

Minamata Convention on Mercury and Japan's Mercury Management



Mercury as a Global Environmental Issue

Mercury and Us

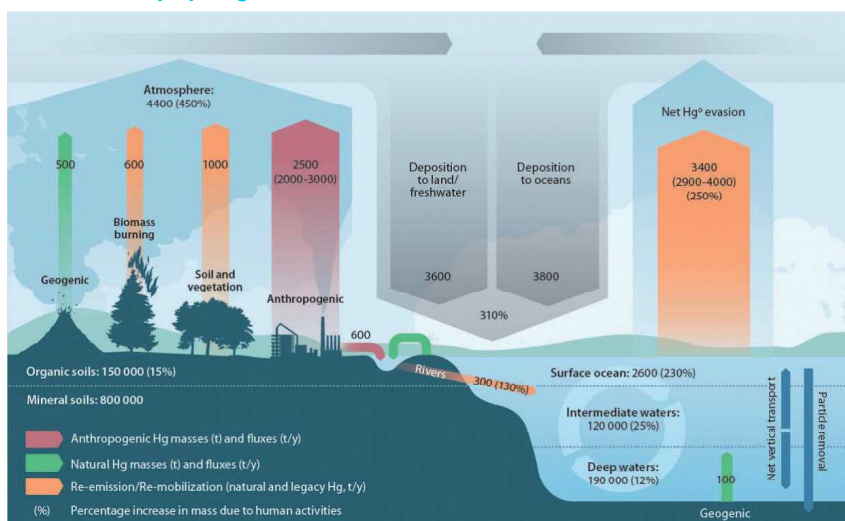
Mercury is a chemical element that has existed on the earth since before the creation of living creatures. Trace amounts of mercury exist in atmosphere and food.

The United Nations Environment Programme (UNEP) published the Global Mercury Assessment in 2002 and reported on the increase in global mercury emissions following industrialization, which resulted in increased levels of atmospheric mercury. The latest edition of the Global Mercury Assessment in 2018 estimated the present atmospheric mercury concentration at four to five times the level before the Industrial Revolution.

Although some mercury is released from natural sources such as volcanic activity, anthropogenic emissions, such as artisanal and small-scale gold mining (ASGM*) and the consumption of fuel and minerals, are claimed to be the contributor to the increase of mercury concentration in the environment. As a result, a legally-binding international instrument (i.e. the Minamata Convention) has been formulated.

* A gold extracting method from ore, where gold is amalgamated by mixing with mercury, which is then evaporated by heat. The mercury is eventually released into the atmosphere.

Global Mercury Cycling in 2015



(Source: Global Mercury Assessment, UNEP, 2018)

Mercury in Various Forms

The toxicity of mercury varies according to the different forms of compounds. Metallic mercury is volatile, and its vapour causes respiratory or neurological symptoms if inhaled in large amounts. Besides natural sources such as volcanic activities, elemental mercury is released into the environment by anthropogenic activities, including the combustion of fossil

fuels and the refining of gold using mercury.

Methylmercury is the most toxic form and the substance that caused Minamata disease. Methylmercury affects the central nervous system, causing adverse sensory effects. It is known that methylmercury exposure at the foetal stage, when neural system is developing, will result in serious

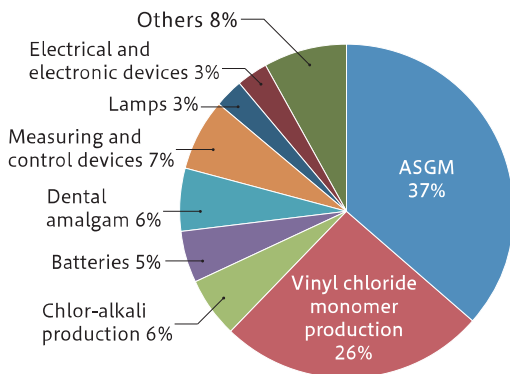
Status of Mercury Use and Emissions

Mercury is the only metal element that is in liquid form at normal temperature. Mercury has been used for various purposes thanks to its unique characteristics such as being a fluid that conducts electricity, having a very high specific gravity, its amalgamating capacity with various metals to form alloys, and strong luminescence emission spectra in the ultraviolet range. Global mercury usage is estimated at 4,500 tons per year as of 2015.

The largest atmospheric mercury emissions come from ASGM which is primarily practiced in developing countries. Coal combustion is another emissions source, as coal contains trace amounts of mercury.

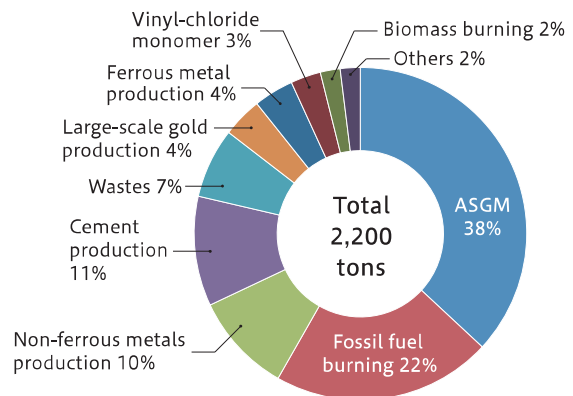


Global Mercury Demand in 2015



(Source: Global Mercury Supply, Trade and Demand, UNEP, 2017)

Global Mercury Emission in 2015

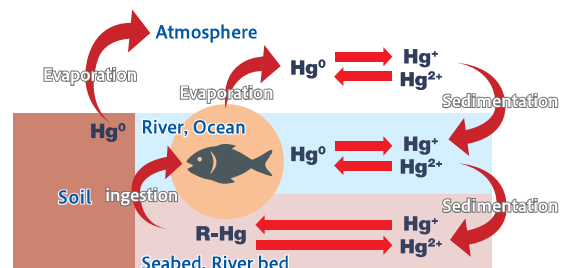


(Source: Global Mercury Assessment, UNEP, 2018)

symptoms. As methylation from inorganic mercury mainly occurs in water or soil through microbial activity, reducing inorganic mercury emissions into the environment is essential.

On the other hand, mercury sulphide, or cinnabar, which is a principal rock-forming mineral with low volatility and solubility, has been used for red pigment since ancient times.

Mercury transport in environmental media



Minamata Convention on Mercury and Mercury Management Framework in Japan

The Conference of Plenipotentiaries on the Minamata Convention on Mercury



'The Minamata Convention on Mercury' was adopted at the Conference of Plenipotentiaries held in Kumamoto city and Minamata city in October 2013. The Convention, named after the place in Japan, demonstrates the global determination that mercury damage like Minamata disease should never be repeated.

The Minamata Convention on Mercury is an agreement on concrete measures for reducing mercury risks throughout its entire lifecycle from production, trade, use, emission to disposal, while ensuring participation of both the developed and developing countries.

Mercury Management Framework in Japan

Key points of security measures for domestic implementation

■ Ban on the use of mercury, etc. for products, manufacturing processes, etc.

- Ban in principle on the manufacturing, import and export of specified products using mercury
- Restriction criteria stricter than the Minamata Convention on the manufacturing, import and export of specified products using mercury
- Ban on the use of mercury etc. for the specified manufacturing processes and gold mining

■ Supply, import and export of mercury, etc.

- Total ban on uses prohibited by the Convention, ASGM, and exports for the purpose of temporary storage
- Listing of not only mercury but also specified mercury compounds, which are easily reducible to mercury, to be subject to the export restrictions
- Prevention of inappropriate trade through the mandatory ex-post reporting of exports

■ Promotion of labelling and the collection of labelled products appropriately (each stakeholder's duty of efforts)

- Government: Obligated to make efforts to provide necessary technical advice etc. in order to appropriately collect waste products using mercury at the municipal levels
- Municipal governments: Obligated to make efforts to implement necessary measures in order to appropriately collect waste products using mercury
- Manufacturers/importers/exporters: Obligated to make efforts to provide information on the labelling of products using mercury that are manufactured/imported, in order to facilitate consumers discarding such products separately

■ Atmospheric emission standards

- Newly establishing the notification system for the five types of source facilities listed by the Convention, and obliging such facilities to comply with the standards and to measure their emissions
- Newly establishing the clauses obliging other facilities, which are not subject to the Convention but whose mercury emissions are considerable, such as pig iron and steel process plants, to make voluntary efforts for emission reduction

■ Environmentally sound disposal of mercury waste

- Waste metallic mercury shall be stabilized and solidified before disposal
- Manage wastes, which have not been managed as waste to date such as sludge from non-ferrous manufacturing, as recyclable resources containing mercury

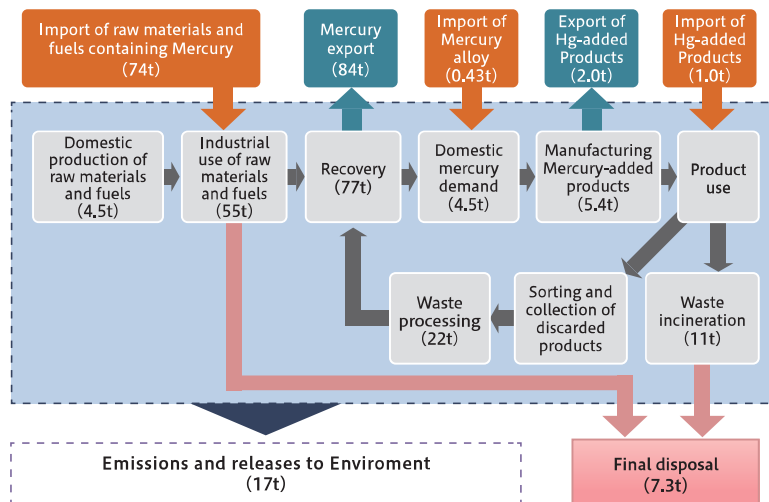
■ Establishing national implementation plan

Status of Mercury in Japan

Mercury Mass Flow in Japan

Having experienced serious damage from mercury, Japan has strengthened its environmental conservation policies, and the central government, local governments, industries and the citizens have jointly made their efforts to implement measures related to mercury. As a result, the domestic demand for mercury is now as low as approximately five tons (1/1,000 of the mercury demand worldwide). Also, domestic mercury emissions into the atmosphere have decreased to approximately 17 tons (less than 1/100 of the amount of atmospheric emissions worldwide).

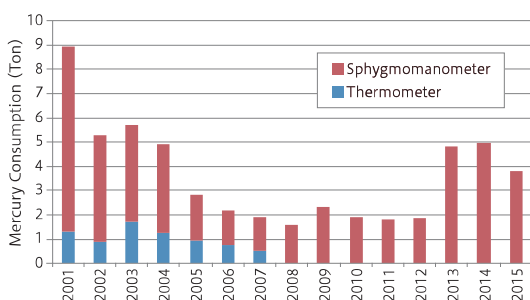
Mercury Material Flow in Japan (FY2014 basis)



Amount of Mercury Used in Mercury-added Products

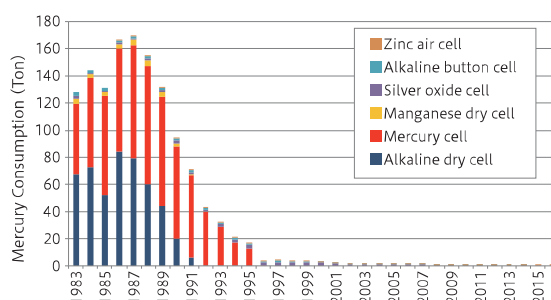
Domestic mercury consumption for manufacturing mercury-added products has significantly decreased in recent years. Technological innovation has contributed in reducing the amount of mercury used for such products and promoted their replacement with mercury-free alternatives. We are moving towards a society with a minimum use of mercury.

Annual mercury usage in medical equipment



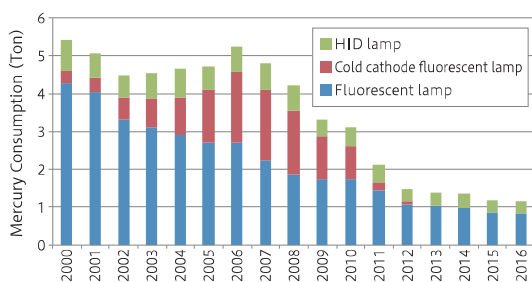
Note: Figures are based on an assumed mercury amount of 1.2g per thermometer and 47.6g per manometer.

Annual mercury demand for domestic primary battery production



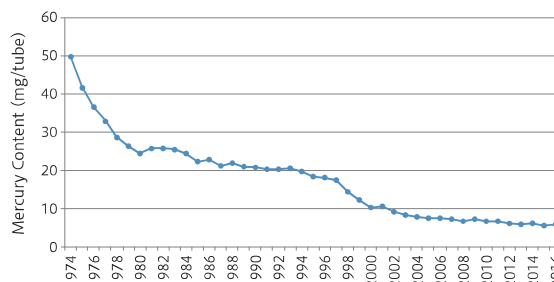
(Source: Battery Association of Japan)

Annual mercury usage in lamps that contain mercury



(Source: Japan Lighting Manufacturers Association (JLMA))

Average mercury content in a fluorescent lamp



(Source: Japan Lighting Manufacturers Association (JLMA))

Japan's Technologies for Mercury Management

Mercury Recycling from Waste

In Japan, mercury-added product waste and non-ferrous metal sludge from sintering processes are collected through voluntary collection by manufacturers or through the sorted waste collection by municipalities and then treated in an environmentally sound manner. Most of the waste containing mercury is recycled and then used for necessary purposes. The waste mercury resulting from the reduced mercury demand will be stabilized by sulfurization and then sent to safe final disposal.



Mercury Emissions Reduction Technologies

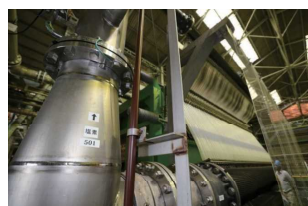


Although mineral resources such as lead, zinc, coal, etc. are indispensable to our modern life, there may be risks of mercury vapour emission into the atmosphere during the process of smelting or combusting the ores. One of the technologies to remove mercury from the exhaust gas is activated carbon. The activated carbon forms different micro-pore structures depending on its raw materials and activation methods, to become products made to remove specially targeted components. Furthermore, the special adsorbent for mercury is made from the activated carbon, which is enhanced to bond with gaseous mercury by chemical reaction inside the pores. Such adsorbent may acquire an adsorption performance significantly higher than ordinary adsorbents.

Reduction of Mercury Use in Manufacturing Processes

Mercury is used in various manufacturing processes, e.g. chlor-alkali (caustic soda), vinyl-chloride monomer or acetaldehyde. Japan has converted all these manufacturing processes into mercury-free methods.

Caustic soda can be produced by a mercury process, diaphragm process or ion-exchange membrane process. During the post-war economic growth period in Japan, caustic soda was produced primarily by the mercury process, and the production of caustic soda by this process accounted for more than a half of the mercury used in Japan from the 1960s through to the mid-1970s. By 1986, the mercury process was completely withdrawn for the production of caustic soda in Japan. As a result of the investment in technology development by the caustic soda industry, the ion-exchange membrane process has become a principal technology of Japan. Since 1999, the ion-exchange membrane process has been used for the entire production of caustic soda in Japan. As it has many advantages, including high product quality and low energy consumption, this technology is exported to the global market.



Mercury Management for Coal Combustion

As coal contains mercury, a coal-fired power plant is listed as one of the point sources of mercury emissions under the Minamata Convention. Power plants in Japan are equipped with the flue gas treatment facilities to comply with the strict standards of SO_x, NO_x and soot/smoke. The same facilities can remove most of the mercury in the exhaust gas and thus contribute to mercury management in Japan. Meanwhile, developing countries still need to use coal for their economic growth, while there remain a number of plants yet to install such treatment facilities. Today, exporting flue gas treatment facilities to developing countries is promoted, thus the Japanese technologies are expected to greatly contribute to atmospheric mercury emission controls.

Consequent to the development of mercury-free technologies and the reinforcement of countermeasures, the demand for mercury has decreased to approximately five tons per year.

International Cooperation on Mercury

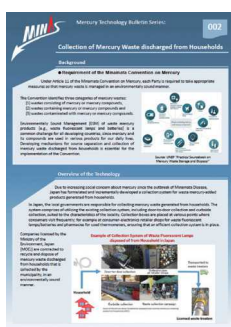
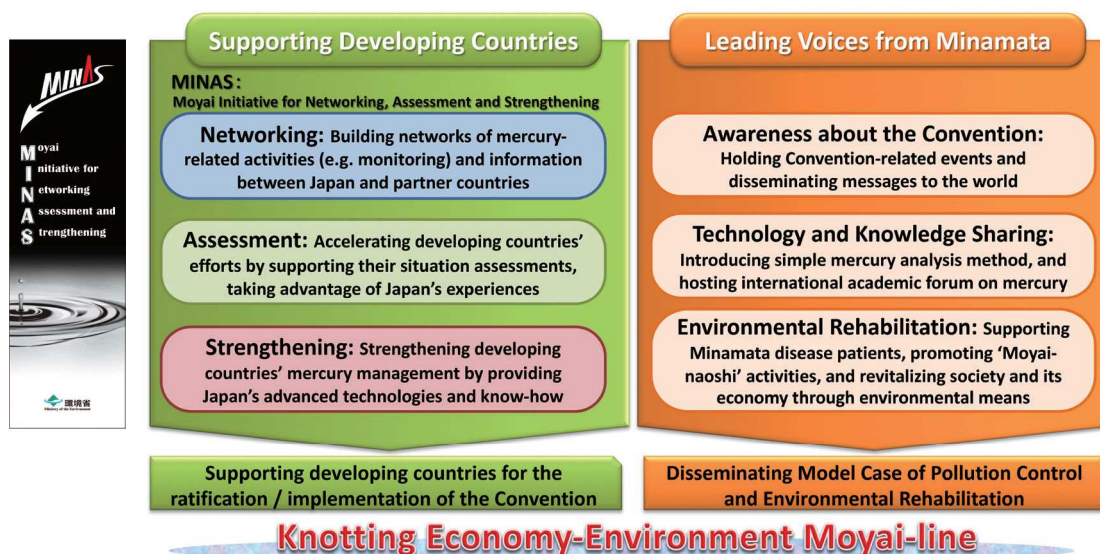
MOYAI Initiative

At the Diplomatic Conference of the Minamata Convention on Mercury, Ministry of the Environment, Japan announced the MOYAI Initiative (*), which reflects its commitment to supporting developing countries as well as to disseminate information from Minamata and promote exchanges.

As a part of the MOYAI Initiative, MOEJ has promoted the MINAS (MOYAI Initiative for Networking, Assessment

and Strengthening) and supports developing countries in implementing the mercury measures in close coordination with the United States Environmental Protection Agency (USEPA), UNEP, JICA and other international entities.

* The Japanese term 'moyai' literally means a bowline rope mooring boats together; it also refers to cooperative work in local communities. In Minamata city, 'Moyai naoshi' (repairing 'moyai') has been promoted to rebuild the local communities through dialogue and collaborative work.



National Institute for Minamata Disease

The National Institute for Minamata Disease (NIMD) is the only organization in the world that specializes in comprehensive mercury research, and it has accumulated a significant amount of mercury-related information as well as numbers of analytical technologies and research outcomes. As a WHO Collaborating Centre, the NIMD conducts dissemination of information on mercury and Minamata disease.

The NIMD is also engaged in surveys and research to assess exposure to mercury and to prevent its impact in countries suffering from environmental pollution by mercury.



Mercury Monitoring Network

MOEJ is monitoring the concentrations of mercury and its compounds in ambient air, rain water, and particles at two monitoring stations in Japan. The monitoring stations have been developed since 2007, and have gathered useful data such as trends in mercury atmospheric concentrations in general and trends in mercury deposition via the atmosphere, etc. The data will contribute towards effectiveness evaluation of the Minamata Convention.

Location map of mercury monitoring



Scene of atmospheric monitoring



Monitoring kit



The gold amalgamation trap is a method used for monitoring mercury in the atmosphere. The advantages of the technology include easy operation and low-cost and a small air sampler, which make the technology suitable for both continual monitoring of the general atmosphere and surveying contaminated areas. MOEJ is aiming to transfer the methods to developing countries, and it has organized demonstrations in more than 10 countries and invited technicians to training programs in Japan. Moreover, in collaboration with the USEPA, etc., MOEJ conducts field studies and training courses for evaluating and strengthening mercury monitoring capacities in the Asia Pacific countries and other developing countries.

Minamata Convention on Mercury

<http://www.env.go.jp/en/chemi/mercury/mcm.html>

Advisory on Mercury in Fish and Shellfish

<https://www.mhlw.go.jp/topics/bukyoku/iyaku/syoku-anzen/suigin/index.html> [in Japanese]

Mercury and Health

http://nimd.env.go.jp/english/kenkyu/docs/Mercury_and_health.pdf

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