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Mercury, Risk, and Justice

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Associate Professor of Law, Seattle University School of Law; Member Scholar, Center for Progressive Regulation. This Article relies on analysis of the U.S. Environmental Protection Agency's (EPA's) data by Douglas Steding, Ph.D., University of Washington Law School Class of 2005. Doug's background in atmospheric chemistry and his knowledge, in particular, of mercury's behavior in the atmosphere were invaluable. I am grateful to the Center for Progressive Regulation for its support of this work. I am also indebted to Dwight Atkinson, Ellen Brown, Mary Jo Krolewski, and Tamara Saltman, EPA; to Neil Kmiecik and Ann McCammon Soltis, Great Lakes Indian Fish and Wildlife Commission; to John Persell, Minnesota Chippewa Tribe; and to John Heinrich, Wisconsin Department of Natural Resources. Each of these individuals graciously shared their time and expertise. The perspectives and errors in this Article are, of course, mine. I am grateful to Doug Steding, Rena Steinzor, and the participants in the Georgetown Environmental Research Workshop, particularly Jason Burnett and Lisa Heinzerling, for their comments. Finally, I am thankful for the extraordinary efforts of Kerry Fitz-Gerald, Reference Librarian, Seattle University School of Law, and for the excellent research and editorial assistance of Kenan Isitt and Melissa Winters.

Introduction

In December 2003, the U.S. Environmental Protection Agency (EPA) announced its long-awaited proposal for regulating mercury emissions from coal-fired utilities.[1] This regulation was widely expected to require a 90% reduction in mercury emissions from these facilities—from approximately 48 tons to 5 tons—to be achieved by 2007. Instead, EPA proposed a rule that would permit coal-fired utilities to continue to emit more mercury for a longer time. In fact, EPA offers two potential approaches, neither of which would require sources to do much to reduce their mercury emissions until well into the next decade. EPA clearly favors a cap-and-trade approach, so expends some effort to locate a statutory home for this approach within the federal Clean Air Act's (CAA's) provisions for toxic air emissions. Perhaps unsure of its success, EPA also produces a technology-based standard, following the ordinary process for regulating air toxics under §112 of the Act. However, the maximum achievable control technology (MACT) standard EPA fashions is so far off the mark that it can only have been intended to serve as a foil for EPA's preferred approach.

EPA's attempt to avoid the steep emissions reductions required by MACT and apply the tool of cap-and-trade to the problem of mercury has met with a raft of criticism. The clamor over the proposed rule is not surprising, given the procedural irregularities that have come to light, given the

1. U.S. EPA, Proposed National Emissions Standards for Hazardous Air Pollutants; and, in the Alternative, Proposed Standards for Performance for New and Existing Stationary Sources: Electric Utility Steam-Generating Units; Proposed Rule, 69 Fed. Reg. 4652 (Jan. 30, 2004) [hereinafter U.S. EPA, Proposed Mercury Rule].

creative interpretations of the CAA on which EPA's proposal rests, and given, importantly, what is at stake from mercury contamination. This critical attention is warranted as well because cap-and-trade, like other regulatory tools, has strengths and weaknesses that make it well suited for some environmental problems but ill suited for others. For a variety of reasons, cap-and-trade—at least as fashioned by EPA—may simply be the wrong tool to address the problem of mercury.

Mercury is highly toxic to humans. Exposure to even small amounts of methylmercury (MeHg) can lead to irreversible neurological damage. Methylmercury's neurodevelopmental effects place the developing fetus and children at particular risk. Humans are exposed to MeHg primarily through the consumption of contaminated fish. Methylmercury contamination is severe and widespread. Vast expanses of the waters that support fish on which humans rely for food are under fish consumption advisory due to MeHg contamination. By the most recent tally, 45 states and several tribes have issued advisories placing some or all of their waters off limits for those who would eat the fish they catch. Mercury advisories blanket the lakes and rivers of the Northeast, the Ohio Valley and the upper Great Lakes. As of 2003, 21 states and 1 tribe have issued advisories covering the entirety of their lakes and/or rivers. In addition, 100% of Lakes Superior, Michigan, Huron, and Erie are under mercury advisory. This is an extraordinary indictment.

Given its promise of a "least-cost" means of securing a given level of emissions reductions, a cap-and-trade approach could potentially address mercury contamination more cheaply than the alternatives. Under its cap-and-trade approach, EPA would set an overall cap on mercury emissions; allocate "allowances" authorizing sources in the aggregate to emit up to the level set by the cap; and permit sources to trade allowances among themselves—buying and selling in order to ensure that each source holds allowances sufficient to cover its relatively larger or smaller quantities of mercury emissions. But EPA's approach does not demand much by way of reducing mercury emissions. EPA's caps are meek. The first-phase cap is set in 2010 to require no reductions beyond those already realized as "co-benefits" of controls required to address criteria pollutants. The second-phase cap, effective in 2018, is set to require roughly a 61% reduction (employing the most generous assumptions) from the current level of emissions. When compared to the 90% reduction by 2007 that was expected to have been required, the more modest—and delayed—reductions under EPA's proposed rule amount to a considerable reprieve to coal-fired utilities. While several caveats must be offered alongside this comparison, the difference—and the burden it transfers to those exposed—is stark. Importantly, given MeHg's neurodevelopmental effects, this reprieve threatens a generation of children.

Of particular moment, EPA's proposed approach raises a host of environmental justice issues. As framed, the cap-and-trade proposal would disproportionately burden various fishing tribes and indigenous peoples, other communities of color, and low-income communities that depend on fish. As amply demonstrated by the National Environmental Justice Advisory Council (NEJAC), the fish consumption practices of these groups differ considerably from those of the "typical U.S. consumer" that is the apparent focus of EPA's proposed approach. Members of these groups consume more fish, at greater frequencies, contaminated at higher levels—with the result that they are more highly exposed than members of the general population. Members of these groups are thus the ones relatively likely to suffer the adverse health effects of allowing more mercury to be emitted for a longer period of time. In fact, given current levels of contamination in walleye, a commonly consumed species in the upper Great Lakes, a woman consuming fish at rates typical of the general U.S. population is currently exposed to MeHg just at EPA's reference dose (RfD)—the level above which exposure is unsafe for humans. A woman consuming at rates typical of those in the Great Lakes states is exposed at levels over twice EPA's RfD. And a woman consuming at rates typical of Great Lakes Indian Fish and Wildlife Commission (GLIFWC) tribal fishers is currently exposed at more than 10 times EPA's threshold. Thus, while the status quo—which the rule looks to preserve—leaves many in this region unprotected, it utterly fails the fishing tribes and their members. For some groups, the harms of a reprieve in emissions reductions may also be felt along interrelated economic, social, cultural, spiritual, and political dimensions. This is the case, for example, for the various Ojibwe[2] tribes and other fishing tribes of the upper Great Lakes.

EPA's proposed approach also introduces the particular concern for "hot spots"—local or regional instances of relatively concentrated emissions and, ultimately, relatively high exposure. The potential for perpetuating or exacerbating hot spots has long been recognized as the Achilles' heel of cap-and-trade approaches. The likelihood that such hot spots will coincide with areas that are home to tribes and indigenous peoples, communities of color and other low-income communities has been more recently acknowledged. EPA's proposed cap-and-trade approach expresses the relevant caps in terms of total mercury emissions and allows mercury to be traded freely among sources anywhere in the United States. By design, it says nothing about how the emissions are distributed within this nationwide boundary. EPA recognizes the theoretical possibility of hot spots under this national cap-and-trade approach, but claims in the Preamble to the proposed rule that it "does not expect any local or regional hot spots." This Article tests this claim empirically. It analyzes EPA's own models and focuses by way of example on the upper Great Lakes states of Michigan, Minnesota, and Wisconsin. This analysis suggests that local and regional hot spots are indeed a possibility in this region. Consider that emissions in this region would decline only 27% by 2020 under cap-and-trade, as compared to the 61% reductions projected nationally during this period—or the 70% reductions promised by EPA in the Preamble to the rule. The two largest emitters in each of these states would continue to be large emitters even in 2020, after the application of the second-phase cap. In fact, of the 11 large emitters in these states, 7 would achieve only modest reductions by 2020 under cap-and-trade and an additional 2 would actually *increase* their emissions, by 12% and 68%. Of course, a

2. According to the GLIFWC, "[t]here are several terms used in reference to the Ojibwe people [including] the term Ojibwe and its plural form, Ojibweg. . . . The Ojibwe people often call themselves Anishinaabe (Anishinaabeg, plural) which in their language means Indian person or original people. An anglicized term for Ojibweg commonly used is Chippewa." GLIFWC, A GUIDE TO UNDERSTANDING OJIBWE TREATY RIGHTS 3 (2002), *available at* http://www.glifwc.org [hereinafter GLIFWC, UNDERSTANDING OJIBWE TREATY RIGHTS].

hot spots analysis in the case of mercury must move beyond an assessment of emissions reductions, given the complexities of mercury fate, transport, and exposure. This Article takes up this more complex analysis as well, based on the most recent data from the field. These emissions statistics, however, provide a sense of the distributive implications of EPA's proposed cap-and-trade approach. The resulting hot spots may affect even members of the general population in this region, given their higher than average rates of fish consumption. And they would impose a profound burden on the fishing tribes, whose practices place them among the most highly exposed.

Additionally, EPA's proposal relies heavily on risk avoidance—that is, it asks those who will bear the risks of unabated mercury contamination to forego eating fish in order to protect themselves. EPA concedes in the Preamble that those who regularly consume fish, particularly members of sensitive subpopulations such as children up to age 20 and women of childbearing age, are at greater risk than the "typical U.S. consumer." "In response," EPA suggests that they take on the responsibility to *avoid* these risks. It refers them to advisories that ask them to eat less fish or different species or to stop consuming fish altogether, despite the widely recognized health benefits of eating fish. This choice of risk avoidance—in lieu of reducing the risks by preventing mercury contamination in the first place—is likely to burden disproportionately fishing tribes and other higher consuming subpopulations. It is to these groups that EPA addresses this "response." And while giving up fish may for some individuals mean finding less palatable substitutes in terms of protein and other nutrients or expending more time and money to travel to less contaminated waters to fish, giving up fish for other individuals may be *impossible*. This is likely the case, for example, for the members of the various Ojibwe and other fishing tribes of the upper Great Lakes, for whom fish and fishing are important for physiological, economic, social, political, cultural, and spiritual health. The burden for these peoples is thus not only different in degree, but also different in kind, than for the general population.

Other commentators have already done considerable work to assess EPA's proposed rule on scientific, legal, and economic bases.[3] I focus here on an assessment from the perspective of environmental justice. In order to lay the foundation for this assessment, Part I provides background on mercury and its regulation under the CAA. Part II prepares the way for a comparison of EPA's proposed cap-and-trade approach with a MACT approach that would be the ordinary means for regulating hazardous air pollutants under §112 of the CAA. Because I conclude that the MACT standard as proposed by EPA is insupportable, Part II sets forth two alternative MACT scenarios for purposes of comparison to cap-and-trade. The balance of this Article undertakes this comparison from the perspective of environmental justice. Part III considers environmental justice issues raised by the reprieve afforded sources under EPA's proposal, such that mercury emissions reductions are both diminished and delayed. Part IV examines EPA's claim that it does not expect any local or regional hot spots to exist under the proposed cap-and-trade approach. This part focuses on the upper Great Lakes states by way of example, and concludes that, at least for this area, EPA's claim is not borne out. Part V critiques EPA's reliance on risk avoidance—rather than risk reduction—to address the adverse human health effects of mercury contamination from coal-fired utilities. Part VI outlines the multiple dimensions of environmental justice where, as here, tribes and indigenous peoples are among those affected. This part discusses relevant legal obligations applicable to mercury contamination in the particular case of the fishing tribes of the upper Great Lakes.

3. *See* Lisa Heinzerling & Rena I. Steinzor, *A Perfect Storm: Mercury and the Bush Administration*, 34 ELR 10297 (Apr. 2004) [hereinafter Heinzerling & Steinzor, *Perfect Storm I*]; Lisa Heinzerling & Rena I. Steinzor, *A Perfect Storm: Mercury and the Bush Administration, Part II*, 34 ELR 10485 (June 2004) [hereinafter Heinzerling & Steinzor, *Perfect Storm II*].

I. Mercury

Mercury has long been known to be highly toxic to humans and to other species. Methylmercury is a potent neurotoxin. Exposure to even minute amounts of MeHg can cause adverse health effects in humans. Children and the developing fetus are particularly sensitive; exposure during this period may result in irreversible neurological damage. While mercury's adverse health effects are widely recognized, its behavior in the environment is less completely understood. Once released into the environment, mercury moves through the air, water, and soils, existing in various forms along the way. The cycle is complex, and includes local, regional, and global components. Although mercury is released into the environment through both natural and anthropogenic processes, anthropogenic releases—from the combustion of fossil fuels or the incineration of mercury-laden wastes—are increasingly the source of mercury in the environment. Anthropogenic emissions of mercury in the United States are currently dominated by emissions from coal-fired utilities. Mercury is emitted from these sources in three species, each of which is characterized by a different fate and transport in the environment. This mercury is then deposited to surrounding land and water, although at varying distances and times. Mercury that has been deposited to or near water bodies becomes methylated and thus available for uptake by fish in these waters. Mercury bioaccumulates in the fish tissue, where it may be consumed by other fish, wildlife, or humans. There are gaps in current knowledge of the processes connecting mercury emissions through atmospheric transport and deposition; indeed, understandings here are rapidly evolving. It is clear, however, that mercury now contaminates vast expanses of the waters that support fish on which humans rely for food. Importantly, consumption of fish is the primary route of human exposure to MeHg.

By way of background, this part canvasses evidence respecting mercury's human and ecological health effects, the sources of mercury in the environment, the extent of mercury contamination of waters in the United States, and the variables affecting human exposure to MeHg through the fish consumption pathway. This background is meant to convey current understandings, and is offered together with the caveat that understandings in some of the relevant areas are yet evolving. This part then provides an overview of the regulation of mercury under the CAA and considers the particular efforts that led up to the proposed rule for regulating mercury emissions from coal-fired utilities.

A. Adverse Human and Environmental Health Effects

Mercury is a heavy metal that has long been recognized to be highly toxic to humans.[4] Among the various forms of mercury to which humans might be exposed, MeHg is considered the most toxic.[5] Although some questions remain about the nature and extent of human health effects of exposure to MeHg at very low doses, there is widespread agreement that exposure to even minute amounts of MeHg in the environment is responsible for a variety of adverse health effects.

Methylmercury is a potent neurotoxin, with adverse effects associated with fetal, childhood, and adult exposure.[6] The fetus is particularly sensitive to exposure to MeHg. Exposure *in utero* may result in irreversible damage to the developing central nervous system.[7] Effects range from severe neurological damage, seizure disorders, cerebral palsy, blindness, and deafness to more subtle neurological deficits, including poor performance on neurobehavioral tests, particularly those gauging attention, fine-motor function, language, visual-spatial abilities, e.g., drawing, and verbal memory.[8] Childhood, adolescent and adult exposure to MeHg have all been associated with additional adverse neurological effects.[9]

The adverse health effects of MeHg are not limited to the nervous system, a concern brought to the fore by the most recent studies. Fetal MeHg exposure has been associated with cardiac abnormalities in children[10] and adult MeHg exposure has been associated with increased risk of heart attacks.[11]

Mercury contamination adversely affects ecological health as well. Methylmercury exposure has been associated with adverse neurological, reproductive, and other effects in fish-eating birds such as loons, kingfishers, osprey, and bald eagles.[12] According to a recent EPA report, 30% of adult male loons in the northeastern United States have mercury levels high enough to cause adverse health effects.[13] Methylmercury exposure has similarly been documented to result in reproductive stress, behavioral abnormalities, and death in mammals dependent on fish such as river otters, minks, and the endangered Florida panther.[14] Mercury contamination may also be responsible for the precipitous decline in wild rice over the last few decades, as studies conducted by the Fond du Lac Tribe have shown that mercury contamination negatively affects growth of wild rice in its early stages.[15]

B. Sources of Mercury in the Environment

Mercury is released into the environment through both natural and anthropogenic processes. Natural processes, such as the weathering of rock containing mercury, have contributed to the mobilization and cycling of mercury since the earth was formed.[16] Increasingly, however, anthropogenic processes, such as the combustion of fossil fuels or the incineration of mercury-laden medical and other wastes, have been the source of mercury releases to the environment.[17] In the environment, mercury becomes part of a complex cycle with local, regional, and global components. As part of this process, mercury that is emitted or re-emitted to the air enters water bodies, primarily through atmospheric deposition. It is clear that there has been an increase in mercury deposition relative to historic levels, and that this increase is attributable to increased emissions from anthropogenic sources.[18] The precise relationship between anthropogenic emissions and deposition, however, is less clear. Although some aspects of this relationship are well described by current data, other aspects are only incompletely characterized. Moreover, understandings here are evolving at an especially rapid pace, as more recent data and more sophisticated models quickly replace those even a few years old. Thus, the description that follows must be offered with the caveat that it is marked by uncertainty and subject to change.

1. Anthropogenic Emissions

Anthropogenic mercury emissions in the United States are dominated by emissions from coal-fired utilities. As of 1999, coal-fired utilities emitted 47.8 tons of mercury per year, which comprises 41% of U.S. mercury emissions.[19]

4. National Research Council (NRC), Toxicological Effects of Methylmercury 175-81 (2000) [hereinafter NRC, Methylmercury].
5. *Id*. at 14.
6. *Id*. at 16-18.
7. *Id*. at 17.
8. *Id*. at 4, 17.
9. *Id*. at 17-18; Katsuyuki Murata et al., *Delayed Brainstem Auditory Evoked Potential Latencies in 14-Year-Old Children Exposed to Methylmercury*, 144 J. Pediatrics 177 (2004).
10. Phillippe Grandjean et al., *Cardiac Autonomic Activity in Methylmercury Neurotoxicity: 14-Year Follow-Up of a Faroese Birth Cohort*, 144 J. Pediatrics 169 (2004).
11. NRC, Methylmercury, *supra* note 4, at 18; Eliseo Guallar et al., *Mercury, Fish Oils, and the Risk of Myocardial Infarction*, 347 New Eng. J. Med. 1747 (2002).
12. Office of Air Quality Planning and Standards, U.S. EPA, 1 Mercury Study Report to Congress 3-43 to 3-45 (1997) [hereinafter Mercury Study Report to Congress]; *see also* David C. Evers, Assessing the Impact of Methylmercury on the Common Loon in Southern New Hampshire 17 (BioDiversity Research Institute, Report No. BRI-2001-04, 2001), *available at* http://www.chem.unep.ch/mercury/2001-ngo-sub/sub13ngoatt1.pdf.
13. U.S. EPA, Deposition of Air Pollutants to the Great Waters, Third Report to Congress II-18 (2000), *available at* http://www.epa.gov/oar/oaqps/gr8water [hereinafter Great Waters Report].
14. Mercury Study Report to Congress, *supra* note 12, at 3-43 to 3-45.
15. Telephone Interview with Larry Schwarzkopf, Fond du Lac Resources Program (July 12, 2001).
16. NRC, Methylmercury, *supra* note 4, at 15.
17. *Id.*
18. Hubbard Brook Research Foundation (untitled comments on Proposed National Emissions Standards for Hazardous Air Pollutants; and, in the Alternative, Proposed Standards for Performance for New and Existing Stationary Sources: Electric Utility Steam-Generating Units; Proposed Rule), at 3 (findings of 36 independent environmental scientists) (citing several studies and concluding that "[d]eposition of mercury has generally increased two to three-fold over the past two centuries following the increase of mercury emissions associated with industrialization, with some locations exhibiting greater than a twenty-fold increase") [hereinafter Hubbard Foundation Scientists]. This document, along with other comments on the proposed rule, can be found in EPA's online rulemaking docket. The docket is accessible at http://cascade.epa.gov/RightSite/dk_public_collection_detail.htm?ObjectType=dk_docket_collection&cid=OAR-2002-0056&ShowList=items&Action=view [hereinafter Docket OAR-2002-0056-]. The Hubbard Foundation Scientists comments are available at Docket OAR-2002-0056-2858.
19. Clear the Air, Reel Danger: Power Plant Mercury and the Fish We Eat 4 (2004) (citing Northeast States Coordinated for Air Use Management, Mercury Emissions From Coal-Fired Power Plants: The Case for Regulatory Action 2-4 (2003)) [hereinafter Clear the Air, Reel Danger].

The next largest source categories are industrial and commercial boilers and chlorine manufacturing, which contribute, respectively, 9.7 and 6.5 tons per year (approximately 8 and 6% of the U.S. total).[20] A handful of other source categories round out the roster of sources contributing greater than 1% of total U.S. mercury emissions.[21]

A decade ago, the share of total U.S. mercury emissions contributed by coal-fired utilities was rivaled by emissions from two other source categories—medical waste incinerators and municipal waste combustors.[22] In 1990, coal-fired utilities generated 26%; medical waste incinerators generated 26%; and municipal waste incinerators generated 22% of total U.S. mercury emissions.[23] However, sources in each of these other categories have reduced their mercury emissions on the order of 90%, as a result of regulations issued by EPA in the mid-1990s.[24] As of 1999, medical waste incinerators had reduced their mercury emissions to 2.8 tons per year, or 2% of the U.S. total, and municipal waste incinerators had reduced their mercury emissions to 5.1 tons per year, or 4% of the U.S. total.[25] Coal-fired utilities, by contrast, remain unregulated.

Mercury emissions from U.S. sources comprise a relatively small percentage of the total global mercury emissions,[26] a statistic oft-cited by energy industry commentators advocating more lenient (or no) regulation of mercury emissions from coal-fired utilities.[27] In making this claim, note, coal-fired utilities ride on the coattails of all of the other source categories in the United States that have already reduced their mercury emissions. That is, now that other sources here have cut their emissions, and so reduced the total U.S. contribution, it is less urgent (so the argument goes) that coal-fired utilities do so. This claim also ignores the large contribution of U.S. mercury emissions, including emissions from coal-fired utilities, to deposition within the United States.

2. Deposition

Mercury is persistent in the environment, where it cycles through the air, water, and soils, existing in various forms along the way.[28] Mercury participates in a complex global cycle that includes emission to the air, atmospheric transport, deposition to land and water, and revolatilization from the land and water.[29] Mercury that is emitted or re-emitted to air enters water bodies both directly, through atmospheric deposition to the surface of the water body, and indirectly, through atmospheric deposition to surrounding lands and tributary waters in a watershed (which then travels through the watershed, e.g., in surface water runoff, to the water body at issue).[30]

Mercury that is emitted to the air from anthropogenic sources and subsequently deposited accounts for most of the mercury currently entering U.S. water bodies.[31] For example, roughly 80% of the mercury input to Lake Michigan is the result of atmospheric deposition.[32] Similarly, the major source of mercury to inland lakes in Minnesota is atmospheric deposition.[33]

EPA estimates that "roughly 60[%] of the total mercury deposited in the [United States] comes from U.S. anthropogenic sources."[34] EPA further concludes that U.S. power plants are likely the source of some 29% of the total mercury deposited in the United States.[35] If one looks at the regional or local level, the percentage of deposition accounted for by U.S. anthropogenic sources—including coal-fired utilities—is in many instances even more pronounced. Thus, for example, EPA notes that its 60% national estimate likely understates the percent contribution of U.S. anthropogenic sources in some regions, such as the Northeast.[36] Similarly, recent EPA data reveal that in-state sources (as opposed to "global background" or other sources) of mercury emissions are significant contributors to local deposition.[37] In-state sources account for 44% to 79% of the mercury deposited at the site of maximum deposition for the state in Illinois

20. *Id.*
21. *Id.*
22. *Id.*
23. *Id.*
24. 40 C.F.R. pt. 60, subpts. Ce, Ec (hospital waste incinerators); *id.* subpts. Cb, Eb (large municipal waste combustors).
25. Clear the Air, Reel Danger, *supra* note 19, at 4.
26. Mercury Study Report to Congress, *supra* note 12, at 2-6. The *Mercury Study Report to Congress* puts the figure at 3%, based on 1995 data.
27. Utility Air Regulatory Group (UARG), Comments on the Proposed National Emissions Standard for Hazardous Air Pollutants; and, in the Alternative, Performance Standards for New and Existing Stationary Sources: Electric Utility Steam-Generating Units 4-5 (June 29, 2004) (Docket OAR 2002-0056-2922) (putting the contribution to global emissions at 1%) [hereinafter UARG, Comments]. The UARG "is a voluntary, nonprofit association of electric generating companies and organizations and four national trade associations (the Edison Electric Institute, the National Rural Electric Cooperative, the American Public Power Association, and the National Mining Association)." *Id*. at 1.
28. Great Waters Report, *supra* note 13, at II-4.
29. This mercury cycle is elaborated at *id.*, and at NRC, Methylmercury, *supra* note 4, at 16-17.
30. *Id.*
31. U.S. EPA, Regulatory Finding on Emissions of Hazardous Air Pollutants From Electric Steam-Generating Units, 65 Fed. Reg. 79825, 79827 (Dec. 26, 2000) [hereinafter U.S. EPA, 2000 Regulatory Finding]; *accord* Hubbard Foundation Scientists, *supra* note 18, at 3 (citing several studies, at least one of which "systematicallly rule[s] out alternate hypotheses, such as the role of natural weathering processes as possible mercury sources").
32. Office of Wetlands, Oceans, and Watersheds, U.S. EPA, Frequently Asked Questions About Atmospheric Deposition 3 (2001); *accord* Great Waters Report, *supra* note 13, at II-4 ("Atmospheric deposition is the principal source of mercury to several Great Waters, followed by riverine inputs.").
33. John A. Sorensen et al., *Regional Patterns of Wet Mercury Deposition*, 28 Envtl. Sci. & Tech. 2025 (1994).
34. U.S. EPA, 2000 Regulatory Finding, *supra* note 31, at 79827.
35. Mercury Study Report to Congress, *supra* note 12, at 5-2, concluding that

> [a] strong case can be made that the combined Hg^{2+} and Hg_p components of anthropogenic mercury emissions can be used as an indicator of eventual deposition of those emissions to the lower 48 states and surrounding areas. The emission inventory and estimated chemical/physical profiles indicate that of all combined Hg^{2+} and Hg_p emissions, 29% is from electrical utility boilers.

36. U.S. EPA, 2000 Regulatory Finding, *supra* note 31, at 79827.
37. R. Dwight Atkinson, U.S. EPA, Air Deposition Modeling and the TMDL Program: Mercury Loadings to States and Regions (powerpoint slides, on file with the author); E-mail from R. Dwight Atkinson, U.S. EPA, to author (Jan. 13, 2004) (noting that the relevant models are undergoing peer review and "should be considered draft at this point"). *See also* Environmental Defense, Out of Control and Close to Home: Mercury Pollution From Power Plants 13 (2003), *available at* http://www.environmentaldefense.org/documents/3370_MercuryPowerPlants.pdf.

(65%), Indiana (79%), Michigan (79%), Minnesota (58%), and Ohio (44%).[38]

Mercury is emitted from coal-fired utilities as a mixture of three species: in its elemental form (Hg(0)), as oxidized mercury (Hg^{++}) (sometimes referred to as reactive gaseous mercury or ionic mercury), and as particulate-bound mercury (Hg(p)).[39] Each of these species is characterized by a different fate and transport in the atmosphere. Elemental mercury may reside in the atmosphere for a period ranging from months to one year, and during this time be transported great distances, even globally, on air masses.[40] Oxidized mercury and particulate-bound mercury have much shorter atmospheric residence times and travel more locally: these species may be deposited within a few days, and within a few to a few hundred miles of the source.[41] Note, however, that there may be significant conversions between mercury species that occur once emissions leave the stack, during atmospheric transport and even in the emissions plume.[42] This component of mercury fate and transport is less fully understood, but recent data suggest a complex role for each species on a local, regional, and global scale.[43] Thus, for example, recent studies have found that the atmospheric residence time for elemental mercury "can be significantly decreased in certain environments, and it can therefore contribute to local and regional mercury pollution."[44]

A number of factors affect the amount of mercury that will be deposited in the vicinity of a given power plant. Although lacunae in current understandings make impossible any precise accounting of the sources of the mercury deposited in a particular location, the contributing factors have been identified. Important among these factors is the amount of mercury emitted as oxidized mercury or as particulate-bound mercury, given the more localized deposition of each of these species of mercury (although, as noted above, the most recent data suggest that this statement cannot be viewed as absolute).[45] While as a national average, coal-fired power plant emissions are comprised of roughly 50% Hg(0), 40% Hg^{++}, and 10% Hg(p), there is considerable variation among sources.[46] The Monticello plant in Texas, for example, emits 39.2% Hg(0), 60.4% Hg^{++}, and 0.3% Hg(p).[47] Other factors include physical characteristics of the facility, such as stack height; meteorological conditions, such as wind direction; and climatic conditions such as those governing precipitation.[48]

In addition, a number of factors affect the degree of mercury contamination in a given water body, and, in turn, the degree of mercury contamination in the fish and wildlife supported by that water body. That is to say, a given quantity of mercury deposited to different watersheds at comparable distances from a source may encounter environments that are more or less conducive to methylation, that have relatively high bioaccumulation rates, or that are otherwise more or less "mercury-sensitive."[49] Recent studies have suggested that, as a result, such mercury-sensitive ecosystems can experience "significant methyl mercury contamination in fish and wildlife in the upper trophic levels" given relatively small inputs of mercury.[50]

C. Mercury Contamination and Human Exposure

Mercury now contaminates vast expanses of the waters that support fish on which humans rely for food. Once mercury enters the water, it is converted to its methylated form, primarily by microorganisms present in these aquatic environments.[51] Methylmercury is an extremely bioavailable form of mercury, readily uptaken by fish.[52] Methylmercury bioaccumulates in fish tissue, and is thus present in increasing concentrations higher up the food chain.[53] Predator species such as pike and walleye may harbor mercury in their tissue at concentrations 1 to 10 million times the concentration of dissolved MeHg present in surrounding waters.[54] Birds and mammals—including humans—that eat fish are exposed to this MeHg concentrated in the fish tis-

38. *Id.* In addition, neighboring states' mercury emissions often contributed significantly to local deposition. Thus, for example, in the case of Illinois, while Illinois sources accounted for 63% of the mercury deposited at the site of maximum deposition, Indiana sources accounted for an additional 9% and Wisconsin sources for an additional 1% of the mercury deposited at this site. *Id.* Moreover, it is likely that improved models will reveal the percent contribution of in-state sources to be even higher. Telephone Interview with R. Dwight Atkinson, U.S. EPA (Aug. 12, 2004).

39. 3 Mercury Study Report to Congress, *supra* note 12, at 2-6.

40. *Id*. at 2-7 to 2-8; *accord* Northeast States Coordinated for Air Use Management (NESCAUM), Mercury Emissions From Coal-Fired Power Plants: The Case for Regulatory Action 2-4 (2003) [hereinafter NESCAUM Mercury Report].

41. 3 Mercury Report to Congress, *supra* note 12, at 2-7 to 2-8; *accord* NESCAUM Mercury Report, *supra* note 40, at 2-4 (Hg^{++} and Hg(p) deposit "within 50 to 500 miles" of the source).

42. *See, e.g.*, NESCAUM Mercury Report, *supra* note 40, at 2-4; Hubbard Foundation Scientists, *supra* note 18, at 3-5; Electric Power Research Institute (EPRI), Comments on EPA Proposed Emission Standards/Proposed Standards of Performance, Electric Utility Steam-Generating Units: Mercury Emissions 17-19 (June 16, 2004) (Docket OAR-2002-0056-2578) [hereinafter EPRI, Comments].

43. *Id.*

44. Hubbard Foundation Scientists, *supra* note 18, at 5 (noting specifically that these findings include elemental mercury that is emitted by "domestic electric utilities").

45. 3 Mercury Study Report to Congress, *supra* note 12, at 2-7 to 2-8; NESCAUM Mercury Report, *supra* note 40, at 2-5; *see also infra* notes 242-62 and accompanying text.

46. Pacyna et al., *Mapping 1995 Global Anthropogenic Emissions of Mercury*, 37 Atmospheric Env't Supp. S109 (2003); *accord* 4 Mercury Study Report to Congress, *supra* note 12, at 2-14 & tbl. 2-11 (citing ratio of 50% Hg(0), 30% Hg^{++}, and 20% Hg(p)); Terrence M. Sullivan et al., Assessing the Mercury Health Risks Associated With Coal-Fired Power Plants: Impacts of Local Depositions 3-4 (2003), *available at* http://www.netl.doe.gov/coalpower/environment/air_q/health_effects/reduced_mercury.html (citing ratio of 58% $Hg(\overline{0})$, 40% $\overline{Hg}^{++}$, and 2% $Hg(\overline{p})$).

47. Sullivan et al., *supra* note 46, at 3-4.

48. NESCAUM Mercury Report, *supra* note 40, at 2-5.

49. Hubbard Foundation Scientists, *supra* note 18, at 11; *accord* U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4701 (discussing the potential for the formation of local or regional "hot spots" as the result of its cap-and-trade proposal, the EPA notes that "the ecosystems in some regions (e.g., the lakes regions of the Upper Midwest), may be more sensitive to Hg deposition"). *See infra* notes 334-40 and accompanying text.

50. Hubbard Foundation Scientists, *supra* note 18, at 11 (citing Wiener et al., *Ecotoxicology of Mercury, in* Handbook of Ecotoxicology 409 (forthcoming 2004)).

51. 3 Mercury Report to Congress, *supra* note 12, at 2-13.

52. NRC, Methylmercury, *supra* note 4, at 16.

53. *Id*.

54. Office of Water, U.S. EPA, Mercury Update: Impact on Fish Advisories 2 (2001), *available at* http://www.epa.gov/ost/fishadvice/mercupd.pdf [hereinafter U.S. EPA, Mercury and Fish Advisories].

sue.[55] Consumption of contaminated fish is the primary route of human exposure to MeHg.[56]

1. Exposure

Based on studies documenting the human health effects catalogued above, EPA has derived a reference dose of 0.1 microgram per kilogram of body weight per day.[57] This RfD represents the amount of MeHg that EPA believes can be ingested each day over the course of a lifetime without adverse health effects.[58] The National Research Council of the National Academy of Sciences recently conducted an extensive review of EPA's RfD and concluded that it "is a scientifically justifiable level for the protection of public health."[59]

A recent study indicates that 15.7% of women of childbearing age in the United States—roughly one in six—had blood mercury levels that pose a risk to a developing fetus.[60] This analysis, which takes into account recent data on the ratio of maternal blood mercury to umbilical cord blood mercury, produces a figure nearly double that of earlier estimates.[61] One result is a new estimate that 630,000 children are born annually with umbilical cord mercury levels above levels corresponding to the reference dose set by EPA.[62]

Notably, this study found marked differences in blood mercury levels among groups categorized by race/ethnicity. Whereas 15.3% of (non-Hispanic) white women of childbearing age had mercury in their blood at levels that pose a risk to a developing fetus, this number rises to 31.5% of women of childbearing age who identified themselves as "Other," a category comprised primarily of Native Americans, Pacific Islanders, those of "Asian origin," or those of "mixed race."[63] Other sources report racial disparities in blood mercury levels among children as well. The Centers for Disease Control and Prevention, for example, recently found that (non-Hispanic) white children aged 1-5 had lower blood mercury levels than their (non-Hispanic) black and Mexican-American counterparts.[64]

Numerous studies have confirmed the association between elevated blood mercury levels and relatively higher levels of fish consumption. Studies from diverse geographic locations throughout the United States have documented fish-associated exposures producing blood mercury levels ranging from approximately 30 micrograms/liter (μg/L) to >140 μg/L—remarkable figures considering that that EPA's RfD corresponds to a blood mercury level of 5.8 μg/L.[65] "Groups of people with [blood mercury levels] in this range include recreational anglers, subsistence fishers, members of some Native American Tribes, and others consuming a substantial portion of dietary protein from fish in pursuit of health benefits."[66] As fish consumption increases, there is a consequent incremental increase in exposure to MeHg.[67] This observation is corroborated by studies showing that as fish consumption increases, there is a corresponding increase in blood mercury levels.[68]

The variables critical to determining MeHg exposure via this pathway are: (a) fish consumption rate; (b) frequency of fish consumption; (c) level of MeHg found in the fish species consumed; and (d) body weight of the individual.[69] There is considerable variability among humans with respect to fish consumption practices. There is also considerable variability among fish species with respect to MeHg concentration. These sources of variability mean that different individuals will have quite different levels of exposure. In particular, those who are members of fishing tribes and indigenous peoples, other communities of color, and low-income communities that depend on fish have practices that place them among the most exposed to MeHg via the fish consumption pathway.[70] Members of these groups consume

55. Consumption of contaminated fish is the primary route of exposure to methlymercury for wildlife. NRC, Methylmercury, *supra* note 4, at 1.

56. *Id*.

57. U.S. EPA, Integrated Risk Information System, *Toxicological Profile for Methyl Mercury, CASRN 22967-92-6*, *at* http://www.epa.gov/iris/subst/0073.htm.

58. NRC, Methylmercury, *supra* note 4, at 2.

59. *Id*. at 11. For a sense of the controversy behind EPA's RfD and the impetus for the National Academy of Sciences review, see Heinzerling & Steinzor, *Perfect Storm I*, *supra* note 3, at 10299-303.

60. Kathryn R. Mahaffey et al., *Blood Organic Mercury and Dietary Mercury Intake: National Health and Nutrition Examination Survey, 1999 and 2000*, 112 Envtl. Health Persp. 562 (2004); Kathryn R. Mahaffey, "Methylmercury: Epidemiology Update," Presentation to the National Forum on Contaminants in Fish, San Diego, Cal. (2004) (powerpoint slides on file with author).

61. Mahaffey et al., *supra* note 60, at 562; *see also* U.S. EPA, America's Children and the Environment (2003) (citing earlier estimate that approximately 8% of women of childbearing age have levels of mercury in their blood at or above a level of 5.8 micrograms/liter (μg/L), which corresponds to EPA's RfD).

62. Guy Gugliotta, *Mercury Threat to Fetus Raised: EPA Revises Risk Estimates*, Wash. Post, Feb. 6, 2004, at A3.

63. Mahaffey et al., *supra* note 60, at 565, tbl. 3. Among the categories for "race/ethnicity" employed by the National Health and Nutrition Examination Survey, analyzed by Mahaffey et al., is the category "Other." "Participants who designated themselves as other include Native American Tribal people, individuals of Pacific Island origin, persons of Asian origin, and persons of mixed race who did not designate another category." *Id.* at 565.

64. Centers for Disease Control & Prevention, Second National Report on Human Exposure to Environmental Chemicals 19 (2003), *available at* http://www.cdc.gov/exposurereport/2nd/pdf/secondner.pdf.

65. Mahaffey et al., *supra* note 60, at 562.

66. *Id. Accord* Minnesota Chippewa Tribe, Comments on EPA's Mercury Reduction Rule 1 (2004) (Docket OAR-2002-0056-3325) (noting that "20% to 80% of Tribal members have blood mercury levels above the EPA safe level of 5.8 parts per billion") [hereinafter Minnesota Chippewa Tribe, Comments].

67. 4 Mercury Study Report to Congress, *supra* note 12, at ES-2.

68. Mahaffey et al., *supra* note 60, at 566.

69. 4 Mercury Study Report to Congress, *supra* note 12, at ES-2. Although the last parameter, body weight, also varies among subpopulations of individuals, e.g., as between adults and children, as between men and women, this parameter varies to a lesser extent among subpopulations defined along racial, ethnic, and/or socioeconomic lines and so is often considered not to vary in analyses of exposure and thus will be considered not to vary for purposes of the following discussion.

70. NEJAC, Fish Consumption and Environmental Justice 21-49 (2002), *available at* www.epa.gov/compliance/resources/publications/ej/fish_consump_report_1102.pdf [hereinafter NEJAC, Fish Consumption Report]. Of particular relevance to the upper Great Lakes region, the NEJAC report documents the higher fish consumption rates and other practices of low-income African-American fishers along the Detroit River in Michigan; Hmong and Laotian fishers along the Fox River in Wisconsin; and the various Ojibwe tribes in Wisconsin. *Id.* at 4, 7, 9, 27-28, 35-36. *Accord* Comments of R.T. Rybak, Mayor of Minneapolis, Minnesota on Proposed National Emissions Standards for Hazardous Air Pollutants (2004) (Docket OAR-2002-0056-2023) (observing that "[s]tudies have shown that . . . African Americans eat fish more often and in greater quantities than white people . . . . In Minneapolis, members of many immigrant communities—Hispanic, Hmong, Af-

fish in greater amounts, at higher frequencies, and, often, in accordance with different seasonal or cultural constraints than members of the general population. Members of these groups also often consume different species and obtain their fish from different sources than "the typical U.S. consumer eating a wide variety of fish from restaurants and grocery stores."[71]

(a) Fish Consumption Rate

Fish consumption rates vary considerably among groups. Members of fishing tribes and indigenous peoples and members of other communities of color are among the highest consumers, often consuming vastly greater quantities of fish than do members of the general population. And while fish consumption has increased generally in the United States in the last decades,[72] recent studies measuring fish intake continue to produce fish consumption rates for the general population that severely underestimate consumption by these higher consuming subpopulations.[73] These fish consumption rates, reflective of the general population, are then typically the rates that inform health and environmental policies.[74] Studies also show that members of fishing tribes in the Great Lakes and elsewhere are among the very highest consumers.[75]

Fish consumption rates for even the general population vary. The *Mercury Study Report to Congress*, for example, cites a range in consumption rates for adults that varies from zero to 300 grams per day (g/day), based on several national dietary surveys conducted in the mid-1990s.[76] The fish consumption rate currently recommended by EPA as a default for use in setting water quality standards for the general population is 17.5 g/day.[77]

Fish consumption rates for various "subsistence" subpopulations are recognized to be much greater than for the general population. In fashioning a hypothetical "high-end" or "subsistence fisher," the *Mercury Study Report to Congress* selects a fish consumption rate of 60 g/day for adults.[78] EPA's default value for use in setting water quality standards for subsistence fishers is 142.4 g/day.[79]

In fact, fish consumption rates for some groups may well be markedly greater than even these values for "subsistence" fishers. This is the case, for example, for members of the various Ojibwe tribes of the Great Lakes. A survey of tribal spearers conducted by the GLIFWC in 1993 found that those consuming an average number of walleye meals in the fall (the season of lowest walleye consumption) had intake rates ranging from 115.8 g/day to 240.7 g/day.[80] Those consuming an average number of walleye meals in the spring (the season of highest consumption) had intake rates ranging from 189.6 g/day to 393.8 g/day.[81] The Leech Lake Band, one of six bands comprising the Minnesota Chippewa Tribe, has determined that a fish consumption rate of 227 g/day describes tribal intake consonant with its treaty protected right to take fish.[82]

(b) Frequency of Fish Consumption

Methylmercury's particular health endpoints mean that relatively short periods of consumption, corresponding to developmental periods during which MeHg is likely to damage the developing nervous system of a fetus or a growing child, can contribute to adverse health effects. Thus, monthly or seasonal consumption patterns become relevant to understanding MeHg exposure. As explained in the *Mercury Study Report to Congress*:

> Because [MeHg] is a developmental toxin that may produce adverse effects following a comparatively brief exposure period (i.e., a few months rather than decades), comparatively short-term dietary patterns can have importance. . . . It is these moderate-term patterns that are the most relevant exposure period for the health-based endpoint that formed the basis of the RfD—i.e., develop-

rican—fish in our local lakes and rivers to provide protein for their families."). *See also* 4 Mercury Study Report to Congress, *supra* note 12, fig. 4-1.

71. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4658. This "typical U.S. consumer," EPA assures, "is not in danger of consuming harmful levels of methylmercury from fish and is not advised to limit fish consumption." *Id.*

72. 4 Mercury Study Report to Congress, *supra* note 12, at 4-50 to 4-51.

73. NEJAC, Fish Consumption Report, *supra* note 70, at 21-49. *See also* Catherine A. O'Neill, *Variable Justice: Environmental Standards, Contaminated Fish, and "Acceptable" Risk to Native Peoples*, 19 Stan. Envtl. L.J. 3 (2000).

74. *Id.*

75. *See infra* notes 263-75 and accompanying text & tbl. 1.

76. 4 Mercury Study Report to Congress, *supra* note 12, at ES-3 (based on the various National Health and Examination Survey (NHANES) and Continuing Survey of Food Intake by Individuals (CSFII) national dietary surveys).

77. U.S. EPA, Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health 4-25 to 4-27 (2000) (based on the 90th percentile value for freshwater and estuarine fish intake by adults in the U.S. Department of Agriculture's (USDA's) CSFII survey, a national dietary survey, for the years 1994 to 1996) [hereinafter U.S. EPA, Ambient Water Quality Criteria Methodology].

78. 4 Mercury Report to Congress, *supra* note 12, at 2-11 (based on the mean consumption rate of 59 g/day for Columbia River Tribes, according to a 1994 study conducted by the Columbia River Inter-Tribal Fish Commission). Note that the 90th percentile value from this survey is between 91-130 g/day. Columbia River Inter-Tribal Fish Comm'n, Technical Report 94-3, A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin (1994).

79. U.S. EPA, Ambient Water Quality Criteria Methodology, *supra* note 77, at 4-25 to 4-27.

80. GLIFWC, 1993 Survey of Tribal Spearers (1993) [hereinafter GLIFWC, 1993 Survey]. The GLIFWC is in the process of publishing more recent fish consumption data, based on a five-year study of member tribes' practices. This more recent data, once published, will better represent current consumption practices; as such, the data from the 1993 survey is offered with the caveat that more current and comprehensive data will shortly be available. E-mail from Neil Kmiecik, Director, GLIFWC Biological Services Division, to author (June 30, 2004); Telephone Interview with Ann McCammon Soltis, Policy Analyst, GLIFWC Intergovernmental Affairs (July 19, 2004).

81. GLIFWC, 1993 Survey, *supra* note 80. This survey gathered data regarding only walleye consumption. Because tribal members also consume other species, the values from this survey may understate total fish consumption.

82. *See* Letter from John Persell, Director, Minnesota Chippewa Tribe Water Quality, to Margaret Watkins, Grand Portage Environmental Department (Jan. 19, 2004) (on file with the author) [hereinafter Letter from John Persell]; Telephone Interview with John Persell, Director, Minnesota Chippewa Tribe Water Quality (Sept. 16, 2004).

mental deficits in children following maternal exposure to [MeHg].[83]

Based on a national dietary survey, roughly 88% of all adults consume fish and shellfish at least once a month; 58% consume fish and shellfish at least once a week; and 1% consume fish daily.[84] Whereas the percentage of infrequent consumers tended to be equal across subpopulations identified as "White," "Black" and "Other" (a category comprised primarily of Native Americans, Asian-Americans and Pacific Islanders, and others), the percentage of frequent consumers differed markedly among these groups.[85] Thus, while 11.6% of White respondents indicated that they consumed fish three times a week or more, this number increased to 15% for Black respondents and nearly doubled, to 22.9%, for subpopulations in the category "Other."[86] And while only 1.9% of White respondents consume fish daily, this number jumped to 8.9% for Native Americans, Asian-Americans and Pacific Islanders, and other groups represented in the category "Other."[87]

More specialized surveys also highlight the differences among various subpopulations in the frequency with which they consume fish and in other factors, such as seasonality, affecting exposure to MeHg via the fish consumption pathway. Thus, for example, a survey of tribal spearers from various Ojibwe tribes found that over 95% of respondents consumed at least one meal per week of the walleye they had caught, and over 12% consumed more than 7 meals per week.[88] In addition, whereas there may be little seasonal variation in fish intake by members of the general population,[89] this variation is marked for Ojibwe tribal spearers. The average number of meals of walleye caught and consumed ranges from a low of 2.2 meals per week in the fall to a high of 3.6 meals per week in the spring.[90] This translates into fluctuations in fish consumption rates as well, with intake that can vary by as much as 150 g/day between fall and spring.[91]

In addition, the size of the average "meal" may differ considerably among various subpopulations. EPA assumes that the average meal for fish consumers in the United States is 6 ounces—roughly 170 grams.[92] The GLIFWC survey revealed that the average size of a fish meal for tribal fishers ranged from 13 to 27 ounces—roughly 369 to 766 grams.[93]

83. 4 Mercury Study Report to Congress, *supra* note 12, at 4-2, 4-82.

84. *Id.* at 4-19 (citing NHANES III data).

85. *Id.* Between 85% and 89% of all adults in each of these groups consume fish at least once a month.

86. 4 Mercury Study Report to Congress, *supra* note 12, at 4-18, tbl. 4-15a.

87. *Id.*

88. GLIFWC, 1993 Survey, *supra* note 80, attach. 2, at 2.

89. 4 Mercury Report to Congress, *supra* note 12, at 4-54 to 4-55.

90. GLIFWC, 1993 Survey, *supra* note 80, attach. 2, at 2.

91. These calculations are based on GLIFWC, 1993 Survey, *id*., assuming a range of 13-27 ounces per meal, and an average of 2.2 meals/week in the fall versus an average of 3.6 meals/week in spring; range is from 115.83 g/day to 240.69 g/day in the fall to 189.6 g/day to 393.8 g/day in spring; difference between 240.69 and 393.8 is 153.11 g/day.

92. U.S. EPA & U.S. Food and Drug Administration, What You Need to Know About Mercury in Fish and Shellfish, *available at* http://www.epa.gov/waterscience/fish/MethylmercuryBrochure.pdf.

93. GLIFWC 1993 Survey, *supra* note 80.

(c) Level of MeHg Found in the Fish Species Consumed

The concentration of MeHg present in fish tissue varies from species to species, and from fish to fish within a particular species.[94] The differences in MeHg content are due, among other things, to the trophic level occupied by a species, i.e., whether that species lives relatively far up the food chain, the size or age of a particular fish, and the level of MeHg that is available to that fish from the surrounding environment. In discussing differences in MeHg concentrations among freshwater fish, the *Mercury Study Report to Congress* summarizes: "Older and larger fish, which occupy higher trophic positions in the aquatic food chain, would, all other factors being equal, be expected to have higher mercury concentrations."[95]

Consumption data for the general population in the United States show that marine species, e.g., tuna, Alaska pollack, salmon,[96] crab, cod, are the most frequently consumed, followed by estuarine species, e.g., shrimp, and freshwater fish, e.g., catfish.[97] These data show, nonetheless, some regional differences in consumption patterns.[98] Thus, the most popular fish species on the East Coast are haddock, cod or Alaskan pollack, flounder, lobster, blue crab, and shrimp; the most popular species in the South are shrimp, catfish, grouper, red snapper, and blue crab; the most popular species on the West Coast are salmon, dungeness crab, shrimp, and rockfish; and the most popular species in the Midwest are perch, walleye, chubs, and "multiple varieties of freshwater fish."[99] According to the GLIFWC, important species for consumption by fishers and their families in member tribes include walleye, muskellunge, northern pike, lake trout, whitefish, perch, and other freshwater fish species.[100]

Recent U.S. Health and Human Services (DHHS) and EPA data for commercially important fish and shellfish provide measured mean mercury concentrations for various relevant species, as follows: tuna (albacore), 0.35 parts per million (ppm); tuna (light), 0.12 ppm; Alaskan pollock, 0.06 ppm; shrimp, <0.01ppm; salmon, 0.01 ppm; crab, 0.06 ppm; cod, 0.11 ppm; catfish, 0.05 ppm.[101] Recent EPA data for freshwater fish provide measured average mercury concentrations for various relevant species, as follows: white perch, 1.03 ppm; smallmouth bass, 0.52 ppm; walleye, 0.35 ppm; lake trout, 0.30 ppm; northern pike, 0.30 ppm;

94. 4 Mercury Study Report to Congress, *supra* note 13, at 4-59 to 4-73.

95. *Id.* at 4-72.

96. Although salmon are anadromous, spending a portion of their lives in marine, estuarine, and freshwater environments, they get classified as "marine," either entirely or predominantly, in national surveys of fish consumption such as the CSFII and NHANES III.

97. 4 Mercury Study Report to Congress, *supra* note 12, at 4-19 to 4-21, 4-53. Note that these 7 species represent seven of the top 10 species consumed nationally. *Id.*

98. *Id.* at 4-56.

99. *Id.*

100. GLIFWC, *2004 Treaty Spearing and Netting Season Fast and Furious*, Mazina'igan, Summer 2004, at 1, *available at* http://www.glifwc.org [hereinafter GLIFWC, *2004 Season*].

101. U.S. DHHS & U.S. EPA, Mercury Levels in Commercial Fish and Shellfish, *available at* www.cfsan.fed.gov/~frf/seamehg.html. Note that mercury concentration in shrimp was denoted as "ND," that is, below the detection level of 0.01 ppm. *Id.*

flathead catfish, 0.25 ppm.[102] Data gathered by states in the upper Great Lakes show measured average mercury concentrations in walleye to be 0.39 ppm in Michigan, 0.38 ppm in Minnesota, and 0.45 ppm in Wisconsin.[103] Measured average mercury concentrations in northern pike in these states are 0.51 in Michigan, 0.36 in Minnesota, and 0.31 in Wisconsin.[104]

The contamination of freshwater species deserves particular note, given that methylmercury exists in relatively high concentrations in many freshwater species, particularly those occupying positions further up the food chain.[105] A recent analysis of data gathered by EPA's National Study of Chemical Residues in Lake Fish Tissue—an analysis of freshwater fish tissue from a representative sample of lakes in the continental United States—found that "[80%] of the predator fish samples contained mercury levels exceeding EPA's safe limit [of 0.13 ppm] for women."[106] This analysis found further that 55% of all freshwater fish samples tested by EPA exceeded EPA's safe limit for women and 76% of all freshwater fish samples tested by EPA exceeded EPA's safe limit for children under age three.[107] Smallmouth bass, walleye, largemouth bass, lake trout, and northern pike had the highest average mercury concentrations.[108] These EPA data buttress mercury contamination data from earlier and ongoing fish tissue sampling efforts by states and tribes.[109] Wisconsin, for example, has conducted extensive fish tissue sampling and found that 90% of largemouth bass, 84% of northern pike, 90% of smallmouth bass, and 92% of walleye tested had mercury levels that exceed EPA's safe limit for women.[110] Note, of course, that consumers of freshwater fish may also consume non-freshwater species, some of which may contain mercury in concentrations of concern.

2. Fish Consumption Advisories

Given these data demonstrating extensive fish tissue contamination and consequent human exposure, agencies throughout the United States have been compelled to issue fish consumption advisories for mercury. These advisories warn of the health risks of consuming fish contaminated with MeHg, and recommend that humans reduce or eliminate their consumption of particular fish species caught from particular waters.[111] These advisories generally include more restrictive consumption guidelines for women of childbearing age and for children, given the concern for MeHg's adverse neurodevelopmental effects.[112]

Fish consumption advisories for mercury place a growing list of waters and species "off limits" to those who would eat the fish they catch. While a variety of chemical contaminants give rise to fish consumption advisories throughout the United States, mercury is responsible for 76% of all advisories.[113] As of 2003, 45 states and several tribes had issued fish consumption advisories due to mercury contamination.[114] The geographic scope of these advisories is considerable, as 13,068,990 lake acres—roughly 32% of the nation's lake acreage—and 766,872 river miles are currently subject to mercury advisories.[115] In addition, 100% of Lakes Superior, Michigan, Huron, and Erie are under mercury advisory.[116] Remarkably, 21 states and 1 tribe have issued advisories covering the entirety of their lakes and/or rivers; 12 states and 1 tribe have issued advisories for the entirety of their coastal waters.[117] These statewide mercury advisories blanket the lakes and rivers in the Northeast, the Ohio Valley and the upper Great Lakes.[118] Further, although fish consumption advisories have historically been the province of states and tribes, mercury contamination spurred federal

102. Clear the Air, Reel Danger, *supra* note 19, at 19-20 & tbl. J. The analysis is of data from EPA's National Study of Chemical Residues in Lake Fish Tissue, a four-year study of 268 chemicals in fish sampled from 500 lakes in the continental United States. This study was begun in 1998 and will be completed by 2006; it is notable that this study employs a random sampling method. *Id.* at 14.

103. *Id.* at app. C (listing Supplemental Data for EPA's National Survey of Mercury Concentrations in Fish, 1999).

104. *Id.*

105. The authors of the *Mercury Study Report to Congress* conclude that freshwater fish consumption is of particular interest inasmuch as it "may pose a significant source of methylmercury exposure to consumers of such fish." 4 Mercury Report to Congress, *supra* note 12, at ES-2. They note elevated exposures among some of these consumers, "evidenced by analyses of blood mercury showing concentrations in excess of 10 micrograms per liter (μg/L) that have been reported among multiple freshwater fish-consumer subpopulations." *Id.*

106. Clear the Air, Reel Danger, *supra* note 19, at 18. This assessment is based on EPA's RfD for mercury and assumes a woman of average weight (according to EPA estimates of 143 pounds), consuming an average meal (according to EPA estimates of six ounces of cooked fish per meal), two times a week (in accordance with American Heart Association guidelines for adults). *Id*. at 10.

107. *Id.* at 17. The analysis for children assumes a child under age three of average weight (26 pounds), consuming an average meal (two ounces), two times a week. *Id.*

108. *Id.* at 18 (these results are for species for which EPA had collected and analyzed more than four composite samples).

109. *Id.* at 21 & app. C; GLIFWC, *How to Enjoy Fish Safely: Facts About Fish and Nutrition*, Mazina'igan, Fall 2000 (Supp.), at 1, *available at* http://www.glifwc.org [hereinafter GLIFWC, *Enjoy Fish Safely*].

110. Clear the Air, Reel Danger, *supra* note 19, at app. C.

111. *See, e.g.*, GLIFWC, *Enjoy Fish Safely*, *supra* note 109; Wisconsin Department of Natural Resources (WDNR), *Hook Into Healthy Fish!* and *Choose Wisely: A Health Guide for Eating Fish in Wisconsin*, both available on the Internet at http://www.dnr.wi.gov/org/water/fhp/fish/pages/consumption/mercury.shtml. For an extensive discussion of fish consumption advisories' forms, functions, and effectiveness, see NEJAC, Fish Consumption Report, *supra* note 70, at 90-127.

112. *Id*.

113. U.S. EPA, Office of Water, Update: National Listing of Fish and Wildlife Advisories 4 (2004), *available at* http://www.epa.gov/waterscience/fish/ [hereinafter U.S. EPA, Fish Advisories].

114. *Id*. at 5; GLIFWC, *Enjoy Fish Safely*, *supra* note 109.

115. U.S. EPA, Fish Advisories, *supra* note 113, at 4, 2. Note that this represents an 8% increase from 2002 to 2003 in lake acres subject to advisories for mercury, and a 62% increase during this period in river miles subject to advisories. Compare *id.* with U.S. EPA, Office of Water, Update: National Listing of Fish and Wildlife Advisories (2003). Note that the percent increase in fish consumption advisories from previous years, a statistic formerly provided by EPA, is not given in the most recent national listing; thus, this number is based on my calculations.

116. U.S. EPA, Fish Advisories, *supra* note 113, at 3. Note that "[t]he Great Lakes and their connecting waters are considered separately from other waters and are not included in the above calculations of total lake acres or river miles." *Id.* at 2.

117. *Id*. at 4.

118. *Id*. at 2-4. In the upper Great Lakes, statewide mercury advisories have been issued by Minnesota, Michigan, and Wisconsin; in the Ohio Valley, statewide mercury advisories have been issued by Illinois, Indiana, Kentucky, and Ohio; and in the Northeast, statewide mercury advisories have been issued by Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, Pennsylvania, Rhode Island, and Vermont covering their inland lakes and rivers. In addition, Florida, Missouri, Montana, North Dakota, and Washington have issued a statewide mercury advisory covering their inland lakes and rivers.

agencies in 2001 to issue the first-ever advisory that is national in scope.[119] EPA and the U.S. Food and Drug Administration (FDA) expanded this advisory in 2004 to include additional fish species and more restrictive consumption recommendations.[120]

D. Regulation of Mercury Emissions Under the CAA

Among the important changes ushered in by the 1990 Amendments to the CAA is the serious attention given to the problem of hazardous air pollutants (HAPs). The comprehensive scheme for reducing HAPs that emerged is housed in §112.[121]

Although HAPs had been subject to control under §112 of the CAA since 1970, they remained largely unregulated as the 1990 Amendments were taking shape. Under the pre-1990 provisions, EPA was required to list each pollutant it deemed hazardous as a precondition to issuing emissions standards.[122] EPA was directed then to promulgate emissions standards that protected the public health with an ample margin of safety.[123] This chemical-by-chemical, health-based approach was plagued by inadequate data, unrealistic statutory deadlines, controversial risk analyses, and Agency reticence.[124] After 20 years, EPA had managed to list only 8 hazardous air pollutants, and to regulate only 7 of these.[125] For even these pollutants, coverage was spotty.[126] For example, while arsenic was listed as a hazardous air pollutant, the standards for arsenic applied to emissions from only a handful of source categories: primary copper smelters, glass manufacturing plants, and arsenic plants.[127]

This widely heralded failure spurred the U.S. Congress to enact sweeping reforms in 1990. Rather than wait for EPA to determine whether to list a HAP, Congress itself set forth a list of 188 hazardous chemicals and compounds to be regulated.[128] "Mercury compounds" are among the listed HAPs.[129]

Rather than require EPA to tread the fraught path to health-based standards for each of these HAPs, Congress directed EPA to issue batches of technology-based standards.[130] To this end, Congress instructed EPA to identify the categories of stationary sources primarily responsible for emitting the listed HAPs and to promulgate emissions standards for each source category over a 10-year period beginning in November 1990.[131] The emissions standards must require each source to attain the "maximum degree of reduction in emissions . . . achievable for new or existing sources in [that] category"[132]—more commonly referred to as "maximum achievable control technology" or "MACT." Congress went on to define the stringency of the emissions control that it had in mind. New sources must achieve a level of emissions reductions that is at least as stringent as that achieved in practice by the "best controlled similar source."[133] Existing sources must achieve a level of emissions reductions that is at least as stringent as the "best performing 12[%] of the existing sources."[134] Congress authorized EPA to enlist a wide variety of measures in service of the required reductions.[135] Once EPA issues a MACT standard for a source category, sources were given three years to comply,[136] although EPA was permitted to grant a one-year extension.[137]

Finally, Congress provided for attention to any residual human or environmental health effects insufficiently addressed by the application of MACT. Within eight years of promulgating a MACT standard for a given source category, EPA was required to issue additional standards for that source category as necessary "to provide an ample margin of safety to protect public health" or "to prevent, taking into consideration costs, energy, safety, and other relevant factors, an adverse environmental effect."[138]

Several provisions of the 1990 Amendments evidenced particular concern for—and particularized approaches to—pollution problems involving mercury. Thus, §112(c) directed EPA to turn its immediate attention to a short list of six contaminants, including mercury, and ensure that sources accounting for 90% of the emissions of each of these contaminants were regulated within 10 years.[139] Section 112(m) established a program to evaluate and address the atmospheric deposition of the listed hazardous air pol-

119. U.S. EPA, *EPA National Advice on Mercury in Freshwater Fish for Women Who Are or May Become Pregnant, Nursing Mothers, and Young Children*, as *cited in* Catherine A. O'Neill, *Risk Avoidance, Cultural Discrimination, and Environmental Justice for Indigenous Peoples*, 30 Ecology L.Q. 1 n.26 (2003). Note that this advice is no longer available on EPA's website, having been supplanted in 2004 by a more recently issued document.

120. U.S. EPA & FDA, *What You Need to Know About Mercury in Fish and Shellfish, at* http://www.epa.gov/waterscience/fish/MethylmercuryBrochure.pdf.

121. 42 U.S.C. §7412.

122. 1977 CAA §112(b)(1)(A)-(B); CAA as amended August 1977, Serial No. 95-11, 95th Congress (1977).

123. 1977 CAA §112(b)(1)(B); CAA as amended August 1977, Serial No. 95-11, 95th Congress (1977).

124. *See, e.g.*, Arnold W. Reitze Jr. & Randy Lowell, *Control of Hazardous Air Pollution*, 28 B.C. Envtl. Aff. L. Rev. 229, 237-48 (2001).

125. 40 C.F.R. pt. 61 (1992).

126. *See, e.g.*, Reitze & Lowell, *supra* note 124, at 238.

127. NESHAPs: Standard for Inorganic Arsenic, 51 Fed. Reg. 27956 (Aug. 4, 1986) (to be codified at 40 C.F.R. §§61.160-.167, 61.170-.177, 61.180-.186).

128. 42 U.S.C. §7412(b); *see, e.g.*, S. Rep. No. 101-228, at 3 (1989), *reprinted in* U.S.S.C.A.N. 3385, 3389 ("Very little has been done since the passage of the 1970 [Clean Air] Act to identify and control hazardous air pollutants.").

129. 42 U.S.C. §7412(b).

130. *See, e.g.*, S. Rep. No. 101-228, at 133, *reprinted in* U.S.S.C.A.N. 3385, 3318 (noting that the ineffectiveness of the prior, risk-based approach resulted in "broad consensus that the program to regulate [HAPs] under [§]112 of the [CAA] should be restructured to provide EPA with authority to regulate . . . with technology-based standards").

131. 42 U.S.C. §7412(c)-(e).

132. *Id.* §7412(d)(2).

133. *Id.* §7412(d)(3).

134. *Id.* §7412(d)(3)(A). For those categories comprised of fewer than 30 sources, existing sources must achieve a level of emissions reductions that is at least as stringent as the best performing 5 sources in that category. *Id.* §7412(d)(3)(B).

135. *Id.* §7412(d)(2). These measures run the gamut from process changes to materials substitution to emissions collection and treatment to work practice standards. This section also specifically authorizes a complete prohibition on emissions, where achievable.

136. *Id.* §7412(i)(3)(A).

137. *Id.* §7412(i)(3)(B).

138. *Id.* §7412(f)(2).

139. *Id.* §7412(c)(6). The "specific pollutants" listed under this provision include alkylated lead compounds, polycyclic organic matter, hexachlorobenzene, mercury, polychlorinated biphenyls, 2,3,7,8-tetrachlorodibenzofurans and 2,3,7,8-tetrachlorodibenzo-p-dioxin." *Id.* Note that this provision specifically exempts electric steam-generating units. *Id.*

lutants to the Great Lakes, the Chesapeake Bay, Lake Champlain, and coastal waters (collectively now referred to as the Great Waters).[140] Section 112(n) tackled HAPs emitted by coal-fired and oil-fired utilities. Section 112(n)(1) directed EPA first to conduct and transmit to Congress two studies: one of HAPs from electric steam-generating units and one of mercury emissions from these units.[141] These tasks were to be completed, respectively, by November 1993 and November 1994.[142] Section 112(n) further conditioned regulation of HAPs emitted by utilities on a finding by EPA that such regulation was "appropriate and necessary."[143] EPA completed its *Electric Utility Report to Congress* in February 1998,[144] shortly after having completed its *Mercury Study Report to Congress* in December 1997.[145] In December 2000, EPA made the requisite finding that regulating HAPs from utilities is "appropriate and necessary," and added them to the list of source categories under §112(c).[146]

E. The Proposed Rule for Regulating Mercury Emissions From Coal-Fired Utilities

Following this regulatory finding, EPA began the process of developing a MACT standard under §112(d) for electrical utility steam-generating units. The MACT standard was anticipated to have been proposed by December 2003 and finalized by December 2004, dates agreed upon by EPA in order to settle a lawsuit by the Natural Resources Defense Council (NRDC).[147] EPA convened a working group under the auspices of the CAA Advisory Committee to serve in an advisory capacity; the Utility MACT Working Group began meeting in 2001.[148] The development of a MACT standard under §112 appeared to be proceeding apace.[149] The resulting standard was widely expected to require a 90% reduction in mercury emissions from the current level—from 48 tons per year to approximately 5—in 3 years, i.e., by 2007.[150]

Instead, EPA issued a proposed rule in January 2004 that potentially revises its December 2000 regulatory finding, among other things rescinding its decision to list utilities under §112(c) (which listing decision thereby invoked the requirement to promulgate MACT standards under §112(d) for mercury). EPA sets forth two alternatives for regulating mercury emissions from coal-fired utilities.[151] The first alternative is a cap-and-trade approach that would permit utilities to trade mercury emissions allowances on a national market. This approach, EPA maintains, is authorized under either §111 or §112. Although EPA clearly favors a cap-and-trade approach, it hedges its bets by offering a second alternative, a MACT standard under §112.[152]

The cap-and-trade approach anticipates a nationwide cap on mercury emissions from coal-fired utilities, to be implemented in two phases.[153] New and existing sources would be allocated allowances equal in the aggregate to the emissions cap; each source would demonstrate compliance by holding, at the end of the year, one allowance for each ounce of mercury it emitted.[154] Allowances would be freely transferable among sources, with no geographic or other limitations imposed on trading.[155]

The MACT standard establishes five subcategories of coal-fired facilities, subdividing the source category on the basis of coal rank and, in one instance, on the basis of process differences.[156] Emissions limits are set forth for each of the five subcategories, expressed on the basis of either mercury per unit input or mercury per unit output.[157] Sources would be permitted to average emissions over units within a contiguous plant and to demonstrate compliance "on a rolling 12-month average calculation."[158]

These alternative approaches are elaborated in the next part, which will thus lay the foundation for the comparative analysis that follows in the subsequent parts of this Article.

140. *Id*. §7412(m).

141. *Id*. §7412(n)(1)(A), (B).

142. *Id.*

143. *Id*. §7412(n)(1)(A).

144. Office of Air Quality Planning and Standards, U.S. EPA, Study of Hazardous Air Pollutant Emissions From Electric Utility Steam-Generating Units—Final Report to Congress (1998).

145. Mercury Study Report to Congress, *supra* note 12.

146. U.S. EPA, 2000 Regulatory Finding, *supra* note 31, at 79825.

147. Natural Resources Defense Council v. EPA, No. 92-1415 (D.C. Cir. Nov. 17, 1998); U.S. EPA, Electric Utility Steam-Generating Units MACT Rulemaking Working Group: Charge and Process 2 (2001), *available at* http://www.epa.gov/ttn/atw/combust/utiltox//draft_charge_process.pdf [hereinafter U.S. EPA, MACT Working Group Charge and Process].

148. The working group was convened under the Permits, New Source Review, and Toxics Subcommittee of the CAA Advisory Committee, an advisory committee chartered under the Federal Advisory Committee Act. U.S. EPA, MACT Working Group Charge and Process, *supra* note 147, at 1.

149. *See, e.g.*, Heinzerling & Steinzor, *Perfect Storm I*, *supra* note 3, at 10306.

150. *See, e.g.*, Clear the Air, *The Bush Administration Air Pollution Plan: More Mercury Pollution, Higher Health Risks, available at* http://cta.policy.net/proactive/newsroom/release.vtml?id=24640; NRDC, *EPA's Mercury Proposal: More Toxic Pollution for a Longer Time* (Dec. 5, 2003), *at* http://www.nrdc.org/media/pressreleases/031205.asp; *accord* Heinzerling & Steinzor, *Perfect Storm II, supra* note 3, at 10488-89, 10494 (citing an EPA presentation to the Edison Electric Institute, U.S. EPA, *Discussion of Multipollutant Strategy, Meeting With Edison Electric Institute* (Sept. 18, 2001)). Note that some sources recite 2008 rather than 2007 as the date by which the expected emissions reductions would be achieved. The source of this discrepancy is unclear, although it is likely attributable to differing assumptions regarding the date for compliance with the resulting MACT standards. Under §112(i)(3)(A) this date would be December 2007 for standards promulgated in December 2004. However, EPA is permitted to grant a one-year extension in certain circumstances under §112(i)(3)(B)—an extension that would here bring the deadline for compliance to December 2008. *See, e.g.*, Paul Krugman, Editorial, *The Mercury Scandal*, N.Y. Times, Apr. 6, 2004, at A23 (citing EPA staff estimates of 90% reductions by 2008); *Testimony of David Hawkins, Hearings on S. 485, Clear Skies Act of 2003, U.S. Senate Comm. on Env't and Public Works, Subcomm. on Clean Air, Climate Change, and Nuclear Safety* (Apr. 8, 2003) (citing early EPA proposals for a MACT standard for coal-fired utilities that would result in a reduction in mercury emissions of 90% by 2008).

151. For a critique of the legal basis for EPA's alternative proposals, see Heinzerling & Steinzor, *Perfect Storm I*, *supra* note 3, at 10305-10.

152. *See, e.g.*, Heinzerling & Steinzor, *Perfect Storm I, supra* note 3, at 10307. ("EPA has not decided which approach—trading or MACT—it should adopt, although its clear preference is for trading.").

153. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4698.

154. *Id.* at 4703.

155. *Id.* at 4700-01.

156. *Id*. at 4662.

157. *Id*. at 4662-63.

158. *Id*. at 4663.

II. Alternative Approaches to Regulating Mercury Emissions From Coal-Fired Utilities

There has been much debate about the relative merits of cap-and-trade versus technology-based approaches to reducing air pollution.[159] As this debate has matured, it has become clear that any assessment must be highly contextualized. Specifically, any assessment needs to be undertaken in view of the pollutant of concern, the universe of sources emitting that pollutant, and the particular versions of each of these approaches under consideration. In the case of mercury emissions from coal-fired utilities in the United States, the relevant comparison is between a cap-and-trade approach and a MACT-based approach. EPA's proposed rule indeed invites this comparison, presented as it is in the alternative. Thus, EPA proposes a cap-and-trade approach—the alternative it clearly favors. EPA also proposes a MACT-based approach, but offers a MACT standard that falls so short of the mark that it fails to provide a reasonable basis for comparison. It is therefore necessary to frame a useful alternative MACT-based approach to permit an assessment from the perspective of environmental justice. This part thus outlines EPA's proposed cap-and-trade approach. In the process, it highlights the discrepancies between the stated caps and projected emissions reductions. This part then considers the MACT-based comparison. It finds insupportable the MACT standard as proposed, so offers two alternative MACT scenarios.

A. Cap-and-Trade

The "cap" is the linchpin of any cap-and-trade program: it is the cap that sets the ceiling on aggregate emissions to be permitted within the relevant geographical area.[160] Having determined this overall level of emissions to be permitted, the relevant governmental entity then generates "allowances" authorizing a given quantity of emissions; the total emissions thereby authorized must be equivalent to the cap. It allocates these allowances to the universe of sources to be regulated under the cap-and-trade program. Sources are permitted to emit the regulated pollutant in amounts authorized by the number of allowances each holds. In order to take advantage of the fact that sources' costs of control are different, sources are permitted to trade the allowances freely among themselves. Those sources that can more cheaply reduce their emissions will have the incentive to do, as they can then sell their surplus allowances to sources for whom the costs of control are large. The result is a "least-cost" solution to the problem of obtaining a given level of emissions reductions, i.e., the level established by the cap.[161]

The proposed rule establishes a nationwide cap on total mercury emissions in two phases, with the first to be achieved in 2010, and the second in 2018. The 2010 cap is set equal to whatever mercury emissions reductions would be achieved as a co-benefit of controls for sulfur dioxide (SO_2) and oxides of nitrogen (NO_x) required to meet the 2010 cap established under the proposed Clean Air Interstate Rule (CAIR), formerly the Interstate Air Quality Rule (IAQR).[162] EPA estimates that this first-phase cap will reduce mercury emissions to approximately 34 tons per year.[163] This amounts to roughly a 29% reduction in emissions from the current level of approximately 48 tons per year. The 2018 cap is set at 15 tons per year, in order to achieve a 70% reduction in emissions.[164]

Models suggest that the proposed approach will not in fact lead to the reductions envisioned by the 2018 cap. EPA states in the Preamble to the proposed rule that it set the 2018 cap at 15 tons per year because its "primary goal in this rulemaking is to reduce power plant emissions of Hg by 70[%] from today's levels by 2018."[165] In fact, EPA's models[166] indicate that it will not come close to this goal. Under even the most generous set of assumptions, mercury emissions are projected to decline just to 18.57 tons per year by 2020 (a 61% reduction from the current level).[167] This projection assumes that the "safety valve" feature of the proposed rule is not triggered.[168] These projections also assume a tighter first-phase cap—one permitting only 26 tons per year rather than the proposed 34 tons per year—as would have been the case under the Administration's "Clear Skies Initiative," for which the modeling was conducted.[169] The more lenient first-phase cap in the proposed rule means that emissions reductions need not occur as quickly as under the assumptions modeled.[170] The delay in attaining the 15 ton-per-year cap is explained in part by the fact that the proposed rule permits unlimited banking of allowances during the

159. *Compare*, *e.g.*, Sidney A. Shapiro & Thomas O. McGarity, *Not So Paradoxical: The Rationale for Technology-Based Regulation*, 1991 Duke L.J. 729; Wendy E. Wagner, *The Triumph of Technology-Based Standards*, 2000 U. Ill. L. Rev. 83; *with* Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law*, 37 Stan. L. Rev. 1333 (1985); Cass R. Sunstein, *Administrative Substance*, 1991 Duke L.J. 607.

160. *See generally* T.H. Teitenberg, Emissions Trading: An Exercise in Reforming Pollution Policy (1985).

161. *See, e.g.*, Ackerman & Stewart, *supra* note 159, at 1341-42.

162. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4698.

163. *Id.*

164. *Id.*

165. *Id.*

166. EPA undertook modeling, using the integrated planning model (IPM), for purposes of "evaluat[ing] the cost and emissions impacts of proposed policies to limit emissions of . . . mercury (Hg) from the electric power sector." U.S. EPA, Documentation of EPA Modeling Applications (V.2.1) Using the Integrated Planning Model 1-1 (2002), *available at* http://www.epa.gov/airmarkets [hereinafter U.S. EPA, IPM Documentation]. "IPM is a multi-regional, dynamic, deterministic linear programming model of the U.S. electric power sector." *Id.*

167. Unless noted, all projections of emissions under EPA's proposed cap-and-trade approach are based on EPA's IPM data. The EPA parsed this data for two years, 2010 and 2020, in addition to offering current emissions data, based on 1999 emissions from coal-fired utilities. The parsed 2010 and 2020 data are available at http://www.epa.gov/airmarkets/epa-ipm/results2003.html; the 1999 data are available at http://www.epa.gov/ttn/atw/combust/utiltox/rawdata1.xls [hereinafter, collectively, U.S. EPA, IPM data].

168. *Id.*; *see also* Letter from Eric V. Schaeffer, Director, Environmental Integrity Project, to Michael O. Leavitt, Administrator, U.S. EPA (Feb. 18, 2004) (describing reductions to 18 tons per year between 2018 and 2022, assuming the safety valve is not triggered). If the safety valve is triggered, mercury emissions are projected to decline more slowly, to 22.2 tons per year between 2018 and 2022 (a 54% reduction from the current level), and to about 20 tons per year after that (a 59% reduction from the current level).

169. Telephone Interview with Mary Jo Krolewski, Clean Air Markets Division, U.S. EPA (June 9, 2004).

170. *See, e.g., id.* What effect, if any, the substitution of a 34-ton-per-year first-phase cap for a 26-ton-per-year first-phase cap would have on projections with respect to the final 15 ton-per-year cap is difficult to predict, as EPA did not conduct modeling specific to the proposed rule.

early years of the cap-and-trade program.[171] Modeling undertaken by the U.S. Department of Energy's (DOE's) Energy Information Administration (EIA), which assumes a 34-ton-per-year first-phase cap and assumes that the safety valve feature will be triggered, projects that the final 15-ton-per-year cap will not yet be reached even in 2025, the time limit of its model projections.[172] The Electric Power Research Institute (EPRI) has countered with a model that assumes far less banking will take place; even so, under EPRI's model mercury emissions are projected to decline only to 24 tons per year during 2018 and 2019, and to 15 tons per year in 2020.[173]

Models similarly call into question whether the 2010 cap will be timely reached. As noted above, EPA ties the phase-one cap, to be attained in 2010, to the level of mercury reductions that would be achieved as a co-benefit of controls required under CAIR for SO_2 and NO_x. EPA estimates this level to be equal to 34 tons per year. It concedes, however, in the Preamble to the proposed rule, that modeling done by the EIA suggests that the co-benefits of controls under CAIR will not achieve mercury reductions on this order.[174] In fact, EIA's model projects that the 34-ton-per-year mark will not be met until 2013.[175] EPRI's model similarly incorporates less optimistic assumptions regarding the 2010 cap, projecting emissions to decline only to 40 tons per year by this date.[176]

The upshot is that, on even a generous reading of the proposed cap-and-trade program (and given that we are left to guess EPA's projections had it actually conducted an analysis specific to the proposed rule), emissions are likely to exceed the advertised caps, certainly in 2018 and likely in 2010 as well. In addition, it is unclear when the 70% reductions cited as the rule's "primary goal" will be attained, although this is certainly not projected to occur within the time horizon of roughly 20 years that defines the outer limits of EPA's modeling runs.

B. MACT

The process of setting a MACT standard for a source category is understood to require two steps: a "MACT floor" determination, governed by §112(d)(3), and a "beyond-the-floor" analysis, governed by §112(d)(2). In setting the MACT floor, EPA is required to determine the level of emissions reductions for existing sources that "shall not be less stringent than the average emission limitation achieved by the best performing 12[%] of the existing sources (for which the Administrator has information)" and for new sources that "shall not be less stringent than the emission control that is achieved in practice by the best controlled similar source."[177] In undertaking the beyond-the-floor analysis, EPA is directed to "take into consideration" costs, non-air quality health and environmental impacts, and energy requirements.[178] Notably, costs are to be taken into account only in the second step, i.e., the beyond-the-floor analysis.

EPA's proposed MACT standard establishes five subcategories of coal-fired facilities, subdividing the source category on the basis of coal rank and, in once instance, on the basis of process differences.[179] EPA subdivides new and existing coal-fired units into those that burn bituminous coal, those that burn subbituminous coal, those that burn lignite, those that burn "coal refuse," (a mix of refuse of the above coal ranks) and those that employ the integrated gasification combined cycle process.[180] Emissions limits are set in terms of total mercury for each of the five subcategories, expressed on the basis of either mercury per unit input or mercury per unit output.[181] These limits are estimated to achieve reductions from current emissions levels to approximately 34 tons—a 29% reduction.[182] Under the CAA, sources would be required to comply with the MACT standard within three years of promulgation.[183] Sources would be permitted to average emissions over units within a contiguous plant and to demonstrate compliance "on a rolling 12-month average calculation."[184]

EPA's proposed MACT standard departs considerably from the 90% emissions reductions widely expected to be required by the MACT standard for coal-fired utilities. The proposed MACT standard also departs considerably from the level of emissions reductions typically required by MACT standards applicable to other source categories.[185] Yet, it is, in fact, impossible to say what level of emissions reductions would have constituted MACT had EPA proceeded in accordance with its December 2000 regulatory finding and continued to develop a standard in line with its preliminary determinations. Because EPA suspended these efforts, there is no formal EPA proposal to which one can look to determine the MACT standard that would have been. Nor did the Utility MACT Working Group convened to advise EPA develop a consensus position.[186] On the other hand, the evidence suggests that the "90[%] reduction" figure is not an unreasonable estimate. A tally of the "best performing 12[%] of existing sources," ranked by percent mercury reduction, demonstrates an average of 94.78% mer-

171. *Id.*

172. U.S. DOE, EIA, Analysis of S. 1844, the Clear Skies Act of 2003; S. 843, the Clean Air Planning Act of 2003; and S. 366, the Clean Power Act of 2003 (2004), *available at* http://www.eia.doe.gov/oiaf/servicerpt/csa/executive_summary.html [hereinafter EIA, Analysis of Clear Skies].

173. EPRI, Comments, *supra* note 42, at 28-29, 100-01.

174. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4698.

175. EIA, Analysis of Clear Skies, *supra* note 172.

176. EPRI, Comments, *supra* note 42, at 100.

177. 42 U.S.C. §7412(d)(3)(A).

178. *Id.* §7412(d)(2).

179. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4662.

180. *Id.* at 4662-63.

181. *Id.*

182. *See, e.g.*, Clean Air Task Force (CATF) et al., Comments on the Proposed Rule II-91 (June 29, 2004) (Docket OAR 2002-0056-3459) [hereinafter CATF et al., Comments].

183. 42 U.S.C. §7412(i)(3)(A).

184. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4663.

185. *See, e.g.*, U.S. EPA, Office of Air Quality Protection and Standards, *Summary of EPA's Final Air Toxics MACT Rules*, *at* http://www.epa.gov/air/oaqps/takingtoxics.sum1.html#1 (describing MACT standards and variously providing information in terms of percent reductions or percent control; where information is provided, percent reductions and percent control are at or above 90% for, e.g., organic chemical production plants, industrial process cooling towers, commercial sterilization and fumigation operations, magnetic tape, and chromium electroplating and anodizing operations).

186. Working Group for the Utility MACT, *Recommendations for the Utility Air Toxics MACT: Final Working Group Report* (Oct. 2002), *at* http://www.epa.gov/ttn/atw/combust/utiltox/wgfinalreport10_02.pdf.

cury removed.[187] Similarly, a "white paper" produced by EPA's Office of Research and Development (ORD) for use in developing the MACT standard projects that the best performers among even those sources using low-rank coals would be able to achieve on the order of 90% mercury removal by 2010.[188] The ORD projections range from 60% to 90% removal in 2010, and from 90% to 95% removal in 2015, accounting for a range of current control and future technology configurations and coal ranks.[189] It is notable that even the very worst performers here are projected to be able to attain 60% removal in 2010.[190] Contrast this figure to the roughly 55% removal that will be required by EPA's proposed MACT—ostensibly representing the "average of the best."

In order to assess the cap-and-trade approach's effectiveness at reducing mercury emissions, it is necessary to frame a reasonable technology-based comparison. Specifically, it is necessary to set forth a legally supportable MACT standard against which to compare the proposed cap-and-trade approach. EPA's proposed MACT, however, cannot fit this bill.[191] The next section highlights several deficiencies in EPA's proposal. Although what follows is by no means an exhaustive account, even this sketch suffices to demonstrate the serious flaws in EPA's method and to suggest the need to frame a more reasonable basis for comparison. This task is then taken up in the following section, which sets forth two alternative MACT scenarios.

1. Proposed MACT

EPA's proposed MACT is the result of flawed undertakings at each step in the two-step standard-setting process. First, EPA sets the MACT floor in a manner that is unlikely to be able to survive scrutiny. Among other things, EPA employs subcategories of dubious validity and accounts for variability several times over. In the process, it eschews prior practice for statistical methods biased toward lenient emissions standards. Taken together, these efforts result in a MACT floor that represents something considerably *less* stringent than "the average emission limitation achieved by the best performing 12[%]" for existing sources or emissions control achieved in practice "by the best controlled similar source" for new sources. Second, EPA gives short shrift to the second step in the MACT standard-setting process, the "beyond-the-floor" analysis. The discussion below focuses on the deficiencies in EPA's method for setting the MACT floor.

EPA's decision to subcategorize is questionable for at least three reasons. First, EPA's ability to carve out subcategories is not unlimited. As noted above, §112(c)(1) directs EPA to publish a list of source categories responsible for emitting the hazardous air pollutants of concern.[192] This section specifically authorizes EPA to establish subcategories, "as appropriate."[193] Section 112(d)(1) similarly authorizes EPA to "distinguish among classes, types, and sizes of sources within a category or subcategory" when establishing MACT standards.[194] This authority, of course, is not unfettered. In addition to the constraints imposed by the authorizing language, Congress elsewhere made clear its concern that the ability to subcategorize not be used to undermine the entire structure and effect of the category-by-category approach it had crafted. Section 112(d)(1), for example, goes on to admonish that the authority to subcategorize cannot be used to permit delays in the compliance dates applicable to individual sources.[195] Indeed, Rep. Henry Waxman (D-Cal.), one of the chief architects of the CAA, has indicated that Congress was well aware that industry interests would likely pressure EPA to carve source categories into numerous subcategories, thereby diluting the effect of Congress' directive that MACT be set at levels achieved by the best performers within a category or source category.[196] Taken to an extreme, Congress knew, EPA could establish subcategories that were so narrowly defined as to be applicable to only one or a few sources—with the result that every source would be tops in its subcategory, and no source would have to undertake any amount of additional control to reduce HAPs. Even short of this extreme, "[t]his approach would lead to far less stringent standards for more heavily polluting facilities, and tougher standards for facilities that are already better controlled. Those sources that are already clean would be penalized . . . and requirements for the uncontrolled sources, where tight restrictions are most sorely needed, would be relaxed. This was not Congress' intent . . . ."[197]

187. This tally is based on the data provided by the Ranking Subgroup of the Utility MACT Working Group for purposes of determining the MACT "floor." Memorandum From the Ranking Subgroup to the Utility MACT Workgroup, tbl. 1 (Feb. 5, 2002), *available at* http://www.epa.gov/ttn/atw/combust/utiltox/feb5memo.pdf. NESCAUM similarly relied on the data gathered by the Ranking Subgroup to arrive at a MACT floor of 91.1% mercury removal, based on the inclusion of a slightly different roster of sources among the top 12%. NESCAUM Mercury Report, *supra* note 40, at 3-2. Note that percent removal should not be confused with figures describing percent reductions from current levels.

188. U.S. EPA, Office of Research and Development (ORD), *Control of Mercury Emissions From Coal-Fired Electric Utility Boilers* 15 (undated paper), *at* http://www.epa.gov/ttn/atw/utility/hgwhitepaperfinal.pdf [hereinafter ORD, MACT Projections].

189. *Id.*

190. In fact, this number represents a conservative estimate, as the ORD explains that the projected performance dates are based on the "most difficult case" (lignite) and notes that the projected levels of performance would be expected to occur somewhat earlier for "easier situations" (high-chlorine bituminous coal). *Id.* at 14-15.

191. Numerous commentators have developed at length the argument that EPA's proposed MACT standard is unlikely to survive legal scrutiny. *See, e.g.*, CATF, Comments, *supra* note 182; Forest County Potawatomi Community (FCPC), Comments on Proposed National Emission Standards for Hazardous Air Pollutants; and, in the Alternative, Proposed Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam-Generating Units; Proposed Rule 8-10 (Apr. 27, 2004) (Docket OAR-2002-0056-2173) [hereinafter FCPC, Comments].

192. 42 U.S.C. §7412(c)(1).

193. *Id.*

194. *Id.* §7412(d)(1).

195. *Id.* In a similar vein, §112(c)(1) directs that, to the extent possible, the list of categories and subcategories "shall be consistent with the list of categories" established under §111. *Id.* §7412(c)(1). As the CATF has pointed out, EPA's most recent efforts under this section applied a single new source performance standard to facilities regardless of coal rank; these "fuel neutral" standards were upheld in the face of an industry challenge that fuel-specific subcategories were required. CATF et al., Comments, *supra* note 182, at II-16 (citing Lignite Energy Council v. EPA, 198 F.3d 930, 30 ELR 20279 (D.C. Cir. 1999)).

196. Honorable Henry A. Waxman, *An Overview of the Clean Air Act Amendments of 1990*, 21 Envtl. L. 1721, 1777 (1991).

197. *Id.*

Additionally, EPA's subcategories based on coal rank are wholly arbitrary. Current industry practice belies EPA's claim that sources are beholden to a particular coal rank and supplier for fuel. As EPA recognizes in the Preamble to the proposed rule, approximately one-quarter of the sources routinely fire a blend of more than one rank of coal.[198] Similarly, a group of utilities confirms that many sources today use various blends of coal and switch freely among fuel supplies and suppliers.[199] Indeed, the choice of fuel may here serve as a strategy for compliance with emissions standards, and courts have made it clear that subcategorization on the basis of compliance strategy is impermissible.[200] In addition, as EPA also recognizes, the qualities that form the basis for assigning coal to one rank or another do not lend themselves to neat classification with clean breaks between, say, coals deemed "bituminous" and those deemed "subbituminous."[201] Rather, these qualities exist in continuum. As a consequence, the designation of rank on which EPA proposes to base its subcategories is less than precise. Among other things, this raises concerns for the enforceability of the resulting MACT standards. Note, too, that this feature of coal again undercuts EPA's portrayal of units capable of burning only a single, clearly demarcated class of coal.

Finally, cost is not a permissible basis for subcategorization. As discussed above, the CAA anticipates that the cost of compliance be considered by EPA in setting MACT standards only in the second step, i.e., during the beyond-the-floor analysis. Yet EPA seems to have decided to subcategorize not because a particular subgroup of sources is so inherently different in class, type, or size from the category as a whole, but because it would be more costly for the poorer performing sources in the category to bring their emissions within levels achieved by their best-performing peers. In fact, there is independent evidence that *all* sources, regardless of coal rank used, could achieve on the order of 90% mercury emissions control, and that they could do so today.[202] Again, EPA's efforts here are entirely at odds with the approach to regulating hazardous air pollutants crafted by Congress in the 1990 CAA.[203] MACT standards are meant to be technology-forcing. The MACT floor is tied to the leaders in the field specifically to ensure that the laggards are required to catch up—to control levels that are nonetheless achievable because they are in fact being achieved.

EPA then couples this questionable decision to subcategorize with several generous "adjustments" to the emissions levels observed in practice by the best-performing sources, in the process accounting several times over for variability. These adjustments are insupportable legally and unwarranted (indeed unprecedented) in practice. EPA impermissibly waters down the requirement that the MACT floor be at least as stringent as emissions limitations actually *achieved by* the best performers, by emphasizing instead its concern that the MACT floor be *achievable* by all sources.[204] Having thus reframed the statutorily mandated inquiry, EPA undertakes several adjustments to the emissions limitations achieved by the best performers in each subcategory, each of which has the effect of lowering the bar established by these sources. The method EPA uses to make these adjustments, it bears noting, was supplied by industry—in fact, EPA is more generous to the poor performers than even industry recommended.[205] EPA highlights its need "to account for" intra- and inter-source variability.[206] In its zeal, EPA accounts for such variability multiple times. As a result, EPA devises a MACT floor that we can be confident will be achievable by every source, no matter how poorly it performs. But in the process, EPA effectively substitutes its version of the MACT floor inquiry for that stipulated by §112(d)(3). As the U.S. Court of Appeals for the District of Columbia (D.C.) Circuit held in *Cement Kiln Recycling Coalition v. U.S. Environmental Protection Agency*,[207] EPA cannot make this substitution.

As noted above, Congress made explicit the touchstone for the MACT floor determination: the MACT floor must reflect the average emissions limitations actually being achieved by the best-performing sources in a category. More specifically, Congress directed EPA to set the MACT floor in accordance with levels achieved by the best performers as evidenced by those among the best performers "for which the Administrator has emissions information."[208] As courts have recognized, Congress was quite aware that its focus on emissions levels actually "achieved" by the best performers in practice is different from a focus on emissions levels that are "achievable" by all sources that might employ a particular technology used by the best per-

198. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4665. The figure EPA gives is 23%.

199. Letter from The Clean Energy Group, *The Clean Energy Group's Position on the Utility MACT Issues*, to the Utility MACT Working Goup (Sept. 6, 2002), *available at* http://www.epa.gov/ttn/atw/combust/utiltox/ceg2epa9-6-02.doc. Notably, this group of sources weighed in *against* subcategorization.

200. *See, e.g.*, 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*, 14 Tul. Envtl. L. Rev. 309, 328-30, 335-39 (2001) (discussing fuel-switching to low-sulfur coals as among the compliance strategies undertaken by sources in response to the Acid Rain Program under Title IV of the CAA); CATF et al., Comments, *supra* note 182, at II-8 to II-15 (citing Chemical Mfrs. Ass'n v. EPA, 870 F.2d 177, 218-19, 19 ELR 20989 (5th Cir. 1989), *modified on different grounds on reh'g*, 884 F.2d 253, 20 ELR 20076 (5th Cir. 1989)).

201. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4665-66 (acknowledging "overlap" in categories based on coal rank).

202. *See, e.g.*, J. Phyllis Fox, Comments on Proposed National Emissions Standards for Hazardous Air Pollutants; and, in the Alternative, Proposed Standards of Performance for New and Existing Sources: Electric Utility Steam-Generating Units (Apr. 27, 2004) (appended to the FCPC, Comments, *supra* note 191) (Docket OAR-2002-0056-2194); *see also supra* Part II.B.2 and discussion of alternative MACT scenarios.

203. *Accord* Heinzerling & Steinzor, *Perfect Storm I*, *supra* note 3, at 10311 (raising similar arguments regarding EPA's misuse of its authority to subcategorize in the context of the MACT standard for chlor-alkali plants).

204. Memorandum from William H. Maxwell, to Utility MACT Project Files, *Analysis of Variability in Determining MACT Floor for Coal-Fired Electric Utility Steam-Generating Units* 1 (Nov. 26, 2003), *available at* http://www.epa.gov/ttn/atw/utility/floor_dv_112603.pdf. (noting that "[a]lthough EPA is confident that the data available are representative of the industry," it is evident that emissions vary [both from source to source, "even within a given subcategory," and within a source, over time], and explaining that "EPA decided it was necessary to develop a methodology to address the multiple sources of the observed variability in order to assure that an emission limitation value could be derived that would be achievable") [hereinafter U.S. EPA, Variability Analysis].

205. *Id.* at 4, 7.

206. *Id.*

207. 255 F.3d 855, 31 ELR 20834 (D.C. Cir. 2001).

208. 42 U.S.C. §7412(d)(3)(A).

formers.[209] The D.C. Circuit thus rebuked EPA for its attempt to account for variation among sources' experience with the control technology or technique that had been identified as primarily responsible for the best performers' results.[210] As the court stressed, such efforts to account for inter-source variability are at odds with the express language of the statute.[211] Moreover, they have the potential completely to undermine Congress' approach. If EPA were to "account for" each aspect in which the poorer performers' results vary from the best performers' results, it would serve only to preserve the differences in performance among these two groups. Importantly, it would do nothing to move these poor performers closer to the "level[s] that their best performing peers have shown can be achieved."[212] This is the bar to be attained. As the court stated in *Cement Kiln* in the context of reviewing a MACT standard for hazardous waste combustors, several factors go into the best performers' results.[213] The fact that poorer performing sources may employ less skilled operators of their control technology, may not optimize their operating conditions, or may not adequately account for the different properties in the coal they burn—and so get actual results that vary from the results of the best performers—cannot be cited to diminish these poorer performing sources' obligations to devise a way to match the results of the best performers.[214] Clearly, taken to its logical conclusion, such an effort to "account for" variability would render pointless setting a bar at all.

EPA is permitted, nonetheless, to set MACT standards at levels representative of the best performers' actual performance, including performance under a range of reasonably foreseeable operating conditions at these sources.[215] Thus, if there is reason to believe that the data that EPA has gathered do not accurately represent what the best performers actually achieve, EPA may legitimately account for the degree to which the observed emissions levels differ from the levels achieved under a range of ordinary conditions. Here, however, EPA employs a method that accounts several times for both inter- and intra-source variability.[216] EPA accounts for inter-source variability (a) by subcategorization in the first place and (b) by taking a 97.5 upper confidence limit of data for best performers in each subcategory. EPA accounts for intra-source variability (a) by employing a rolling 12-month average for compliance and (b) by setting emissions levels at the 97.5 percentile of a cumulative frequency distribution for emissions data for the best performers. Even if some accounting for variability is legitimate, double counting is not.

In addition to dividing the category into subcategories—which already reduces considerably the amount of variation in emissions levels achieved as between the best and worst performers—EPA accounts for inter-source variability by applying a 97.5 confidence interval to the emissions data that it has obtained from the best performers in each of the subcategories. EPA employs a 97.5 confidence interval to account for the possibility that the sample population is not representative of the general population in question, here, "the best performing 12[%] of existing sources." The use of the 97.5 value is both unwarranted and unprecedented. In the document explaining EPA's methods, it assures that it is "confident that the data available are representative of the industry" and that it obtained data "that reflected as many different plant configurations as would be found in the entire industry profile and conducted tests at units believed to be representative of those within the source category."[217] Thus, EPA reveals that there is no reason to believe that its data are not representative, so no reason to apply such a conservative confidence interval.[218] EPA's selection of the 97.5 confidence interval is also unprecedented. In fact, EPA has typically employed an arithmetic mean in past determinations of the MACT floor, and has directed states to do so in its guidance under §112(j).[219] Indeed, according to one commentator's analysis, EPA has never used a 97.5 or similar upper confidence limit—except for the rules that it has proposed in the spring of 2004 under the current Bush Administration.[220] The result of employing this 97.5 upper confidence limit, as one commentator has noted, is to set a MACT floor that allows more emissions than currently released by the *worst*-performing facility considered in every subcategory but lignite.[221]

EPA then accounts for intra-source variability in setting the MACT floor and in selecting the period over which compliance will be judged. Thus, EPA accommodates variations in emissions over time at an individual source by allowing each source to demonstrate compliance with the MACT standard "based on a rolling 12-month average calculation."[222] There is some question about the appropriateness of using such a lengthy averaging time. Although EPA cites the chronic effects of mercury as the source of concern, it may be appropriate to consider shorter term acute exposures as well. This is so given the comparatively short neurodevelopmental "window" at issue, given the most recent data showing a short lag time between deposition and bioavailability, and in light of the fact that some groups experience acute exposure, e.g., those that occur when fishing tribes consume large quantities of fish over a very short period as part of ceremonies or traditional gatherings—points taken up below. Assuming the 12-month averaging time is appropriate, it makes generous allowance for any ups and downs experienced by a given source over time. EPA also makes allowance for intra-source variability in setting the MACT floor by setting emissions levels at the 97.5 percentile of a cumulative frequency distribution for emissions data for the best performers. Arguably, EPA is not authorized to manip-

209. *Cement Kiln*, 255 F.3d. at 861.

210. *Id.*

211. *Id.*

212. Sierra Club v. EPA, 353 F.3d 976, 980 (D.C. Cir. 2004).

213. *Cement Kiln*, 255 F.3d at 862-66.

214. *Id*.

215. National Lime Ass'n v. EPA, 233 F.3d 625, 31 ELR 20375 (D.C. Cir. 2000).

216. That EPA allows the variability tail to wag the MACT floor dog is revealed even from structure of the Preamble, in which EPA devotes an entire section to the question framed: "How does EPA account for variability?" U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4670.

217. U.S. EPA, Variability Analysis, *supra* note 204, at 1, 2-3.

218. *Accord* FCPC, Comments, *supra* note 191, at 33 (citing Ted Johnson, TRJ Environmental, Inc., Comments on the Proposed MACT Floors for Mercury Emissions From Coal-Fired Utility Units (Apr. 27, 2004) (Docket OAR-2002-0056-2194) [hereinafter Johnson Analysis]).

219. U.S. EPA, Guidelines for MACT Determinations Under Section 112(j) Requirements (2002).

220. FCPC, Comments, *supra* note 191, at 34-35 (citing Johnson Analysis, *supra* note 218).

221. *Id.* at 35.

222. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4663.

ulate the emissions data in the manner it proposes here. Section 112(d)(3)(A) specifies that EPA is to set the MACT floor based on the "*average* emission limitation achieved by the best performing 12[%] of the existing sources (for which the Administrator has emissions information)."[223] Even if permitted to account for intra-source variability in this way, EPA needs to be aware of the multiplicative effect of its efforts in the name of "accounting for" variability. As EPA explains: "[T]here are two fundamentally different approaches to incorporating variability into the proposed rule: (1) including variability in the MACT floor calculation, or (2) including variability in the compliance method, [for example, by] allowing an averaging time for compliance that would accommodate variations in pollutant emissions over time."[224] While it may be appropriate for EPA to account for variability using one or the other of these approaches, EPA here uses both.

In the end, EPA accounts several times for variability, and then couples this accounting with its decision to subcategorize. There is a multiplicative effect, moreover, such that the MACT floor is set to accommodate performance equal to the worst performer's worst day, *and then to presume that this worst day occurs on each of the 365 days in a year*. It thereby produces a MACT floor for existing sources set at a level keyed to the worst of the worst, rather than the "average of the best." The combined effect is to lower the bar that must be attained by the poorer performing coal-fired utilities—thereby undermining the very point of tying the MACT standards to levels achieved by the best-performing sources in this category. Finally, EPA also gives short shrift to the second step in the MACT standard-setting process, dismissing any beyond-the-floor possibility without any real consideration of the benefits of a more protective standard.[225] For these and other reasons, the MACT standard that EPA proposes is of questionable legality. The MACT standard as proposed, therefore, cannot serve as a reasonable basis for comparing the merits of the cap-and-trade approach to the MACT-based approach anticipated under the CAA.

2. Alternative MACT Scenarios

Although EPA and other commentators have offered some comparison of emissions reductions under a cap-and-trade and a MACT approach, they have based their assessments on the proposed MACT standard, which is so lax (and, as argued above, of questionable legality) as to prohibit any useful comparison. Nonetheless, as noted above, it is impossible to say what MACT would have been, had EPA taken seriously the task of producing a MACT standard for coal-fired utilities. The analysis that follows, therefore, compares emissions reductions under the cap-and-trade approach to emission reductions under two reasonable alternative MACT standards, the first representing a best-case scenario in terms of emissions reductions, the second representing a worst-case scenario in terms of emissions reductions.

The "MACT best-case" scenario entails 94.78% mercury removal. This scenario considers the average emissions reductions achieved by the best performing 12% of existing sources, i.e., the top 10 boilers in the United States, without providing for subcategorization. As noted above, this figure is derived from the data provided by the Ranking Subgroup of the Utility MACT Working Group for purposes of determining the MACT floor.

The "MACT worst-case" scenario entails 60% removal for sources burning low-rank coals and 70% removal for sources burning bituminous coals. This scenario divides facilities according to two subcategories based on coal rank, those burning "bituminous coals" and those burning "low-rank coals," which include subbituminous coals and lignite. This basis for subcategorization follows that outlined by the ORD in the analysis it prepared for use in determining MACT.[226] The removal rates selected reflect the worst-case assumptions employed by the ORD for even those facilities burning low-rank coals.[227]

Thus, these two alternative MACT scenarios are meant to afford reasonable points of comparison for the cap-and-trade proposal for reducing mercury emissions. They are, of course, rough cuts constructed for purposes of this comparison only and should not be taken for more than this. Among other things, as the explanation above indicates, these scenarios were derived without any attention to the required "beyond-the-floor" analysis, which indeed might produce a MACT standard requiring removal at greater rates that would be predicted by calculations for the MACT floor alone. In particular, the MACT worst-case scenario is offered not to take a position on the subcategorization question,[228] but to provide as full a vetting of the cap-and-trade proposal as is plausible under the various interpretations of the relevant data and law.

III. Environmental Justice and Emissions Reductions

When compared to the substantial reductions in mercury emissions—on the order of 90%—to be secured by 2008 under a MACT standard, a 61% reduction by 2018 amounts to a considerable reprieve to sources. Yet EPA's proposed cap-and-trade approach promises only these meager—and delayed—reductions from coal-fired utilities. The proposal can be expected to translate into elevated exposures to MeHg in fish and so to keep fish "off limits" for a large swath of the U.S. population for years to come. Importantly, given MeHg's neurodevelopmental effects, this reprieve in emissions reductions threatens an entire generation of children. Moreover, because fish consumption practices vary considerably among different groups, whereas those in the general population may be relatively unaffected by a reprieve in emissions reductions, those in higher consuming subpopulations stand to bear its brunt. Members of the fish-

223. 42 U.S.C. §7412(d)(3)(A).

224. U.S. EPA, Variability Analysis, *supra* note 204, at 2.

225. *See* Heinzerling & Steinzor, *Perfect Storm II*, *supra* note 3, at 10486-91.

226. ORD, MACT Projections, *supra* note 188, at 15.

227. That is, depending on control technology configurations, only one category of six that considered facilities burning low-rank coals was projected to attain mercury control in the range of 60% to 70% in 2010; the projected removal rates for the other five categories of low-rank coals were 70% for one category, 70% to 80% for two categories, and 90% for two categories, all in 2010. *Id.* Further, as explained above, the ORD notes that these estimates are likely to state conservatively the date by which these control levels could be achieved, inasmuch as they reflect the most difficult case, i.e., facilities that burn lignite, from the perspective of mercury removal. *Id.* at 14.

228. This would require much fuller discussion, and is beyond scope of this Article.

ing tribes of the upper Great Lakes, for example, would be among the most heavily burdened.

This part compares EPA's proposed cap-and-trade approach to two alternative MACT scenarios, the first representing a "best-case" scenario of 94.78% removal, the second representing a "worst-case" scenario of 60% to 70% removal, depending on coal rank. It relies on EPA's own models to do so. It finds that the cap-and-trade approach fares poorly at virtually every point of comparison as against the traditional MACT approach under §112 of the CAA, properly implemented. In fact, it finds EPA's caps so meek that they undercut even the most protective features of a cap-and-trade approach, e.g., its promise of a permanent ceiling on aggregate mercury emissions. In the process of this comparison, this part outlines the most recent evidence supporting the claim that rapid emissions reductions will beget rapid declines in MeHg in fish. This part then concludes that the reprieve afforded sources under EPA's proposed cap-and-trade approach disproportionately burdens those in higher consuming subpopulations, including members of the fishing tribes of the upper Great Lakes.

A. Reprieve Under Cap-and-Trade Relative to MACT

The proposed cap-and-trade approach results in a significant reprieve in emissions reductions relative to emission reductions that would be achieved under either alternative MACT scenario. As the comparisons that follow demonstrate, this is true for the nation as a whole and it is true for the upper Great Lakes region.

In fact, the magnitude of the reprieve is larger than conveyed by the comparison below, as a result of four assumptions generous to the cap-and-trade approach. First, this analysis uses EPA data; as described above, EPA modeled emissions reductions assuming a 26-ton-per-year phase-one cap in 2010 rather than the 34-ton-per-year cap included in the proposed rule. Second, this analysis assumes that the "safety valve" will not be triggered. Third, this analysis assumes that sources will not comply with the MACT standard until 2008, rather than by 2007, as would have been the case had EPA met the December 2004 deadline for promulgation initially agreed upon in settlement. Fourth, because EPA parsed its integrated planning model (IPM) data only for the years 2010 and 2020, the final point of comparison, 2020, allows for two additional years beyond the date by which sources were to have complied with the phase-two cap. Note, too, that the comparison below accounts, as it must, for the effects of projected increases in coal consumption by coal-fired utilities over the relevant period.[229]

Nationally, the reprieve in emissions reductions afforded by cap-and-trade is initially quite large relative to either MACT scenario. Thus, whereas emissions in 2008 under MACT best case decline to just over 4.5 tons, emissions in 2008 under cap-and-trade will remain somewhere between the current level of 48 tons and, optimistically, the 2010 cap of 34 tons.[230] Even under MACT worst case, emissions decline to approximately 28 tons.[231] This is unsurprising, of course, as the MACT scenarios anticipate compliance with required emissions reductions by 2008, whereas the cap-and-trade proposal imposes no requirements until 2010. Even as the phase-one cap is applied in 2010, the modest emissions reductions it entails permit significantly greater mercury emissions than are projected under MACT best case. Thus, assuming facilities meet the 34 ton-per-year cap in 2010, the total mercury emissions under cap-and-trade would still be over seven times the total mercury emissions of roughly 4.7 tons under MACT best case. The difference is smaller if one considers MACT worst case, although even here mercury emissions permitted under cap-and-trade would be 17% higher than the 29 tons emitted under MACT worst case. Even in 2020, two years after the phase-two cap would go into effect, mercury emissions under the cap-and-trade approach are projected to be just over 18.5 tons, whereas they would be only 5.5 tons under MACT best case. In fact, the emissions levels achieved by MACT best case do not converge with those permitted by cap-and-trade *until roughly the turn of the next century*, i.e., 2100, at which point increases in coal consumption would be expected to drive mercury emissions under MACT best case to the 15 ton-per-year level.[232] Whereas emissions levels under cap-and-trade and MACT worst case would be expected to converge sometime between 2010 and 2020,[233] it is important to note that for either MACT scenario, the MACT standard must be reviewed and additional risk-based standards issued for the relevant source category by 2013. This point is taken up below.

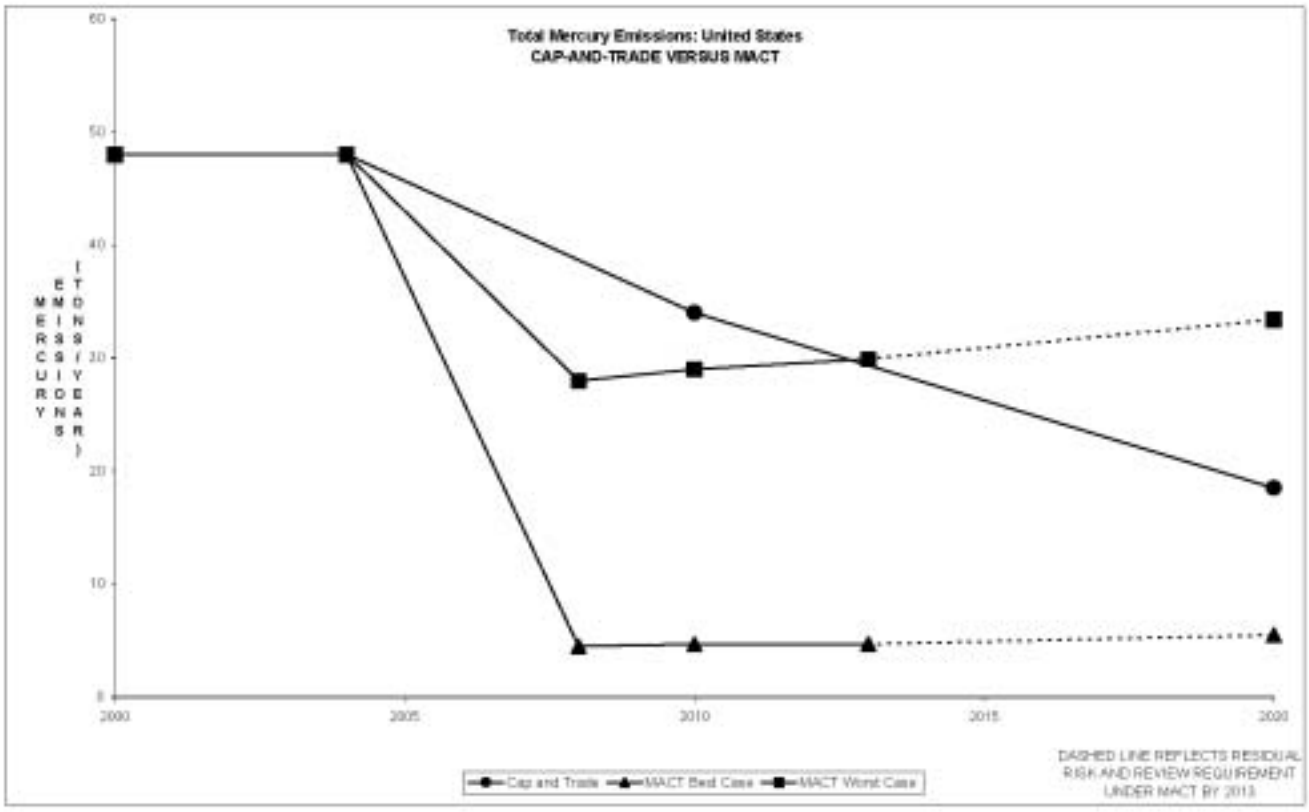
229. The projections for the cap-and-trade approach account for increased coal consumption per the EPA's protocol for its IPM runs. *See* U.S. EPA, IPM Documentation, *supra* note 166. The projections for the alternative MACT scenarios assume increased coal consumption as predicted by the EIA, which projects coal consumption by sector to 2025. U.S. Department of Energy, EIA, Annual Energy Outlook 2004 With Projections to 2025, fig. 111 (2004), *available at* http://www.eia.doe.gov/oiaf/aeo/coal.html and http://www.eia.doe.gov/oiaf/excel/figure111_data.xls [hereinafter EIA, Projections to 2025]. Note that the data sources for the projections are different for the cap-and-trade and MACT scenarios, making the resulting comparison inexact in this regard.

230. The figure for 2008 under the proposed cap-and-trade approach is necessarily an estimate, as EPA parsed the data for its IPM runs for only two years, 2010 and 2020.

231. The values for MACT worst case nationwide were calculated by estimating the proportion of sources firing subbituminous and lignite coals. Applying the assumptions above, i.e., 60% removal for low-rank coals, 70% removal for bituminous coal, this amounted to an assumption of 67.8% control under the MACT worst-case scenario.

232. The projection for MACT best case here is based on a linear extrapolation beyond 2025, based on EIA projections from the present to 2025. *See* EIA, Projections to 2025, *supra* note 229. Of course, projections this far into the future are perilous; the linear extrapolation employed here is meant to provide a rough cut at the question of convergence.

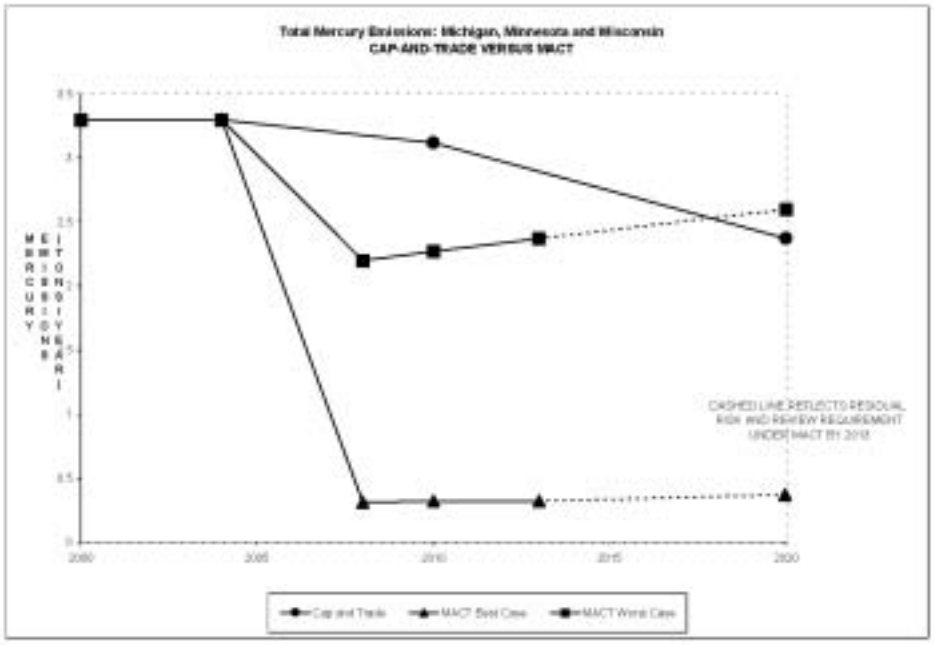
233. Because EPA's IPM runs were generated assuming a 26-ton-per-year cap, it is not possible to pinpoint the time of convergence with MACT worst case. Emissions under MACT worst-case increase gradually from 29.15 tons in 2010, to 30.80 tons in 2015, to 33.39 tons in 2020. Depending on how quickly sources move toward compliance with the phase-two cap, convergence would be expected earlier or later within this time frame, as the IPM data show emissions under cap-and-trade at 18.57 tons in 2020.



If one focuses on the upper Great Lakes states of Michigan, Minnesota, and Wisconsin, the effects of the reprieve are similarly significant. Whereas mercury emissions in 2008 would be expected to remain just under the current level of 3.3 tons under the cap-and-trade approach, they would decline to a fraction of this amount, 0.31 tons, with the application of MACT best case. Under MACT worst case in 2008, emissions would decline to just under 2.20 tons.[234] As the phase-one cap is applied in 2010, emissions under the cap-and-trade approach would decline slightly in this region, to 3.12 tons. Under MACT best case, emissions would be only 0.32 tons. Thus, in 2010 a cap-and-trade approach would permit *eleven times* the mercury emissions in the upper Great Lakes states than the MACT best case approach would allow. Emissions under MACT worst case, at 2.27 tons, would still be significantly lower than under the cap-and-trade approach at this point. In 2020, the cap-and-trade approach would permit emissions of 2.37 tons, whereas emissions under MACT best case would be 0.37 tons. Thus, even two years after the application of the final cap, emissions under cap-and-trade would be nearly *six times* the level under MACT best case for the states of Michigan, Minnesota, and Wisconsin. Astoundingly, emissions levels achieved under MACT best case do not converge with emissions levels permitted under cap-and-trade in this region until sometime around the year 2300; again it is only at this point that increased coal consumption would be expected to drive mercury emissions up to the level permitted by the phase-two cap.[235] Here again, convergence would occur sooner for MACT worst case, sometime between 2017 and 2018. Again, however, this projection does not account for the MACT revisions and additional residual-risk standards required by 2013.

234. The values for MACT worst case for the upper Great Lakes states of Michigan, Minnesota, and Wisconsin were calculated by considering the rank of coal listed for each source in the IPM database, and applying the 60% removal figure for sources burning low rank coals and the 70% removal figure for sources burning bituminous coals.

235. Again, the projection for MACT best case here is based on a linear extrapolation beyond 2025, based on EIA projections from the present to 2025. Of course, projections this far into the future are perilous; the linear extrapolation employed here is meant to provide a rough cut at the question of convergence.



EPA and various industry commentators have attempted to downplay the magnitude of the reprieve granted to coal-fired utilities by the proposed rule. EPRI, for example, compares the emissions reductions under the cap-and-trade proposal to reductions that would be achieved under the MACT standard as proposed—a standard that, as argued above, is extraordinarily lax and rests on questionable legal footing. It then employs various assumptions, e.g., EPRI assumes less banking will take place than does EPA, that result in an earlier estimate of when the 15 ton-per-year cap would be reached, that is, in 2020.[236] It thus concludes that "[a]t an aggregate level, the main benefit of the Hg MACT appears to be that emissions would be lower for a few years," with convergence occurring between about 2012 and 2014.[237] After this, EPRI argues, the emissions reductions under cap-and-trade would be greater than under MACT as proposed.[238] EPA similarly bases its analysis on a comparison between the cap-and-trade approach and the MACT standard as proposed. Although EPA states that it does not have the data to assess the health benefits, it too finds the cap-and-trade approach to be superior to the MACT standard as proposed. Both of these claims, of course, depend on a straw MACT standard. Devised to require very little of the regulated sources, MACT as proposed not surprisingly fares poorly by comparison to the cap-and-trade approach.[239] And both of these claims neglect to account for any reductions required after 2013 under a MACT-based approach.

Moreover, the import of the reprieve granted to coal-fired utilities must be considered in the context of the years of freedom from mercury regulation enjoyed by these sources. As Profs. Lisa Heinzerling and Rena Steinzor document, these sources and their trade associations have worked to thwart efforts to regulate mercury emissions from coal-fired utilities at virtually every turn.[240] Importantly, their tactics have been entirely successful at forestalling regulation. And delay, given the baseline of unregulated mercury emissions, amounts to a huge break for these sources—and an ongoing burden for those exposed. EPA's most recent efforts only perpetuate the unregulated status quo. While under court-approved deadline finally to produce regulations, EPA issued a proposal that was so objectionable that the NRDC was forced to give EPA more time to send it back to the drawing board. The strategic value of this most recent delay has not been lost on commentators, despite Administrator Michael Leavitt's efforts to portray an EPA concerned only with taking the time to "do it right" for the sake of protecting women and children's health.[241] Thus, regardless the form

236. EPRI, Comments, *supra* note 42, at 28-29 ("EPRI estimates that mercury emissions in 2018 would be 23.9 tons, but fall to the Phase I target of 15 tons within two years (i.e., by 2020)").

237. *Id.* at 100-02. Interestingly, EPRI's model projects a quite later point of convergence if one considers only emissions of Hg^{++}. EPRI projects that emissions reductions of this species of mercury under MACT as proposed will be greater than under cap-and-trade until sometime between 2016 and 2017. *Id.* at 101.

238. *Id.* at 100-02.

239. Even so, as EPRI concedes, MACT as proposed provides greater emissions reductions for a period of at least four years (and a period of a decade, if one considers only Hg^{++} emissions) relative to cap-and-trade. This time lag is not insignificant, given mercury's particular health endpoints and its behavior in the environment, points elaborated below.

240. Heinzerling & Steinzor, *Perfect Storm I* and *Perfect Storm II*, *supra* note 3.

241. Heinzerling & Steinzor, *Perfect Storm I*, *supra* note 3, at 10298, 10300, 10305; John Heilprin, *EPA Mercury Plan Aims to Help*

and stringency of the standard that ultimately emerges, the most recent delay engineered by EPA constitutes one more boon to sources. A standard that means emissions reductions that are further delayed and diminished would exacerbate an already generous reprieve to sources, at the expense of the health of many.

B. Delayed Emissions Reductions, Elevated Exposures for Years to Come

Delayed and diminished mercury emissions reductions can be expected to translate into elevated exposures to MeHg in fish, thus placing fish "off limits" for a large swath of the U.S. population for years to come. Recent studies continue to lend support to the link between mercury emissions and MeHg concentrations in fish. Furthermore, the most recent data show that changes in fish MeHg concentrations can be observed in some ecosystems within a relatively short time frame—within as little as a few months or a few years—after a change in the mercury deposition rate. For at least some ecosystems, data show that rapid reductions in mercury emissions will lead to rapid declines in fish MeHg concentrations. Conversely, delayed emissions reductions would forestall declines in fish MeHg concentrations, with consequent adverse effects for those who would consume these fish.

Given the current level and extent of MeHg contamination in fish tissue, a reprieve in emissions reductions would mean that fish would harbor MeHg at levels above EPA's RfD for even the average woman in the Great Lakes region. Such a reprieve would have extraordinary impacts on women from fishing tribes and other higher consuming subpopulations. Indeed, any reprieve in mercury emissions reductions would be borne disproportionately by fishing peoples and other communities that depend on fish, as the same absolute change in fish tissue concentration has a greater relative impact on exposure for individuals in these groups. Moreover, given that MeHg's neurodevelopmental effects are of the greatest concern, the temporal considerations revealed by recent studies take on particular importance: a decades-long reprieve in mercury emissions reductions threatens an entire generation of children.

1. Rapid Reductions, Rapid Responses

Although the relationship is not yet susceptible to precise quantification, recent studies continue to confirm a link between mercury emissions reductions and decreased MeHg concentrations in fish. Moreover, the most recent data from the field demonstrate that changes in fish MeHg concentrations can be observed in some ecosystems within a relatively short time frame after a change in the mercury deposition rate. And while quantification again is not possible, it seems clear that mercury emissions reductions at coal-fired facilities will contribute to decreased MeHg concentrations in fish. As a consequence, more rapid emissions reductions from these sources will contribute to more rapid declines in fish MeHg concentration.

Recent long-term studies suggest a direct relationship between emissions reductions and ecological changes.[242] This relationship is suggested by a study in the Florida Everglades, demonstrating that reduced mercury emissions led to decreased concentrations in fish.[243] This study found a linear relationship between atmospheric mercury deposition and mercury concentration in largemouth bass and concluded that "for any reduction in mercury inputs to the Everglades, a slightly lesser reduction in fish mercury tissue concentrations may be anticipated."[244] It observed a decrease in MeHg concentrations in fish as high as 80% from peak levels in the mid-1990s, corresponding to mercury emissions reductions, primarily from municipal and medical waste incinerators located in southern Florida, of 99% from levels in the mid-1980s.[245] This relationship is also suggested by studies in northern Wisconsin. In a series of studies, decreased mercury deposition was found to lead to decreased mercury concentrations in a precipitation-dominated seepage lake in northern Wisconsin.[246] The authors hypothesize that the observed reductions in mercury in lake waters are "driven by reduced anthropogenic emissions in the region."[247] These studies found that as mercury inputs to this system declined, there was a rapid decline in fish tissue MeHg concentration.[248] This direct relationship is further supported by recent findings from the Mercury Experiment to Assess Atmospheric Loading in Canada and the United States (METAALICUS) study, an ongoing effort to assess the relationship between mercury deposition and fish tissue methylmercury concentration, conducted jointly by U.S. and Canadian researchers.[249]

The most recent data also bring to the fore important temporal considerations. First, changes in fish mercury concentrations can be observed in some ecosystems within a relatively short time after a change in deposition rate. As noted above, the Florida Everglades study found that emissions reductions undertaken since the mid-1980s corresponded to an 80% decrease in fish tissue MeHg concentration to present levels.[250] The studies in Wisconsin similarly observed a rapid decline in fish tissue MeHg concentration as atmospheric mercury deposition declined.[251] The

Children and Women, Sidestep Coal Politics, N. Country Times, Aug. 11, 2004 ("'It is a matter of real importance, and I intend to do it right,' Leavitt told reporters. 'The first principle is that the final rule will concentrate on the need to protect children and pregnant women.'"), *available at* http://www.nctimes.com/articles/2004/08/15/special_reports/science_technology/22_23_518_10_04.txt.

242. Hubbard Foundation Scientists, *supra* note 18, at 12.

243. *Id.*; Florida Dep't of Envtl. Protection (FDEP), Integrating Atmospheric Mercury Deposition With Aquatic Cycling in South Florida (2002, rev. 2003), *available at* http://www.dep.state.fl.us/secretary/hews/2003/nov/pdf/mercury_report.pdf [hereinafter FDEP, Mercury Deposition Study].

244. FDEP, Mercury Deposition Study, *supra* note 243, at ii-iii.

245. *Id.* at 89; *cf.* Press Release, FDEP, *Florida Everglades Study Reveals Decline in Mercury Levels* (Nov. 6, 2003) (citing decline of 60% in fish tissue MeHg), *available at* http://www.dep.state.fl.us/everglades forever/news/2003/110603.ntm.

246. C.J. Watras et al., *Decreasing Mercury in Northern Wisconsin: Temporal Patterns in Bulk Precipitation in a Precipitation-Dominated Lake* 34 Envtl. Sci. & Tech. 4051 (2000).

247. *Id.*

248. *Id.*; T.R. Hrabik & C.J. Watras, *Recent Declines in Mercury Concentration in a Freshwater Fishery: Isolating the Effects of De-Acidification and Decreased Atmospheric Mercury Deposition in Little Rock Lake*, 297 Sci. Total Env't 229, 235 (2002).

249. The METAALICUS project is a large, multidisciplinary, multi-investigator project. *See, e.g.*, Academy of Natural Sciencies Estuarine Research Center, *What Is METAALICUS?, at* http://www.acnatsci.org/research/anserc/metaalicus.html.

250. FDEP, Mercury Deposition Study, *supra* note 243.

251. Watras et al., *supra* note 246, at 4055; Hrabik & Watras, *supra* note 248, at 235.

METAALICUS study has confirmed these findings, observing ecosystem responses to changes in direct mercury deposition within a very short time. The first two years of results from this study show that traceable stable mercury isotopes deposited directly to a lake surface were readily converted to MeHg and can be observed in fish tissue in the same season as the additions commenced. Whereas there is "at least a two-year time lag" before mercury deposited to the surrounding canopy reaches the lake, mercury that is directly deposited to the lake is rapidly methylated.[252] As Dr. Cindy Gilmour, a METAALICUS researcher, explains: "It lands on the lake, moves into sediments, gets methylated and into the food web in three weeks."[253] Additionally, researchers found that, after two years, approximately one-quarter of the methylmercury in young perch was due to mercury that had been deposited to the lake surface.[254]

Second, more recently deposited mercury is more bioavailable than mercury that has been present in an aquatic ecosystem for longer periods. The Wisconsin studies found that newly deposited mercury dominates bioaccumulation processes, even in the presence of a large reservoir of mercury in the watershed and in lake sediments.[255] The METAALICUS study has corroborated these results, finding that the mercury isotopes deposited to the lake surface were more available for methylation and uptake by fish than mercury that had been in the ecosystem for longer periods.[256] Dr. Gilmour elaborates that "the newer mercury is at least five times more readily methylated than the pools of legacy mercury."[257]

Thus, while understandings continue to evolve and numerous questions remain, this recent work usefully addresses some of the questions unanswered by the long-term study in the Florida Everglades. Although that study showed a direct relationship between reductions in mercury emissions from local sources and reductions in fish tissue MeHg concentrations, the question remained whether the particular atmospheric conditions and watershed characteristics of the Everglades were unique, or whether these findings held true in other contexts as well. The Wisconsin and METAALICUS studies suggest that these findings obtain elsewhere. These studies suggest that differences among watershed characteristics are nonetheless relevant, particularly to the rate at which changes to mercury deposition are expected to result in changes to fish tissue MeHg concentration. As a result of this most recent work, then, a group of independent environmental scientists concludes: "For ecosystems that receive a substantial fraction of their load from direct deposition to water and wetland surfaces, rapid reductions in mercury emissions should lead to rapid benefits to human and wildlife health."[258]

Note that none of these studies purports to isolate mercury emissions reductions from coal-fired utilities. EPRI has criticized the results of the Florida study, arguing that the mercury emissions released by municipal and medical waste incinerators are "different" from those released by power plants.[259] Because the emissions reductions in Florida were obtained largely through regulation of these source categories, this argument goes, the consequent reductions in deposition and, ultimately, fish tissue MeHg concentrations shouldn't be expected from different sources, namely coal-fired utilities.[260] Their claim to "difference," however, rests on differences in ratios of mercury's three gaseous species in the emissions from these source categories, i.e., ratio of Hg(0) to Hg++ to Hg(p), and on differences in other physical features, such as stack height, typical at sources within each of these categories.[261] Thus, the most EPRI can say here is that the difference is one of degree rather than kind. It is not that mercury emissions from coal-fired facilities do not contribute to local mercury deposition while mercury emissions from municipal and medical waste incinerators do. Rather, it is that mercury emissions from coal-fired facilities—which themselves differ one from the other in terms of the ratios of mercury's species emitted and such physical parameters as stack height—likely vary in their contribution to local mercury deposition; this variation exists both between source categories and among sources within the source category comprised of coal-fired utilities.

In the end, more data are needed to characterize in any comprehensive fashion the relationship between mercury emissions reductions from coal-fired utilities and resulting decreases in local deposition. It seems clear, however, that mercury emissions reductions from coal-fired utilities, as from other sources, will contribute to decreases in local deposition and, ultimately, in fish tissue MeHg concentration. Indeed, while there remains disagreement about the magnitude of the contribution, there is widespread agreement about its existence.[262]

2. Differences in Exposure

Given the current level and extent of MeHg contamination in fish tissue, a reprieve in emissions reductions would mean that fish would harbor MeHg at levels above EPA's RfD for even the average woman in the Great Lakes region. Such a reprieve would have extraordinary impacts on women from fishing tribes and other higher consuming subpopulations. Indeed, any reprieve in mercury emissions reductions

252. Lisa M. Pinsker, *In Search of the Mercury Solution*, GEOTIMES, Aug. 2003, *available at* http://www.geotimes.org/aug03/feature_mercury.html.

253. *Id.* (quoting Dr. Gilmour).

254. Hubbard Foundation Scientists, *supra* note 18, at 12 (citing Blanchfield, unpublished data).

255. Hrabik & Watras *supra* note 248, at 235; *see also* Watras et al., *supra* note 246, at 4055:

> Our observations suggest that pollution abatement policies can have an effect over a short time scale—despite large stores of Hg in the watershed and lake sediments. These Hg stores may provide some buffering, but they do not over-ride substantial changes in depositional rates, at least in the case of a model seepage lake.

256. Conference presentation by Dr. Gilmour et al. (cited by Hubbard Foundation Scientists, *supra* note 18, at 12).

257. Pinsker, *supra* note 252.

258. Hubbard Foundation Scientists, *supra* note 18, at 13.

259. EPRI, *The Florida Mercury Report—Putting It in Perspective* (undated), *at* http://www.epri.com/corporate/discover_epri/news/HotTopics/env_FloridaMercuryRpt.pdf.

260. *Id.*

261. *Id.*

262. *See, e.g.*, RANDALL LUTTER & ELIZABETH MADER, HEALTH RISKS FROM MERCURY-CONTAMINATED FISH: A REASSESSMENT 9 (2001) *available at* http://www.aei.org (positing that elimination of coal-fired utilities' mercury emissions would result in "about a 21 percent cut in deposition in the U.S."); *see also* SULLIVAN ET AL., *supra* note 46 (modeling decreases in deposition expected at two coal-fired power plants while accounting for particular ratios of mercury species comprising each one's emissions, for physical plant variables such as stack height, and for local atmospheric conditions; finding localized deposition in each case).

would be borne disproportionately by fishing peoples and other communities that depend on fish, as the same absolute change in fish tissue concentration has a greater relative impact on exposure for individuals in these groups.

A sense of the disproportionate impact of such a reprieve is afforded by a comparison among women consuming fish at rates representative of the general U.S. population, of Great Lakes residents, and of GLIFWC member tribes. As noted above, fish consumption practices vary considerably among groups. Studies documenting consumption practices in these three subpopulations have produced fish consumption rates of 17.5 g/day for the general U.S. population,[263] 42 g/day for fish consumers in the Great Lakes states,[264] and 189.6 g/day for fish consumers in the GLIFWC member tribes.[265]

Given current measurements of MeHg concentration in walleye,[266] a commonly consumed fish in the upper Great Lakes region, women consuming fish at rates representative of the general U.S. population are exposed to MeHg at levels virtually at EPA's RfD of 0.10 µg/kg body weight/day, that is, at 0.1050 µg/kg body weight/day.[267] Women consuming fish at rates typical to the Great Lakes region are exposed to MeHg at levels over twice EPA's RfD, that is, at 0.2520 µg/kg body weight/day.[268] Women consuming fish at rates typical of the GLIFWC member tribes are exposed to MeHg at levels *more than 10 times* EPA's RfD, that is, at 1.1376 µg/kg body weight/day.[269]

Were fish tissue MeHg concentration to be reduced by 60%—a change potentially realizable within a decade of sustained reductions in mercury emissions and, consequently, in mercury deposition—exposure for women in the general population would fall to well below EPA's RfD (0.042 µg/kg body weight/day). Exposure for women from the Great Lakes would decline to roughly equal EPA's RfD (0.1008 µg/kg body weight/day). Exposure for women who are members of the Great Lakes fishing tribes would decline to over four times EPA's RfD (0.45504 µg/kg body weight/day). While this hypothetical scenario is designed to be representative of results observed in the real world, e.g., results of the study in the Florida Everglades in which a fish tissue MeHg decline of as high as 80% over a period of a decade was found to correspond to a decrease in mercury emissions of on the order of 90%; results of the Wisconsin and METAALICUS studies documenting the extremely rapid ecological responses to a decrease in mercury deposition—it is not offered here to suggest that a particular decline in exposure will follow from a particular decrease in mercury emissions from coal-fired utilities. Such a prediction is not possible, for the reasons discussed above. Rather, these figures are presented to afford a sense of the relative burden of a significant reprieve in emissions reductions.[270]

Table 1
Methylmercury Exposure Via Fish Consumption

Population	Fish Consumption Rate (g/day)	Current MeHg Exposure: Average Woman (g/kg body weight/day)	MeHg Exposure if Mercury Deposition Reduced 60%: Average Woman (g/kg body weight/day)	Difference (g/kg body weight/day)
United States General Population	17.5	0.1050	0.042	0.063
Great Lakes Fish Consumers	42	0.2520	0.1008	0.1512
GLIFWC Tribal Fish Consumers	189.6	1.1376	0.45504	0.68256

263. This value reflects the 90th percentile value for consumption of freshwater and estuarine fish by all adults (both fish consumers and non-consumers) in the general U.S. population, taken from the USDA's CSFII for the years 1994 to 1996. As noted above, this number has been chosen by EPA as its default value for use in setting water quality standards. U.S. EPA, AMBIENT WATER QUALITY CRITERIA METHODOLOGY, *supra* note 77.

264. This value reflects average consumption for fish consumers among residents in the Great Lakes Basin, as demonstrated by a variety of studies of this subpopulation. Christopher T. De Rosa & Heraline E. Hicks, *Sentinel Human Health Indicators: A Model for Assessing Human Health Status of Vulnerable Communities*, 7 HUM. & ECOLOGICAL RISK ASSESSMENT 1419, 1426 (2001).

265. This value reflects the low value in the range (189.6 g/day to 393.8 g/day) of average walleye consumption during the spring for fish consumers among tribal spearers surveyed by the GLIFWC in 1993. GLIFWC, 1993 SURVEY, *supra* note 80. Note that the Leech Lake Band suggests 227 g/day as the appropriate fish consumption rate for members' consumption. *See* Letter from John Persell, *supra* note 82. Additionally, because the GLIFWC survey that is the source of the value used for comparison includes only walleye consumption, it may underestimate tribal members' exposure to MeHg from other fish species consumed as well.

266. According to data gathered by the states of Michigan, Minnesota, and Wisconsin, average MeHg concentrations in walleye are, respectively, 0.38 ppm, 0.39, ppm, and 0.45 ppm. *See* CLEAR THE AIR, REEL DANGER, *supra* note 19, app. C. For the sake of simplicity, the value for walleye MeHg concentration in Michigan, 0.39 ppm, is used in the calculations that follow.

267. These figures assume that the average woman weighs 65 kg. Note that this assumption may have the effect of overstating actual consumption rates for women in each of these three groups, inasmuch as it is coupled with fish consumption data gathered for both men and women and data suggest that, in general, women consume fish at lower rates than men. *See, e.g.*, De Rosa & Hicks, *supra* note 264, at 1427. On the other hand, women who are pregnant and women who are breastfeeding—subpopulations of particular concern, given MeHg's health endpoints—may consume at higher rates, given their greater caloric needs during there periods. These figures were derived by solving for µg/kg body weight/day, assuming one of the three fish consumption rates, a 65 kg body weight, and an average fish tissue MeHg concentration of 0.39 ppm or 390 µg MeHg/kg fish.

268. *Id.*

269. *Id.*

270. Even this comparison must be offered with the caveat that the fish consumption studies on which it is based were conducted by different methods, such that comparisons will necessarily be imperfect. For example, whereas the value for the general U.S. population reflects per capita consumption, i.e., it includes fish consumers and non-consumers alike, the value for the Great Lakes subpopulation reflects consumption by fish consumers only and the value for the member tribes of the GLIFWC reflects consumption by a subset of fish consumers, specifically, tribal spearers. For a discussion of how design and other differences among fish consumption studies affect fish consumption rates, see O'Neill, *supra* note 73, at 51-63.

Whereas those in the general population may be relatively unaffected by a reprieve in emissions reductions, those in higher consuming subpopulations stand to bear its brunt. Thus, a woman consuming fish at rates consistent with the general population may be protected even if emissions reductions are more modest. A woman consuming fish at rates typical of the Great Lakes is likely to be protected only as emissions reductions become sufficiently large to result in a 60% reduction in fish tissue MeHg concentrations; such a woman would be left to face significantly elevated exposure were emissions reductions to fall short of this. For a woman consuming fish at rates observed in GLIFWC member tribes, the impacts of such a reprieve are even more pronounced.

As the figures in Table 1 illustrate, the same absolute change in fish tissue MeHg concentration translates into relatively greater differences in exposures for higher consuming subpopulations. Thus, a failure to undertake emissions reductions sufficient to attain the 60% decline in fish tissue MeHg concentration illustrated here translates into an increased burden for a woman in the general U.S. population of approximately 0.06 μg/kg body weight/day. It translates into a significantly greater increased burden for a woman in the general Great Lakes population, i.e., 0.15 μg/kg body weight/day. For a woman in the member tribes of the GLIFWC, this increased burden climbs to 0.68 μg/kg body weight/day—an extraordinary figure, given that EPA's RfD is 0.1 μg/kg body weight/day.

In fact, this illustration may understate the *differences* in exposure as between women in the general population and women in higher consuming Great Lakes subpopulations. As discussed above, the variables relevant to estimating MeHg exposure via the fish consumption pathway include not only the fish consumption rate, but also the frequency of fish consumption and the level of MeHg contamination in the particular species of fish consumed.[271] First, given that MeHg is a neurodevelopmental toxin, relatively short periods of consumption—monthly or seasonal fluctuations—become relevant to understanding exposure. Women in the GLIFWC member tribes' fish consumption practices are likely to include periods of elevated and concentrated consumption during certain seasons, e.g., spring, and in conjunction with various ceremonies or tribal gatherings.[272] This resulting acute exposure is generally not experienced by women in the general population. As the *Mercury Study Report to Congress* reminds, short- and moderate-term dietary patterns covering periods of "a few months" are "the most relevant exposure period for the health-based endpoint that formed the basis of the RfD—i.e., developmental deficits in children following maternal exposure to [MeHg]."[273] Second, given differences in MeHg content from species to species, the species of fish consumed by these groups become relevant. As noted above, women in the Great Lakes—particularly women in the fishing tribes of the GLIFWC—are likely to consume a mix of species that is different than that consumed by women in other regions or in the general U.S. population. Consider, for example, that Alaskan pollock and shrimp comprise a significant portion of the fish consumed by those in the general population, whereas walleye, northern pike, and other freshwater fish comprise a significant portion of the fish consumed by those in the fishing tribes of the upper Great Lakes.[274] Whereas recent EPA data indicate an average MeHg concentration of 0.06 ppm for Alaskan pollock and <0.01 ppm for shrimp; these data show a much higher average MeHg concentration of 0.35 ppm for walleye and 0.30 ppm for northern pike.[275] Thus, this illustration, which assumes that walleye comprise the entirety of the fish consumed, would be expected to overstate exposure for women in the general population; it would also likely overstate, although to a lesser degree, exposure for women in the general population in the Great Lakes. By contrast, walleye and similarly contaminated species comprise a considerable portion of the fish consumed by women in the GLIFWC member tribes. In fact, the values for the fish consumption rate for these women are taken from a study specifically focused on walleye consumption. The important result of these two factors is that the differences in exposure between women in the general population and women in the fishing tribes of this region are likely to be even larger than illustrated.

The relevance of these variables to exposure is buttressed by a recent effort to model changes to human health risk from changes in mercury deposited by two coal-fired utilities. This study, conducted under the auspices of the Brookhaven National Laboratory, emphasized that expected changes in human health risks are likely "highly dependent" on the quantity and species of fish consumed by those exposed.[276] In this study, members of the general population near the Monticello plant in Texas, for example, were assumed to consume 16.9 g/day of locally caught freshwater fish, and members of a subsistence fish population were assumed to consume 76.8 g/day of locally caught freshwater fish.[277] The authors conclude that the risks resulting from mercury emissions from coal-fired power plants for the general population are low, even under a scenario in

271. *See supra* Part I.C.1. and accompanying text; note that body weight is also relevant, here held constant for comparative purposes.

272. Note that the fish consumption rate used for GLIFWC members reflects average spring consumption, so accounts in some measure for this, although it relies on a low end of range from 189.6 to 393.8 selected, which may bias numbers downward. Acute consumption in conjunction with harvests, ceremonies, or gatherings, however, wouldn't be accounted for by the choice of a spring consumption value.

273. 4 Mercury Study Report to Congress, *supra* note 12, at 4-2, 4-82.

274. *See supra* Part I.C.1(c) and accompanying text of the predominance of these species among those consumed by members of the general population.

275. *Id.*

276. Sullivan et al., *supra* note 46, at 1.

277. *Id.* at 12, tbl. 5. The 16.9 g/day value for the general population reflects an assumption that 22% of the fish consumed by the general population in this area is comprised of locally caught freshwater fish, multiplied by a mean consumption rate of 76.8 g/day. The 22% figure is "similar to the average value for the Southeast of the United States," based on a national survey of dietary intake. *Id.* at 11 (citing H.L. Jacobs et al., *Estimates of Per Capita Fish Consumption in the U.S. Based on the Continuing Survey of Food Intake by Individuals (CSFII)*, 18 Risk Analysis 283 (1998)). This analysis thus assumes no contribution of MeHg from non-freshwater fish species. The 76.8 g/day value for subsistence fishers reflects an assumption that 100% of the fish consumed by subsistence fishers here is comprised locally caught freshwater fish. The 76.8 g/day mean consumption rate is taken from a study by Joanna Burger conducted along the Savannah River. *Id.* at 12. The article mis-cites the source of the consumption rate; the correct citation is: Joanna Burger et al., *Science, Policy, Stakeholders, and Fish Consumption Advisories: Developing a Fish Fact Sheet for the Savannah River*, 27 Envtl. Mgmt. 501 (2001). *See* E-mail from Terrence Sullivan, to author (May 17, 2004).

which deposition increases by 165% near the plant.[278] They note, however, that the risks for subsistence fishers are much greater—on the order of two orders of magnitude greater—than for the general population.[279]

A crucial point emerges from these illustrations: the fish consumption practices of some groups mean that women in those groups have much greater exposures than the general population, and much greater exposures than EPA appears to have registered. The import of this point becomes clear when one considers the significant risks and considerable disparities that have been observed under even the more modest consumption practices accounted for by EPA. Recall the *Mercury Study Report to Congress*' conclusion that *all* sensitive subpopulations consuming fish from within 25 kilometers (km) of a power plant would be exposed at levels above EPA's RfD (and some of these at levels 10 times above the RfD). The highest consumers considered by the *Mercury Study Report to Congress* were assumed to consume 60 g/day of freshwater fish. By comparison, women in the GLIFWC member tribes may consume highly contaminated species of freshwater fish at roughly *three times* this rate. This point extends to several commentators' analyses as well. Thus, the Brookhaven National Laboratory study recounted above finds high-end consumers subject to risks two orders of magnitude greater than the general population, where high-end consumers were assumed to eat 76.8 g/day of locally caught freshwater fish. Again, this level of consumption likely significantly underestimates consumption by some groups, e.g., the women in the GLIFWC member tribes consuming at 189.6 g/day.

Moreover, it is necessary to keep in mind that the proposed cap-and-trade approach both diminishes *and delays* mercury regulation from coal-fired power plants. That is, it not only ultimately seeks much more modest reductions, but also waits to do so for more than a decade relative to a MACT approach. Assuming the near-linear relationship between mercury deposition and fish tissue MeHg concentration observed in field studies, the difference between 61% emissions reductions and 95% emissions reductions is significant. But the combined effect of this difference and a delay of over a decade must be considered if one is to appreciate fully the disproportionate burden of the reprieve on higher consuming subpopulations such as the fishing tribes of the GLIFWC.

Importantly, this delay threatens a generation of children in these tribes and in other higher consuming groups. Given its neurodevelopmental endpoints, exposure to even low levels of MeHg *in utero* has been found to cause neurological deficits in children. In addition, infants and children with ongoing dietary exposures to MeHg continue to be at risk of neurological damage. As the Children's Health Protection Advisory Committee (CHPAC) explains in a letter to EPA concerning the proposed rule: "Children and infants are sensitive to mercury's effects because their nervous systems continue to develop *until about age 20*."[280] Additionally, although children consume lesser quantities of fish than adults in absolute terms, a child consumes more food relative to his or her body weight than an adult does.[281] "As a result, [children] have a higher risk for adverse health effects than adults do."[282] Moreover, given the different consumption practices of the fishing tribes and other higher consuming groups, it is quite likely that children in these subpopulations will also have greater exposures relative to children in the general population.[283]

Indeed, the fact that any delay in regulating mercury emissions comes at the particular expense of children's health is emphasized by the CHPAC's letter. The CHPAC registers its utter dismay that "the unique vulnerabilities of children, infants, and women of child-bearing age were not adequately considered in the development of EPA's proposed rules."[284] While urging EPA to address these concerns in the final rule, CHPAC admonishes that "[i]n no way should these recommendations delay the finalization of the rule."[285] It bears remarking as well that EPA's decision not to consult the CHPAC—the federal advisory committee whose role it is to provide expert advice on matters of children's environmental health—belies Administrator Leavitt's "children first" rhetoric.[286] EPA did not involve the CHPAC at all in its deliberations; instead, the CHPAC was moved to comment once it saw the proposed rule.[287] It was thus relegated to submitting comments via the route provided for ordinary stakeholders.[288]

278. Sullivan et al., *supra* note 46, at 14. The authors conclude generally that risks to the general population are small, "even in the vicinity of the power plant where deposition could double." *Id.* at 16. Because of this, they opine that "a cap-and-trade approach appears to be acceptable" from the perspective of population risk. They qualify this conclusion, however, based on the modeled results at Monticello. "It is interesting to note that if [one assumes that] a linear increase in deposition leads to a linear increase in fish Hg levels, the predicted fish average mercury level for this deposition rate [i.e., a 165% increase, from 20 $\mu g/m^2$/year to 53 $\mu g/m^2$/year] increases from 0.53 ppm to 1.4 ppm, well in excess of any regulatory limit for issuing fish consumption advisories." *Id.* at 14. "If this is substantiated through data collection, there may be justification for plant specific emission limits." *Id*. at 16.

279. *Id.* at 1, 14-15. The model predicts risks to the general population attributable to deposition from the plant ranging from 1.2 (10^{-5}) in the base case to 9.0 (10^{-5}) in the case of a 165% increase in local deposition—here, within 10 km of the plant. *Id.* at 14. The model predicts corresponding risks to the subsistence population ranging from 6.3 (10^{-3}) in the base case to 5.5 (10^{-2}) in the case of a 165% increase in local deposition. *Id.* at 15. The authors define risk in terms of the probability of a 5% increase of observing any of a variety of health endpoints of relevance to the benchmark dose for mercury exposure. *Id.* at 11.

280. Letter from CHPAC, to Michael Leavitt, Adminstrator, U.S. EPA, att. A (Jan. 26, 2004) (emphasis added), *available at* http://yosemite.epa.gov/ochp/ochpweb.nsf/content/20040126.htm/$file/20040126.pdf [hereinafter CHPAC, Letter].

281. *Id*. at 6 & n.4.

282. *Id.* at 6.

283. It is also worth noting that children constitute a higher proportion of the population for American Indians and Alaska Natives (and for some other communities of color) than they do for Whites; whereas children under 20 comprise 38.85% of the American Indian and Alaska Native population, they comprise only 28.32 % of the White population. Statistical Abstract of the United States (2002) (computations based on this data on file with the author). Thus the harms of increased exposure will be visited on a larger percentage of the population for these groups.

284. CHPAC, Letter, *supra* note 280, at 3.

285. *Id.* at 2.

286. *See* Heilprin, *supra* note 241. It should be acknowledged, however, that the rulemaking process began under Adminstrator Leavitt's predecessor.

287. E-mails from Dr. Melanie Marty, Chair, CHPAC, to Melissa Pelsor (Apr. 8, 12, 2004) (on file with the author).

288. *Id.*

C. A Permanent Ceiling

Throughout the Preamble to the proposed rule, EPA trumpets the certainty and permanency of the 15-ton-per-year cap. The Agency elaborates:

> The cap and trade approach to regulating Hg emissions offers certain other advantages over the unit-by-unit or facility-by-facility approach that we have traditionally employed under [§]112. For example, a cap and trade system establishes fixed emissions caps that cannot be exceeded, even when existing plants are expanded and new plants are constructed. Thus, the cap provides absolute certainty with regard to national emissions.[289]

This feature of cap-and-trade approaches is indeed a virtue, and one that becomes more important the more growth expected in a given sector. According to the EIA's current forecasts, which project energy use out to the year 2025, coal consumption by the utility sector is indeed expected to increase during this time.[290] Thus, whereas coal consumption by utilities is estimated to be 1004 million short tons in 2004, it is projected to increase to 1136 million short tons in 2010 and to 1301 million short tons in 2020.[291] Of course, these figures are not static: several factors affect industry decisions regarding fuel use, among them, regulatory requirements. However, the fact that coal use, and therefore the potential for mercury emissions, is expected to increase raises the possibility that the permanent cap afforded by a cap-and-trade approach would require lower mercury emissions levels in the long term relative to a MACT-based approach.

While the prospect of a permanent ceiling on emissions despite growth ought to auger well for human and environmental health, the cap here is so lackluster that any relative benefits are not realized until far into the future. As the comparison above demonstrates, the emissions reductions achievable under MACT best case are so significant that even growth in coal consumption will not bring mercury emissions to levels approaching those permitted under EPA's cap-and-trade proposal until somewhere around the year 2100 nationally, and 2300 if one considers only the upper Great Lakes states. Thus this potential virtue of cap-and-trade approaches becomes quite tarnished in EPA's hands.

In addition, it is important in this case to recognize that the "traditional" approach under §112 entails two parts. As outlined above, Congress directed EPA first to issue a technology-based standard for a given source category and then to follow with additional standards for that source category as necessary "to provide an ample margin of safety to protect human health" or "to prevent, taking into consideration costs, energy, safety, and other relevant factors, an adverse environmental effect."[292] These additional "residual risk" standards are to be promulgated "within 8 years after promulgation of [MACT] standards for each category or subcategory of sources," i.e., here, by 2013.[293] If each source must meet these additional standards set to protect human health with an ample margin of safety, there is presumably little reason (at least after 2013) to fear expanded capacity or an expanded universe of sources—as would be the case if only a one-time technology-based standard were applicable—from the perspective of human and environmental health. As the comparison above shows, mercury emissions under either MACT best case or MACT worst case will be lower than under cap-and-trade until at least 2013. *Thus, the traditional MACT-based approach set forth in §112 promises better protection of human health and the environment than the proposed cap-and-trade approach at every point of comparison*.

Note, too, that §112(d)(6) requires EPA to "review and revise as necessary" the MACT standards it has issued at least every eight years.[294] By this means, EPA is directed to incorporate any advances in control technology realized in the intervening years. This feature of the MACT-based approach under §112 similarly addresses some of the potential deficiencies of a one-time technology-based standard relative to cap-and-trade.

As comparative matter, it bears noting that there is no evidence that the 15-ton-per-year cap is set at a level that is tied in any way to human health. This analysis was simply not undertaken.[295] Nowhere in the Preamble to the rule does EPA respond to the *Mercury Study Report to Congress*' finding that "almost all" sensitive populations (here, defined to include recreational fishers, subsistence fishers, and children of subsistence fishers) eating fish from a lake within 25 km of a coal-fired power plant are exposed to MeHg above the level of EPA's RfD and in some cases at a level 10 times the RfD. It is possible, of course, that the cap is set at a level that overprotects human health; it is also possible that it is set at a level that underprotects human health.[296] While EPA assures that "the typical U.S. consumer" will be adequately protected, it is clearly less confident when it comes to the women and children in this group, let alone those in sensitive subpopulations. Rather, as discussed at greater length below, EPA advises the large numbers of people falling into these groups to reduce or eliminate fish from their diets. In fact, EPA intends to undertake an analysis of the health effects of its proposed approach only *after* the approach will have worked or not, i.e., after implementation of the 2010 and 2018 caps.[297] Compare EPA's vague (presumably unenforceable) commitment in the Preamble finally to consider "health risks" sometime "after implementation" of its proposal with the statutorily re-

289. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4687. Similarly, EPA explains, that "[u]nder our proposal, the 2018 cap would be a permanent cap that could not be exceeded, regardless of future growth in the energy sector. Thus the cap would effectively become more stringent as more and more plants are required to keep their collective emissions below 15 tons." *Id.* at 4698. *See also id.* at 4686, 4701 (extolling virtues of certain, permanent cap).

290. EIA, Projections to 2025, *supra* note 229. Note that while overall coal consumption by utilities increases during this period, its relative share as an energy source is expected to decline during this time. *Id.*

291. *Id.*

292. 42 U.S.C. §7412(f)(2)(A).

293. *Id.* (assuming promulgation by the revised date of March 2005).

294. *Id*. §7412(d)(6); *see also* David P. Novello, *The Air Toxics Program at the Crossroads: From MACT to Residual Risk*, 18 Nat. Resources & Env't, Winter 2004, at 57, 61 (noting that EPA has indicated that it will conduct its initial periodic reviews in conjunction with the residual risk determinations required by §112 (f)(2)(A)).

295. Telephone Interview with Mary Jo Krolewski, *supra* note 169.

296. As Professors Heinzerling and Steinzor point out, there is no effort on EPA's part to assess whether a more stringent cap would result in even greater benefits to human health and, ultimately, in even more efficient regulation. Heinzerling & Steinzor, *Perfect Storm II*, *supra* note 3, at 10490.

297. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4686-87.

quired health-based review that accompanies the MACT--based approach under §112.

Finally, although a minor point, the proposed rule's claim to impose a "permanent" ceiling on mercury emissions from coal-fired utilities is susceptible to the critique that no administration can make a credible claim to bind its successors to a particular cap on emissions.[298] A future administration might be pressured to raise the ceiling, for example, in order to accommodate an expanded universe of sources. Of course, the observation that the regulatory lay of the land may change holds for a MACT-based approach as well. But it is proponents of the cap-and-trade approach, not those of the MACT-based approach, who hang their hats on the permanency argument.

D. Environmental Injustice

In the Preamble to the proposed rule, EPA explicitly acknowledges that among those "at a greater risk to the adverse health effects from Hg due to increased exposure" are Native Americans, other communities of color and lower income fishers.[299] The Agency further recognizes that members of some of these groups rely on fish both because fish constitute "a primary source of nutrition" and because fish figure prominently in cultural practices. Yet EPA goes no further to address these points or their implications—except to indicate that "in response" EPA and other agencies have issued fish consumption advisories. (I take up this response in Part V.) It thus begins and ends its inquiry into environmental justice here, having just framed the issue.

EPA cannot ignore the fact that particular, identifiable subpopulations are exposed to MeHg via fish consumption at greater levels than the general population. Nor can the Agency ignore the fact that among the most highly exposed subpopulations are Native peoples such as those in the upper Great Lakes. That is, EPA cannot claim to be assessing tradeoffs in terms of identitiless, statistical lives. It cannot pretend ignorance as to whose children will be the ones at risk of neurological deficits, the ones "who have to struggle to keep up in school."[300] While it seems clear that EPA is aware of these facts, its analysis of the proposed cap-and-trade approach appears nonetheless to focus entirely on the "typical U.S. consumer eating a wide variety of fish from restaurants and grocery stores," who, the Agency assures, "is not in danger" as a result of methylmercury contamination permitted under the proposed rule.[301] By considering adverse effects only from a perspective that excludes all those who "regularly and frequently" consume greater amounts of fish—including not only those in fishing tribes and other communities of color that depend on fish, but recreational and subsistence fishers as well—EPA is able to claim the harms are modest. Other commentators who have found minimal adverse health effects from the proposed rule have similarly focused on population risk.[302] For example, as noted above, the authors of the Brookhaven National Laboratory study modeled the impact of increased mercury emissions and concluded that the resulting risks to the general population would be low. They concluded that the risks "are primarily borne by individuals at the high end of the [exposure] distribution," i.e., by individuals who both consume fish at high rates and consume species with high mercury content, adding "it must be recognized that they comprise only a small fraction of the general population.[303] This observation helps expose the problem with framing the inquiry in terms of the general population when affected subpopulations' exposures are markedly higher. This inquiry gets it wrong from the perspective of public health and gets it wrong from the perspective of environmental justice.

From the perspective of public health, it is completely illogical to study only those who do not eat fish if one wishes to determine the health effects of eating fish. EPA clearly does not go this far, of course. But a focus on the general population—a group that in fact includes many individuals who do not eat fish at all—dilutes the impacts on particular affected subpopulations given that the distribution for exposure here is characterized by marked variability.[304] A question framed only in terms of population risk allows decision makers to gloss over potentially profound adverse effects for highly exposed groups within this population.

From the perspective of environmental justice, a central question is that of disproportionate burden as between the general population and tribes and their members, other communities of color, or low-income communities.[305] For indigenous peoples, environmental justice encompasses not only this distributive inquiry, but other dimensions as well.[306] In the case of Native peoples in the United States, environmental justice requires attention to the interrelated cultural, spiritual, social, ecological, economic, and political dimensions of environmental decisions. In the context at hand, it is necessary to recognize the importance of fish to the Native peoples of the Great Lakes not only in terms of physical health and economic well-being but also in terms of cultural flourishing and self-determination. Thus, the disproportionate burden on the fishing tribes relative to the general population is not only a matter of degree, but also a matter of kind.

I have argued at length elsewhere that EPA is under both normative and legal obligations to address the resulting en-

298. *See, e.g.*, Vivien Foster & Robert W. Hahn, *Designing More Efficient Markets: Lessons From Los Angeles Smog Control*, 38 J.L. & Econ. 19, 44 (1995). Of course changes to a cap could go either way, resulting in a more stringent or a more lenient cap. *See, e.g., id*. at 43-44 (citing sources' concern that cap will be altered downward, and allowances necessarily diminished in quantity or quality, e.g., each entitling the bearer to emit only a fraction of former entitlement). What experience exists, however, shows the opposite. For example, the emissions reduction-forcing aspect of the cap imposed by California's RECLAIM program was suspended by the South Coast Air Quality Management District in the face of pressure from sources. *See* Heinzerling & Steinzor, *Perfect Storm II*, *supra* note 3, at 10495.

299. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4709.

300. NRC, Methylmercury, *supra* note 4, at 9.

301. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4658. Moreover, EPA has received extensive counsel in this regard from the NEJAC, the federal advisory committee formed to advise EPA on matters of environmental justice; NEJAC produced a lengthy report on the subject of fish consumption for EPA in 2002. NEJAC, Fish Consumption Report, *supra* note 70.

302. *See, e.g.*, Lutter & Mader, *supra* note 262; EPRI, Comments, *supra* note 42.

303. Sullivan et al., *supra* note 46, at 14-15.

304. *See generally* O'Neill, *supra* note 73.

305. *See, e.g.*, Robert R. Kuehn, *A Taxonomy of Environmental Justice*, 72 ELR 10681 (Sept. 2000); *cf.* Sheila Foster, *Justice From the Ground Up: Distributive Inequities, Grassroots Resistance, and the Transformative Politics of the Environmental Justice Movement*, 86 Cal. L. Rev. 775 (1998); Eric Yamamoto & Jen-L. W. Lyman, *Racializing Environmental Justice*, 72 U. Colo. L. Rev. 311 (2001).

306. *See infra* Part VI and accompanying text.

vironmental injustice.[307] I will canvas these claims briefly, in Part VI. Before doing so, it will also be important to consider two additional sources of concern with EPA's proposed rule from the perspective of environmental justice.

IV. Environmental Justice and Hot Spots

The potential for "hot spot" creation has long been recognized as the Achilles' heel of cap-and-trade approaches.[308] While cap-and-trade approaches establish an overall ceiling on the quantity of pollutants that may be emitted in the relevant geographic area (here, the United States), these approaches by design say nothing about how the emissions are to be distributed among sources within this area. Indeed, the efficiency gains that are the chief virtue of cap-and-trade approaches are realized precisely because sources within this geographic area are permitted to trade allowances freely among themselves—with the result that those sources who can more cheaply reduce emissions will have the incentive to do so, because they can sell the excess allowances thereby generated to those sources for whom emissions reductions are more costly. As a consequence, cap-and-trade approaches may perpetuate or exacerbate localized instances of relatively high emissions and, ultimately, relatively high exposure.

Recently, commentators and environmental justice advocates have observed that the hot spot problem peculiar to cap-and-trade approaches may have disproportionate impacts on tribes and indigenous peoples, other communities of color, and low-income communities.[309] Economic theory predicts—and empirical data support—that older, heavily polluting facilities will be located disproportionately in these communities.[310] While cap-and-trade approaches promise an overall decrease in emissions, they make no guarantees about decreases in emissions from any one source. Quite to the contrary, they theoretically permit the entire quantity of capped emissions to be released by one or a few sources. This result may be problematic from an environmental justice perspective depending, among other things, on whether the subject pollutant is deposited locally or is dispersed more broadly; whether the increase in emissions at any individual source will exceed levels that are believed to result in adverse human health impacts; and whether other variables affecting exposure are such that those who will bear the increased risk that results from this redistribution are tribes and indigenous peoples, other communities of color, and low-income communities. Commentators have argued that, as a result of trading, emissions will become concentrated at facilities in these communities, in many instances resulting in emissions at levels above those considered protective of human health.[311]

Appropriately, these have been contextualized inquiries. As a result, analyses of hot spots from an environmental justice perspective have not yet tackled many of the complexities raised by mercury. More specifically, there has been no sustained inquiry into the existence and impacts of hot spots under the proposed cap-and-trade approach for mercury emissions from coal-fired utilities, although many commentators have brought this issue to EPA's attention.

This part considers evidence regarding the existence of hot spots in this context, in the process recognizing the possibility that hot spots here might be conceived in terms of emissions hot spots, deposition hot spots, biological hot spots, and exposure hot spots. By way of example, the analysis focuses on the upper Great Lakes states of Michigan, Minnesota, and Wisconsin. Although EPA claims that there will be no "local or regional hot spots" under its proposed national cap-and-trade program, the evidence provided by EPA's own models suggests otherwise, at least in the upper Great Lakes. After considering this evidence, this part examines the arguments offered by EPA for its claim and finds that EPA's confidence is not justified. This part concludes that the potential for hot spots in the upper Great Lakes imposes a disproportionate burden on members of the fishing tribes of this area, who are among the most highly exposed to the resulting MeHg contamination.

A. Hot Spots

In the case of mercury, a hot spot analysis is complex. It is possible, of course, to consider the distributive impacts of a cap-and-trade approach in terms of emissions, and to conclude that hot spots exist where trading perpetuates or exacerbates localized instances of relatively high mercury emissions. Given that the primary route of exposure to mercury is through ingestion of fish contaminated with MeHg, however, it is also possible to consider the distributive impacts of a cap-and-trade approach in terms of deposition, bioavailability and, ultimately, exposure. Through these respective lenses, hot spots exist where trading perpetuates or exacerbates localized instances of relatively high mercury deposition, MeHg bioavailability or MeHg exposure. A group of environmental scientists elaborates two of these possibilities:

> While overall atmospheric deposition will likely decrease with mercury controls, trading could result in variability in the deposition pattern, with some areas showing decreases in deposition and other areas experiencing little or no decrease. As a result, "deposition hotspots" may emerge. . . .
>
> It is also possible that unconstrained trading with an inadequate cap could result in [little or no change in] deposition in areas with high mercury sensitivity. This could lead to "biological hotspots" that show elevated concentrations of mercury in biota compared to other areas in the United States. These biological hotspots can be created by elevated deposition, high watershed sensitivity to mercury deposition, or both.[312]

307. O'Neill, *supra* note 73, at 86-116.

308. *See, e.g.*, Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law*, 37 Stan. L. Rev. 1333, 1350-52 (1985). Note, however, that these early proponents of cap-and-trade approaches argued that technology-based approaches similarly failed to address resulting distributive inequities.

309. *See, e.g.*, Richard Toshiyuki Drury et al., *Pollution Trading and Environmental Injustice: Los Angeles' Failed Experiment in Air Quality Policy*, 9 Duke Envtl. L. & Pol'y F. 231 (1999); Stephen M. Johnson, *Economics v. Equity: Do Market-Based Reforms Exacerbate Environmental Injustice?*, 56 Wash. & Lee L. Rev. 111 (1999).

310. Although this claim is not uncontested, it is fair to say that it is, on balance, supported by anecdotal evidence and quantitative study. *See, e.g.*, Luke Cole & Sheila R. Foster, From the Ground Up: Environmental Racism and the Rise of the Environmental Justice Movement 10, 54-79 & app. (2001); Clifford Rechtschaffen & Eileen Gauna, Environmental Justice: Law, Policy, and Regulation 55-85 (2002).

311. *See, e.g.*, Drury et al., *supra* note 309, at 271.

312. Hubbard Foundation Scientists, *supra* note 18, at 17.

In a similar vein, what might be termed "exposure hot spots" can be created by elevated methlymercury concentration in fish tissue, high fish consumption rate and frequency relative to body weight among exposed populations, or both.

EPA addresses the resulting definitional issue in the Preamble to the proposed rule:

> In this discussion, we are assuming that a power plant may lead to a hot spot if the contribution of the plant's emissions of Hg to local deposition is sufficient to cause blood Hg levels of highly exposed individuals near the plant to exceed the RfD. For the purposes of choosing a regulatory tool to address hot spots, the relevant question is what is the contribution of these plants to hot spots under a cap-and-trade approach, relative to their current contribution and their projected contribution under a traditional [§]112 approach.[313]

EPA's definition thus trains the hot spot inquiry on what might be termed "human exposure hot spots" and focuses in particular on those humans who are among the most exposed via the fish consumption pathway.[314] From the perspective of those concerned with environmental justice, this definition appropriately attends to the impacts on humans whose fish consumption practices place them among the most exposed.[315] As demonstrated above, members of fishing tribes and peoples, other communities of color, and low-income communities are disproportionately likely to be among this population. The discussion that follows will similarly focus, to the extent permitted by current understandings, on human exposure hot spots and particularly on the effects on those humans most exposed the MeHg via the fish consumption pathway. It will nonetheless recognize as relevant various possible definitions of a "hot spot" in the context of a cap-and-trade approach to regulating mercury, for two reasons. First, although a focus on human health usefully illuminates a fundamental source of concern, note that this definition does not completely capture the disproportionate impacts on some groups—for example, it does not account for the adverse impacts of depleted wild rice resources on members of various Ojibwe tribes or for the affront of harms to other non-human components of aquatic ecosystems from the perspective of members of the Forest County Potawatomi Community.[316] Second, as discussed above, existing data do not yet enable predictions of each particular source's contribution to deposition affecting each lake fished by highly exposed individuals. Our ability to predict the distributive impacts of trading along the lines required by EPA's definition is imperfect, with gaps accumulating as we try to forecast outcomes later in the chain connecting emissions to exposure. That is, while we might be fairly confident of claims made with respect to emissions hot spots, we must be less confident of claims that connect changes in emissions to changes in human exposure via fish consumption. For both of these reasons, then, the discussion that follows will keep in mind the various possible definitions of a "hot spot" in the context of a cap-and-trade approach to regulating mercury.

Having thus defined hot spots, EPA states that it "does not expect any local or regional hot spots" under a national cap-and-trade approach for mercury.[317] EPA offers four arguments in support of this claim and adds an assurance of continued monitoring in case it is wrong. First, the Agency cites the 70% reduction in emissions and its experience with cap-and-trade systems in the context of the Acid Rain Program for SO_2, which "did not result in local areas with 'hot spots,'" for the overarching claim that there are unlikely to be any local or regional hot spots under a national cap-and-trade program for mercury.[318] Second, EPA argues that its models predict that larger facilities, which tend to have relatively high levels of mercury emissions, will be the ones to control their emissions and sell the allowances thereby generated—with the result that the "larger local deposition footprints" likely cast by these facilities will be addressed.[319] Third, EPA argues that the species of mercury that contribute to local deposition, Hg^{++} and Hg(p), will be captured as a "co-benefit" of efforts to control fine particles, SO_2, and NO_x.[320] As utilities invest to comply with the proposed CAIR and new state implementation plan (SIP) for fine particles and ozone, they will likely become net sellers of mercury allowances while facilities with significant emissions of Hg(0) will likely be net buyers of allowances—with the result that species contributing to local deposition will be addressed first, "thereby reducing any local hotspots."[321] Fourth, EPA cites modeling undertaken for the Clear Skies Initiative showing that Hg^{++} from plants located within 10 km of a water body are projected to decrease by 60%, and that deposition in some areas could be reduced by 5 to 15% from existing baselines.[322] By way of assurance, EPA commits to continue monitoring mercury emissions and notes that "[w]e retain authority to make adjustments to the program if we find remaining areas with heavy, localized emissions and higher health risks (i.e., if we find hot spots)."[323] These arguments will be assessed below, after an examination, by way of example, of data regarding hot spots in the upper Great Lakes.

B. Evidence

As EPA observes, in assessing alternative regulatory tools, the relevant question is to what extent coal-fired utilities

313. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4702.

314. *Id.* In the paragraph commencing its discussion of hot spots, EPA explains what it has in mind: "Mercury emissions from power plants sometimes are deposited locally near the plant. Nearby lakes may be a source of fish consumption for recreational and/or subsistence fisherman (sic), and thus local Hg deposition in nearby lakes could be a source of what are called hot spots." *Id*.

315. This definition, however, is potentially problematic in other respects. Depending on how much one reads into it, it might be taken to allow claims, such as those advanced by some industry commentators, that unless a source contributes >50% to local deposition, it cannot be viewed as "lead[ing] to a hot spot." *See, e.g.*, EPRI, Comments, *supra* note 42, at 2. Such claims are insupportable for a number of reasons.

316. *See, e.g.*, FCPC, Comments, *supra* note 191, at 6-7 (describing the cultural importance of "pure water" and other resources, and noting that "[a]s one of the four major spirits, water has a role of singular significance in the Tribe's culture. Water in its pure form is needed for FCPC ceremonies and rituals and is essential to preparation of certain medicines and foods"). By contrast, ecosystem health is explicitly considered under a MACT-based approach, as part of the residual risk analysis required by CAA §112(f)(2)(A).

317. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4701.

318. *Id.* at 4701-02.

319. *Id*. at 4702.

320. *Id*.

321. *Id*.

322. *Id.* at 4703.

323. *Id*. at 4702-03.

would contribute to hot spots under a cap-and-trade approach relative to the extent they would contribute to hot spots under other approaches, namely under a MACT-based approach. Additionally, it may be useful to compare this information to sources' contribution to hot spots under the unregulated status quo.[324] The inquiry that follows focuses on the upper Great Lakes states of Michigan, Minnesota, and Wisconsin. Although EPA claims that there will be no "local or regional hot spots," an analysis of available data suggests otherwise.

1. Emissions Hot Spots

Emissions hot spots are projected to occur both on a regional and a local scale in the upper Great Lakes. The comparison that follows considers total mercury emissions and is based on EPA's model and the alternative MACT scenarios outlined above. As such, it includes the same assumptions generous to the cap-and-trade approach noted above.[325] Even so, the comparison reveals elevated mercury emissions virtually across the board under cap-and-trade relative to MACT best case in 2020. Other aspects of the emissions hot spots picture are more complex.

In 2020, emissions are projected to be higher under cap-and-trade than under MACT best case *for every source in the upper Great Lakes states of Michigan, Minnesota, and Wisconsin but one*.[326] At all but six of these sources, moreover, emissions under cap-and-trade are at least double the level achieved by application of MACT best case; for several sources, emissions permitted under cap-and-trade are an order of magnitude greater. Notably, whereas the largest single source of emissions in each state continues to emit large quantities of mercury in 2020 under cap-and-trade—indeed, emissions from the Monroe Power Plant in Michigan would *increase* by 11.8% from 0.4052 tons at present to 0.4532 tons in 2020 under cap-and-trade—these sources emit anywhere from one-third to one-tenth as much mercury in 2020 under MACT best case as under cap-and-trade.[327] In 2010, the picture is similar, with elevated emissions under cap-and-trade relative to MACT best case for all but one source.[328]

Cap-and-trade fares better when compared to MACT worst case in this region. This is not surprising given the lenient assumptions of the MACT worst-case scenario respecting sources that use subbituminous coals, as outlined above, and the greater proportion of sources that are listed as using this coal rank in the three upper Great Lakes states relative to the nation as a whole. In 2020, emissions are projected to be higher under cap-and-trade than under MACT worst case for only 21 of the 44 sources.

It is also instructive to consider the results under the proposed cap-and-trade approach as compared to the unregulated status quo. As of 2020, cap-and-trade is estimated to reduce emissions in the upper Great Lakes region by 26.59% from current levels. Importantly, in 2020, emissions actually *increase* under cap-and-trade as compared to present levels at 7 (out of 19) sources in Michigan; at 7 (out of 10) sources in Minnesota; and at 6 (out of 15) sources in Wisconsin. These sources, and the percent by which emissions increase at each, are listed in Table 2. Note that these sources represent a mix of small, medium and large emitters in each state.

Table 2
Mercury Emissions Under Cap-and-Trade Facilities With Increased Emissions 1999-2020

Plant	State	Percent Increase in
Monroe Power Plant	MI	11.8
Presque Isle	MI	22.7
J.B. Sims	MI	52.3
Belle River Power Plant	MI	67.9
Endicott	MI	98.8
TES Filer City Station	MI	506.8
Marysville Power Plant	MI	833.8
Riverside Generating Plant	MN	11.7
Hoot Lake	MN	20.4
Allen S. King Generating Plant	MN	77.2
Black Dog Generating Plant	MN	78.8
High Bridge Generating Plant	MN	117.5
Silver Lake	MN	484.9
Minnesota Valley	MN	14900.0
Port Washington	WI	3.6
Rock River	WI	19.6
Pulliam	WI	26.4
Blount Street	WI	410.9
Alma	WI	470.7
Bay Front Generating Plant	WI	1205.0

In addition, emissions remain large (above 0.1000 tons/year) for several sources in each state under cap-and-trade in 2020. The 11 sources in this group are listed in Table 3. Whereas five sources in Michigan at present emit more than 0.1000 tons/year, three of these sources would continue to emit above this level in 2020 after the application of cap-and-trade. Both of the sources in Minnesota that currently

324. *Id*. at 4702.

325. Note that there is a discrepancy between the total aggregate emissions for the three upper Great Lakes states, *supra* Part III, and the total emissions for the individual facilities in these states cited below. This is due to the fact that data for one facility, the Conners Creek Plant, was not available for both the present, i.e., 1999, and projected emissions. Note that throughout the term "source" is used interchangeably with the term "facility;" to the extent that data were provided in the various EPA databases by unit rather than by facility, these data were summed to provide totals for each facility.

326. This source is the High Bridge Generating Plant, located in Minnesota. Note further that for the comparisons of cap-and-trade versus MACT-based approaches, the universe of sources in Michigan, Minnesota, and Wisconsin is 44, given the lack of complete data for the Conners Creek Power Plant. For the comparisons of cap-and-trade to current emissions, the universe of sources for 1999 is 44, while the universe for 2010 and 2020 is 45 due to the presence of the Conners Creek Power Plant.

327. Thus, emissions at the Monroe Power Plant (Michigan) are 0.4052 tons/year in 1999, 0.4532 tons/year under cap-and-trade in 2020, and 0.0456 tons/year under MACT best case in 2020; emissions at the Sherburne County plant (Minnesota) are 0.2907 tons/year in 1999, 0.2319 tons/year under cap-and-trade in 2020, and 0.0327 under MACT best case in 2020; emissions at the Pleasant Prairie plant (Wisconsin) are 0.4084 tons/year in 1999, 0.1283 tons/year under cap-and-trade in 2020, and 0.0459 tons/year under MACT best case in 2020.

328. This source is the Sherberne County Generating Plant, located in Minnesota.

emit more than 0.1000 tons/year would continue to emit above this level in 2020 after the application of cap-and-trade. Two of the four sources in Wisconsin with emissions above this level at present would continue to emit above 0.1000 tons/year in 2020. In fact, the two largest emitters in each of these states are in this group, and would continue to be large emitters in 2020 under cap-and-trade.

Moreover, while EPA advertises the 70% emissions reduction to be achieved by 2018 under the cap-and-trade approach, the picture is far different for reductions from the 11 largest emitters in the upper Great Lakes states. Only two of these sources achieve reductions in this neighborhood by the year 2020 under cap-and-trade.[329] At seven of these large sources, reductions are more modest, ranging from approximately 20% to 58%.[330] At two of these large sources, emissions actually increase, by approximately 12% and 68%.[331] Note, too, that in several instances, e.g., at the St. Clair Power Plant in Michigan and at the Columbia and Edgewater plants in Wisconsin, emissions decrease in 2020 only after a significant increase in 2010.

In addition to these 11 large emitters, 20 medium and small emitters throughout Michigan, Minnesota, and Wisconsin increase their mercury emissions in 2020 under cap-and-trade relative to the unregulated status quo.[332] The percentage increase at these sources ranges from roughly 4% to 14,900%. While these sources clearly emit lesser quantities of mercury emissions, they nonetheless contribute to local deposition.[333]

2. Deposition Hot Spots

Although, as noted above, the complexities of mercury's behavior once it exits an emissions stack make conclusions here tentative, existing data nonetheless raise the concern that deposition hot spots would exist in the upper Great Lakes under cap-and-trade. Atmospheric deposition has been identified as the major source of mercury loadings to water bodies in this region. In addition, as discussed above, recent studies support the link between anthropogenic mercury emissions, including emissions from coal-fired utilities, and local deposition. The complexities noted above must be accounted for, of course: the particulars of speciation, plant configuration, etc., mean that even an increase in total mercury emissions at a given source may not translate into a commensurate increase in local or regional deposition. Although this relationship cannot yet be quantified, it is notable that some of the important research connecting changes in mercury emissions to changes, ultimately, in fish tissue MeHg concentrations has been conducted in northern Wisconsin, under conditions typical of much of this region. These observations in the field are further supported by modeling conducted by EPA that has attributed the bulk of the deposition at the points of maximum

Table 3
Mercury Emissions Under Cap-and-Trade Large Emitters

Plant	State	1999	2010	2020	Percent Difference 1999-2010	Percent Difference 1999-2020
Monroe Power Plant	MI	0.4052	0.4532	0.4532	11.8	11.8
J.H. Campbell	MI	0.2551	0.1276	0.1276	-50	-50
St. Clair Power Plant	MI	0.123	0.2047	0.0253	66.4	-79.4
Belle River Power Plant	MI	0.1214	0.1929	0.2038	58.9	67.9
Dan E. Karn	MI	0.107	0.0469	0.0469	-56.1	-56.1
Sherburne Cty.	MN	0.2907	0.2804	0.2319	-3.5	-20.2
Clay Boswell	MN	0.1689	0.1226	0.1131	-27.4	-33.0
Pleasant Prairie	WI	0.4084	0.1692	0.1283	-58.6	-68.6
Columbia	WI	0.1613	0.2393	0.127	48.4	-21.3
South Oak Creek	WI	0.1354	0.0987	0.0906	-27.1	-33.1
Edgewater	WI	0.1031	0.1919	0.0435	86.1	-57.9

329. Emissions at the St. Clair Power Plant (Michigan) are 0.123 tons/year in 1999 and 0.253 tons/year under cap-and-trade in 2020, a reduction of 79.4%; emissions at the Pleasant Prairie plant (Wisconsin) are 0.4084 tons/year in 1999 and 0.1283 tons/year under cap-and-trade in 2020, a reduction of 68.6%.

330. Emissions at the Sherburne County plant (Minnesota) are 0.2907 tons/year in 1999 and 0.2319 tons/year under cap-and-trade in 2020, a reduction of 20.2%; emissions at the Columbia plant (Wisconsin) are 0.1613 tons/year in 1999 and 0.127 tons/year under cap-and-trade in 2020, a reduction of 21.3%; emissions at Clay Boswell (Minnesota) are 0.1689 tons/year in 1999 and 0.1131 tons/year under cap-and-trade in 2020, a reduction of 33.0%; emissions at South Oak Creek (Wisconsin) are 0.1354 in 1999 and 0.0906 tons/year under cap-and-trade in 2020, a reduction of 33.1%; emissions at J.H. Campbell (Michigan) are 0.2551 tons/year in 1999 and 0.1276 tons/year under cap-and-trade in 2020, a reduction of 50%; emissions at Dan E. Karn plant (Michigan) are 0.107 tons/year in 1999 and 0.0469 tons/year under cap-and-trade in 2020, a reduction of 56.1%; emissions at Edgewater plant (Wisconsin) are 0.1031 in 1999 and 0.0435 tons/year under cap-and-trade in 2020, a reduction of 57.9%.

331. Emissions at Monroe Power Plant (Michigan) are 0.4052 tons/year in 1999 and 0.4532 tons/year under cap-and-trade in 2020, an increase of 11.8%; emissions at Belle River Power Plant (Michigan) are 0.1214 tons/year in 1999 and 0.2038 tons/year under cap-and-trade in 2020, an increase of 67.9%.

332. Thus, emissions from 15 medium sources in these states increased from 1999 to levels between 0.010 and 0.0999 in 2020 under cap-and-trade; and emissions at an additional 4 small sources in these states increased from 1999 to levels under 0.010.

333. 4 Mercury Study Report to Congress, *supra* note 12, at 2-18, tbl. 2-15 (finding contributions from small, medium, and large facilities to mercury fish tissue concentration in lakes located within 2.5, 10, and 25 km of the source). Note, however, that the MSRC employs a different delineation of the "small," "medium," and "large" categories than used above. *Id*.

deposition in several states to in-state emissions sources. Again, it is notable that among the states documented by this effort are Michigan and Minnesota. Additionally, to the extent that EPA has released data from deposition modeling, its models do not predict significant decreases in deposition in the upper Great Lakes under cap-and-trade, even by 2020.[334]

3. Biological Hot Spots

Again, in view of the complexities of mercury's environmental fate and transport, conclusions about biological hot spots are necessarily tentative; nonetheless, conditions in the upper Great Lakes region raise the possibility of biological hot spots under cap-and-trade. Among other things, given the large area covered by lakes and rivers in the upper Great Lakes region relative to other regions in the United States, even a crude assessment suggests that this region is relatively likely to host biological hot spots. Put simply, mercury deposited here is more likely to meet with a lake or its connecting waters—and, ultimately, the fish they support—than the equivalent amount of mercury deposited elsewhere. Consider, for example, a trade between a source whose emissions affect Oklahoma and a source whose emissions affect Wisconsin. Whereas only approximately 2% of Oklahoma's total area is comprised of water, 17% of Wisconsin's total area is made up of lakes, rivers, and streams.[335] For Michigan, the comparison is even more stark: 41% of its total area is comprised of lakes and connecting waters.[336] Indeed, whereas the average for the continental United States is roughly 7%, the average for the three upper Great Lakes states is roughly 23%.[337] In addition, as explained above, recent field work suggests that mercury that is deposited directly to a lake surface has a relatively rapid impact on fish tissue MeHg concentrations as compared to mercury that is deposited to land. This would seem to suggest that regions in which surface waters comprise a greater percentage of total area would see an equivalent amount of mercury deposition translated relatively rapidly into MeHg contamination in fish. Again, it is notable that this field work includes studies in Wisconsin.

Moreover, there is evidence that some lakes in the upper Great Lakes region are indeed "mercury sensitive."[338] Thus, for example, extensive studies have been conducted on Devil's Lake, a lake located within the boundaries of the Forest County Potawatomi reservation in Forest County, Wisconsin, that receives the vast majority of its mercury from atmospheric deposition.[339] These studies indicate high levels of MeHg in the lake and suggest that conditions there permit a relatively high rate of conversion from inorganic mercury to MeHg.[340]

4. Exposure Hot Spots

Exposure hot spots in the three upper Great Lakes states are also a source of real concern, given widespread MeHg contamination in the fish species consumed by humans and given the relatively higher fish consumption rates among the general population and various subpopulations here. Extensive testing has found elevated levels of MeHg in fish tissue throughout Michigan, Minnesota, and Wisconsin. Given the importance of fish and fishing to this region, the states and tribes here have for years studied the extent of MeHg contamination in the fish species consumed by humans.[341] The states of Michigan, Minnesota, and Wisconsin, for example, have measured average MeHg concentrations in walleye and northern pike at several times the level corresponding to EPA's RfD for women.[342] Similarly, the Forest County Potawatomi Community has tested yellow perch in Devil's Lake, and found "relatively high concentrations of mercury when compared to other lakes in northern Wisconsin."[343] As a result, 100% of the inland lakes in this region and 100% of the abutting Great Lakes are under fish consumption advisory.[344] In fact, the Wisconsin Department of Natural Resources has coupled its statewide advisory with "more stringent advice" for particular waters where fish have been found to have even higher concentrations of MeHg.[345] Fish consumption practices among the general population in the upper Great Lakes states and, especially, among fishing tribes here place individuals in this region among the most exposed relative to the general U.S. population. Quantitative data show that even the general population in this region is likely to have a fish consumption rate at least double that of the general U.S. population.[346] Anecdotal data support these numbers, as fishers describe fishing on the lakes every day in the warmer months and characterize themselves as "catch-and-eat" fishers.[347] Quantitative data show that subpopulations representing the various fishing tribes have fish consumption rates on the order of *10 times* that of the general population.[348] These data also re-

334. U.S. EPA, *Clear Skies Technical Support Package* §B, at B-41, *at* http://www.epa.gov/clearskies/03technical_package_sectionb.pdf [hereinafter U.S. EPA, *Clear Skies Technical Support*].

335. U.S. Census Bureau, Statistical Abstract of the United States (2003), *available at* http://www.census.gov/prod/www/statistical-abstract-03.html.

336. *Id*.

337. *Id.* Note that these figures include both coastal and inland waters considered to be part of each state's territory.

338. *See, e.g.*, U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4701 (discussing the potential for the formation of local or regional "hot spots" as the result of its cap-and-trade proposal, EPA notes that "the ecosystems in some regions (e.g., the lakes regions of the Upper Midwest), may be more sensitive to Hg deposition"); *see generally* Hubbard Foundation Scientists, *supra* note 18, at 11.

339. FCPC, Comments, *supra* note 191, at 8-10.

340. *Id.* (citing findings of Dr. Carl Watras); *see also* Horsley & Witten, Inc, *Devil's Lake Summary Report: Water Years 1996 to 2002*, at 3 (2003) (OAR-2002-0056-2179) (A variety of conditions, including the influence of highly biologically productive wetland areas, "allow for the efficient transfer and transport of [MeHg] within this system.").

341. *See, e.g.*, Clear the Air, Reel Danger, *supra* note 19, at 21, app. C.; GLIFWC, *Enjoy Fish Safely*, *supra* note 109.

342. *See supra* notes 103-04, 110 and accompanying text.

343. FCPC, Comments, *supra* note 191, at 10 (noting that yellow perch were selected for testing because of their abundance in the lake and their importance as a food source for larger fish, e.g., largemouth bass, and for wildlife, e.g., wading birds and small mammals).

344. U.S. EPA, Fish Advisories, *supra* note 113, at 4.

345. Wisconsin Dep't of Natural Resources, Statewide Mercury Advisory Background (2004), *available at* http://dnr.wi.gov/org/water/fhp/fish/pages/consumption/mercury.shtml.

346. *See supra* Part III.B.2 and discussion.

347. *See, e.g.*, NOW With Bill Moyers, Transcript, June 25, 2004, *available at* http://www.pbs.org/now/printable/transcript326_full_print.html (quoting Ed Mongin).

348. *See supra* Part III.B.2 and discussion.

veal elevated seasonal consumption patterns that are more pronounced than any fluctuations in consumption by the general population. Anecdotal data similarly support these numbers for the tribes.[349] Thus, it is the case that the MeHg contamination found in fish tissue in this region is reaching a general population and particular subpopulations that consume fish in relatively greater quantities and frequencies than the general U.S. population, with a resulting serious potential for human exposure hot spots.

The picture that emerges suggests the likelihood of local and regional hot spots in the upper Great Lakes under the proposed cap-and-trade approach. While current understandings may not permit a more certain claim than this, the evidence that exists nonetheless raises real concerns. At the very least, EPA's quick dismissal of the hot spot problem is wholly inappropriate, at least for this region. Indeed, EPA's own model predicts that trading will result in emissions hot spots. This is the case at the regional level, where mercury emissions in 2020 would be reduced by an unimpressive 26.59% from current levels (compared to the roughly 61% reductions projected nationally by 2020 under cap-and-trade or the 70% reductions promised by EPA). This is also the case at the local level, where mercury emissions actually *increase* by 2020 under cap-and-trade at 20 of the 44 sources in the region. Although conclusions with respect to deposition hot spots are more tentative, both models and field observations from this region support the relationship between emissions reductions, decreased deposition, and, ultimately decreased fish tissue MeHg concentration. And it has long been known that atmospheric deposition is the major source of mercury loadings to the water bodies in this region. Given the emissions hot spots predicted above, atmospheric conditions in the upper Great Lakes conducive to deposition could give rise to deposition hot spots. Moreover, the mercury that is deposited in this region is relatively apt to come in direct contact with water bodies and so, as the most recent studies show, relatively rapidly bioavailable for uptake by fish. Additionally, some water bodies in this region have been shown to be mercury sensitive. As a result, this area is a likely candidate for biological hot spots. Finally, given the extensive data demonstrating widespread contamination of the fish species consumed by humans in this region coupled with consumption practices that place even those in the general population in this region among the more exposed, there is a likelihood of human exposure hot spots. This is especially so for the highest consuming subpopulations, including members of the various fishing tribes in the upper Great Lakes, a point explored below. Indeed, with *every lake* under mercury advisory in this region—including Lakes Huron, Michigan, and Superior—it is difficult to deny the possibility of human exposure hot spots. The upshot is that hot spots of these various sorts may indeed be perpetuated or exacerbated in the upper Great Lakes region under the proposed cap-and-trade approach.

C. Arguments and Responses

As noted above, EPA offers four arguments in the Preamble to the proposed rule for its claim that it "does not expect any local or regional hot spots" under the cap-and-trade proposal. I address these in turn.

First, EPA relies heavily on its experience with cap-and-trade in the context of the Acid Rain Program, invoking its "success" here in numerous instances throughout the Preamble. EPA also repeatedly highlights this experience in public documents and statements.[350] In a Guest Comment in the *Detroit Free Press*, for example, EPA Administrator Leavitt decried the "unwarranted" "accusations" that the proposed rule could permit hot spots in some areas in the face of the "proven" and "enormously successful" cap-and-trade approach to reducing SO_2: "Our [10] years of experience with cap-and-trade—and it is extensive—demonstrates that [hot spots] will not happen because the highest polluting facilities are the first to be cleaned up."[351]

EPA's reliance is inapposite: neither the pollutant nor the program is analogous. First, the Acid Rain Program addresses SO_2 emissions. The primary route of human exposure to SO_2 is through inhalation.[352] Thus, the currency for exchange under the Acid Rain Program—the SO_2 allowance—is the same as the chemical entity of concern from the perspective of human health. As a result, correlations between changes in SO_2 emissions and resulting changes in human inhalation of SO_2 involve a much simpler chain of events than do correlations between changes in emissions of total mercury and changes in human ingestion of MeHg. From the perspective of human exposure, the fate and transport of SO_2 in the environment is quite simple: SO_2 is emitted, e.g., from the combustion of fossil fuels such as coal, and humans inhale this gaseous phase SO_2.[353] As described above, the complexities introduced by the numerous additional links in the chain, e.g., speciation, deposition, methylation, bioaccumulation, fish consumption, connecting emissions of total mercury and human exposure through ingestion of fish make perilous any attempt to apply the experience with SO_2 to the problem of mercury. The currency for exchange under the proposed cap-and-trade approach—total mercury emissions—is far removed from the chemical entity of concern—MeHg—from the perspective of human health. Second, the Acid Rain Program is not analogous, because its claim to be hot spot-free depends on the safety net established by the national ambient air quality standards. There is no such ambient ceiling on mercury concentration.[354] EPA, in fact, recognizes this dependence. In a

349. *See infra* notes 434-35 and accompanying text.

350. *See, e.g.*, U.S. EPA, *Emissions Cap and Trade and Hotspots* (Clear Skies Workshop, June 19, 2002), *at* http://www.epa.gov/air/clearskies/clearskies_hotspots.pdf.

351. Mike Leavitt, *Guest Comment: EPA on Track With Limiting Mercury Emissions by Plants*, Detroit Free Press, Feb. 26, 2004, *available at* http://www.freep.com/cgi-bin/forms/printerfriendly.pl.

352. Agency for Toxic Substances and Disease Registry, Toxicological Profile for Sulfur Dioxide 122 (1998), *available at* http://www.atsdr.cdc.gov/toxprofiles/tp116.html.

353. *Id.* The picture is more complex from the perspective of environmental health, as processes of deposition, i.e., acid rain, become involved. *Id.* at 117-20.

354. EPA attempts to invoke a safety net of sorts, in the form of the fact that a handful of states have taken it upon themselves to issue more protective mercury regulations covering coal-fired utilities. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4702. This attempt is unconvincing. State rules cannot adequately serve the role of safety net, because their coverage is spotty. They do not provide uniform, national protection. And it is hardly a recommendation for a national cap-and-trade approach that EPA must depend on state and local regulation to address the hot spot problem that results. Additionally, from the perspective of affected tribes, leaving the regulatory work to the states is an unsatisfactory substitute, because states are not bound by the federal trust responsibility. *See infra* notes 450-56 and accompanying text; *accord* Fond du Lac Reservation Business

recent newsletter from its Clean Air Markets division, EPA responded to a question whether trading results in hot spots by highlighting this feature of the Acid Rain Program:

> Cap and trade is only one component of an environmental regulatory toolkit. In addition to the reductions required under the U.S. SO_2 Allowance Trading Program, all areas of the United States must meet national, health-based air quality standards that are separate from the cap and trade program's requirements. No source may use allocated or purchased allowances to emit more SO_2 than the level specified for protecting human health.[355]

EPA next cites modeling runs showing that larger facilities are likely to have "larger local deposition footprints" than medium- or small-size facilities and argues "the trading of allowances is likely to involve large Utility Units controlling their emissions more than required and selling allowances to smaller Utility Units rather than the reverse scenario. This prediction arises from the basic economies of capital investment in the utility industry."[356]

Without a more complete explanation, we are left to guess what EPA means by "large," and so unable to check its claim that large sources as EPA defines them "tend to have relatively high Hg emissions" and thus "are likely to have larger local deposition footprints."[357] However, as the data for the upper Great Lakes region demonstrate, EPA's own model predicts less than uniform support for a claim that *large emitters* will be the ones to reduce emissions. Consider, for example, that of the two very largest sources, each of which currently emits above 0.4 tons/year, one decreases emissions by 2020 under cap-and-trade while the other increases emissions. If one considers the remaining two sources that currently emit over 0.25 tons/year, one reduces emissions by half, to 0.1276 tons/year in 2020 under cap-and-trade, while the other reduces emissions only modestly, to 0.2319 tons/year in 2020. And, as the discussion above indicates, numerous sources in Michigan, Minnesota, and Wisconsin continue to emit at levels greater than 0.100 tons/year in 2020 under cap and trade. Moreover, as noted above, the *Mercury Study Report to Congress* found that medium and small sources also play a role in local deposition. Additionally, as elaborated above, a host of factors, e.g., stack height, etc., affect whether emissions from a particular coal-fired facility will deposit locally and, ultimately, contribute to exposure hot spots. Thus, a small- or medium-size facility might emit sufficient amounts of the various species of mercury (especially, although not exclusively, Hg(p) and Hg^{++}), have a sufficiently short stack, and otherwise be described by characteristics that will result in significant local deposition. Related to this point, it bears noting that while the "deposition footprint" of a large emitter may be larger in terms of area, this does not eliminate the possibility that a greater number of lakes (or a greater number of mercury-sensitive lakes, or a greater number of mercury-sensitive lakes fished by high-end fish consumers) are located within the more modest footprint of a medium or small emitter. Thus, even if EPA is correct in its prediction that large sources will be net sellers and medium and small sources net buyers, it does not follow necessarily that there will be no exposure hot spots as a result of trading.

Third, EPA argues that mercury emissions reductions will initially be comprised of the species of mercury that contribute to local deposition, Hg^{++} and Hg(p), and only the latter of the species that is of less concern, Hg(0). This is so, EPA explains, because the control technologies that sources use to control fine particles, SO_2, and NO_x also capture these species of mercury as a "co-benefit."[358] As utilities invest to comply with the proposed CAIR and new SIP for fine particles and ozone, EPA argues, they will likely become net sellers of mercury allowances, while facilities with significant emissions of Hg(0) (which requires mercury-specific control technology to reduce) will likely be net buyers of allowances. The result, according to EPA, is that species contributing to local deposition will be addressed first, "thereby reducing any local hotspots."[359]

This point seems not to support a claim that trading here will reduce local hot spots, but to respond to an argument that might be made, stemming from fact that the cap is expressed in terms of total mercury, that it is possible that some sources would be reducing mostly Hg(0) and so freeing up allowances, which they would in turn sell to sources whose total mercury emissions are comprised of a greater percentage of Hg^{++} and Hg(p). That is, it is a response to a potential criticism that, overall, a cap expressed in terms of total mercury might not produce very much by way of reductions in Hg^{++} or Hg(p). While this point addresses an important concern raised by mercury speciation, it does so *in the aggregate*. But it does not speak to the *distribution* of any Hg^{++} and Hg(p) emissions that remain. It thus does not necessarily address the point that a particular source would continue to contribute a certain amount of Hg species with local effects at a particular site, i.e., it doesn't address the hot spot point. Indeed, unless EPA is claiming here that the decrease in Hg^{++} and Hg(p) emissions will be so complete that there will no longer be any local deposition anywhere (and that the Hg(0) that remains will have zero local impact), it cannot support the claim that "any local hot spots" will be reduced by cap-and-trade.[360]

Finally, EPA throws out two snippets of data, based on modeling efforts undertaken for its Clear Skies Initiative.[361] One projects a 60% reduction in Hg^{++} emissions from those power plants within 10 km of a water body.[362] The other pro-

Committee, *Comments to Proposed Utility Mercury Reductions Rule* 3 (Mar. 8, 2004) (Docket OAR-2002-0056-1327).

355. U.S. EPA, *Clean Air Markets Update* 5 (Issue 4, Summer 2004), *at* http://www.epa.gov/airmarkets/camupdate/camupdate4.pdf.

356. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4702.

357. *Id*.

358. *Id.*

359. *Id.*

360. Note, too, that from a comparative perspective, the basis for EPA's claim here provides roughly equal support to a MACT-based approach. Assuming that sources under a MACT-based approach must also comply with the CAIR and the SIP for fine particles and ozone, the early co-benefits in terms of Hg^{++} and Hg(p) control would obtain regardless. A sufficiently ambitious MACT standard might *also* require sources to undertake the "Hg-specific control technologies" that EPA cites as capturing Hg(0); a less ambitious MACT would presumably do so only later. Either way, so long as CAIR and SIP for fine particles in place, and so long as MACT is not written to require use of technology that preferentially captures Hg(0) relative to Hg++ and Hg(p)—and there is no reason to do this—EPA's claim applies as well to a MACT-based approach.

361. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4703.

362. Although EPA doesn't identify its source, this statistic appears to be drawn from U.S. EPA, *Clear Skies Technical Support*, *supra* note 334, at B-43.

jects a 5% to 15% decrease in deposition "across much of the eastern United States."[363] As a preliminary matter, of course, recall that the Clear Skies cap-and-trade proposal required a more ambitious first-phase cap; as such, the model projections may not square with the different requirements of the proposed cap-and-trade approach. In addition, the model includes assumptions, e.g., that the "safety valve" is not triggered, that are generous to the cap-and-trade proposal and so may overstate actual emissions reductions. Importantly, the model uses quite large grids to predict deposition and thus provides only a crude picture of the likely effects.[364] Assuming nonetheless that the model offers some useful information, EPA's selective account gives only part of picture. As to the first statistic, this claim is relevant but too limited to address the concerns about the effects of local deposition and the potential for hot spots. First, it says nothing of water bodies located outside of a 10 km radius, which is a quite small area—just over 6 miles. Hg^{++} is known to deposit locally, where "local" is considered to range from a few to a few hundred miles.[365] Also, given the *Mercury Study Report to Congress*' finding that "almost all" sensitive populations eating fish from a lake within 25 km of a coal-fired power plant are exposed to mercury above the level of the RfD, it would seem that EPA would have at least been aware of the need to consider water bodies within 25 km of sources from the perspective of addressing human exposure hot spots.[366] Second, this statistic says nothing of the magnitude of the remaining Hg^{++} emissions. If the 60% reduction comes from the very largest emitters of Hg^{++}, it is quite possible that the remaining 40% may still lead to local deposition or exposure hot spots. Third, this statistic leaves unaddressed reductions in Hg(p) or Hg(0) and their potential contributions to local deposition.

As to the second statistic, EPA's claim is again relevant but partial. Although EPA's model predicts reductions in many parts of the East, it projects little change in mercury deposition for vast expanses of the United States.[367] For this large territory, the model predicts that deposition will range between a decrease of 5% to an increase of 5% relative to a scenario in which there were no mercury-specific regulation in 2020.[368] Included in the areas that would see little, if any, reduction in mercury deposition are all of Lake Superior and Lake Huron; virtually all of Lake Michigan; and the majority of Lake Erie and Lake Ontario.[369] Also included are all of Minnesota and Michigan's Upper Peninsula; and virtually all of Wisconsin and Michigan's Lower Peninsula.[370] Given the large contribution of atmospheric deposition to mercury contamination in this area, the fact that this area is blanketed with fish consumption advisories, and the relatively higher fish consumption rates here, it is difficult to see how EPA could view its selective account as adequately responding to the potential for hot spots. It is difficult to see how EPA can conclude: "Based on this available information, the proposed cap-and-trade mechanism in this regulatory proposal can be expected to reduce Hg deposition similarly in most areas. Consequently, EPA does not anticipate significant local health-based concerns under a national Hg trading program."[371]

In the end, we have EPA's reminder of its "intention to take a hard look at the Hg emissions inventory after full implementation of the first phase cap," and its assurance that it "retain[s] authority" to make adjustments to the cap-and-trade program if it finds "remaining areas with heavy, localized emissions and higher health risks (i.e., if [it finds] 'hot spots')."[372] However, as noted above, any such appraisal will come only after the fact. If EPA's confidence that there will not be any hot spots turns out to be misplaced (a distinct possibility), significant numbers of women and children in the Great Lakes and potentially elsewhere may be left unprotected in the interim. A decade spent in the shadow of a hot spot is a significant period in a child's life, given the crucial window for MeHg's neurodevelopmental effects. Note, too, that a comprehensive hot spots analysis would require much greater monitoring and other capabilities than EPA appears to have at present. Among other things, as a group of independent environmental scientists observes, "[d]espite advances in mercury monitoring and research, the current national monitoring network for airborne mercury in the U.S. is insufficient to measure the full impact of the proposed new regulations. In particular, it is not designed to detect environmental responses to changes in mercury emissions or the emergence of hotspots that might accompany a pollution trading program."[373]

In any cap-and-trade program, a sufficiently ambitious cap could serve to lessen the potential distributive concerns. In the extreme, if the cap were set to require 100% control of emissions, then human exposure hot spots attributable to emissions would cease to exist. Even short of this extreme, if aggregate emissions reductions were sufficiently steep, there might be less reason for concern for the health of even those affected by emissions from net buyers. That is, if the cap were such that even the largest emitters after trading did not emit much (or, more precisely, did not emit at levels with consequences for human or environmental health), it would matter little how aggregate emissions were distributed among sources. Indeed, this observation helps explain why the MACT approach fares so well by comparison to the cap-and-trade approach proposed here.[374] A cap that re-

363. Although EPA doesn't identify its source, this statistic appears to be drawn from *id.* at B-41.

364. EPA recognizes as much, noting in the Preamble that its second claim is "based on regional-scale Hg deposition model predictions." U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4703.

365. 3 Mercury Study Report to Congress, *supra* note 12, at 2-7 to 2-8; NESCAUM Mercury Report, *supra* note 40, at 2-4 (oxidized and particle-bound mercury deposit "within 50 to 500 miles of the source").

366. Indeed, EPA includes this very finding in the Technical Support Package for Clear Skies on the page sandwiched between the pages from which EPA takes the statistics it offers here in support of its proposal. EPA, *Clear Skies Technical Support*, *supra* note 334, at B-42.

367. *Id.* at B-41.

368. *Id.*

369. *Id.*

370. *Id.*

371. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4703. Note that if EPA is basing its conclusion on additional modeling, especially modeling undertaken using a finer resolution, it has not made this information available to the public in any reasonably accessible form.

372. *Id.*

373. Hubbard Foundation Scientists, *supra* note 18, at 17 (noting that, "currently there are only 63 federal monitoring sites in the U.S. run by the National Atmospheric Deposition Program").

374. Because the CAA requires that MACT standards are stringent, often requiring between 90% and 100% control, the potential distributive inequities that also plague technology-based approaches are, assuming an appropriately written MACT standard, largely alleviated. *See supra* note 185 and accompanying text. This point responds to Profs.

quires only modest reductions, and that allows sources years to attain them—as is the case with EPA's proposal—cannot hope thereby to avoid the hot spots problem.[375]

In theory, too, various structural mechanisms, e.g., trading ratios, might be enlisted to address the potential for hot spots.[376] Of course, any adjustments to market boundaries or other restrictions on trade introduce administrative difficulties and diminish the efficiency gains that are the primary benefit of cap-and-trade approaches.[377] In the case of mercury emissions, importantly, the complex chain between emission of mercury and human exposure to MeHg in fish tissue, e.g., speciation, deposition, methylation, bioaccumulation, fish consumption, would make establishing ratios a less-than-straightforward exercise.

D. Environmental Injustice

As the evidence above shows, there is real concern for the existence of local and regional hot spots in the upper Great Lakes under EPA's proposed cap-and-trade approach. Given that this area is home to numerous fishing tribes and given fish consumption data placing these groups among the most highly exposed, EPA must consider the injustice of opting for a cap-and-trade approach. As noted above, a cap-and-trade approach by design says nothing about the distribution of the pollutants permitted under the cap. But this distributive inquiry is crucial to discerning environmental injustice. EPA is, of course, quite aware of the potential for hot spots, and makes some effort to consider this problem. EPA's analysis of this potentially fatal weakness, however, is disappointingly lacking in rigor. EPA appears eager to dismiss the possibility of hot spots, and does so on the basis of information it cobbles together—from experience in a dissimilar context, from modeling on a course scale undertaken for a different proposal, and from partial data that address only some of the issues. Thus, if EPA's analysis is to be judged by its discussion in the Preamble and other publicly available sources, its confidence that there will be no "local or regional hot spots" is misplaced.

Notably, EPA nowhere addresses the potential for coincidence of hot spots and areas affecting fishing tribes, other communities of color, and low-income communities that depend on fish. Such an inquiry would enable it to discern the potential for exposure hot spots among the various fishing tribes of the upper Great Lakes. Having identified these peoples as among those disproportionately burdened, EPA would then need to attend to the multiple dimensions of environmental justice that are implicated when indigenous peoples are affected. As noted above and explored further below, EPA must here recognize the importance of fish to the tribes of the Great Lakes not only in terms of physical health and economic well being, but also in terms of cultural flourishing and self-determination. Thus, EPA must appreciate that the disproportionate burden that hot spots would impose on fishing tribes is not only a matter of degree, but also a matter of kind.

V. Environmental Justice and Risk Avoidance

Having opted for a regulatory approach that does little to reduce mercury contamination—indeed, an approach that may permit localized instances of increased contamination—EPA recognizes that many people who eat fish will continue to be exposed to MeHg at levels that are not safe. Rather than view this as a signal that it ought to consider more meaningful efforts to reduce mercury contamination, EPA shifts the burden to those who are at risk to take steps to shield themselves from the contamination, namely, to reduce or eliminate their intake of fish. EPA thus declines to require coal-fired utilities—the sources of mercury contamination—to reduce their emissions. Instead, it instructs people who are thereby exposed to MeHg contamination in fish tissue to alter their ways in compliance with fish consumption advisories and so *avoid* the resulting risks. EPA's embrace of "risk avoidance" in the proposed rule has been celebrated by industry commentators. The National Mining Association (NMA), for example, applauds the cost savings to be obtained from a regulatory approach that favors what it euphemistically terms "dietary modification and education."[378] But EPA's reliance on risk avoidance is troubling for several reasons, not the least of which is a concern for environmental justice. This part discusses these issues, focusing in particular on the inappropriateness of EPA's approach from the perspective of the fishing tribes of the upper Great Lakes.

A. The Proposed Rule's Embrace of Risk Avoidance

In the Preamble to the proposed rule, EPA states that the "typical U.S. consumer eating a wide variety of fish from restaurants and grocery stores is not in danger of consuming harmful levels of [MeHg] from fish and is not advised to limit fish consumption."[379] Those who "regularly and frequently consume large amounts of fish," EPA concedes, "are more exposed."[380] After noting that the developing fetus is particularly sensitive to the effects of methylmercury, EPA advises women of childbearing age to consult the fish consumption advisories issued by EPA, the FDA, and states.[381]

Thus EPA appears satisfied with a rule that reduces the risks of mercury contamination for only a fraction of the

Bruce Ackerman and Richard Stewart in this regard. Ackerman & Stewart, *supra* note 308, at 1350-52. This point also speaks, at least in part, to concerns raised by environmental justice advocates. *See generally* Kuehn, *supra* note 305. Additionally, the CAA marries a stringent initial technology-based standard with a residual health-based standard, ensuring that human exposure hot spots (and, it should be noted, biological hot spots) are addressed.

375. EPA nonetheless gestures in this direction, holding up "the 70[%] emission reduction" alongside its "experience with cap-and-trade systems" to support its claim that there will be no local or regional hot spots under the cap-and-trade proposal. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4701.

376. *See, e.g.*, Jonathan Nash & Richard Revesz, *Markets and Geography: Designing Marketable Permit Schemes to Control Local and Regional Pollutants*, 28 Ecology L.Q. 569 (2001). EPA is aware of this possibility and solicits suggestions to this end. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4701.

377. *See, e.g.*, Foster & Hahn, *supra* note 298, at 40-42 (studying the effect of offsets used by the RECLAIM program to address distributive concerns and concluding that "[w]hile a move toward geographical segmentation can be justified in environmental terms, the consequent effect on price dispersion illustrates the problems that can arise in the operation of a tradeable permits market").

378. NMA, Comments on the Proposed Rule 8 (May 14, 2004) (Docket OAR-2002-0056-2422) [hereinafter NMA, Comments].

379. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4658.

380. *Id.*

381. *Id*.

U.S. population, but leaves fishing tribes and indigenous peoples, other communities of color, and low-income communities who depend on fish—as well as a large swath of the general population (women of childbearing age and children up to age 20)—to undertake avoidance measures to protect themselves from the mercury that remains. EPA's strategy here is an example of the current Administration's embrace of regulatory approaches that favor risk avoidance in lieu of risk reduction.[382] While this embrace may be perilous as a general matter, it is especially troubling as a matter of environmental justice.

Environmental regulatory efforts have, until recently, focused on *risk reduction*. Under this approach, environmental risks are reduced by targeting the first link in the chain that connects environmental contamination with adverse health effects in humans, i.e., by aiming to clean up, limit, or prevent environmental contaminants. Increasingly, however, EPA is relying on *risk avoidance*. Under this approach, environmental risks are addressed by intervening late in the chain, breaking the link at the point of human exposure. These strategies leave contamination unabated. Instead, they look to those whose practices or lifeways expose them to contamination and require these individuals to alter their ways, thereby "avoiding" the risk. The proposed rule exemplifies just this shift: rather than seek to reduce the risks to those who "regularly and frequently consume large amounts of fish" by decreasing the amount of mercury emitted to the environment, it places responsibility on those affected to avoid the risks by altering their fish consumption practices.

Indeed, EPA's proposed rule is particularly bold in its embrace of risk avoidance. Until recently, agencies have characterized risk avoidance measures as regrettable, temporary and exceptional responses to contamination.[383] In this vein, EPA has maintained that fish consumption advisories are a temporary means to address human health risks while risk reduction is pursued with vigor.[384] Thus, for example, EPA's Office of Water opened the 2001 National Forum on Contaminants in Fish by declaring:

> [W]ater quality-based programs at both the federal and state levels seek not only to advise people on ways to minimize public health risks, but also to implement management measures to reduce the pollution problems so that measures like fish consumption advisories can be rescinded. No one wants consumption advisories in place any longer than necessary.[385]

While EPA has been less than successful in this regard, it has nonetheless continued to maintain that it is committed to risk reduction in the long term, even if increased advisories are necessitated in the short term alongside risk reduction efforts.[386] The proposed rule, by contrast, explicitly invokes risk avoidance in lieu of risk reduction. It relies on advisories to shore up protection for those who regularly consume large amounts of fish—given that EPA has no intention of reducing contamination to protective levels. Remarkably, it also unflinchingly acknowledges precisely who it is that will be subjected to avoidance measures:

> Some subpopulations in the U.S., such as: Native Americans, Southeast Asian Americans, and lower income subsistence fishers, may rely on fish as a primary source of nutrition and/or for cultural practices. Therefore, they consume larger amounts of fish than the general population and may be at a greater risk to the adverse health effects from Hg due to increased exposure. . . . In response, . . . EPA and FDA have issued fish consumption advisories which provide recommended levels of consumption for certain fish species for different populations. EPA and FDA are currently developing a joint advisory that has been released in draft form. This newest draft FDA-EPA fish advisory recommends that women and young children reduce the risks of Hg consumption in their diet by moderating their fish consumption, diversifying the types of fish they consume, and by checking any local advisories that may exist for local rivers and streams.[387]

The move to risk avoidance, perhaps unsurprisingly, is celebrated by various industry groups. The NMA, for example, applauds EPA for a regulatory approach that eschews risk reduction in favor of "dietary modification and education."[388] Like other advocates of risk avoidance, the NMA claims that risk avoidance is more cost-effective than risk reduction.[389] As discussed below, however, this claim ignores the considerable shortcomings of risk avoidance.

Indeed, as EPA permits risk fish consumption advisories to become a staple of regulatory efforts—no longer a last resort or a temporary stop-gap—it makes possible the offensive use of risk avoidance. That is to say, commentators may invoke risk avoidance, whether expected or undertaken, to alter baseline assumptions about exposure.[390] If people are assumed to be eating less fish, then they can be assumed to be less exposed to MeHg via fish consumption; if people are not exposed, there is little call for regulatory efforts to reduce mercury contamination. There are several variations

382. *See* O'Neill, *supra* note 119.

383. *Id.* at 6-20.

384. *Id.* at 10-12.

385. Elizabeth Southerland, U.S. EPA, Office of Water, Proceedings of the National Forum on Contaminants in Fish, May 6 and 9, 2001, at I-10 (2001), *available at* http://www.epa.gov/ost/fish/forum/fishforum.pdf.

386. O'Neill, *supra* note 119, at 23.

387. U.S. EPA, Proposed Mercury Rule, *supra* note 1, at 4709. Note that the joint advisory is broader in coverage and more onerous than its predecessor.

388. NMA, Comments, *supra* note 378, at 8 (citing Environmental Defense' "Seafood Selector," an on-line resource that gathers and sorts fish consumption advice issued by various federal, tribal, and state agencies). Remarkably, NMA claims the concurrence of environmental groups. "Indeed, the environmental community is becoming increasingly aware that dietary modification and education are the keys to an effective mercury risk management strategy." *Id*. NMA cites as evidence for this claim the fact that Environmental Defense maintains an on-line resource to publicize the existence of fish consumption advisories. Nowhere on this site, however, does Environmental Defense endorse anything like the policy favored by NMA, which supports "modifying dietary behavior" in lieu of reducing mercury emissions. Instead, Environmental Defense states that its goal in providing the "Seafood Selector" is to help consumers "make sense of today's confusing array of information on fish." Environmental Defense, *Seafood Selector*, *at* http://www.environmentaldefense.org/seafood/fishhome.cfm. In fact, Environmental Defense elsewhere on the site makes quite the opposite policy recommendation, concluding the abstract to its December 2003 report *Out of Control and Close to Home: Mercury Pollution From Power Plants*, with the declaration: "Reducing power plant pollution is critical to lowering local mercury hot spots and avoiding the dangerous contamination of fish, wildlife and people." *Id.*

389. NMA, Comments, *supra* note 378, at 8; *see* O'Neill, *supra* note 119, at 20-21 (discussing cost savings as prominent among the justifications offered by proponents of risk avoidance).

390. Industry, perhaps unsurprisingly, has been most explicit in invoking risk avoidance in this manner.

on this sort of maneuver. The Utility Air Regulatory Group (UARG), for example, chides EPA for citing the widespread need for fish consumption advisories as evidence of an MeHg contamination problem.[391] Instead, the UARG uses the existence of advisories to alter the baseline. By taking as a given that people will be reducing their consumption of fish in order to avoid the risks of mercury contamination, the UARG can claim that there will be no human health issues resulting from exposure to contaminated fish, and so insufficient warrant for regulating mercury emissions. "Indeed, the primary purpose for fish advisories is to warn the public about undue consumption of fish from given water bodies in an effort to change behavior patterns and thus *avoid* health issues."[392] In a similar vein, EPRI suggests that EPA adjust its estimates of MeHg exposure to reflect the fact that the effect of fish consumption advisories will be to "redirect consumption" away from fish in water bodies with high levels of MeHg.[393] The implication is that—again taking risk avoidance as a given—if human exposure to MeHg via fish consumption will be lower than EPA assumes given current consumption practices, then less ambitious mercury emissions reductions are warranted.[394]

Note that such arguments spell increasingly bleak prospects for those who would consume fish. The choice of risk avoidance may set in motion a downward spiral, whereby water bodies contaminated with MeHg will support only decreased fishing and fish consumption.[395] This decreased rate of fish consumption (and consequent decreased level of exposure) will then be relied upon to justify less protective environmental standards, with the result that these and other water bodies will become even more contaminated.[396] In turn, fish consumption advisories will be expanded, apparent fish consumption rates will continue to decline, and so the downward spiral will continue.[397]

B. The Perils of Risk Avoidance

A shift to risk avoidance in lieu of risk reduction is, as I have argued elsewhere, perilous as a general matter and particularly troubling from the perspective of environmental justice.[398] The proposed rule provides a case in point.

First, risk avoidance is myopic. Risk avoidance measures intervene late in the chain linking contamination and human health effects, at the point of human exposure. As a result, such measures leave unaddressed the myriad adverse effects of contamination that do not directly threaten human health, that is, the adverse effects on all non-human components of the affected ecosystems.[399] Loons cannot read fish consumption advisories. Even for those concerned chiefly with human health, risk avoidance may be short-sighted. Given, among other things, the complex relationships between human and ecological health, allowing contamination to remain untreated may in fact leave unaddressed many indirect and direct effects on humans.[400] In the case of mercury, for example, data suggest that mercury contamination may impede the normal growth of wild rice in the inland lakes in Minnesota and Wisconsin.[401] The potential adverse effects for humans who rely on wild rice are great: members of the various Ojibwe and other tribes, for example, depend on wild rice as a staple of physical, economic, cultural and spiritual health.[402] Yet these and other adverse effects on humans are missed entirely when the risks of mercury are addressed by means of fish consumption advisories. In either event, any cost savings cited as a virtue of risk avoidance may well be overstated and enjoyed only in the short term.[403]

Second, risk avoidance is often not effective. In order for risk avoidance to work, advisories must be received and understood, restrictions must be enforced, and, ultimately human behaviors must be changed. Even proponents of risk avoidance concede the considerable hurdles here.[404] These hurdles loom larger when those affected do not speak the language or share the culture of the dominant population, and they may become insurmountable when those affected are opposed on philosophical, moral or cultural grounds. Evidence suggests that each of these limitations plagues fish consumption advisories.[405] For example, according to a re-

391. UARG, Comments, *supra* note 27, at 2-3, 27-28.

392. *Id.* at 27-28 (emphasis added).

393. EPRI, Comments, *supra* note 42, at 124. EPRI makes this argument in service of its assessment of the effect of mercury emissions reductions on human exposure. *Id.* at 118-32.

394. *Id.*

395. The point that contamination and depletion of aquatic environments may lead to a fish consumption rate for a given population that is artificially decreased or "suppressed" from an appropriate baseline level of consumption for that population was first recognized by Pat West and his colleagues. *See* NEJAC, Fish Consumption Report, *supra* note 70, at 43-49 (citing Pat West et al., School of Natural Resources, Natural Resources Sociology Lab, University of Michigan, Ann Arbor, Technical Report No. 2, Michigan Sports Anglers Fish Consumption Survey: Supplement I, Non-Response Bias and Consumption Suppression Effect Adjustments (1989). The point that agencies' choice of risk avoidance over risk reduction may set in motion a downward spiral, resulting in increasing contamination and decreasing fish consumption—with particular implications for fishing tribes—is elaborated at O'Neill, *supra* note 119, at 50-51.

396. NEJAC, Fish Consumption Report, *supra* note 70, at 43-49.

397. *Id.*

398. O'Neill, *supra* note 119.

399. This focus on human health, to the exclusion of non-human health, is troubling in and of itself for anyone for whom human health is but one component of ecological health and but one end of appropriate regulatory efforts—a perspective reflected in the conception of environmental justice articulated by many tribes and indigenous peoples. *See, e.g.*, *id.* at n.92. *Accord* Minnesota Chippewa Tribe, Comments, *supra* note 66, at 1-2 ("Mercury is known to seriously impact fish eating wildlife such as loons and mink. These animals are a value to the ecosystem they inhabit and they are clan symbols for Tribal members. If these animals are threatened, Tribal culture is threatened.").

400. O'Neill, *supra* note 119, at 23.

401. Telephone Interview with Larry Schwarzkopf, Fond du Lac Resources Program (July 12, 2001).

402. GLIFWC, Wildlife and Wild Plants 31-32 (2003), *available at* http://www.glifwc.org ("In the fall comes the traditional harvest of manoomin (wild rice), a basic food in the diet of Ojibwe people. . . . Wild rice management and restoration has always been a priority for [GLIFWC] member tribes, because manoomin is such a culturally important food to the Ojibwe people.") [hereinafter GLIFWC, Wildlife and Wild Plants]; *see generally* Winona LaDuke, All Our Relations: Native Struggles for Land and Life 115 (1999).

403. O'Neill, *supra* note 119, at 23-24.

404. *See, e.g.*, John Pendergrass, *Sustainable Redevelopment of Brownfields: Using Institutional Controls to Protect Public Health*, 29 ELR 10243 (May 1999) (observing that "[i]t is unlikely that public health warnings [or notices] can be 100 percent effective at preventing all exposure to risk, because some people will not receive the warning, some who receive it will not understand it, and some who understand it will choose to ignore it").

405. For an extensive discussion of fish consumption advisories' effectiveness, see NEJAC, Fish Consumption Report, *supra* note 70,

cent study, half of those consuming fish caught recreationally on the Great Lakes were unaware of the relevant fish consumption advisories.[406] People of color, women, and those without a high school degree evidenced the least awareness.[407] Even where advisories for mercury have been received and understood, those who customarily catch and eat fish often find it difficult to alter their ways. As one recreational fisher in Wisconsin concedes, although he stopped eating fish for a period to address the elevated mercury levels in his blood, he "can't help himself" and so "now cheats a bit."[408] Indeed, those for whom fish consumption includes spiritual, traditional, or cultural dimensions may feel that it is not possible to cease eating fish. In the case of members of the various Ojibwe tribes, a recent survey showed that whereas 57% of tribal fishers were aware of mercury advisories for walleye, only 9% had ever refused to eat walleye in a group setting such as a feast or a ceremonial gathering because of mercury concerns.[409]

Third, risk avoidance is an approach with finite possibilities. This claim includes both a particular and a more general point. Some pollutants can be more readily avoided than others. The options for avoiding mercury in fish are few. A fisher seeking to avoid polychlorinated biphenyl (PCB) contamination might be able to alter his preparation methods—trimming the skin and fat from fillets and broiling or grilling so that the fats drips off while cooking—but to continue to fish at his customary sites and for his customary species.[410] A fisher seeking to avoid mercury contamination, by contrast, cannot do so merely by altering her preparation methods, because MeHg accumulates in the muscle tissue that comprises the fillet.[411] Instead, she must take steps to reduce—and, in some cases, eliminate altogether—her total consumption of particular species caught from contaminated waters and to pace her allowable intake to avoid acute exposure. As a general matter, the more risk avoidance is allowed to supplant risk reduction, the fewer the options for risk avoidance. Heavy reliance on risk avoidance would eventually lead to a world in which there are no longer any healthful alternatives, as uncontaminated environments are permitted one by one to become and remain degraded. Pregnant women would avoid lake trout, but be left with only poor substitutes in terms of protein and other nutrients. Bad River tribal fishers would avoid fishing in English Lake, Siskiwit Lake, and the Turtle-Flambeau Flowage, instead having to make the trip to Lac Sault Dore or High Lake—and potentially having to limit the frequency of their intake of walleye caught even here.[412] Eventually, if mercury emissions were to continue unabated, there would be no "safe" species, no lakes free of contamination.

Fourth, risk avoidance may introduce unintended risk-risk tradeoffs. If those exposed change their ways in order to avoid risks posed by contamination, they may adopt practices that subject them to a different set of risks. To the extent that those affected "comply" with fish consumption advisories, the potential for countervailing risks is a serious concern, given the celebrated nutritional benefits of frequent fish consumption. Fish are an efficient source of protein, omega-3 fatty acids, selenium, and other nutrients important to human health.[413] By forgoing these benefits, those affected may open themselves to an increased risk of coronary and other diseases. In addition, for those for whom fish forms a part of a traditional diet, including those in the fishing tribes of the upper Great Lakes, regular consumption of fish and other traditional foods may function to promote health and to combat diabetes, a particular concern for tribes given the high rate of diabetes among American Indians and Alaska Natives.[414] The possibility for risk-risk tradeoffs, of course, has been brought to the attention of agency decision makers.[415] The choice of a particular risk avoidance measure may in fact represent an agency's informed trade off among risks. As I have argued elsewhere, such trade offs are likely to reflect the values of the dominant society; this is problematic to the extent that these values are different from those on whom the burden of undertaking risk avoidance will fall.[416] The point nonetheless remains that agency decisionmakers may not foresee fully the roster of countervailing risks introduced by avoidance measures. Where this is so, any cost savings will again be overstated.

Thus, by relying on risk avoidance in lieu of risk reduction, the proposed mercury rule suffers in each of these re-

at 90-127; *but cf.* Emily Oken et al., *Decline in Fish Consumption Among Pregnant Women After a National Mercury Advisory*, 102 Obstetrics & Gynecology 346 (2003) (study showing increased compliance with national advisories among middle class pregnant women visiting obstetrics offices in eastern Massachusetts practice).

406. John Tilden et al., *Health Advisories for Consumers of Great Lakes Sport-Fish: Is the Message Being Received?*, 105 Envtl. Health Persp. 1360 (1997).

407. *Id.*; *accord* NEJAC, Fish Consumption Report, *supra* note 70, at 90-127.

408. NOW With Bill Moyers, *supra* note 347.

409. GLIFWC, 1993 Survey, *supra* note 80, att. 2, at 1, 5.

410. PCBs are lipophilic and thus accumulate in a fish's fatty tissue. *See., e.g.*, U.S. EPA, Office of Water, Polychlorinated Biphenyls (PCBs) Update: Impact on Fish Advisories 4 (1999), *available at* www.epa.gov/waterscience/fish/pcbs.pdf; GLIFWC, *Enjoy Fish Safely*, *supra* note 109, at 2; WDNR, *Choose Wisely*, *supra* note 111, at 5-6, 11. Note that even the relatively expansive options for avoiding PCBs may be inappropriate from the perspective of some groups, inasmuch as a suggestion that preparation and cooking methods be altered may be perceived as an cultural affront and may be resisted, rendering advisories ineffective, among other things. *See, e.g.*, NEJAC, Fish Consumption Report, *supra* note 70, at 90-127.

411. U.S. EPA, Mercury and Fish Advisories, *supra* note 54, at 2; GLIFWC, Enjoy Fish Safely, *supra* note 109, at 2; WDNR, *Choose Wisely*, *supra* note 111, at 5-6, 9.

412. According to the WDNR, women of childbearing age and children under the age of fifteen should not consume any walleye larger than 17" from English Lake, 20" from Siskiwit Lake, and 18" from the Turtle-Flambeau Flowage. WDNR, *Choose Wisely*, *supra* note 111, at 9-10. According to the GLIFWC's mercury maps, women of childbearing age and children under the age of fifteen should not consume any walleye larger than 15" in length from Siskiwit Lake or the Turtle-Flambeau Flowage, and should not consume more than one meal per month of walleye larger than 15" from English Lake. GLIFWC, *Mercury Maps*, *at* http:// www.glifwc.org. The GLIFWC suggests that women of childbearing age and children, as well as others, are free to consume walleye of any size from Lac Sault Dore and High Lake; the WDNR has issued statewide advisories for mercury suggesting that women of childbearing age and children limit their intake of walleye from these lakes to one meal per month, whereas others limit their intake to one meal per week. *Id.*

413. *See, e.g.*, Renate D. Kimbrough, *Consumption of Fish: Benefits and Perceived Risk*, 33 J. Toxicology & Envtl. Health 82 (1991).

414. Telephone Interview with John Persell, *supra* note 82; *see generally Health Disparities Experienced by American Indians and Alaska Natives*, Morbidity & Mortality Wkly. Rep., Aug. 1, 2003, at 1 ("The rates of . . . diabetes . . . were two to three times as high among [American Indians and Alaska Natives] than among all racial/ethnic populations combined.").

415. Risk v. Risk: Trade Offs in Protecting Health and the Environment (John D. Graham & Jonathan Baert Wiener eds., 1995).

416. O'Neill, *supra* note 119.

spects—a cause for grave concern for all. Attention to environmental justice, however, introduces additional issues.

C. Environmental Injustice

In the first place, the burden of undertaking risk avoidance measures is likely to fall disproportionately on tribes and indigenous peoples, other communities of color, and low-income communities, because it is these communities who are likely to be among the most exposed. Moreover, risk avoidance measures are likely to be evaluated by reference to the understandings and commitments of the dominant society, and adopted only where avoidance is thought not to occasion great costs or profound loss. Yet the understandings and commitments of those who will be faced with altering their practices and lifeways may be quite different than those of the dominant society. This will often be the case where Native peoples are prominent among the risk-bearers, as they are when the source of risk is MeHg contamination. Thus, environmental injustice here arises not only from distributive inequities, but also from cultural discrimination.

Risk avoidance measures do not impose their burdens equally. Those who enjoy relative freedom from exposure to environmental contaminants will not be called upon to alter their ways so as to decrease their exposure. Those who are more highly exposed, however, will be asked to make such sacrifices. Under the proposed rule, this group includes all those who "regularly and frequently consume large amounts of fish" and so are "more exposed" to MeHg—particularly sensitive subpopulations such as children and women of childbearing age. As such, they are the ones directed by the proposed rule to moderate their fish consumption, diversify the types of fish they consume, and to otherwise alter their practices in accordance with local advisories. They are the ones who are directed to forego the myriad health benefits of frequent fish consumption—an extraordinary burden, considering that a child's neurological development continues until age 20 and that a woman's childbearing years span roughly an additional 30 years. In some regions of the United States, this burden will affect a broad swath of the population. This is the case, for example, in the upper Great Lakes, where there are relatively high numbers of recreational fishers, where there are several communities of color and low-income communities that depend on fish, and where, as everywhere, children under age 20 and women of childbearing age comprise a substantial portion of the population. Moreover, as detailed above, the members of the Ojibwe and other fishing tribes in this area are among the most highly exposed, and so among those most heavily burdened by EPA's embrace of risk avoidance. Whereas members of the general population—especially those who do not consume fish—are not much affected by a turn to advisories in lieu of reduced contamination, members of these fishing peoples will be faced with the "choice" of curtailing severely their fish intake, or being exposed to MeHg in fish at levels determined to be unhealthful for humans. Thus, the inequitable distribution of the burdens imposed by risk avoidance becomes clear. By featuring risk avoidance instead of meaningful risk reduction, EPA's proposal perpetuates the maldistribution of environmental burdens and benefits that is the hallmark of environmental injustice.

From the perspective of the fishing tribes, however, environmental injustice in this context stems not only from distributive inequities but from cultural discrimination as well. Not only are the Ojibwe and other fishing peoples the ones most heavily burdened by reliance on fish consumption advisories, but they are likely to understand differently the nature of this burden. There are likely profound differences in the value attached to fish, fishing, and fish consumption as between various indigenous peoples and the dominant society.[417] For the fishing tribes of the Great Lakes, as for fishing peoples elsewhere, fish and the lifeways associated with fish are central to their identity as peoples. For these peoples, fish, fishing, and fish consumption are indispensible to physical, social, economic, political, spiritual, and cultural health. For the dominant society, by contrast, these practices, while important, are likely not constitutive of their very identity.[418] Thus, for example, a member of the general population who habitually consumes two meals of fish per week might, in the face of fish consumption advisories for mercury, look to substitute food sources with relatively modest accommodations to palate and pocketbook. A member of the Mille Lacs Band, however, might view such risk avoidance measures as *impossible*, given the affront this would mean to her tribe's very identity, to what it means to *be* Ojibweg.

For Ojibwe peoples, fish, fishing, and fish consumption are vital for multiple, interrelated reasons. For these peoples, fishing and fish consumption perform necessary functions in ensuring the health of their members and the existence of the fish resource itself.[419] Indeed, the Ojibweg view themselves as having a responsibility to continue to fish and to eat fish, in accordance with prescribed practice, in order to maintain the health of the resource and, indeed, that of the larger environment.[420] Fishing and fish consumption are integral components of traditional and ceremonial activities at the heart of Ojibwe culture.[421] Ojibwe peoples depend on fish for subsistence.[422] Fish such as walleye are a staple food, and fishers can feed their families or sell their catch as a means of income.[423] Fishing and eating fish provide important occasions for the intergenerational transfer of knowledge (including ecological, historical and social knowledge) that forms a central part of the inheritance of succeeding generations.[424] Fishing and eating fish are also important to tribes' ability to exercise fully their treaty rights. The inestimable value that these peoples place on fish, fishing, and fish consumption is marked in language, story and ceremony; in treaties negotiated with the settler

417. *Id*. at 28-30, 35-51.

418. *Id.*

419. *See, e.g.*, GLIFWC, Comments on the Proposed Rule 2 (June 29, 2004) (Docket OAR-2002-0056-3527).

420. *Id.*

421. *Id.*

422. *See, e.g.*, Minnesota Chippewa Tribe, Comments, *supra* note 66, at 1 (observing that "[s]ome Tribal members eat fish because they are remotely located and fish is the major food source available to them. All Tribal members eat fish because it is our culture and tradition.").

423. *See, e.g.*, GLIFWC, *2004 Season*, *supra* note 100, at 1-2 (noting that "2004 provided ample fish for tribal tables and freezers. . . . As is customary, many tribal fishermen share their catch with family, extended family and tribal elders and also provide fish for ceremonies and community feasts.").

424. *See, e.g.*, GLIFWC, Comments, *supra* note 419, at 2 ("The practice of harvesting, sharing, and consuming *ogaa* (walleye) is passed down from generation to generation."); LaDuke, *supra* note 402.

populations[425]; in past and present fishery management practices[426]; in contemporary leadership in monitoring, protecting and restoring the ecosystems on which fish depend[427]; and in the ongoing political and legal struggle for the survival of the fish and the flourishing of their fishing cultures.[428]

As a corollary to these different understandings, whereas many in the dominant society may see several possibilities for avoiding the risks of MeHg in fish, those in the fishing tribes of the Great Lakes would understand any of these options to occasion great anguish and enormous loss. Thus, some in the dominant society could readily comply with an instruction to eat different species of fish, or to limit consumption of particular species to one meal per month, or to pass over a usual fishing spot in favor of a lake with less restrictive warnings. These efforts might be attended by some amount of hardship in terms of money, convenience or predilection, but they might nonetheless be acceptable.[429]

Indeed, several industry commentators go so far as to imply that fish consumption is not only expendable, but somewhat of an outlier practice—a bad habit—in the first place. The UARG, for example, casts fish consumption in this light when it observes that "the primary purpose of fish advisories is to warn the public about *undue consumption* of fish from given water bodies. . . ."[430] In a similar vein, the NMA borrows the language of criminology when it discusses consumption "by women *with a propensity to consume seafood containing high levels of mercury*."[431]

By contrast, the fishing tribes in the upper Great Lakes and elsewhere have emphasized the intolerable loss that would accompany having to avoid the risks of unabated MeHg contamination in fish. The Fond du Lac Tribe, for example, notes the importance of consuming traditional foods, including fish, and avoids discouraging members from doing so.[432] Instead, it emphasizes "the tremendous cultural and nutritional benefits of harvesting, hunting and consuming these foods."[433] The GLIFWC offers an account of the traditional and ceremonial aspects of fishing on Mille Lacs Lake and describes fishing as a matter of "responsibility for your community, your family, the fishing gear, and the fish."[434] It focuses on the social relationships, including intergenerational relationships between tribal youth and elders, that are cemented through proper fishing practice.[435] Moreover, tribal members are not free simply to go "elsewhere" to fish. Treaty fishing rights are tied to particular waters.[436] The legal protections that flow from these rights cannot just be re-established somewhere else. As well, the particularized skills and ecological knowledge that these tribes have developed over generations are also place-specific and, therefore, not transferable to other locations. Thus, this means of avoiding the risks of contamination, while possible for most members of the general population, is simply unavailable to tribal members. A regulatory approach that asks members of the fishing tribes to consume less fish or to alter their fishing practices would not only be unacceptable but, in many ways, impossible.

By permitting significant mercury contamination to remain and relying instead on fish consumption advisories, EPA perpetuates a long history of cultural discrimination against American Indian peoples. Importantly, by sanctioning the contamination and depletion of tribal resources, the choice to rely on advisories works to undermine tribal self-determination. Because tribal management of these resources is an important exercise of tribal sovereignty and self-government,[437] a threat to the health of these resources as a practical matter constitutes an encroachment on a tribe's political autonomy. EPA's choice threatens to eviscerate tribes' treaty rights and to hinder their exercise of cultural self-determination.[438] These threats are unique to tribal members.

EPA appears here to have opted for risk avoidance in the form of fish consumption advisories over meaningful risk reduction by reference to a framework that ignores the resulting environmental injustice from the perspectives of tribes and indigenous peoples. EPA does not make explicit its reason for depending so heavily on fish consumption advisories when it is clear that EPA is aware which groups will be burdened by this choice; we are left to surmise that it has done so on the basis of its assessment of the relative costs and benefits of addressing mercury contamination. To the extent that EPA has undertaken this calculus, it can only have assessed the costs and benefits in the aggregate, with these terms defined narrowly, according to the values of the dominant society. In so doing, EPA fails to account for the distributive consequences: fishing peoples are disproportionately among the risk-bearers asked to undertake avoidance. EPA also fails to consider the different understandings of what it asks—understandings respecting the importance of fishing and consuming particular species, at particular

425. *See generally* GLIFWC, Understanding Ojibwe Treaty Rights, *supra* note 2; Ronald N. Satz, Chippewa Treaty Rights (1991).

426. *See, e.g.*, GLIFWC, Understanding Ojibwe Treaty Rights, *supra* note 2, at 9-25 (describing the GLIFWC's and member tribes' efforts to regulate fish harvest in Michigan, Minnesota, and Wisconsin).

427. *See, e.g.*, GLIFWC, Wildlife and Wild Plants, *supra* note 402, at 35-41 (discussing the GLIFWC's and member tribes' efforts to ensure the health of water, aquatic ecosystems, and fish); Fond du Lac Environmental Program, Office of Water Protection, *Water Protection Program*, *at* http://www.fdlrez.com/nr/environmental/water.htm [hereinafter Fond du Lac Environmental Program].

428. *See, e.g.*, GLIFWC, *2004 Season, supra* note 100, at 1 (describing harassment endured by tribal fishers exercising their treaty-protected rights to spear on the Rice River Flowage in Oneida County, Wisconsin, "a specter of the spearfishing seasons in the '80s").

429. O'Neill, *supra* note 119, at 38.

430. UARG, Comments, *supra* note 27, at 27-28.

431. NMA, Comments, *supra* note 378, at 8.

432. Fond du Lac Environmental Program, *supra* note 427.

433. *Id.*; *accord* Telephone Interview with Nancy Costa, Fond du Lac Environmental Program (July 31, 2001) ("The last thing we want to do is to discourage tribal members from eating fish—given (among other things) the serious health effects we have seen for those who have gotten away from a Native diet.").

434. GLIFWC, *Doing It Right: A Boy, His Teachings, and His Net*, Mazina'igan, Summer 2004, at 12.

435. *Id.* at 12-13.

436. *See generally* GLIFWC, Understanding Ojibwe Treaty Rights, *supra* note 2 (describing the ceded areas under the various treaties relevant to the eleven member tribes).

437. Rebecca Tsosie, *Tribal Environmental Policy in an Era of Self-Determination: The Role of Ethics, Economics, and Traditional Ecological Knowledge*, 21 Vt. L. Rev. 225 (1996).

438. *See* Robert J. Miller, *Exercising Cultural Self-Determination: The Makah Indian Tribe Goes Whaling*, 25 Am. Indian L. Rev. 165, 206 (2002) (defining "cultural self-determination" as "the right of a distinct and identifiable group of people or a separate political state to set the standards and mores of what constitutes its traditional culture and how it will honor and practice that culture").

places, in accordance with particular ways—from the perspective of those on whom the burden will rest. EPA's choice, therefore, perpetuates rather than ameliorates environmental injustice.

VI. Environmental Justice and the Fishing Tribes of the Great Lakes

Where Indian tribes and their members are among those affected, environmental justice implicates a particular constellation of issues—issues that are different than those affecting the general population and, often, other subpopulations.[439] In such instances, environmental justice requires attention to the interrelated ecological, economic, social, cultural, spiritual, and political dimensions of environmental law and policy. For Native peoples in the United States, of course, environmental justice cannot be contemplated apart from a recognition of tribes' unique legal and political status: tribes are sovereign governments, with rights to and management authority over tribal lands and resources. Further, environmental justice requires an appreciation of each tribe's particular historical circumstances and contemporary aspirations. Prof. Dean Suagee explains:

> [I]f you look closely you are bound to find impacts that affect tribal people differently from the way they affect other groups. Any activity that affects the environment has the potential to cause impacts on a tribal community that are different from the impacts suffered by other communities because of the ways in which the natural world is important to tribes for cultural and religious reasons. . . . Some tribes, and some people within any given tribe, are more dependent than others on traditional cultural practices for their basic survival needs. Traditional religions have more practitioners in some tribes than in others. But for all American Indian and Alaska Native people, traditional cultural and religious practices are an important aspect of tribal identity. Impacts on culturally important biological communities or sacred places are bound to affect tribal communities differently.[440]

In the context of the decision how to regulate mercury emissions from coal-fired utilities, environmental justice would require EPA to acknowledge these different impacts on the various tribes, including the fishing tribes of the upper Great Lakes. More particularly, environmental justice would require EPA to attend to tribal members' different circumstances of exposure; to the distributive impacts of trading under a cap-and-trade approach; and to the origins and effect of risk avoidance measures from tribes' perspectives. As I have argued elsewhere, various normative commitments to environmental justice guide the work of EPA and other agencies to this end.[441] Additionally, several positive legal commitments direct EPA's efforts here. In the case of decisions affecting the fishing tribes of the upper Great Lakes, EPA is governed among other things by treaties between the various tribes and the United States; by the federal trust responsibility; and by executive commitments to environmental justice and to consultation with tribal governments. I will sketch briefly each of these obligations.

First, EPA is bound by treaties with the American Indian nations that are the predecessors to the present-day fishing tribes.[442] EPA must honor treaties from the mid-1800s by which the various Ojibwe bands ceded vast areas within what is now Michigan, Minnesota, and Wisconsin, but reserved rights to hunt, fish, and gather in the ceded territory. Thus, for example, the Treaty of 1837, between the Lake Superior Chippewa and the United States, provides: "The privilege of hunting, fishing, and gathering the wild rice, upon the lands, the rivers and the lakes included in the territory ceded, is guaranteed to the Indians . . . ."[443] According to the GLIFWC, whose 11 member tribes are the successors to these treaty-guaranteed rights, "[t]he purpose of this guarantee was to ensure that the tribes could continue their way of life to meet subsistence, economic, cultural, spiritual and medicinal needs."[444] Since the time of the treaties, courts have reaffirmed their guarantees. For example, in *Lac Courte Oreilles Band of Lake Superior Chippewa Indians v. Wisconsin*,[445] the court stated that, by dint of the 1837 and 1842 treaties, the Chippewa were

> guaranteed the right to make a moderate living off the land and from the waters in and abutting the ceded territory and throughout that territory by engaging in hunting, fishing, and gathering as they had in the past and by consuming the fruits of that hunting, fishing, and gathering, or by trading the fruits of that activity for goods they could use and consume in realizing that moderate living.[446]

Thus, the district court here explicitly recognized that treaty protections include not only tribal members' right to fish in the ceded area, but also their right to consume the fish they catch, or to sell it to others for others' consumption. By sheer force of logic, if fish in the ceded area are permitted to become so contaminated as to be unfit for human consumption, the treaty-guaranteed "privilege of . . . fishing," and the concomitant right of "consuming the fruits of that . . . fishing" are greatly compromised.[447] Additionally, courts construing these treaties have usefully elaborated that Indian fishing rights *differ* from those of non-Indians, because of

439. Because of the work of tribes and other commentators this observation has now become commonplace. *See, e.g.*, Dean B. Suagee, *Dimensions of Environmental Justice in Indian Country and Native Alaska*, Second National People of Color Environmental Leadership Summit Resource Paper Series (2002), *available at* http://www.ejrc.cau.edu/summit2/IndianCountry.pdf; Jana L. Walker et al., *A Closer Look at Environmental Justice in Indian Country*, 1 Seattle J. for Soc. Justice 379 (2002).

440. Suagee, *supra* note 439, at 7.

441. O'Neill, *supra* note 73, at 86-100.

442. This point is considered at greater length, chiefly in the context of treaties applicable to the fishing tribes of the Pacific Northwest, in *id.* at 101-06.

443. Treaty with the Chippewa, July 29, 1837, art. V, 7 Stat. 536. *See also* Treaty With the Chippewa, Oct. 4, 1842, art. II, 7 Stat. 591; Lac Courte Oreilles Band of Lake Superior Chippewa Indians v. Wisconsin, 653. F. Supp. 1420 (W.D. Wis. 1987).

444. GLIFWC, Comments, *supra* note 419, at 1.

445. 653 F. Supp. 1420 (W.D. Wis. 1987).

446. *Id*. at 1426.

447. A similar logic supported the district court's finding in the second phase of *United States v. Washington*, interpreting treaties guaranteeing the fishing tribes in the Pacific Northwest the right "to take fish." United States v. Washington, 506 F. Supp. 187, 11 ELR 20016 (W.D. Wash. 1980) (Phase II), *vacated by* United States v. Washington, 759 F.2d 1353, 15 ELR 20813 (9th Cir. 1985). There, the court reasoned that "implicitly incorporated in the treaties' fishing clause is the right to have the fishery habitat protected from man-made despoilation. . . . The most fundamental prerequisite to exercising the right to take fish is the existence of fish to be taken." *Id.* at 203. Although this opinion was vacated on other grounds, the logic remains unassailable.

the treaties.[448] Importantly, courts have emphasized that treaty-protected rights to fish cannot be "balanced away" by competing interests or concerns.[449]

The treaty guarantees should therefore be understood to constrain EPA's decisions affecting treaty-protected resources and activities. EPA's proposed cap-and-trade approach, however, may well permit contaminant levels in the ceded areas in Michigan, Minnesota, and Wisconsin in excess of levels that would support tribes' treaty-protected right to catch and consume fish. The features of the proposal that leave mercury emissions unabated and hot spots unaddressed arguably run afoul of EPA's duty to honor the treaty protections. Recall, for example, that the Leech Lake Band has determined that fish consumption at a rate of 227 g/day is consonant with the exercise of the treaty-protected right to take and eat fish, properly understood. The unambitious emissions reductions anticipated by EPA's proposed rule would fall far short of reasonably diligent efforts to uphold this right. EPA's reliance on risk avoidance, moreover, would seem to fly directly in the face of these treaties. EPA expressly acknowledges that "Native Americans" are among the subpopulations that consume fish at greater rates than the general population and so among those directed to curtail their fish consumption in order to avoid the adverse effects of MeHg contamination. A regulatory effort so lax that it must include such advice obviously works precisely contrary to a treaty guarantee to catch and consume fish. Moreover, EPA is not empowered simply to balance away these treaty-protected rights, even where the tradeoffs appear pressing from a political or economic perspective. Although EPA is aware that Native Americans will be burdened by its proposal, it nowhere acknowledges the treaty rights that are therefore at issue for many Native American tribes.

Second, EPA must uphold the federal government's trust responsibility to the tribes. The trust responsibility elaborates a standard of conduct for the federal government vis-à-vis American Indian tribes and their members; the duty imposed is that of the "most exacting fiduciary."[450] According to contemporary understandings, the object of the trust relationship is furtherance of tribal self-determination and cultural integrity.[451] The trust responsibility in the context of federal environmental decisions includes a duty to protect tribal lands, resources, and rights—including retained rights to off-reservation resources such as fish.[452] Indeed, courts have emphasized agencies' heightened obligations where their decisions affect treaty-protected fishing rights: "In carrying out its fiduciary duty, it is [an agency's] responsibility to ensure that Indian treaty rights are given full effect."[453] The trust responsibility is a doctrine that infuses agencies' work, as treaties, statutes, executive orders, regulations and agreements must all be construed in light of trust obligations.[454] Prof. Mary Christina Wood elaborates:

> [The] trust responsibility can be thought of as an interstitial body of law that, when applied in concert with applicable statutes, imposes on agencies a duty to protect tribal interests in carrying out general statutory mandates. . . . The trust responsibility provides a parameter to guide [agencies'] discretion when Indian rights are affected. In the environmental context, the trust obligation to protect tribal resources should often translate into a higher level of ecological protection than that which might result when solely non-Indian interests are affected.[455]

Additionally, in order to fulfill its fiduciary obligations under the trust doctrine, agencies such as EPA need to ensure that tribes' perspectives are heard and considered in decisions affecting tribal resources and rights.[456]

The trust responsibility should thus be understood to permeate EPA's work on the proposed rule, given its profound impact on tribal resources and rights. EPA is thus held to the highest standard as it considers the relevance of tribes' treaty rights, as it interprets its statutory mandate under the CAA, as it determines the reach of executive commitments to environmental justice and tribal consultation, and as it undertakes the host of judgments in fashioning its approach to regulating mercury emissions from coal-fired utilities. Although EPA appears adept at invoking its broad discretion in favor of a novel and lenient cap-and-trade approach, it neglects entirely to exercise this discretion, as it must, in order to uphold its duty to protect tribal resources, rights, and lifeways. To the contrary, by permitting more mercury emissions for a longer period of time and by permitting hot spots, EPA's proposal would allow the contamination of tribal resources on reservation lands and in the ceded areas of the upper Great Lakes. It would therefore threaten the health and well-being of current and future generations in the fishing tribes, burdening the practices at the center of tribal cultures and thwarting the inter-generational transfer of knowledge that attends these practices. Far from upholding a heightened obligation to facilitate tribes' cultural self-determination, EPA's proposal instructs tribal members to abandon their fish consumption practices and associated lifeways. Finally, as discussed further below, EPA falls short of upholding its obligations under the trust doctrine to consult with tribes where, as here, its decisions affect tribal interests, including treaty-protected interests.

Third, EPA is governed by executive commitments to environmental justice and tribal consultation. Included among

448. *See, e.g., Lac Courte Oreilles*, 653 F. Supp. at 1429 ("Plaintiffs enjoy greater rights to hunt, fish, and gather in the ceded territory than do non-Indians.").

449. *See, e.g.*, United States v. Michigan, 471 F. Supp. 192, 281 (W.D. Mich. 1979) ("[T]he right of the . . . tribes to fish in ceded waters of the Great Lakes is . . . distinct from the rights and privileges held by non-Indians and may not be qualified by any action of the state . . . except as authorized by Congress.").

450. *See* Felix S. Cohen, Handbook of Federal Indian Law 226 (Rennard Strickland et al. eds., 3d ed. 1982) (quoting Seminole Nation v. United States, 316 U.S. 286, 297 (1942)).

451. *See, e.g.*, S. James Anaya, *In the Supreme Court of the American Indian Nations: Lone Wolf, Principal Chief of the Kiowas et al.*, 7 Wtr. Kan. J.L. Pub. Pol'y 117, 131-34 (1997).

452. *See* Mary Christina Wood, *Fulfilling the Executive's Trust Responsibility Toward the Native Nations on Environmental Issues: A Partial Critique of the Clinton Administration's Promises and Performance*, 25 Envtl. L. 733 (1995) [hereinafter Wood, *Native Nations*]; Mary Christina Wood, *Indian Land and the Promise of Native Sovereignty: The Trust Doctrine Revisited*, 1994 Utah L. Rev. 1471; Mary Christina Wood, *Protecting the Attributes of Native Sovereignty: A New Trust Paradigm for Federal Actions Affecting Tribal Lands and Resources*, 1995 Utah L. Rev. 109.

453. Northwest Sea Farms v. Corps of Eng'rs, 931 F. Supp. 1515, 1520 (W.D. Wash. 1996) (involving Lummi fishing rights).

454. *See* Cohen, *supra* note 450, at 220-21.

455. Wood, *Native Nations*, *supra* note 452, at 743-45.

456. *See, e.g., Northwest Sea Farms*, 931 F. Supp. at 1524.

these are Executive Order No. 12898, which speaks to environmental justice,[457] and Executive Order No. 13175, which addresses consultation with tribal governments wherever federal agencies' actions "significantly or uniquely" affect tribal interests.[458] While these executive orders do not provide a separate source of substantive rights, they should nonetheless inform agency undertakings. Additionally, as noted above, these executive orders must themselves be interpreted in light of the trust responsibility, such that agencies take the utmost care to protect tribal resources and rights as they carry out the duties outlined in these executive orders. Of particular import is EPA's obligation to consult, on a government-to-government basis, with tribes whose interests are likely to be affected by its actions. According to Executive Order No. 13175, this requires "meaningful and timely" consultation with tribes as agencies develop regulations or policies. EPA has recently reaffirmed its commitment to this obligation, originally outlined in its Indian Policy in 1984.[459] This policy states that "[i]n keeping with [its] trust responsibility, the Agency will endeavor to protect the environmental interests of Indian Tribes when carrying out its responsibilities that may affect the reservations."[460] It further commits EPA to "work directly with Indian tribal governments on a one-to-one basis (the government-to-government relationship), rather than as a subdivision of other governments."[461] In reaffirming its Indian Policy, EPA summarizes:

> The United States has a unique legal relationship with Tribal Governments based on the Constitution, treaties, statutes, Executive Orders, and court decisions. This relationship includes a recognition of the right of tribes as sovereign governments to self-determination, and an acknowledgement of the Federal government's trust responsibility to the Tribes.[462]

In its advisory capacity to EPA, the Indigenous Peoples Subcommittee of the National Environmental Justice Advisory Committee has issued guidance on consultation and collaboration with tribal governments.[463] This guidance elaborates the requirements of consultation and notes, among other things, that consultation differs from, and goes beyond, standard public participation.[464]

EPA should honor its commitments to consult with tribal governments where, as in the case of the proposed rule, its decisions significantly and uniquely affect tribes' interests. EPA's proposed approach not only disproportionately burdens tribal resources and rights, but it imposes burdens on tribes and their members that are different in kind from the adverse effects felt by even other higher consuming subpopulations. Despite this clear occasion to consult with tribal governments—and to do so in time to afford meaningful exchange between EPA and the tribes—EPA virtually ignored these commitments.[465] Instead of according tribes the status of governments and consulting with them on this basis during its decisionmaking process, EPA relegated tribes to the status of undifferentiated members of the general public.[466] Tribes were notified of EPA's decision only after the fact, and left to provide input in the form of comments during the period for general public comment. Quite belatedly, two months after it issued the proposed rule, EPA capitulated to tribal environmental professionals' requests to meet with them regarding the rule.[467] At this meeting, EPA was asked whether it had consulted with tribes regarding its proposal. Notably, according to the meeting minutes, "EPA staff acknowledged that *tribes weren't really consulted* on the proposed mercury rule . . . ."[468] Although EPA's various offices have also held a handful of other discussions with tribal representatives in the months following the proposal, these discussions amount to episodic, after-the-fact efforts and not meaningful and timely consultation.[469] EPA's failure here is a glaring affront to tribes' status as sovereign governments.

EPA's failure to consult affected tribes is also unwise if it hopes to produce a legally and scientifically defensible rule. Tribes have substantial, often unique, expertise relevant to the proposed rule.[470] Tribes in the upper Great Lakes have developed considerable knowledge regarding the sources of mercury that impact local environments, the patterns of mercury deposition and methylation, and the extent of MeHg contamination in area waters and fish.[471] This knowledge has been amassed through generations of residency in place and through decades of contemporary monitoring, management and restoration efforts.[472] As such, it constitutes a body of expertise for which there are no surrogates. Moreover, tribes are uniquely positioned to understand the practices, including traditional cultural practices, that place tribal members among the most highly exposed to MeHg via fish consumption. They are similarly likely the only ones able fully to appreciate the multiple dimensions of the im-

457. Executive Order No. 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 59 Fed. Reg. 7629 (Feb. 11, 1994).

458. Executive Order No. 13175, Consultation and Coordination With Indian Tribal Governments, 65 Fed. Reg. 67249 (2000).

459. U.S. EPA, Memorandum Reaffirming EPA Indian Policy (2001), *available at* http://www.epa.gov/indian/pdfs/reaffirmindpol01.pdf.

460. *Id.* attach. (attaching U.S. EPA Indian Policy (1984)).

461. *Id.*

462. *Id.*

463. NEJAC, Indigenous Peoples Subcommittee, Guide on Consultation and Collaboration With Indian Tribal Governments and the Public Participation of Indigenous Groups and Tribal Members in Environmental Decisionmaking (2000), *available at* http://www.epa.gov/oeca/ej.

464. *Id.* at 13-15.

465. *See, e.g.*, GLIFWC, Comments, *supra* note 419 at 3; FCPC, Comments, *supra* note 191, at 19 ("To date, except for holding a regional hearing open to any participant, EPA has taken no steps to specifically consult with FCPC or any other tribes (to our knowledge).").

466. *Id.*

467. Minutes of Meeting Between Tribal Environmental Professionals and EPA Staff, Denver, Colo. (Mar. 11, 2004) (Docket OAR-2002-0056-2060).

468. *Id.* at 5. EPA also suggested that they had "tried to get some tribal folks to participate on the Working Group but understood that tribes have limited personnel that cover many areas of responsibility and so didn't push when the tribes declined to participate." *Id.*

469. *Id.* at 1 (referring to recent discussions between Administrator Leavitt and the National Tribal Environmental Council); Notation of Teleconference Between EPA Region V and Tribal Representatives (Apr. 1, 2004) (Docket OAR-2002-0056-1945) (identifying purpose as "to listen and respond to tribal questions about the Hg allowance allocation process").

470. *Accord* FCPC, Comments, *supra* note 191, at 18-19.

471. Telephone Interview with John Persell, *supra* note 82 (discussing Minnesota Chippewa Tribe's and member bands' substantial efforts to advance scientific knowledge regarding mercury contamination over the past two decades).

472. *See, e.g., id.*

pacts to tribal resources, rights and lifeways.[473] Consultation with tribes is thus essential if EPA is to ensure that the rule is legally supportable and scientifically sound.

Conclusion

EPA's proposed rule is deeply troubling from the perspective of environmental justice. While delivering a boon to coal-fired utilities, it does so only by taxing severely the fishing tribes and other groups who depend on fish. Perhaps most disconcerting, the rule visits its harms on an entire generation of children, given MeHg's neurodevelopment impacts.

EPA's favored alternative, the cap-and-trade approach, fares poorly in terms of environmental justice. It is worth noting that some of the serious deficiencies discussed above stem not from the cap-and-trade tool itself, but from EPA's particular application of the tool. That is, it is not a necessary feature of cap-and-trade approaches that the cap be set to require only minimal emissions reductions or that ultimate compliance be delayed for over a decade. EPA could have proposed a cap requiring 95% control of mercury emissions by 2008. However, it did not. It is in fact notable that several cap-and-trade programs to date have been marked by lackluster caps. While programs such as the Acid Rain Program earn high marks for cost savings, they have been quite unambitious in terms of emissions reductions.[474] Nonetheless, a concern for environmental justice counsels attention to the potential for economic dislocation and other economic effects of regulation. As such, it is appropriate to consider broadly the possibilities for addressing various pollution problems. Given the particular context of mercury contamination, and given the particular contours of EPA's proposal, however, cap-and-trade seems an inapt tool.

Among the serious obstacles in this context is the potential for hot spots. As the analysis above demonstrates, there is a real concern that local and regional hot spots will be permitted under the cap-and-trade approach, at least in Michigan, Minnesota, and Wisconsin. Importantly, any hot spots in this region would coincide with a general population that consumes relatively large amounts of fish and with several subpopulations, including the various Ojibwe and other fishing tribes, that consume at the very highest level. Women and children in these groups would thus be placed at particular risk. Given the complexities of mercury fate, transport, and exposure, moreover, this seems an unlikely place for the application of ratios or other market design features adequate to the task of addressing hot spots.

Finally, EPA's embrace of risk avoidance in the form of fish consumption advisories is especially disquieting. Having opted to do little to reduce mercury contamination—indeed, to tolerate localized instances of increased contamination—EPA recognizes that many people who eat fish will be exposed under the proposed rule to MeHg levels that are not safe. Rather than view this as a call for more meaningful regulatory efforts, EPA shifts the burden to those who are at risk to protect themselves from the contamination by altering their fish consumption practices. Among other things, this approach introduces its own adverse health effects, as fish—an excellent source of protein and other nutrients and a staple of many traditional diets—are placed virtually off-limits for children until the age of 20 and for women for nearly 30 years beyond that. EPA's embrace of fish consumption advisories is a particular affront to many in the fishing tribes of the upper Great Lakes and elsewhere, for whom fishing and consuming fish are also culturally important and treaty-guaranteed practices. It may indeed be utterly inappropriate for EPA to direct these peoples to reduce or eliminate their consumption of fish.

Had EPA consulted and collaborated with the tribes affected by the proposed rule, EPA may have been better positioned to understand the injustices of its approach. Given tribes' considerable and unique expertise, EPA may also have been better equipped to put forth a rule that is legally and scientifically defensible. Among other things, EPA would had to have attended to its obligations under treaties, the federal trust responsibility, and various executive commitments.

Instead, we have a proposed rule that seeks to employ cap-and-trade in a manner that is ill suited for the job at hand and that works a grave injustice for many.

473. *See, e.g.*, FCPC, Comments, *supra* note 191, at 19:

> The tribes are a primary source of knowledge and information regarding the lands, waters, natural resources, and historic and cultural resources in the area that may be impacted by the proposed rule. Indeed, because the protection of historic and cultural resources often depends on maintaining the confidentiality of information about such resources, the tribes and their members are likely to be the only source of certain information.

474. *See, e.g.*, Swift, *supra* note 200, at 408 ("A central conclusion of this study is that both the Title IV NO_x and SO_2 standards were too lenient, and failed to align the private costs faced by firms in reducing pollution with the society-wide benefits of pollutant reductions.").