The Global Burden of Mercury Pollution

PURE EARTH

A CALL TO ACTION

DEATHS DUE TO MERCURY POISONING

Mercury (Hg), a silvery, liquid and toxic metal [1], is one of the "ten chemicals of public health concern" according to the World Health Organization (WHO) [2]. Mercury is dangerous to anyone exposed, but it is especially harmful to developing fetuses [3,4] and to people who are regularly exposed to high levels of mercury [5]. The repercussions go beyond health, extending to the economic, social and political spheres.

SOURCES OF EXPOSURE TO MERCURY

Globally, anthropogenic sources of mercury emissions into the atmosphere are, in descending order:

CHARACTERISTICS RELEVANT TO HUMAN EXPOSURE

Mercury has three main chemical forms [1,5,9,10]:

- **Elemental: Liquid at room temperature; mostly used in ASGM [11, 12].**
- **Inorganic: Formed when mercury combines with other elements. It is used in industrial processes and in the manufacture of other chemical products.**
- **Organic: Methylmercury, the most common and harmful form [13]. It bioaccumulates in aquatic food chains such as fish and is ingested by humans [14, 15].**

Mercury is transboundary and persistent: once released into the environment, mercury migrates rapidly and can travel long distances through the air and rivers, eventually depositing in soil, water or plants, contaminating crops, food chains and ecosystems [16]. Mercury persists in the environment and cannot be destroyed.

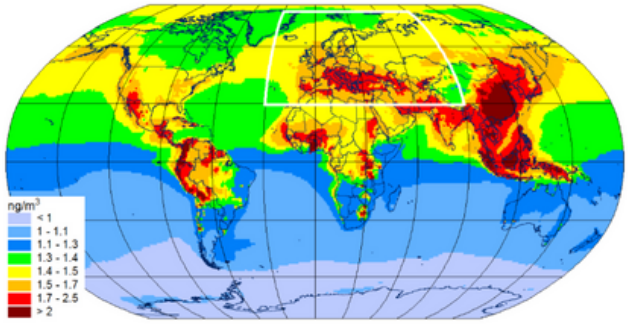
HEALTH IMPACTS

NEUROLOGICAL IMPACTS	◦ Tremors ◦ Insomnia ◦ Headache ◦ Memory loss ◦ Deficits in motor and cognitive function tests ◦ Muscle disorders (weakness, muscle atrophy, spasms) ◦ Nerve involvement in different parts of the body
BEHAVIORAL IMPACTS	◦ Emotional instability (mood swings, irritability, nervousness, excessive shyness).
RESPIRATORY IMPACTS	◦ Cough ◦ Respiratory difficulty ◦ Pulmonary involvement
DIGESTIVE IMPACTS	◦ Vomiting, sometimes with blood ◦ Abdominal pain
KIDNEY IMPACTS	◦ Acute and chronic kidney failure

IMPACTS OF MERCURY POISONING

- Mercury is dangerous to anyone exposed, but it is especially harmful to developing fetuses [3, 4] and to people who are regularly exposed to high levels [5].
- The repercussions go beyond health. A recent study of mercury levels in people in 15 low- and middle-income countries published in the Journal of Environmental Management estimated economic losses attributable to decreased productivity at $77.4 million [6].
- A 2021 study on an artisanal and small-scale gold mining (ASGM) area in Brazil estimated that due to mercury-related DALYs, economic losses amounted to between USD $100,000 and USD $400,000 per kilogram [7].

Global Distribution of Annual Mean Hg Concentrations in the Air, 2018



Pure Earth Global Mercury Program Priority Countries:

Country	Average Annual Tons Released [17]	Disability-Adjusted Life Years (DALYs) (2014)[18]	# of Mercury-Contaminated Sites Investigated (TSIP)
Indonesia	427 tons as of 2012	21,800 - 31,516	48 sites
Peru	327 tons	6,104 - 8,824	16 sites
Colombia	175 tons	23,370 - 52,694	76 sites
The Philippines	70 tons	31,915 - 46,139	39 sites
Ghana	55 tons	17,440 - 126,062	23 sites

SOLUTIONS TO MERCURY POLLUTION

Support the Transition of Miners to Mercury-Free Techniques

- Promotion by governments (policy and regulatory recommendations).
- Awareness and community education among miners and their families.
- Training on mercury-free mining techniques (technical capacity for transition).
- Testing of new technologies.
- Market-based activities that: 1) increase demand for mercury-free gold; 2) offer other incentives to produce or purchase mercury-free gold; 3) ensure a low-friction market for mercury-free gold transactions.
- Other activities that guarantee responsible miners an economically advantageous future (including actors in the jewelry industry, the main user of gold).

Manage Sites Contaminated with Mercury

- Toxic Site Identification Program (TSIP). This includes environmental assessments, health risk assessments and database management of contaminated sites.
- Tailings management (cleanup and disposal).
- Reforestation, biochar fixation and phytoremediation methods.
- Responsible mercury waste management strategies, including disposal.
- Community awareness and education as well as risk communication activities.

1. ATDSR, Toxicological Profile for Mercury. 2022.
2. World Health Organization. Mercury and Health - key facts. Fact sheet 2017 [cited 2021 8th of February 2021]; Available from: https://www.who.int/news-room/fact-sheets/detail/mercury-and-health.
3. Basu, N., et al., Our evolved understanding of the human health risks of mercury. Ambio, 2023.
4. Harada, M., Minamata disease: methylmercury poisoning in Japan caused by environmental pollution. Crit Rev Toxicol, 1995. 25(1): p. 1-24.
5. Ha, E., et al., Current progress on understanding the impact of mercury on human health. Environ Res, 2017. 152: p. 419-433.
6. Trasande, L., et al., Economic implications of mercury exposure in the context of the global mercury treaty: Hair mercury levels and estimated lost economic productivity in selected developing countries. Journal of Environmental Management, 2016. 183: p. 229-235.
7. de Bakker, L.B., et al., Economic Impacts on Human Health Resulting from the Use of Mercury in the Illegal Gold Mining in the Brazilian Amazon: A Methodological Assessment. Int J Environ Res Public Health, 2021. 18(22).
8. UN Environment, Global Mercury Assessment 2018. 2019, UN Environment Programme Chemicals and Health Branch,: Geneva, Switzerland. p. 62
9. Fowler, B.A. and R.K. Zalups, Mercury, in Handbook of the Toxicology of Metals Volume I: General Considerations, G.F. Nordberg and M. Costa, Editors. 2022, Elsevier: London. p. 796.
10. Afandiyev, I., et al., Children's Exposure to Mercury Compounds. 2010, Geneva, Switzerland: WHO Document Production Services. 105.
11. Baughman, T.A., Elemental mercury spills. Environ Health Perspect, 2006. 114(2): p. 147-52.
12. World Health Organization, ed. Decommissioning medical devices. WHO medical device technical series, ed. W.H. Organization. 2019: Geneva.
13. Karagas, M.R., et al., Evidence on the human health effects of low-level methylmercury exposure. Environ Health Perspect, 2012. 120(6): p. 799-806.
14. Du, H., et al., Significant bioaccumulation and biotransformation of methyl mercury by organisms in rice paddy ecosystems: A potential health risk to humans. Environ Pollut, 2021. 273: p. 116431.
15. Rothenberg, S.E., L. Windham-Myers, and J.E. Creswell, Rice methylmercury exposure and mitigation: a comprehensive review. Environ Res, 2014. 133: p. 407-23.
16. Obrist, D., et al., A review of global environmental mercury processes in response to human and natural perturbations: Changes of emissions, climate, and land use. Ambio, 2018. 47(2): p. 116-140.
17. United Nations Environment Programme, ed. Global Mercury Assessment - Annex. 2017, UNEP (United Nations Environment Programme) Chemicals: Geneva, Switzerland.
18. Steckling, N., et al., The burden of chronic mercury intoxication in artisanal small-scale gold mining in Zimbabwe: data availability and preliminary estimates. Environ Health, 2014. 13(1): p. 111.

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