Exposures to Mercury: Valuable Lessons for Human Health and the Environment

Friday, 8 August 2008, 12:00-14:00
Room 3, International Environment House 1

Mercury (with the chemical symbol of Hg) is a naturally occurring element found in air, water, and soil. It is distributed throughout the environment by both natural and anthropogenic (human) processes. The three primary forms include elemental, inorganic, and organic mercury, with methylmercury being the most important.

Mercury is a toxic, persistent pollutant that biomagnifies through food webs. People are exposed to methylmercury mainly through their diet, especially through the consumption of freshwater and marine fish and consumption of other animals that consume fish (such as marine mammals). People may also be exposed to elemental or inorganic mercury through inhalation of ambient air during occupational activities; and from dental amalgams. Occupational exposures can occur where mercury or mercury compounds are produced, used in processes, or incorporated in products.

UNEP together with WHO is launching a guidance document entitled “Identifying Populations at Risk from Mercury Exposure”. The document is intended to assist countries concerned about the potential national impacts of mercury pollution to identify specific populations or subpopulations that may be at risk. It aims to provide guidance on estimating exposures to mercury through biomonitoring as well as exposures to methylmercury using data on dietary fish intake. It gives an overview of mercury toxicity, exposure pathways, health and environmental impacts, as well as available reference levels. This document is being issued as a joint UNEP/WHO document in cooperation with the FAO. You are cordially invited to listen to an overview of the guidance document.

12:00 Sandwiches/ Video presentation on “Minamata Disease”
12:30 Welcome and introduction
- UNEP Chemicals, Division of Technology, Industry and Economics (DTIE)

Mercury sources of exposure, impact on the environment and health
- UNEP Chemicals, DTIE

Risk management of methylmercury in fish
- Health Security and Environment, WHO

Current Activities of the UNEP Mercury Programme
- UNEP Chemicals, DTIE

13:45 Open forum
14:00 Closing
- UNEP Chemicals, DTIE
Mercury:
What we need to know…

Desiree M. Narvaez
Programme Officer
Mercury and other metals programme
Chemicals Branch, DTIE
UNEP
Mercury (Hg) is a heavy metal

Species:
- Metallic or elemental: Hg°
- Ionic or Inorganic: Hg⁺ and Hg²⁺
- Organic Hg when combined with C
  - Notably methylmercury: MeHg⁺ or CH₃Hg⁺
  - Ethylmercury, Phenylmercury

Source: UNIDO
Natural mercury releases

- Mercury is an element, neither created or destroyed
- Average 0.05 mg/kg in earth’s crust
- Gradual release from crust to atmosphere
- Volcanoes
- Weathering of rock
- Under sea vents
Anthropogenic releases

• Releases from mobilisation of mercury impurities:
  Coal-fired power, Cement production, non-ferrous metals mining

• Releases from intentional extraction and use of mercury:
  primary Hg mining, chlor alkali, small scale gold mining, manufacturing of products

• Releases from Waste Treatment:
  such as incineration/
  waste disposal sites, landfill
## Sources of Global Mercury Supply

<table>
<thead>
<tr>
<th>Sources of mercury supply (2005)</th>
<th>Mercury supply (metric tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary mercury mining</td>
<td>1350-1600</td>
</tr>
<tr>
<td>By-product mercury</td>
<td>450-600</td>
</tr>
<tr>
<td>Recycled mercury from chlor-alkali wastesa)</td>
<td>90-140</td>
</tr>
<tr>
<td>Recycled mercury - otherb)</td>
<td>450-520</td>
</tr>
<tr>
<td>Mercury from chlor-alkali cells (decommissioning)c)</td>
<td>600-800</td>
</tr>
<tr>
<td>Stocksd)</td>
<td>0-200</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3000-3800</strong></td>
</tr>
</tbody>
</table>

Mercury Trade 2004

Figure 4  Commodity mercury shipments among world regions, 2004

Mercury continues to be used…

- Electrical and electronic [150-250]
- Measuring and control [150-250]
- Dental use [240-300]
- Batteries [300-600]
- Lighting [100-150]
- Chlor-alkali production [500-700]
- Small-scale/artisanal gold mining [800-1000]
- Vinyl chloride monomer production [600-800]
- Other [20-60]

* Laboratory, pharmaceutical, cosmetic, cultural/traditional uses, etc.

... and there is a global demand.

Mercury demand by region - 2005 (metric tonnes)

- **European Union (25 countries)**
  - (25 countries)
  - [400-480]

- **East and Southeast Asia**
  - (1,600-1,900]

- **North America**
  - (200-240]

- **South America**
  - (140-200]

- **South Asia**
  - (300-500]

- **CIS and other European countries**
  - (150-230]

- **West and Sub-Saharan Africa**
  - (50-120]

- **Middle Eastern States**
  - (50-100]

- **Central America and the Caribbean**
  - (40-80]

- **North Africa**
  - (30-50]

**TOTAL**
- 3,000 - 3,900 metric tonnes

Source: UNEP Supply, Trade and Demand Information on Mercury. Nov 2006

Uses of mercury

As a metal:

- Extraction of gold/silver (ASM)
- Catalyst for chlor-alkali production
- Manometers for measuring and controlling pressure
- Thermometers
- Electrical and electronic switches
- Backlight of computers
- Fluorescent lamps
- Dental amalgam fillings
Uses of mercury

*As a chemical compound (among others):*

- Batteries
- Biocides in paper industry, pains and on seed grain
- Antiseptics in pharmaceuticals
- Laboratory analyses reactants
- Catalyst
- Pigment and dyes
- Detergents
- Explosives
Global Cycle

- Hg moves through environmental media (air, sediment, water, soil)-undergoes complex transformation

- Atmosphere: Hg vapor circulates up to one year-dispersed and transported thousands of miles from source; oxidized in the atmosphere to water soluble ionic mercury returned to earth in precipitation
Transport of Mercury

- Ultimately enters water bodies and deposits either close to source or long distance from source
- Chemical and physical forms determine their behavior in the environment and pattern of deposition
  - Divalent Hg- water soluble and relatively reactive and likely to deposit within a short distance
  - Elemental Hg-tends to disperse long distance and may not deposit until it has traveled thousands of kilometers
Fate of Mercury

Metabolic conversion, bioaccumulation biomagnification through “food-chain”

- Hg in sediments converts into methylmercury (MeHg)
- MeHg enters the aquatic food chain: fish (marine freshwater), marine mammals
- MeHg uptake by humans through fish consumption
MethylMercury

Organic (Methylmercury)- ingestion (95% absorbed in GIT) of freshwater and marine fish-bound in protein tissue, not in fatty deposits-trimming and skinning of contaminated fish do not reduce Hg
Effects on the Environment and the Ecosystem

- Causes neurological and reproductive effects, particularly in birds and predatory mammals
- High levels seen in seals, whales, polar bears

Source: Hylander 2008
Exposure Pathway and Effects on Humans

Methylmercury from fish and shellfish enters the body, travels through the intestines to the stomach and liver, and is excreted in feces, blood, urine, hair, and nails.
<table>
<thead>
<tr>
<th>Mercury Species</th>
<th>Sources</th>
<th>Routes of exposure</th>
<th>Elimination</th>
<th>Toxicity</th>
</tr>
</thead>
</table>
| **Elemental (metallic)** | • ASM  
• Chlor alkali  
• Non ferrous mining  
• Waste incineration  
• Amalgams  
• Manufacturing of medical devices  
• Folk remedies  
• Cosmetics/soaps | Inhalation, Dermal | Urine and faeces  | CNS  
Kidney  
Lungs  
Skin (Acrodynia in children) |
| **Inorganic (mercuric chloride)** | • Manufacturing and breakage of Lamps, Batteries  
• Disinfectants  
• Cosmetics/soaps  
• Folk medicine | Inhalation, Ingestion, Dermal | Urine  
Ingestion  
Dermal | CNS  
Kidney  
GI tract  
Skin (Acrodynia in children) |
| **Organic (methyl; ethyl)** | • Fish  
• Fungicides  
• Preservatives (vaccines) | Ingestion, Parenteral, Transplacental; inhalation | Faeces | CNS  
Cardiovascular |
Mercury: Toxic Effects

- Neurotoxicity: CNS main target (endpoint in exposure to organic and elemental Hg)
- Nephrotoxicity: kidney (endpoint in exposure to inorganic Hg)
- Teratogenicity: MeHg is a teratogen (Minamata disease)
- CVS: elevated risk of heart attack, hypertension (?)
- Carcinogenicity: MeHg is a possible human carcinogen (Group 2B: IARC)
- Mutagenesis: Hg seems not to be mutagen
- Reproduction: no clear evidence of effect
- Immunotoxicity: under scientific discussion
Mercury: Acrodynia

Uncommon syndrome "Pink disease":
- Pain in the extremities
- Pinkish discoloration and desquamation
- Hypertension
- Sweating
- Insomnia, irritability, apathy

Considered as idiosyncratic reaction.
Source: WHO Children’s Environmental Health
Factors affecting Occurrence and Severity of Health Effects

- Chemical form
- Dose
- Age
- Duration
- Route of exposure
- Dietary patterns of fish and seafood consumption
Susceptible Population

- More sensitive- fetus, newborn, children
  Mothers, pregnant women, women of reproductive age

- Exposed to high levels of Hg-subsistence fishers, recreational anglers, regular eaters of fish, shellfish, muscles and organs from marine mammals

- Individuals with diseases of the liver, kidney, nervous system, lungs

- Individuals with dental amalgams

- Workers with high occupational exposure

- Users of products (soaps, creams, traditional/cultural)
Exposure Assessment: Biomonitoring

• Hair-chronic exposure to methylHg, direct relationship with blood
• Blood
• Cord blood or tissue
• Urine
• Nails
• Human milk

0.1µg/kg/day intake of methylHg =
1 µg/g hair=5-6 µg/li in cord blood=4-5 µg/li blood
Health Assessment: Collection of Hair Samples

Instructions for hair sampling for mercury analysis

A small lock of hair (thickness about a match) from the back of the neck is tied together with a cotton string. The knot is tied about 1 cm from the scalp.

The lock is cut as close to the scalp as possible and placed in a marked paper envelope (not plastic due to problems with static electricity). The hair sample below to the right is ideal, because the hair strands are aligned, and proximal end of the hair is easily identified (the yellow arrow).

The envelopes with hair samples can be stored at room temperature.

Please label the envelope with the following information:
- Project name or number
- Subject name and/or code
- Date of sampling
- Sampling number (if appropriate)

Trace Elements Laboratory
University of Southern Denmark/ Odense University Hospital
April, 2005
# Reference Levels for Methylmercury

<table>
<thead>
<tr>
<th>Country/Organization</th>
<th>Reference Level (µg MeHg/kg bw/week)</th>
<th>Year adopted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada(^5)</td>
<td>1.4 (^6) 7</td>
<td>1997</td>
</tr>
<tr>
<td>Japan(^8)</td>
<td>2.0</td>
<td>2005</td>
</tr>
<tr>
<td>Netherlands(^9)</td>
<td>0.7</td>
<td>2000</td>
</tr>
<tr>
<td>United States(^10)</td>
<td>0.7 (^7)</td>
<td>2001</td>
</tr>
<tr>
<td>JECFA(^11)</td>
<td>1.6</td>
<td>2003</td>
</tr>
</tbody>
</table>

\(^5\) Bureau of Chemical Safety

\(^6\) For pregnant women, women of childbearing age and young children. The reference level for the general population of 3.3 µg MeHg/kg bw was established in 1972.

\(^7\) Originally expressed in terms of µg MeHg/kg bw/day

\(^8\) Food Safety Commission

\(^9\) National Institute for Public Health and the Environment

\(^10\) US Environmental Protection Agency

\(^11\) Joint FAO/WHO Expert Committee on Food Additives
Maximum allowable Hg in Fish to be sold in the market

- Codex Alimentarius: .5 mg methylHg in non predatory fish;
  1 mg methylHg in predatory fish
- USFDA: set an action level of 1 mg methylHg in finfish and shellfish
- EC: allows .5 mg Hg/kg in fish products
- Japan: .3 mg methylHg/kg in fish

Source: FAO
The worst:
Empty head/
Vacant mind

Healthy brain

Brain from a
person with
Minamata disease.

An empty space in a shrinking brain due to necros/small neuron

Lars.Hylander@hyd.UU.SE
Guidance for Identifying Populations at Risk from Mercury Exposure

June 2008

Available at...

http://www.chem.unep.ch/mercury/Populationsatrisk.htm

http://www.chem.unep.ch/mercury/
Risk Management of Mercury in Fish

Dr Gerald G. Moy
Food Safety and Zoonoses Department
Cluster on Health Security and Environment
World Health Organization
Geneva, Switzerland
World Health Organization

- Established in 1948
- Currently 192 Member States
- Headquarters and 6 Regional Offices

- Provides guidance in the field of health
- Strengthens national health programmes
- Develops and transfers appropriate health technology, information and standards
WHO and Food Safety

**WHO Constitution**
Develop, establish and promote international standards with respect to food (1948)

**Milestones**
Toxic hazards of pesticides (1953)
Codex Alimentarius Commission (1963)
WHO Food Safety Programme est. (1978)
Food safety in environmental health and nutrition (UNCED and ICN, both 1992)
Where chemical hazards arise in the food supply

- Vehicle emission
- Agricultural practices
- Landfills
- Industrial emissions and effluents

Where chemical hazards arise in the food supply:
- Crops
- Livestock
- Seafood
- Processing
- Storage
- Distribution
- Retail
- Cooking
- Consumer
Risk Analysis Paradigm

- Risk assessment
- Risk management
- Risk communication
Risk Assessment

- Hazard Identification
- Hazard Characterisation
- Exposure Assessment
- Risk Characterisation
Risk Management

- Risk Evaluation
- Management Option Assessment
- Implementation of Selected Option
- Monitoring and Review
Risk Communication

Risk Management

Hazard Identification

Exposure Assessment

Risk Characterization

Risk Evaluation

Option Assessment

Option Implementation

Monitoring and Review

Consumers, Industry and Other Interest Parties

Risk Assessment

Hazard Characterization

Risk Communication

Consumers, Industry and Other Interest Parties
Risk Assessment and Management at International Level

- Joint FAO/WHO Expert Committee on Food Additives (JECFA)
- Codex Alimentarius Commission
Dietary Intake of Mercury by Adults

Mean Weekly Intake (ug/kg body weight)

*Previous FAO/WHO Provisional Tolerable Weekly Intake for Methylmercury – 3.2 ug/kg body weight

*Median Weekly Intake
Guideline Levels for Methylmercury

- 0.5 mg/kg for non-predatory fish
- 1.0 mg/kg for predatory fish
Dietary Intake of Mercury by Adults

FAO/WHO Provisional Tolerable Weekly Intakes
Methylmercury – 1.6 ug/kg body weight

*Median Weekly Intake

Mean Weekly Intake (ug/kg body weight)
Need for Guidance for Risk Managers

- Focus on fetus
- Consider benefits of fish consumption
- Refine exposure assessment of main target group, i.e. women of childbearing age
- Use tiered approach to promote cost-effectives
- Include consideration of uncertainty
Risk Manager's Guide to Methylmercury in Fish

Hazard Identification

Risk Assessment

STEP 1
Determine the importance of fish in the diet
<table>
<thead>
<tr>
<th>Country or authority</th>
<th>Level in ug/kg bw/week</th>
<th>Year of adoption</th>
</tr>
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<tr>
<td>Canada</td>
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</table>
STEP 1
Determine the importance of fish in the diet

- Low (< 1 meal/week)
  - Perhaps promote fish for the population
  - No further action required

- Average (1 ≤ meals/week ≤ 3)
  - Young children and women of childbearing age
    - Consumption of predatory fish: (< 1 meal/week)
      - No further action required
    - Consumption of predatory fish: (1 ≤ meals/week ≤ 3)
      - STEP 2 Determine Hg levels in composite hair samples
  - Other consumers
    - No further action required

- High (> 3 meals/week)
  - STEP 2 Determine Hg levels in composite hair samples
STEP 2
Determine Hg levels in composite hair samples

Hg in composite hair samples $<< 2 \, \mu g/g$
No further action required

Hg in composite hair samples $\geq 2 \, \mu g/g$
STEP 3
Determine Hg levels in individual hair samples
STEP 3
Determine Hg levels in individual hair samples

Distribution of Hg levels mainly < 2 μg/g, with few individuals over 2 μg/g

No further action required

Distribution of Hg levels mainly < 2 μg/g, but some individuals over 2 μg/g

Risk management judgement

Distribution of Hg levels mainly ≥ 2 μg/g

STEP 4
Refine exposure database
STEP 4
Refine exposure database

Determine fish intake by species, amount and frequency
Determine total Hg in species of fish consumed
Determine consumer body mass

STEP 5
Calculate Hg exposure
STEP 5
Calculate Hg exposure

MeHg intake
< 1.6 μg/kg bw/week*
< 3.2 μg/kg bw/week**

No further action required

MeHg intake
≥ 1.6 μg/kg bw/week*
≥ 3.2 μg/kg bw/week**

STEP 6
Determination of MeHg in composite fish samples

STEP 7
Calculation of MeHg exposure from fish

* Valid for women of childbearing age and young children
** Valid for other adults
STEP 7
Calculation of MeHg exposure from fish

MeHg intake:
< 1.6 μg/kg bw/week*
< 3.2 μg/kg bw/week**

No further action required

MeHg intake:
≥ 1.6 μg/kg bw/week*
≥ 3.2 μg/kg bw/week**

Implement public education

Implement regulatory measures

* Valid for women of childbearing age and young children
** Valid for other adults
Consider regulatory measures to:

- Prohibit sale of fish not in compliance with guideline levels
- Restrict fishing in water where fish are known to be high in Hg
- Implement environmental measures to reduce emissions
Consider public education by promoting:

- Consumption of non-predatory fish species
- Consumption of fish species of smaller size
- Reduction of fish intake among high consumers
Acknowledgements

Dr Edenise Garcia

Ms Melissa Legrand

Ms Jennifer Murcott
MERCURY : A Global Approach

UNEP’s mercury initiative

Sheila Logan
Coordinator
Mercury and other metals programme
Overview of Presentation

- Overview and Context of the UNEP Mercury Programme
- Political Process
- UNEP Global Mercury Partnership
- Air Emissions Report
The problem with mercury – the global assessment

- Initiated by UNEP GC in 2001;
- Concerns that national/regional actions were not sufficient
Key Findings of the Global Mercury Assessment …

- Hg is persistent and cycles globally – emissions in any continent can contribute to deposition in others thus an international issue.

- Due to long-range transport, even nations with minimal Hg releases, and other areas remote from industrial activity, may be adversely affected.

- Sufficient evidence of significant global adverse impacts from mercury to warrant further international action.
Mandates for Mercury Work

- 2001: global assessment of mercury
- 2003: national, regional and global actions, to be initiated ASAP
- 2005: call for partnerships between Governments, IGOs, NGOs and private sector to reduce risks from mercury
- 2007: Recognition that efforts were inadequate
Mandates for Mercury Work

2007: UNEP’s Governing Council:

- Concluded that further long-term international action is required; and
- Decided to review the options of enhanced voluntary measures and new or existing legally binding instruments
- Strengthened the role of partnerships
Overarching objective for the UNEP mercury programme

- 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.
UNEP Mercury Programme focused in three main areas

1. Open ended working group process
   - POLITICAL

2. Mercury partnership programme
   - PLATFORM FOR ACTIONS

3. Development of reports
   - BASIS FOR DECISION-MAKING
1. Open Ended Working Group

- Established in 2007 to review and assess options for enhanced voluntary measures and new or existing international legal instruments.
- Final meeting from 6-10 October 2008, Nairobi.

- Possible final recommendations to address mercury include:
  - Utilization of relevant elements of existing instruments (both legally binding and voluntary)
  - Drafting new protocols or procedures for inclusion in existing instruments
  - Negotiation of a “stand-alone” agreement (could be legally binding and/or voluntary).
2. UNEP Global Mercury Partnership

- UNEP was mandated to strengthen to the Partnership programme through:
  
  - Developing an overarching framework for the UNEP Global Mercury Partnership (developed and to be presented to the Governing Council in February 2009).
  
  - Development of business plans, identify partnership objectives for individual partnership areas.
  
  - Strengthening actions.
What is the role of a partner…?

- Supports the overall goal of protecting 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.

- Commits to contribute resources or expertise towards the development and implementation of partnership activities.

- Networks with other organizations/agencies/individuals.
Mercury partnership activities currently underway

- artisanal/small-scale gold mining;
- coal combustion;
- chlor-alkali sector;
- reduction in products
  - batteries, dental amalgams, measuring and control (largely medical sector), electric and electronic switches, fluorescent lamps, cosmetics; and
- air transport and fate research.
- waste combustion
New partnership areas proposed by Governing Council Decision

- vinyl chloride monomer production
- non-ferrous metals mining
- cement production
- supply and storage
UNIDO has developed ground level expertise in this area:

- wrapping up a pilot project in 6 countries (Brazil, Lao PDR, Indonesia, Sudan, Tanzania and Zimbabwe)
- looking to broaden and build on the pilot project;
- Currently fundraising and organising Phase II of the project

UNEP is organising regional projects within the partnership with SAICM QSP in Asia and Latin America
Coal fired power & heat production

- **Current Priority actions**
  - Encourage use of BAT/BEP to reduce or eliminate mercury releases into the environment.
  
  - Assist countries in evaluating environmental impacts of coal combustion and evaluating the opportunities to achieve multi-pollutant emission reductions.
  
  - Support the development and/or improvement of mercury emission inventories to evaluate both mercury emissions and the effectiveness of emission reduction approaches.
  
  - Increase the awareness of mercury as a pollutant of concern through increased outreach efforts and collaboration with complementary programmes (such as at UNFCC level).
On-going and Planned Activities

- Arctic Council Action Plan (ACAP) has been working closely with Russia’s Volgograd Caustic:
  - UNEP working with ACAP to see if pilot project can be used to demonstrate more broadly planning and changeover process

- World Chlorine Council working to catalogue facilities using mercury-cell technology and collecting information on use and emissions from its facilities;

- UNEP surveying existing chlor-alkali plants to update use and release information
Mercury in products

- Mercury in products awareness workshops
- Health care sector- hospital projects in Mexico, China, Argentina, South Africa
- Schools project- Philippines
- Waste management guidelines;
- Arctic Council Action Plan (ACAP) mercury project ‘Collection, storage and treatment of mercury containing waste in Russia Demonstration Project’;
- Linkages within DTIE Sustainable Consumption & Production Branch.
Air Transport and Fate Research

On-going and Planned Activities

- Italy is planning a monitoring project in China.
- An overall plan indicating contributions of various countries is being developed by Italy.
- The partnership is making a contribution to the updated emissions study requested by GC 24/3.
- Work on inventories in Asia and Latin America will contribute information to this partnership.
Waste partnership

- Led by Japan
- Business plan developed
- A ‘waste’ project building on previous inventory work is proposed as an activity under this partnership
  - Working in partnership with the secretariat of the Basel Convention
3. Reports, guidelines and guidance

- UNEP has developed a number of reports over the last three years to provide information and guide country activities
  - Guidance for Identifying Populations at Risk from Mercury Exposure (launched today!)
  - Toolkit for identification and quantification of mercury releases
  - Guide for reducing major uses and releases of mercury
  - Summary of Supply, Trade and Demand information on mercury
UNEP is developing an air emissions data report

- Based on best available data;

- Where possible includes an analysis by country region and sector, including consideration of driving trends and applicable regulatory mechanisms.

- Large improvements, new methodologies, improved estimations, however still large uncertainties!
Scenarios included

- Scenario developed for 2020:
  - The Status Quo
    - Based on expected increase in economic activity, but with current patterns and uses of Hg and no change in emissions control
  - The Extended Emissions Control
    - Implementation of emissions control measures practiced or committed to in Europe extended globally
  - The Maximum Feasible Technological Reduction
    - Assume implementation of all possible measures to reduce mercury emissions
Report availability

- Currently out for review

- Draft report will be made available to second meeting of OEWG in October

- Final report will be tabled at GC 25, 16 – 20 February 2009
Looking ahead in 2008…

1. Second meeting of the OEWG
   - 6-10 October 2008
   - Will present options and any consensus recommendations to the Council at its twenty-fifth regular session;

2. Partnership:
   - Activities to reduce uses and releases of mercury ongoing (ASM, waste, storage, products)

3. Air emissions report will be published late 2008
Further information can be found at:

http://www.chem.unep.ch/mercury/

mercury@chemicals.unep.ch