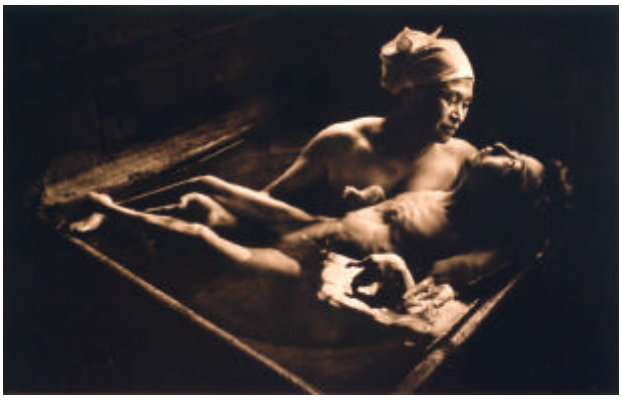


Mercury Exposure:
The World's Toxic Time Bomb

A Report by:
Ban Mercury Working Group

Prepared for the 22nd
United Nations Environment Programme
Governing Council Meeting
Nairobi, Kenya

A Call To Action

In the last century mercury levels in the global environment have tripled as a result of increased pollution from industrial, occupational, medicinal and domestic uses. This alarming, yet under-publicized, rise in mercury pollution has exponentially increased the risk of dangerous and deadly exposure to all peoples, wildlife and ecosystems, and threatens the long-term security of fish as one of the world's most important protein sources.

Mercury concentrations in the environment are now on the verge of exceeding a threshold that endangers the citizenry of every continent. Major food sources have already been contaminated; children are poisoned by excessive thimerosal vaccine schedules; indigenous groups from Baffin Island to the Guyana Shield risk losing irreplaceable food staples in fragile subsistence economies; and millions of people breathe mercury vapor into their lungs everyday through dental mercury-fillings.

No single country can resolve the mercury problem on its own. There are alternatives to mercury, but there is no alternative to international cooperation.

Economically viable alternatives to mercury exist for almost every known human use. Control technologies and conservation strategies are available that could reduce releases from the largest source of mercury pollution—coal-fired power plants.[1] Nevertheless, global releases of mercury to the environment are growing dramatically. Recognizing the immediate global threat, in September 2002 at the United Nations Environment Program (UNEP) Global Mercury meeting in Geneva, 150 experts concluded *"there is sufficient evidence of significant global adverse impacts to warrant international action to reduce the risks to human health and the environment arising from the release of mercury into the environment."*

Over the past half-century, numerous large scale exposure epidemics in places like Japan, Iraq, South Africa, India and Peru have provided the scientific community with all too many opportunities to study the effects of methylmercury on human health. This body of research has clarified what many had long feared: human health is compromised by significantly smaller concentrations of mercury than ever imagined. Accordingly, our understanding of so-called safe exposure levels has become more precise. In 1991, the World Health Organization concluded that *a safe level of mercury exposure below, which no adverse effects occur, has never been established*.[2]

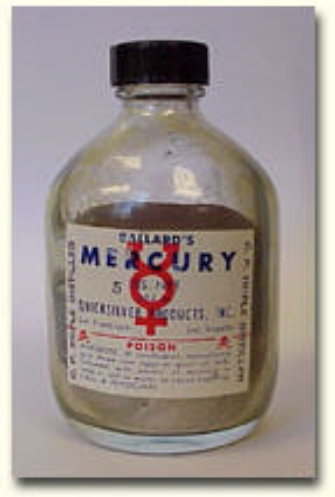
Developed countries are increasingly concerned of the risk to their children of neurological and developmental defects from mercury passing through the placental and blood-brain barrier during pregnancy. For people in developing countries—particularly gold miners, subsistence fishers and indigenous communities—the impact of mercury is very real and more than just a concern. The developing world experiences a disproportionate mercury pollution burden from industrialized nations exporting their excess elemental mercury, outdated industrial processes and mercury-containing products to nations with weaker environmental regulations, awareness of how harmful mercury is, and human rights protection.

To avert this impending global mercury crisis, concrete and binding international action must be developed to coordinate and harmonize action at the local, national and regional levels. Only a binding international instrument can require equal responsibility to all state-actors and prevent the unjust transfer of mercury from the developed to the developing world. Voluntary and aspirational international targets are insufficient: *no single country can resolve the mercury problem on its own. There are alternatives to mercury, but there is no alternative to international cooperation.*

Mercury pollution compromises the most basic human rights—life, clean food and water, work in safe environments, environmental health, and the rights of indigenous peoples to preserve traditional ways of life and foodways. These basic rights are threatened by the buildup of mercury dental fillings, vaccines, and in fish, and the transference of mercury from richer, developed countries to poorer, less developed nations.

In order to create a healthy and equitable living environment for future generations, we must stop the circle of poison that mercury use and pollution perpetuates, and take immediate steps to limit human exposure. As the authors of the UNEP Global Mercury Assessment Report point out, despite remaining data gaps in our understanding of how mercury negatively affects human and environmental health, *international actions to address the global mercury problem should not be delayed*.

In response to this growing ecological and health crisis, this report of the BAN-HG Working Group provides an overview of the toxicological impact of methylmercury, and highlights five primary sources of human exposure to mercury: 1) Consumption of Contaminated Fish; 2) Occupational Exposure; 3) Dental Amalgam; 4) Vaccines; and 5) Domestic Use. It also lays out a framework of recommendations for addressing exposure pathways to mercury through international agreements, coupled with actions at the national and local community levels.



Introduction: Background Toxicology

Mercury occurs in three basic forms: elemental (metallic), inorganic and organic mercury. Metallic mercury is poorly absorbed in the digestive track, but enters the body via inhalation.[3] Exposure to high levels of elemental mercury vapor can result in severe neurological disorders; metallic mercury is transformed into methylmercury—sometimes years after its initial release.[4]

While most mercury released into the environment is in the form of elemental or inorganic mercury, it is organic mercury—in particular, methlymercury—that poses the greatest threat to people and wildlife. A potent neurotoxin, exposure to methylmercury impairs the brain, kidneys and liver, and causes developmental problems, reproductive disorders, disturbances in sensations, impairment of speech and vision, hearing and walking difficulties, mental disturbances, and death.[5] Methylmercury concentrates in fish tissue, becoming increasingly potent in predatory fish and fish-eating mammals, sometimes reaching toxic levels over a million times greater than the surrounding waters.[6]

At present global mercury loading rates, the equivalent of less than 1/50th of a teaspoon of mercury per 20 acre lake surface is enough to make fish unfit for human consumption.[7] In Sweden, for instance, fish in 50 percent of the country's 100,000 lakes have mercury levels exceeding WHO limits, and in 10 percent of the lakes levels are double the recognized limits. Once

Recommendations For Action

The BAN-HG Working Group invites the Governing Council to consider the following recommendations:

1. Convene an open-ended ad hoc working group with a mandate to propose international action to reduce releases of mercury to the environment, with a mandate to consider all measures to reduce or eliminate releases of mercury to the environment.

2. Adopt as its goal, the virtual elimination of all uses and releases of human-induced mercury pollution, including the development and implementation of national and regional action plans and agreements that aim to reduce or eliminate all mercury release to all media, to the maximum extent possible, within a specified time.

3. Develop and promote the creation of an international inventory to account for and monitor mercury emissions, sources, uses, imports and exports.

4. Develop an international binding instrument that contains the following:

a) Strict control measures on the global trade of mercury, mercury wastes, and technologies, and prevention of mercury trafficking from developed to developing countries;

b) Permanent retirement of all existing civil and military mercury stockpiles, including chlor-alkali mercury and the Defense National Logistics Agency stocks;

c) Promotion of mercury-free alternatives in the small-scale gold mining sector;

d) Return of mercury to countries of origin for permanent storage;

e) Funding mechanism for the rehabilitation of communities and environments negatively affected by industrial processes knowingly transferred from developed nations to less developed countries in Asia, Africa, Latin America, Central Asia and Eastern Europe; included in this should be technical and financial assistance to developing countries to support efforts to reduce releases of mercury to the environment and substitute use of mercury with safer alternatives; and

f) End of government subsidies for primary mining of mercury, and an effective strategy for managing byproduct mercury produced in the metals mining industry, including gold mining.

ingested by people, methylmercury is rapidly absorbed through the gastrointestinal tract, and it easily penetrates the blood-brain and placental barriers in humans, allowing passage of mercury from a pregnant woman to her fetus.

I. Fish: A Toxic Mercury Time Bomb

The mercury exposure route of greatest concern to the international community is the contamination of the world food supply. Recognizing the increasing risks of consuming mercury-contaminated freshwater fish and seafood, a recent European Commission report says that, "exposure to methyl mercury via diet is the critical mercury problem for Europe, the reduction of potential exposure to this Hg species should be the focus for the steps to be taken in Europe..."[8]

Through regular fish consumption in their diet, entire populations are exposed to methylmercury. Virtually 100 percent of the mercury found in such seafood as tuna, king mackerel, swordfish, and shark, is methylmercury. More than one billion people around the world rely on fish and other vulnerable seafood as their primary protein source. Indeed, global fish consumption is at record levels, reaching 121 million tons in 1996—making fish a more important global staple than beef, pork and poultry. In the developing world, the dietary importance of fish is even more profound. Fish provides as much as 25 percent of all animal protein in Asia, and 17 percent in Africa, while in many indigenous communities fish is at the center of centuries-old subsistence economies.

The most recent US Centers for Disease Control data indicates that 8 percent of US women of childbearing age have unsafe mercury levels, translating into over 300,000 children born each year in the US at risk of exposure to mercury.[9] Eating fish during pregnancy and through nursing exposes infants to dangerous levels of mercury. Daily consumption of as little as 60 grams—or just 2.5 ounces— of fish can exceed the safe levels set for mercury exposure of the average woman.

Both pre- and post-natal mercury exposure from fish is linked to impaired development of the infant's nervous system.[10] A 1997 population study conducted in the Faroe Islands demonstrated that children born to mothers who consumed mercury-contaminated whale meat during pregnancy, exhibited cognitive delays and irregular cardiovascular development.[11] Concentrations of mercury in cord blood among Faroe Islands children who were exclusively breast-fed averaged about four times the recommended exposure limit recommended by the U.S. EPA.

Indeed, global fish consumption is at record levels, reaching 121 million tons in 1996—making fish a more important global staple than beef, pork and poultry.

Several recent advisories have been issued in Europe and the US to protect developing infants from methylmercury poisoning. The recent European Commission report acknowledges, "dietary restriction with respect to fish with high levels of MeHg should be advised for pregnant women."[12] And in May 2002, Britain's Food Standards Agency began advising pregnant women, women intending to become pregnant, and children less than 16 years of age, to avoid eating swordfish, shark, and marlin because of high mercury levels. Forty-one American states have issued fresh water fish advisories, and 10 now advise women and children to limit consumption of canned fish.

In the U.S., fish consumption—particularly canned tuna—is thought to be the main culprit for the 7-8 percent of women between the ages of 15-44 who have excessive mercury levels in their bodies. According to one U.S EPA scientist, canned tuna is a threat not because its mercury levels are so high, but because people consume so much of it that even at the relatively low average exposure rate of 0.2 ppm, canned tuna is still likely the largest source of mercury exposure.

Adults in fish-eating indigenous communities frequently consume as much as of 40 to 60 micrograms of mercury per day from predatory fish contaminated by pollution….

From the Arctic to the Amazon, mercury's propensity to bioaccumulate in the environment is particularly threatening to indigenous communities. Adults in fish-

eating indigenous communities frequently consume as much as of 40 to 60 micrograms of mercury per day from predatory fish contaminated by pollution from artisanal gold mining —about 6 to 10 times the international average consumption. In one Inuit community in Baffin Island, Canada, more than 50 percent have mercury levels in their daily diet of seal, walrus and narwhal blubber that exceed the WHO's guidelines for tolerable daily intake. People with the highest intake have mercury levels six times higher than the provisional tolerable weekly intake of mercury.[13] Meanwhile, among the Wayana in French Guiana, close to 60 percent of the community exceeded WHO safe limits.[14] And roughly 14 percent of the fish taken from the heavily mined Caroni River surpassed safe levels.[15]

A recent Finnish study links cardiovascular risks to mercury exposure through contaminated fish. Among middle-aged men in Finland, patients who consumed greater than 30 g/day fish had 56% higher mean hair Hg (mercury) content than people who consumed less than 30 g/day of fish. The higher consumption and subsequent higher hair-mercury levels were associated with a 2-fold increase of risk of acute myocardial infarction and coronary heart disease.[16]

II. Occupational Exposure: Protecting Workers' Rights

Countless people throughout the world are put in harm's way as a result of regular occupational exposure to mercury. Mercury use spans many industries and continents, including chlor-alkali production, thermometer factories, primary mercury mining, gold, silver, lead, copper and nickel production, dental clinics, and coal-fired power plants.

The world's most severe mercury-related occupational exposure crisis is happening far from the focus of any media attention. Millions of people engaged in small-scale—or artisanal—gold mining use mercury to extract gold from unwanted sediment. Bonded gold-mercury amalgam is then heated with an intense flame to burn off mercury, directly exposing miners and bystanders to deadly elemental vapors. As much as 95 percent of all the mercury used in artisanal gold mining is lost to the environment. This mercury methylates after mixing with organic matter—bioaccumulating in fish and contaminating precious food supplies. Although the informal nature of this industry makes accurate numbers difficult to ascertain, in Brazil 130 tons of mercury per year are released into local rivers for every 90 tons of gold produced from artisanal gold mining.[17]

…faced with stringent environmental standards in developed countries, multinational companies regularly shift their mercury-based operations to the developing world, where they literally get away with murder….

Weak enforcement of labor rights in developing countries places a disproportionate burden of mercury pollution on their people. These communities are faced with an exploitative paradigm of profound poverty and official disregard for basic human rights protection and respect for human dignity. When faced with stringent environmental standards in developed countries, multinational companies regularly shift their mercury-based operations to the developing world, where they literally get away with murder, sacrificing human life in the name of the bottom line.

Lenient environmental laws in much of the developing world means that even in more formal industrial sectors occupational exposure to mercury is a persistent threat to human health. According to environmental and community groups in Kodaikanal, a hill station in southern India, 10 people died and dozens others were poisoned from mercury inhalation at the local thermometer factory—run by a subsidiary of the multinational giant Unilever. The company—which has since closed the factory but denies all allegations of personal injury to workers—employed no occupational safety measures, even though mercury levels inside the plant were reportedly 600-times greater than internationally accepted safety limits.

While the workers' rights case against Unilever rages on, a similar pattern can be detected in the now decade old case against British operated Thor Chemicals in KwaZulu-Natal, South Africa. Workers were systematically exposed

to elemental mercury for over a decade before the government finally stepped in and shut down the plant. At least two workers died as a result of occupational exposure, while dozens more reported the typical symptoms of mercury poisoning, such as nervous disorders, infertility, and madness.

Nevertheless, mercury-related occupational exposure issues are not limited to developing countries. The US Department of Labor's Mine Safety and Health Administration reports that 12.5 percent of workers tested at gold and silver mines—where thousands of tons of "byproduct" mercury are produced—showed dangerous levels of mercury in their bodies.[18] In 50 percent of these cases mercury levels were more than twice the permissible limit, while some workers' mercury levels were 50 times safe limits. Mine workers' families were also found to be at risk from trace mercury entering their homes attached to items of clothing worn at the mines.

The WHO and several US federal and health and research agencies, confirm that dental amalgam…is the largest source of human exposure to elemental mercury….

People working in resource extractive industries are not the only employees exposed to mercury. Dentists and dental clinic employees are another high-risk group of workers. Mercury dental amalgam is generally heated in the dental office in order to extract silver, volatilizing elemental mercury vapor, and exposing workers via the skin and the lungs.[19] A recent Scottish study revealed high rates of kidney disease and memory disorders among dentists whose urine samples contained four-times the normal level of mercury.[20]

III. Dental Amalgam

The WHO[21] and several US federal and health and research agencies,[22] confirm that dental amalgam—an inexpensive alloy of silver, copper, tin and 50 percent mercury—is the largest source of human exposure to elemental mercury for those who have dental amalgam.[23] The lungs rapidly absorb 75-85% of elemental mercury vapors coming from dental amalgam.[24] Recent research confirms that mercury escapes from dental amalgam and is converted to methylmercury after combining with bacteria in the mouth.[25] Laboratory tests have shown that the average person with dental amalgam gets 10 times as much daily mercury exposure as the average person without amalgam fillings. Depending on the number of amalgam surfaces in a person's mouth, average daily absorption of mercury is between 3 and 17 micrograms of mercury.[26]

Dental amalgam is the predominant mercury source in wastewater systems. In addition to exposing dental industry workers directly to mercury vapors, waste mercury from clinics accounts for 40 percent of the mercury load in U.S. sewer systems—three times the pollution from the next largest contributor. Mercury in wastewater systems makes its way back into the environment by passing through sewage treatment plants and leaching from landfills and sites where sewage sludge is applied for agricultural use, into rivers, lakes, ocean and groundwater. It is directly distributed to the atmosphere as air emissions when sludge is incinerated.

The governments of Sweden, Germany, Denmark, Norway, Finland, Austria, and Canada have taken steps to significantly reduce dental mercury release and limit or phase out mercury use in amalgams, especially among sensitive populations including pregnant women, children and those with impaired kidney functions. Nevertheless,

the mainstream US dental establishment continues the unabated use of dental-mercury amalgam.

In 2001, U.S. dental clinics used 44 metric tons of mercury to make 100 million amalgamated fillings—an increase of three tons from 1999. Meanwhile, insurance companies perpetuate this exposure crisis by only covering the cost of cheaper mercury fillings, despite recent findings that blood mercury levels from dental amalgam can be as high as 20 micrograms per liter—more than twice the mean concentration for blood. Ironically, two industries—the dental and insurance industry—that exist for the sake of serving the public health and protecting people from

harm, are knowing contributors to one of the world's critical mercury exposure crises.

IV. Thimerosal

Thimerosal, a mercury-containing preservative, was first added to vaccines in the 1930s to protect against bacterial contamination. A proprietary formulation of the Eli Lilly Company, thimerosal is composed of nearly 50 percent mercury, and metabolizes to ethyl mercury and thiosalicylate. Although ethyl mercury toxicity has not yet been thoroughly evaluated, its composition is very close to methylmercury.[27]

In 1999, European regulatory agencies and the US FDA agreed that exposure risks warranted removing single-dose mercury-containing vaccines from the market as soon as possible.[28] Based on EU and US calculations, the cumulative impact of mercury-vaccines on a six-year-old child exceeds the acceptable reference dose level set by EPA. Until recently, all pediatric diphtheria-tetanus-pertussis (DTP and DTaP), hepatitis B (hepB), Hib (haemophilus influenzae type b), meningococcal vaccines, and some rabies and pneumococcal vaccines, manufactured and used in the U.S. contained thimerosal.

Until the 1980's, pre-school children received only one mercury-containing vaccine (DTP) in the U.S. Six other mercury-free vaccines gave a total of 23 doses. But over the last two decades, administering vaccines to infant children has multiplied exponentially, and in 1988, four new doses of a mercury-containing vaccine (Hib) were added to the routine childhood vaccination schedule in the U.S. This was followed in 1991 by three doses of mercury-containing hepatitis B vaccine, first given in the newborn nursery at birth. By 1999, before the FDA and EPA told U.S. drug companies to remove the mercury preservative from all pediatric vaccines, the U.S. Centers for Disease Control directed pediatricians to inject all young children with 30 doses of 11 different vaccines in the first 18 months of life, when children are most susceptible to neuro-developmental disruption caused by mercury poisoning.[29]

High mercury levels detected in hair and blood samples of autism patients[30] have contributed to mounting evidence that childhood exposure to thimerosal in vaccines is linked to the onset of autism, as well as other cognitive disorders such as attention deficit disorder and speech/language delay.[31] And studies initiated by the FDA demonstrate that the cumulative impact on a six-month-old infant from mercury-containing vaccines exceeds the acceptable reference-dose-level established by US EPA and upheld by the US National Academy of Sciences in their July 2000 report. Until 2000, a 6-month old infant undergoing standard pediatric vaccination recommendations in the U.S. would have received 187.5 mcg of mercury, almost three times the calculated exposure limit of 65 micrograms, based on EPA guideline of 0.1 microgram/kg/day.[32] Despite current recommendations, an infant may still receive excessive levels of mercury if given some brands of Hib, hepB and pneumococcal vaccines.

Although most vaccines in the U.S. are now available without thimerosal, pharmaceutical companies continue to sell mercury-based vaccines—including DTP, hepB and Hib—to developing countries where mercury ingestion guidelines are less stringent or non-existent. Sixty percent of thimerosal-containing DTP world vaccine supply is produced locally outside of the U.S. and used in developing countries.[33] The WHO guideline used for thimerosal exposure from vaccines in countries worldwide is five times higher than the safety limit recommended by the U.S. EPA, and higher than those established by the Agency for Toxic Substances Disease Registry[34] and the FDA.

Although most vaccines in the US are now available without thimerosal, pharmaceutical companies continue to sell mercury-based vaccines—including DTP, hepB and Hib—to developing countries where mercury ingestion guidelines are less stringent or non-existent.

Infants who are vaccinated in developing countries typically receive 150-175 micrograms of mercury by 18 months.[35] And even though the WHO has recognized the potential side effects of thimerosal since 1990,[36] the recommended vaccine schedules from African countries includes large quantities of mercury from DTwP, hepB and Hib vaccines.

Although some developing countries can only afford routine vaccines of DTP or DTwP, those children vaccinated in such a country would still be exposed to levels of mercury exceeding the U.S. EPA safety guideline. WHO's Joint Expert Committee on Food reaffirmed that the mercury exposure limit of 3.3 micrograms per kilogram per week should be reduced by a factor of 5 for pregnant women and nursing mothers. However, it was not made as a specific official recommendation.[37]

V. Domestic Mercury Use

Domestic sources of mercury such as thermostats, thermometers, manometers, batteries, light switches, fluorescent lights, pesticides, gas regulators, and ritual uses of mercury among Afro-Caribbean peoples, all expose people to mercury vapors in their homes.[38] According to a recent study, as much as 10 percent of U.S. households may have mercury exposure levels that exceed the worker safety standard established by OSHA-PEL—a relatively conservative risk level targeted for healthy adults rather than more at-risk segments of the population like children and pregnant women.[39] Mercury may also be transported home by children returning from school science labs, and by people who work with mercury-bearing equipment at medical facilities.[40] As noted earlier, employees at thermometer plants or gold mines frequently track mercury home on shoes and clothing.

Once mercury enters the domicile, it can be difficult to remove—exposing people to volatile vapors over extended periods with little hope for remediation. Mercury vapors can remain for months or years on furniture, carpet, floors and walls, and is tracked and transferred easily from shoes, personal items and clothing. In modern "tight" buildings, vapors can also be trapped for long periods of time, continually re-exposing inhabitants.

Some Mercuric Facts on Coal

Humans have mined and used mercury throughout the world for more than 2000 years. But widespread mercury emissions from fossil-fuel energy production, mining and industrial practices like chlorine production have increased mercury pollution 300 percent since the beginning of the industrial age 250 years ago. While total mercury emissions in North America and Europe have decreased since about 1990, expanding global coal-use is creating unprecedented mercury pollution levels.

Worldwide, 2500 tons of mercury are emitted from human activities each year.[i] Fifty-percent of all U.S. mercury emissions are from coal-fired power plants. China and India account for about half of the world's anthropogenic mercury emissions. In Asia, coal burning accounts for 42 percent of mercury emissions;[ii] in eastern Africa and the former Soviet Union coal accounts for 40 percent.[iii]

Over the next two decades, total coal consumption is expected to double to 10 billion tons per year. Nearly 50 percent of this increase is will come from China, while 15 percent will be from the U.S. and 7 percent from India. Without the employment of effective control strategies or an increased emphasis on cleaner fuels (such as natural gas), renewable energy (e.g. wind, biomass, and solar) and conservation and efficiency improvements, expanding coal use will dramatically increase worldwide mercury emissions.[iv]

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In parts of the developing world—notably China—coal is used for domestic functions such as heating and cooking, and is burned in simple household stoves, exposing people directly to emissions of mercury and other toxic metals and organic compounds. The US Geological Survey reports that hundreds-of-millions of people in rural China commonly burn raw coal in unvented stoves, and use coal briquettes to dry corn and other foods.[41] This type of coal-use poses an extremely high risk because the coal typically has higher mercury concentrations than coal burned in a U.S. or European power plant *(see sidebar page 7)*. For instance, in Guizhou Province in southwest China—where domestic coal consumption is commonplace—mercury levels in coal were measured as high as 55 ppm, approximately 200 times the average mercury concentration for U.S. coals.

To Conclude…

The tripling in mercury levels in the global environment for the past 100 hundred years has resulted in increased risks to all peoples, wildlife and ecosystems, and threatens the future viability of fish as one of the world's most important protein sources.

Mercury from a variety of industrial, occupational, household and health care uses—as well as local and global mercury sources—poses further exposure risks to millions of people around the globe each day.

Various large-scale exposure epidemics over the last 50 years have demonstrated the devastating impacts of severe mercury poisonings. From Minimata, Japan to Choropampa, Peru and across the world over, direct human exposure to mercury has injured and killed tens-of-thousands of people, devastating generations of survivors, wrecking communities, and ruining contaminated sites for decades.

People in developing countries-- and in particular gold miners, subsistence fishers and their families-- are disproportionately impacted by mercury, due to their economic and cultural situations and lack of awareness of the exposure risks posed by mercury. Mercury's propensity to bioaccumulate and persist in the environment is particularly threatening to indigenous communities from the Arctic—where atmospheric deposition from coal burning in industrialized countries accumulates in fish and mammals—to the Amazon, where mercury releases from small-scale gold mining is threatening critical ecosystems.

These are the worrisome facts, chronicled in the brutal history of mercury. The world's people have a right to ask, how many more must be poisoned by mercury before nation's unite to stop the toxic trade, use and release of mercury forever? Unless an alternate path is clearly articulated, increasing fossil-fuel generation, gold-mining, mercury cell chlor-alkali production, waste disposal, and new industrial and domestic uses for mercury will push the planet beyond the thresholds for living beings.

Clearly, to avert a global mercury catastrophe, concrete and binding international action must be developed to coordinate and harmonize action at the local, national and regional levels in order to protect children and future generations from mercury exposure - the world's toxic time bomb. *Written by: Shefa Siegel, Lori Stratton, Michael Bender, and Richard Gutierrez, Cover Photo: Copyright Eugene Smith.*

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[35] This assumes that measles, polio, BCG, and yellow fever vaccines do not contain mercury because they are live vaccines.
[36] Schumacher, 1999.
[37] Pless, 1999.
[38] Elemental forms of mercury exposure in homes from consumer products, health and beauty aids, ritualistic, religious and cultural uses are well documented; see RUMTF, USEPA July 2001.
[39] US OSHA-PE regulation.
[40] ATDSR, 1999.
[41] "China and U.S. Geological Survey…Working Together on Environmental Issues." USGS News Release, June 23, 1998.