Mercury:
What we need to know…

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Mercury (Hg) is a heavy metal

UNEP

Species:

- ✓ Metallic or elemental : Hg^0
- ✓ Ionic or Inorganic : Hg^+ and Hg^{2+}
- ✓ Organic Hg when combined with C

  Notably methylmercury (MeHg or CH_3Hg),

  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 mercury releases

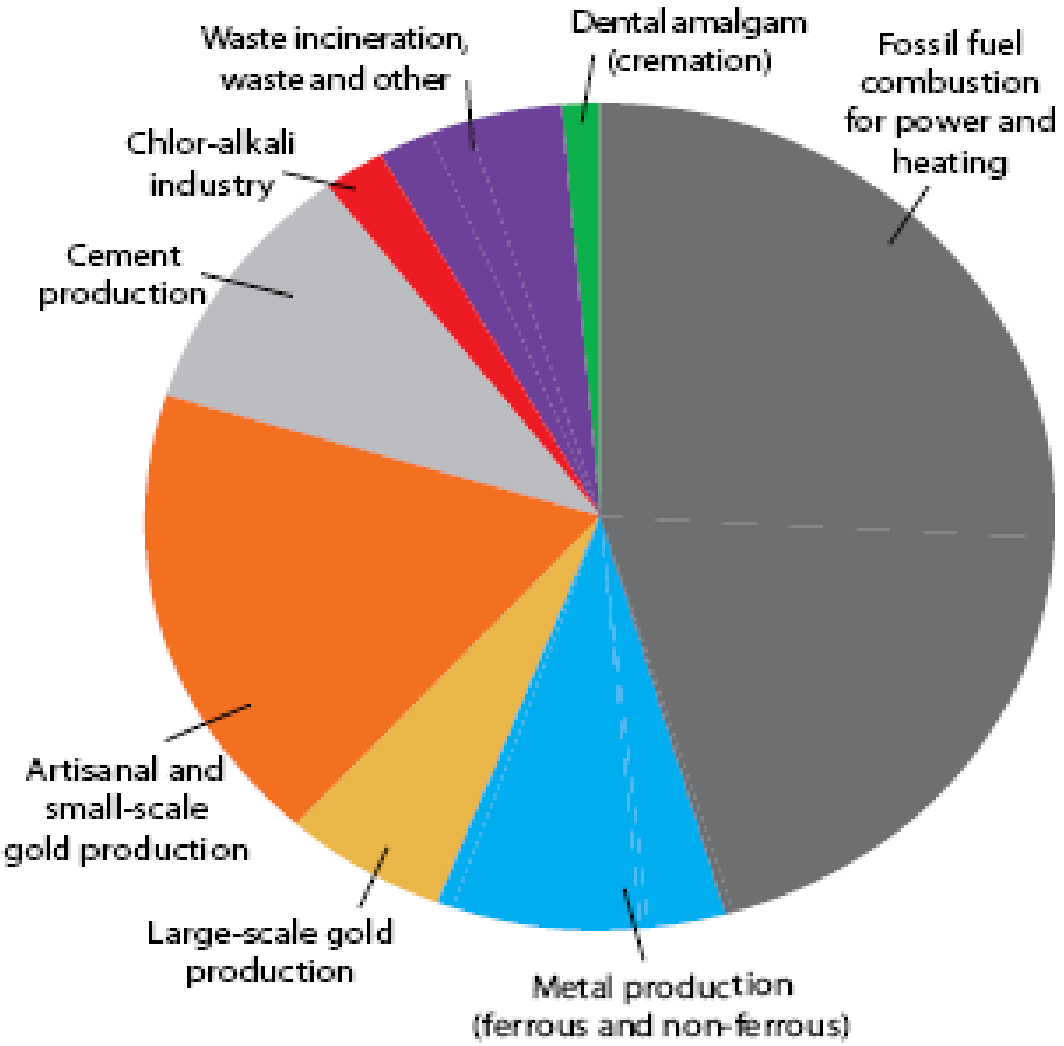
- **Releases from mobilisation of mercury impurities:**
  Coal-fired power, Cement production,
  non-ferrous metals mining

- **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

2005 Emissions by Sector

- Combustion of fossil fuels (in particular coal): 45%
- Artisanal and small-scale gold mining: 20%
- Waste and Other figures are conservative estimates and highly uncertain

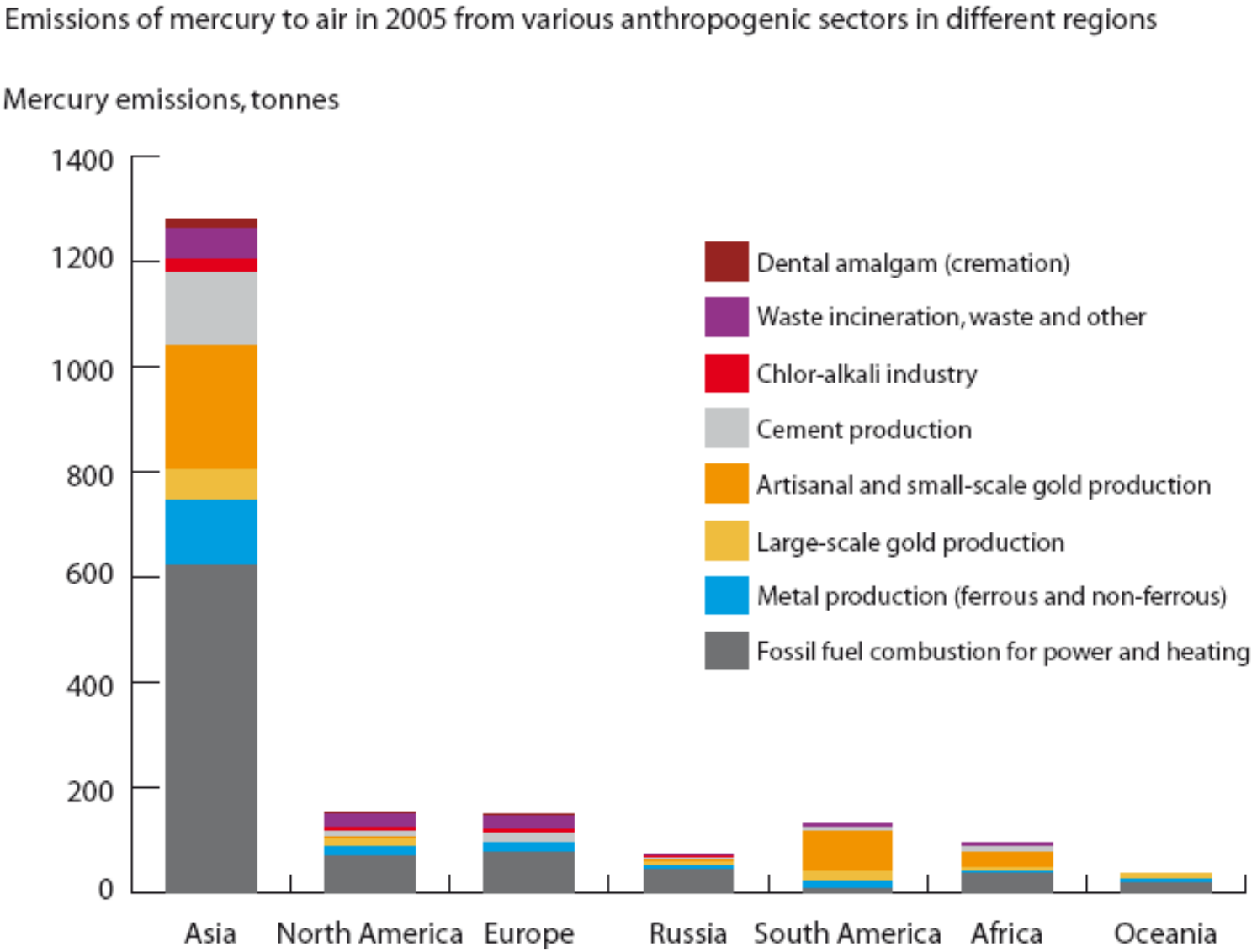


2005 emissions by region

Geographical distribution reflects economic activity and technology, and presence of ASGM

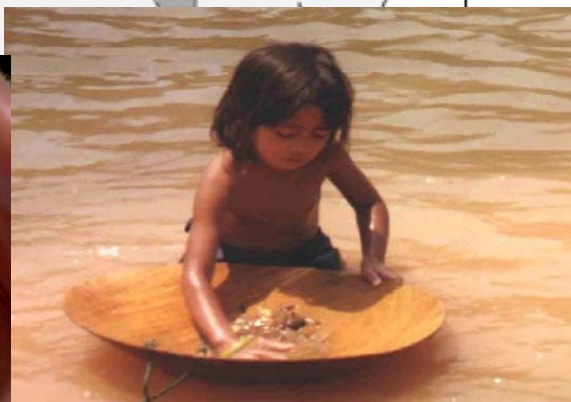
Two-thirds from Asian sources

(mainly China and India)

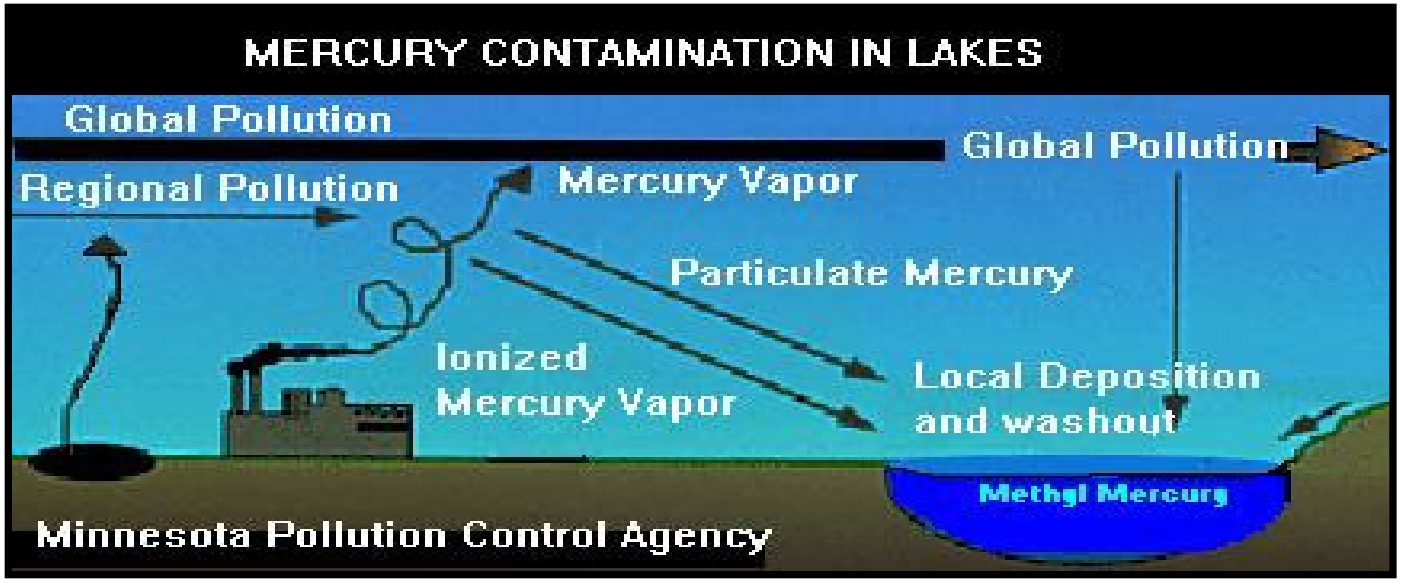


Mercury Trade 2004

Figure 4 Commodity mercury shipments among world regions, 2004



Global Cycle and Transport of Mercury

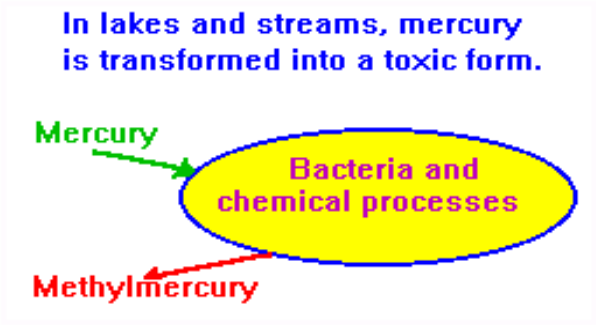


- Hg moves through environmental media and ultimately enters water bodies and deposits either close to source or long distance from source *EPA*
- Chemical and physical forms determine their behavior in the environment and pattern of deposition

❖ Divalent Hg- water soluble and relatively reactive and likely to deposit within a short distance

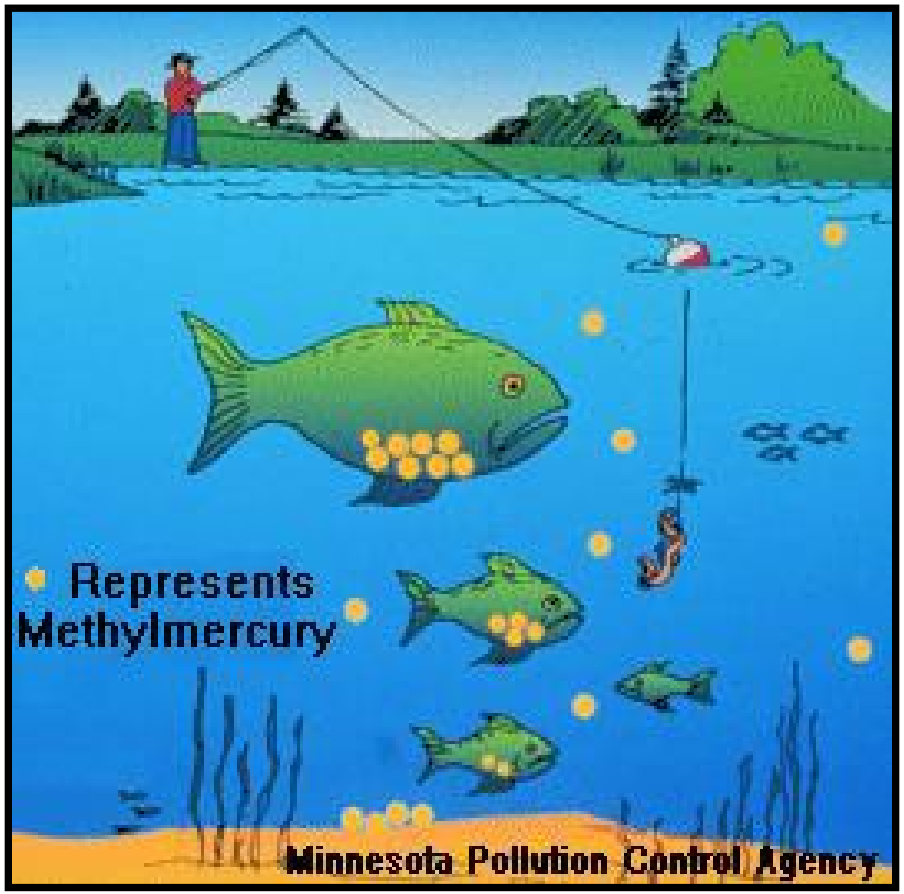
❖ Elemental Hg-tends to disperse long distance and may not deposit until it has traveled thousands of kilometers

Fate of Mercury



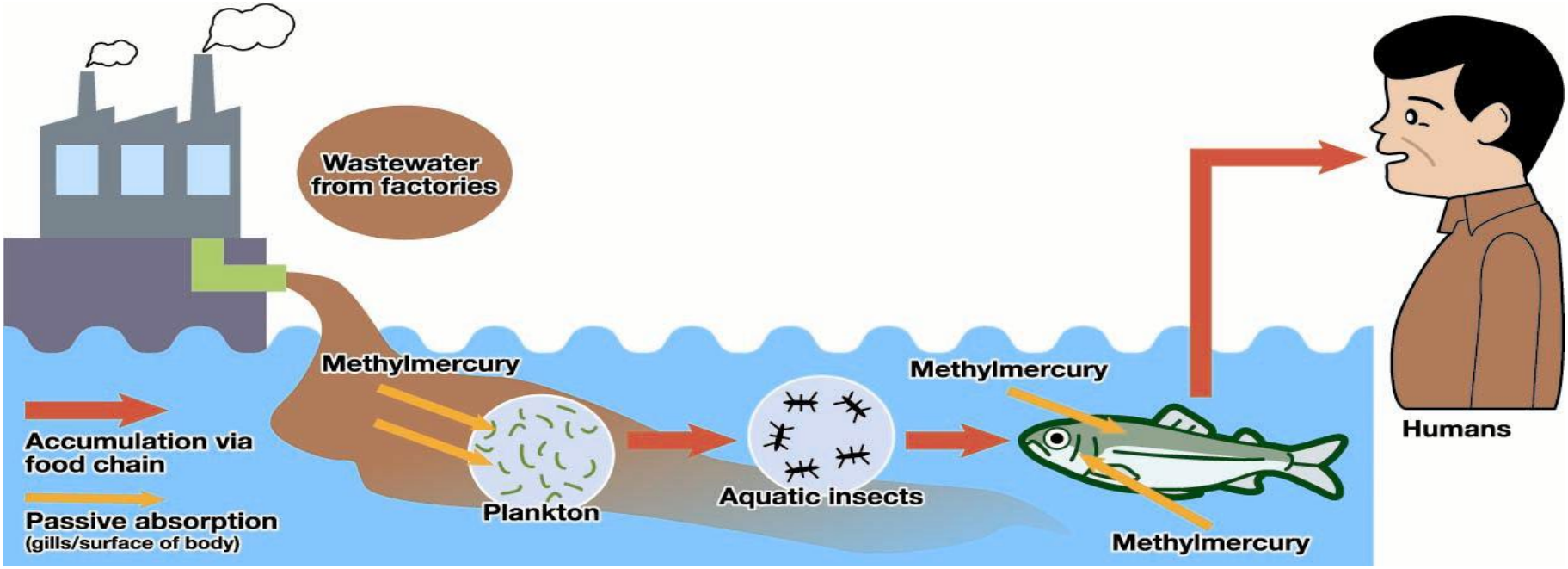
Metabolic conversion,
bioaccumulation
biomagnification
through "food-chain"

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



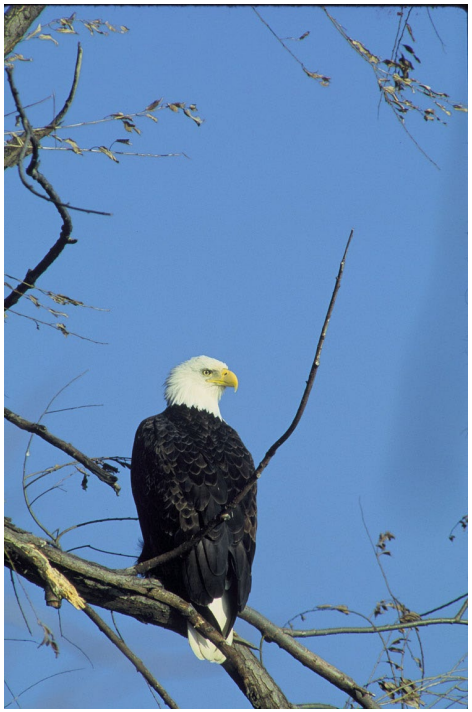
EPA

MethylMercury

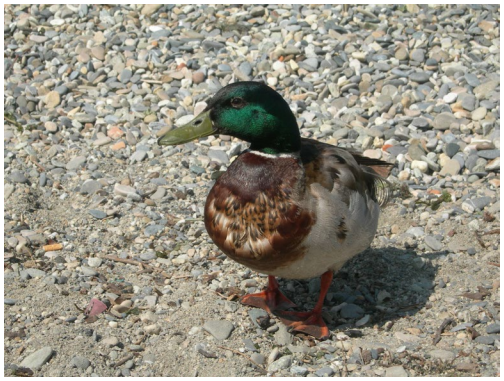


Organic (Methylmercury)- ingestion (95% absorbed in GIT) of freshwater and marine fish
-bound in protein tissue, not in fatty deposits
-trimming and skinning of contaminated fish do not reduce Hg

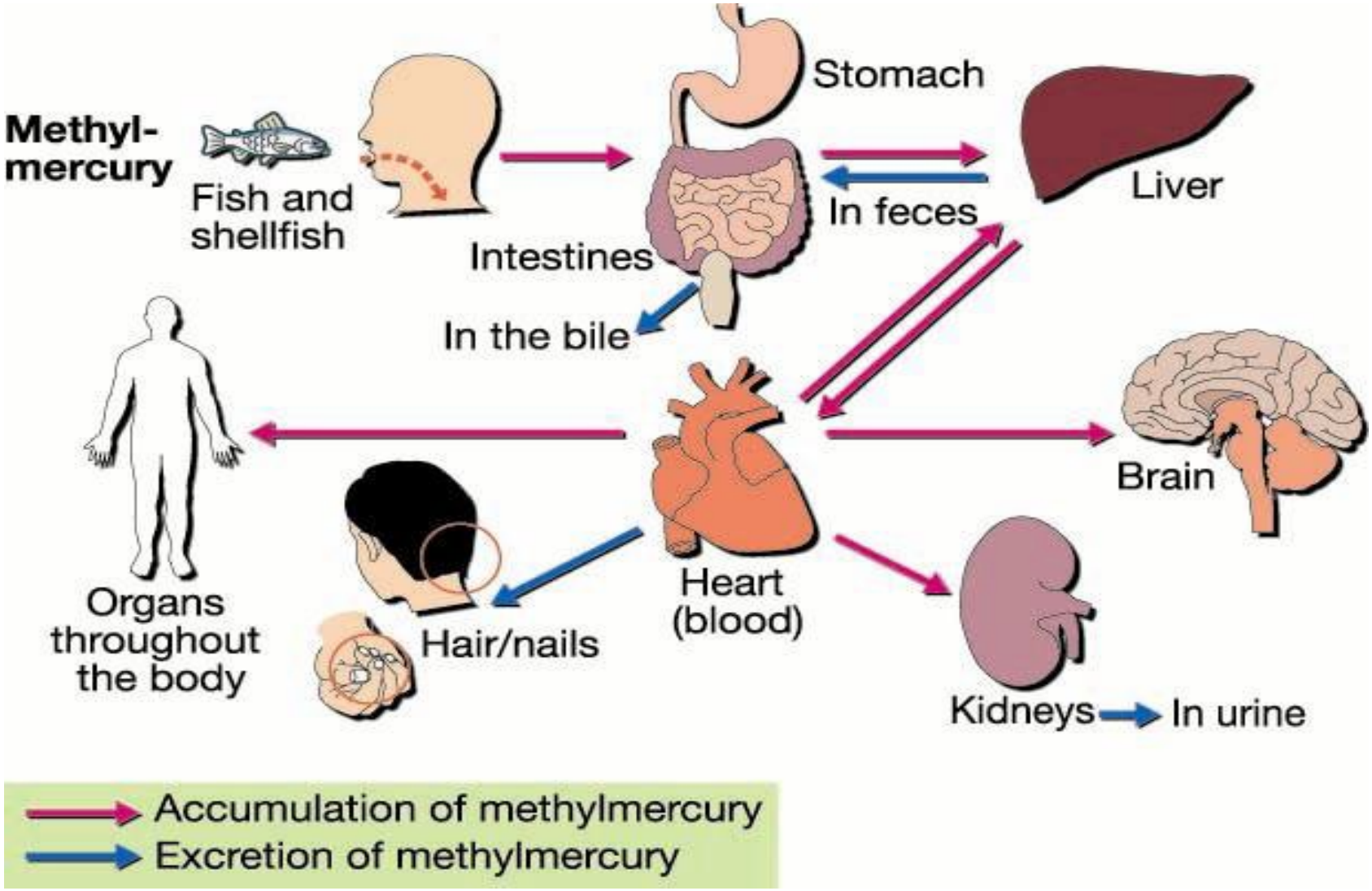
Effects on the Environment and the Ecosystem



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



Exposure Pathway and Effects on Humans

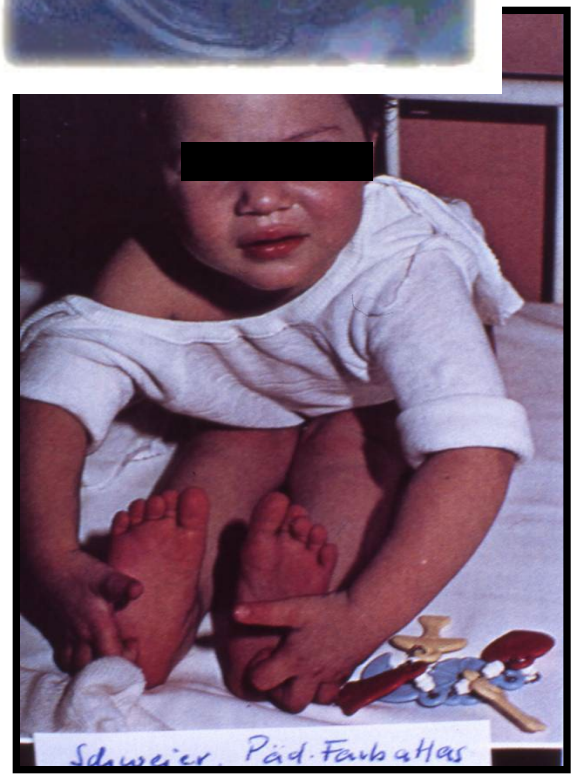


Mercury Species	Sources	Routes of exposure	Elimination	Toxicity
Elemental (metallic)	•ASM •Chlor alkali •Non ferrous mining •Waste incineration •Amalgams •Manufacturing of medical devices •Folk remedies •Cosmetics/soaps	Inhalation Dermal	Urine and faeces	CNS Kidney Lungs Skin (Acrodynia in children)
Inorganic (mercuric chloride)	•Manufacturing and breakage of Lamps, Batteries •Disinfectants •Cosmetics/soaps •Folk medicine	Inhalation Ingestion Dermal	Urine	CNS Kidney GI tract Skin (Acrodynia in children)
Organic (methyl; ethyl)	•Fish •Fungicides •Preservatives (vaccines)	Ingestion Parenteral Transplacental; inhalation	Faeces	CNS Cardiovascular

Mercury Effects on Fetus and Children

Uncommon syndrome "Pink disease":

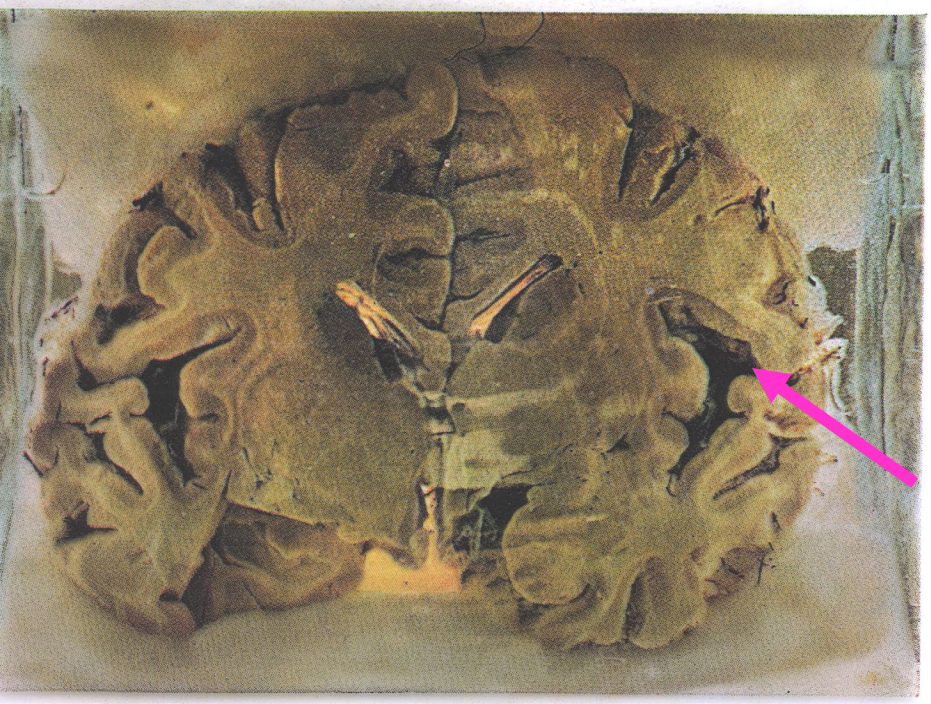
- Pain in the extremities
- Pinkish discoloration and desquamation
- Hypertension
- Sweating
- Insomnia, irritability, apathy



Muhlendahl

Source: WHO Children's Environmental Health

Healthy Brain



Brain from a person with Minamata disease.

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

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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)

Biomonitoring

- Hair~chronic exposure to methylHg, dire relationship with blood
- Blood ,Cord blood, Urine, Nails, Human milk

.1µg/kg/day intake of methylHg=

1 µg/g hair=5~6 µg/li in cord blood=4~5 µg/li blood

Environmental monitoring

- Sediments, soil, air

Maximum allowable Hg in Fish to be sold in the market

- Codex Alimentarius: .5 mg/kg methylHg in non predatory fish;

  1 mg/kg methylHg in predatory fish
- USFDA: set an action level of 1 mg/kg methylHg in finfish and shellfish
- EC: allows .5 mg Hg/kg

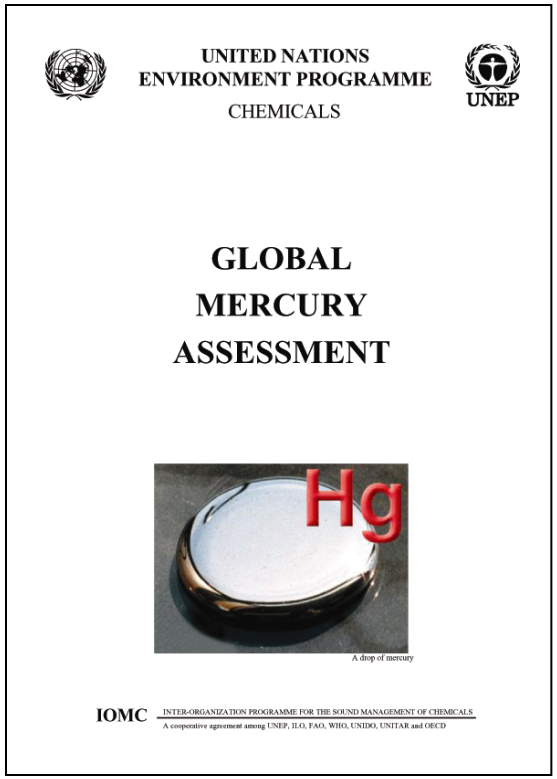
  in fish products
- Japan: .3 mg methylHg/kg

  in fish

Source: FAO

Mandates of Mercury Work

- Initiated by UNEP Governing Council in February 2001 (21st session)
- Responded to concerns raised in different fora that national/regional action not sufficient to address mercury pollution



UNEP 2002

GC Decision 22 (2003)
Need for global policy response

The Governing Council

- Endorsed conclusions of the Working Group
- Decided (GC 22/4)

national, regional and global actions should be initiated ASAP

UNEP Headquarters Nairobi

- Urged all countries to adopt goals and take actions to identify exposed populations and reduce anthropogenic Hg releases

Establishment of a UNEP Mercury Programme

- To support efforts of countries to take action to reduce Hg pollution, the Governing Council requested UNEP to initiate technical assistance and capacity building activities to support the efforts of countries.

United Nations, Geneva

- In response, UNEP established a mercury programme within its Chemicals Branch in Geneva, Switzerland.

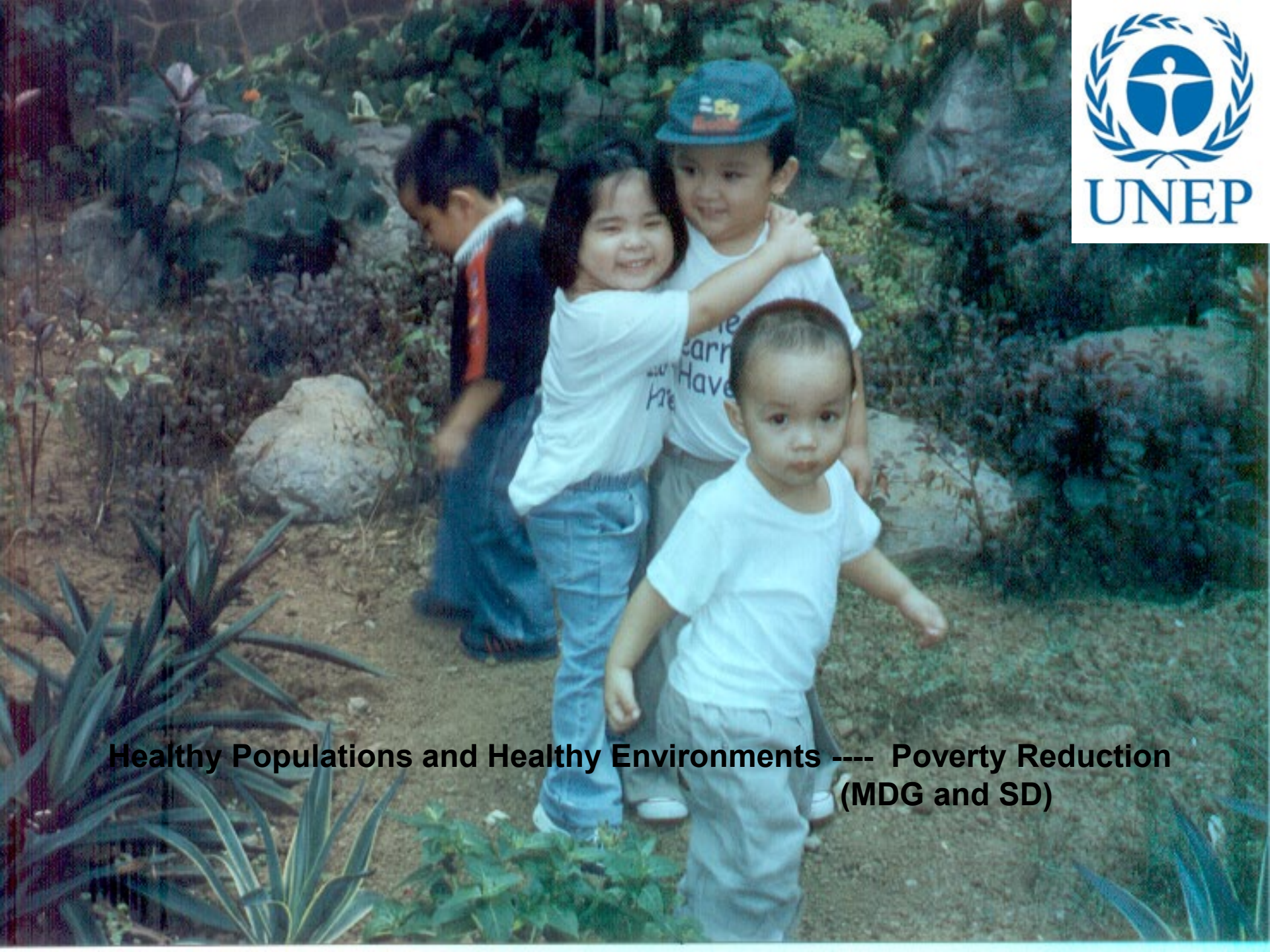
GC 23/9 (2005): Strengthened UNEP Mercury Programme

- Reiterated the conclusions of the GMA report on the global adverse impacts of Hg on health and environment
- Reiterated its decision that national, regional and global actions should be initiated ASAP
- Urged all countries to adopt goals and take actions to identify exposed populations and reduce anthropogenic Hg releases
- Urged Governments, IGOs, NGOs and private sector implement PARTNERSHIPS in a clear, transparent and accountable manner, as one approach to reducing risks from mercury

GC Decision 24/3 (2007)

- Recognised that current efforts to reduce risks from mercury are not sufficient to address the global challenges posed by mercury
- Options of enhanced voluntary measures and new or existing legally binding instruments will be reviewed and assessed in order to make progress in addressing this issue

GC Decision 25 (2009)…



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Healthy Populations and Healthy Environments ---- Poverty Reduction (MDG and SD)

More information on the UNEP Mercury Programme available at…

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