COMPETITIVE ENTERPRISE INSTITUTE

COMMENTS ON NRDC'S TESTIMONY ON POWER PLANT REGULATION

Prepared by
Joel Schwartz
Adjunct Scholar, Competitive Enterprise Institute
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INTRODUCTION AND SUMMARY

The Natural Resources Defense Council (NRDC) is the leading force behind Sen. James Jeffords's (I-Vt.) Clean Power Act (S. 366), a bill that would impose costly new controls on power plant emissions of sulfur dioxide, nitrogen oxides, mercury, and carbon dioxide. The Bush Administration's Clear Skies Initiative, which would establish new controls on sulfur dioxide, nitrogen oxides, and mercury, but not carbon dioxide, is, in no small measure, a "me-too" response to Senator Jeffords's bill. It is thus fair to say that NRDC is driving much of the debate in Washington over Clean Air Act "reform."

NRDC Climate Center Director David Hawkins has testified twice on the Clean Power Act, and once on the Clear Skies Act (S. 485).[1] Mr. Hawkins has argued that the Bush plan will kill thousands of Americans every year because it does not go far enough to reduce power plant emissions.

This paper examines NRDC's claims regarding the health and mortality effects of fine particulate matter ($PM_{2.5}$) and mercury emissions. It finds that $PM_{2.5}$ at current levels is unlikely to be increasing mortality, and that sulfate—the form of PM caused by power plant emissions—is a particularly implausible cause of deaths, because sulfate is not toxic.

Current power plant mercury emissions are also an implausible cause of harm. Power-plant mercury is a concern because high levels are found in some non-commercial freshwater fish consumed by sport-fishers and their friends and families. But less than one in 1,000 women have blood mercury levels as high as those associated with even subtle reductions in children's neurological health. Furthermore, as EPA concluded, no one knows where the mercury in fish is coming from. Most of it may come from past emissions that remain in the environment and are continually deposited and reemitted, and/or from areas outside the U.S. where mercury emissions are much higher. Thus, there is a significant risk that mandatory reductions in power plant mercury emissions will not significantly reduce mercury levels in freshwater fish.

Because higher incomes allow people to enhance their overall health and safety, the economic burdens of the Clean Power Act and the Clear Skies Act are likely to do more harm than good for public health.

[1] David G. Hawkins, Director, NRDC Climate Center, Testimony at the Hearing on S. 485 ("Clear Skies Act of 2003" to the U.S. Senate Committee on Environment and Public Works, Subcommittee on Clean Air, Climate Change, and Nuclear Safety, April 8, 2003.

1. DEATH AND DISEASE FROM POWER PLANT POLLUTION

NRDC Claim: "Sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions from power plants create dangerous concentrations of fine particles and ozone (soot and smog) in the air that 175 million people breathe. Soot and smog caused by power plant emissions is causing 30,000 premature deaths, hundreds of thousands of asthma attacks, and millions of days of illness and lost work each year." [2]

a. CEI Comments:

i. Sulfate particulate matter is not toxic.

The claim of 30,000 deaths is based on the presumed health effects of airborne particulate matter (PM). Almost all power-plant-related PM is in the form of sulfate due to sulfur dioxide emissions.[3] But it is not plausible that sulfate is causing either death or respiratory distress, because toxicology studies show sulfate is non-toxic across the range of levels found in air. For example:

A. Inhaled ammonium sulfate is used as an inactive control (that is, a substance with no health effects) in studies with human volunteers of the effects of inhaling acidic aerosols.[4] Ammonium sulfate is the principal form of sulfate PM.[5]

B. Inhaled magnesium sulfate is used therapeutically to *reduce* airway constriction in asthmatics.[6]

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[2] NRDC is relying on the following study, which was commissioned by environmental groups: Abt Associates, *The Particulate-Related Health Benefits of Reducing Power Plant Emissions*, prepared for the Clean Air Task Force, October 2000. See Exhibit 6-3, pg. 6-4 for the claim of 30,100 deaths due to particulate matter. The Abt study's mortality claim is itself ultimately based on the American Cancer Society study of particulate matter (PM) and mortality (Daniel Krewski et al., *Reanalysis of the Harvard Six Cities Study and the American Cancer Society Study of Particulate Air Pollution and Mortality,* Health Effects Institute, July 2000, and C. A. Pope et al., "Particulate Air Pollution as a Predictor of Mortality in a Prospective Study of U.S. Adults," *American Journal of Respiratory and Critical Care Medicine*, vol. 151, no. 3 part 1 (1995), pp. 669-74). EPA used the American Cancer Society study as a main justification for its annual-average $PM_{2.5}$ standard of 15 micrograms per cubic meter ($\mu g/m^3$).

[3] Nitrogen oxide (NOx) emissions from power plants are not a significant factor in the mortality claims. PM reductions are the source of all the mortality benefits EPA and environmentalists predict from reducing power plant emissions. NOx accounts for only a few percent of PM in the eastern U.S., and only about one-fourth of NOx comes from power plants (one-third if coal-fired industrial boilers are added). Sulfur dioxide reductions account for almost all of the PM reductions because sulfur dioxide is the main source of power-plant-related PM. (See, for example, Mei Zheng et al., "Source apportionment of $PM_{2.5}$ in the Southeastern United States Using Solvent-Extractable Organic Compounds as Tracers," *Environmental Science and Technology* 36 (2002), pp. 2361-71, and Glen R. Cass et al., "Determination of Fine Particle and Coarse Particle Concentrations and Chemical Composition in the Northeastern United States, 1995," prepared for NESCAUM, December 1999.)

[4] R. B. Schlesinger and L. C. Chen, "Comparative Biological Potency of Acidic Sulfate Aerosols: Implications for the Interpretation of Laboratory and Field Studies," *Environmental Research*, vol. 65, no. 1 (1994), pp. 69-85; J. Q. Koenig, et al., "Respiratory Effects of Inhaled Sulfuric Acid on Senior Asthmatics and Nonasthmatics," *Archives of Environmental Health*, vol. 48, no. 3 (1993), pp. 171-5.

[5] Environmental Protection Agency, "Latest Findings on National Air Quality: 2001 Status and Trends," September 2002.

[6] L. J. Nannini, Jr. and D. Hofer, "Effect of Inhaled Magnesium Sulfate on Sodium Metabisulfite-Induced Bronchoconstriction in Asthma," *Chest*, vol. 111, no. 4 (1997), pp. 858-61.

C. Sulfate is already present in our bodies at many times the amount that could possibly be inhaled given current sulfate PM levels.[7]

D. Sulfate is sometimes present as an acid (sulfuric acid), which could have health effects. But even in asthmatics, 70 micrograms per cubic meter was the minimum amount necessary to cause any health effects—much greater than is ever found in air.[8]

If sulfate is non-toxic, then claims about the relationship between power plant pollution and mortality and respiratory disease are false. There is then no health justification for the sulfur dioxide reduction requirements of President Bush's Clear Skies Initiative or Senator Jeffords's Clean Power Act.[9]

The NRDC recommendations will impose billions per year in costs on electricity consumers, but will not improve health.

ii. Regulatory costs cause deaths. People ultimately bear regulatory costs through reductions in their disposable income, because regulations increase the costs of producing useful goods and services. People, on average, use their income to increase health and safety for themselves and their loved ones. Therefore reducing people's income reduces their health. Only policies that do more good than harm can deliver *net* benefits for public health and welfare.

A. Researchers estimate that every $15 million in additional regulatory costs results in one additional induced fatality.[10] Expected health benefits of a regulation must be weighed against these health costs in order to increase the likelihood that a given regulation will provide net health benefits to the public.

1. NRDC claims its proposal would cost $10 billion per year. If so, it would result in an additional 670 deaths per year, based on the relationship between income and mortality.

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[7] D. J. Edwards et al., "Plasma Concentrations of Inorganic Sulfate in Alzheimer's Disease," *Neurology*, vol. 43, no. 9 (1993), pp. 1837-8; D. E. Cole, "Microassay of Inorganic Sulfate in Biological Fluids by Controlled Flow Anion Chromatography," *Journal of Chromatography*, vol. 225 (1981), pp. 359-367.

[8] J. Q. Koenig, et al., "Respiratory Effects of Inhaled Sulfuric Acid on Senior Asthmatics and Nonasthmatics," EPA, "Air Quality Criteria for Particulate Matter, Third External Review Draft," pg. 7-27.

[9] For a detailed discussion of the PM and mortality see, Joel Schwartz, "Particulate Air Pollution: Weighing the Risks," Competitive Enterprise Institute, April 2003.

[10] Randall Lutter, John F. Morrall, and W. Kip Viscusi, "The Cost-per-Life-Saved Cutoff for Safety-Enhancing Regulations," *Economic Inquiry*, vol. 37 (1999), pp. 599-608. Their "best estimate" was $15 million, with a range of $10 million to $50 million.

2. POWER PLANT NOx EMISSIONS AND OZONE

NRDC Claim: "Sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions from power plants create dangerous concentrations of fine particles and ozone (soot and smog) in the air that 175 million people breathe. Soot and smog caused by power plant emissions is causing 30,000 premature deaths, hundreds of thousands of asthma attacks, and millions of days of illness and lost work each year."

a. CEI Comments:

i. EPA's "NO_X SIP Call" regulation requires a 60 percent reduction in eastern coal-fired power plant NO_X emissions starting in 2004, eliminating most eastern coal-plant NO_X emissions. The NO_X SIP Call caps systemwide NO_X emissions from power plants and industrial boilers at 60 percent below current levels from May to September—the "ozone season." Starting in 2008, Clear Skies would simply extend these reductions to the rest of the year when they would do little or nothing to improve health, and would reduce NO_X emissions another 7 percentage points in 2018.

ii. The NO_X SIP Call, combined with vehicle standards implemented during the last eight years, and already-adopted vehicle standards that will be implemented in 2004 (EPA's "Tier 2" standards for light-duty vehicles), and 2007 (EPA's heavy-duty rule)[11] will eliminate almost all remaining ozone-forming pollutants during the next 20 years.

A. NO_X combines with volatile organic compounds (VOCs) to form ozone. Coal-fired boilers—including power plants and industrial boilers—account for about one-third of eastern NO_X emissions, with most of the rest coming from automobiles and diesel trucks. About two-thirds to three-quarters of VOCs come from motor vehicles.[12]

B. As measured in on-road studies and in vehicle emissions inspection programs, automobile emissions have been dropping by about 10 percent per year due to fleet turnover to progressively cleaner and more durable vehicles.[13]

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[11] EPA, "Regulatory Impact Analysis: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements," Report no. EPA420-R-00-026, December 2000, and EPA, "Control of Air Pollution From New Motor Vehicles: Tier 2 Motor Vehicle Emissions Standards and Gasoline Sulfur Control Requirements; Final Rule, *Federal Register,* February 10, 2000.

[12] EPA claims that less than half of VOC comes from motor vehicles; but real-world "source apportionment" studies of VOCs in air find much higher vehicle contributions (John G. Watson et al., "Review of Volatile Organic Compound Source Apportionment by Chemical Mass Balance," *Atmospheric Environment,* vol. 35 (2001), pp. 1567-84).

EPA's official NO_X inventory *overestimates* off-road diesel NOx emissions by a factor of 2.2 and *underestimates* on-road heavy-duty diesel-truck NO_X emissions by a factor of 2 (Andrew J. Kean, Robert F. Sawyer and Robert A. Harley, "A Fuel-Based Assessment of Off-Road Diesel Engine Emissions," *Journal of the Air and Waste Management Association*, vol. 50 (2000), pp. 1929-39).

[13] Joel Schwartz, "No Way Back: Why Air Pollution Will Continue to Decline," American Enterprise Institute, May 2003 (forthcoming, but available now in draft form). This study is based on real-world vehicle emissions data and the requirements of future standards. EPA's own MOBILE6 model makes a similar prediction.

C. Even after accounting for growth, already-adopted vehicle emission standards will eliminate more than 80 percent of vehicle VOC and NO_X emissions during the next 20 years, as the fleet turns over to progressively cleaner vehicles.[14]

D. The cheapest quickest way to get additional near-term pollution reductions would be to speed the retirement of the remaining stock of older, high-polluting vehicles. For example, on-road measurements show that about half of automobile VOC emissions come from the worst 5 percent of vehicles. On-road remote sensing can be used to identify some of these vehicles and offer their owners cash for scrapping them.[15]

iii. Clear Skies and the Clean Power Act provide few or no marginal benefits for ozone. Because already-adopted measures will eliminate most remaining ozone-forming air pollution in coming years, the marginal benefit of Clear Skies and the Clean Power Act over and above already-adopted requirements is small and may be zero.[16] To eliminate near-term air pollution, remote-sensing-targeted scrappage is the quickest, cheapest way to achieve reductions, and such a policy would also avoid imposing large ongoing costs on the American public.

[14] Ibid.

[15] Ibid.

[16] EPA predicts in its Clear Skies analysis that some counties would fail to attain the 8-hour ozone standard even after implementation of the already-adopted vehicle and power plant regulations. This is likely due to EPA's serious underestimation of the contribution of automobiles to the VOC inventory and of diesel trucks to the NOx inventory (see note 12 above). Because automobile and diesel truck emissions contribute a much larger fraction of ozone-forming pollution than EPA assumed in its analysis, EPA's already-adopted rules will eliminate a much greater percentage of current air pollution than EPA assumed.

3. MERCURY EMISSIONS FROM COAL-FIRED POWER PLANTS

NRDC Claims: "One in 12 women of childbearing age has mercury levels above EPA's safe health threshold…Nationally, this translates into nearly 4.9 million women of childbearing age with elevated levels of mercury from eating contaminated fish and more than 300,000 newborns at risk of neurological impairment from exposure *in utero*."

"An estimated 60,000 children are born each year at a significantly increased risk of adverse neurological effects from mercury and current exposure levels increase the number of children 'who have to struggle to keep up in school and who might require remedial classes of special education,' according to the National Academy of Sciences. Eating mercury-tainted fish also can harm cardiovascular and immune systems in adults."

"Mercury is a potent brain poison (neurotoxin) even in very small amounts."

a. CEI Comments:

i. Less than one in 1,000 women have blood mercury as high as levels associated with subtle neurological effects in children.

The first sentence in NRDC's statement is true, but misleading. One in 12 women do have blood mercury levels greater than EPA's "reference dose" (RfD).[17] But EPA sets the RfD with several substantial safety factors built in, so it is far below the actual level estimated to have even subtle health effects. The chain of safety factors is as follows:[18]

A. *EPA chose the one epidemiological study that reported a mercury effect from fish consumption though two others did not.* There are three major epidemiological studies of mercury and neurological impairment in children due to consumption of mercury-contaminated fish—in the Faroe Islands, the Seychelles, and New Zealand. The study populations were chosen due to their traditional diet high in types of fish and sea mammals with high levels of mercury contamination. Only the Faroe Islands study reported neurological effects across the range of exposures in the group studied. EPA used this study to set the RfD.

B. *The Faroe Islands result may be due to unique fish consumption patterns that do not occur in the United States.* The positive result in the Faroe Islands study might have resulted from a unique mercury exposure pattern due to "opportunistic" high consumption of whale meat when a whale happened to be killed for food. As a result, mercury exposure temporarily more than doubled for several days. These temporary high exposures, rather than lower ongoing exposures, could have caused the observed association between mercury and neurological health.

C. *The safety limit is set to protect against the most sensitive health effect.* In setting a RfD, EPA begins with the health effect with the lowest threshold dose level. In this case, the RfD was set based on the lowest mercury dose that resulted in reduced

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[17] Centers for Disease Control and Prevention, *Second National Report on Human Exposure to Environmental Chemicals* (Atlanta, January 2003).

[18] Randall Lutter and Elizabeth Mader, *Health Risks from Mercury Contaminated Fish: A Reassessment*, AEI-Brookings Joint Center for Regulatory Studies, March 2001; and EPA, Integrated Risk Information System, "Methylmercury Reference Dose."

scores on the Boston Naming Test, a relatively specific neurological test in which children name objects based on line drawings. The Faroe Islands study did not find any relationship between prenatal mercury exposure and broader tests of cognitive and intellectual performance.[19]

D. *A statistical safety factor is added.* EPA estimates a "benchmark dose" (BMD) as the first quantitative step in setting the RfD. The BMD is the estimated blood mercury level required to cause a decrease in scores on the Boston Naming Test. In this case, the BMD was 85 parts per billion (ppb). To be conservative, EPA then estimated the lower limit of the 95 percent confidence interval (95 percent CI) for the BMD (the "true" value of the benchmark dose has a 95 percent chance of lying within the 95 percent CI). This value is 58 ppb and is referred to as the "BMDL"—the benchmark dose lower limit.

E. *An uncertainty factor is added.* To get the reference dose, EPA takes the BMDL and divides by 10, for an RfD of 5.8 ppb blood mercury level. The factor of 10 is included to account for uncertainties in individual responses to mercury exposure across the U.S. population and is a standard method of setting safety limits for chemical exposure.

The chart on page 9 compares the distribution of mercury exposures in women aged 16-49 with mercury doses estimated, based on the Faroe Islands study, to be associated with reduction in scores on the Boston Naming Test.

To summarize:

- Although one in 12 women have blood mercury greater than the RfD, most are near the RfD. Only about 1 in 100 women have blood mercury greater than 5 times the RfD (half the BMDL), and only about 1 in 1,000 have blood mercury greater than the BMDL.
- NRDC notes correctly that one in 12 women have blood mercury levels greater than the RfD, but then claims incorrectly that these mercury levels are high enough to cause serious neurological impairment to children exposed *in utero*.
- NRDC ignores all of the safety factors between the RfD and doses that actually cause harm. Because the RfD is so conservative, exceeding the RfD is unlikely to cause harm.
- Nevertheless, NRDC implies that current mercury exposures are resulting in hundreds of thousands of learning disabled children. But we have seen that of the one in 12 women with blood mercury above the RfD, only about one percent of them have blood mercury greater than the BMDL. This means that, even taking the results of the Faroe Islands study results at face value, the worst-case scenario for the children of these women is a small reduction in performance on a very specific neurological test, and no effect on broader cognitive and intellectual performance.

[19] Ibid.

While NRDC wants to scare us into believing that as many as 300,000 children per year are being severely impaired by mercury exposure through freshwater fish, the evidence suggests that at worst a few hundred per year are being subtly impaired. While this certainly isn't good, it is a far cry from the public health crisis NRDC and other environmental groups are trying to manufacture.

ii. EPA does not know whether reducing power-plant mercury emissions will reduce fish mercury levels.

A. In its *Mercury Report to Congress*, EPA concluded: "Because of the current scientific understanding of the environmental fate and transport of this pollutant, it is not possible to quantify the contribution of U.S. anthropogenic emissions relative to other sources of mercury, including natural sources and re-emissions from the global pool, on methylmercury levels in seafood and freshwater fish consumed by the U.S. population. Consequently, the U.S. EPA is unable to predict at this time how much, and over what time period, methylmercury concentrations in fish would decline as a result of actions to control U.S. anthropogenic emissions."[20]

In other words, we could spend $8.4 billion per year reducing power plant mercury emissions and have nothing to show for it but higher electricity bills. The $8.4 billion per year is the Energy Information Administration's (EIA) estimate of the cost of a 90 percent mercury reduction, as recommended by NRDC and required by the Jeffords bill.[21]

B. Using the relationship of one induced death per $15 million in regulatory costs,[22] $8.4 billion in regulatory costs would result in more than 500 additional deaths per year—a toll virtually certain to outweigh any conceivable benefits from the mercury reductions.

The actual cost could be substantially higher. EIA's analysis assumed an emissions trading program whereby utilities with high mercury abatement costs could purchase mercury emission allowances from utilities with low abatement costs. The Jeffords bill, however, does not allow trading under the mercury cap.

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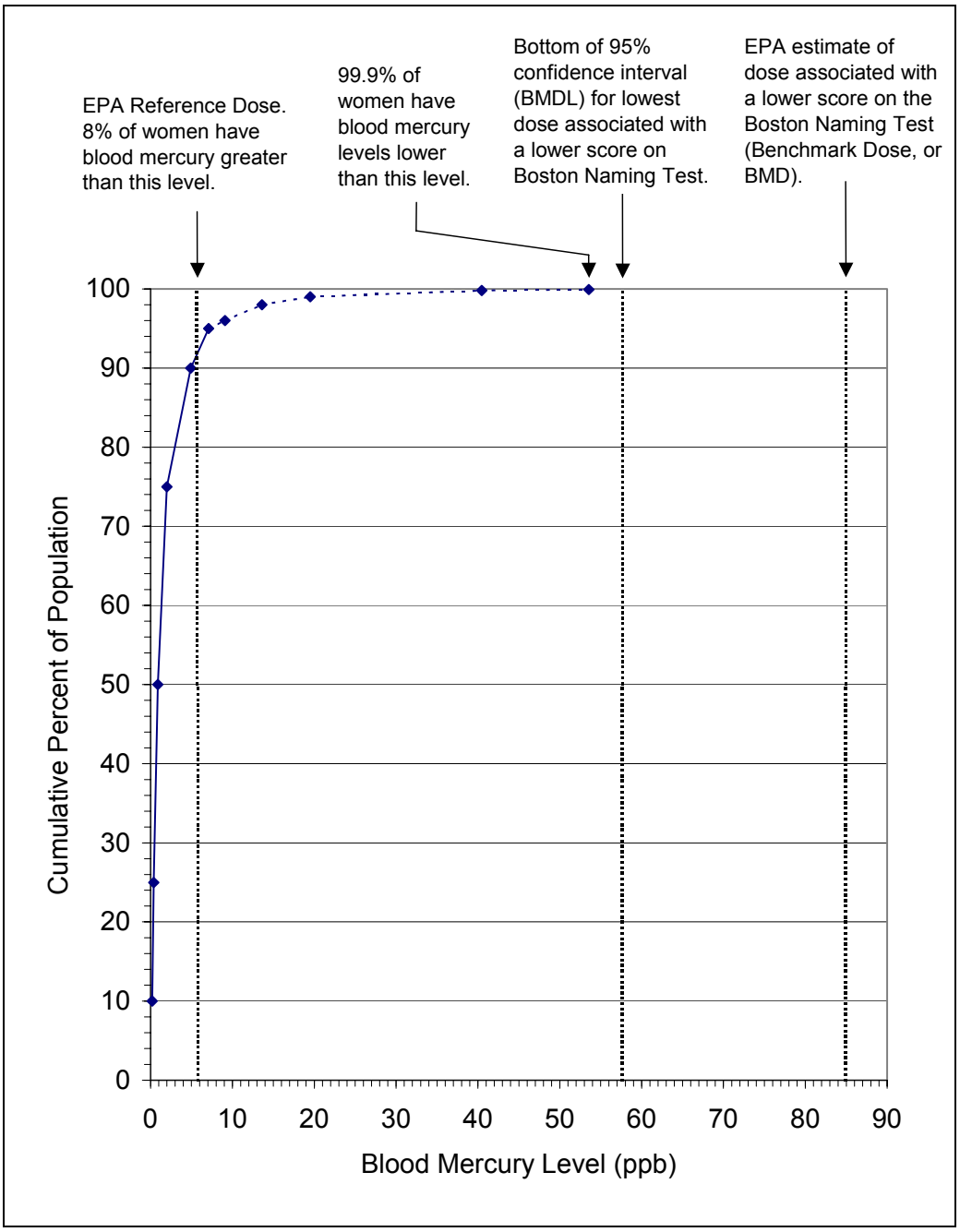
[20] EPA, *Mercury Study Report to Congress, Executive Summary*, 1997.

[21] Energy Information Administration, "Analysis of Strategies for Reducing Multiple Emissions from Electric Power Plants: Sulfur Dioxide, Nitrogen Oxides, Carbon Dioxide, and Mercury and a Renewable Portfolio Standard," July 2001.

[22] Lutter, Morrall, and Viscusi, "The Cost-per-Life-Saved Cutoff for Safety-Enhancing Regulations."

Comparison of Blood Mercury Levels in Women Aged 16-49 with Levels Associated with Health Effects



Notes: Data on women's mercury exposure come from the Centers for Disease Control, "Second National Report on Human Exposure to Environmental Chemicals." The CDC report gives levels up to the 95th percentile of the population. Mercury exposure above this level was estimated based on the assumption of a lognormal distribution.

iii. Complete elimination of coal-plant mercury emissions could reduce freshwater fish mercury levels by 20 percent at most, and likely far less.

EPA predicts that only about 60 percent of all mercury deposited in the U.S. comes from U.S. emissions, and only 1/3 of U.S. emissions come from coal plants; coal plants could thus account for at most 20 percent of U.S. mercury deposition (0.6 * 0.33 = 0.2 or 20 percent).[23] If there is a one-to-one relationship between coal plant mercury emissions and freshwater fish levels, then mercury in freshwater fish would decline by 20 percent, given a 100 percent reduction in coal-plant mercury emissions. There would be no effect on ocean fish, which are affected by the "global pool" of mercury already in the environment and emissions from other parts of the world (the U.S. makes up only three percent of world mercury emissions).

If all mercury exposure came only from eating contaminated, non-commercial[24] freshwater fish, then the maximum exposure reduction would be 20 percent. In reality, we have no idea whether reducing coal-plant mercury emissions will have any effect on mercury in freshwater fish. Furthermore, only a portion of mercury exposure comes from eating non-commercial freshwater fish. Thus, the actual reduction in mercury exposure would be much lower than 20 percent. There would be no reduction at all in mercury exposure if reducing coal-plant mercury emissions turns out to have no effect on freshwater fish mercury levels.

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[23] EPA, *Mercury Study Report to Congress, Volume II*, 1997.

[24] The mercury exposure concern for freshwater fish centers on non-commercial fish that sport-fishers catch for consumption by themselves and their family and friends, rather than on commercially sold freshwater fish, which is regulated by the Food and Drug Administration.

4. POLLUTION HOT SPOTS

NRDC Claim: "Under the administration's bill, a power plant can pollute at any level so long as it buys sufficient pollution allowances credits from other plants. The fact that power plant pollution may decline nationwide, however, provides no protection to the communities affected by a plant whose emissions stay the same, or even increase, because of its owner's reliance on emissions trading."

a. CEI Comments: Trading programs do not produce hot spots.

i. In a trading program, the highest polluting facilities are the most likely to reduce emissions. Under the Clean Air Act Title IV sulfur dioxide trading program, the plants with the highest emissions were the most likely to reduce their emissions. This is to be expected based on the following reasoning: Under a trading program, facilities with the lowest pollution control costs will account for most pollution reductions. But the facilities with the lowest pollution control costs are the ones with the highest emissions. This is because the facilities with the highest emissions have high emissions because they have not installed any controls. Since the marginal cost of control is lowest for the first increment of pollution reduction, the highest-emitting facilities have the lowest control costs and are therefore the first to have their emissions reduced.[25]

ii. Power plant emissions aren't causing hot spots. The emissions of concern are nitrogen oxides (NO_X), sulfur dioxide (SO_2), and mercury. None of these pollutants cause local exceedances of air pollution standards—virtually the entire country complies with NO_X and SO_2 health standards, almost always by a large margin.[26] Power plant emissions of NO_X and SO_2 are of concern because they can cause elevated ozone and PM levels hundreds of miles downwind. Mercury is of concern not as an air pollutant per se, but because some environmentalists believe that coal-plant mercury emissions are responsible for high mercury levels in some freshwater fish.

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[25] Byron Swift, "How Environmental Laws Work: An Analysis of the Utility Sector's Response to Regulation of Nitrogen Oxides and Sulfur Dioxide Under the Clean Air Act," *Tulane Environmental Law Journal* (Summer 2001), pp. 309-425

[26] All of the nation's several hundred NOx monitoring sites meet the NOx health standard, while all but one or two meet the SO_2 standard.