

Rachel's Environment & Health News

#597 - Mercury -- How Much Is Safe

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A fight is shaping up over the amount of toxic mercury that the government will call "safe" in the human diet. The outcome of the fight will determine how strictly the government will control mercury emissions from incinerators, from coal-burning power plants, and from other industrial sources. The outcome will also directly affect the future of the commercial and recreational fishing industries. And of course it will affect the health of people --especially children --who eat mercury-contaminated food.

Mercury is an element, one of the 92 basic building blocks of everything on Earth. It is a silvery toxic metal that is liquid at room temperatures; many people know it as the silver liquid inside thermometers.

Humans ingest mercury mainly by eating fish. More than 95% of the mercury in fish takes the chemical form called methyl mercury, which is the most toxic form of the element. In 1996, U.S. EPA [Environmental Protection Agency] set a new guideline for methyl mercury in the diet: 0.1 micrograms of mercury per kilogram of body weight per day (0.1 ug/kg/day). This is 4.7 times as strict as the World Health Organization's (WHO's) standard of 0.47 ug/kg/day. EPA's science advisory board has approved EPA's guideline, which was established to protect children, including children who might be exposed in the womb. (The EPA's guideline is officially called a "reference dose" or RfD; it is the amount of methyl mercury that people are thought to be able to eat without any harmful effects.)

If the EPA's reference dose is taken seriously, it means that people should severely restrict their consumption of fish and shellfish. EPA recently published results of two surveys of mercury in freshwater fish, one completed in 1985 and one completed in 1994. The 1985 survey found an average of 0.11 parts per million [ppm] mercury in fresh water fish,[1,pg.4-71] and the 1994 survey found an average of 0.26 ppm mercury.[1,pg.4-73] Ocean fish have average mercury levels of 0.21 ppm. [1,pgs.4-66,4-67] Taken together, fresh water and marine fish have an average mercury concentration of about 0.2 ppm.

An average woman weighing 60 kilograms (132 pounds) can ingest $60 \times 0.1 = 6$ micrograms of mercury per day without exceeding the EPA reference dose. If each gram of fish contains 0.2 micrograms of mercury, our average woman could only eat $6/0.2 = 30$ grams of fish per day without exceeding the EPA reference dose. There are 28 grams in an ounce, so roughly one ounce of fish per day (7 ounces per week) is the maximum amount that it is "safe" to eat, assuming that the fish is contaminated at the average level of 0.2 ppm mercury. Thus one good-sized serving of fish per week is about all that is safe, if the fish are contaminated at average levels.

EPA says that the fish species that people prefer to eat are contaminated at a level of only 0.12 to 0.14 ppm, for an average of 0.13 ppm.[2,pg.5-16] At this level of contamination, our average woman could safely eat 46 grams (1.6 ounces) of fish per day, or 322 grams (11.5 ounces) per week.

Of course some people prefer to eat species of fish that happen to accumulate large amounts of mercury: shark, swordfish, sea bass, walleye, and largemouth bass can contain 0.5 to 1.0 ppm or more. [2,pg.5-17] At these levels of contamination, consumption must be strictly limited to remain within EPA's guidelines.

U.S. Food and Drug Administration (FDA) has set an "action level" of 1.0 ppm mercury for fish in interstate commerce but FDA has a very limited ability to measure how much mercury is actually in fish. If an "action level" is exceeded, FDA can issue a warning to consumers, but warnings are not posted where consumers might see them (for example, at fish markets); instead FDA warnings appear only in FDA publications. Furthermore, FDA's 1.0 ppm mercury limit was established to protect adults, not children.[3,pgs.35-46]

How much do Americans actually eat? EPA recently addressed this

question. In 1990, there were 248.7 million Americans.[2,pg.5-29] Some 177 million were adults. Of these, 58% (or 102 million) eat fish once a week. Between 13% and 23% eat fish or shellfish 2 or 3 times a week. An estimated 1% (1.8 million people) eat fish or shellfish daily.[1,pg.4-19] Several populations eat more fish than average: people who fish commercially or for recreation tend to eat far more than average. Native people, people from the Caribbean, African-Americans, Asian-Americans, and Pacific-islanders tend to eat far more fish than average. Among these groups, some individuals eat 330 grams (12 ounces) of fish each day.

EPA believes that the critical population is women of childbearing age (15 to 44), of which there are 58.6 million in the U.S. Among women in this age group who report eating any fish at all, EPA estimates that half exceed the reference dose, 25% are ingesting twice the reference dose, 10% are ingesting four times the reference dose, and 5% are ingesting five times the reference dose.[2,pg.6-29]

Another critical population is young children. Mercury damages the nervous system, and the nervous system continues to develop through at least age 6. There are 15 million children in the U.S. between the ages of 3 and 6; EPA estimates that 20% of them (or 3 million children) exceed the reference dose for methyl mercury.[2,pg.6-32]

Fish is an important source of animal proteins and other nutrients.[4] At the fish store, fish is now expensive, but to subsistence fishers, it is often the only source of low-cost protein. Fish and shellfish are low in saturated fats, and they provide antioxidants such as selenium and vitamin E. They also offer beneficial omega-3 polyunsaturated fatty acids (PUFAs). PUFAs are important for optimal development of motor skills, the brain, and vision. Some, though not all, studies have shown that fish oils protect against heart attacks, and reduce blood pressure.

Based on the benefits that humans derive by eating fish, some authorities are urging that EPA relax its reference dose, to allow more methyl mercury into our diets.[4] For example, the Agency for Toxic Substances and Disease Registry (ATSDR) has proposed the the U.S. should adopt the World Health Organization's mercury standard of 0.47 ug/kg/day.[5]

An estimated 1600 to 4000 metric tons (3.5 to 8.8 million pounds) of mercury enters the atmosphere from natural sources each year.[6] Rain and snow then bring it down to Earth, where it ends up in streams and lakes, and ultimately the oceans. Humans roughly double this amount, contributing somewhere between 2000 and 6000 metric tons (4.4 to 13.2 million pounds) of mercury to the atmosphere each year.[7] The main human sources are solid waste incinerators, medical waste incinerators, hazardous waste incinerators, coal combustion, cement kilns, and the manufacture of chlorine using the chlor-alkali process.

The human contribution of mercury to the atmosphere is increasing at least 2% each year and in some countries the increases are even greater than that. So long as these increases continue, mercury will continue to accumulate in the bodies of fish.

As it is, 47 states in the U.S. have issued a total of 11,531 fish advisories for some or all of their waters during 1996, warning residents to limit their consumption of fish.[3,pgs.6-7] Of these warnings, 64% were for mercury.[3,pg.8] The mercury problem is serious now, and is getting steadily worse.

Making the mercury health standard more permissive will take some of the pressure off of mercury-emitting industries and it will help the fishing business maintain its economic vitality, but it is a dubious public health proposition.

The EPA's reference dose, as strict as it seems to some people, was developed based on certain assumptions that are questionable. First, EPA based its estimates on the assumption that mercury has a

half-life in the human body of 70 days.[2,pg.518] This is true, but the biological half-life of mercury in the brain is 230 days[8] --and the brain is the main organ that mercury attacks. (The biological half-life is the time it takes for the human body, or one of its organs, to rid itself of half of its burden of mercury.)

Second, EPA set its reference dose based on data derived from an acute poisoning incident in Iraq, not on the kind of chronic poisoning that produced so many mentally defective children near Minamata Bay in Japan. The mercury poisoning of some 10,000 people who lived around Minamata Bay during the period 1956 to 1974 showed that children can be poisoned by daily ingestion of fish polluted at only 0.11 ppm.[9]

And lastly, the EPA's reference dose was developed on the assumption that people who ingest mercury in fish are not also ingesting other toxicants. This is obviously a false assumption. A recent study by the Natural Resources Defense Council (NRDC)[3] shows unmistakably that fish in the U.S. are contaminated not only with mercury but also with numerous organochlorine compounds such as PCBs, DDT, chlordane, and dioxins. And of course lead is a constant threat to the health of American children, as it is in most other countries today.

Based on our own dismaying history of poisoning our children with lead and dioxins, we should be very cautious about declaring that we know what is a "safe" dose of mercury for anyone, especially for children growing in the womb.

--Peter Montague (National Writers Union, UAW Local 1981/AFL-CIO)

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[1] Kathryn R. Mahaffey and Glenn E. Rice, MERCURY STUDY REPORT TO CONGRESS VOLUME IV: AN ASSESSMENT OF EXPOSURE TO MERCURY IN THE UNITED STATES [EPA-452/R-97-006] (Washington, D.C.: U.S. Environmental Protection Agency, December 1997). Available on the world wide web at: <http://www.epa.gov/oar/mercury.html>.

[2] Kathryn R. Mahaffey, Glenn E. Rice, and Rita Schoeny, MERCURY STUDY REPORT TO CONGRESS VOLUME VII: CHARACTERIZATION OF HUMAN HEALTH AND WILDLIFE RISKS FROM MERCURY EXPOSURE IN THE UNITED STATES [EPA-452/R-97-009] (Washington, D.C.: U.S. Environmental Protection Agency, December 1997). Available on the world wide web at: <http://www.epa.gov/oar/mercury.html>.

[3] Amy D. Kyle, CONTAMINATED CATCH; THE PUBLIC HEALTH THREAT FROM TOXICS IN FISH (New York: Natural Resources Defense Council, April, 1998). Available for \$14 plus \$3.00 shipping from: Natural Resources Defense Council, 40 West 20th Street, New York, NY 10011; telephone (212) 727-4486.

[4] Grace M. Egeland and John P. Middaugh, "Balancing Fish Consumption Benefits with Mercury Exposure," SCIENCE Vol. 278 (December 12, 1997), pgs. 1904-1905.

[5] Rebecca Renner, "Mercury health standard eased by U.S. agency," ENVIRONMENTAL SCIENCE & TECHNOLOGY Vol. 32, No. 1 (January 1, 1998), pgs. 8A-9A.

[6] William F. Fitzgerald and others, "The Case for Atmospheric Mercury Contamination in Remote Areas," ENVIRONMENTAL SCIENCE & TECHNOLOGY Vol. 32, No. 1 (January 1, 1998), pgs. 1-7.

[7] Carola Hanisch, "Where is Mercury Deposition Coming From?" ENVIRONMENTAL SCIENCE & TECHNOLOGY Vol. 32, No. 7

(April 1, 1998), pgs. 176A-179A.

[8] Masazumi Harada with Aileen Smith, "Minamata Disease: A Medical Report," in W. Eugene Smith and Aileen M. Smith, editors, MINAMATA (New York: Holt, Rinehart and Winston, 1975), pgs. 180-192.

[9] Tomohiro Kawaguchi, [Letter to the editor], SCIENCE Vol. 279 (January 23, 1998), pg. 460. And see Masazumi Harada, "Minamata Disease: Methylmercury Poisoning in Japan Caused by Environmental Pollution," CRITICAL REVIEWS IN TOXICOLOGY Vol. 25, No. 1 (1995), pgs. 1-24. And: Bernard Weiss, "Long Ago and far Away: A Retrospective on the Implications of Minamata," NEUROTOXICOLOGY Vol. 17, No. 1 (1996), pgs. 257-264. And: Tadashi Ninomiya and others, "Expansion of Methylmercury Poisoning outside of Minamata: An Epidemiological Study on Chronic Methylmercury Poisoning outside of Minamata," ENVIRONMENTAL RESEARCH Vol. 70 (1995), pgs. 47-50.

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