
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 action to protect human health and the environment from the release of mercury and its compounds to the environment. 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 overall goal of the UNEP Global Mercury Partnership is to protect human health and the global environment from the release of mercury and its compounds by minimizing and, where feasible, ultimately eliminating global, anthropogenic mercury releases to air, water and land.

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

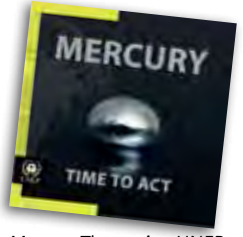
To become a partner, interested entities or individuals should submit a letter to UNEP signifying their support for the UNEP Global Mercury Partnership and their commitment to achieving its goal, and specifying how they will contribute to meeting the goal of the UNEP Global Mercury Partnership.



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

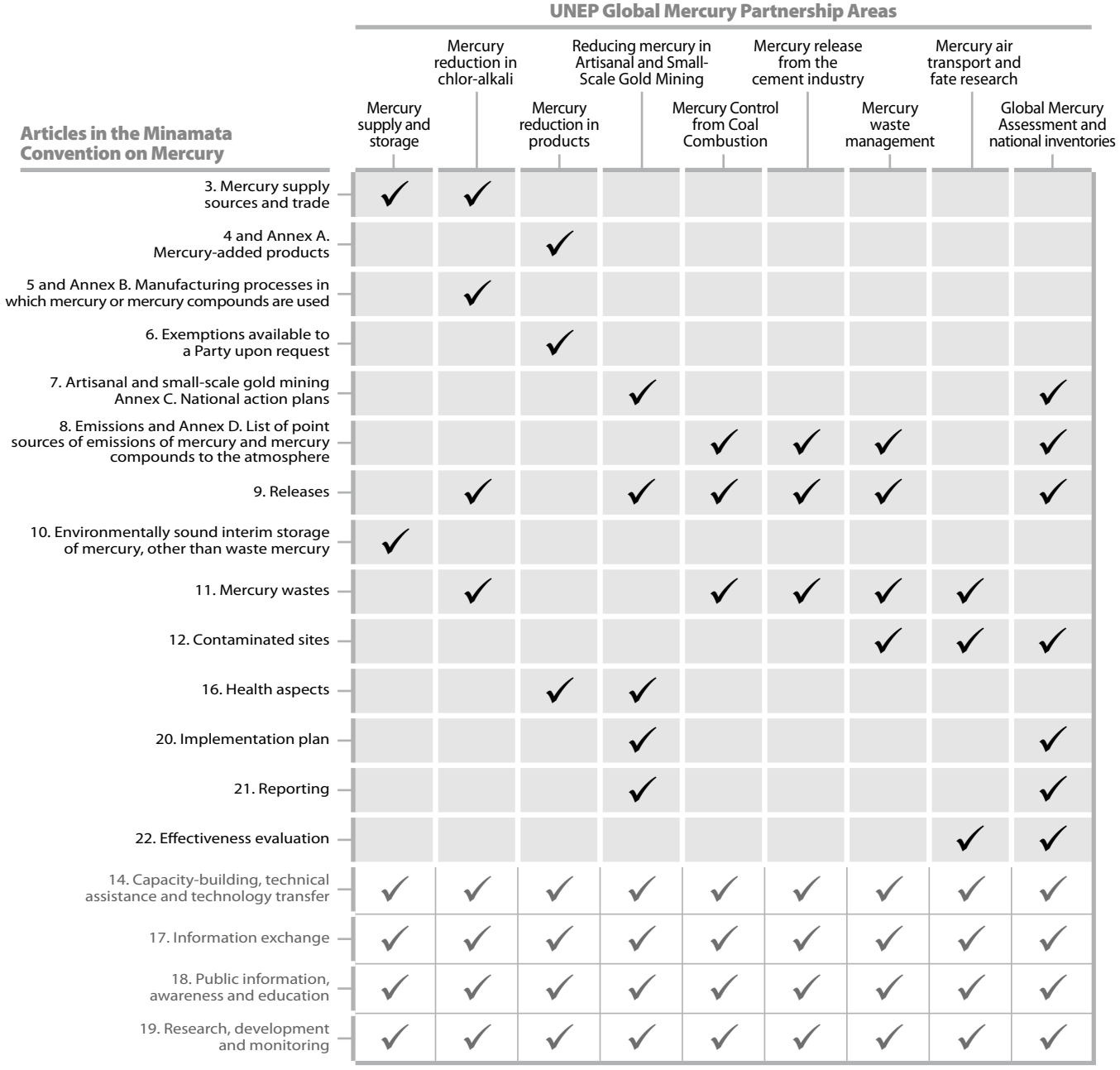
*Study on Mercury Sources and Emissions, and Analysis of Cost and Effectiveness of Control Measures (Paragraph 29 Study), UNEP 2010*

*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**

**! Key messages**

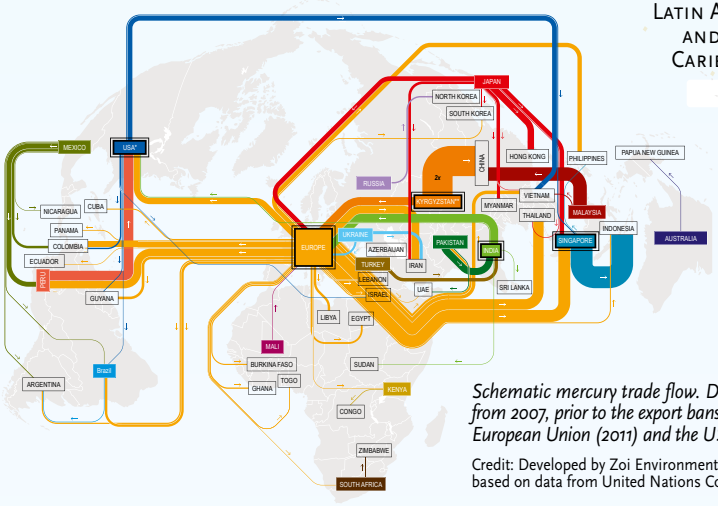
- Mercury is an element that cannot be created nor destroyed
- Excess mercury supply should be stored in an environmentally sound manner and should be prevented from going back to the marketplace

GOBIERNO DE ESPAÑA
MINISTERIO DE AGRICULTURA, ALIMENTACIÓN Y MEDIO AMBIENTE

MVOTMA

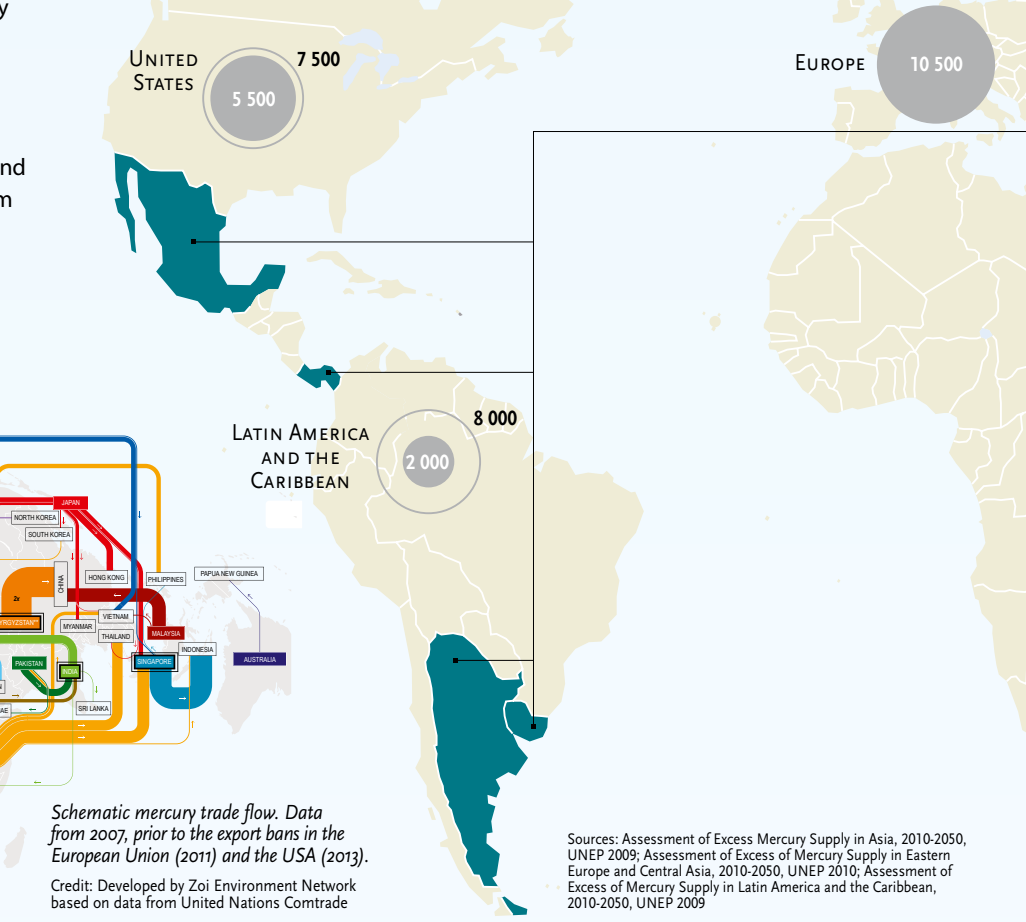
**Leads**: Ministry of Agriculture, Food and Environment, Spain, and Ministry of Housing, Land Planning and Environment, Uruguay

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

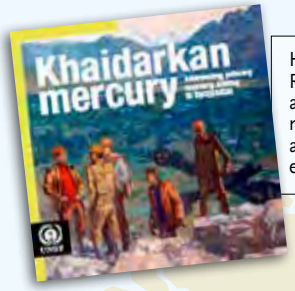



*Schematic mercury trade flow. Data from 2007, prior to the export bans in the European Union (2011) and the USA (2013).*

Credit: Developed by Zoi Environment Network based on data from United Nations Comtrade




Sources: Assessment of Excess 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 of 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.


*Sources of mercury supply.*

*Interim storage facility.*

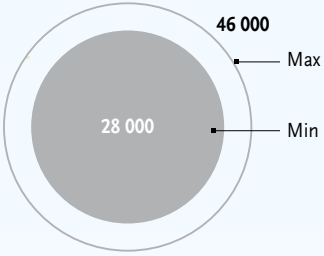

*Underground waste disposal.*


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




**Studies show that supply of mercury will exceed demand in all regions of the world by 2020. By 2050 total excess supply is estimated as:**




All units are in tonnes of mercury

Countries supported by the UNEP Global Mercury Partnership area of Supply and Storage


*Vacuum mixer to form solid mercury sulphide*


*Sulphur polymeric matrix.*


*Black mercury sulphide and paraffin matrix.*

Several stabilization and encapsulation techniques are now available to reduce or eliminate mercury releases by converting elemental mercury into a solid that is less hazardous, potentially resulting 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 an inert matrix. Stabilization and encapsulation techniques are applicable to elemental mercury and to various mercury wastes and result in materials that are technically inert.

# 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:*

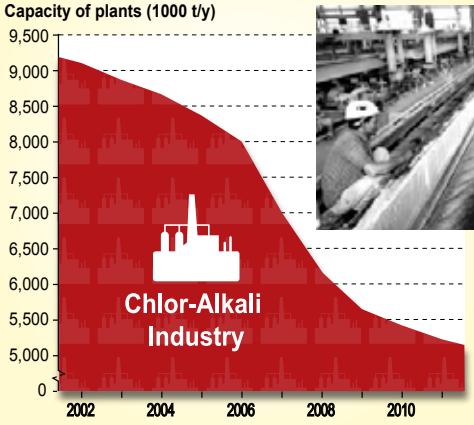
- *Greater energy efficiency*
- *Lower operating costs*
- *Lower environmental impact*
- *High quality product*


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**



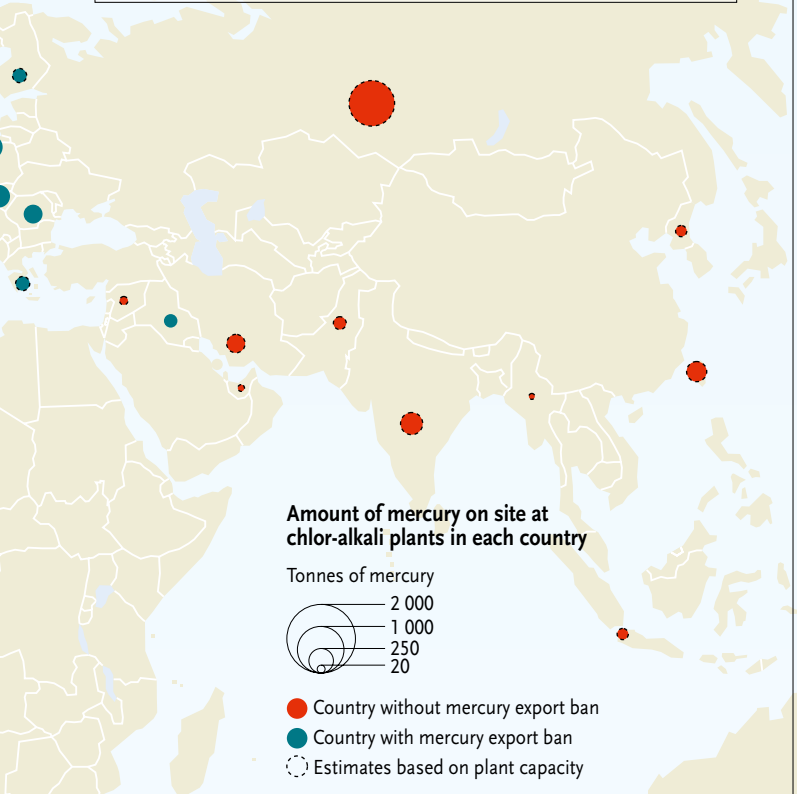

Source: Adapted from WCC Hg reporting to the Chlor-Alkali Partnership, 2012.
Designed by Zoï Environment Network / GRID-Arendal, December 2012.


*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 |
| **2013** | 5136 | 81 |





Total estimated mercury at existing chlor-alkali facilities is 10,456 tonnes in 2012 according to World Chlorine Council. 7507 tonnes will be managed in the EU and US that have export bans in place. The remaining 2948 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 via the acetylene route. The China Council for International Cooperation on Environment and Development estimated that consumption of mercury would be in excess of 1000 tonnes per year by 2012. 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

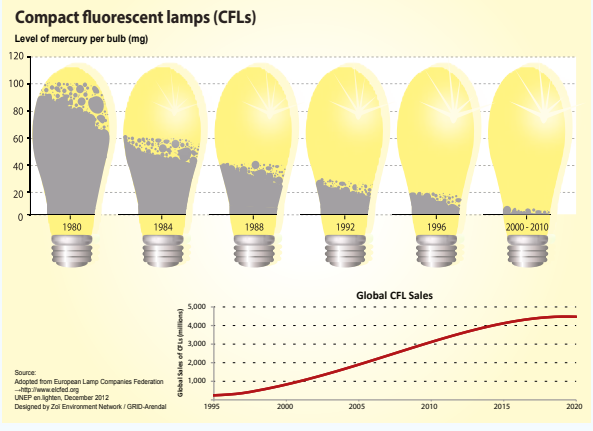
■ **Articles 4, 6, 14, 16, 17, 18, 19 and Annex A**

**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 processes.


*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.

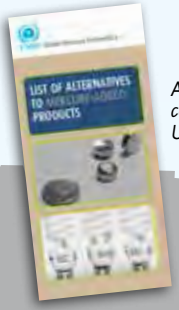



Work in East Africa by UNEP, World Health Organization, the World Dental Federation, dental manufacturers, dental recyclers and national authorities shows that phasing down dental amalgam will require:

- 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

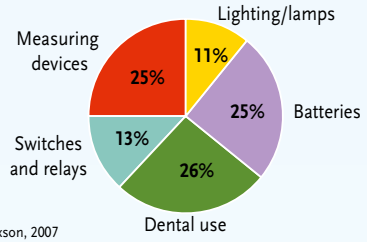



*Alternatives to mercury-containing products, UNEP 2013*

## Key messages

- Reducing mercury in products will 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 will reduce mercury releases from amalgam use
- Sound management should consider all stages of
- a product's life-cycle

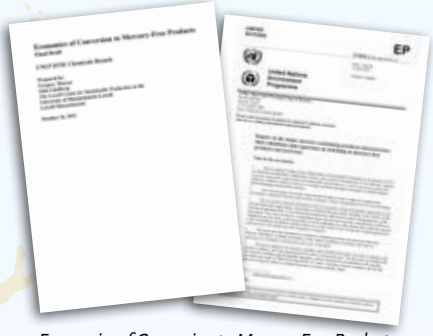
### Consumption of mercury in products




Source: Maxson, 2007

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



*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).*

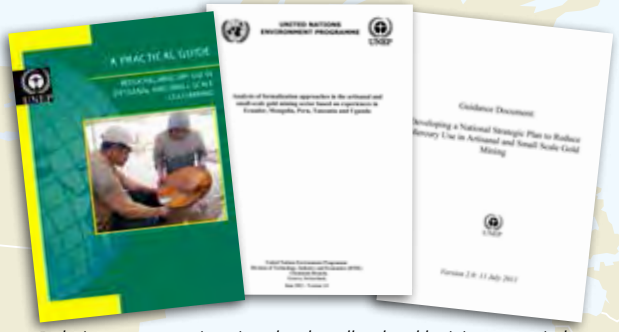
# Reducing Mercury in Artisanal and Small-Scale Gold Mining

■ **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.

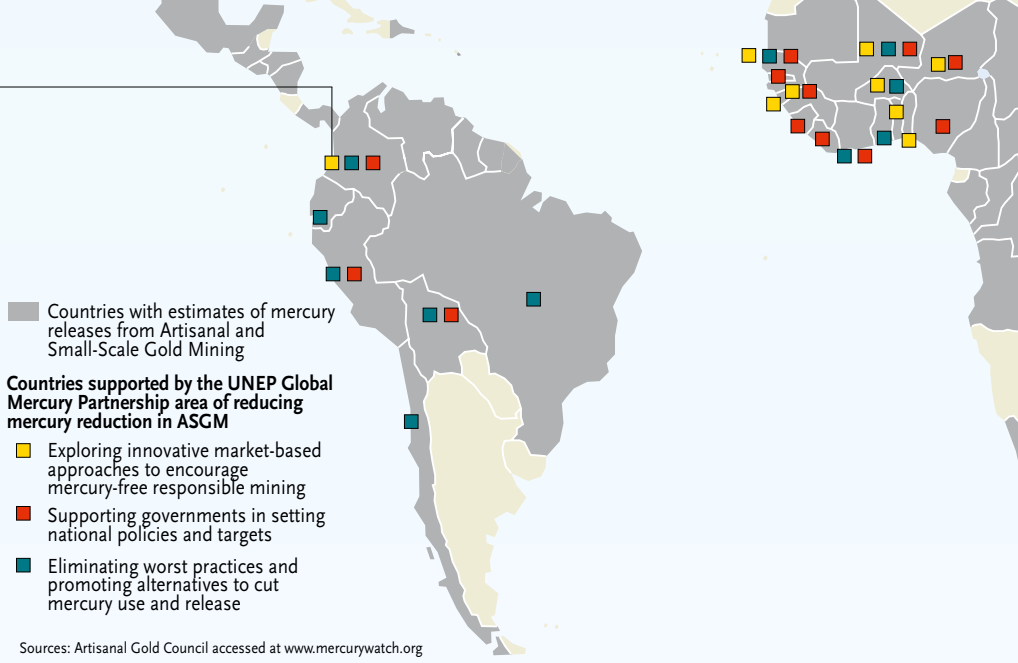
**Leads**: United Nations Industrial Development Organization and Natural Resources Defense Council

**Target**: 50% reduction in mercury demand in ASGM by the year 2017




*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).*

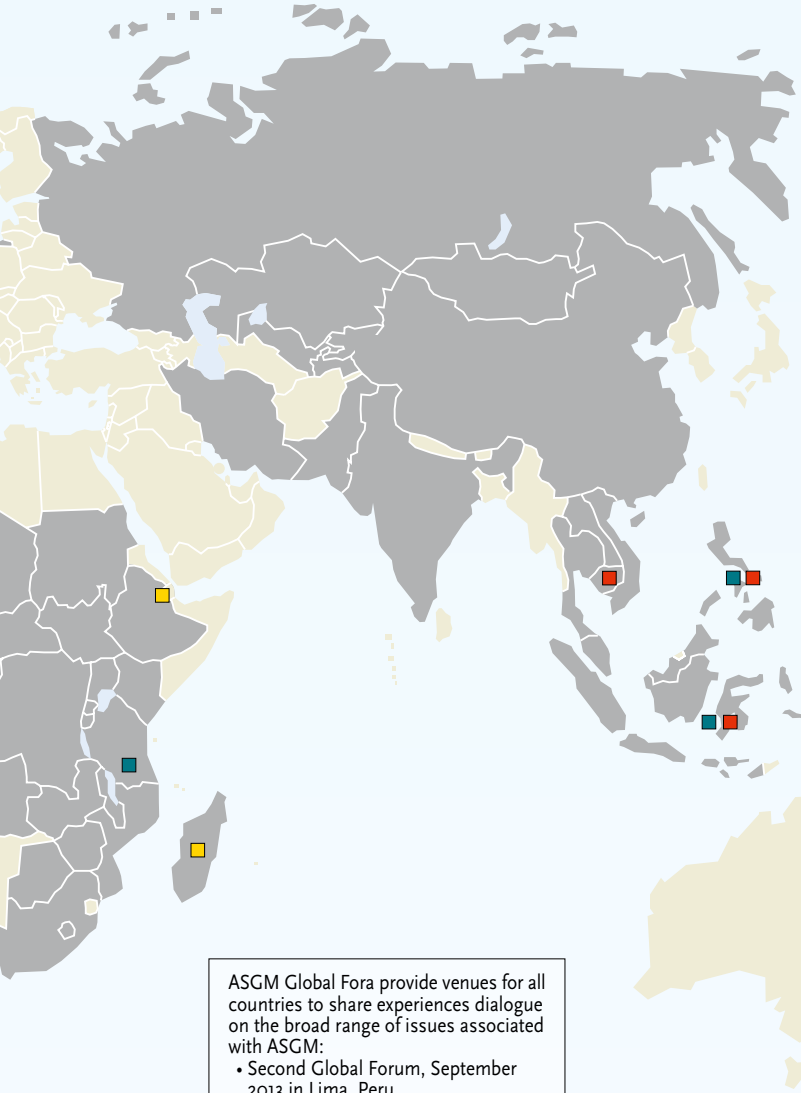
The green gold miners of Oro Verde, Colombia, shown here, employ an environmental way of gold mining that does not use mercury or other chemicals.


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.*



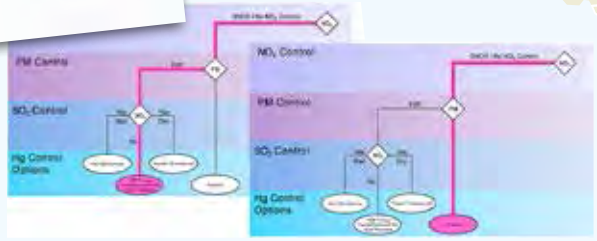
# Mercury Control from Coal Combustion

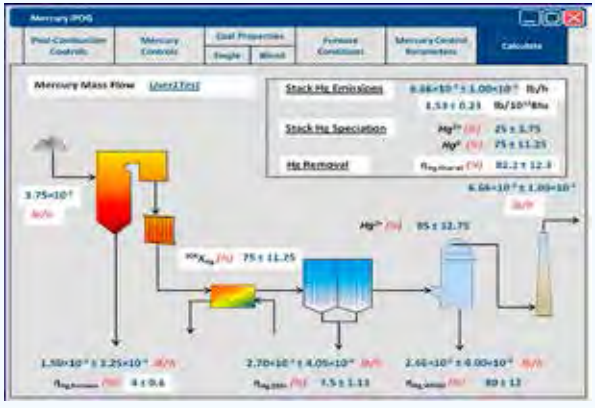
■ **Articles 8, 9, 11, 14, 17, 18, 19 and Annex D**

**Lead**: International Energy Agency Clean Coal Centre

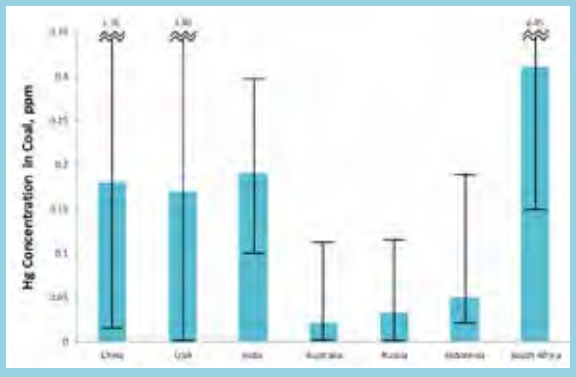
**Objective**: Reduce mercury releases from coal combustion.


*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

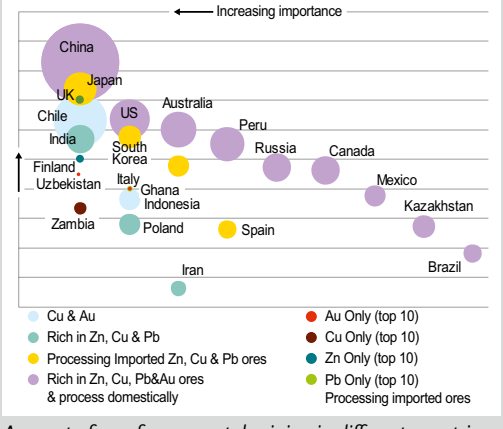
Source: International Energy Agency Clean Coal Centre

## ! 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.*

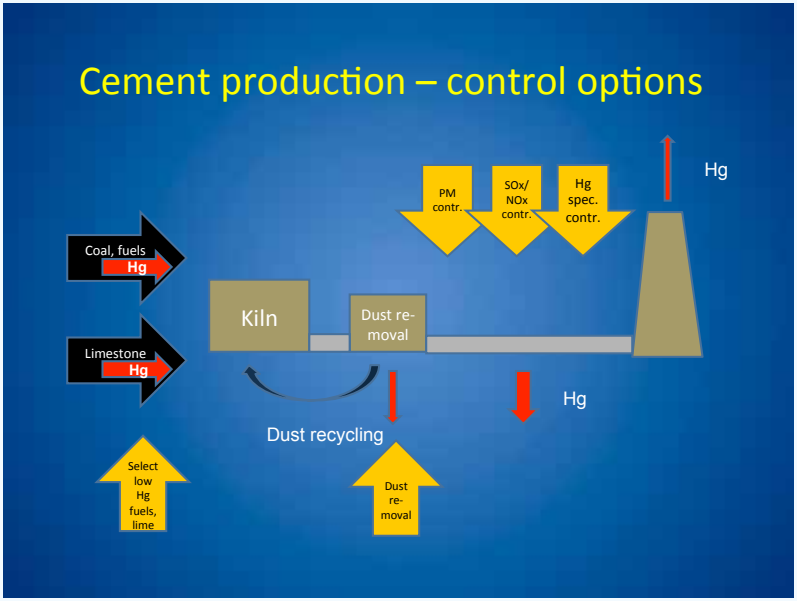
# Mercury releases from the Cement Industry

■ **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

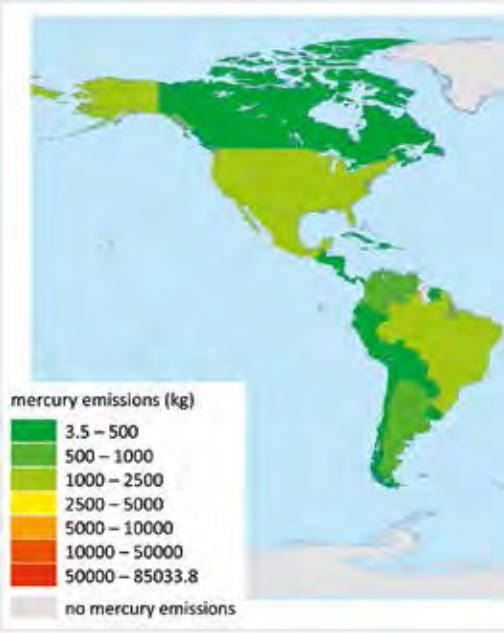


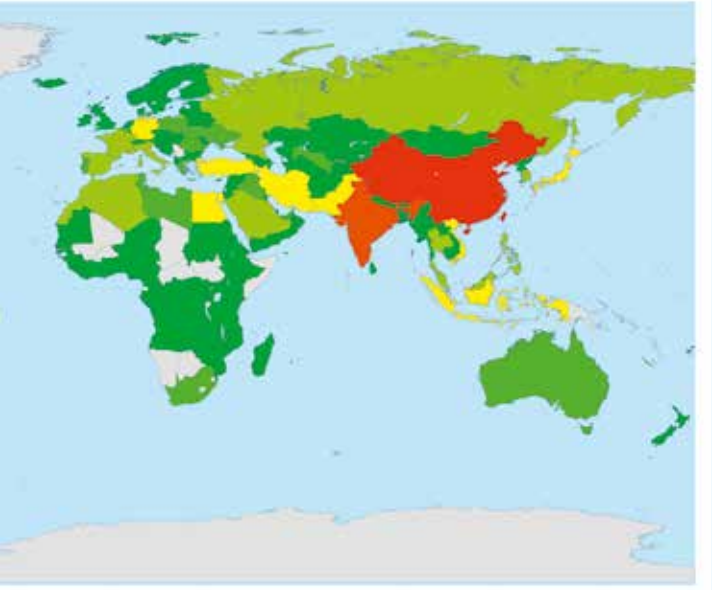

*Cement production process. Possible control options:*
- *Switching to fuels and raw materials with lower mercury content*
- *Removal of cement kiln dust from stack gases*
- *Various pollution controls of the flue gas: a) particulate (PM) controls (most common), b) sulfur oxides (SOx) and/or nitrogen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

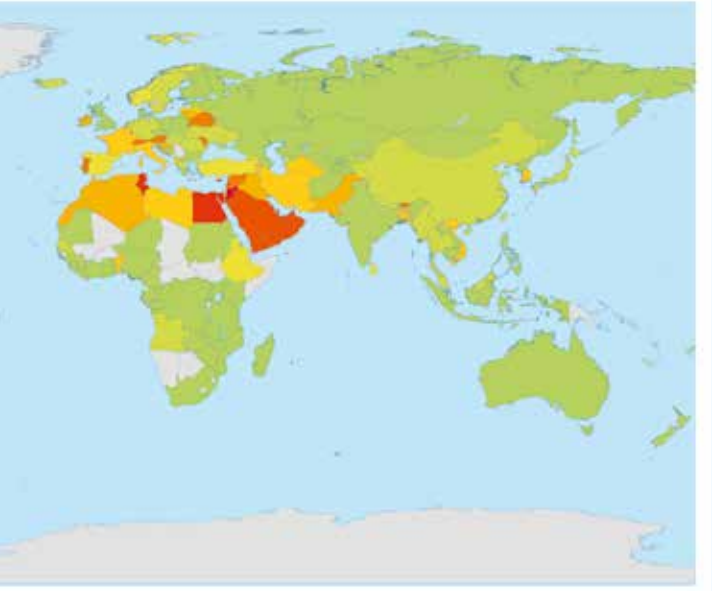
Credit: UNEP, IVL Swedish Environmental Research Institute

*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.





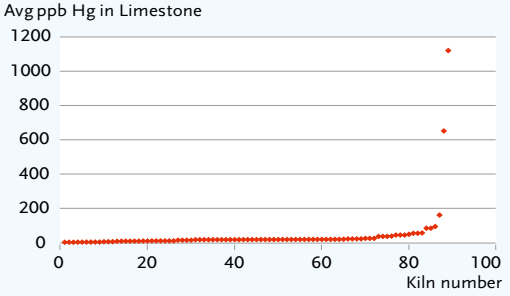
## ! Key messages

- 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**: The Government of Japan

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

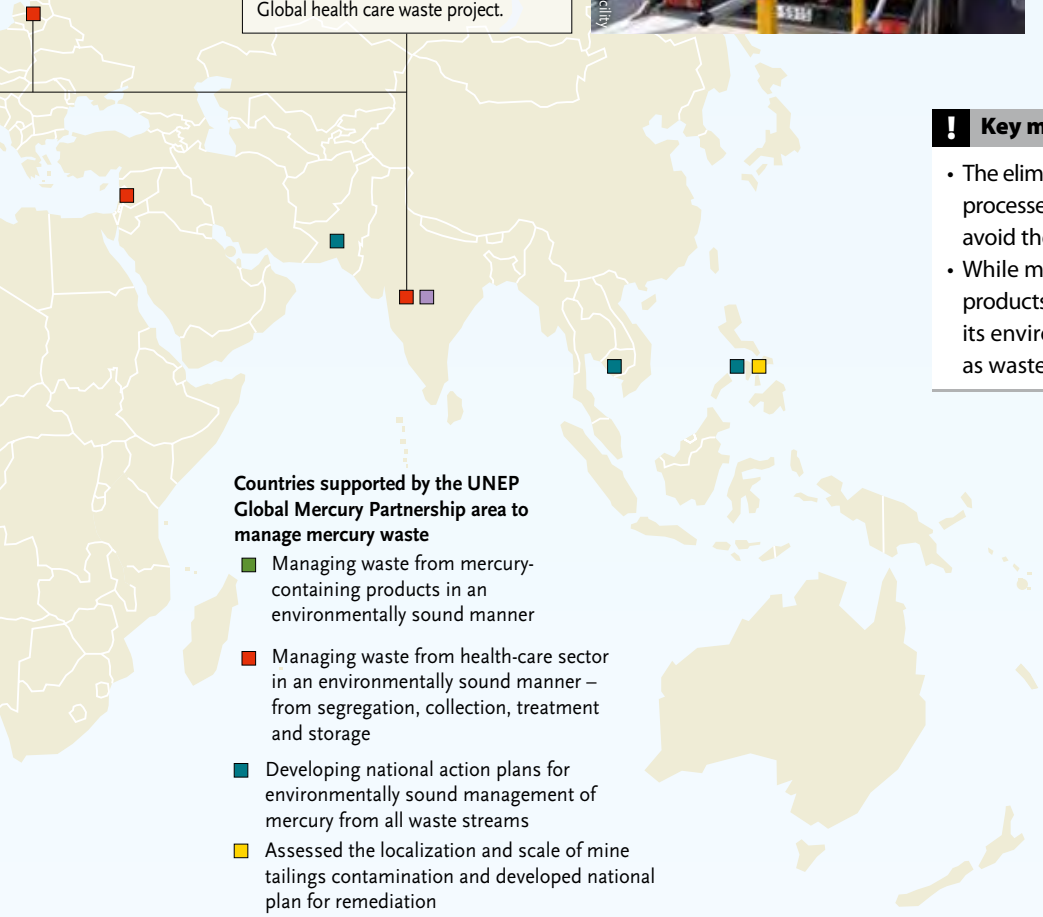
A list of resource persons has been established to facilitate technical assistance to reduce mercury release from waste.

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


*Location of identified tailings in Andacollo, Chile.*



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


*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

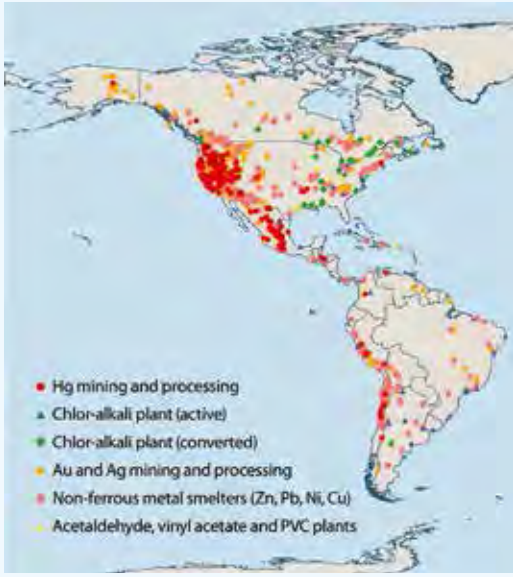
■ **Articles 11, 12, 14, 17, 18, 19 and 22**

Consiglio Nazionale delle Ricerche

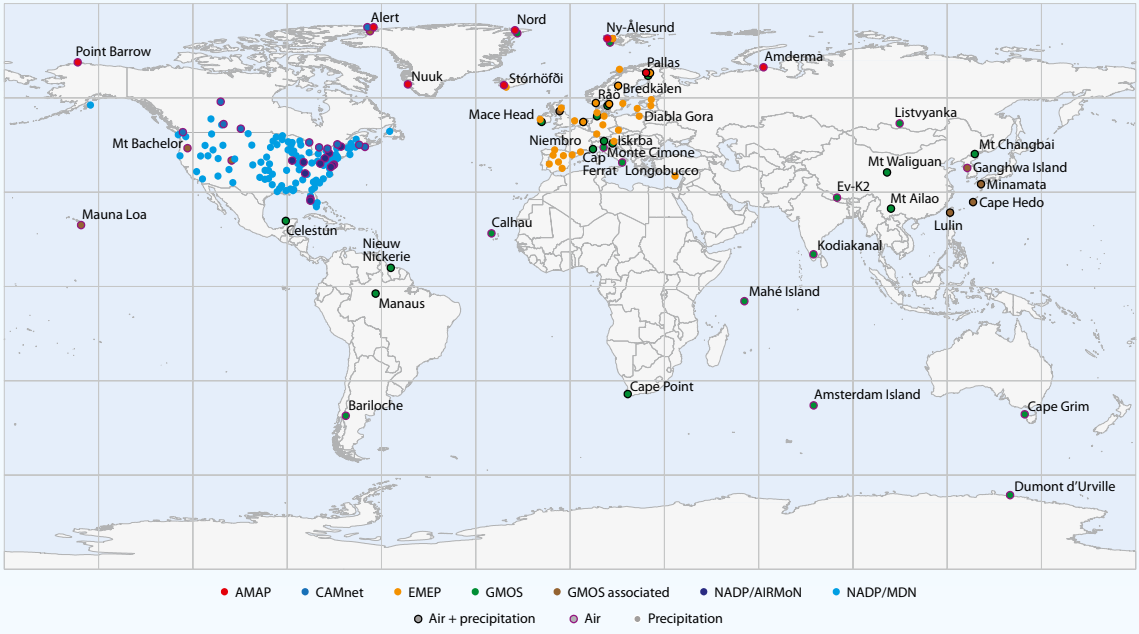
**Lead**: Consiglio Nazionale delle Ricerche – Istituto sull'Inquinamento Atmosferico, Italy

**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.



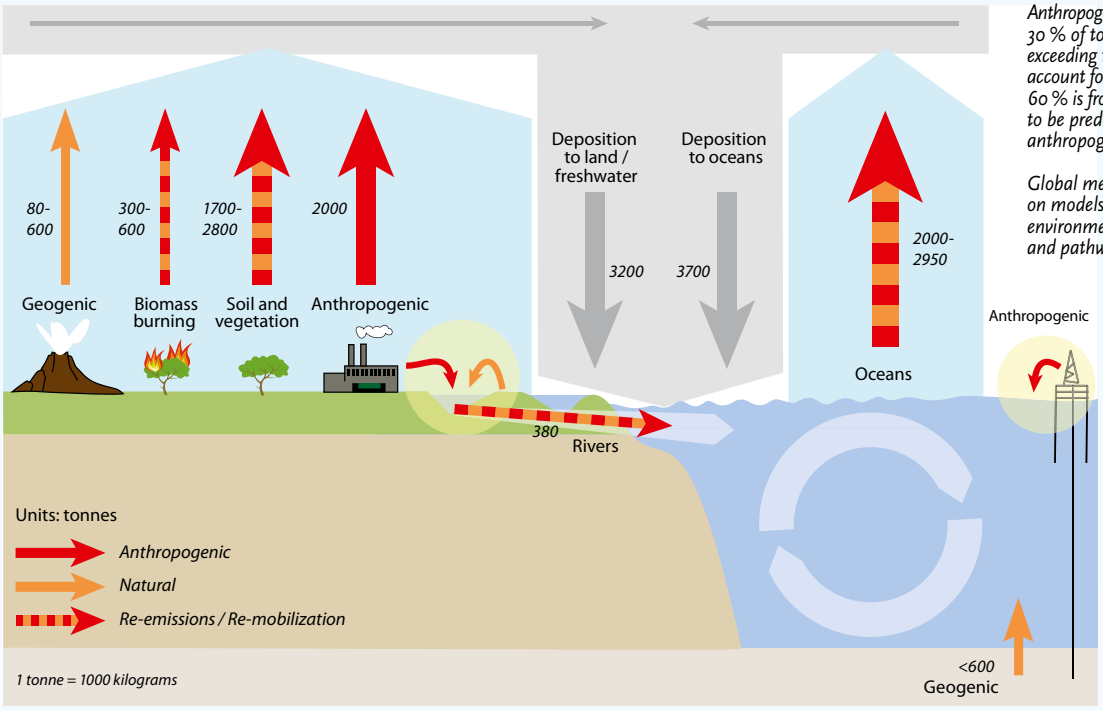

Global Mercury Assessment 2013: Sources, Emissions, Releases and Environmental Transport, UNEP 2013




*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.*

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.*



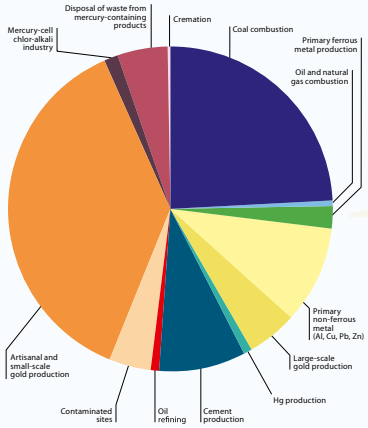

*Anthropogenic emissions represent 30 % of total emissions to air, exceeding the natural sources that account for 10 %. The remaining 60 % is from re-emissions, likely to be predominantly of anthropogenic origin.*

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

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

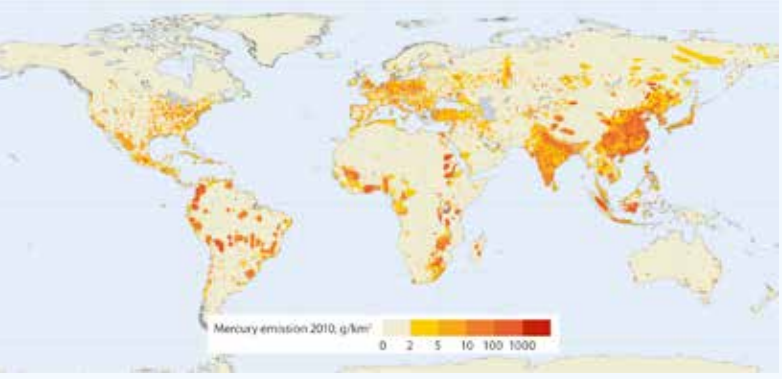
UNEP Global Mercury Assessments provide increasingly robust information on emissions and releases from key sectors and regions.

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

- Coal
- Non-ferrous metals
- Cement

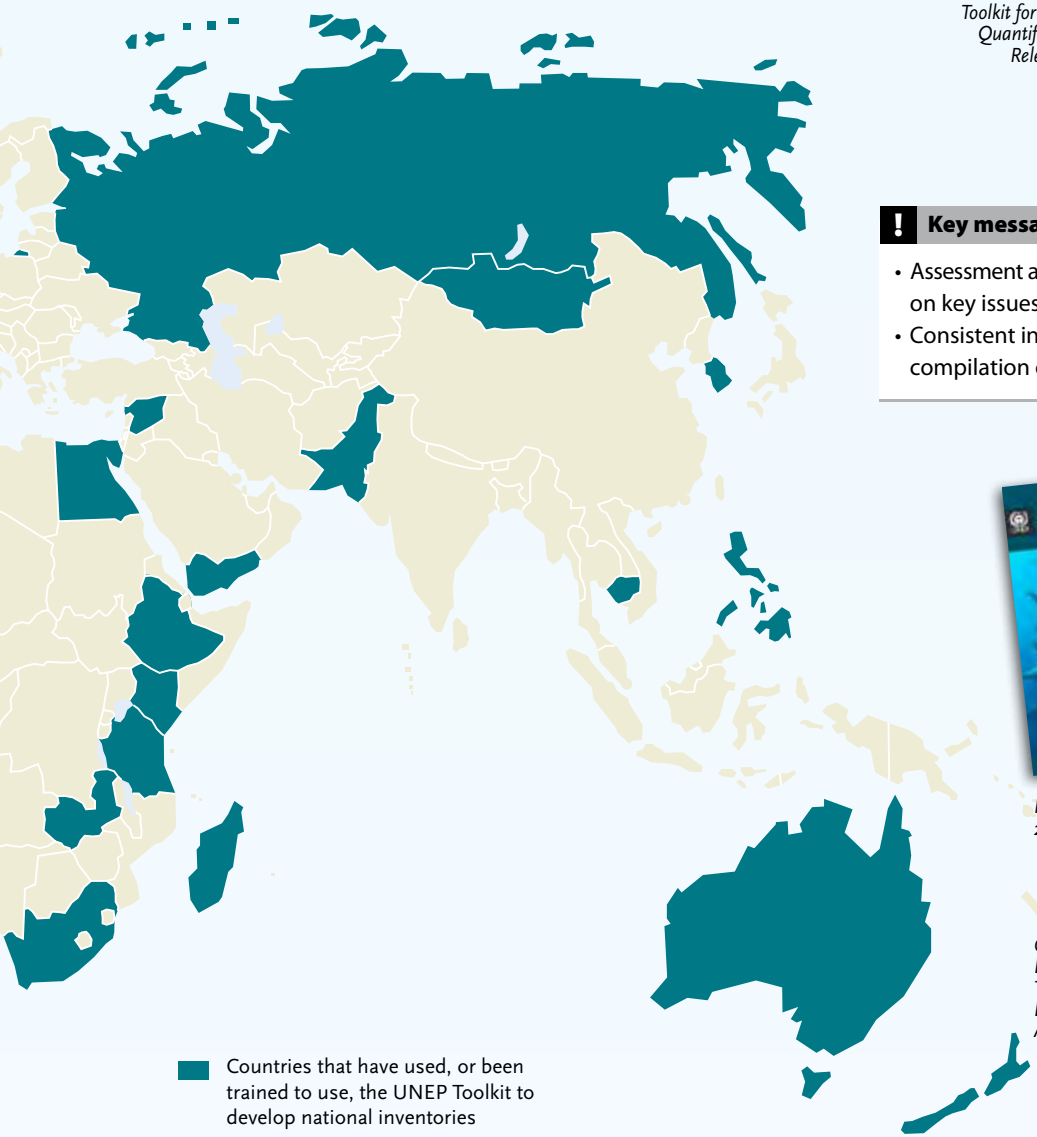
About half of the anthropogenic emissions to air come from:

- 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



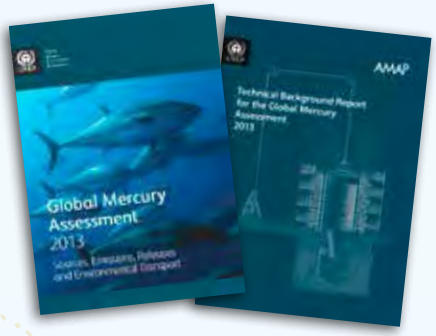
Countries that have used, or been trained to use, the UNEP Toolkit to develop national inventories

*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

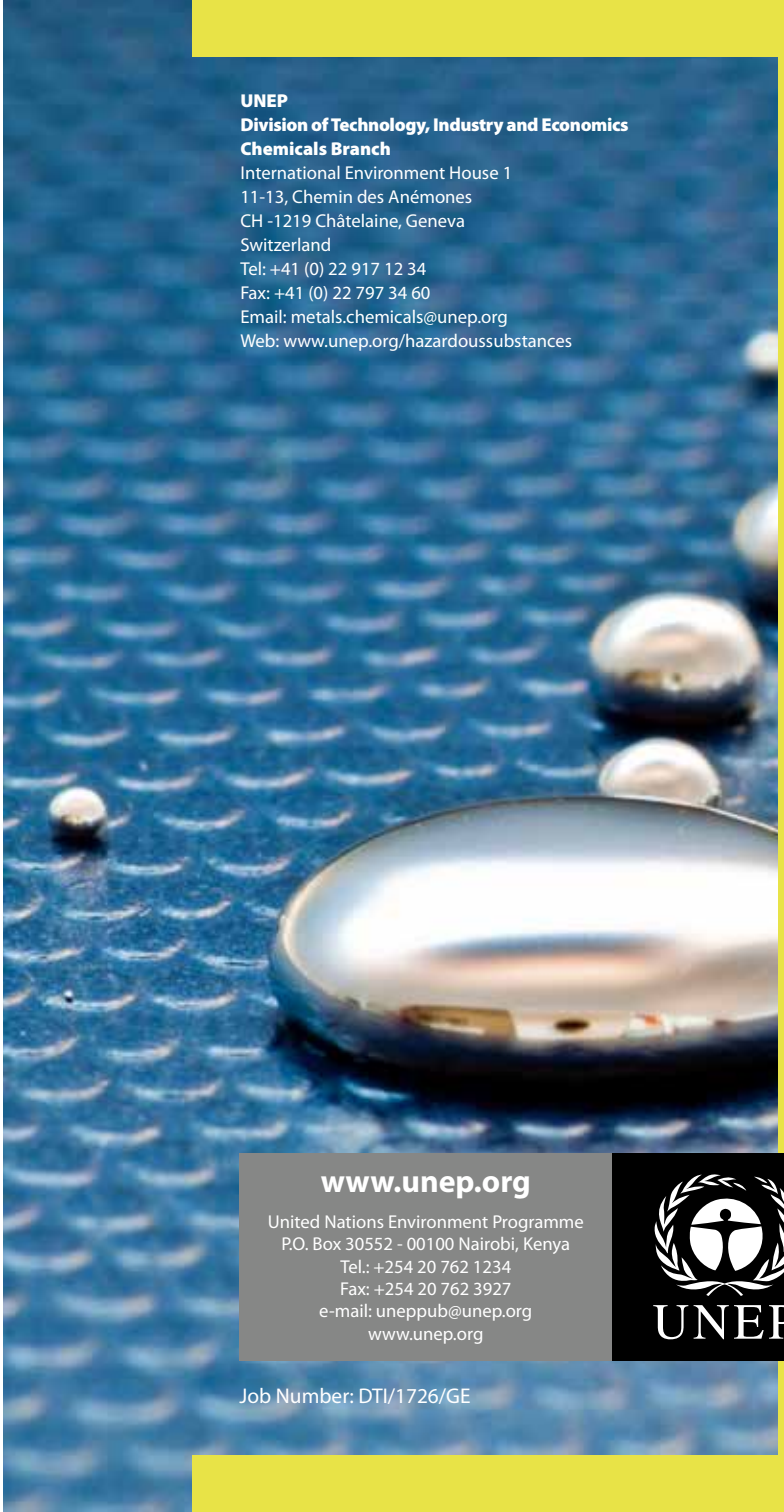



*Partners contributed to the development of the 2013 UNEP Global Mercury Assessment by:*

- *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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