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*spot*light

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Fish Tales About Mercury

Why regulation of mercury is all cost and no benefit

SUMMARY: North Carolina utility consumers may face higher rates for no justifiable reason if extreme mercury regulations are adopted. The United States Environmental Protection Agency (EPA) is regulating, for the first time ever, mercury emissions from power plants. The purpose is to minimize potentially harmful mercury levels in fish consumed by humans. However, there has never been any documented case in the United States of mercury poisoning from fish. Data linking fish consumption to any type of adverse effect in humans is very weak. In addition, the EPA acknowledges that it does not know the impact mercury emissions from power plants have on the mercury levels in fish. Despite the lack of benefits and the additional costs, North Carolina's Environmental Management Commission (EMC) is considering whether to adopt regulations which exceed the new and stringent federal standards.

In 2005, the United States Environmental Protection Agency (EPA) issued regulations, called the Clean Air Mercury Rule (CAMR), to reduce mercury emissions by 70 percent from coal-fired power plants (hereafter referred to as "power plants"). In North Carolina, these power plants generate about 61 percent of the total electricity.[1] The United States now is regulating mercury emissions from power plants for the first time and is the only country in the world to do so.[2] Despite this unprecedented step, North Carolina's Environmental Management Commission (EMC), an appointed body that adopts environmental regulations for the state,[3] is considering whether to go beyond the federal requirements when it finalizes the state's mercury regulations.[4]

The purpose of regulating mercury emissions is to reduce a form of mercury called methylmercury that is found in fish. The alleged problem is that mercury emitted from power plants is deposited in water bodies that contain fish. The deposited mercury then gets transformed into methylmercury that is eaten by the fish. It is further alleged that these fish have an unhealthy methylmercury level for human consumption. This *Spotlight* explains why methylmercury in fish and mercury emissions from power plants generally are not problems. There will be no benefits from going beyond the federal standards yet there will be costs that likely will be passed on to utility consumers.

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Public Health Concerns

Background on Methylmercury. Microscopic organisms can convert mercury deposited in water bodies, such as lakes, into methylmercury. Predators not only consume their own methylmercury but also take in the methylmercury of their prey — this process called bioaccumulation continues up the food chain. As a result, top predators, such as sharks, contain higher levels of methylmercury in their tissue than fish lower in the food chain.[5]

Can Methylmercury in Fish Ever Be Dangerous? At extremely high levels, methylmercury can cause significant health effects. Two tragic poisoning incidents in Japan, one in Minamata City during the 1950s and one in Niigata in 1965, led to methylmercury poisoning of humans. In both instances, manufactured methylmercury was directly released into the water causing excessively high levels of methylmercury in fish.[6] Two other direct poisoning incidents occurred in Iraq, however they were caused by the consumption of methylmercury in grain—methylmercury was used as a fungicide to treat the grain.[7] These tragedies though do not provide guidance as to whether North Carolinians and Americans are at risk when eating fish at the low-levels of methylmercury generally found in fish throughout the world.

Methylmercury Generally Is Not a Public Health Concern. The University of Maryland's Center for Food, Health, and Agriculture Policy puts the entire methylmercury question into perspective: "No case of mercury poisoning from fish consumption has ever occurred in the United States."[8] Dr. Thomas Clarkson, who is a toxicologist at the University of Rochester School of Medicine, has indicated that the two Japanese incidents are the only fish-related mercury poisoning cases in the scientific literature.[9]

Researchers have tried to find any possible harm caused by methylmercury in fish. In testimony provided to the Food and Drug Administration (FDA), Alaska state epidemiologist John Middaugh provided an overview of current research by stating, "Data linking low-level methylmercury exposure to adverse health effects are weak."[10]

Major Studies. The fetus and very young children are believed to be the most susceptible to methylmercury in fish.[11] The National Institute of Environmental Health Sciences, which is part of the National Institutes of Health (NIH), funded two major longitudinal studies. Both studies tried to determine the impact that prenatal methylmercury exposure had on children.

Researchers from the University of Rochester Medical Center conducted a study in the Seychelles Islands (Seychelles Islands study) that found that prenatal exposure to methylmercury caused no negative effects.[12] Women in the Seychelles eat the same kind of fish, with about the same level of mercury,[13] that are eaten by Americans. Dr. Gary Myers, the senior author of the Seychelles study stated, "These are the same fish that end up on the dinner table in the United States and around the world."[14] Amazingly, Seychelles women also eat 10 times more fish than Americans.[15]

Researchers from the Harvard School of Public Health conducted a study in the Faroe Islands (Faroe Islands study) that found that there were subtle neuropsychological effects from prenatal methylmercury exposure.[16] Unlike the similarity of diets found in Seychelles Islands study, the diet in the Faroe Islands is far different than the diet of Americans. The major source of methylmercury consumption in the Faroe Islands is whale blubber. The population in the Faroe Islands also is far less diverse than in the Seychelles Islands.[17]

In a November 29, 2000, letter to Environmental Protection Agency (EPA), technical information staff, Dr. Michael Dourson and Dr. Kenneth Poirier, former co-chairs of an EPA working group that studies issues such as human methylmercury levels, argued:

> Comparisons of fish consumption between the US and the Faroe Islands should not be used, in part, as a basis of the choice of critical study. … In this regard, studies from the Faroe Islands are inferior when compared to studies from the Seychelles.[18]

The EPA, however, adopted a National Research Council (NRC) committee's recommendations. The NRC recommended using the Faroe Islands study instead of the Seychelles Islands study to analyze the risk of methylmercury. There was only one reason why the Faroe Island study was selected over the Seychelles Islands study: "The committee concluded that it would be inappropriate to pick the Seychelles study as the basis for risk assessment, given the

available evidence for positive effects."[19] In other words, the Seychelles study was not selected because it did not show any problems caused by methylmercury.

The debate over these studies does not change the fact that regulation of mercury emissions is based on speculation, not on any known poisoning incident. There is no scientific consensus on whether methylmercury in fish has even a minor effect on humans. As Joel Schwartz argues in an American Enterprise Institute study:

> Indeed, the very reason for the controversy over the health effects of low-level mercury exposure is that the hypothesized effects are so small and subtle as to be difficult to detect even with large samples of children and a battery of specialized neurological tests.[20]

The Transport of Mercury from Power Plants

Reducing mercury emissions from power plants by 70 percent does not mean that methylmercury in fish will be reduced by 70 percent. There are many steps, as shown in Figure 1, that have to take place for mercury emitted from power plants to have any possible impact on fish. This whole process is poorly understood. The EPA recently explained in the proposed mercury regulations:

> Given the current scientific understanding of the environmental fate and transport of this element, it is not possible to quantify how much of the methylmercury in fish consumed by the U.S. population is contributed by U.S. [power plant] emissions relative to other sources of Hg [mercury] (such as natural sources and re-emissions from the global pool). As a result, the relationship between Hg [mercury] emission reductions from Utility Units [power plants] and methylmercury concentrations in fish cannot be calculated in a quantitative manner with confidence. In addition, there is uncertainty regarding over what time period these changes would occur. This is an area of ongoing study.[21]

The EPA is not even confident that reducing mercury emissions will have any impact on fish. However, the EPA still is pushing forward with its mercury regulations. The follow-

Figure 1: The Transport of Mercury: From Power Plant to Methylmercury in Fish

The following is a simple overview of the complex process that power-plant emissions must undergo to affect methylmercury levels in fish. The actual process is far more complicated.

Step One: Emissions

Mercury is released into the atmosphere by power-plant smokestacks.

Step Two: Deposition

Some of the emitted mercury eventually gets deposited in water bodies.

Step Three: Methylation

Some of the mercury reaching the water undergoes a complex chemical process turning it into methylmercury.

Step Four: Fish Consumption

To complete the process, some fish would have to consume the methylmercury directly or by eating other fish that have consumed the methymercury.

Figure 2: Global Mercury Emissions, 1999

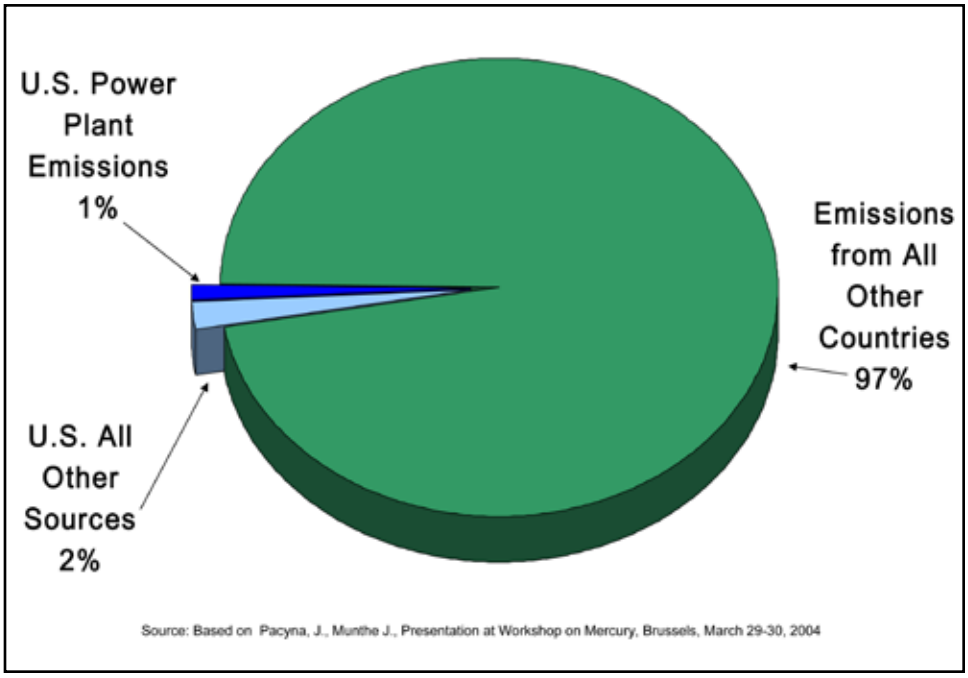
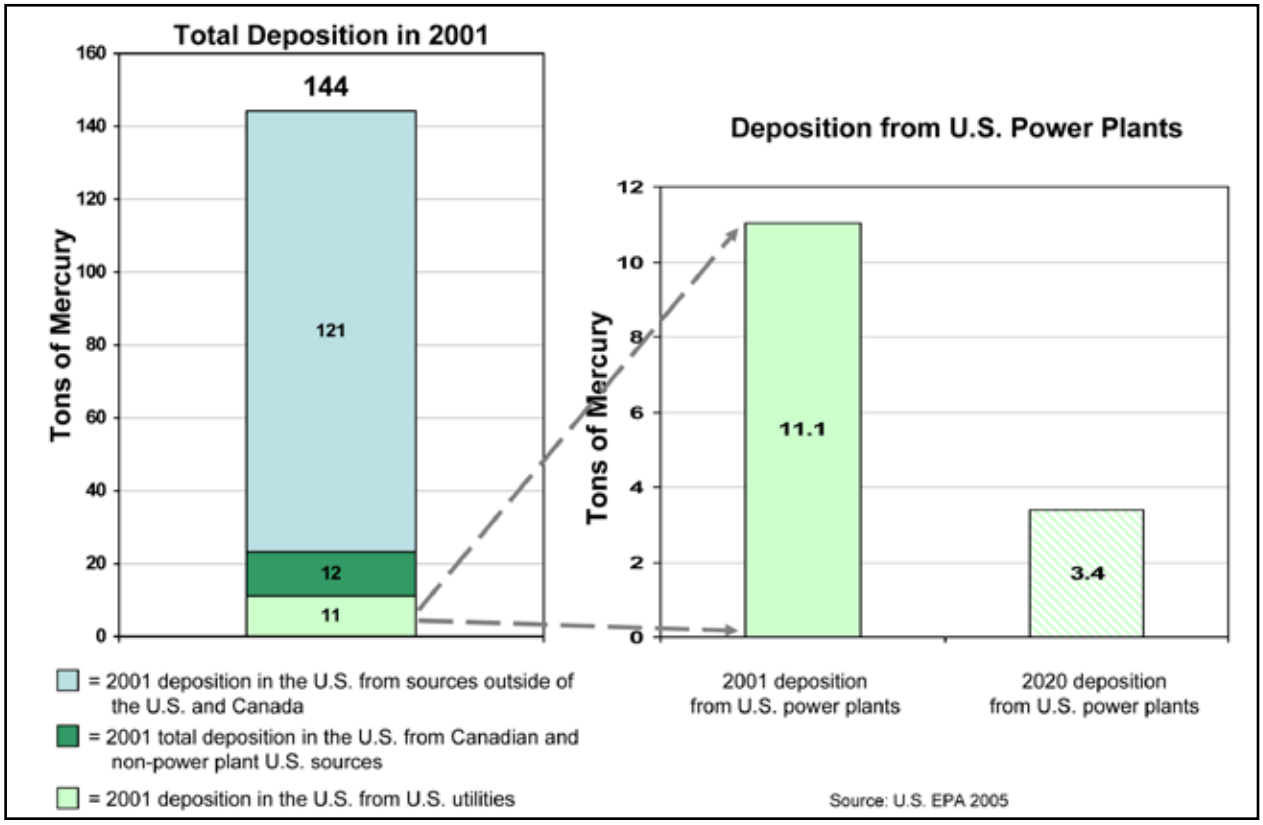


Figure 3: Mercury Deposition in the U.S.



ing provides some guidance on mercury emissions and this poorly understood process.

Mercury Emissions. If someone were to simply listen to some media accounts and environmental groups, an individual would think mercury emissions are far worse today in the United States than in the past. According to the EPA, since 1990, mercury emissions overall have dropped by 45 percent.[22]

U.S. power plant emissions also are a very small part of total emissions. As shown in Figure 2, U.S. power plant emissions account for only 1 percent of all global emissions.[23] It is worth noting that all man-made emissions (not just power plants) only account for one-third of all emissions. The remaining two-thirds consist of natural sources, such as volcano eruptions, and re-emitted sources (past human emissions re-emitted in the atmosphere)—each account for one-third of all emissions.[24]

Mercury Deposition. Mercury may be emitted from a power plant but this does not mean that the mercury is deposited on land or in a water body. Mercury emitted in the United States also may not be deposited within the country. The EPA has articulated the global nature of mercury:

> Mercury is a global problem that knows no national or continental boundaries. It can travel thousands of miles in the atmosphere before it is eventually deposited back to the earth in rainfall or dry gaseous forms.[25]

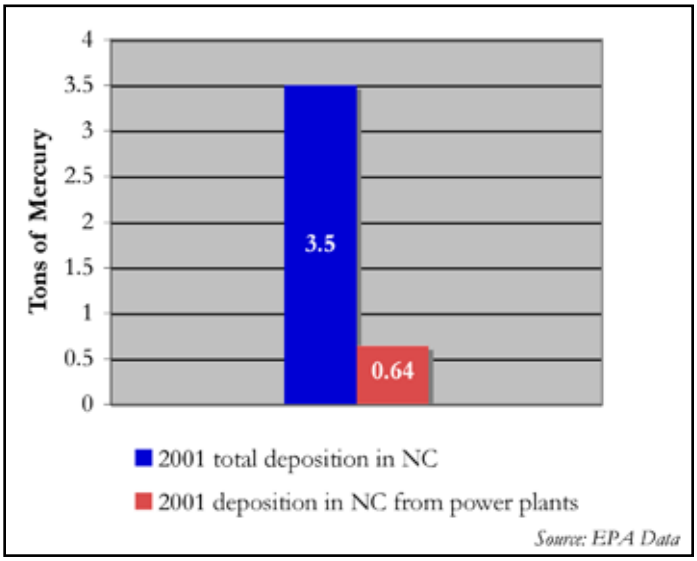
In its just released report entitled "EPA's Roadmap for Mercury," the EPA discusses some findings from its sophisticated modeling technology. The EPA estimates that 83 percent of the mercury that is deposited in the United States comes from international sources. The remaining 17 percent come from both U.S. and Canadian sources. This number, besides including Canadian sources, does not separate out the amount that comes from U.S. utilities.

As shown in Figure 3, the total amount of U.S. deposition from power plants in 2001 was 11.1 tons out of a total of 144 tons deposited.[26] This is only about 8 percent of all deposition in the country. The 2020 number of only 3.4 tons is the projected estimate after compliance with federal regulations. This would be about a 70 percent decrease in the amount of tons deposited by power plants.

These numbers are national numbers — there are going to be differences by region.[27] In North Carolina, power plant deposition still is only 18 percent of all deposition (see Figure 4). This number is comparable to the other states in

the region and is less than some of the states in the region such as Virginia (25 percent). As shown in Figure 5, in 2020, deposition will be drastically reduced in the state. Federal regulations are predicted to reduce power plant deposition in North Carolina by 81 percent. Also, in the state, global sources of deposition (other than the U.S. and Canada) will be 21 times greater than power plant deposition.[28]

Figure 4: Total Mercury Deposition in N.C., 2001



Methylation and Fish Consumption. The amount of mercury deposited in a specific water body is not equivalent to how much methylmercury will be consumed by fish. Mercury that gets deposited into a water body must first be transformed into methylmercury — this process is called methylation. For methylmercury to affect fish, the fish have to consume the methylmercury or consume other fish that have consumed methylmercury. The methylation rate and the impact methylmercury has on fish is contingent on numerous factors, including the characteristics of the ecosystem.

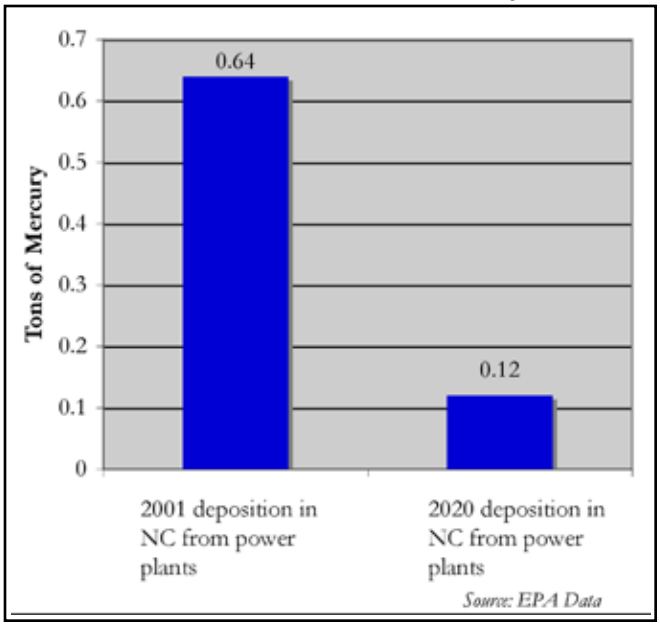
There have been some studies that have tried to determine the relationship between mercury deposition (not just from power plants) to the methylmercury levels in fish. As would be expected, the results have varied tremendously and demonstrate the complexity of the process. One study found that as deposition decreased, methylmercury levels in fish declined at half that rate. Another study found a one-third decline, and another study even found an inverse relationship—in other words, as deposition declined, methylmercury in fish actually increased.[29] This is highly unlikely but again shows that many factors unrelated to deposition determine methylmercury levels in fish.

Freshwater Self-Caught Fish

Lost in the mercury emissions debate is this critical point supported by the EPA: Mercury regulations, at best, would have an impact only on freshwater fish caught by recreational and subsistence fishers (freshwater self-caught fish). The EPA, in a detailed discussion in a recent regulatory document, concludes that marine fish (saltwater fish), estuarine and near-coastal fish, freshwater aquaculture fish, and freshwater commercial fish all are of small concern when it comes to mercury emissions — the focus should be on freshwater self-caught fish.[30] As it relates to marine fish, for example, the EPA wrote:

> EPA maintains that marine fish are a pathway of small concern when evaluating the health impact of Hg [Mercury] emissions from U.S. power plants.[31]

Figure 5: Mercury Deposition in N.C. from Power Plants, 2001 and 2020 (Projected)



Out of the fish that Americans eat, only about 7-8 percent are freshwater fish.[32] When freshwater aquaculture fish and freshwater commercial fish are removed from this number, it likely is reduced dramatically. Freshwater self-caught fish represent whatever number is left — a number that will be far less than even the low, 7-8 percent number.

Assuming that mercury emissions from power plants do increase methylmercury levels in freshwater self-caught fish to higher than recommended levels (within reason), this likely still is not a problem. Eating an occasional freshwater self-caught fish high in methylmercury is not going to be a health concern. Generally, the only concern would be for individuals

that eat freshwater self-caught fish as a regular part of their diet.

To put it simply, the only possible benefit, if there is any, even from the EPA's perspective, is to address methylmercury levels in freshwater self-caught fish for people that eat these fish as a regular part of their diet. There are no exact numbers, but it probably is fair to say that the number of people in North Carolina that could possibly be affected is miniscule.

Conclusion

North Carolina government officials should be angry that the federal government is imposing this mandate on the state for no justifiable reason. Instead, some policymakers and environmental groups are angry that the federal government did not go far enough.

For too long, environmental groups and utilities have been thought of as the sole "stakeholders" on environmental matters. All North Carolinians have a stake in environmental regulations. Utility consumers, for example, likely will be forced to pay higher rates if more stringent regulations are adopted—many of these consumers never will know that they are subsidizing the utilities so they can comply with the law. If North Carolina goes beyond the federal regulations, it is clear that we are not an environmental leader, as some policymakers so desperately want to call the state. North Carolina would simply be an environmental follower marching to the demands of environmental extremists.

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Notes

1. "North Carolina State Energy Plan," North Carolina State Energy Office, p. 21, at www.energync.net/sep/docs/sep03.pdf.
2. EPA Clean Air Mercury Rule web page entitled "Basic Information" at www.epa.gov/air/mercuryrule/basic.htm.
3. Environmental Management Commission (EMC) web site at h2o.enr.state.nc.us/admin/emc.
4. 2006 EMC agenda web page at h2o.enr.state.nc.us/admin/emc/2006/EMCAgenda2006.htm.
5. EPA web page entitled "Frequent Questions about Mercury" at www.epa.gov/mercury/faq.htm#2.
6. "Mercury in Fact and Fiction," House Resources Committee Chairman Richard W. Pombo and House Energy and Mineral Subcommittee Chairman Jim Gibbons, p. 14.
7. *Ibid.* at pp. 14-15.
8. See University of Maryland's Real Mercury Facts web site (specifically, see the definition of mercury poisoning) at www.realmercuryfacts.org/about_research_studies/index.htm.
9. Szwarc, Sandy, "Fishy Advice: The Politics of Methylmercury in Fish and Mercury Emissions," Competitive Enterprise Institute, December 2004 at p. 3, www.cei.org/pdf/4330.pdf, citing Milloy S., "Fishy Mercury Warning." Fox News, December 25, 2003.
10. Robert Ferguson and Willie Soon, "EPA Mercury Rule MACT Rulemaking Not Justified by Science," Center for Science and Public Policy, at p. 6, citing John P. Middaugh, testimony before the Food and Drug Administration Advisory Committee on Methylmercury, July 24, 2002.
11. "EPA's Roadmap for Mercury," United States Environmental Protection Agency, July, 2006 at p. 7.
12. "No Detectable Risk from Mercury in Seafood, Study Shows," University of Rochester Medical Center Press Release (May 15, 2003) at www.eurekalert.org/pub_releases/2003-05/uorm-ndr051503.php.
13. *Ibid.*
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15. Sally Squires, "Good fish, bad fish," *The Washington Post*, August 8, 2006, at www.washingtonpost.com/wp-dyn/content/article/2006/08/07/AR2006080700956_3.html.
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18. Letter from Dr. Kenneth Poirier and Dr. Michael L. Dourson to the EPA Technical Information Staff, November 29, 2000.
19. National Research Council, 2000, *Toxicological Effects of Methylmercury*, Washington, D.C.: National Academy Press at p. 286.
20. *Op. cit.*, note 17, at p. 21.
21. 69 Fed. Reg. 4652, 4658 (January 30, 2004) at a257.g.akamaitech.net/7/257/2422/30jan20041000/edocket.access.gpo.gov/2004/pdf/04-1539.pdf.
22. EPA Clean Air Mercury Rule web site includes chart entitled "Mercury Emissions have Dropped 45% Since 1990" at www.epa.gov/air/mercuryrule/pdfs/slide1.pdf.
23. EPA Clean Air Mercury Rule web site includes chart entitled "Mercury Emissions are a Global Problem" at www.epa.gov/air/mercuryrule/pdfs/slide3.pdf.
24. EPA web page on mercury entitled "Mercury Emissions: The Global Context" at www.epa.gov/mercury/control_emissions/global.htm.
25. *Ibid.*
26. EPA Clean Air Mercury Rule web site includes chart entitled "Mercury Deposition in the U.S." at www.epa.gov/air/mercuryrule/pdfs/slide2rev1.pdf.
27. *Op. cit.*, note 24.
28. EPA's web site contains data on mercury regulations, including state-by-state deposition modeling at www.epa.gov/ttn/atw/utility/OAR-2002-0056-6703.pdf.
29. *Op. cit.*, note 17, at pp. 11-12, and see footnotes 28, 30, and 31.
30. EPA's Notice of Reconsideration of Final Rule (Reconsideration of Regulatory Finding on Utility Emissions), October 21, 2005 at www.epa.gov/air/mercuryrule/pdfs/prop20051021b.pdf.
31. *Ibid.*
32. Calculations were based on data provided in "Estimated Per Capita Fish Consumption in the United States," United States Environmental Protection Agency, August, 2002 at pp. 4-39, www.epa.gov/waterscience/fish/consumption_report.pdf.