

SafeMinds Energy Policy

November 9, 2009

Introduction:

At SafeMinds, we understand that climate change is a great threat to humanity. We think “global poisoning” from mercury is an equally great threat. All life forms on earth from plants,¹ worms,² fish,³ birds and insects,⁴ dogs and cats,⁵ to humans⁶ are overexposed to mercury from human activity. No place or life is left uncontaminated, and we have little understanding of the long-term consequences.

What we do know is that mercury is a toxic heavy metal which persists in the environment, concentrates in the food chain, and causes nerve and brain damage, heart disease and endocrine system dysfunction. Unlike some poisons that flush out of the body, mercury accumulates in tissues and stores in ever-increasing amounts.⁷ The most sensitive to mercury’s devastating effects are fetuses, children and the elderly. Recent studies suggest as the rate of global mercury rises, the incidence of mercury-associated neurodegenerative diseases, such as Autism and Alzheimer’s disease, are rising as well.^{8,9}

Mercury is the most important global chemical toxicity issue facing us today. SafeMinds is perhaps best known for its advocacy to remove mercury from vaccines, an initiative that SafeMinds continues to push forward. However, mercury from other sources including energy-generation also contributes to neurological damage (including autism) and other systemic adverse health conditions. Multiple studies have linked environmental mercury to neurological disorders and developmental delay, including:

- Faroe Islands study¹⁰ – mercury in fish linked to developmental delays
- Palmer studies^{11,12} – mercury in air from coal-plant emissions linked to autism
- DeSoto study¹³ – blood mercury levels linked to autism
- Windham study¹⁴ – mercury in air in San Francisco area linked to autism rates
- Kong study¹⁵ – mercury linked to ADHD
- Holmes study¹⁶ – inability to excrete mercury linked to autism
- Adams study¹⁷ -- mercury in baby teeth linked to autism

SafeMinds advocates for energy policy that most rapidly reduces and eventually eliminates energy-associated mercury poisoning. By far the predominant source of energy-associated mercury poisoning is from the use of coal as combustion fuel for energy generation, and the first goal of the SafeMinds energy policy is to eliminate coal as a fuel for energy generation.

Background Information on Energy-Associated Mercury:

Currently, the top source of global energy generation is coal combustion. Since mercury is highly concentrated in coal, coal combustion is the largest man-made source of mercury contamination in the environment¹⁸. Natural gas and petroleum also contain mercury, but in far lower concentrations than coal.^{19,20} Technology designed to capture mercury from coal combustion emissions concentrates the mercury in the coal-combustion by-products (CCB's), and that mercury finds its way into the environment as CCB's are disposed in landfills or used in construction products (e.g. drywall) that eventually find their way into landfills. Similarly, mercury-capture technologies for natural gas purification and petroleum processing create solids with high mercury content that must be disposed of as hazardous waste²¹, but the mercury-containing waste is a far lower problem than with coal due to the much lower mercury content in natural gas and petroleum. The best mercury-capture technologies can capture only 70-90% of the mercury, with the remaining mercury being emitted into the atmosphere as the coal, natural gas, or petroleum is burned. Because mercury content is far higher in coal than in natural gas or petroleum, coal is by far the 'worst offender' amongst energy technologies both via mercury emissions and mercury in solid waste products.

When analyzing energy-associated mercury poisoning, SafeMinds maintains that it is crucial to look at the overall mercury contribution from the energy technology. This means that we must look at mercury contained in emissions, mercury included in waste by-products, and mercury captured and transported to the future national mercury storage facility. The overwhelming mercury problem is from coal, due to its very high mercury content compared to other fuels for energy generation.

SafeMinds maintains that there is no such thing as "clean coal." The mining of coal, by all methods (e.g. underground, longwall or mountaintop removal) initiates environmental damage which results in the contamination of water run-off with mercury. Subsequent storage and disposal of coal, coal sludge, tailings and fly ash cause additional widespread pollution of land, water and air, contaminating the food chain and adversely affecting human health and local communities. The mercury subsequently leaches from coal and coal-combustion by-products (CCB's) into the environment. Further, SafeMinds maintains that "carbon storage" technology to store greenhouse gases underground are not a viable solution for mercury contamination for two reasons: a) carbon storage doesn't address the mercury in the coal-combustion by-products, and b) carbon storage doesn't prevent mercury in the emissions (instead, it just delays the date at which the mercury emissions intermixed with the greenhouse gases must be dealt with). SafeMinds maintains that proposed "clean coal" and "carbon storage" technologies could at best only marginally reduce the health risk on a temporary basis, and that the long-term policy to eliminate the health risk from mercury in coal is to keep the coal in the ground (i.e. cease the use of coal as a fuel for energy generation). Instead of coal, other sources of energy generation must be utilized long-term to supply world-wide energy demand.

By necessity, natural gas will play a role in the transition from coal-combustion energy generation to non-greenhouse gas, non-mercury energy generation. Natural gas has a much lower mercury content than coal, and the technology to capture much of the mercury is simpler and less expensive than with coal. The current generation of nuclear

power is expensive, has long installation timeframes, and suffers from public concern about potential ‘meltdown’ accidents similar to Three Mile Island. Nuclear power is undergoing a transitional shift to next-generation technologies that may potentially be dramatically safer and less expensive, but this transition will likely take much time before being ready for widespread adoption. Other non-mercury energy generation technologies (e.g. wind, solar, and geothermal, along with associated energy storage technologies to deal with the intermittent nature of electricity generation from these technologies) are not yet mature enough to replace the energy-generation capacity of coal plants. Natural gas energy generation is ready now to replace much of coal’s energy-generation capacity, and SafeMinds advocates for the expansion of natural gas energy-generation in the near-term in order to accelerate the transition from high-mercury coal-based energy-generation. In the long-term once mercury-free energy-generation technologies become viable for base-load energy generation, a gradual transition from natural gas energy-generation to these technologies can be encouraged.

Similarly out of necessity, petroleum for transportation and home heating (“fuel oil”) will have a near-term role as an energy source. Similar to natural gas, petroleum has a much lower mercury content than coal. For geopolitical, economic, and environmental (“global-warming”) reasons unrelated to mercury, there currently are policy efforts to migrate away from petroleum for transportation and home heating. SafeMinds agrees with a long-term migration away from petroleum as a fuel source, due to our concerns about the health effect of petroleum emissions that include small amounts of mercury and other toxins. However, SafeMinds supports a nuanced approach to this migration that will not trade petroleum fuel for coal-based electricity generation. The combustion of natural gas should be encouraged for electricity generation in order to avoid an increased combustion of coal to provide electricity for transportation (e.g. electric cars). Also, natural gas should be encouraged in the near-term as the replacement for “fuel oil” home heating, either via direct combustion of natural gas in home heating furnaces or via combustion of natural gas to provide electricity for electric home heating systems. In parallel, policies should encourage the continued advancement of mercury-free energy-generation technologies such as nuclear, solar, wind, geothermal, and hydroelectric.

Mercury is used in fluorescent and compact fluorescent (CFL) light bulbs, which are currently promoted for their “energy-saving” capability. The use of these bulbs can reduce mercury contributions associated with coal-combustion electricity generation. However in many states, such as California, the mercury contribution from CFL light bulb disposal in landfills exceeds the mercury reduction from reducing coal combustion²². The long-term migration from coal to other energy sources means that CFL and fluorescent light bulbs will increasingly contribute more mercury to the environment than would be contributed by the coal-based electricity generation that is avoided due to the increased energy-efficiency. Further, recent technological breakthroughs have brought the lighting industry to the cusp of offering equivalent energy-efficient light bulbs without using mercury. It is time now to accelerate the migration to mercury-free, energy-efficient lighting technologies.

There are mercury concerns regarding several of the ‘renewable’ combustion-based energy technologies. Incineration of municipal waste can cause significant mercury emissions, since municipal waste contains mercury from fluorescent light bulbs and other

mercury-containing products. Biomass combustion, particularly forest biomass such as wood chips, generates mercury emissions due to mercury that has accumulated through many years of exposure to mercury in the air and soil. Some biofuels are targeted to be created by algae or similar organisms which will feed on carbon dioxide emissions from coal-combustion plants. Since those emissions will contain high levels of mercury, there is significant concern that the later combustion of these algae biofuels for transportation will emit significant mercury into the atmosphere. Ethanol is a biofuel which currently has significant government incentives for development, yet mercury contributions from ethanol are unknown. Cellulosic ethanol converts forest or other plant by-products to ethanol that is later burned as transportation fuel, there is concern regarding mercury emissions due to the high levels of mercury deposition from the atmosphere into forests and fields that supply the plant by-products that are converted into ethanol.

SafeMinds Energy Philosophy:

SafeMinds advocates that energy policy should eventually eliminate mercury contributions to the environment. A key aspect of energy policy should be to increase the cost of contributing energy-related mercury to the environment. Pragmatically, this energy policy should result in the effective phase-out of coal-based energy-generation as soon as is practical. Natural gas and petroleum are acceptable near-term alternatives to coal due to their much lower mercury content, with a long-term goal of gradually transitioning from these energy fuels in favor of mercury-free energy-generation technologies such as solar, wind, geothermal, tidal, nuclear, and hydroelectric.

SafeMinds supports the introduction of new laws and regulatory policies which sharply increase the cost of contributing energy-associated mercury to the environment. Charges for mercury contributions should be highest for direct mercury emissions to the atmosphere, high for mercury in solid-waste by-products, and moderate for mercury that is properly captured and transferred to the future long-term USA government mercury-storage facility. The goal is to change the economics of energy generation and energy efficiency technologies to favor the lowest-mercury technologies and to maximize mercury-capture. These mercury-charges should be applied to all energy-generation technologies including coal, natural gas, petroleum, biomass combustion, ethanol, municipal waste incineration, etc. Given that coal has far higher mercury content than natural gas and petroleum, the pragmatic effect of these policies should make the cost of coal-based energy generation unattractive versus natural gas-based electricity generation and natural gas or petroleum combustion for home heating. These mercury-charges should also assist in accelerating investment in mercury-free energy technologies such as solar, wind, geothermal, nuclear, and hydroelectric.

However SafeMinds does not support the concept of “mercury credits”, which would be trade-able rights to emit mercury (similar to the concept of “carbon credits” that are meant to address global-warming). Whereas the purchase and trading of carbon credits may be seen as a viable economic incentive to encourage a gradual reduction in greenhouse gases, it is based upon a view that incremental carbon releases in the near-term do not harm fellow humans (it is the aggregate long-term effect of carbon releases that can be catastrophic to humans globally). Conversely, mercury releases are immediately harmful to humans, particularly those living locally near the mercury emission source. If a coal-based power plant trades for ‘mercury credits’ that allow it to emit more mercury, the people living in that geographic area can’t trade with another part of the country for the air that they breathe. SafeMinds is philosophically opposed to the concept that any company could “buy” the right to poison others with mercury. Further, “mercury credits” could also have the perverse effect of discouraging the use of the latest mercury-capture technologies.

SafeMinds supports far more aggressive laws and regulatory policies to accelerate the development and deployment of mercury-free energy generation technologies such as solar, wind, geothermal, tidal, nuclear, and hydroelectric. Additionally energy-efficiency technologies should be encouraged in order to reduce demand for energy generation, particularly in the near-term so that there is lessened demand for coal-based energy generation. The regulatory mechanisms should encourage mercury-free energy

generation and energy-efficiency technologies via feed-in tariffs, investment tax credits, and requirements that an increasing percentage of power utility energy-generation is provided by these technologies.

Because the effort to reduce global-warming focuses primarily on fossil fuels, and fossil fuels contain mercury (particularly coal, which has both the highest mercury content and the largest global-warming-gas contribution when burned), the proposed policies to reduce greenhouse gases are often synergistic with SafeMinds' proposed policies to reduce mercury contributions from energy generation. However, there are some philosophical differences in areas where global-warming policies don't properly address mercury contamination. In such cases, we must ask: Have we secured a safe future for humanity if we reduce greenhouse gases, but ignore widespread mercury contamination from human activity? The effects from exposure to mercury can be seen through altered epigenetic errors that are passed down to descendants for generations. We need to eliminate both threats; not one at the expense of the other. Below are listed some potential differences between SafeMind's views and the views of organizations focused on global-warming:

- SafeMinds does not support investment tax credits on "coal carbon storage" technology, since this technology does not address the large mercury contribution to the environment in coal-combustion by-products (CCB's).
- SafeMinds is not willing to support investment tax credits for development of several new combustion-based energy technologies, such as ethanol, biofuels, municipal waste incineration, and biomass combustion, without further analysis as to the mercury-contribution from such technologies.
- To receive policy support, energy-efficiency technologies must be mercury-free. Policies encouraging the use of mercury-containing CFL's should be ended, with the policies instead being tailored to encourage mercury-free lighting technologies.
- SafeMinds does not support trade-able "mercury credits", for reasons explained above. Charges for mercury contributions should be paid by the relevant party responsible (typically the power utility), and the costs should be sufficiently high to encourage a migration to lower-mercury (and eventually non-mercury) energy-generation.

SAFEMINDS ENERGY POLICY

1. Regulatory policies should enact cost charges on mercury associated with energy-generation. These mercury-charges should be applied to all energy-generation technologies including coal, natural gas, petroleum, biomass combustion, ethanol, municipal waste incineration, etc. Given that coal has far higher mercury content than natural gas and petroleum, the pragmatic effect of these policies should make the long-term cost of coal-based energy generation unattractive versus natural gas-based electricity generation and natural gas or petroleum combustion for home heating. Costs for mercury contributions should be highest for direct mercury emissions to the atmosphere, high for mercury in solid-waste by-products, and moderate for mercury that is properly captured and transferred to the long-term USA government mercury-storage facility.
2. Immediate enforcement of “best-availability technology” rules under the Clean Air Act to ensure that coal-based power plants use the best-performing mercury-capture technology.
3. Regulation of coal-combustion by-products (CCB’s) as hazardous waste
4. New regulations to phase-out the use of coal-combustion by-products in construction materials and other products which can find their way into landfills
5. Government law and regulations to enforce recycling for fluorescent and compact fluorescent light bulbs (CFL’s), primarily by requiring lighting manufacturers and retailers to bear the costs of recycling.
6. Government law and regulations to encourage energy-efficient lighting should be modified to encourage mercury-free energy-efficient lighting and phase out mercury-containing fluorescent light bulbs.
7. Acceleration of research, development, and deployment of mercury-free energy generation technologies such as solar, wind, nuclear, tidal, geothermal, and hydroelectric via the economic-incentive techniques such as feed-in tariffs and investment tax credits.
8. Promotion of mercury-free energy-efficiency technologies, such as high-efficiency mercury-free light bulbs, home weatherproofing, and higher-efficiency appliances, to reduce near-term need for coal-based energy generation.
9. Analysis of biofuel, ethanol, biomass, municipal waste incineration, and other new combustion-based energy technologies to determine the mercury contribution such that EPA regulations are enforced and “mercury charge” costs are applied.
10. Regarding policies to migrate away from petroleum for transportation and home heating, all policies should be reviewed to ensure that they do not inadvertently increase mercury contributions by encouraging additional coal-combustion energy-generation. Natural gas combustion for home heating, and for electricity generation, is preferred due to its much-lower mercury content versus coal.

-
- ¹ <http://www.springerlink.com/content/n143r7138u856g31/>
- ² Ando T, et al. Bioaccumulation of mercury in a vestimentiferan worm living in Kagoshima Bay, Japan. *Chemosphere*. 2002 Nov;49(5):477-84.
- ³ U.S. EPA, Office of Water, "Update: National Listing of Fish and Wildlife Advisories", EPA-823-F-03-003, (May 2003)
- ⁴ <http://www.sciam.com/podcast/episode.cfm?id=717C8018-E7A1-25E5-75F9FC7BF75C4E34>
- ⁵ <http://www.ewg.org/reports/pets>
- ⁶ CDC Second National Report on Human Exposure to Environmental Chemicals, January 2003 and <http://www.atsdr.cdc.gov/tfacts46.html#bookmark03>
- ⁷ <http://hsc.unm.edu/pharmacy/iehms/docs/QS%20Science.pdf>
- ⁸ Chen, C, et al. Factors Associated with the Diagnosis of Neurodevelopmental Disorders: A Population Based Longitudinal Study. *Pediatrics* **119**, 8 (2007).
- ⁹ Yan, S, et al. Is the Dementia Rate increasing in Beijing? Prevalence and Incidence. *Acta Psychiatrica Scandinavica*, Volume 115, Number 1, January 2007 , pp. 73-79(7)
- ¹⁰ Murata K, Weihe P, Budtz-Jorgensen E, Grandjean P. Delayed brainstem auditory evoked potential latencies in 14-year old children exposed to methylmercury. *J Pediatr* 144: 177-83.
- ¹¹ Palmer RF, Blanchard S, Wood R. Proximity to point sources of environmental mercury release as a predictor of autism prevalence. *Health Place*. 2009 Mar;15(1):18-24. Epub 2008 Feb 12.
- ¹² Palmer RF, Blanchard S, Stein Z, Mandell D, Miller C. Environmental mercury release, special education rates, and autism disorder: an ecological study of Texas. *Health Place*. 2006 Jun;12(2):203-9.
- ¹³ DeSoto, CM, Hitlan RT. Blood levels of mercury are related to diagnosis of autism: a reanalysis of an important data set. *J Child Neurol*. 2007;22:1308-1311.
- ¹⁴ Windham GC, Zhang L, Gunier R, Croen LA, Grether JK. Autism spectrum disorders in relation to distribution of hazardous air pollutants in the San Francisco bay area. *Environ Health Perspect*. 2006 Sep;114(9):1438-44.
- ¹⁵ Cheuk DK, Wong V. Attention-deficit hyperactivity disorder and blood mercury level: a case-control study in Chinese children. *Neuropediatrics*. 2006 Aug;37(4):234-40.
- ¹⁶ Holmes AS, Blaxill MF, Haley BE. Reduced levels of mercury in first baby haircuts of autistic children. *Int J Toxicol* 2003;111(4).
- ¹⁷ Adams JB, Romdalvik J, Ramanujam VM, Legator MS. Mercury, lead, and zinc in baby teeth of children with autism versus controls. *J Toxicol Environ Health A*. 2007 Jun;70(12):1046-51.
- ¹⁸ United Nations Environmental Programme -- The Global Atmospheric Mercury Assessment: Sources, Emissions, and Transport. Dec 2008.
- ¹⁹ Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency -- Mercury in Petroleum and Natural Gas: Estimation of Emissions from Production, Processing, and Combustion -- 2001 -- <http://www.epa.gov/nrmrl/pubs/600r01066/600r01066.pdf>

²⁰ Mercury Technology Services – Mercury in Fuel Oil – Wilhelm, 2005.
http://www.hgtech.com/Data/Oil/Fuel_Oil.html

²¹ European Commission. Options for Reducing Mercury Use in products and Applications, and the Fate of Mercury Already Circulating in Society. Dec 2008

²² Eckelman MJ, Anastas PT, Zimmerman JB, Department of Chemical Engineering, Yale University. Spatial Assessment of Net Mercury Emissions from the Use of Fluorescent Bulbs. *Environ Sci Technol*. 2008 Nov 15;42(22):8564-70.