COMMENTARY

ON MERCURY EXPOSURE RISKS

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A Real Plan of Action on Mercury

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THE OFTEN UNSPOKEN, BUT ALARMING, REALITY OF A CENTURY OF human activities having tripled mercury levels in our environment is that millions of us are now threatened with exposure to this poison through consuming mercury-contaminated fish. The risk to fetuses and infants is of particular concern; impaired development of the nervous system (affecting sensory, motor, and cognitive functions and resulting in such problems as difficulty in learning to read and inability to concentrate)[1] and high blood pressure have been linked to mercury exposure in the womb and postnatally.[2]

Mercury is pervasive in the global environment, and mercury concentrations in some fish consumed in the US are greater than the levels deemed safe.[3] The 1998 *Northeast States/Eastern Canadian Provinces Mercury Study* inventories mercury levels in more than 5000 lake and stream fish species.[4] This inventory shows clear evidence that for the general population, there is a one in 10 chance of consuming fish with mercury levels greater than 0.5 parts per million (ppm),[4] the level on which many US states and other countries base their fish consumption warnings. A 1991 Florida study found that 10% of samples of canned tuna—the seafood Americans consume the most[5]—had mercury concentrations >0.5 ppm.[6]

The Environmental Protection Agency's (EPA) 1997 *Mercury Study Report to Congress* notes that fish consumption patterns are putting millions of women and children at risk for mercury poisoning.[7] In her article in this issue of *Public Health Reports* *(see p. 396–415)*, EPA scientist Kathryn Mahaffey explains these exposure risks in more detail.

The EPA study also identifies the sources of mercury emission into the environment. The vast majority of anthropogenic releases of mercury into the environment result from combustion of coal or of mercury-containing products.[7] Coal contains mercury; when coal is burned, mercury spews out into the atmosphere. It then rains down into freshwater bodies and oceans and bioaccumulates in fish. When mercury-containing products, devices, and equipment are incinerated or disposed of in landfills, mercury is released into the environment.[8] In addition, when chlor-alkali

plants use mercury cells to manufacture commercial chemicals, they produce large quantities of mercury-contaminated brines. These brines are burned, shipped to Canada for burial, illegally exported to unsuspecting Third World countries, or just dumped "out back."[9]

LACK OF ACTION AT THE NATIONAL LEVEL

A logical step toward eliminating anthropogenic mercury releases into the environment would be to curtail, with the goal of eventually eliminating, mercury emissions from combustion of coal, while bringing the manufacture, importation, and use of mercury-bearing products to a halt. Since most mercury-containing products and devices have non-mercury replacements, it would seem prudent to discourage their use, while encouraging the marketing of substitute products. (A new Dutch law bans the manufacture and importation of non-essential mercury-bearing products beginning January 1, 2000.[10])

Despite the logic of these conclusions given the demonstrated risk, policies that would encourage these activities are slow in coming at the national level. The EPA continues to set regulatory standards for incinerators that do not mandate the removal of mercury from the wastestream.[11] Current EPA regulations for mercury-bearing hazardous wastes continue to allow their incineration in hazardous waste incinerators,[12] and the regulations for both medical and municipal waste incinerators do not mandate the removal of mercury from an incinerator's feedstock.[7]

Coal use is increasing and with it, mercury emissions, due both to electric utility deregulation and a loophole in the Clean Air Act that exempts coal-burning power plants from modern anti-pollution standards. Analysts expect current mercury emissions from coal-fired power plants to increase in proportion to mercury emissions from other sources given the lack of controls or emission limits.[13] Enormous amounts of coal are also being used as a fuel in the production of cement. The EPA has no idea how much mercury is being emitted from these sources and where the mercury is ending up, but to its credit the agency recently issued Information Collection Requests to require some offending industries to report annual mercury releases.

Due to the clear risks documented in the *Mercury Study Report to Congress*,[7] the EPA initiated a Mercury Action Plan. Unfortunately, the agency has failed to delineate a strategy to aggressively reduce the amounts of mercury emitted in the US. Worse than that, little attention is being paid to effectively targeting and reaching either people who eat large quantities of fish or sensitive populations—including women of childbearing age, pregnant women, and children—to alert them to the risks posed by eating mercury-contaminated fish.

LACK OF ADEQUATE SAFEGUARDS

Although 40 states have consumption advisories for mercury in freshwater fish,[14] most do not provide guidance on what the public eats the most: ocean fish. On average, an American adult consumes about 18 pounds of fish per year.[5] Of that amount, more than three-quarters (approximately 15 pounds) is commercially sold, mostly ocean fish.[5]

The Food and Drug Administration (FDA) is charged with protecting consumers from mercury in commercially sold ocean fish. The FDA's original action level for mercury, established in 1969, was 0.5 ppm; this was changed a decade later to a weaker standard, 1.0 ppm, after intervention by the fishing industry.[15] These levels were established to protect the average adult from risks associated with eating mercury-contaminated fish, not sensitive populations; the FDA itself has acknowledged the lack of protection for pregnant women and children and the weaknesses of this approach.[16]

Case studies have shown that the FDA's action level is not protective of those with consumption rates outside the norm. For instance, in 1994, the Wisconsin health department investigated members of a family who had experienced mercury-related symptoms due to regularly consuming sea bass with mercury levels well below 1 ppm.[17] The authors concluded that their study demonstrated "the inability of food safety regulations that are based on average consumption rates and body weights to protect individuals whose dietary habits and body weight fall outside the normal range."[17]

The FDA's action level, even if it were strong enough, would not provide adequate protection to consumers because it serves only as a guideline, not as a regulatory limit. Fish contaminated above the action level routinely make it into the marketplace and are consumed by the public. The action level gives the public a false sense of food security, and the FDA has not been diligent in warning the general public, and, most important, sensitive populations, about the risk of mercury exposure from eating mercury-contaminated ocean fish.

In the past few years, rather than "alarm" the public, the FDA has simply stopped monitoring mercury levels in domestically caught species of ocean fish that are among the most widely consumed species contaminated with

mercury: tuna, swordfish, and mako shark. A large percentage of the shark and swordfish sold in the US have mercury levels well above the FDA's action level, with swordfish containing, on average, >1 ppm of mercury (Personal communication, Gregory M. Cramer, PhD, Office of Seafood, FDA, November 21, 1998).

Even if the FDA were to adequately warn the public about mercury in ocean fish, its standards are four times less stringent than the EPA's reference dose (RfD), the guidance level that states typically use to warn sensitive populations about mercury in freshwater fish. According to the EPA's RfD, consuming 0.1 micrograms (one-millionth of a gram) methylmercury per kilogram of body weight per day is a "safe" rate. People consuming fish with mercury concentrations >1 ppm at consumption rates of approximately one to two ounces (30–60 grams) per day are ingesting mercury at levels approaching or exceeding 10 times the EPA's reference dose. If consumed in more than typical quantities (for example, more than a tunafish sandwich per week), some commercial fish sold in your local market is either potentially unsafe for consumption by sensitive populations or completely safe, depending on whether the EPA's RfD or the FDA's action level is applied.

Clearly, the current FDA mercury standards are not protective of sensitive populations. As early as 1991, in a report entitled *Seafood Safety*, the Institute of Medicine recommended that couples who intended to have children in the near future should avoid eating swordfish.[18] The report recommended that "much lower levels of mercury" (than FDA-approved levels) "should be maintained" in canned tuna products, concluding that it was "highly doubtful" that the FDA's action level would protect fetuses.

Another federal health agency, the Agency for Toxic Substances and Disease Registry (ATSDR), recently released its *Toxicological Profile for Mercury*.[19] ATSDR adopted a "safe level" of exposure three times less stringent than the EPA's RfD, not because the agencies disagreed about the risk of mercury exposure, but because they disagreed about the uncertainty surrounding the risk. Instead of adopting a more conservative approach that incorporates a safety factor to account for differences in consumption, metabolism, age, and lifestyles, ATSDR adopted an uncertainty factor that does not account for the large variability in the US population.

Given the inconsistencies between the actions of federal agencies, Congress directed the National Academy of Sciences (NAS) to review the evidence on the toxicity of mercury. In doing so, Congress has also heeded the call from special interests by mandating that the EPA not adopt emission limits on coal-fired power plants until the NAS study is completed. So, just as the tobacco industry was able to cloud the picture about the dangers of cigarette smoking, special interests including the coal industry and the utilities have been successful in continuing to delay mercury reduction initiatives at the state and federal levels by creating a cloud of uncertainty over the "safe" level of mercury in fish.

LACK OF PUBLIC AWARENESS

Compounding the inadequacy of regulatory safeguards is a lack of public awareness about the existence of fish consumption advisories for mercury and about what they mean. Recent studies have clearly demonstrated this lack of public awareness.

A May 1999 survey of residents of a fishing community in Maine found a lack of consumer awareness about the exposure risks from fish.[20] More than 75% of the survey respondents said that they regularly ate fish. About half of all respondents said they knew about their state's fish consumption advisories, yet only a third knew the potential dangers associated with eating mercury-contaminated fish.[20] Similar results were reported from a 1996 Great Lakes study, which found that about half of fish eaters were aware of advisories then in place.[21] Members of minority groups were disproportionately represented among those who consumed large amounts of fish and on average ate 1.5 fish meals for every one eaten by whites. Men were twice as likely as women to report being aware of fish advisories, and white respondents were four times as likely as members of minority groups. Among minority group member of both sexes, awareness was about 22%. The findings of this study suggest that fish advisories are not reaching the populations most at risk—women and minorities—and recommends targeted communication and outreach for these sensitive populations.

SAFEGUARDING THE PUBLIC

Rising mercury emissions from anthropogenic sources are continuing to increase mercury exposures in fish, wildlife, humans, and the environment. Some promising initiatives are being implemented at the state and regional levels to reduce mercury emissions *(see p. 414–415)*, but much more needs to be done to reduce emissions and safeguard the public.

When the federal government won't assume its full responsibility to reduce mercury pollution and warn and protect the public, then the states, the public health community, and the fishing industry need to move swiftly to fill the gap.

Several states now warn their residents about the dangers of eating ocean fish contaminated with mercury. A few states go even further and specifically warn sensitive populations about limiting consumption of ocean fish. The New Jersey Health Department warns that children younger than age 7 should not eat swordfish or shark and cautions that pregnant women can safely eat up to eight ounces of canned tuna each week provided they consume no other mercury-contaminated fish.[22] The Health Departments of Minnesota and Michigan advise pregnant women not to eat swordfish or shark and advise limits on the consumption of canned tuna.[23] The State of Vermont Health Department is on the verge of issuing similar warnings for swordfish, shark, and canned tuna.[24]

Medical and public health organizations, too, are starting to fill the void left by federal health agencies' lack of effective action in warning the public about mercury. Earlier this year, the EPA and the American Hospital Association signed a Memorandum of Understanding that encourages hospitals to become mercury-free. In early July, the American Academy of Pediatrics announced plans to provide additional information on the risk of mercury exposure to health practitioners and encouraged pediatricians to urge pregnant women, nursing mothers, and young children to follow fish advisories. In November, the American Public Health Association will consider a resolution calling for action by public health practitioners to reduce mercury releases and help prevent mercury exposure.

Clearly, we need more such progressive actions if we are to be successful in reducing the public's exposure to mercury. At the same time, we need to take significant actions to *eliminate* anthropogenic mercury emissions. In a resolution adopted in January 1999, the tuna processing members of the US Tuna Foundation (StarKist Foods, Bumble Bee Seafoods, and Chicken of the Sea International) urged "all levels of government to take responsible steps to focus on protecting one of the world's most important food supplies—fish—for future generations, and to support necessary steps to accurately identify... and ensure the effective regulation of anthropogenic mercury emissions, with an immediate goal of reducing the emissions and an ultimate goal of eliminating emissions" (Letter to M. Bender from David G. Burney, United States Tuna Foundation; 1999 Jan 29).

Yet even if we ceased all mercury emissions tomorrow, our fish may not be safe to eat for decades. Once emitted into the environment, mercury cycles for years through the air, the water, the food chain, and into our bodies. It is up to the public health community to get out the message that we are facing a potentially serious risk both to ourselves and to future generations.

A RECOMMENDED PLAN OF ACTION

We call on all levels of government and on public health officials across the country to stop acting as if mercury is not a serious problem—especially in its effect on America's greatest resource, our children. In particular, we strongly urge federal and state agencies to take the following precautionary steps to protect the health of the public and the environment.

1. *Set standards protective of sensitive populations and set a regulatory limit for mercury in commercially sold fish.* Government agencies should adopt consistent consumption warnings regarding mercury in fish that are fully protective of the most sensitive populations, including women of childbearing age, pregnant women, and children. These warning should take into account: (*a*) the unique sensitivities of women of childbearing age, pregnant women, and children, (*b*) variations within the general population in weight and in the ability to eliminate mercury from the body, and (*c*) the dramatic increase in fish consumption by the general population (per capita fish consumption increased 25% from 1980 to 1989[25]) as well as the higher consumption patterns of certain segments of the population, such as Native American subsistence fishers.

A regulatory limit for methylmercury in ocean fish should be established that would be binding on the FDA and the industry and provide consistent protection for the public.

2. *Conduct adequate fish surveillance and testing.* Agencies at the appropriate levels of government should conduct adequate surveillance, monitoring, and testing of representative samples of the most commonly consumed commercial fish species and the larger predatory fish species sold through interstate commerce. The FDA, the EPA, and the states should also ensure that the public, and, in particular sensitive populations, have adequate and continuously updated information about mercury-contaminated food and ways to avoid exposure.

3. *Provide quarterly updates to the public on fish testing and surveillance programs. Conduct outreach to sensitive populations, ethnic groups that consume large quantities of fish, groups that rely on subsistence fishing, and people living along US coasts.* State and federal agencies should be responsible for establishing effective consumer outreach

programs that include posting of information on the Internet and developing publications that can be widely distributed to health professionals (including midwives and health educators), community and women's groups, and other individuals and groups with direct access to sensitive populations. In particular, state and federal agencies should target outreach efforts to sensitive populations and groups of people who tend to eat more ocean fish than the general population.

4. *Effectively reduce and eventually eliminate mercury emissions from human sources.* The EPA should set strict mercury emissions standards for coal- and oil-fired power plants and should require investment in energy efficiency and non-polluting renewable energy. Because the EPA estimates that municipal waste incinerators are the second largest source of mercury pollution and medical waste incinerators are the fourth largest, current emissions standards for existing medical and municipal waste incinerators should be significantly strengthened. In addition, all mercury-containing products should be removed from incinerator feedstocks and the use of all non-essential mercury-containing products should be phased out. While waiting for these changes to occur, it would also seem logical to label mercury-bearing products and require manufacturer take-back programs so that they can be kept out of incinerators, recycled, and retired in a manner that does not contribute to more mercury cycling in the global pool. The EPA should no longer allow hazardous waste incinerators to burn mercury-bearing waste. Finally, the EPA should expand its inventory of mercury sources to include all of the sources suspected of emitting mercury and then outline a strategy for curtailing mercury releases from these sources.

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