters[a]

Land Use Type	Rainfall / Erosivity Index	Soil Erodibility Index	Length-Slope Factor	Cover Management Factor	Supporting Practices Factor	Unit Soil Loss	
	R (100 ft-ton/ac)	K (ton/ac/(100 ft-ton/acre))	LS (USCS)	C (USCS)	P	A (ton/ac/yr)	A ($kg/m^2/d$)
TVA Gallatin							
No Vegetation	225	0.17	0.47	0.45	1	8.09	4.97E-03
Untilled Soil	225	0.34	0.47	0.082	1	2.95	1.81E-03
Deciduous forest	225	0.26	0.47	0.1	1	2.75	1.69E-03
Santee Cooper Jefferies							
Untilled Soil	325	0.14	0.06	0.082	1	0.22	1.4E-04
Evergreen forest	325	0.13	0.06	0.1	1	0.25	1.6E-04
Evergreen Wetlands/ Wetlands	325	0.13	0.06	0.14	1	0.35	2.2E-04

[a] See section 3.2.5 for details on specific parameters

Table A-7.1. Terrestrial Plant Placement – TVA Gallatin

Surface Soil Volume Element	Surface Soil Depth (m)	Deciduous Forest	Untilled Soil	No Vegetation
S1	0.01	x		
N2	0.01		x	
N3	0.01	x		
NW	0.01	x		
W	0.01			x
SW4	0.01	x		
E	0.01		x	
S3	0.01		x	
SW1	0.01		x	
S2	0.01		x	
NE	0.01	x		
SW2	0.01	x		
N1	0.01	x		
SW3	0.01		x	
SW0	0.01	x		
SE0	0.01		x	
S0	0.01			x
NE0	0.01	x		
NW0	0.01	x		

Table A-7.2. Terrestrial Plant Placement – Santee Cooper Jefferies

Surface Soil Volume Element	Surface Soil Depth (m)	Evergreen Forest	Evergreen Forest/ Wetland
NW1	0.01	x	
W	0.01	x	
SW2	0.01	x	
S2	0.01	x	
S1	0.01	x	
SE1	0.01	x	
SE2	0.01	x	
E	0.01	x	
NE	0.01	x	
NW2	0.01	x	
SW1	0.01	x	
NW0	0.01		x
NE0	0.01	x	
SE0	0.01		x
SW0	0.01	x	

Table A-8. Terrestrial Plant Parameters

Parameter Name	Units	Deciduous Forest[a]		Grass/Herb[a]	
		Value Used	Reference	Value Used	Reference
Leaf Compartment Type					
Allow exchange	1=yes, 0=no	seasonal[b]	Begins on day of last freeze in the spring and ends on day of first freeze in the fall.-	seasonal[b]	Begins on day of last freeze in the spring and ends on day of first freeze in the fall.–
Average leaf area index	m^2[leaf]/ m^2[area]	3.4	CDIAC 2010 (Harvard Forest, dom. red oak and red maple)	5.0	Mid-range of 4-6 for old fields, R.J. Luxmoore, ORNL.
Calculate wet dep interception fraction (Boolean)	1=yes, 0=no	0	Professional judgment.	0	Professional judgment.
Correction exponent, octanal to lipid	unitless	0.76	Trapp 1995 (From roots)	0.76	Trapp 1995 (From roots)
Degree stomatal opening	unitless	1	Set to 1 for daytime based on professional judgment (stomatal diffusion is turned off at night using a different property, IsDay).	1	Set to 1 for daytime based on professional judgment (stomatal diffusion is turned off at night using a different property, IsDay).
Density of wet leaf	kg/m^3	820	Paterson et al. 1991.	820	Paterson et al. 1991.
Leaf wetting factor	m	3.00E-04	Muller and Prohl 1993 (1E-04 to 6E-04 for different crops and elements)	3.00E-04	Muller and Prohl 1993 (1E-04 to 6E-04 for different crops and elements)
Length of leaf	m	0.1	Professional judgment.	0.05	Professional judgment.
Lipid content	kg/kg[wet weight]	0.00224	Riederer 1995 (European beech)	0.00224	Riederer 1995 (European beech)
Litter fall rate	1/day	seasonal[c]	value assumes 1st-order relationship and that 15% of leaves fall each day for 30 days after the first freeze	seasonal[c]	-
Stomatal area normalized effective diffusion path length	1/m	200	Wilmer and Fricker 1996.	200	Wilmer and Fricker 1996.
Vegetation attenuation factor	m^2/kg	2.9	Baes et al. 1984 (Grass/hay)	2.9	Baes et al. 1984 (Grass/hay)

325

Table A-8 (cont.). Terrestrial Plant Parameters

Parameter Name	Units	Deciduous Forest[a]		Grass/Herb[a]	
		Value Used	Reference	Value Used	Reference
Water content	unitless	0.8	Paterson et al. 1991.	0.8	Paterson et al. 1991.
Wet deposition interception fraction	unitless	Calculated within TRIM.FaTE	Calculated based on the meteorology data used within TRIM.FaTE	Calculated within TRIM.FaTE	Calculated based on the meteorology data used within TRIM.FaTE
Wet mass of leaf per soil area	kg[fresh leaf]/m^2[area]	0.6	Simonich and Hites 1994 (Calculated from leaf area index, leaf thickness, density of wet foliage)	0.6	Calculated from leaf area index and Leith 1975.
Particle on Leaf Compartment Type					
Allow exchange	1=yes, 0=no	seasonal[c]	-	seasonal[b]	-
Volume particle per area leaf	m^3[leaf particles]/m^2[leaf]	1.00E-09	Coe and Lindberg 1987 (Based on particle density and size distribution for atmospheric particles measured on an adhesive surface)	1.00E-09	Coe and Lindberg 1987 (Based on particle density and size distribution for atmospheric particles measured on an adhesive surface)
Root Compartment Type - Nonwoody Only					
Allow exchange	1=yes, 0=no	-	-	seasonal[b]	-
Correction exponent, octanol to lipid	unitless	-	-	0.76	Trapp 1995.
Lipid content of root	kg/kg[wet weight]	-	-	0.011	Calculated.
Water content of root	kg/kg[wet weight]	-	-	0.8	Professional judgment.
Wet density of root	kg/m^3	-	-	820	Paterson et al. 1991 (Soybean)
Wet mass per soil area	kg/m^2	-	-	1.4	Jackson et al. 1996 (Temperate grassland)
Stem Compartment Type - Nonwoody Only					
Allow exchange	1=yes, 0=no	-	-	seasonal[b]	-
Correction exponent, octanol to lipid	unitless	-	-	0.76	Trapp 1995
Density of phloem fluid	kg/m^3	-	-	1,000	Professional judgment.

326

Table A-8 (cont.). Terrestrial Plant Parameters

Parameter Name	Units	Deciduous Forest[a]		Grass/Herb[a]	
		Value Used	Reference	Value Used	Reference
Density of xylem fluid	kg/cm^3	-	-	900	Professional judgment.
Flow rate of transpired water per leaf area	m^3[water]/m^2[leaf]	-	-	0.0048	Crank et al. 1981.
Fraction of transpiration flow rate that is phloem rate	unitless	-	-	0.05	Paterson et al. 1991.
Lipid content of stem	kg/kg[wet weight]	-	-	0.00224	Riederer 1995 (Leaves of European beech)
Water content of stem	unitless	-	-	0.8	Paterson et al. 1991
Wet density of stem	kg/m^3	-	-	830	Professional judgment.
Wet mass per soil area	kg/m^2	-	-	0.24	Calculated from leaf and root biomass density based on professional judgment.

[a] See separate table for assignment of plant types to surface soil compartments.

[b] TVA Gallatin begins March 9 (set to 1), ends November 7; Santee Cooper Jefferies begins March 21 ends November 11 (set to 0).

[c] TVA Gallatin begins November 7, ends December 7; Santee Cooper Jefferies begins November 11, ends December 11; rate = 0.15/day during this time (value assumes 99 percent of leaves fall in 30 days).

327

Table A-9. Surface Water Parameters

Parameter Name	Units	TVA Gallatin	Santee Cooper Jefferies	Reference
Algae carbon content (fraction)	unitless	0.465	0.465	APHA 1995.
Algae density in water column	g[algae]/L[water]	0.00703	0.0095	Based on Roberts, 1986. See section 3.1.6 for methodology.
Algae growth rate	1/day	0.7	0.7	Hudson et al. 1994 as cited in Mason et al. 1995b
Algae radius	um	2.5	2.5	Mason et al. 1995b.
Algae water content (fraction)	unitless	0.9	0.9	APHA 1995.
Average algae cell density (per vol cell, not water)	g[algae]/m^3[algae]	1,000,000	1,000,000	Mason et al. 1995b, Mason et al. 1996.
Boundary layer thickness above sediment	m	0.02	0.02	Cal EPA 1993.
Chloride concentration	mg/L	8.0	8.0	Kaushal et al. 2005.
Chlorophyll concentration	mg/L	0.0029	0.0029	ICF Estimate, additional details in ICF (2005)
Depth[a]	m	Varies by lake[b]	Varies by lake[c]	TVA Assessment, 2002; Bowers, 1992; Tufford & McKellar, 1999
Dimensionless viscous sublayer thickness	unitless	4	4	Ambrose et al. 1995.
Drag coefficient for water body	unitless	0.0011	0.0011	Ambrose et al. 1995.
Flush rate	1/year	Varies by lake[d]	Varies by lake[d]	Calculated based on pond dimensions and flow calculations.
Fraction Sand	unitless	0.25	0.25	Professional judgment.
Organic carbon fraction in suspended sediments	unitless	0.02	0.02	Professional judgment.
pH	unitless	7.9	7.6	TVA Assessment, 2002; Bowers, 1992
Suspended sediment deposition velocity	m/day	2	2	U.S. EPA 1997.
Total suspended sediment concentration	kg[sediment]/m^3[water column]	0.05	0.05	U.S. EPA 2005.
Water temperature	degrees K	298	298	U.S. EPA 2005.

[a] Set using the volume element properties named "top" and "bottom."
[b] Average depth for Old Hickory (East and West) = 5.69 m, Priest Reservoir 8.74 m
[c] Average depth for Lake Moultrie and the Upper and Lower Reservoirs = 5.7 m, Lake Marion = 4 m
[d] See section 3.2.5 for Lake specific values.

Table A-10. Sediment Parameters

Parameter Name	Units	Value Used	Reference
Depth[a]	m	0.05	McKone et al. 2001 (Table 3).
Fraction sand	unitless	0.25	Professional judgment.
Organic carbon fraction	unitless	0.02	McKone et al. 2001 (Table 3).
Porosity of the sediment zone	volume[total pore space]/volume[sediment compartment]	0.6	U.S. EPA 1998.
Solid material density in sediment	kg[sediment]/m^3[sediment]	2,600	McKone et al. 2001 (Table 3).

[a] Set using the volume element properties named "top" and "bottom."

Table A-11. Aquatic Plants

Parameter Name	Units	Value Used	Reference
Macrophyte biomass per water area	kg/m^2	0.5	Professional judgment.
Density of macrophytes	kg/L	1	Professional judgment.

Table A-12. Aquatic Food Web

Aquatic Biota (Consuming Organism)	Fraction Diet											
	Algae	Macrophyte	Zooplankton	Bethic Invertebrate	Water Column Herbivore	Benthic Omnivore	Water Column Omnivore	Benthic Carnivore	Water Column Carnivore	Biomass (kg/m^2)	Body Weight (kg)	Reference
Macrophyte	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.5	-	Professional judgment.
Zooplankton	100%	0%	0%	0%	0%	0%	0%	0%	0%	0.0379	5.70E-08	Professional judgment.
Benthic Invertebrate	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.0182	2.55E-04	Professional judgment.
Water Column Herbivore	0%	0%	100%	0%	0%	0%	0%	0%	0%	0.00466	0.025	Professional judgment.
Benthic Omnivore	0%	0%	0%	100%	0%	0%	0%	0%	0%	0.00466	0.25	Professional judgment.
Water Column Omnivore	0%	0%	0%	0%	100%	0%	0%	0%	0%	0.001169	0.25	Professional judgment.
Benthic Carnivore	0%	0%	0%	50%	0%	50%	0%	0%	0%	0.00233	2.0	Professional judgment.
Water Column Carnivore	0%	0%	0%	0%	0%	0%	100%	0%	0%	0.00047	2.0	Professional judgment.

Table A-13. Mercury Chemical-Specific Properties

Parameter Name	Units	Value			Reference
		Hg(0)[b]	Hg(2)[b]	MeHg[b]	
CAS number	unitless	7439-97-6	14302-87-5	22967-92-6	-
Diffusion coefficient in pure air	m^2[air]/day	0.478	0.478	0.456	U.S. EPA 1997.
Diffusion coefficient in pure water	m^2[water]/day	5.54E-05	5.54E-05	5.28E-05	U.S. EPA 1997.
Henry's Law constant	Pa-m^3/mol	719	7.19E-05	0.0477	U.S. EPA 1997.
Melting Point	degrees K	234	550	443	CARB 1994.
Molecular weight	g/mol	201	201	216	U.S. EPA 1997.
Octanol-water partition coefficient (Kow)	L[water]/kg[octanol]	4.15	3.33	1.7	Mason et al. 1996.
Vapor washout ratio	m^3[air]/m^3[rain]	1,200	1.6E+06	0	U.S. EPA 1997, based on Petersen et al. 1995.

[a] All parameters in this table are TRIM.FaTE chemical properties.

[b] On this and all following tables, Hg(0) = elemental mercury, Hg(2) = divalent mercury, and MHg = methyl mercury.

Table A-14. Mercury Chemical-Specific Properties for Abiotic Compartments

Parameter Name	Units	Value			Reference
		Hg(0)	Hg(2)	MeHg	
Air Compartment Type					
Particle dry deposition velocity	m/day	500	500	500	McKone et al. 2001 (CalTOX value)
Demethylation rate	1/day	N/A	N/A	0	Professional judgment.
Methylation rate	1/day	0	0	0	Professional judgment.
Oxidation Rate	1/day	0.00385	0	0	U.S. EPA 1997 (Low end of half-life range (6 months to 2 years))
Reduction rate	1/day	0	0	0	Professional judgment.
Washout Ratio	m^3[air]/m^3[rain]	200,000	200,000	200,000	Professional judgment.
Surface Soil Compartment Type					
Input characteristic depth (user supplied)	m	0.08	0.08	0.08	Not used (model set to calculate value).
Use input characteristic depth (boolean)	0 = no, Else = yes	0	0	0	Professional judgment.
Soil-water partition coefficient	L[water]/kg[soil wet wt]	1,000	58,000	7,000	U.S. EPA 1997.
Vapor dry deposition velocity	m/day	50	2500	0	Hg(0) - from Lindberg et al. 1992; Hg(2) - estimate by U.S. EPA using the Industrial Source Complex (ISC) Model - [See Vol. III, App. A of the Mercury Study Report (U.S. EPA, 1997)].
Demethylation rate	1/day	N/A	N/A	0.06	Range reported in Porvari and Verta 1995 is 3E-2 to 6E-2 /day; value is average maximum potential demethylation rate constant under anaerobic conditions.
Methylation rate	1/day	0	0.001	0	Range reported in Porvari and Verta 1995 is 2E-4 to 1E-3 /day; value is average maximum potential methylation rate constant under anaerobic conditions.
Oxidation rate	1/day	0	0	0	Value assumed in U.S. EPA 1997.
Reduction rate	1/day	0	1.25E-05	0	Value used for untilled surface soil (2cm), 10% moisture content, in U.S. EPA 1997; general range is (0.0013/day)*moisture content to (0.0001/day)*moisture content for forested region (Lindberg 1996; Carpi and Lindberg 1997).

333

Table A-14 (cont.). Mercury Chemical-Specific Properties for Abiotic Compartments

Parameter Name	Units	Value			Reference
		Hg(0)	Hg(2)	MeHg	
Root Zone Soil Compartment Type					
Input characteristic depth (user supplied)	m	0.08	0.08	0.08	Not used (model set to calculate value).
Use input characteristic depth (Boolean)	0 = no, Else = yes	0	0	0	Professional judgment.
Soil-water partition coefficient	L[water]/kg[soil wet wt]	1,000	58,000	7,000	U.S. EPA 1997
Demethylation rate	1/day	N/A	N/A	0.06	Range reported in Porvari and Verta 1995 is 3E-2 to 6E-2 /day; value is average maximum potential demethylation rate constant under anaerobic conditions.
Methylation rate	1/day	0	0.001	0	Range reported in Porvari and Verta 1995 is 2E-4 to 1E-3 /day; value is average maximum potential methylation rate constant under anaerobic conditions.
Oxidation rate	1/day	0	0	0	Value assumed in U.S. EPA 1997.
Reduction rate	1/day	0	3.25E-06	0	Value used for tilled surface soil (20 cm), 10% moisture content, in U.S. EPA 1997 (Lindberg 1996; Carpi and Lindberg 1997).
Vadose Zone Soil Compartment Type					
Input characteristic depth (user supplied)	m	0.08	0.08	0.08	Not used (model set to calculate value),
Use input characteristic depth (Boolean)	0 = no, Else = yes	0	0	0	Professional judgment.
Soil-water partition coefficient	L[water]/kg[soil wet wt]	1,000	58,000	7,000	U.S. EPA 1997.
Demethylation rate	1/day	N/A	N/A	0.06	Range reported in Porvari and Verta 1995 is 3E-2 to 6E-2 /day; value is average maximum potential demethylation rate constant under anaerobic conditions.
Methylation rate	1/day	0	0.001	0	Range reported in Porvari and Verta 1995 is 2E-4 to 1E-3 /day; value is average maximum potential methylation rate constant under anaerobic conditions.
Oxidation rate	1/day	0	0	0	Value assumed in U.S. EPA 1997.

334

Table A-14 (cont.). Mercury Chemical-Specific Properties for Abiotic Compartments

Parameter Name	Units	Value			Reference
		Hg(0)	Hg(2)	MeHg	
Reduction rate	1/day	0	3.25E-06	0	Value used for tilled surface soil (20cm), 10% moisture content, in U.S. EPA 1997 (Lindberg 1996; Carpi and Lindberg 1997).
Ground Water Compartment Type					
Soil-water partition coefficient	L[water]/kg[soil wet wt]	1,000	58,000	7,000	U.S. EPA 1997.
Demethylation rate	1/day	N/A	N/A	0.06	Range reported in Porvari and Verta 1995 is 3E-2 to 6E-2 /day; value is average maximum potential demethylation rate constant under anaerobic conditions.
Methylation rate	1/day	0	0.001	0	Range reported in Porvari and Verta 1995 is 2E-4 to 1E-3 /day; value is average maximum potential methylation rate constant under anaerobic conditions.
Oxidation rate	1/day	1.00E-08	0	0	Small default nonzero value (0 assumed in U.S. EPA 1997).
Reduction rate	1/day	0	3.25E-06	0	Value used for tilled surface soil (20 cm), 10% moisture content, in U.S.EPA 1997 (Lindberg 1996; Carpi and Lindberg 1997).
Surface Water Compartment Type					
Algal surface area-specific uptake rate constant	nmol/[μm^2-day-nmol]	0	2.04E-10	3.60E-10	Assumes radius = 2.5 mm, Mason et al. 1995b, Mason et al. 1996; Hg(0) assumed same as Hg(2).
Dow ("overall Kow")	L[water]/kg[octanol]	0	-[a]	-[b]	Mason et al. 1996.
Solids-water partition coefficient	L[water]/kg[solids wet wt]	1,000	100,000	100,000	U.S. EPA 1997.
Vapor dry deposition velocity	m/day	N/A	2500		U.S. EPA 1997 (Vol. III, App. A).
Demethylation rate	1/day	N/A	N/A	0.013	Average of range of 1E-3 to 2.5E-2/day from Gilmour and Henry 1991.
Methylation rate	1/day	0	0.001	0	Value used in U.S. EPA 1997; range is from 1E-4 to 3E-4/day (Gilmour and Henry 1991).
Oxidation rate	1/day	0	0	0	Professional judgment.

335

Table A-14 (cont.). Mercury Chemical-Specific Properties for Abiotic Compartments

Parameter Name	Units	Value			Reference
		Hg(0)	Hg(2)	MeHg	
Reduction rate	1/day	0	0.0075	0	Value used in U.S. EPA 1997; reported values range from less than 5E-3/day for depths greater than 17m, up to 3.5/day (Xiao et al. 1995; Vandal et al. 1995; Mason et al. 1995a; Amyot et al. 1997).
Sediment Compartment Type					
Solids-water partition coefficient	L[water]/kg[solids wet wt]	3,000	50,000	3,000	U.S. EPA 1997.
Demethylation rate	1/day	N/A	N/A	0.5	Value representative of Lake Waccamaw, NC. (Knightes, et al. 2009.)
Methylation rate	1/day	0	0.02	N/A	Value representative of Lake Waccamaw, NC. (Knightes, et al. 2009.)
Oxidation rate	1/day	0	0	0	Professional judgment.
Reduction rate	1/day	0	1.00E-06	0	Inferred value based on presence of Hg(0) in sediment porewater (U.S. EPA 1997; Vandal et al. 1995).

[a] TRIM.FaTE Formula Property, which varies from 0.025 to 1.625 depending on pH and chloride concentration.
[b] TRIM.FaTE Formula Property, which varies from 0.075 to 1.7 depending on pH and chloride concentration.

336

Table A-15. Mercury Chemical-Specific Properties for Plant Compartments

Parameter Name	Units	Value			Reference
		Hg(0)	Hg(2)	MeHg	
Leaf Compartment Type					
Transfer factor to leaf particle	1/day	0.002	0.002	0.002	Professional judgment (assumed 1% of transfer factor from leaf particle to leaf).
Demethylation rate	1/day	N/A	N/A	0.03	Calculated from Bache et al. 1973.
Methylation rate	1/day	0	0	0	Assumed from Gay 1975, Bache et al. 1973.
Oxidation rate	1/day	1.0E+06	0	0	Professional judgment; assumed close to instantaneous
Reduction rate	1/day	0	0	0	Professional judgment.
Particle on Leaf Compartment Type					
Transfer factor to leaf	1/day	0.2	0.2	0.2	Professional judgment.
Demethylation rate	1/day	N/A	N/A	0	Professional judgment.
Methylation rate	1/day	0	0	0	Professional judgment.
Oxidation rate	1/day	0	0	0	Professional judgment.
Reduction rate	1/day	0	0	0	Professional judgment.
Root Compartment Type - Grasses and Herbs [a]					
Alpha for root-root zone bulk soil	unitless	0.95	0.95	0.95	Selected value.
Root/root-zone-soil-water partition coefficient	m^3[bulk root soil]/ m^3[root]	0	0.18	1.2	Hg2- geometric mean Leonard et al. 1998, John 1972, Hogg et al. 1978; MHg- assumed, based on Hogg et al. 1978.
t-alpha for root-root zone bulk soil	day	21	21	21	Professional judgment.
Demethylation rate	1/day	N/A	N/A	0	Professional judgment.
Methylation rate	1/day	0	0	0	Professional judgment.

Table A-15 (cont.). Mercury Chemical-Specific Properties for Plant Compartments

Parameter Name	Units	Value			Reference
		Hg(0)	Hg(2)	MeHg	
Oxidation rate	1/day	0	0	0	Professional judgment.
Reduction rate	1/day	0	0	0	Professional judgment.
Stem Compartment Type - Grasses and Herbs[a]					
Transpiration stream concentration factor (TSCF)	m^3[soil pore water]/ m^3[xylem fluid]	0	0.5	0.2	Calculation from Norway spruce, Scots pine, Bishop et al. 1998.
Demethylation rate	1/day	N/A	N/A	0.03	Calculated from Bache et al. 1973.
Methylation rate	1/day	0	0	0	Professional judgment.
Oxidation rate	1/day	0	0	0	Professional judgment.
Reduction rate	1/day	0	0	0	Professional judgment.
Macrophyte Compartment Type					
Water Column Dissolved Partition-Alpha of Equilibrium	unitless	0.95	0.95	0.95	Selected value.
Water Column Dissolved Partition-Partition Coefficient	L[water]/ kg[macrophyte wet wt]	0.883	0.883	4.4	Ribeyre and Boudou 1994 (*Elodea densa*)
Water Column Dissolved Partition-Time to Reach Equilibrium	unitless	0.95	0.95	0.95	Selected value.
Oxidation rate	1/day	1.00E+09	0	0	Professional judgment.
t-alpha	day	18	18	18	Ribeyre and Boudou 1994 (Experiment duration)

[a] Roots and stems are not modeled for deciduous or coniferous forest in the current version of TRIM.FaTE.

338

Table A-16. Mercury Chemical-Specific Properties for Aquatic Species

Parameter Name	Units	Value			Reference
		Hg(0)	Hg(2)	MeHg	
Benthic Invertebrate Compartment Type					
Alpha of equilibrium for sediment partitioning	unitless	0.95	0.95	0.95	Selected value.
Benthic invertebrate-bulk sediment partition coefficient	kg[bulk sediment]/kg[invertebrate wet wt]	0.0824	0.0824	5.04	Saouter et al. 1991 (Hg(0) - assumed based on Hg(2) value; Hg(2) and MeHg)
t-alpha for equilibrium for sediment partitioning	day	14	14	14	Experiment duration from Saouter et al. 1991.
All Fish Compartments Types [a]					
Elimination adjustment factor	unitless	3	3	1	Trudel and Rasmussen 1997.
Assimilation efficiency from food	unitless	0.06	0.06 [b]	0.5 [c]	Professional judgment based on Trudel and Rasmussen 2001, Muir, 1986.
Demethylation rate	1/day	N/A	N/A	0	Professional judgment.
Methylation rate	1/day	0	0	0	Professional judgment.
Oxidation rate	1/day	1.0E+06	0	0	Professional judgment.
Reduction rate	1/day	0	0	0	Professional judgment.
Water-column Herbivore Compartment Type					
Assimilation efficiency from plants	unitless	1	1	1	Phillips and Gregory 1979.

[a] The modeling scenario includes the following aquatic biota: Algae, Macrophyte, Zooplankton, Benthic Invertebrates, Water-column Herbivore, Benthic Omnivore, Water-column Omnivore, Benthic Carnivore, and Water-column Carnivore.
[b] Zooplankton were assigned an assimilation efficiency of 0.2 for divalent mercury to compensate for the absence of naturally occurring direct diffusion processes in the model.
[c] Water Column Carnivores were assigned an assimilation efficiency of 0.2 for methyl mercury to compensate for the absence of naturally occurring death , growth, reproduction and predation processes in the scenario/model.

339

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Mr. WHITFIELD. Thank all of you very much for joining us this afternoon, and we look forward to working with you as we continue to move forward on these issues.

With that, the hearing is adjourned.

[Whereupon, at 1:47 p.m., the subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

FRED UPTON, MICHIGAN
CHAIRMAN

HENRY A. WAXMAN, CALIFORNIA
RANKING MEMBER

ONE HUNDRED TWELFTH CONGRESS

Congress of the United States

House of Representatives

COMMITTEE ON ENERGY AND COMMERCE

2125 RAYBURN HOUSE OFFICE BUILDING
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Majority (202) 225–2927
Minority (202) 225–3641

February 24, 2012

The Honorable Gina A. McCarthy
Assistant Administrator
Office of Air and Radiation
U.S. Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Dear Assistant Administrator McCarthy:

Thank you for appearing before the Subcommittee on Energy and Power on Wednesday, February 8, 2012, to testify at the hearing entitled "The American Energy Initiative." This day of the hearing focused on what EPA's Utility MACT Rule will cost U.S. consumers.

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for 10 business days to permit Members to submit additional questions to witnesses, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and then (3) your answer to that question in plain text.

To facilitate the printing of the hearing record, please respond to these questions by the close of business on Friday, March 9, 2012. Your responses should be e-mailed to the Legislative Clerk, in Word or PDF format, at Allison.Busbee@mail.house.gov.

Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,

Ed Whitfield

Ed Whitfield
Chairman
Subcommittee on Energy and Power

cc: Bobby L. Rush Ranking Member, Subcommittee on Energy and Power

Attachment

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CONGRESSIONAL
AND INTERGOVERNMENTAL RELATIONS

JUN 29 2012

The Honorable Ed Whitfield
Chairman
Subcommittee on Energy and Power
Committee on Energy and Commerce
United States House of Representatives
Washington, DC 20515

Dear Chairman Whitfield:

Thank you for your letter of February 24, 2012, requesting responses to Questions for the Record following the February 8, 2012, hearing before the Subcommittee on Energy and Power, entitled "The American Energy Initiative."

The responses to your questions are provided as an enclosure to this letter. Again, thank you for your letter. If you have any further questions, please contact me, or you staff may contact Cheryl Mackay in EPA's Office of Congressional and Intergovernmental Relations at (202) 564-2023.

Sincerely,

Laura E. Vaught

Laura Vaught
Deputy Associate Administrator
for Congressional Affairs

Enclosure

cc: The Honorable Bobby L. Rush, Ranking Member

House Energy and Commerce Committee
Subcommittee on Energy and Power
Hearing on "The American Energy Initiative"
February 8, 2012
Additional Questions for the Record

The Honorable Ed Whitfield

1. What will be the total estimated up-front capital costs? Specifically, what is the estimated total investment required to design, procure and install all the equipment required to comply with the Utility MACT rule?

EPA estimates that the total capital costs of the final rule amount to about $35 billion. This represents the total capital investment prompted by the rule in 2015, for which payments are then spread out over time periods up to 30 years through financing.

2. What is the total present value of non-capital costs, including the estimated operating and maintenance costs for that equipment, monitoring, and reporting to comply with the rule, over the period that EPA assumed that capital costs would be amortized?

Our economic analysis of MATS was conducted in compliance with relevant Executive Orders and guidance on economic analysis from the Office of Management and Budget (OMB), and was reviewed by OMB before we released it. It followed standard, peer-reviewed methodologies and provided consistent information about anticipated benefits and costs, ensuring the public would have access to an effective and reliable comparison of benefits and costs. Specifically, the MATS Regulatory Impact Analysis (RIA) projected annualized costs of $9.6 billion and annual benefits in a range of $37 billion to $90 billion for 2016 ($2007), the year in which our modeling assumes MATS will be fully implemented.

Though we have not calculated the present value of all costs or all benefits across multiple individual years, the benefits outweigh the costs in the 2016 assessment year, we anticipate that annualized costs to comply with MATS will decline in future years for which we have annualized cost estimates, and we anticipate that benefits will increase as a result of population growth among other effects. Therefore, the 2016 comparison of benefits and costs is a conservative estimate. Total benefits will significantly exceed total costs in future years well beyond 2016.

3. EPA's Regulatory Impact Analysis for the Utility MACT rule estimated the annualized compliance costs for coal-fired generation would be $9.4 billion in 2015, $8.6 billion in 2020, and $7.4 billion in 2030.

a. Can you provide us with estimates for the intervening years?

EPA has not estimated annualized costs in intervening years.

b. How long past 2030 do these annualized costs continue?

As explained in the response to question 1 above, EPA assumes that the capital investments made to comply with the rule will be financed over a period of 30 years, as has historically been the case for many environmental retrofits in the power sector. To the extent the facilities continue to operate outside of this time period, they will continue to incur operating and maintenance costs.

4. Dr. Anne Smith, a witness on the second panel, estimates that to comply with this rule, the U.S. electricity sector will have to raise about $84 billion of additional capital between 2012 and 2015.

a. Does EPA believe this represents a reasonable estimate?

Based on the limited information that is available, EPA believes that Dr. Smith's report dramatically overstates the costs of complying with EPA's MATS rule while ignoring the benefits of implementing MATS. Additionally, Dr. Smith's assessment excludes detailed information on the design and assumptions used, making the results difficult to interpret. EPA's MATS assessment uses peer-reviewed models and provides detailed information on its assessment of MATS as it relates to retirements, reliability, economic impacts, job creation, and benefits. EPA's analysis estimates that the total capital costs of the final rule amount to about $35 billion and that the health benefits outweigh the costs by as much as 9-to-1. EPA also notes that even Dr. Smith's modeling assumes that MATS will not result in any adverse impacts in electric generation resource adequacy.

The assumptions used in Dr. Smith's assessment, which generally are not well documented, inappropriately increase the prevalence of projected scrubber installations for MATS compliance by ignoring or artificially limiting other cost-effective compliance options. For example, the assessment limits dry sorbent injection (DSI) technology to units no larger than 300 MW burning sub-bituminous coal. The authors offer no explanation for this artificial limitation, which directly leads to exaggerated compliance costs. While currently available data suggest that DSI may not be effective for HCl control on coals with sulfur content higher than 2 lbs/MMBTU, this does not rule out the use of DSI for bituminous coals entirely. The report also offers no reason why a model should be prevented from considering the economics of potential DSI application for HCl control to units larger than 300 MW. Additionally, it is not clear to what extent the assessment allows compliance using cost effective upgrades to electrostatic precipitators and flue-gas desulfurization.

Moreover, it is unclear how the model used by Dr. Smith (the NewERA model) is assessing the best retrofits for MATS compliance given that it cannot analyze the emissions being regulated. MATS regulates HCl, not SO_2. Yet, the NewERA model appears to contain no information about the chlorine content of coal, a major factor in HCl emissions. In contrast, EPA's modeling specifically simulates HCl emissions and includes a detailed representation of varying levels of chlorine found across different coal supplies, providing what we understand is a far more accurate projection of likely compliance behavior.

Further, Dr. Smith's report does not provide detailed information on a number of significant modeling assumptions including its electricity demand forecast, its natural gas supply or price projections, or its coal supply or price projections. The report also estimates that MATS will cause "a loss in income equivalent to 180,000 full-time jobs" but does not describe the assumptions used to develop this estimate. It is unclear whether the analysis is accounting for jobs created to build, install, operate, and maintain emission controls, or the indirect jobs created as a result of those new jobs. Additionally, healthy people are better workers. The NERA analysis does not account for any benefits in productivity due to cleaner air.

b. If not, what amount of capital does EPA estimate will need to be raised to comply with the rule?

EPA estimates that the total capital costs of the final rule, which (through financing) are actually spread out over time periods up to 30 years, amount to about $35 billion.

5. Did the Department of Homeland Security (DHS) participate in the Utility MACT rule development process, prior to OMB review?

No.

a. Has DHS provided EPA with any analysis-even a preliminary or partial analysis-- of the potential impacts of EPA's power sector rules on critical infrastructure or key resources?

No.

b. If yes, is it available on EPA's public docket for the Utility MACT rule, and what is the document identification number in the docket?

6. The U.S. military is the largest consumer of electricity within the Federal government, and is 99% dependent on power from the commercial sector.

a. Did DOD participate in the Utility MACT rulemaking process, prior to OMB review?

No.

b. If yes, has DOD assured EPA that they have no concerns with the costs of the rule or its potential impacts of this rule on electric reliability?

7. Witnesses have testified that the standards under the Utility MACT rule for new units are so stringent that new coal-fired units will be unable to achieve the standards, even using the best technology available on the market.

a. Besides the Logan unit you referenced in your testimony as potentially being able to meet the new standards, is there any other unit you are aware of that would meet the Utility MACT rule's standards for new plants?

EPA does not have data sufficient to identify further EGUs that have demonstrated the potential to achieve all of the new source MATS limits simultaneously. However, EPA has identified a number of other existing facilities that are able to meet one or more of the new-source standards relevant to them, including 24 existing EGUs able to meet the Hg standard; 8 able to meet the HCl standard; and 12 able to meet the PM standard. Furthermore, the data available to the agency did not indicate that there were any technical reasons that sources emitting all three of those hazardous air pollutants could not meet all three of those standards simultaneously

b. Did all tests at the Logan facility demonstrate that the unit would meet the new standards?

No. some, but not all of the data EPA has for Logan demonstrated that the facility has achieved the level of the new limit for hydrogen chloride. This is despite the fact that the Logan facility is not a new unit, and therefore was not designed to meet, nor is required to meet, the new unit hydrogen chloride requirements.

c. Are there aspects of the Logan facility other than technology that influence emissions, such as attributes of the fuel burned at that facility?

EPA is not aware of any other aspects of the Logan facility that would make it unique or otherwise unrepresentative.

d. Are you aware of any planned new conventional coal unit that would meet the requirements of the Utility MACT rule?

EPA does not have adequate information to answer this question. However, information provided to the agency and included in the administrative record supporting the MATS rule indicates that new conventional coal units can meet the MATS new source limits using currently available control technologies.

e. Has EPA identified vendors that can guarantee that its standards for new coal-fired units under the Utility MACT rule can be met?

The EPA has not specifically solicited performance guarantees from control technology vendors; accordingly, we do not know which vendors are or are not able to offer such guarantees.

8. For existing plants subject to the Utility MACT rule:

a. Will plants be required to update their plant operating permit (i.e. their Title V permit)?

Clean Air Act section 112 standards, including the MATS rule, are considered applicable requirements under Title V. For an affected source under the MATS rule, if the source's existing Title V operating permit has 3 or more years remaining (on its 5-year permit term), the permit must be reopened within 18 months after promulgation of the MATS to incorporate MATS requirements.

If the remaining permit term is less than 3 years, the source's Title V permit does not have to be reopened and can be updated to incorporate the MATS rule requirements at the time of renewal.

b. Will Prevention of Significant Deterioration (PSD) permits potentially be required to comply with the Utility MACT rule?

We expect that few, if any, sources will be required to obtain a PSD permit as a result of MATS. As a result of the MATS, some power plants will upgrade existing controls (especially particulate matter controls like electrostatic precipitators). Power plants may also install new controls (such as fabric filters, dry sorbent injection, or activated carbon injection).

These sources could have an emissions increase of certain PSD pollutants for which their surrounding area is in attainment of the NAAQS or for which there is no NAAQS (e.g., NOx, SO2, CO, GHG) as a result of operating the control equipment (e.g., producing CO2 from removal of SO2 by limestone scrubbers) and providing additional power to operate the control devices. However, we expect that, in most cases, any emissions increase resulting from the control equipment will not be large enough to trigger the requirement for a PSD permit for any of these pollutants. In the case of GHG emissions, major sources that undergo a modification, including the addition of pollution control equipment, could only trigger the requirement for a PSD permit for their emissions of GHGs if such emissions increase by at least 75,000 tons per year of CO2 equivalent. However, in the rare case that the increase in a facility's emissions from complying with the MATS were large enough to trigger the requirement for a PSD permit, the facility would need to obtain a PSD permit.

c. Will New Source Review (NSR) permits potentially be required to comply with the Utility MACT rule?

Similar to the above conclusion on PSD permitting implications, we expect that few, if any, sources will be required to obtain a nonattainment NSR (NNSR) permit as a result of MATS. It is conceivable that some small number of sources located in nonattainment areas making modifications for the purpose of complying with MATS (e.g., upgrading existing control equipment and/or installing new controls) could trigger the requirement for a NNSR permit, but that would be the case only in limited circumstances where such projects result in a significant emissions increase of the specific criteria pollutant(s) for which the area is designated nonattainment (e.g., ozone – NOx as a precursor).

d. What additional types of federal and/or state permits may also be required to comply with the rule?

State permitting authorities may require some sources to obtain minor source permits for construction of the control equipment.

e. How long does EPA expect will be required for utilities to obtain the necessary permits to install new equipment?

As noted above, we expect that few, if any, sources will trigger major NSR or PSD requirements as a result of complying with the MATS rule. In most if not all cases, at most a minor source permit will be needed, and these permits generally require less analysis and fewer procedural steps by the applicant and the permitting authority, in comparison to a major NSR permit. Thus, whereas a major NSR permit may take up to a year to process, a minor source permit should take 3-6 months. This timeframe considers the time from which an applicant provides the complete permit application through final permit issuance, including public notice and sometimes a public hearing.

f. What assurances, if any, can EPA provide that plant owners seeking to comply with the Utility MACT rule will not be subject to citizen suits relating to permitting or other regulatory requirements?

The EPA understands this question to refer to citizen suits brought under Section 304 of the Clean Air Act, which, among other things, authorizes any person to commence a civil action against any person alleged to have violated or to be in violation of an emission standard or limitation under the CAA, which includes permitting requirements and the standards promulgated in the MATS rule. Although the EPA cannot provide specific assurances that no third party will bring such a suit against a source that is (or is alleged to be) in violation of permitting requirements or the MATS rule itself, achieving timely compliance with the permitting requirements and MATS rule (including any applicable extensions) will provide a strong defense.

g. If there are permitting delays or legal challenges to permits that have been granted by state or federal permitting authorities, will this be a basis for obtaining additional time for compliance?

Existing sources have up to three years to comply with the emission standards in the final MATS rule. As noted in the preamble to the final MATS rule, Title V permitting authorities have the authority to grant extensions to the compliance time of up to one year if needed for installation of controls. If an existing source is unable to comply within 3 years, a permitting authority has the authority to grant such a source up to a 1-year extension, on a case- by-case basis, if such additional time is necessary for the installation of controls. In the preamble to the final MATS rule, the EPA provided guidance indicating that this fourth year should be broadly available in a wide range of scenarios where more time is needed for the installation of technology. 77 Fed. Reg. 9304, 9406-11 (Feb. 16, 2012). Even if a PSD or NNSR permit is challenged by a citizen in a federal court once it has been issued, it is not automatic for the court to prevent construction from taking place. EPA has also provided a clear pathway for units that are shown to be critical for electric reliability to obtain a schedule to achieve compliance within up to an additional year beyond the four years mentioned above. This pathway is set forth in a policy memorandum from the EPA's Office of Enforcement and Compliance Assurance.[1]

[1] EPA Memorandum December 16, 2011. "The Environmental Protection Agency's Enforcement Response Policy For Use of Clean Air Act Section 113(a) Administrative Orders in Relation To Electric Reliability and the Mercury and Air Toxics Standard" http://www.epa.gov/compliance/resources/policies/civil/erp/mats-erp.pdf

9. What is the process that utilities seeking to comply with the Utility MACT rule will have to follow to obtain a one-year extension beyond the 3 years provided for in the rule?

In the preamble to the final MATS rule, the EPA provided guidance indicating that the fourth year extension should be broadly available in a wide range of scenarios where more time is needed for the installation of technology. 77 Fed. Reg. 9304, 9406-11 (Feb. 16, 2012). The general process for obtaining a one-year extension of MATS and similar rules under section 112(i)(3)(B) of the Clean Air Act is set forth in EPA's General Provision for Part 63 at 40 C.F.R. 63.6(i). These regulations identify the general procedural requirements associated with a request to the permitting authority for a one-year extension, including timing and general content. Based on outreach to state permitting authorities that have processed such requests, EPA's understanding is that this process generally has been straightforward and timely.

10. For a one-year extension to comply with the Utility MACT rule, what specific requirements or commitments will utilities have to meet in order to receive an extension?

Section 112(i)(3)(B) of the Clean Air Act provides that the relevant permitting authority (generally the States) can grant a one-year extension where necessary for the installation of controls. This provision confers discretion to provide this one-year extension on the relevant permitting authorities, but the preamble to the final MATS rule provides guidance as to scenarios in which this authority may be exercised. Please see the MATS Rule Preamble, 77 Fed. Reg. 9304, 9406-11 (Feb. 16, 2012). In general, the preamble articulates the EPA's view that the additional year under this provision should be available in a broad range of situations. It should be available, for example, where necessary to install controls on the relevant unit or to construct replacement power on the same site as the unit. In addition, the preamble states that the additional year may be available in a number of situations in which pollution controls are not being directly installed on the relevant unit, but where the unit must run in order to avoid a serious risk to electric reliability in certain circumstances.

11. For reliability critical units seeking to continue to operate beyond the 3 years, what is the process utilities will have to follow to apply for authorization from EPA to allow them to continue to operate during a 4th or 5th year?

The process with regard to one-year extensions under section 112(i)(3)(B) of the Clean Air Act (providing existing sources with a fourth year to comply with MATS) is described in the response to question 10 above.

In addition, on December 16, 2011, EPA's Office of Enforcement and Compliance Assurance (OECA) issued a memorandum discussing the EPA's intended approach regarding the use of administrative orders ("AOs") under CAA Section 113(a) with respect to sources that must operate in noncompliance with the MATS rule for up to a year to address a specific and documented reliability concern (allowing such sources up to five years total to comply). This policy addresses the process that owner's/operator's of reliability critical unit should follow to

receive an AO. The policy can be accessed at:
http://www.epa.gov/compliance/resources/policies/civil/erp/mats-erp.pdf.

12. For an authorization for reliability critical units to continue to operate during a 4th or 5th year, what specific requirements or commitments will utilities have to meet in order to receive such an authorization from EPA?

As explained in the response to question 10 above, with regard to one-year extensions under section 112(i)(3)(B) of the Clean Air Act, the provision commits to the relevant permitting authorities' (generally the States) discretion to decide whether to grant the extension. However, as explained in the response to question 10 above, EPA in the MATS preamble has provided guidance on illustrative scenarios in which it would be appropriate to provide the extension. These include situations in which pollution controls are not being directly installed on the relevant unit, but where the unit must run in order to avoid a serious risk to electric reliability in certain circumstances.

As explained above, on December 16, 2011, OECA issued a memorandum discussing the EPA's intended approach regarding the use of AOs under CAA Section 113(a) with respect to sources that must operate in noncompliance with the MATS rule for up to a year to address a specific and documented reliability concern. This policy describes, in Section III, elements that an owner/operator should include in a request for an AO in connection with this policy, which include (1) a plan for expeditious compliance with the MATS within one year, and (2) a proposal for operational limits and/or work practices to minimize or mitigate any emissions of hazardous air pollutants to the extent practicable. As stated in the policy, the EPA does not intend to seek civil penalties for violations of the MATS that occur as a result of operation for up to one year in conformity with an AO, unless there are misrepresentations in the materials submitted in a request for an AO under this policy.

The Honorable John D. Dingell

1. In order for utilities to request a one-year extension to comply with the new rule, what specific requirements or commitments will utilities have to meet in order to receive an extension?

Please see the response to questions 10 and 11 from Chairman Whitfield above.

2. I know the final rule has not yet been published in the Federal Register but have any utilities contacted you to discuss the process of requesting the one-year extension discussed in the final rule?

The States generally are the permitting authorities to which requests for the one-year extension would be directed. EPA does not at this time have data on the number of requests for one year extensions, if any, that state permitting authorities have received thus far. EPA is the permitting authority in certain areas of the country (e.g. tribal lands), and has not yet received any requests for a one-year extension at this time. The rule has now been published, with the citation of 77 Fed. Reg. 9304 (Feb. 16, 2012).

3. As utilities prepare to upgrade their larger facilities to meet the new rule, some of these facilities will have to be taken off-line in order to install the new technology. While these larger facilities are off-line, utilities may have to rely on older facilities to meet base and peak demand. These older facilities will likely not be upgraded to meet the new rule. As utilities are going through this retrofitting process, can they apply for a waiver for the older facilities to operate beyond the three years to ensure reliability during this transition?

Please see the response to question 4, below, and the responses to Chairman Whitfield's questions 10 and 11 above for further information on how available flexibilities with regard to compliance timing apply to units that may be slated for deactivation but which may need to run beyond otherwise applicable deadlines to maintain reliability.

4. I understand that there have been two instances where the Department of Energy required utilities to reactivate generation facilities in order to meet reliability requirements. These facilities were not in compliance with Clean Air Act requirements and it is my understanding that they were subsequently fined by the EPA. Do you believe the new Mercury and Air Toxics Standards provide room and flexibility to ensure reliability is not jeopardized?

If you are referring to the situation in 2001 involving a company then known as Mirant (now Gen On) with respect to its Potrero, CA plant, and the situation in 2007 involving then Mirant's (now GenOn's) Potomac River plant, in neither instance was the company ultimately fined by the EPA. Rather, in each instance, the EPA used its enforcement flexibility – and specifically Administrative Orders – as a means to bring sources to compliance while ensuring reliability. The EPA worked with the company, other regulatory agencies, States and the regulated community to formulate case-specific approaches to ensure that critical power plants could operate when needed. By way of clarification, note that only the Potomac River plant operated pursuant to a DOE section 202(c) order. We are not aware of any instance in which EPA fined facilities for non-compliance following DOE orders to reactivate generation in order to meet reliability (a.k.a. Federal power Act Section 202(c) orders.

EPA took steps in the final MATS standards to address stakeholder concerns that compliance with MATS could not be achieved within the maximum three-year compliance date authorized under the statute. In the final rule, EPA described in detail the wide range of situations where we believe an additional year for compliance could be granted by permitting authorities. This fourth year - in addition to the three years provided to all sources - is provided by the Clean Air Act as needed to complete installation of control technologies. EPA suggests that permitting authorities make this fourth year broadly available to sources that require it to complete their compliance activities, including installing pollution control equipment, constructing on- or off-site replacement power, and upgrading transmission. EPA is also encouraging the fourth year to be available as needed to units that continue to operate for reliability purposes while other units are installing pollution controls. As a result, EPA estimates that sources generally will have until spring of 2016 to comply – one year longer than our analysis indicates is necessary for most sources.

Although EPA's analysis indicates that most, if not all, sources can comply within three years, and that the fourth year should be available in the broad range of situations described above, EPA is also providing a clear pathway for units that are shown to be critical for electric reliability to obtain a schedule to achieve compliance within up to an additional year beyond the four years mentioned above. This pathway is set forth in a policy memorandum from EPA's Office of Enforcement and Compliance Assurance.[2] As stated above, EPA believes there will be few, if any, situations in which this pathway will be needed.

As part of the Administration's commitment to maximize flexibilities under the law, MATS was accompanied by a Presidential Memorandum that directs EPA to take a number of steps to ensure continued electric reliability. These steps include: 1) working with State and local permitting authorities to make the additional year for compliance with MATS provided under section 112(i)(3)(B) of the Clean Air Act broadly available to sources; 2) working with the Department of Energy, the Federal Energy Regulatory Commission, State utility regulators, Regional Transmission Organizations, the North American Electric Reliability Corporation and regional electric reliability organizations, other grid planning authorities, electric utilities, and other stakeholders, as appropriate to promote early, coordinated, and orderly planning; and 3) making available to the public, including relevant stakeholders, information that describes the process for identifying circumstances where electric reliability concerns might justify allowing additional time to comply. EPA is in the process of taking a number of steps to implement the directives in this memo.

EPA is actively engaging power plants and other entities that will be involved in getting power plants retrofitted while maintaining the reliability of the electric grid. EPA has held, and will continue to hold, a series of regular discussions with the Department of Energy, the Federal Energy Regulatory Commission, State utility regulators, Regional Transmission Organizations, the North American Electric Reliability Corporation, regional electric reliability organizations, and other grid planning authorities to promote early compliance planning, to support orderly implementation of the MATS standards, and to ensure that any potential, localized reliability concerns are identified and addressed. EPA has held and will continue discussions with power plant owners and operators to help them understand their responsibilities under the standards and their role in early, coordinated, and orderly planning. EPA is conducting specific outreach to stakeholders with unique concerns such as rural electric cooperatives, public power facilities, and investor-owned utilities. In addition, EPA will also engage in outreach to states and permitting authorities to help ensure that the fourth year for compliance is broadly available and that the process for sources to request and states to grant the extensions is clear and straightforward.

The Honorable Gene Green

1. Ms. McCarthy you said that the EPA plans to make available to the public, including relevant stakeholders, information that describes the process for identifying circumstances where electric reliability concerns might justify allowing additional time to comply. When will this information be publicly available and will ERCOT be involved in indentifying these circumstances?

[2] EPA Memorandum December 16, 2011. "The Environmental Protection Agency's Enforcement Response Policy For Use of Clean Air Act Section 113(a) Administrative Orders in Relation To Electric Reliability and the Mercury and Air Toxics Standard" http://www.epa.gov/compliance/resources/policies/civil/erp/mats-erp.pdf

See the response to question 2, below.

2. Ms. McCarthy, you mention in your testimony that the EPA will continue to hold a series of discussions with grid planning authorities to promote early compliance planning, to support orderly implementation of the MATS standards, and to ensure that any potential, localized reliability concerns are identified and addressed. Where are you in this process?

EPA is now in regular contact with planning authorities such as regional transmission organizations (including ERCOT, SPP, MISO, and PJM) as well as with utility companies that operate as planning authorities (such as Southern Company) and the North American Electricity Reliability Council and Regional Entities. In addition, EPA is working with the National Association of Regulatory Utility Commissioners (NARUC) and the regional utility commissioner organizations to promote early compliance planning and effective coordination of pollution control retrofit installations. These ongoing discussions are designed to encourage early information sharing and coordinated planning among relevant power sector authorities overseeing the actions that electric generators are expected to take in order to comply with the MATS standards. EPA expects that electric generators subject to MATS should be making a good-faith attempt to proactively identify any potential unit-specific implementation concerns and to share detailed information as soon as possible regarding those concerns not only with the Agency, but with the other relevant authorities with whom EPA is engaged in these planning discussions. This process of "early diagnosis" is intended to enable the generator, EPA, and related authorities to consider multiple options for resolving any particular unit-level concern within the timeframe allotted for MATS compliance.

3. The EPA estimates that sources generally will have until spring of 2016 to comply – one year longer than your analysis indicates is necessary for most sources. Do you have a breakdown (in percentages of the entire utility fleet) of how many companies will come into compliance in each year?

EPA did conduct a feasibility assessment to consider the industry's overall ability to deploy the projected pollution control technology within the Clean Air Act statutory timeframe allotted for MATS compliance, available online at http://www.epa.gov/ttn/atw/utility/revised_retrofit_feasibility_tsd_121611.pdf. While this assessment examined at a broad level the likely pattern of retrofit installations over time, it did not attempt to prescribe specific compliance plans to any single unit, facility, or company. EPA's assessment shows that a reasonable, moderately paced effort of the power sector and supporting industry, including some early starts, would result in the majority of the needed retrofits being installed by April 2015 with the possibility of some installations needing up to an additional year for completion. In the event that individual projects cannot be completed by the April 2015 statutory deadline for compliance, the Clean Air Act offers affected sources the opportunity to apply for a one-year extension. In the preamble to the final MATS rule, the EPA provided guidance indicating that this fourth year should be broadly available in a range of illustrative scenarios where more time is needed for the installation of technology. 77 Fed. Reg. 9304, 9406-11 (Feb. 16, 2012).

4. Critics of the rule argue that your approving the fourth and fifth year compliance extensions will be used under very limited circumstances. What kind of assurances can you give them that these extensions will not just be used under very limited circumstances? Do you have any examples you can cite?

Section 112(i)(3)(B) authorizes CAA Title V permitting authorities (generally States) to "issue a permit that grants an extension permitting an existing source up to 1 additional year to comply with standards under [CAA Section 112(d)] if such additional period is necessary for the installation of controls." Although the statute confers the ultimate discretion to provide this one-year extension to the relevant permitting authorities, the preamble to the final MATS rule provides guidance as to scenarios in which this authority may be exercised. 77 Fed. Reg. 9304, 9406-11 (Feb. 16, 2012). In general, the preamble articulates the EPA's view that the additional year under this provision should be available in a broad range of situations. It should be available where necessary to install controls on the relevant unit or to construct replacement power on the same site as the unit. In addition, the preamble states that the additional year may be available in a number of situations in which pollution controls are not being directly installed on the relevant unit, but where the unit must run in order to avoid a serious risk to electric reliability. Scenarios discussed in the preamble include situations in which a unit is needed to run until (a) another unit can complete the installation of controls, (b) new offsite replacement power generation is brought online, or (c) needed transmission upgrades are completed. In such scenarios, the EPA encourages permitting authorities to request that the owner/operator provide information from the relevant grid planning authority or other entity with relevant expertise demonstrating that retirement or deactivation of the unit within the otherwise applicable 3-year compliance period would result in a serious risk to electric reliability.

On December 16, 2011, EPA's Office of Enforcement and Compliance Assurance (OECA) issued a memorandum discussing the EPA's intended approach regarding the use of administrative orders ("AOs") under CAA Section 113(a) with respect to sources that must operate in noncompliance with the MATS rule for up to a year to address a specific and documented reliability concern. The policy can be accessed at: http://www.epa.gov/compliance/resources/policies/civil/erp/mats-erp.pdf. AOs are not extensions of the statutorily permitted timeframe. An AO is an individual exercise of the EPA's enforcement authority under Section 113(a) of the CAA.

As EPA has explained in the preamble to the MATS rule, its analysis indicates that most, if not all units, will be able to complete the installation of controls within the default 3-year period set forth in the statute. The EPA believes that there are likely to be few, if any, cases in which it is not possible to mitigate a reliability issue within four years, and that there are likely to be fewer, if any, cases in which it is not possible to mitigate a reliability issue within the further year contemplated under the enforcement policy. Thus, the EPA believes there will be a limited need for either a fourth year extension or an AO.

That being said, in the case of MATS we expect that the fourth year will be broadly available when it is needed. The EPA believes that making it clear that permitting authorities have the authority to grant the 1-year compliance extension under CAA Section 112(i)(3)(B) where necessary, in the range of situations discussed above, further alleviates any concern that utilities will not have sufficient time to comply.

There are not many examples to cite with respect to the one-year extension that may be granted by permitting authorities because in general most sources do comply with regulations similar to MATS within the three-year time frame. However, when needed, permitting agencies have made the fourth year available.

While we do not expect to have to issue many AOs pursuant to the enforcement policy, it is worth noting that the EPA has a lot of experience in using AOs to bring sources into compliance. In just FY 2011, for example, the EPA issued over one hundred Section 113(a) Clean Air Act administrative compliance orders (ACSOs) across industrial sectors and over 1,300 ACOs across media and statutes. A great many of these were "on consent," meaning that the receiving party had agreed to the path for coming into compliance by signing the ACO. The EPA is committed to achieving compliance with the MATS while ensuring electric reliability and crafted the enforcement policy to create a pathway to address reliability issues in an efficient and timely manner.

The Honorable Morgan Griffith

1. **Is it correct that the vast majority of mercury emissions in our air come from nature (such as volcanoes or forest fires), or foreign sources?**

There are large uncertainties regarding projected mercury global inventories. Mercury is emitted through natural and anthropogenic processes, and previously deposited mercury from either process may be re-emitted. The majority of natural mercury emissions arise from volcanoes, geothermal activity, mercury-enriched topsoil, and vegetation. Unlike power plant mercury emissions, these natural mercury emissions are dominated by the elemental form of mercury, and as a result have more impact on the global mercury pool than on deposition in the region of the emissions. See below for a more detailed discussion of mercury deposition.

2. **Is it correct that in EPA's proposed rule, EPA cites estimates of global mercury emission that range from 7,300 to 8,300 tons per year, and between 50 and 70% of that is from natural sources, less than 50% is from man-made sources?**

Current estimates of total global mercury emissions based on a 2005 inventory range from 6,600 to 7,500 metric tons per year (mt/yr). The United Nations Environment Programme (UNEP) estimates of global mercury emissions for 2005 are somewhat lower, at 5,600 mt/yr. Global anthropogenic mercury emissions, excluding biomass burning, have been estimated by many researchers. UNEP's 2005 estimate is approximately 1,900 mt/yr (with a range of 1,200 to 3,000 mt/yr) and the 2005 estimate by Pirrone, et al. is approximately 2,400 mt/yr. Global fossil-fuel fired power plants total approximately 500 to 800 mt/yr, a large fraction (25 to 35 percent) of the total global anthropogenic emissions.

3. How much mercury in the U.S. air comes from U.S. power plants, relative to natural, foreign, and non-power plant sources?

UNEP estimates the U.S. contributes approximately 3% of global mercury emissions, and power plants make up approximately half those emissions. But, the location and form of emissions matters. While emissions from other continents contribute to mercury deposition in the U.S., published research shows that U.S. coal-fired power plants significantly contribute to local and regional mercury deposition. Additionally, two of the forms of mercury emitted by power plants (particulate mercury and reactive gaseous mercury) deposit very quickly near the sources and tend to affect local and regional watersheds. Therefore, mercury emissions from US power plants can continue to put people at risk long into the future because mercury is persistent in the environment and it can be re-emitted from previous deposition.

4. Is it true that EPA forecast in the proposed rule that even without the Utility MACT rule, U.S. mercury emissions will continue to decline?

EPA projected total U.S. mercury emissions will decrease from 105 tons (2005) to 62 tons in 2016 without the MATS rule. Despite this decrease, however, EGUs would still account for about 50% of the total anthropogenic mercury emissions. With the MATS rule US emissions are projected to decrease to 42 tons.

5. Assuming that U.S. power plants are responsible for 0.3% of the mercury emissions in U.S. air, using estimates of global and source-specific emissions that EPA published in its proposed rule, and we reduce these emissions by 90%, how does reducing that small amount even to zero meaningfully improve public health when it fails to reduce the remaining 99.7% of mercury emissions?

When considering mercury in ambient air within the U.S. in terms of its potential public health impact, an important factor to consider is the deposition of that mercury to watersheds where people fish. From a public health standpoint, mercury in ambient air is likely to have its greatest public health impact not through direct inhalation, but rather through deposition to watersheds and subsequent build up of that mercury in fish which are caught and consumed by fishers.

U.S. power plants are today and will remain the largest source of mercury emissions in the U.S. unless we regulate them. In 2016, while on average the EPA estimates that US power plants will only contribute 2 percent of total deposition to watersheds in the U.S. (with the remaining mercury coming from other US sources, natural sources and foreign sources), in some areas, such as the Ohio River Valley, U.S. power plants can contribute up to 11 percent or more of total mercury deposition to some U.S. watersheds (76 FR 25009, May 3, 2011, Table 7 of the proposed rule - http://www.epa.gov/ttn/atw/utility/fr03my11.pdf).

Ten percent of watersheds have deposition of mercury from US power plant emissions that, when considered alone, causes a public health hazard, even without taking into account mercury deposition from other sources. In 24 percent of watersheds, mercury from EGUs, along with mercury from other emission sources, causes a public health hazard, and EGUs contribute at least 5 percent of the mercury deposited. In total, up to 29 percent of U.S. watersheds have populations that are potentially at risk from mercury emitted by U.S. EGUs.

Mercury emissions from EGUs can also contribute to future public health risks because mercury is persistent in the environment and can be re-emitted from previous deposition of mercury. While we can't solve the mercury problem just by regulating U.S. EGUs, we can reduce the largest domestic source of mercury exposures by regulating them.