BEYOND COAL

Coal Threats to Human Health – Fact Sheet Series

Although abundant here, Alaskans do not rely on coal as a primary fuel source. Here in Alaska, we are increasingly looking for cleaner sources of energy to supplement or replace fossil fuels. While there is increasing pressure to develop coal for foreign export and domestic use,[1] ***coal is dirty****. Coal exploration and development threaten human health and our land, air, water and food, with hazardous emissions possible at every stage.[2] Pollutants from coal adversely affect all major organ systems in the human body and contribute to four of the top five causes of death in the United States: heart disease, cancer, stroke, and chronic lower respiratory diseases.[2] To prevent these human health risks, a growing number of health care providers, tribes, parents, fishing groups, ratepayers, and other concerned Alaskans are working together to* ***keep Alaska's coal in the ground****.*

MERCURY AND YOUR HEALTH

WHAT IS MERCURY?

Mercury is a heavy metal that is naturally found in several forms in the environment. When elemental mercury is released into soil and water, microscopic organisms may convert it into methylmercury, which builds up in the bodies of fish, marine mammals, wildlife, and people (bioaccumulation) and concentrates up the food web (biomagnification).[3,4,5,6,7] According to the United States Environmental Protection Agency (EPA), levels of mercury in living organisms increase by approximately a factor of ten or more with each level of the food web.[8]

MERCURY AND THE COAL INDUSTRY

The largest single source of mercury emissions in the U.S. comes from coal-fired power plants, accounting for 33% of all human-related environmental mercury emissions.[9,10] Trace amounts of mercury are present in coal and are released into the environment when coal is burned.[2] While Alaska currently has only one operating coal mine, coal exploration is underway throughout the state.[11] The development of these coal mines and power plants would lead to increased combustion of coal and potentially significant sources of mercury emissions.[11]

At present, the primary sources of mercury pollution in Alaska are emissions from Asian industry and other global sources that travel to Alaska via air and ocean currents. Thus, even when Alaska coal is exported to other countries, it may have a negative impact on the health of Alaskans.[11] Proposed coal development will lead to increased export of Alaskan coal to Asia, which will in turn increase mercury pollution here in Alaska.[11]

HOW ARE WE EXPOSED?

Coal combustion releases **elemental mercury** in a gaseous form, which can circulate in the atmosphere and travel far from its source.[11] Exposure to elemental mercury can occur through inhalation of contaminated air near coal-fired power plants and other locations where mercury emissions have taken place.[3,5,12] Elemental mercury is only minimally absorbed after ingestion of contaminated items or contact with skin.[3]

The primary source of exposure to coal-related mercury is consumption of fish and seafood contaminated with **methylmercury**.[2,13,14,15,16] Methylmercury is present at some level in all fresh and saltwater fish, but certain types of fish have higher levels than others.[13] Because methylmercury builds up in muscle tissue, eating large, predatory fish and other marine wildlife at the top of the aquatic food web commonly results in higher exposures.[3,13,17,18] Large, non-predatory marine mammals tend to have low levels of methylmercury. All species of wild Alaska salmon are very low in mercury levels, so salmon is not a major source of mercury exposure.[19]

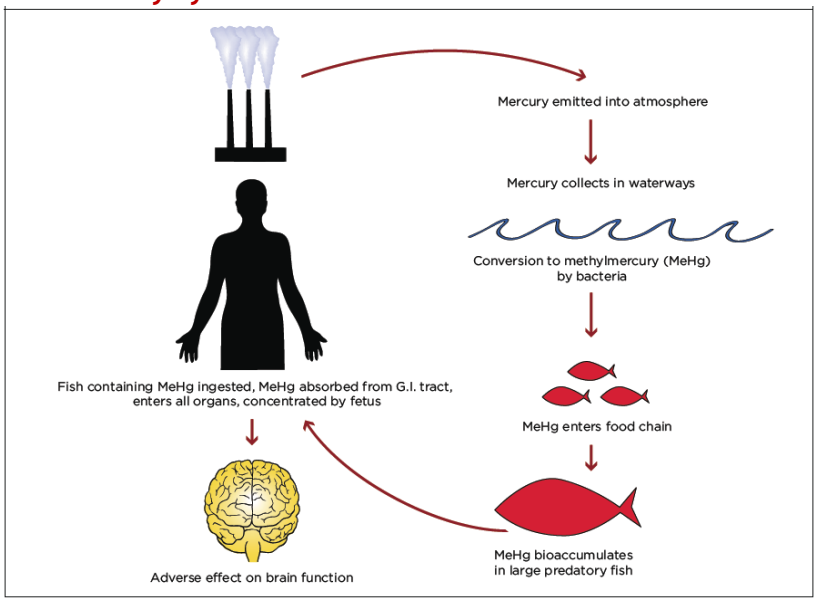
Once mercury has been absorbed by adult women, it can be passed on to their children. Fetuses and infants

Above, left: www.solarpowerwindenergy.org Center: Sierra Club Right: www.coal-is-dirty.com

are exposed to methylmercury because it readily crosses the placenta and is excreted in breastmilk.[3,15,20]

Mercury is also dangerous when it binds to dust, known as **particulate mercury**.[11] This form of mercury is deposited close to its source, making it a particular problem near areas of coal combustion such as coal-fired power plants. Alaska has six coal-fired power plants, all located between Healy and Fairbanks.[21] According to the EPA Toxics Release Inventory, the Golden Valley Electric Association plant in Healy released 10-12 kg of mercury in 2005 and 2006, and the Chena Power Plant in Fairbanks released 14 kg in 2004 and 4 kg in 2005.[11,22] These areas may contain particulate mercury, and possible exposures could occur in workers, local residents and wildlife.

The Mercury Cycle



Source: Physicians for Social Responsibility

MERCURY IN OUR BODIES

National Trends

The U.S. Centers for Disease Control and Prevention (CDC) conducts periodic assessments of the U.S. population's exposure to mercury and other chemicals as part of the National Health and Nutrition Examination Survey (NHANES). Results from NHANES in 1999 and 2000 revealed that blood methylmercury levels were over six times higher in women who reported eating fish within the past 30 days (prior to testing) compared with women who reported they had not (2.7 parts per billion [ppb] and 0.43 ppb, respectively). Based on the blood concentrations of mercury in adult female participants in the 1999-2000 NHANES, it is estimated that more than 300,000 newborns born in the U.S. each year may have been exposed *in utero* to methylmercury levels higher than the level considered to be without increased risk of adverse neurodevelopmental effects (5.8 ppb).[23,24]

Another analysis of NHANES data confirmed these findings: "Between 316,588 and 631,233 children are born in the U.S. each year with blood mercury levels high enough to cause lifelong loss of intelligence," as reported by Physicians for Social Responsibility.[2,25] Researchers concluded that the lifelong loss of intelligence from methylmercury toxicity results in reduced economic productivity and costs society $8.7 billion per year, of which $1.3 billion annually is attributable to mercury emissions from power plants in the U.S.

Biomonitoring in Alaska

In a study conducted by the Arctic Monitoring and Assessment Programme (AMAP) from 2003-2006, 75 Yupik mothers and women of reproductive age from the Yukon-Kuskokwim Delta were tested for blood levels of mercury.[26] Of these women, 19% had levels higher than 5.8 ppb.[26] AMAP also found that, from 1999-2003, the mean concentration of mercury in maternal blood was lower among Iñupiat from the North Slope Arctic coast mothers than Yupik mothers.[26] The authors attribute the lower levels among Iñupiat mothers to dietary differences, as the Iñupiat consume land mammals and bowhead whale (herbivorous) as compared to the Yupik who predominantly consume salmon, seals and sea lions.[26]

In February 2010, results from the *Mind, Disrupted* biomonitoring project were released, the first project to identify toxic pollution in people from the learning and developmental disabilities community.[27] The Alaska participant in this project, a lifelong Alaskan woman raised on subsistence foods, had blood levels of mercury of approximately 1.5 ppb, almost twice as high as the national average reported in females surveyed by the CDC.[5] While this amount is still lower than the levels

associated with adverse health effects, emerging science suggests that there is no "safe" level of mercury exposure.[28]

The Alaska Department of Health and Social Services, Division of Public Health (DPH) has offered the Statewide Maternal Hair Mercury Biomonitoring Program since 2002, which provides free and confidential testing of mercury levels in hair for all Alaskan women of childbearing age.[29,30] The program has tested over 350 women and found none of these women had hair mercury levels higher than the World Health Organization's guideline of 14 parts per million (ppm), which is considered the lowest level linked to adverse health effects on the fetus.[30,31] The three women with the highest levels, above 5 ppm, were from the Yukon-Kuskokwim Delta and Aleutian Islands and may have these higher levels as a result of eating large amounts of marine mammal liver and kidneys as part of their traditional diet.[30]

Pollution in People

Evidence shows that proximity to sources of mercury pollution is associated with body burdens of mercury. In a 10-year study, researchers found that individuals who lived 2 kilometers (1.25 miles) from a mercury polluting hazardous waste treatment plant had increased median hair total mercury concentrations, as compared to unexposed control groups who lived further away.[32] The association of mercury concentrations (in humans as well as plants and animals) to sources of mercury pollutants has been consistently reported by a number of similar studies.[33,34,35,36,37,38]

What Does Exposure to Mercury Mean for Our Health?

The presence of environmental chemicals in the human body does not necessarily cause adverse health effects; however,

FISH CONSUMPTION IN ALASKA

In response to mercury levels detected by the Alaska Department of Environmental Conservation's Fish Monitoring Program, the State of Alaska issued fish consumption guidelines in 2007 to advise Alaskans on safe amounts and types of fish to eat based on mercury levels.

Eat fish with lower mercury levels, such as all species of wild Alaska salmon. The Alaska DPH recommends eating **as much as you want** of the following fish:[19]

- Wild Alaska salmon (all species)
- Pacific cod
- walleye Pollock
- black rockfish
- Pacific ocean perch
- halibut under 20 pounds
- lingcod under 30 inches length
- canned chunk light (not white) tuna

Other fish that have been found to have lower mercury levels are:

- sardines
- anchovies
- Atlantic herring
- Dungeness crab
- farmed striped bass
- tilapia
- farmed catfish
- clams
- mussels
- Pacific oysters

When eating ocean fish, consider eating smaller, younger fish whenever possible, as older fish tend to build up more mercury over time.[18] The DPH recommends eating **less** of the following fish which are known to have high mercury levels:[19]

- sablefish
- halibut larger than 20 pounds
- lingcod greater than 30 inches length
- rougheye rockfish
- yelloweye rockfish
- salmon shark
- spiny dogfish

Try to **avoid** eating long-lived and large predator fish that are known to be higher in mercury, such as:[19]

- king mackerel
- tilefish
- swordfish
- orange roughy
- marlin

Try to limit your consumption of tuna steaks and canned "white" albacore.

Other guides are available to assist in evaluating the mercury levels in fish:

Natural Resources Defense Council (NRDC) Mercury in Fish wallet card:
http://www.nrdc.org/health/effects/mercury/calculator/start.asp
and NRDC Mercury Calculator:
http://www.nrdc.org/health/effects/mercury/calculator/start.asp

environmental chemical exposures can and do affect human health. It is important to note that both the dosage and the timing of exposure have significant effects on any potential health outcome. The following information summarizes the current state of knowledge on the health effects of mercury, including both human and animal studies. Alaskans face the following potential health risks from increased mercury exposure if proposed coal-fired power plants and coal mines were to be developed in the state.

Neurological Toxicity

Mercury is a potent neurotoxin that is known to cause learning and developmental disorders.[39] At high exposure levels associated with catastrophic environmental releases of mercury, it can cause mental retardation, cerebral palsy, and seizures.[13,14,40] Methylmercury has long been known to adversely influence neurodevelopment in both humans and experimental animals. Neurobehavioral effects reported include altered motor function and memory, as well as learning disabilities.[41]

Methylmercury is highly toxic and is linked to a variety of adverse health effects on the central nervous system, including visual and hearing impairment, tremors, and muscle spasms.[3] There is strong evidence that mercury exposure is linked to diseases such as cerebral palsy; impaired learning, memory, coordination, and attention span; mental retardation; hearing loss; dermatitis; psychiatric disturbances; seizures;[40] and acute bronchitis and pneumonitis.[42] In a study of men from the Faroe Islands who consumed large amounts of seafood, symptoms arose when blood mercury levels reached approximately 58 ppb.[43]

Developing fetuses and children are particularly vulnerable to mercury intoxication, which may lead to impairment of the developing central nervous system, as well as lung and kidney damage.[14,44,45] One study found that prenatal methylmercury exposure through mothers' regular consumption of fish and marine mammals resulted in deficits in language, attention, and memory in children,[46] even after researchers controlled for co-contamination by polychlorinated biphenyls (PCBs).[47]

Early signs of long-term exposure to elemental mercury may include the following nonspecific symptoms of the central nervous system: insomnia, forgetfulness, loss of appetite, and mild tremor. These symptoms may be misdiagnosed as psychiatric illness.[3]

Cardiovascular Effects

A recent study found that higher levels of mercury (as measured in blood, hair, and toenails) were significantly associated with increased blood pressure and common carotid intima-media thickness (an indicator of atherosclerosis, or a build-up of plaque in the arteries). The study was carried out in a highly exposed population, but the results support the notion that increased methylmercury exposure promotes the development of cardiovascular disease.[43] Consumption of fish containing methylmercury has been shown to increase the risk of heart attacks. Omega-3 fatty acids in the fish reduced that risk, but consumption of large amounts of contaminated fish had an overall negative effect.[48]

HEALTH EFFECTS LINKED TO MERCURY

- Learning & developmental disorders:
  - Learning disabilities
  - Impaired memory, motor function and attention span
  - Mental retardation
  - Cerebral palsy
- Cardiovascular disease (CVD):
  - Increased blood pressure
  - Increased risk of heart attacks
- Hearing loss
- Psychiatric disturbances
- Immune suppression

Immune System Effects

Mercury is also known to have adverse effects on the immune system. Mercury is associated with suppression of immune resistance to pathogens in mice.[49] There is evidence that mercury promotes the development of autoimmune disease in animals. However, these effects develop at significantly higher doses than those experienced by most people.[50] While it is yet unknown whether mercury directly causes autoimmune disease, mercury has been found to interact with other disease triggers (such as genetic predisposition and infection) to increase the risk and severity of autoimmune diseases in mice.[51]

Cancer

Mercury is a known mutagen (an agent that changes, or mutates, genetic material) and teratogen (an agent that disrupts fetal or embryonic development) and a suspected carcinogen.[17] While the EPA has not classified elemental mercury as a human carcinogen, based on "inadequate human and animal data,"[52] it has determined that methylmercury is a possible human carcinogen.[20,53]

REGULATION OF MERCURY

Federal Regulations

In the United States, mercury is regulated under a number of federal and state statutes and multiple agencies. The EPA regulates mercury in pesticides and releases into the environment through air, water, land, and as hazardous waste.[54] The EPA has set a limit of 2 ppb of mercury in drinking water.[20]

The Food and Drug Administration (FDA) regulates mercury in food, cosmetics and dental products. [54] The FDA has set a maximum permissible level of 1 ppm of methylmercury in seafood (1 ppm).[20]

The Occupational Safety and Health Administration (OSHA) regulates mercury air exposures in the workplace.[54] OSHA has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 mg/m^3) and 0.05 mg/m^3 of metallic mercury vapor for 8-hour shifts and 40-hour work weeks.[20]

While mercury emissions from power plants can be reduced by using air pollution control devices, "if coal-fired power plant capacity is expanding in Asia, India, Russia, and Eastern Europe, gains made by the U.S. may be overshadowed and mercury deposits to Alaska could continue to increase despite U.S.regulations."[11]

Clearly, regulation is not enough. To protect the health of Alaskans from mercury exposure, we need to prevent the development of coal-fired power plants and coal mines in Alaska, and the subsequent pollution resulting from coal combustion and export.

OTHER HEALTH IMPACTS

Other coal mining or mercury-related health impacts to people may result from:

- *Destruction of fish and wildlife habitat in subsistence use areas*
- *Changed migration patterns as wildlife avoid industrial mining areas*
- *Reduction in harvest of fish where fish advisories are posted due to mercury levels*
- *Reduction in harvest of traditional foods due to fear of mercury contamination*

- Zamzow KL, 2010. *Coal and Mercury in Alaska.* Center for Science in Public Participation.

Global Mercury Treaty

In 2009, governments of 140 nations resolved unanimously to begin negotiations on an international treaty to address global emissions and discharges of mercury.[55] This action by the Governing Council of the United Nations Environment Programme (UNEP) is a landmark step to protect the lives of hundreds of millions of people from the devastating health effects of mercury exposure.

In February 2010, the International POPs Elimination Network (IPEN), a global network of health and environmental organizations working in more than a hundred countries to protect human health and the environment from persistent organic pollutants (POPs) and other toxic chemicals, announced the adoption of the *IPEN Views on a Global Mercury Treaty*. This statement explains the necessity of a global treaty on mercury, the global implications of mercury pollution and the need for international actions: "There is now an international consensus on the need to take action to **minimize and eliminate mercury exposure from anthropogenic sources**. Because mercury travels long distances in the environment and is traded globally **no country or region acting alone can protect its people and its environment from the harms caused by mercury contamination**."

The IPEN statement also proposes a vision for the treaty: "The goal of the global mercury treaty should be to protect human health, wildlife and ecosystems by **eliminating where feasible anthropogenic sources of mercury and methylmercury**. The treaty should achieve this by **controlling industrial processes that use and/or release mercury**; phasing-out the manufacture and sale of mercury-containing products and devices; **controlling global mercury supply and trade**; properly managing mercury wastes; and taking other necessary measures. Its aim should be to **reduce the total quantity of mercury circulating in the global environment to pre-industrial levels**."[56]

Implementation of a global treaty on mercury is especially significant for Alaskans, because we are at risk of exposure from both local and global sources of mercury pollution. It is important for individuals, as part of the world's civil society, take action to ensure that this global treaty is as protective as possible.

WHAT CAN I DO?

Get involved in actions to prevent coal development in Alaska and to protect your community from mercury and other hazardous chemicals associated with coal development:

- Look for action alerts at www.akaction.org and www.alaskacoal.org.
- Sign up for email alerts and information about health impacts of coal by contacting sarah@akaction.org.

For more information, contact Alaska Community Action on Toxics at 907-222-7714 or visit www.akaction.org.

[1] Tizon, TA. 2009, July/August. The Great Alaska Coal Rush. *Sierra Magazine*. Available: http://www.sierraclub.org/sierra/200907/coal.aspx.
[2] Physicians for Social Responsibility (PSR). 2009, November. *Coal's Assault on Human Health*. Available: http://www.psr.org/resources/coals-assault-on-human-health.html [Accessed 16 Dec 2009].
[3] Etzel RA, Balk SJ, eds. 2003. *Pediatric Environmental Health*. 2nd ed. Elk Grove Village, IL: American Academy of Pediatrics.
[4] United States Centers for Disease Control and Prevention (CDC). May 2009. *Mercury*. Available at: http://www.cdc.gov/ExposureReport/pdf/factsheet_mercury.pdf.
[5] United States Centers for Disease Control and Prevention (CDC). 2009. *Fourth National Report on Human Exposure to Environmental Chemicals*. Atlanta, GA: CDC.
[6] MacGregor A. 1975. Analysis of control methods: Mercury and cadmium pollution. *Environmental Health Perspectives* 12, 137–148.
[7] Mahaffey KR. 1999. Methylmercury: A new look at the risks. *Public Health Reports* 114(5), 396–399, (402–413).
[8] US Environmental Protection Agency (EPA). 2009. Technical Factsheet on Mercury. Available: http://www.epa.gov/safewater/pdfs/factsheets/ioc/tech/mercury.pdf.
[9] US EPA. 1997. Mercury study report to Congress. Publication number: EPA 452/R97-003.
[10] US EPA. Clean Air Mercury Rule. Available: http://www.epa.gov/camr/basic.htm [Accessed 8 February, 2010].
[11] Zamzow KL. 2010. *Coal and Mercury in Alaska: An Environmental Research and Position Paper*. Center for Science in Public Participation.
[12] Breithaupt A. 2009. *A Case for the Development of Mercury Regulations for Alaska's Existing and Proposed Gold Mines.* Anchorage: Alaskans for Responsible Mining. Available: http://www.earthworksaction.org/publications.cfm?pubID=399.
[13] Myers, GJ and Davidson PW. June 2000. Does Methylmercury Have a Role in Causing Developmental Disabilities in Children? *Environmental Health Perspectives* 108(S3): 413-420.
[14] Gilbert SG and Grant-Webster S. 1995. Neurobehavioral Effects of Developmental Methylmercury Exposure. *Environmental Health Perspectives* 103(S6): 135-142.
[15] Myers GJ and Davidson PW. 1998. Prenatal Methylmercury Exposure and Children: Neurologic, Developmental, and Behavioral Research. *Environmental Health Perspectives* 106(S3): 841-847.
[16] Trasande L, Landrigan PJ, and Schechter C. 2005. Public Health and Economic Consequences of Methyl Mercury Toxicity to the Developing Brain. *Environmental Health Perspectives* 113(5): 590-596.
[17] Eisler R. 2004. Mercury hazards from gold mining to humans, plants, and animals. *Rev Environ Contam Toxicol 181*: 139-198.
[18] United States Geological Survey (USGS). 2000, October. Mercury in the Environment. Fact Sheet 146-00. Available: http://www.usgs.gov/themes/factsheet/146-00/.
[19] Verbrugge LA. 2007, October 15. *Fish Consumption Advice for Alaskans.* The Alaska Department of Department of Health and Social Services, Division of Public Health (DPH), Section of Epidemiology. Available: http://www.epi.alaska.gov/bulletins/docs/rr2007_04.pdf [Accessed April 9, 2009].
[20] Agency for Toxic Substances and Disease Registry. 1999. ToxFAQs for Mercury. Available: http://www.atsdr.cdc.gov/tfacts46.html#bookmark05.
[21] Ground Truth Trekking. 2009, Dec 19. Coal Power in Alaska. Available: http://groundtruthtrekking.org/WildResource/Issues/AlaskaCoalPower.html [Accessed 22 February, 2010].
[22] US EPA. Toxics Release Inventory. Available: http://www.epa.gov/triexplorer.
[23] Mahaffey KR, Clickner R, and Bodurow C. 2004. Blood Organic Mercury and Dietary Mercury Intake: National Health and Nutrition Examination Survey, 1999 and 2000. *Environmental Health Perspectives* 112(5):562-570.
[24] Schober SE, Sinks TH, Jones RL, Bolger PM, McDowell M, Osterloh J, et al. 2003. Blood mercury levels in U.S. children and women of childbearing age, 1999-2000. *JAMA* 289:1667–1674.
[25] Trasande L, Landrigan PJ, Schechter C. 2005. Public health and economic consequences of methyl mercury toxicity to the developing brain. *Environ Health Perspectives* 113(5):590–596.
[26] Arctic Monitoring and Assessment Programme (AMAP). 2009. *AMAP Assessment 2009: Human Health in the Arctic*. Oslo: AMAP. Available: http://www.amap.no [Accessed March 16, 2010].
[27] Gonzeles S. 2010. *Mind, Disrupted: How Toxic Chemicals May Change How We Think and Who We Are, A Biomonitoring Project with Leaders of the Learning and Developmental Disabilities Community*. Available: http://www.minddisrupted.org/media.php
[28] United Nations Environment Programme (UNEP). UNEP Annual Report 2007. Available: http://www.unep.org/PDF/AnnualReport/2007/AnnualReport2007_en_web.pdf [Accessed April 8, 2010].
[29] Women of child-bearing age are encouraged to participate in the Alaska Mercury Biomonitoring Program. Information can be found online at www.epi.hss.state.ak.us/eh/biom or by calling 907-269-8000.
[30] Alaska Department of Health and Social Services, Division of Public Health (DPH). 2007, February 26. *State of Alaska Epidemiology Bulletin: Alaska Mercury Biomonitoring Program Update, July 2002 - December 2006*. Bulletin No. 4.
[31] Joint FAO/WHO Expert Committee on Food Additives (JECFA). 2003. *Summary and Conclusions, Sixty-first Meeting, Rome, Italy*. Available at: http://www.who.int/entity/ipcs/food/jecfa/summaries/en/summary_61.pdf [Accessed January 9, 2009].

[32] Kurttio P, Pekkanen J, Alfthan G, Paunio M, Jaakkola J, Heinonen O. 1998. Increased mercury exposure in inhabitants living in the vicinity of a hazardous waste incinerator: A 10-year follow-up. *Archives of Environmental Health* 53 (2), 129–137.
[33] Ordonez A, Loredo J, De Miguel E, Charlesworth S. 2003. Distribution of heavy metals in the street dusts and soils of an industrial city in northern Spain. *Archives of Environmental Contamination and Toxicology* 44 (2), 160–170.
[34] Fernandez JA, Aboal JR, Carballeira A. 2000. Use of native and transplanted mosses as complementary techniques for biomonitoring mercury around an industrial facility. *Science of the Total Environment* 256 (2–3), 151–161.
[35] Hardaway C, Gauthreaux K, Sneddon J, Beck JN. 2002. Atomic absorption spectrometric determination of chromium, copper, lead, mercury, and zinc in sediments collected in Bayou d'Inde, southwestern Louisiana. *Journal of AOAC International* 85 (1), 225–232.
[36] Navarro M, Lopez H, Sanchez M, Lopez MC. 1993. The effect of industrial pollution on mercury levels in water, soil, and sludge in the coastal area of Motril, southeast Spain. *Archives of Environmental Contamination and Toxicology* 24(1),11–15.
[37] Kalac P, Burda J, Staskova I. 1991. Concentrations of lead, cadmium, mercury and copper in mushrooms in the vicinity of a lead smelter. *Science of the Total Environment* 105, 109–119.
[38] Moore J, Sutherland D. 1981. Distribution of heavy metals and radionuclides in sediments, water, and fish in an area of great bear lake contaminated with mine wastes. *Archives of Environmental Contamination and Toxicology* 10 (3), 329–338.
[39] Gilbert, SG. 2008. Scientific Consensus Statement on Environmental Agents Associated with Neurodevelopmental Disorders. Developed by the Collaborative on Health and the Environment's Learning and Developmental Disabilities Initiative.
[40] Collaborative on Health and the Environment. n.d. CHE toxicant and disease database. Available: http://database.healthandenvironment.org/index.cfm.
[41] Johansson C, Castoldi AF, Onishchenko N, Manzo L, Vahter M, Ceccatelli S. 2007 Neurobehavioural and molecular changes induced by methylmercury exposure during development. *Neurotoxicity Research* 11(3,4):241-260.
[42] Jaffe KM, Shurtleff DB, Robertson WO. 1983. Survival after acute mercury vapor poisoning. *Am J Dis Child 137*:749-751.
[43] Choi AL, Weihe P, Budtz-Jergensen E, Jorgenson PJ, Salonen JT, Tuomainen TP, Murata K, Nielson HP, Pertersen MS, Askham J, Grandjean P. 2009. Methylmercury Exposure and Adverse Cardiovascular Effects in Faroese Whaling Men. *Environmental Health Perspectives* 117(3): 367-372.
[44] Counter SA, Buchanan LH. 2004. Mercury exposure in children: A review. *Toxicology and Applied Pharmacology* 15;198(2):209-30.
[45] Rice DC. 1995. Neurotoxicity of Lead, Methylmercury, and PCBs in Relation to the Great Lakes. *Environmental Health Perspectives* 103(S9):71-87.
[46] Grandjean P, Weihe P, White RF, Debes F, Araki S, Yokoyama K, Murata K, Sorensen N, Dahl R, Jorgensen PJ. 1997. Cognitive deficit in 7-year-old children with prenatal exposure to methylmercury. *Neurotoxicol Teratol* 6:417-428
[47] Budtz-Jorgensen E, Keiding N, Grandjean P, White R, Weihe P. 1999. Methylmercury toxicity independent of PCB exposure. *Environmental Health Perspectives 107*(5): A236-7.
[48] Guallar E, Sanz-Gallardo MI, Van't Veer P, Bode P, Aro A, Gomez-Aracena J, Kark Jd, Riemersma RA, Martin-Moreno JM, Kok FJ. 2002. Mercury, fish oils, and the risk of myocardial infarction. *N Engl J Med* 347(22):1747- 1754
[49] Christensen MM, Ellermann-Eriksen S, Rungby J, Mogensen SC. 1996. Influence of mercuric chloride on resistance to generalized infection with herpes simplex virus type 2 in mice. *Toxicology* 15:57–66.
[50] Havarinasab S, Hultman P. 2005. Organic mercury compounds and autoimmunity. *Autoimmunity Reviews.* 4:270-275
[51] Silbergeld EK, Silva I A, Nyland JF. 2005. Mercury and autoimmunity: implications for occupational and environmental health. *Toxicology and Applied Pharmacology* 207:s282-292.
[52] US EPA. Integrated Risk Information System (IRIS). 2008, January 10. Mercury, elemental (CASRN 7439-97-6). Available: http://www.epa.gov/iris/subst/0370.htm.
[53] US EPA. Integrated Risk Information System (IRIS). 2008, January 10. Methylmercury (MeHg) (CASRN 22967-92-6). Available: http://www.epa.gov/iris/subst/0073.htm.
[54] US EPA. 1998. Updated 2008. Great Lakes Binational Toxics Strategy, Stakeholder Forum – 1998; Implementing the Binational Toxics Strategy; Mercury Workgroup; Background Information on Mercury Sources and Regulations. Available at: http://www.epa.gov/glnpo/bnsdocs/mercsrce/mercreg.html.
[55] United Nations Environment Programme (UNEP). 2009, February 20. Historic Treaty to Tackle Toxic Heavy Metal Mercury Gets Green Light. Available: http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=562&ArticleID=6090&l=en [Accessed 9 April 2010].
[56] International POPs Elimination Network (IPEN). 2010, February. *IPEN Views on a Global Mercury Treaty.* Available: http://www.ipen.org/ipenweb/documents/work%20documents/ipenviews_mercurytreaty_2.pdf [Accessed 23 February, 2010].