Mercury Emissions

Mercury is an element that occurs naturally in the environment. However, many industrial processes, such as coal combustion, medical and hazardous waste incineration, municipal waste combustion, gold mining, and certain chemical manufacturing operations, have increased the amount of mercury released to the air. What happens to mercury after it is emitted depends on several factors: the form of mercury emitted, the location of the emissions sources, how high above the landscape the mercury is released (e.g., the height of the stack), the surrounding terrain, and the weather. Depending on these factors, atmospheric mercury can be transported over a range of distances before it is deposited, potentially resulting in deposition on a local, regional, continental, or global scale. While some domestic anthropogenic mercury emissions are deposited within the contiguous U.S., the majority of such emissions combine with anthropogenic emissions from other countries and natural emissions worldwide to form a pool of mercury that circulates globally (Seigneur et al., 2004; U.S. EPA, 1996).

Because it does not degrade in the environment, most mercury emitted to the atmosphere eventually deposits onto land or water bodies. Through a series of chemical transformations and environmental transport processes, airborne mercury that deposits to the Earth's surface can eventually accumulate in the food web (the Lake Fish Tissue indicator), most profoundly in those species near the top of the food web (e.g., shark, swordfish). The Blood Mercury indicator describes the human health effects associated with mercury exposure.

This indicator presents mercury emissions from the following categories: (1) "Gold mining"; (2) "Hazardous waste incineration"; (3) "Electric arc furnaces"; (4) "Chlorine production"; (5) "Medical waste incineration"; (6) "Municipal waste combustion"; (7) "Other industrial processes," which includes chemical production and other miscellaneous industrial processes; (8) "Industrial, commercial, and institutional boilers"; (9) "Utility coal boilers"; and (10) "Mobile sources" (but only for inventory years starting in 2002). To better characterize mercury emissions, this indicator presents different source categories than other emissions indicators in the Report on the Environment, including separate categories for utility coal boilers and various industrial processes that release mercury.

Mercury emissions data are tracked by the National Emissions Inventory (NEI). The NEI is a composite of data from many different sources, with mercury data coming primarily from numerous state, tribal, and local air quality management agencies; the Toxics Release Inventory (data provided by industry to EPA); and other data supplied by industry. Different data sources use different data collection methods, and many of the emissions data are based on estimates rather than actual measurements. For most fuel combustion sources and industrial processes, emissions are estimated using emission factors. For utility coal boilers, the 2008 and 2011 NEI data are based primarily on test data from 2010, collected as part of the Mercury and Air Toxics Standard (MATS) development.

NEI data have been compiled since 1990 and cover all 50 states and their counties, D.C., the U.S. territories of Puerto Rico and Virgin Islands, and some of the territories of federally recognized American Indian nations. Data are presented for the baseline period (1990-1993) and the latest years for which data are available (2002, 2005, 2008, and 2011). The baseline period represents a mix of years depending on data availability for various source types. While NEI data for air toxics (including mercury) were also compiled for 1996 and 1999, the methodology used in those years for air toxics differs considerably from the methodology used in 1990-1993, 2002, 2005, 2008, and 2011 and therefore cannot be compared directly to those data.

What the Data Show

Between 1990-1993 and 2011, annual nationwide air emissions of mercury decreased from 246 tons per year to 52 tons per year, a decrease of 79 percent (Exhibit 1). The source categories accounting for the majority of the reduced mercury emissions over this time frame are medical waste incinerators, municipal waste combustors, and utility coal boilers. In 2011, coal-burning power plants were the largest anthropogenic source of mercury emissions to the air in the U.S., accounting for 49 percent of all domestic anthropogenic mercury emissions that year.

Limitations

- The emissions data in this indicator are primarily based on estimates, not direct measurements. Approximately 25 tons of 2011 emissions estimates are based on continuous emissions monitoring data for utility coal boilers. Although the mercury emissions estimates have inherent uncertainties, the data have been generated using well-established estimation methods.
- The trend shown is based on nationwide aggregate data. Regional and state trends may be different.
- Not all states and local air quality management agencies provide the same data or level of detail for a given year.
- In most cases, consistent emissions estimation methodologies were used across all inventory years. One notable difference is that the 2008 and 2011 NEI data for utility coal boilers are based primarily on data collected as part of MATS rule development. More information on mercury emissions estimation approaches is available in NEI references (U.S. EPA, 2014a).
- Version 1 of the 2011 NEI was completed prior to the release of the most recent MOVES model (MOVES2014).

Data Sources

Summary data in this indicator were provided by EPA's Office of Air Quality Planning and Standards, based on mercury emissions data in the NEI. The most recent data are taken from Version 1 of the 2011 NEI (U.S. EPA, 2014b). These and earlier emissions data can be accessed from EPA's emission inventory website (http://www3.epa.gov/ttn/chief/eiinformation.html). This indicator aggregates NEI data by source category.

References

U.S. EPA (United States Environmental Protection Agency). 2014a. 2011 National Emissions Inventory, Version 1, technical support document. Draft report. http://www3.epa.gov/ttn/chief/net/2011nei/2011_nei_tsdv1_draft2_june2014.pdf (PDF) (287 pp, 11.5MB).

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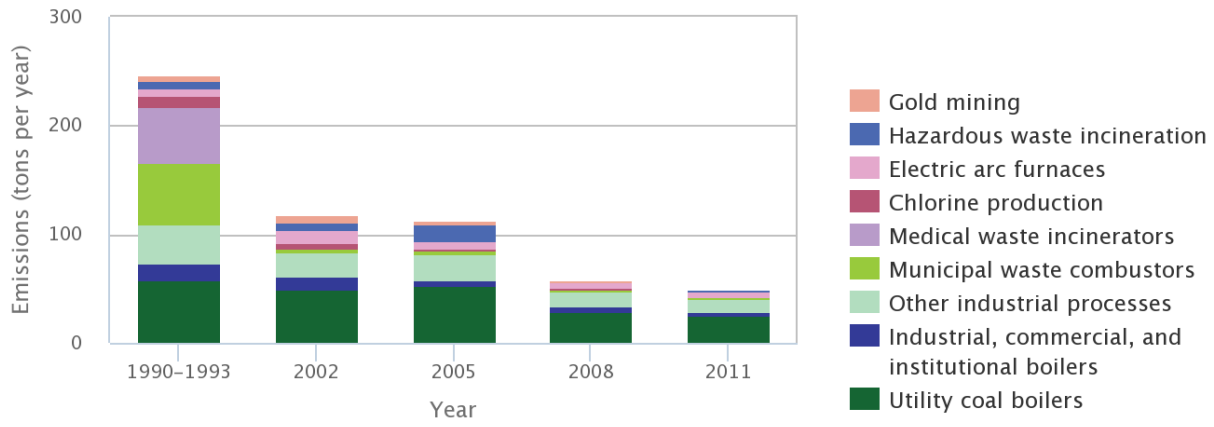
Seigneur, C., K. Jayaraghavan, K. Lohman, P. Karamchandani, and C. Scott. 2004. Global source attribution for mercury deposition in the United States. Environ. Sci. Technol. 38:555-569.

U.S. EPA. 1996. Mercury study report to Congress, volumes I to VII. EPA/452/R-96/001b.

Washington, DC. http://www2.epa.gov/mercury/mercury-study-report-congress.

Exhibit 1. Anthropogenic mercury emissions in the U.S. by source category, 1990–2011



1990–1993 is considered the baseline period for mercury emissions. The baseline period spans multiple years due to the availability of emissions data for various source categories. The data presented for the baseline period are annual emissions (tons per year) and are therefore comparable to the 2002, 2005, 2008, and 2011 data.

Mercury emissions from mobile sources are not depicted because they have been estimated only for inventory years 2002 (0.8 tons), 2005 (1.1 tons), 2008 (1.8 tons), and 2011 (1.2 tons), not for the baseline period.

Changes shown from 1990–2011 include both emissions changes and methods changes. While trends shown are generally representative, actual changes from year to year could have been larger or smaller than those shown.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2014a