
MERCURY
ACTING NOW!
UNEP

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Production
GRID-Arendal

MERCURY ACTING NOW!

The UNEP Global Mercury Partnership

THE UNEP Global Mercury Partnership was initiated in 2005 to take immediate actions to protect human health and the environment from the release of mercury and its compounds to the environment by minimizing and where feasible, ultimately eliminating global, anthropogenic mercury releases to air, water and land. It is a voluntary multi-stakeholder partnership that operates based on an Overarching Framework (right top document). The eight work areas of the Partnership have business plans setting out objectives, targets and priorities for action.

The Partnership has more than 100 partners. For details, please visit the UNEP Global Mercury Partnership website.

To become a partner, interested entities or individuals should submit a letter to UNEP signifying their support for the UNEP Global Mercury Partnership and their commitment to achieving its goal, and specifying how they will contribute to meeting the goal of the UNEP Global Mercury Partnership. In addition, the following forms should be filled out:

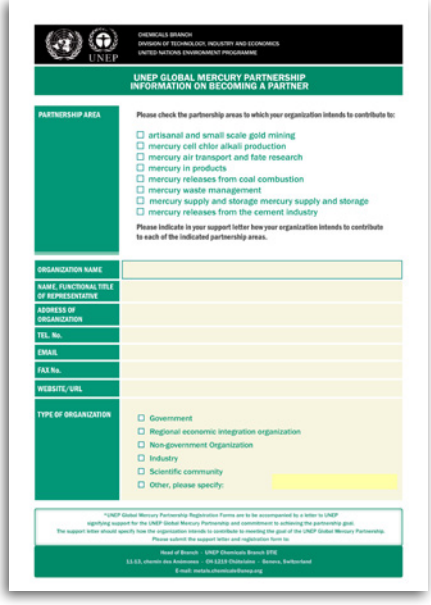
UNEP GLOBAL MERCURY PARTNERSHIP
INFORMATION ON BECOMING A PARTNER

GOAL OF THE PARTNERSHIP

PARTNERSHIP AREAS

OUR PARTNERS

BECOMING A PARTNER



UNEP GLOBAL MERCURY PARTNERSHIP
INFORMATION ON BECOMING A PARTNER

PARTNERSHIP AREA

Please check the partnership areas to which your organization intends to contribute to:

- ☐ artisanal and small scale gold mining
- ☐ mercury cell chlor alkali production
- ☐ mercury air transport and fate research
- ☐ mercury in products
- ☐ mercury releases from coal combustion
- ☐ mercury waste management
- ☐ mercury supply and storage mercury supply and storage
- ☐ mercury releases from the cement industry

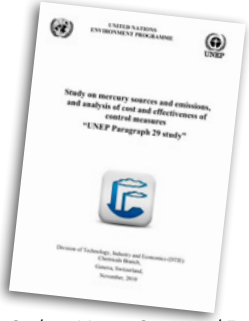
Please indicate in your support letter how your organization intends to contribute to each of the indicated partnership areas.

ORGANIZATION NAME	
NAME, FUNCTIONAL TITLE OF REPRESENTATIVE	
ADDRESS OF ORGANIZATION	
TEL. No.	
EMAIL	
FAX No.	
WEBSITE/URL	

TYPE OF ORGANIZATION

- ☐ Government
- ☐ Regional economic integration organization
- ☐ Non-government Organization
- ☐ Industry
- ☐ Scientific community
- ☐ Other, please specify:

Overarching Framework UNEP Global Mercury Partnership, third edition, UNEP 2012

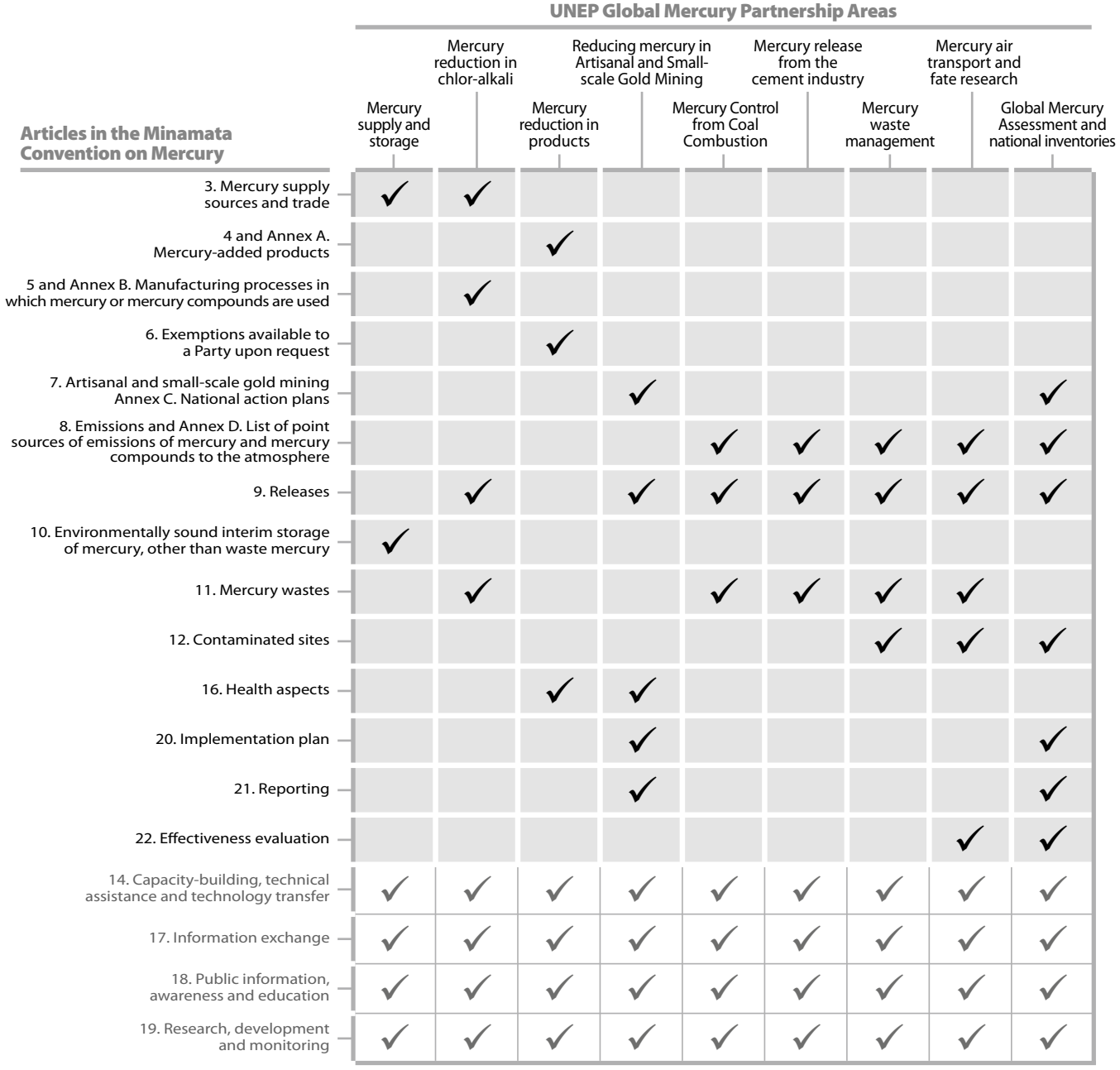


Study on Mercury Sources and Emissions, and Analysis of Cost and Effectiveness of Control Measures (Paragraph 29 Study), UNEP 2010

Guidance for Identifying Populations at Risk from Mercury Exposure, UNEP 2008

Mercury: Time to Act, UNEP 2013

How the UNEP Global Mercury Partnership contributes to the implementation of the Minamata Convention on Mercury



Mercury Supply and Storage

■ **Articles 3, 10, 14, 17, 18 and 19**

GOBIERNO DE ESPAÑA
MINISTERIO DE AGRICULTURA, ALIMENTACIÓN Y MEDIO AMBIENTE

MVOTMA
Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente

Leads: Ministry of Agriculture, Food and Environment, Spain, and Ministry of Housing, Land Planning and Environment, Uruguay

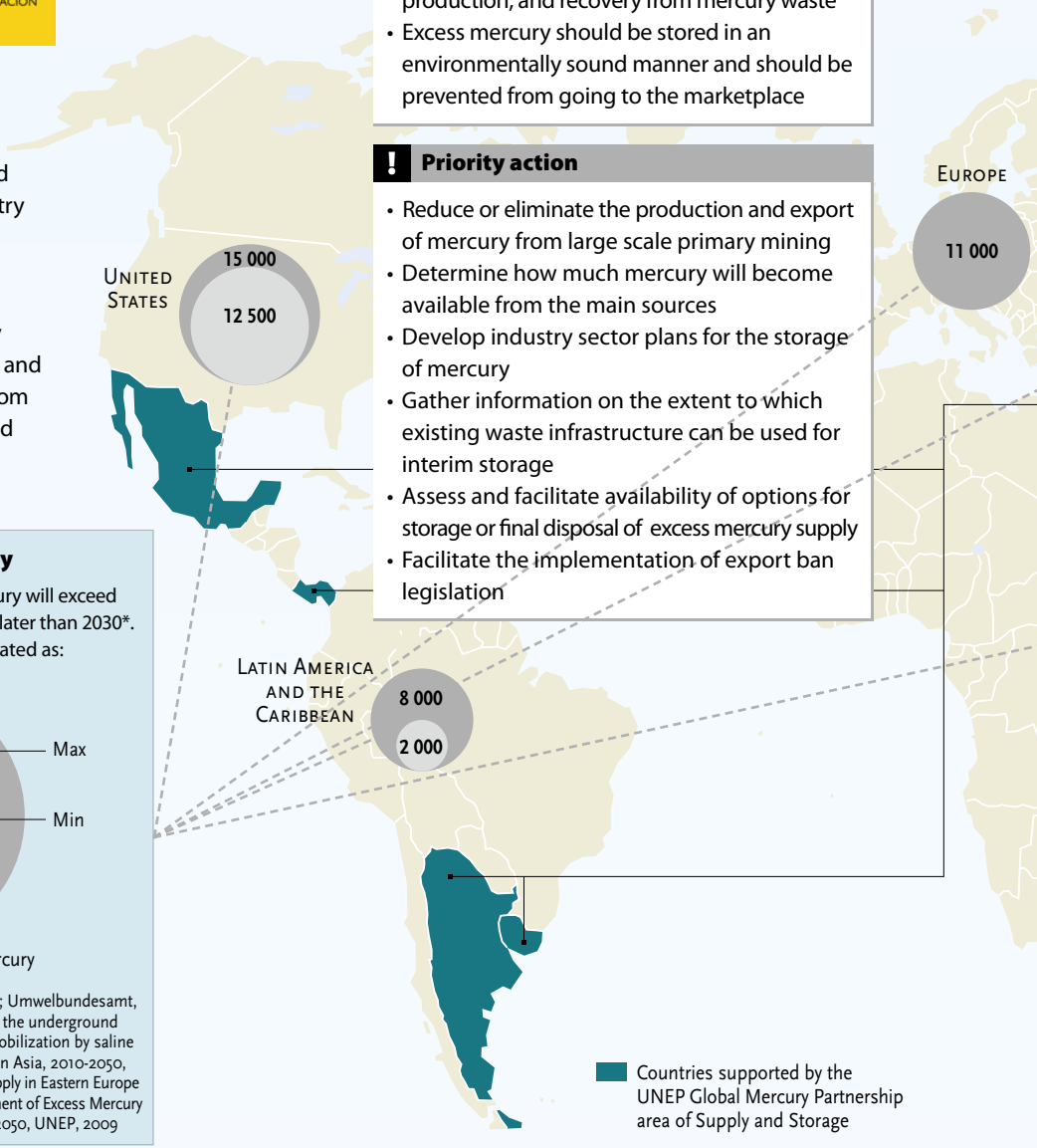
Objective: Reduce mercury supply considering an hierarchy of sources, and support the retirement of mercury from the market to environmentally sound storage.

! Key messages

- Mercury is an element that cannot be destroyed
- The main sources of mercury supply are primary mercury mining, non-ferrous metal production, decommissioning of mercury cells in chlor-alkali production, and recovery from mercury waste
- Excess mercury should be stored in an environmentally sound manner and should be prevented from going to the marketplace

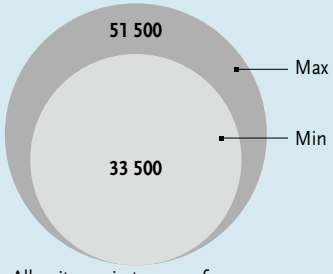
! Priority action

- Reduce or eliminate the production and export of mercury from large scale primary mining
- Determine how much mercury will become available from the main sources
- Develop industry sector plans for the storage of mercury
- Gather information on the extent to which existing waste infrastructure can be used for interim storage
- Assess and facilitate availability of options for storage or final disposal of excess mercury supply
- Facilitate the implementation of export ban legislation



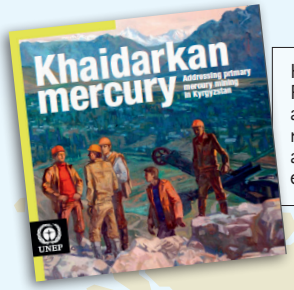
Global excess supply

Studies suggest that the supply of mercury will exceed demand in all regions (except Africa) no later than 2030*. By 2050, the total global excess is estimated as:



All units are in tonnes of mercury

*US EPA, Mercury Storage Cost Estimates, 2007; Umwelbundesamt, Behavior of mercury and mercury compounds at the underground disposal in salt formations and their potential mobilization by saline solutions, 2014; Assessment of Mercury Supply in Asia, 2010-2050, UNEP, 2009; Assessment of Excess of Mercury Supply in Eastern Europe and Central Asia, 2010-2050, UNEP, 2010; Assessment of Excess Mercury Supply in Latin America and the Caribbean, 2010-2050, UNEP, 2009



Helping the Kyrgyz Republic to transition away from primary mercury mining to a more sustainable economic activity.

Storage and disposal options

Warehouse storage

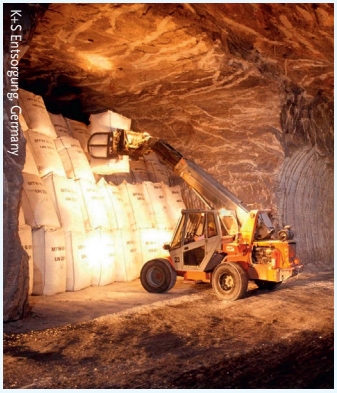
Specially engineered landfill

Seeking solutions for safe and environmentally sound storage of mercury and mercury waste. Assisting countries to:

- Inventory different waste streams
- Review legislation and regulation
- Strengthen interagency collaboration
- Assess storage and management options including the use of existing hazardous waste facilities

INTI, Argentina

Interim storage facility



K+S Entsorgung, Germany

Underground waste disposal

Eastern Europe and Central Asia

10 000

2 500

Asia and Pacific

7 500

5 500

Treatment technologies

Gesellschaft für Anlagen und Reaktorsicherheit

Solidification as mercury sulphide.

Nomura Kohsan Co., Ltd.

Solidification as sulphur polymer.

Chemical and physical transformation of mercury and mercury waste can significantly reduce the risk for mercury to reach the environment. Several such stabilization and encapsulation techniques are now available. They convert elemental mercury into a solid that is significantly less hazardous. This also results in lower waste management costs. Stabilization typically involves mixing mercury with sulphur to form solid mercury sulphide. Encapsulation involves the incorporation of stabilized mercury sulphide into a matrix. Stabilization and encapsulation techniques are applicable to elemental mercury and to various mercury wastes.

National Technological Center for Mercury Decontamination

Monolithic block after the treatment of metallic mercury.

Monolithic block after the treatment of zinc waste contaminated with mercury.

Monolithic block after the treatment of mercury-containing fluorescent lamp dust.

Ministry of Agriculture, Food and Environment, Spain

Stabilized and microencapsulated final products.

Mercury Reduction in Chlor-alkali

■ **Articles 3, 5, 9, 11, 14, 17, 18, 19 and Annex B**

Lead: United States Environmental Protection Agency

Objective: Reduce global mercury releases to air, water, and land that may occur from chlor-alkali production facilities.

The report 'Conversion from Mercury to Alternative Technology in the Chlor-Alkali Industry' illustrated that facilities using membrane technology have:

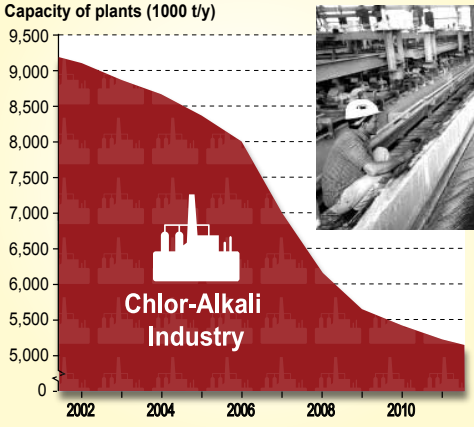
- *Greater energy efficiency*
- *Lower operating costs*
- *Lower environmental impact*
- *High quality product*

The World Chlorine Council has made available good practice guidance to non members of the Council. This includes advice on:

- Conversion to mercury-free technologies
- Environmentally sound management of excess mercury from closed or converted facilities

Mercury use in the chlor-alkali industry

Capacity of mercury electrolysis units in USA / Canada / Mexico, EU, Russia, India and Brazil / Agentina / Uruguay



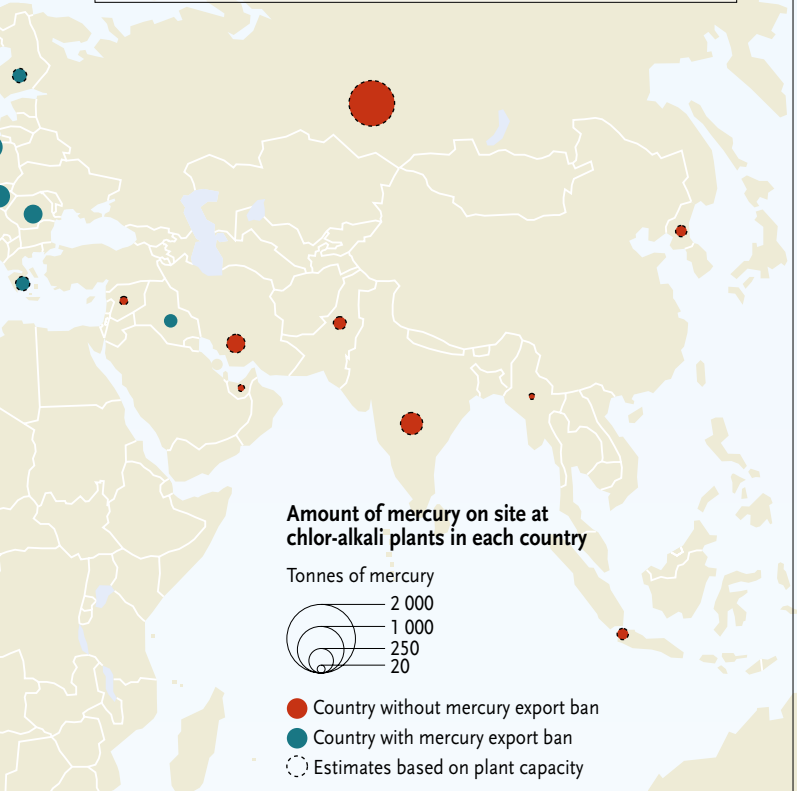
Source: Adapted from WCC Hg reporting to the Chlor-Alkali Partnership, 2012.
Designed by Zoï Environment Network / GRID-Arendal, December 2012.

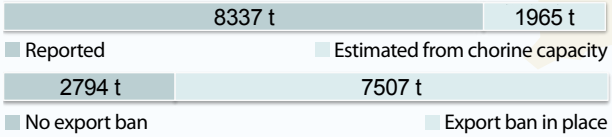
An open mercury-cell at a chlor-alkali plant.

Source: Mercury Time to Act, UNEP 2013

Sources: World Chlorine Council report, 2012
UNEP Chlor-alkali Inventory 2010, 2012

	Global Chlorine Capacity (1000 t Cl_2)	Number of Facilities
2005	9000	~140
2010	6425	101
2012	5046	75





Total estimated mercury at existing facilities is 10,302 tonnes in 2012 according to The UNEP Global Mercury Partnership. 7507 tonnes will be managed in the EU and US that have export bans in place. The remaining 2794 tonnes in chlor-alkali facilities elsewhere need to be safeguarded.

! Key messages

- Mercury-cell chlor-alkali production is a significant use of mercury
- Mercury-cell facilities are being replaced by plants using mercury-free technologies
- Environmentally sound management of surplus and waste mercury is required at mercury-cell facilities that close or convert to mercury-free technologies

Other mercury using manufacturing processes

The Minamata Convention on Mercury recognizes other mercury using manufacturing processes that require control:

- Sodium or potassium methylate or ethylate production using mercury cell electrolysis
- Vinyl chloride monomer, acetaldehyde, and polyurethane production using mercury as a catalyst

China is the principal consumer of mercury as a catalyst in vinyl chloride monomer production (VCM) via the acetylene route. The China Council for International Cooperation on Environment and Development estimated that consumption of mercury may exceed 1,000 tonnes per year. Mercury is lost in production waste and spent catalyst. Release pathways are not yet fully quantified.

The Partnership has supported efforts to move to low mercury or mercury-free catalysts.

Carbide-based polyvinyl chloride (PVC) plant in China. Vinyl chloride monomer is used in the production of PVC.

Mercury Reduction in Products

Articles 4, 6, 14, 16, 17, 18, 19 and Annex A

Lead: United States Environmental Protection Agency

Objective: Phase out mercury in products and eliminate releases during product life cycles via environmentally sound production, transportation, storage, and disposal procedures.

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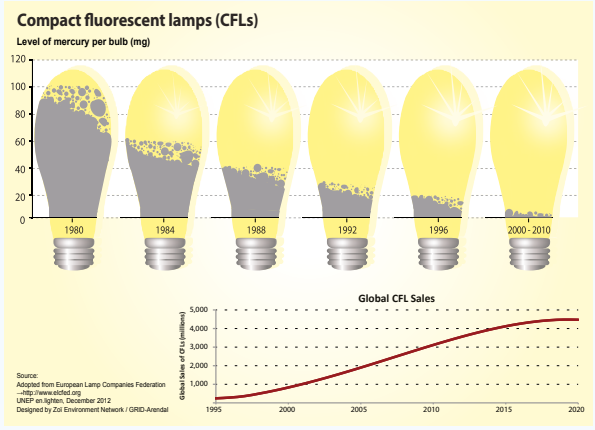
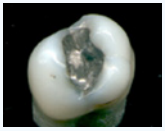
Digital thermometer and blood pressure device.

The UNEP-Global Environment Facility en.lighten initiative is promoting energy efficiency through the use of efficient solutions, such as compact fluorescent lamps (CFLs). Manufacturers engaged in the project have reduced the mercury content of lamps meeting the 5mg limit set in the Minamata Convention. In addition, participating countries are developing legislation limiting mercury contents in lamps in line with the Minamata Convention and collection and recycling schemes for used lamps.



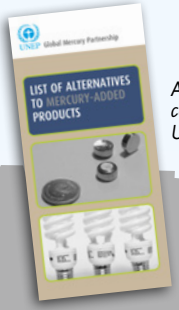


Work in East Africa by UNEP, World Health Organization, the World Dental Federation, dental manufacturers, dental recyclers and national authorities shows that phasing down dental amalgam will require:

- Raising awareness on alternatives
- Oral health promotion
- Training of dental professionals
- Best management practices in clinics
- Sound management of dental waste

Sources: Lowell Center for Sustainable Production, University of Massachusetts, Lowell and UNEP-Global Environment Facility en.lighten initiative

Source: Mercury: Time to Act, UNEP 2013

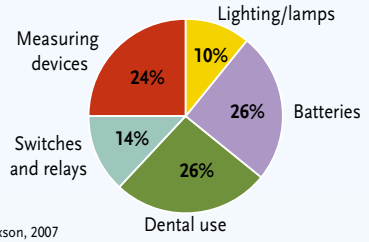


Alternatives to mercury-containing products, UNEP 2013

Key messages

- Reducing mercury in products can be the most effective means to reduce mercury in waste
- Affordable alternatives to mercury are available for most products including thermometers; switches and relays; batteries other than button cells; thermostats; high-intensity discharge lamps; and sphygmomanometers
- Good practices in dental care can reduce mercury releases from amalgam use
- Sound management should consider all stages of
- a product's life cycle

Consumption of mercury in products



Source: Maxson, 2007

Relative demand for mercury for different product categories. Demand in most sectors is declining.

Economics of Conversion to Mercury-Free Products, UNEP 2011 (left), and Report on the major mercury-containing products and processes, their substitutes and experience in switching to mercury-free products and processes, UNEP 2008 (right).

Country with mercury containing product manufacturers

Countries where phase down of dental amalgam has been undertaken as a result of government-led initiatives

Countries supported by the UNEP Global Mercury Partnership area of mercury reduction in products

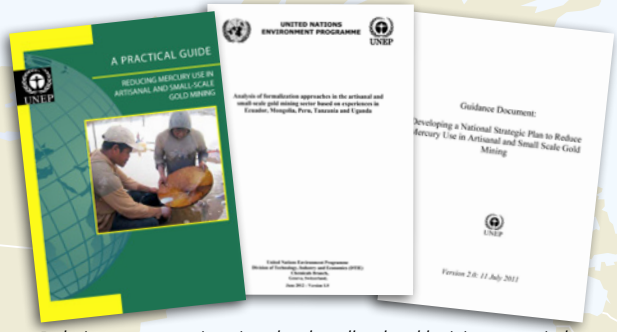
- Lamps (supported by the UNEP GEF en.lighten initiative)
- Dental amalgam
- Cosmetics
- Hospital, medical devices and health care

Reducing Mercury in Artisanal and Small-Scale Gold Mining

Articles 7, 9, 14, 16, 17, 18, 19, 20, 21 and Annex C

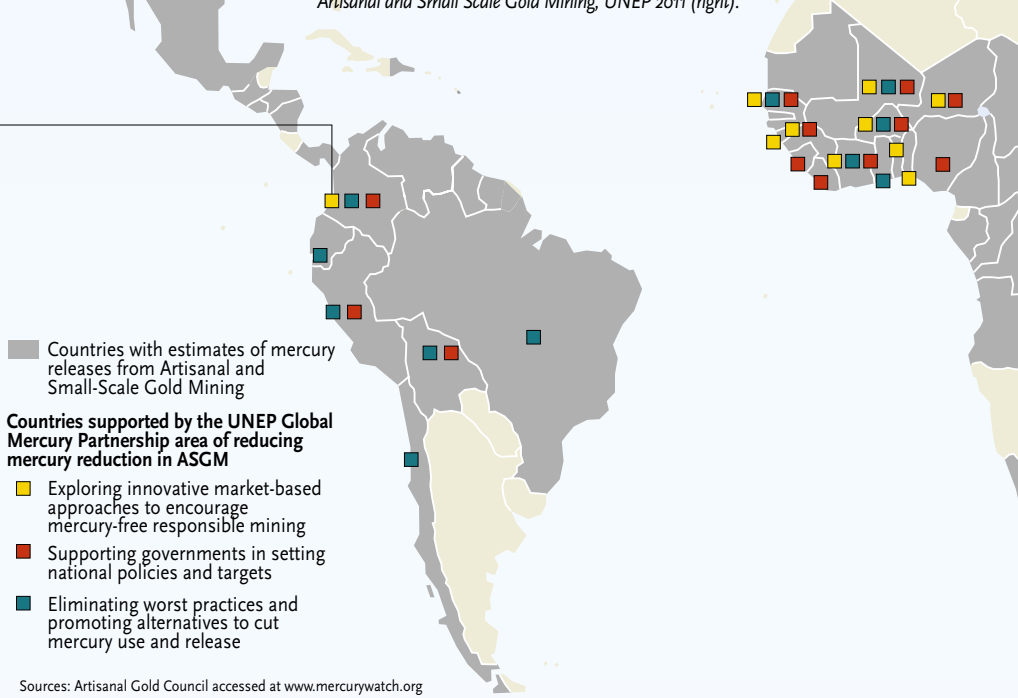
According to mercurywatch.org, artisanal and small-scale gold mining (ASGM) is practised in more than 70 countries. It is likely that mercury amalgamation is used to separate gold in all of these countries, leading to significant releases.

Leads: United Nations Industrial Development Organization and Natural Resources Defense Council



Reducing mercury use in artisanal and small-scale gold mining: a practical guide, UNEP 2012 (left), Analysis of formalization approaches in the artisanal and small-scale gold mining sector based on experiences in Ecuador, Mongolia, Peru, Tanzania and Uganda, UNEP 2012 (middle), and Guidance Document: Developing a National Strategic Plan to Reduce Mercury Use in Artisanal and Small Scale Gold Mining, UNEP 2011 (right).

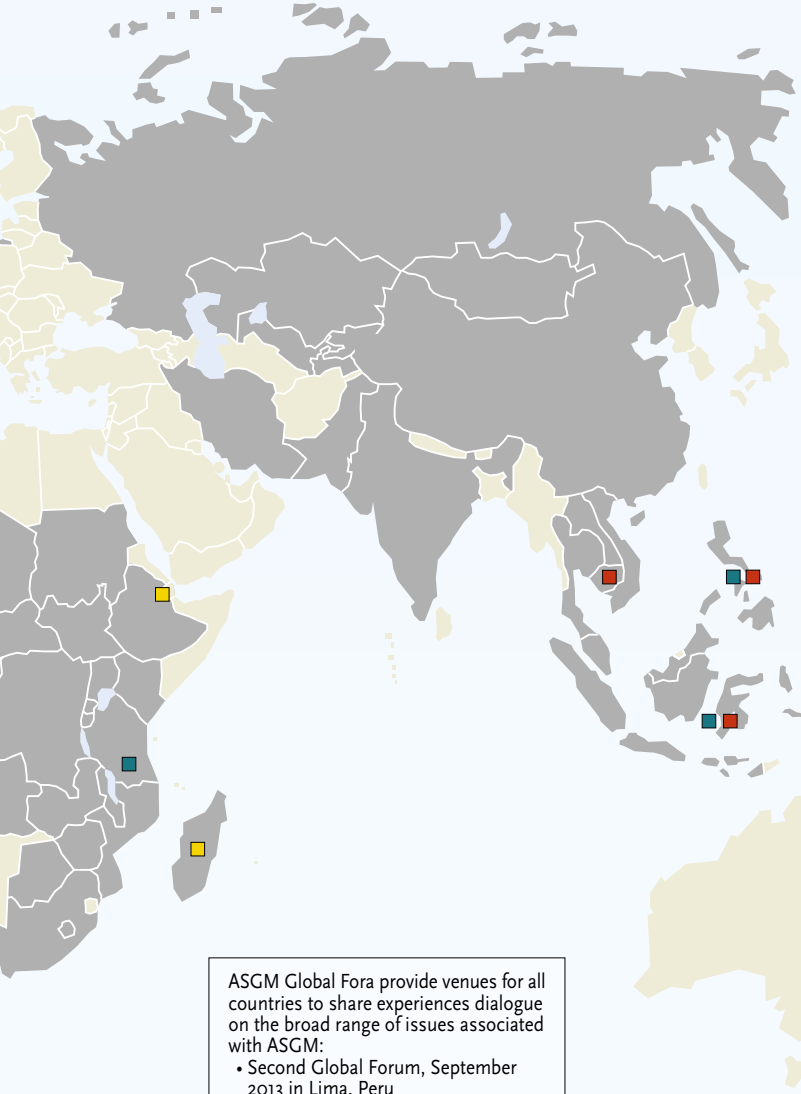
The green gold miners of Oro Verde, Colombia, shown here, employ an environmental way of gold mining that does not use mercury or other chemicals.



Sources: Artisanal Gold Council accessed at www.mercurywatch.org

Key messages

- The source of the largest releases of mercury, estimated at 1400 tonnes per year in 2011
- Whole ore amalgamation is a worst practice that should be stopped
- Cost effective low mercury and mercury-free techniques are available
- The rising price of mercury is encouraging the use of alternative techniques
- Disseminating information and training miners is challenging with 10–15 million miners in more than 70 countries
- Initiatives to reduce mercury use in ASGM need to be integrated with broader development interventions including healthcare, education and formalization



ASGM Global Fora provide venues for all countries to share experiences dialogue on the broad range of issues associated with ASGM:

- Second Global Forum, September 2013 in Lima, Peru
- First Global Forum, December 2010, in Manila, Philippines

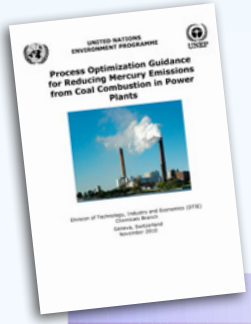
Good practices: *Gravity methods like panning are one of the best and most widely used methods to eliminate mercury use in ASGM (right). Capturing and recycling mercury with fume hoods (bottom left) or retorts (bottom right) can be an effective first step in moving towards mercury-free processing.*

Mercury Control from Coal Combustion

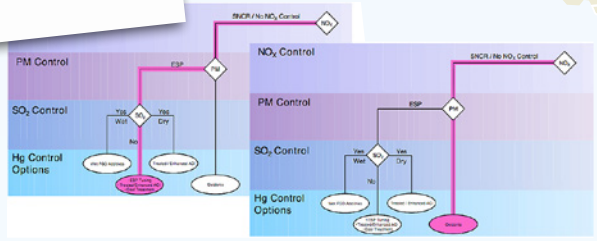
■ **Articles 8, 9, 11, 14, 17, 18, 19 and Annex D**

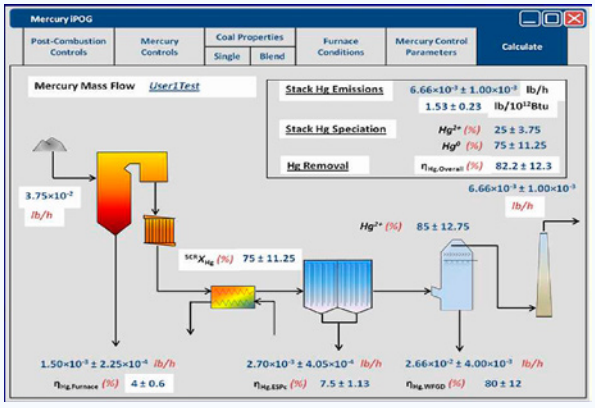
Lead: International Energy Agency Clean Coal Centre

Objective: Reduce mercury releases from coal combustion.

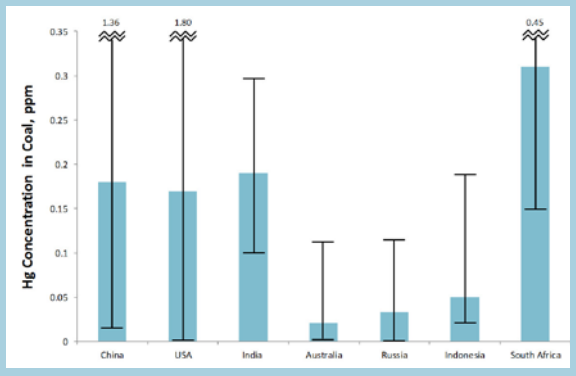


The Process Optimization Guidance (POG) and the Interactive Process Optimization Guidance (iPOG) set out good management practices to reduce mercury emissions from coal combustion by allowing users to identify mercury reduction options.





Mercury content in coals used in power generation



Data by mean – China, US, India, Indonesia. Data by median – Australia, Russia, South Africa. Tops of the blue bar give the mean/ median value. Ranges are given with min and max values.

Source: adapted from pp. 260–268 International Journal of Geology, vol. 77, 2009; Das, T.B. and Mukherjee, A., Mercury Emissions from Three Super Thermal Power Stations of India, 2012; Reducing Mercury Emissions from Coal Combustion in the Energy Sector in South Africa, Final Project Report, UNEP 2011; Reducing Mercury Emissions from Coal Combustion in the Energy Sector of the Russian Federation, UNEP 2011; Reducing Mercury Emissions from Coal Combustion in the Energy Sector, Tsinghua University, Beijing, China, 2011; Mercury in U.S. Coal – Abundance, Distribution, and Modes of Occurrence, U.S. Geological Survey, USGS Fact Sheet FS-095-01, September 2001; Wilson, P., Morrison A., Shah, P., Stezov, V., and Malfroy, H. 2010. Measurements of Mercury Speciation from Combustion of Australian Coals, ACARP Project C16046, 2010.

Coal-fired power plant in Russia.

China is currently developing its own mercury control projects at several plants.

The top 10 countries generating electricity from coal; these countries generate 85% of all electricity generated from coal

Countries supported by the UNEP Global Mercury Partnership area of mercury control from coal combustion

- Demonstration projects reduce mercury emissions by optimizing existing multi-pollutant control systems
- Studies of coal-fired power plant sector including analysis of coal used

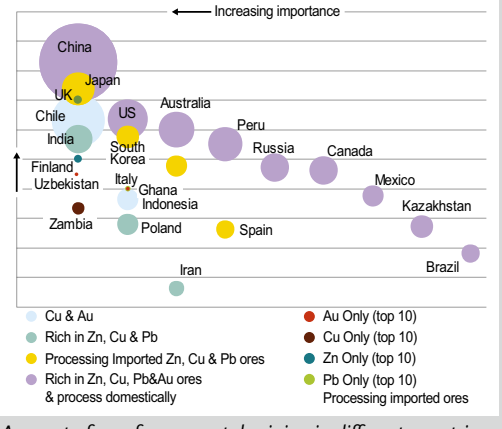
Source: International Energy Agency Clean Coal Centre

! Key messages

- Coal combustion is a major source of anthropogenic emissions of mercury to air. The releases from power plants and industrial boilers represent roughly a quarter of anthropogenic mercury emissions to the atmosphere
- Mercury emissions from power plants could be reduced by up to 95% by improving coal and plant performance and optimizing existing multipollutant control systems

Mercury emissions from non-ferrous metals sector

- 24 countries account for nearly 90% of the global non-ferrous metals production
- Mercury concentration in non-ferrous metal ores varies greatly
- Third largest source of global anthropogenic emissions (15%)
- Largest source of releases to water from point sources
- By-product sulphuric acid is a potential source of re-emission
- A number of effective mercury control technologies exist and are currently used in the non-ferrous industry
- Releases also occur during recycling of scrap metals



Amount of non-ferrous metal mining in different countries.

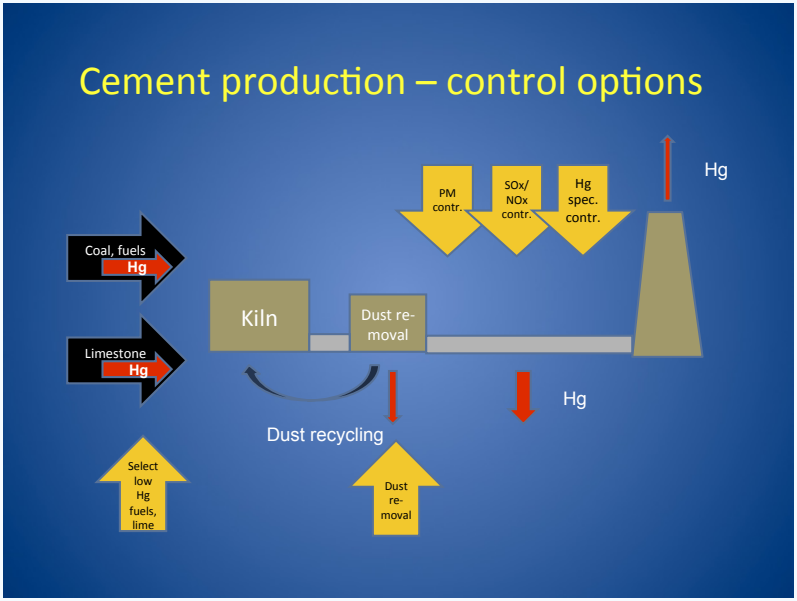
Mercury releases from the Cement Industry

■ **Articles 8, 9, 11, 14, 17, 18, 19 and Annex D**

World Business Council for Sustainable Development
Cement Sustainability Initiative

Lead: World Business Council For Sustainable Development – Cement Sustainability Initiative

Objective: Minimize mercury releases to the environment from cement manufacture

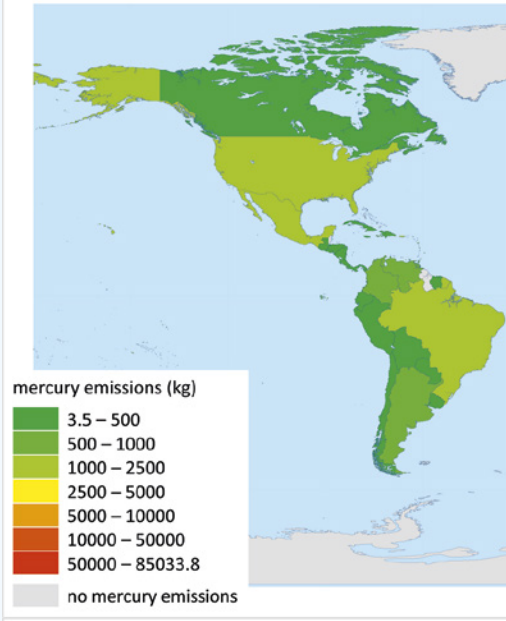


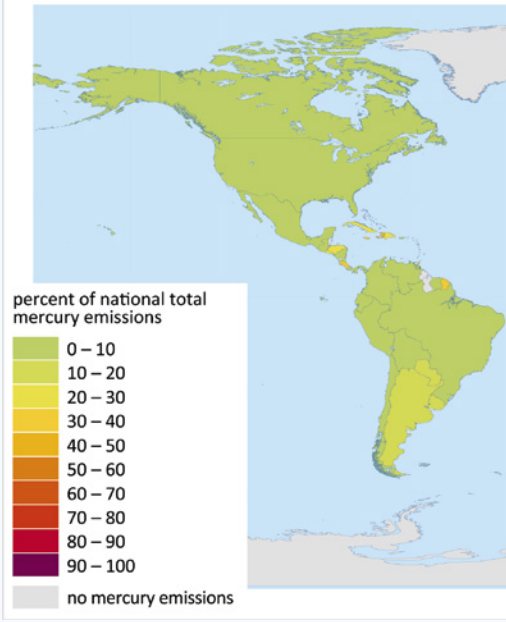
Cement production process. Possible control options:
- *Switching to fuels and raw materials with lower mercury content*
- *Removal of cement kiln dust from stack gases*
- *Various pollution controls of the flue gas: a) particulate (PM) controls (most common), b) sulfur oxides (SOx) and/or nitrogen oxides (NOx) controls, c) mercury specific controls (e.g. activated carbon injection).*

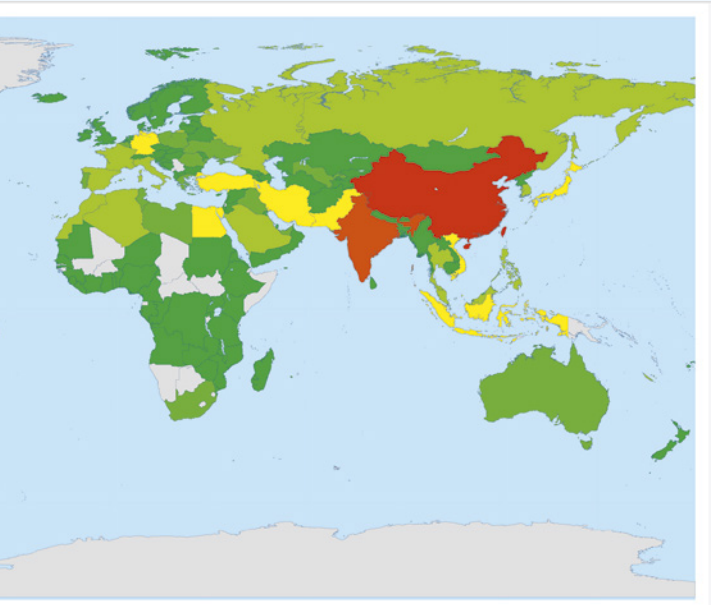
Credit: UNEP, IVL Swedish Environmental Research Institute

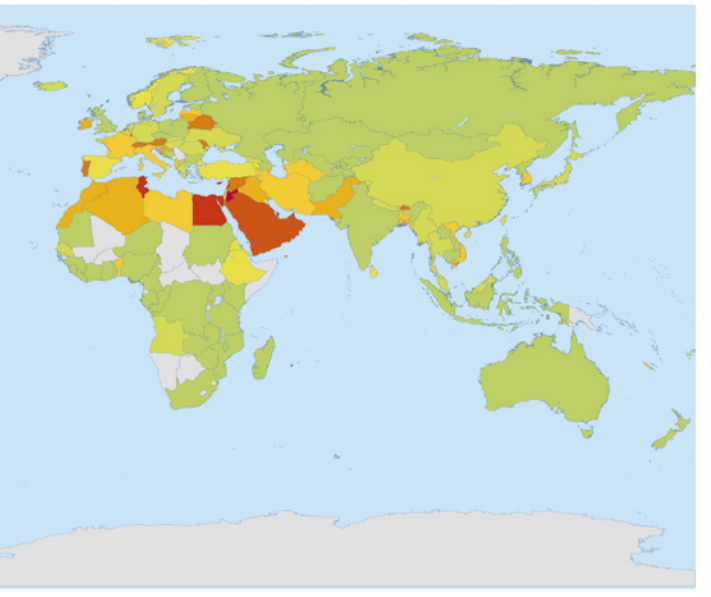
Total emissions from cement production (top) and Mercury emissions from cement manufacture as a proportion of total national mercury emissions (bottom).

Source: UNEP, Arctic Monitoring and Assessment Programme, Frits Steenhuisen.









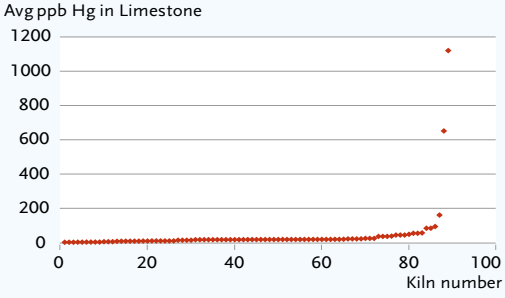
! Key messages

- Mercury in the cement industry originates from three basic sources: the limestone, the fuel, other additives or fuels
- Cement manufacture is estimated to have generated 9% of total anthropogenic emissions of mercury to air in 2010
- The major pathway for mercury releases from cement production is to the air. Mercury may also be released to the soil, in wastes and residues and in the cement product itself

! Priority action

- Establish sectoral mercury inventories and baseline scenarios for the industry
- Encourage use of most appropriate techniques to reduce or minimize mercury releases into the environment.
- Increase the awareness of the cement industry to mercury as a pollutant.

Average Mercury Content of Limestone



Source: adapted from the presentation of United States Environmental Protection Agency, Final Portland Cement Rule 2013, at the UNEP Global Mercury Partnership Cement Partnership launch event, 18 June 2013

The mercury content of limestones used for cement manufacture in the USA shows a strongly log-normal distribution. As a result, a relatively large portion of total national emissions from the sector comes from a relatively small number of plants.

Mercury Waste Management

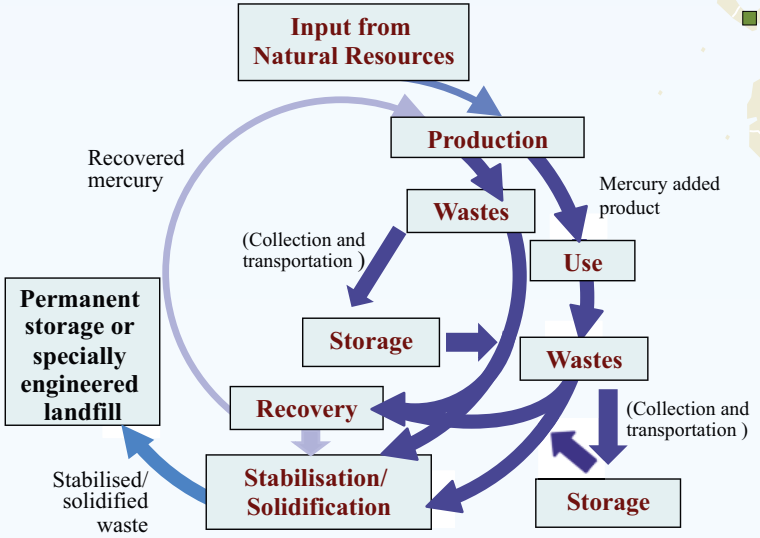
■ **Articles 8, 9, 11, 12, 14, 17, 18, 19 and Annex D**

Lead: Ministry of Environment, Japan

Objective: Reduce mercury releases to air, water, and land from mercury waste by following a lifecycle management approach.

A list of resource persons has been established to facilitate technical assistance to reduce mercury release from waste.

Good Practices for Management of Mercury Releases from Waste, UNEP 2010



*This figure does not cover the flow of waste contaminated with mercury.

Global health care waste project.

Countries supported by the UNEP Global Mercury Partnership area to manage mercury waste

- Managing waste from mercury-containing products in an environmentally sound manner
- Managing waste from health-care sector in an environmentally sound manner – from segregation, collection, treatment and storage
- Developing national action plans for environmentally sound management of mercury from all waste streams
- Assessed the localization and scale of mine tailings contamination and developed national plan for remediation
- Assessed pollution in mercury thermometer plant

! Key messages

- The elimination of mercury in products and processes may be the most efficient way to avoid the presence of mercury in waste
- While mercury is being phased out of products and processes, there is a need for its environmentally sound management as waste

! Priority action

- Identify and disseminate environmentally sound collection, transport, treatment and disposal techniques/practices
- Assess environmental impacts of current waste management practices and processes
- Promote public awareness of the hazards regarding mercury wastes and their management

Partners assisted in the development of the Basel Convention Technical Guidelines for the Environmentally Sound Management of Wastes Consisting of Elemental Mercury and Wastes Containing or Contaminated with Mercury.

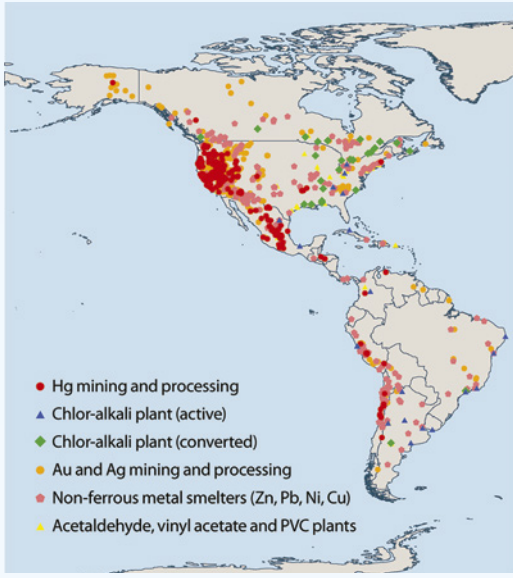
Mercury Air Transport and Fate Research

■ **Articles 8, 9, 11, 12, 14, 17, 18, 19 and 22**

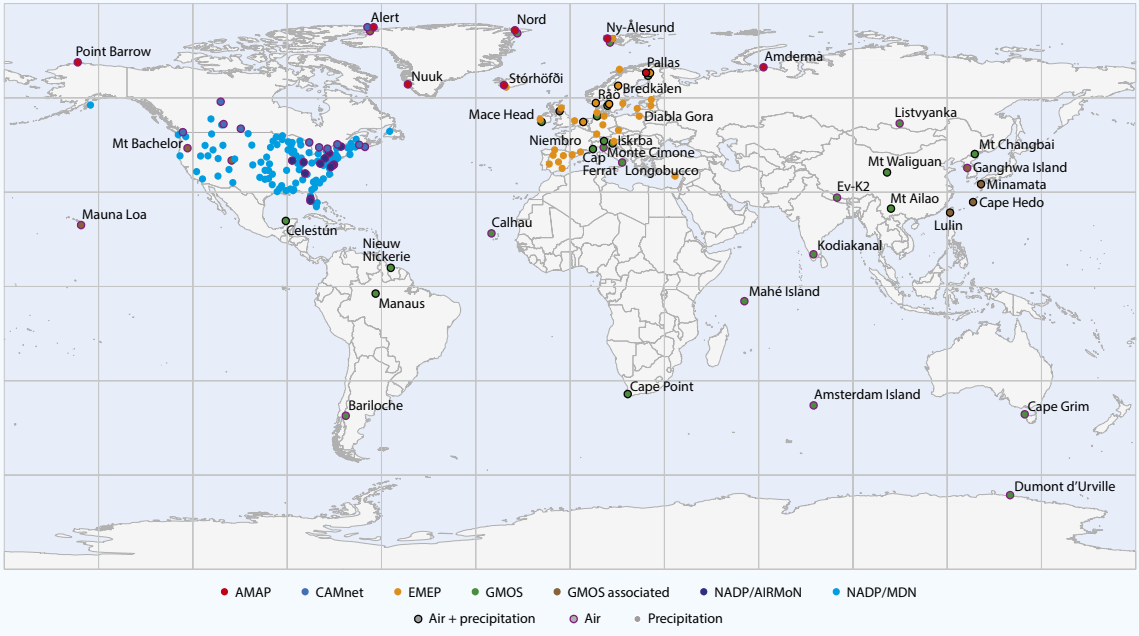
Lead: CNR – National Research Council, Institute of Atmospheric Pollution Research, Italy

Objectives:

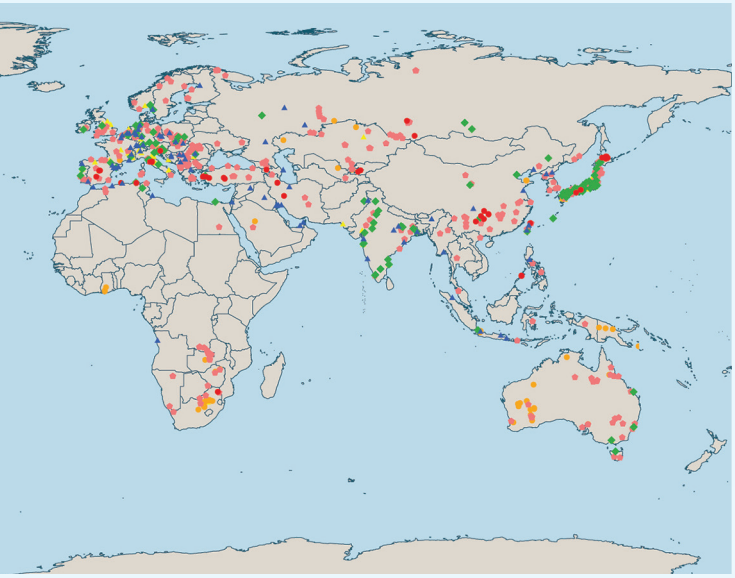
- Increase global understanding of international mercury emissions sources, fate and transport.
- Accelerate the development of sound scientific information to address uncertainties and data gaps in global mercury cycling and its patterns.
- Enhance compilation and sharing of such information among scientists, between scientists and policymakers, with various global stakeholders, and other interested parties.



Source: Global Mercury Assessment 2013: Sources, Emissions, Releases and Environmental Transport, UNEP 2013

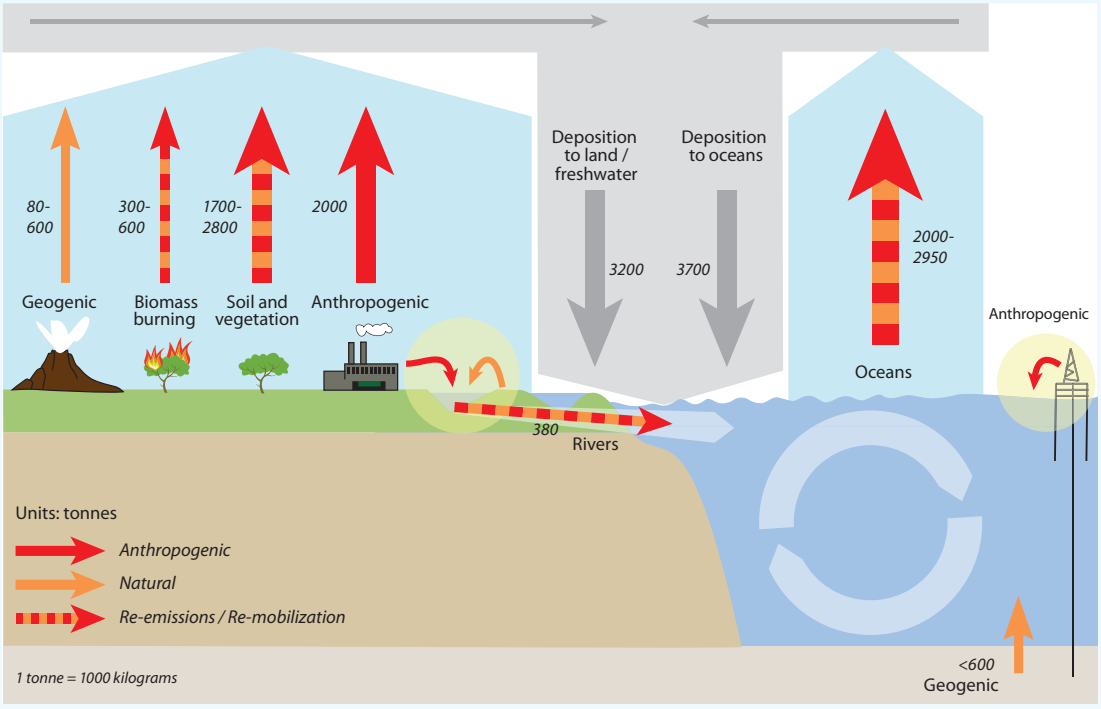


Global Mercury Observation System (GMOS) project builds on existing national and regional monitoring networks to create a coordinated global system for monitoring mercury, including a large network of ground-based monitoring stations. New sites are being installed in regions where few monitoring stations exist, especially in the Southern Hemisphere.



Source: Technical Background Report for the Global Mercury Assessment 2013, UNEP 2013

Compiled for the first time the global distribution of mercury contaminated sites and their mercury releases and emissions to the atmosphere and the aquatic environment, as presented in the 2013 UNEP Global Mercury Assessment.



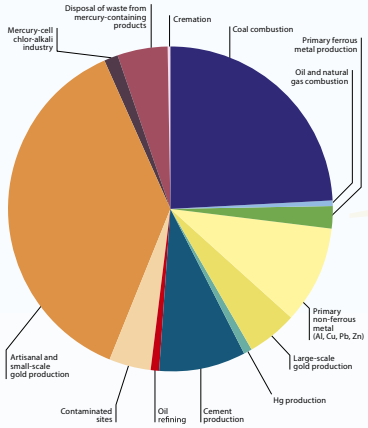
Anthropogenic emissions represent 30 % of total emissions to air, exceeding the natural sources that account for 10 %. The remaining 60 % is from re-emissions, likely to be predominantly of anthropogenic origin.

Global mercury budgets, based on models, illustrate the main environmental compartments and pathways of importance.

Source: Global Mercury Assessment 2013: Sources, Emissions, Releases and Environmental Transport, UNEP 2013

Global Mercury Assessment and National Inventories

Articles 7, 8, 9, 12, 14, 17, 18, 19, 20, 21, 22 and Annexes C and D



Source: Global Mercury Assessment 2013: Sources, Emissions, Releases and Environmental Transport, UNEP 2013

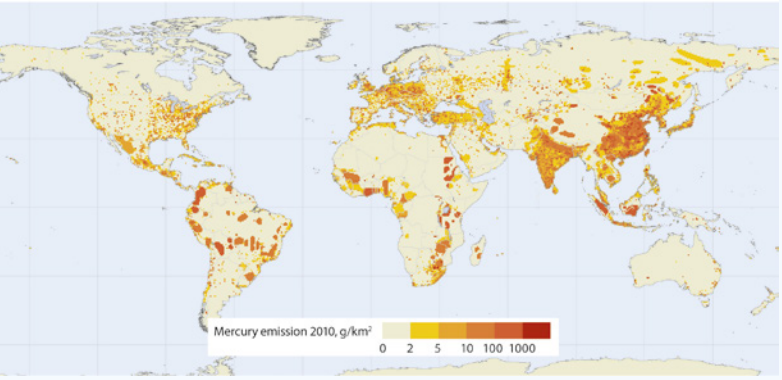
UNEP Global Mercury Assessments provide increasingly robust information on emissions and releases from key sectors and regions.

About half of anthropogenic emissions to air come from industries using raw materials with natural traces of mercury:

- Coal
- Non-ferrous metals
- Cement

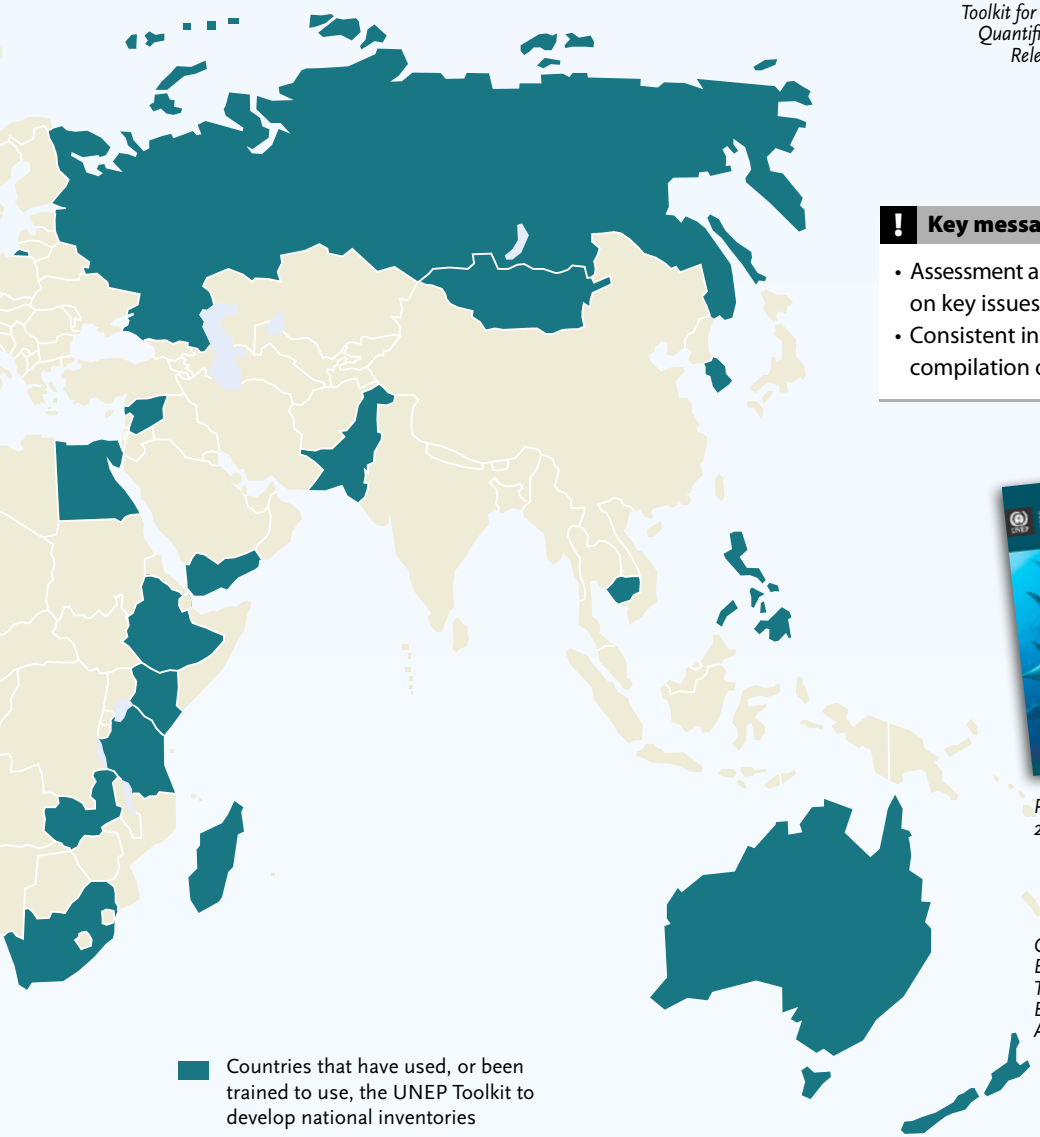
About half of the anthropogenic emissions to air come from:

- Artisanal and small-scale gold mining
- Industries using mercury in processes and products
- Waste disposal of mercury containing products



Global distribution of anthropogenic mercury emissions to air in 2010.

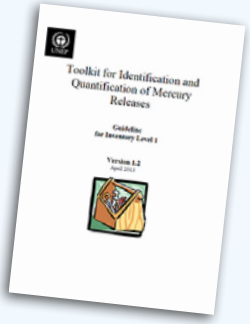
Source: Global Mercury Assessment 2013: Sources, Emissions, Releases and Environmental Transport, UNEP 2013



Countries that have used, or been trained to use, the UNEP Toolkit to develop national inventories

UNEP has developed and deployed tools that enable rapid assessment of the key sources of emissions and releases at the national level.

Toolkit for Identification and Quantification of Mercury Releases, UNEP 2013.



! Key messages

- Assessment and inventories help focus attention on key issues at global and national level
- Consistent inventory information facilitates compilation of needs at the global level

Partners contributed to the development of the 2013 UNEP Global Mercury Assessment by:

- *Providing scientific information and knowledge to the summary report*
- *Developing sections of the technical background report*

Global Mercury Assessment 2013: Sources, Emissions, Releases and Environmental Transport, UNEP 2013 (left) and Technical Background Report for the Global Mercury Assessment 2013, UNEP 2013 (right).

The UNEP Global Mercury Partnership is acting now on the substantive areas of the Minamata Convention on Mercury. This brochure illustrates key issues and how they are being addressed by partners of the UNEP Global Mercury Partnership.

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