

# EPA's Roadmap for Mercury

## V. Addressing International Mercury Sources

July 2006

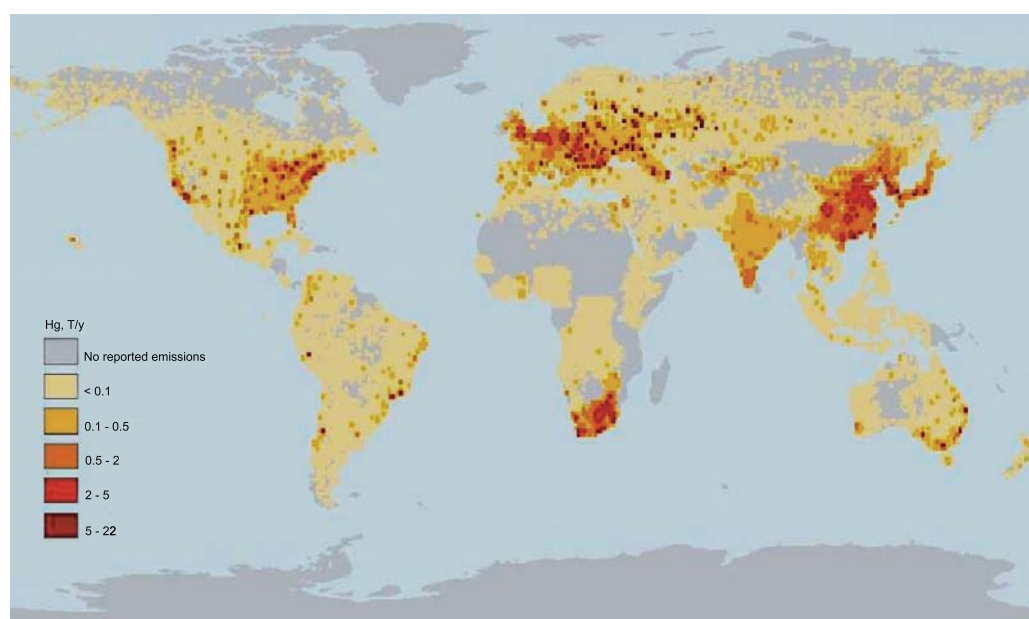
## V. ADDRESSING INTERNATIONAL MERCURY SOURCES

### OVERVIEW

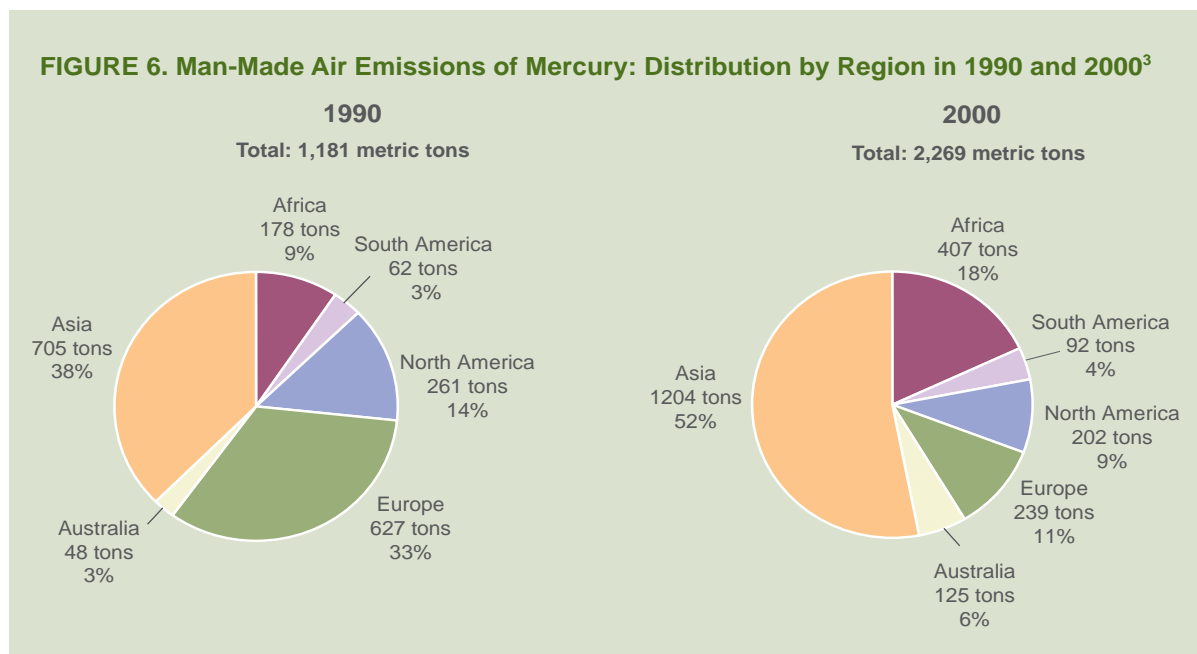
EPA is actively engaged and collaborating with international organizations and partners to address risks associated with mercury uses, releases, and exposure. As previously discussed, the greatest mercury exposure to the general population is from eating fish containing methylmercury, including marine fish. EPA has estimated that over three quarters (83 percent) of the mercury deposited in the U.S. originates from international sources (with the remaining 17 percent coming from U.S. and Canadian sources). These figures include mercury from natural and re-emitted sources. This estimate is

based on an advanced, state-of-the-science modeling assessment of atmospheric fate, transport, and deposition of mercury. EPA's modeling indicates that a substantial variation in mercury deposition occurs

**FIGURE 5. Where are Man-Made Mercury Emissions Originating?<sup>1</sup>**



1995, metric tons per year.



across the U.S., with domestic sources influencing mercury deposition much more in the eastern U.S. and global sources being a more significant contributor to mercury deposition in the west, where relatively few domestic sources exist. The scientific community's understanding of mercury atmospheric chemistry is evolving, and there remain uncertainties regarding simulation of mercury in atmospheric chemistry models. EPA continues to work to advance the state of the science on mercury chemistry and fate and transport modeling.<sup>2</sup> International collaboration is critical to refining our understanding of global mercury sources, international transport pathways, and environmental impacts, and most importantly, for addressing the adverse impacts of mercury on human health and the environment globally.

**Sources.** A number of key international emission sources contribute to global cycling and deposition of mercury via air pathways, including: coal-fired combustion sources; mining and metals production, such as smelting; mercury-cell chlor-alkali

manufacturing facilities; and combustion or incineration of waste products containing mercury. The United Nations Environment Program (UNEP) estimates that the total global emissions of mercury (anthropogenic and natural to the atmosphere) range from 4,400 to 7,500 metric tons per year.<sup>4</sup> EPA estimates that 50–70 percent of current global anthropogenic atmospheric emissions come from fuel combustion, and much of this is from China, India, and other Asian countries.<sup>5</sup> Coal consumption in Asia is expected to grow significantly over the next 20 years. This source of mercury emissions may grow substantially if left unaddressed.<sup>6</sup> Small-scale “artisanal” gold and silver mining is an important mercury emissions source in numerous Asian, South American, and African countries. Atmospheric mercury emissions from artisanal gold mining have been estimated by UNEP to be about 300 metric tons per year,<sup>7</sup> but some experts estimate that total mercury releases from artisanal gold mining are between 650 and 1,000 metric tons per year on a global basis.<sup>8</sup> An estimated 13 million people in 55 countries work and

are affected by occupational exposures in artisanal mining.<sup>9</sup>

Using data presented in the 2002 United Nations Environment Program Global Mercury Assessment, EPA has calculated that mercury-cell chlor-alkali factories are the third largest source of atmospheric mercury releases to the global environment. While the number of mercury-cell chlor-alkali facilities has been greatly reduced in the United States and Europe over the last two decades, the process is prevalent in many parts of the world including Russia, several South American countries, and India, which is estimated to have the most plants of any developing country.<sup>10</sup> EPA estimates that there may be 135–170 mercury-cell plants globally, with half located in developing countries.<sup>11</sup>

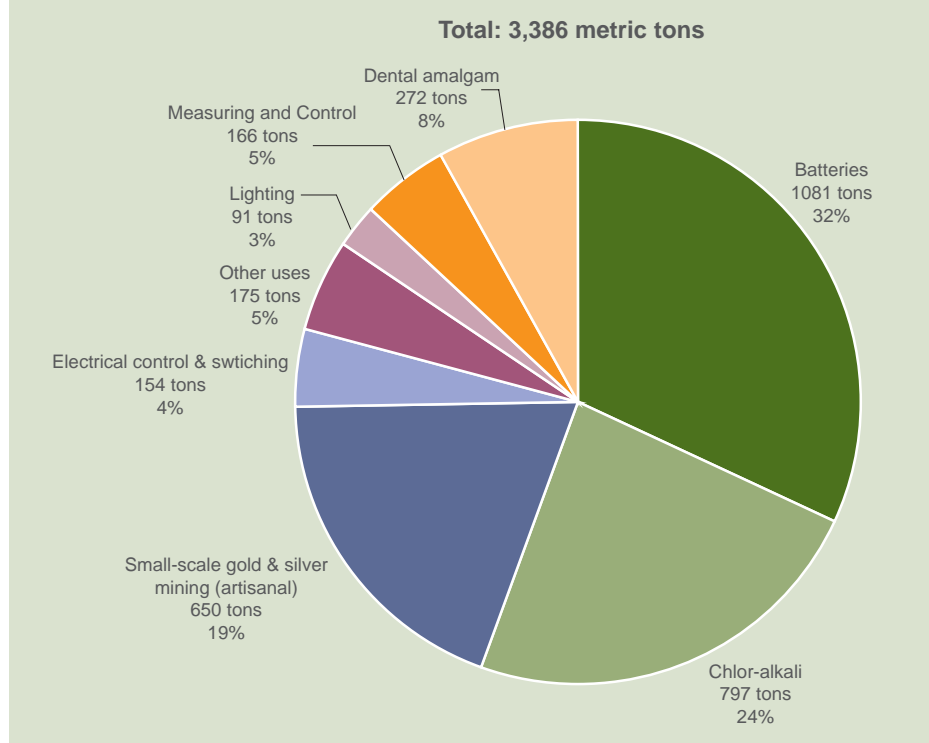
Global estimates for mercury use in processes and products range from 2,000–3,400 metric tons per year.<sup>12</sup> Mercury-cell chlor-alkali facilities are among the principal users of mercury in the world. In addition to industrial uses, mercury has been used in numerous products, including household appliances, electronics, batteries, automobile switches, dental amalgam, and thermometers. While mercury use in pesticides, fungicides, paints, and most batteries has been banned or phased-out in the U.S. and other developed countries, these uses are continuing in developing countries. For example, battery production accounts for an estimated one third of global mercury use in products (see Figure 7).<sup>13</sup>

**Progress to date.** EPA is currently engaged in the implementation of a wide range of bilateral, regional,

and international programs and agreements to address mercury uses, releases, and the resulting exposure around the globe. These include:

- ***U.S./Canada Great Lakes Binational Toxics Strategy***, which provides a framework for actions to reduce or eliminate mercury and other persistent toxic substances. The Strategy sets forth challenge goals to reduce mercury use by 50 percent and to reduce releases by 50 percent by 2006 (from the 1990 baseline). The use goal has been met. The releases goal has almost been met. Mercury releases have decreased by 47 percent. By 2006, additional regulations and voluntary activities are expected to reduce mercury emissions by at least 50 percent, meeting the release goal as well.<sup>14</sup>
- ***New England Governors/Eastern Canadian Premiers Regional Mercury***

**FIGURE 7. Global Mercury Use, 2000**



**Action Plan**, which establishes long-term and short-term regional mercury reduction goals. The plan addresses mercury emission reductions; source reduction and safe waste management; outreach and education; and research, analysis and strategic monitoring. Due to successfully reaching the goal of 50 percent reduction of emissions by 2003, the Governors and Premiers are now working on meeting a 75 percent reduction goal for emissions by 2010.<sup>15</sup>

- **Commission for Environmental Cooperation (CEC) North American Regional Action Plan for Mercury**, which aims to reduce man-made mercury releases to the North American environment through appropriate international and national initiatives to amounts that are attributable to naturally-occurring levels and fluxes. The U.S. has made considerable progress in implementing the provisions of the plan regarding mercury air emissions; processes, operations, and products; and waste management; as well as research, monitoring, modeling, and inventories; and communication activities.<sup>16</sup>
- **United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution Protocol on Heavy Metals** is a legally-binding agreement that targets emissions of cadmium, lead, and mercury. The U.S. is a party to the Heavy Metals Protocol, which went into effect in December 2003. The protocol aims to cut emissions from industrial sources, combustion processes, and waste incineration through application of best available technologies and emission limit values for new and existing stationary sources. The

protocol also requires mandatory mercury concentration limits for certain types of batteries, and encourages parties to consider various management measures to address use of mercury in other products. The U.S. meets the provisions of the Heavy Metals Protocol.<sup>17</sup>

- **UNEP Mercury Program**, which was created at the February 2003 meeting of the United Nations Environment Program (UNEP) Governing Council. The United States government was instrumental in providing much of the initial funding and leadership for the creation of the UNEP Mercury Program. This program is based on the key finding of the 2002 *UNEP Global Mercury Assessment* that there is sufficient evidence of significant global adverse impacts from mercury and its compounds to warrant international action to reduce the risks to human health and the environment. Supported by the 130 nations attending the Governing Council meeting, the UNEP Mercury Program endorses immediate actions to reduce mercury uses and releases, assist developing countries to create mercury emissions inventories, raise awareness, and provide technical assistance. The U.S. government has been involved in all of these efforts, and has funded the majority of the UNEP Mercury Program to date. EPA funded technical staff to work in the UNEP Mercury Program for two years, provided technical review of UNEP draft mercury guidance, and sent experts to conduct training at the UNEP regional mercury workshops.<sup>18</sup>

At the twenty-third session of the UNEP Governing Council, which was

held in Nairobi, Kenya, February 21–25, 2005, delegates agreed to further develop the UNEP Mercury Program and to support the efforts of countries to take action to reduce mercury exposure, releases, and uses. The Governing Council urged governments, intergovernmental and non-governmental organizations, and the private sector to develop and implement partnerships in a clear, transparent, and accountable manner to reduce the risks of mercury to human health and the environment.<sup>19</sup>

The U.S. initiated five mercury partnerships for: (1) artisanal and small-scale gold mining; (2) chlor-alkali manufacturing; (3) products; (4) coal combustion; and (5) fate and transport research. EPA held consultative meetings with other countries and domestic and international stakeholders on the first three partnerships in 2005. The partnerships created will leverage resources, technical expertise, technology transfer, and information exchanges to provide immediate, effective action that will result in tangible reductions of mercury use and emissions.<sup>20</sup>

- **United Nations Industrial Development Organization (UNIDO) Global Mercury Project**, which provides training on best management practices to reduce occupational exposures, to reduce emissions, and to reduce the amount of mercury used in small-scale “artisanal” gold and silver mining operations around the world. EPA has provided funding and technical expertise to assist in this effort.<sup>21</sup>
- **Arctic Mercury Project**, which was developed in the context of the Arctic

Council Action Plan (ACAP) and the Arctic Monitoring and Assessment Program (AMAP). EPA has worked to strengthen capacity building and technical cooperation programs among the Arctic countries, particularly to assist Russia in the development of Russia’s mercury action plan.<sup>22</sup> In 2005, two ACAP mercury reports were issued. The first, an “Arctic Mercury Releases Inventory,” summarizes current releases, usage, and disposal of mercury within all eight Arctic countries. The second, an “Assessment of Mercury Releases from the Russian Federation,” represents the first comprehensive assessment of mercury releases at the national level by that country. With the cooperation of the Russian authorities, a limited number of point sources in the Russian Federation are being evaluated in terms of their potential as sites for mercury demonstration projects. The Agency is coordinating U.S. federal government involvement, which includes the U.S. Geological Survey, Department of Energy, Department of State, and National Oceanic and Atmospheric Administration.

**Future focus.** EPA will continue to work with the U.S. Department of State and other federal agencies to provide international leadership in addressing mercury in international fora, including the CEC, UNECE, Arctic Council, and UNEP. Consistent with the 2005 UNEP Governing Council Decision on mercury, the goal of the U.S. government is to reduce human and ecosystem risks associated with the use and emissions of mercury from international sources. Global mercury reductions can be accomplished by addressing all major aspects of the global mercury problem and collaborating on the develop-



ment of partnerships and specific results-oriented projects to reduce mercury uses and emissions nationally, regionally, and globally. It is critical to more fully engage developed and developing countries, industry, environmental groups, international organizations, and funding institutions to bring needed technical expertise and financial resources to address the global mercury problem.

### **Priority Activities to Reduce Global Mercury Sources and Releases**

The following is a list of important components to an international approach to facilitate global reductions in mercury use, releases, and exposure, followed by brief descriptions, and EPA's priority actions in each area. These activities build upon and complement existing actions under UNEP, UNECE, Arctic Council, UNIDO, and multi-lateral and bilateral agreements, and may include the development of or participation in specific partnerships and projects in the following areas:

- Increase international awareness of mercury risks and risk communication approaches
  - Improve global understanding of international emissions sources, releases and transport mechanisms
  - Address mercury emissions from point sources
  - Address mercury use in products and processes where there is an opportunity to reduce risk
  - Address mercury supply issues
  - Improve management of mercury-containing wastes and surplus mercury
- ***Increase International Awareness of Mercury Risks and Risk Communication Approaches*** – There is a need to enhance international awareness and understanding of mercury sources (national, regional, and global) and risks to the general public. It is important to develop and share key health messages and methods regarding exposure from dietary sources (e.g., fish consumption advisories, testing methods, and protocols for determining the level of mercury in fish) and non-dietary sources (e.g., consumer products) and the need to use mercury alternatives.
 

*EPA will work with its federal, state, non-governmental, and international partners to:*

    - Share sampling and analysis protocols that have been developed to determine the level of mercury in fish. **Timeline: Ongoing**
    - Support international outreach efforts to communicate risk. **Timeline: Ongoing**
  - ***Improve International Understanding of Global Emissions Sources, Releases, and Transport Mechanisms*** – International cooperation has helped shape understanding of mercury cycling on local, regional, and global scales, and determine the effects of mercury exposure on human health. Working with international partners is critical to improving understanding of mercury's global impacts. Areas of collaboration will include transport and fate research; development of production, use, source, and emissions data.

*EPA will work with its federal, state, non-governmental, and international partners to:*

- Coordinate monitoring research and measurement work in Asia and elsewhere. **Timeline: Ongoing**
  - Continue to conduct high altitude research in the U.S. to continue to transect with ongoing long-range transport monitoring in other parts of the world by the U.S. and other countries. **Timeline: Ongoing**
  - Develop and implement workplans with UNEP, United Nations Institute for Training and Research (UNITAR) and other countries for assessment/inventory of mercury emissions and use. **Timeline: 2006**
  - Support the development of a global partnership on mercury fate and transport research. **Timeline: Initiate in 2006**
  - ***Address Mercury Emissions from Point Sources*** – Mercury is emitted to the air from combustion of fossil fuels, metal production, mining, mercury-cell chlor-alkali plants, waste incinerators, zinc smelters, and other point sources. International efforts to build on a number of existing techniques to reduce mercury emissions from these point sources by sharing information and expertise on air control technologies and multi-pollutant approaches will be key.
- EPA will work with other federal agencies and departments to:*
- Build on bilateral agreements to improve inventories and introduce control technologies in China, India, and Russia. **Timeline: Ongoing**
  - Achieve reductions of global mercury emissions from the coal-fired power sector through voluntary partnerships. **Timeline: Initiate in 2006**
  - Raise awareness and knowledge of the applicability, effectiveness and cost of newly emerging mercury and multi-pollutant control technologies. **Timeline: Ongoing**
  - Coordinate with the Chinese government, the private sector, Japan, and Canada to follow up on the workshop conducted in Beijing, China in November 2005 to provide information on coal-fired power plant multi-pollutant strategies and mercury control techniques, and to establish mechanisms to ensure continued information exchange with China and other countries. **Timeline: Ongoing**
  - Review data on emissions from international large-scale metals mining operations in areas with high mercury content ore and explore options for transfer of EPA Region 9's Mining Voluntary Partnership Program. **Timeline: 2006/2007**
  - ***Address Mercury Use in Products and Processes*** – Mercury is used globally in a variety of products and industrial processes. For most products and processes, there are cost-effective



alternatives available that could replace mercury, which would reduce demand and emissions. There is a need for several sector-oriented approaches, including: (1) developing an industry partnership on chlor-alkali best management practices to reduce mercury use and emissions in countries or regions that use or emit the largest amounts of mercury; (2) reducing global demand for commodity-grade mercury through the use of inventories and partnering with national and international stakeholders to share information and approaches for mercury reductions and substitutes, particularly for measuring devices, batteries, and products used in the health care sector; and (3) promoting artisanal mining techniques that are safer and that eliminate or reduce the input of mercury.

*EPA will work with its federal, state, non-governmental, industry, and international partners to:*

- Develop a multi-stakeholder global partnership on mercury-cell chlor-alkali sector. The partnership would include pilot projects; information exchange on best management practices and conversion to non-mercury processes; and use reporting, to reduce mercury releases from facilities that use or emit the largest amounts of mercury, including facilities in Mexico, India and Russia. **Timeline: Initiated in 2005**
- Develop a multi-stakeholder global partnership for reducing or eliminating mercury use in products where there are cost-effective

substitutes through pilot projects and activities, such as:

- Sharing information and approaches for mercury reductions and substitutes (e.g., batteries and other products).
- Conducting a mercury product workshop to build capacity in Mexico and other countries in the Caribbean, Central and South America through the CEC Mercury Task Force (U.S., Canada, and Mexico) in Merida, Yucatan, Mexico in 2006.
- Developing country-specific use inventories, e.g. the Americas, Africa.
- Transferring successful reduction programs, such as EPA's successful Hospitals for a Healthy Environment program and the U.S. Green Suppliers Network to other countries, e.g., China. **Timeline: Initiate in 2006**
- Expand upon the UNIDO work on best management practices for artisanal mining to develop a multi-stakeholder global partnership on artisanal and small-scale gold mining to address use, exposure, and releases from this sector. Activities include the development of pilot projects, training, and monitoring, among others. **Timeline: Initiated in 2005**
- ***Address Mercury Supply Issues*** – Given declining demand in many developed countries, ongoing primary

mercury mining, and growing global supplies from secondary sources, prices for mercury are expected to decline. A global mercury market surplus is expected by 2020 (but may occur earlier), keeping the price of mercury low and potentially discouraging its safe storage and management, the implementation of best management practices, substitution, and phase-out. The 2005 Governing Council Decision 23/9 requests that the UNEP prepare a report on mercury supply, trade, and demand information for consideration of possible further action. The Decision also requests governments, the private sector, and international organizations to take actions to reduce risks posed on a global scale by mercury in products and processes, such as considering curbing primary mercury production (mining) and introduction of mercury into commerce.

*EPA will work with the U.S. Department of State, other federal agencies, and international partners to:*

- Share U.S. data on mercury imports and exports with UNEP. **Timeline:** 2006
- Explore mechanisms for facilitating the phase-out of primary mercury mining. **Timeline:** Initiate in 2007
- ***Improve Management of Mercury-Containing Wastes and Surplus Mercury*** – Mercury-containing wastes present significant challenges, where municipal, hazardous, and medical waste management systems are ill-equipped to separate mercury from

the waste stream. In addition, the global supply of commodity-grade mercury will increase as various secondary sources of mercury overtake the shrinking demand. There will be an increasing need to safely manage mercury supplies for the long term. Actions may include: (1) sharing information on successful approaches and best management practices for storage of commodity-grade mercury and safe treatment, retorting, and disposal of waste, including discarded mercury-containing products; (2) coordinating waste management activities with the Basel Convention's capacity-building program for waste management to avoid duplication and to leverage resources;<sup>23</sup> and (3) as technologies come on-line, building capacity to create waste disposal/recycling programs for mercury-containing batteries, lamps, scrap metal, etc.

*EPA will work with its federal and state partners, non-governmental organizations, and international partners to:*

- Share U.S. best management practices for automobile switch removal, collection, and recycling programs. **Timeline:** 2006
- As previously discussed in the Commodity section of the Roadmap, EPA will establish a stakeholder process to address the mercury surplus issue. **Timeline:** Initiate in 2006