Mercury

Why is Mercury so special?

• Only metal liquid at standard conditions of temperature & pressure

• Used in temperature and pressure measuring equipment

• Forms amalgam with a number of metals

• Used in a number of industrial process and products

• Used in dentistry

• Highly toxic, especially in its organic form
Mercury

Toxicity

• Mercury vapour
  • damages nervous system
  • damages kidneys
  • causes insomnia
  • causes tremors
  • causes depression
  • causes gum disease

• Case: Gold Shop in Vittoria (Brazil)
  • raw gold has mercury left in it
  • artisanal goldshop on 1st floor burns gold to extract mercury
  • vapors of mercury go to the 2nd floor
  • after breeding the vapors for 10 years, 2nd floor resident suffers
  • his nervous system is destroyed

Source: UNIDO GMP
Mercury

Toxicity

- Mercury vapour
  - damages nervous system
  - damages kidneys
  - causes insomnia
  - causes tremors
  - causes depression
  - causes gum disease

Source: UNIDO GMP
Mercury

Toxicity

• Mercury vapour

• Methyl Mercury

  Minamata disease
  • causes severe neurological damages
  • causes ataxia, muscular atrophy, contraction of visual field, speech impairment, tremor, hearing impairment, mental disorder, infertility
  • penetrates the placental barrier causing spontaneous abortion, babies are born with severe neurological symptoms or mental deficiency

Source: http://earthhopenetwork.net/recent_environment_news_9-07.htm and UNIDO
Mercury

Toxicity

- Mercury vapour
- Methyl Mercury
- Liquid Mercury
  - has low toxicity

Mercury

International Response to Mercury
Governments

• removal of mercury thermometers in hospitals
• removal of dental amalgams
• replacement of mercury in industrial processes (chloralkali plants…)
• replacement of mercury in products (batteries…)
• ban of mercury amalgamation in industrial gold mines
Mercury

International Response to Mercury
International Organisations

- International Conference on Mercury as Global Pollutant in Rio de Janeiro in 1999
- UNEP Global Mercury Partnership (2008 – on going)
## Mercury

### Why should we intervene?

<table>
<thead>
<tr>
<th>Natural sources (1,400 t/a)*</th>
<th>Anthropogenic sources (3,000 t/a)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Volcanoes</td>
<td>Intentional Use</td>
</tr>
<tr>
<td>• Forest fires</td>
<td>• Artisanal and small-scale gold mining (1,000 t/a)**</td>
</tr>
<tr>
<td>• Volatilisation from the ocean</td>
<td>• Chloralkali processing</td>
</tr>
<tr>
<td>• Emission from melting icecaps</td>
<td>• Mercury used in products</td>
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<td>Non intentional release</td>
</tr>
<tr>
<td></td>
<td>• Coal Combustion (1,400 t/a)</td>
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<td>• smelting</td>
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* Global Mercury Assessment - 2002 estimates
** UNIDO 2004 estimations
### Mercury

**Where can UNIDO intervene?**

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**Intentional Use**

- Artisanal and small-scale gold mining (1,000t/a)** 1/3<sup>rd</sup>!**
- Chloralkali processing
- Mercury used in products

**Non intentional release**

- Coal Combustion (1,400t/a)
- Smelting
- Waste incineration

* Global Mercury Assessment - 2002 estimates
** UNIDO 2004 estimations
Mercury

Where can UNIDO intervene?

Artisanal and small-scale gold mining (ASM)

- provides livelihood for an estimated 10-15 million people all over the world
- major global source of mercury contamination
- artisanal gold miners:
  - produce an estimated 800 tonnes of gold annually
  - release as much as 1000 tonnes of mercury to the environment annually

* Global Mercury Assessment - 2002 estimates
** UNIDO 2004 estimations
Mercury

Where can UNIDO intervene?

Artisanal and small-scale gold mining (ASM)

• Working with miners, artisans to introduce simple technologies and know how

• Working with governments of developing countries:
  • to improve policy and legislation
  • to protect and formalize sector
  • to target education and health care

* Global Mercury Assessment - 2002 estimates
** UNIDO 2004 estimations
UNIDO’s Global Mercury Project (GMP)

- Target: Artisanal and small-scale gold mining (ASM)
- Countries: Brazil, Indonesia, Lao PDR, Sudan, Tanzania, Zimbabwe
- Pilot Phase 2002-2007 with GEF financing
- Total project cost: US$ 21.3 million
  - (GEF Grant US$ 6.8 mil & Co-finance: US$ 14.5 mil)
- Study areas all located in key trans-boundary river/lake basins
- In these areas ASM involves nearly 2 million people, and supports more than 10 million dependents
- [http://www.globalmercuryproject.org](http://www.globalmercuryproject.org)

* Global Mercury Assessment - 2002 estimates
** UNIDO 2004 estimations
Mercury

Artisanal Gold Mining Problem

*What happens when Mercury gets in the water?*

**Amalgamation of the Whole Ore**

Huge Hg losses, large environmental problem

**Cyanidation of Hg-contaminated tailings**

**Hg<sup>0</sup>**

CH<sub>3</sub>Hg in fish

**Hg<sup>0</sup> vapor**

**lungs**

**Burning Amalgams in Pans**

Health problem for miners, family and neighbors
Mercury

Artisanal Gold Mining

Problems

Tanzania, 2000

Venezuela, 1995

Zimbabwe, 2005

Cambodia, 2006
Mercury

Artisanal Gold Mining

Problem

• Case: Tanzania
  • irresponsible digging to find 1-2 grams of gold is common
  • leads to deforestation & massive destruction of the environment

• Solution:
  • teach methods for mining without degrading the environment
Mercury

Artisanal Gold Mining

Problem

• Case: Zimbabwe
  • mixing dirt with mercury on plated pan
  • creating amalgam
  • this method releases mercury in nearby rivers
  • rivers carry the mercury into fish and other organisms

• Solution
  • teaching know-how to miners in order to avert mercury going into rivers

Zimbabwe, 2005
Mercury

Artisanal Gold Mining

Problem

• Case: Venezuela
  • amalgam is placed in a shovel
  • it is burned to obtain gold
  • this person is in the kitchen of his house!

• Solution:
  • teaching ways to recover mercury with simple utensils, such as a “retort”
Mercury

Artisanal Gold Mining

*Problem*

- Case: Cambodia
  - amalgam burned in a pan
  - children and women are present
  - *vapors are inhaled by all*

*Cambodia, 2006*
Mercury
Artisanal Gold Mining Projects
2nd Phase project with GEF now under planning
Countries: Green (with past UNIDO intervention) Purple (newly added)
Mercury

Chloralkali plants

*Production of chlorine and caustic soda*

- Mercury cells were extensively used in the past

- Only a few sites still use this process

- UNIDO could assist in transferring alternative technologies (recently proposed by our field office in Mexico)
Mercury

Mercury in Products / Waste

- UNEP Global Mercury Partnership areas
- Partnership with Cleaner Production Centres
Mercury

Mercury in Products / Waste
SAICM Quick Start Programme in Uruguay

**Project:** Sound Management for Mercury Products

**Objectives:** Ensure proper management and proper disposal of mercury containing products, in particular lamps

**Proposed outcomes:**
- National sources inventory & quantification of Hg releases
- National Hg lamps assessment, with a life cycle analysis
- Report on life cycle analysis of lightning alternatives
- Guideline of good practices in the management of Hg lamps, with a Cleaner Production approach
- Proposal for a National Plan for the management of Hg lamps
- Document outlining the findings of the regional survey on the management of products containing mercury, in particular mercury lamps
- National and regional publication of the results of the project
Mercury

Outreach - Collaboration

• ILO
  Mining legislation
  Child labour in mining sites
Mercury

Outreach - Collaboration

• ILO

• UNEP

Global Mercury Partnership area on artisanal and small-scale gold mining (Lead = UNIDO)
Global Mercury Partnership area on mercury containing wastes (Lead = Japan)
Global Mercury Partnership area on mercury in products (Lead = USEPA)
SAICM Quickstart Projects in Asia and Latin America
Mercury

Outreach - Collaboration

- ILO
- UNEP
- USEPA

- Fume hoods in gold shops in Brazil
- Awareness raising workshop in Francophone Western Africa
- Project development in Peru
Mercury

Outreach - Collaboration

• ILO
• UNEP
• USEPA
• WHO

Health-related awareness campaigns in the field
Treatment of mercury intoxicated miners
Mercury Outreach - Collaboration

• ILO
• UNEP
• USEPA
• WHO
• Academia (UBC, University of Aachen, University of Montpellier…)

Development of mercury-free gold processing techniques
Mercury

Outreach - Collaboration

- ILO
- UNEP
- USEPA
- WHO
- Academia

- GESAMP Joint Group of Experts and the Scientific Aspects of Marine Environment Protection
Mercury

Conclusions

• In the next few years, mercury trade will be banned by the US and the EU Governments – **UNIDO should assist artisanal gold miners to transfer to alternative technologies before mercury becomes too expensive**

• Artisanal gold mining and mercury-containing wastes are the only sources of mercury for which no reduction of emissions is foreseen – **UNIDO has a major role to play in both sectors**