Minamata Convention: Initial Assesment of Turkey

Ivan Holoubek [1, 2, 3]

[1] RECETOX, Masaryk University, Brno, CR

[2] CzechGlobe, Academy of Science, Brno, CR

[3] TOCOEN, s.r.o., Brno, CR

holoubek@recetox.muni.cz; http://recetox.muni.cz

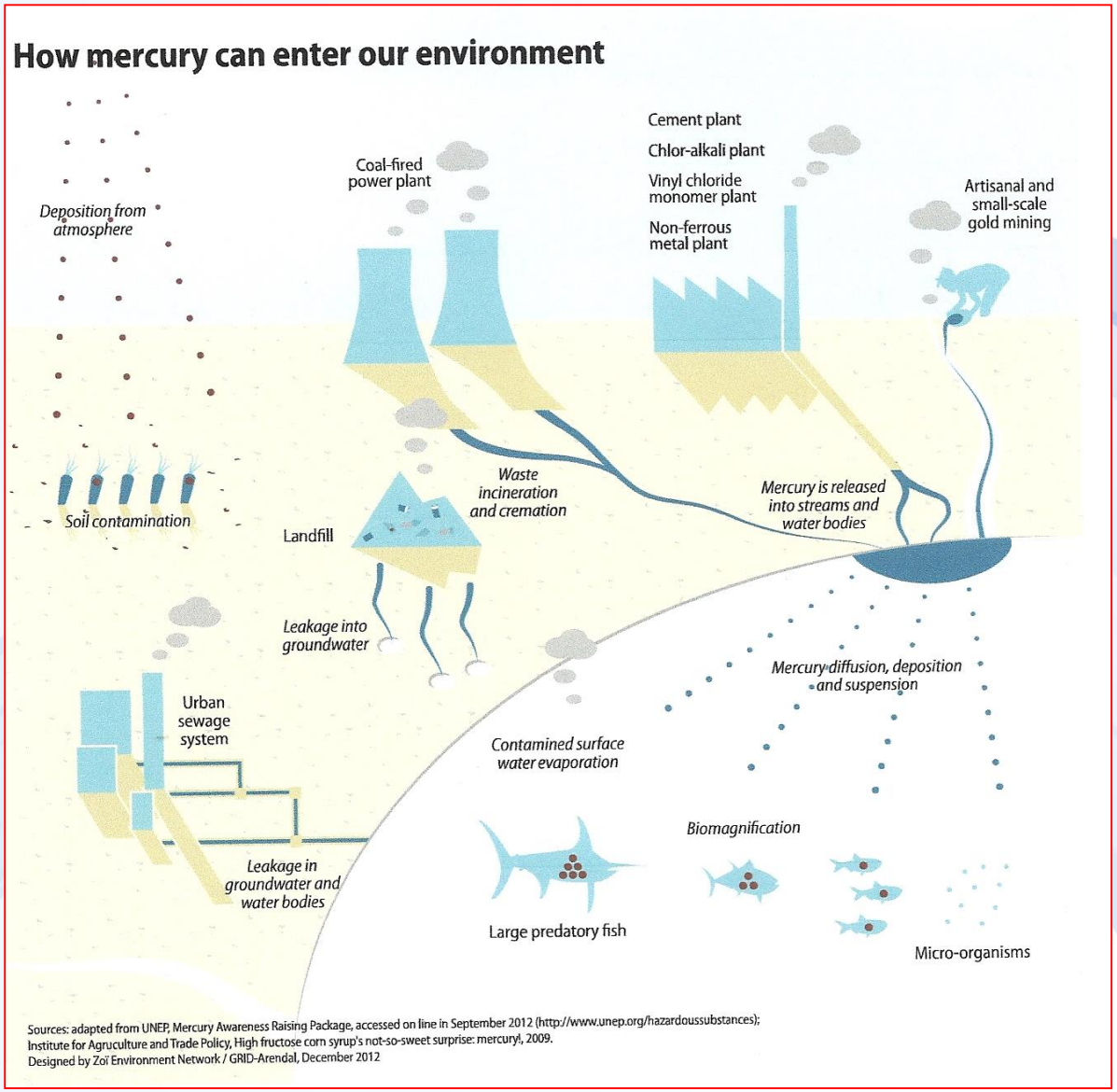
Inventory Mercury Training Meeting

29 – 31/01/2018, Hilton Garden Inn Eskişehir

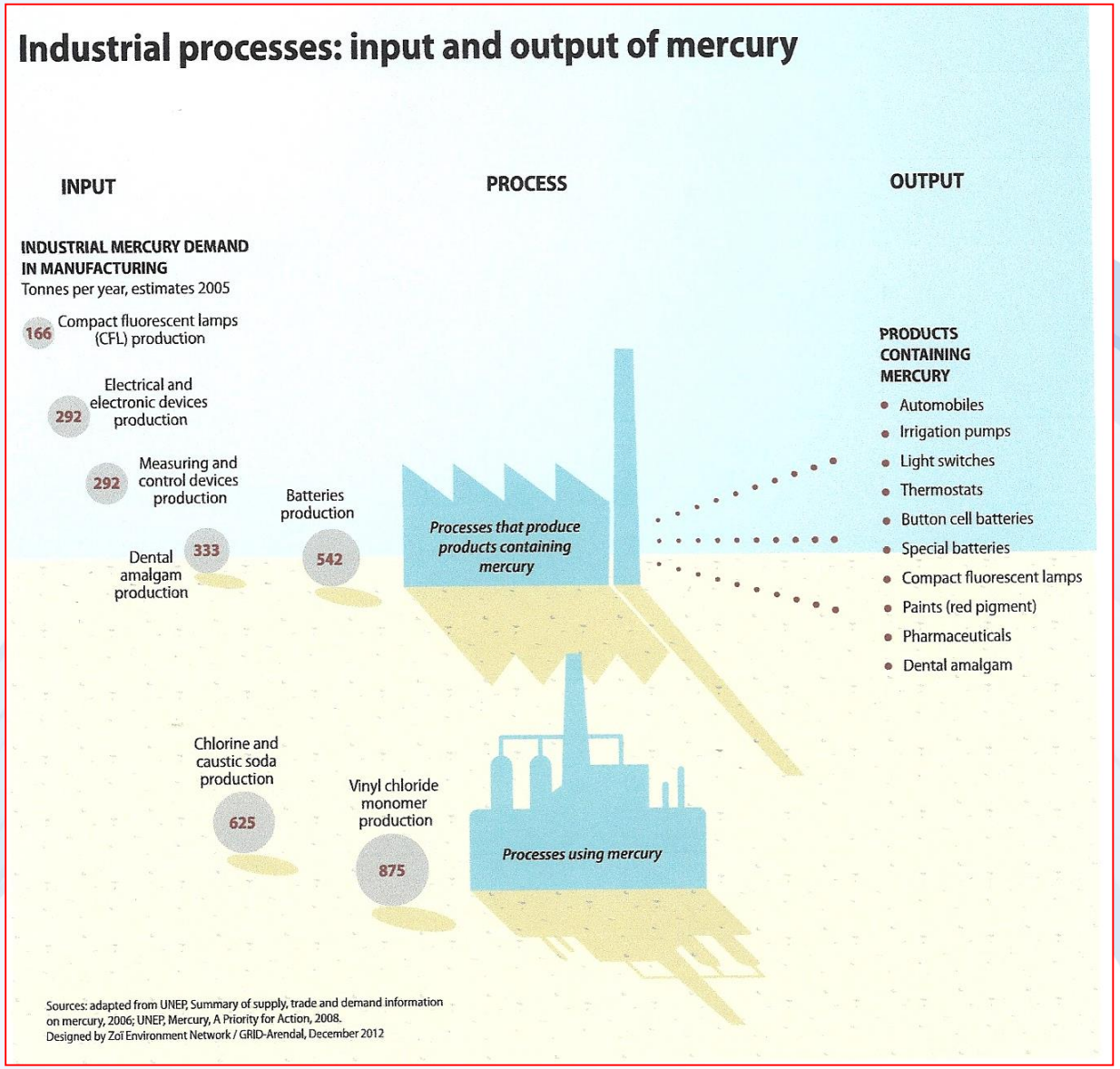
Lecture 3

Mercury Sources: Related Sectors

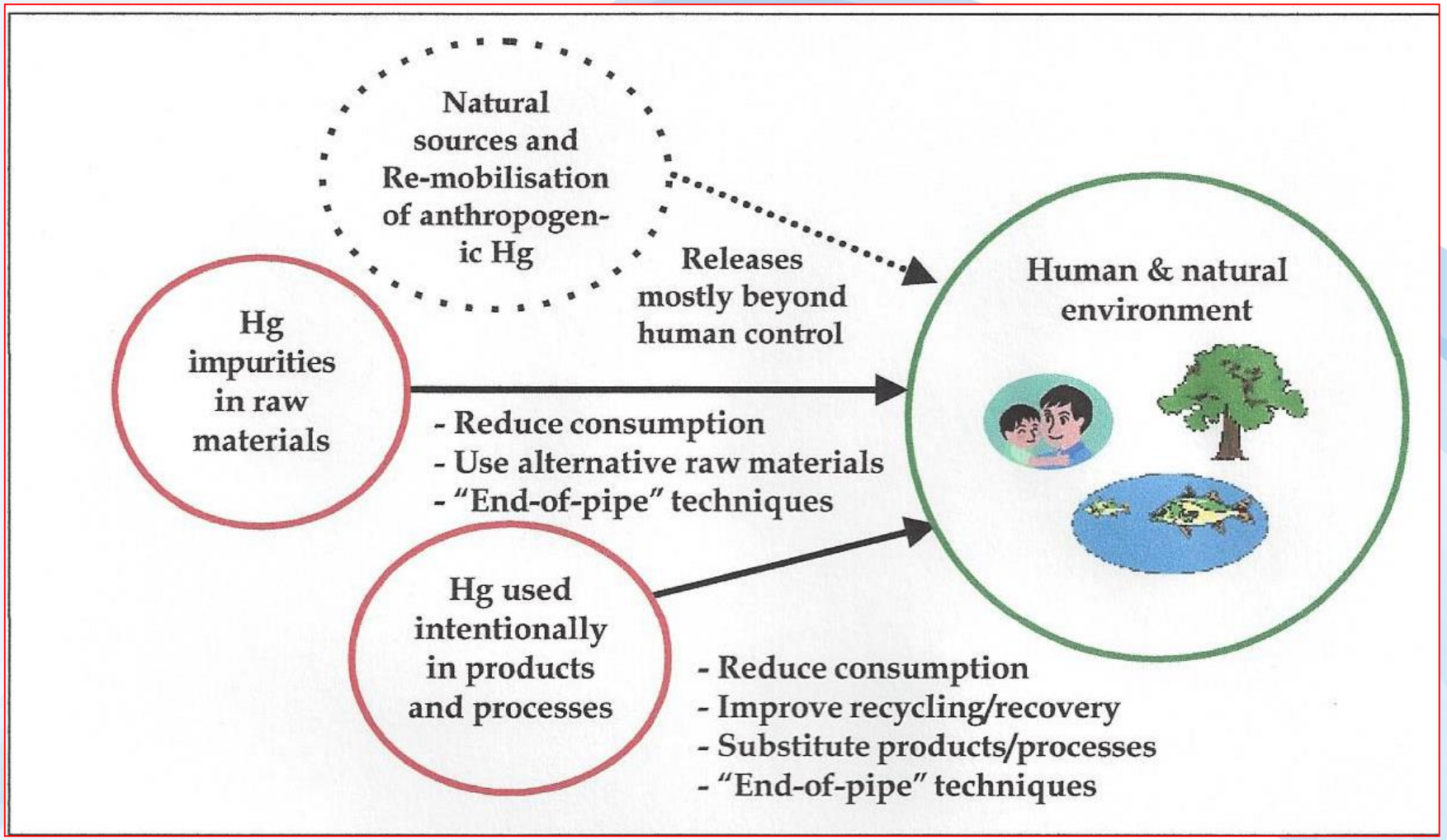
Mercury environmental enters



Industrial processes – input and output of Hg



Main sources of mercury releases and main control options



The releases of mercury to the biosphere can be grouped in four categories (UNEP, 2002)

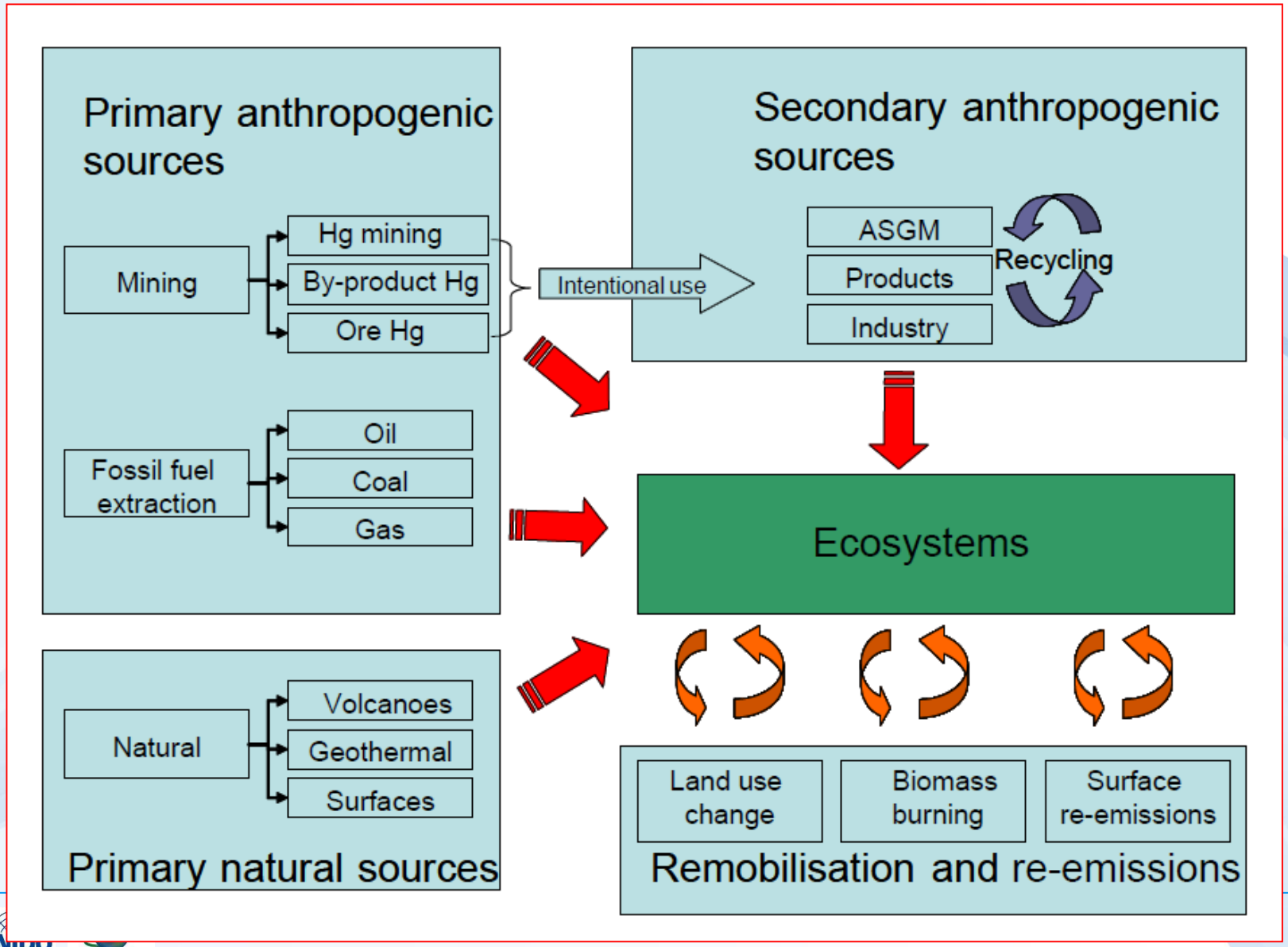
Natural sources - releases due to natural mobilization of naturally occurring mercury from the Earth's crust, such as volcanic activity and weathering of rocks;

Current anthropogenic (associated with human activity) releases from the mobilization of mercury impurities in raw materials such as fossil fuels – particularly coal, and to a lesser extent gas and oil – and other extracted, treated and recycled minerals;

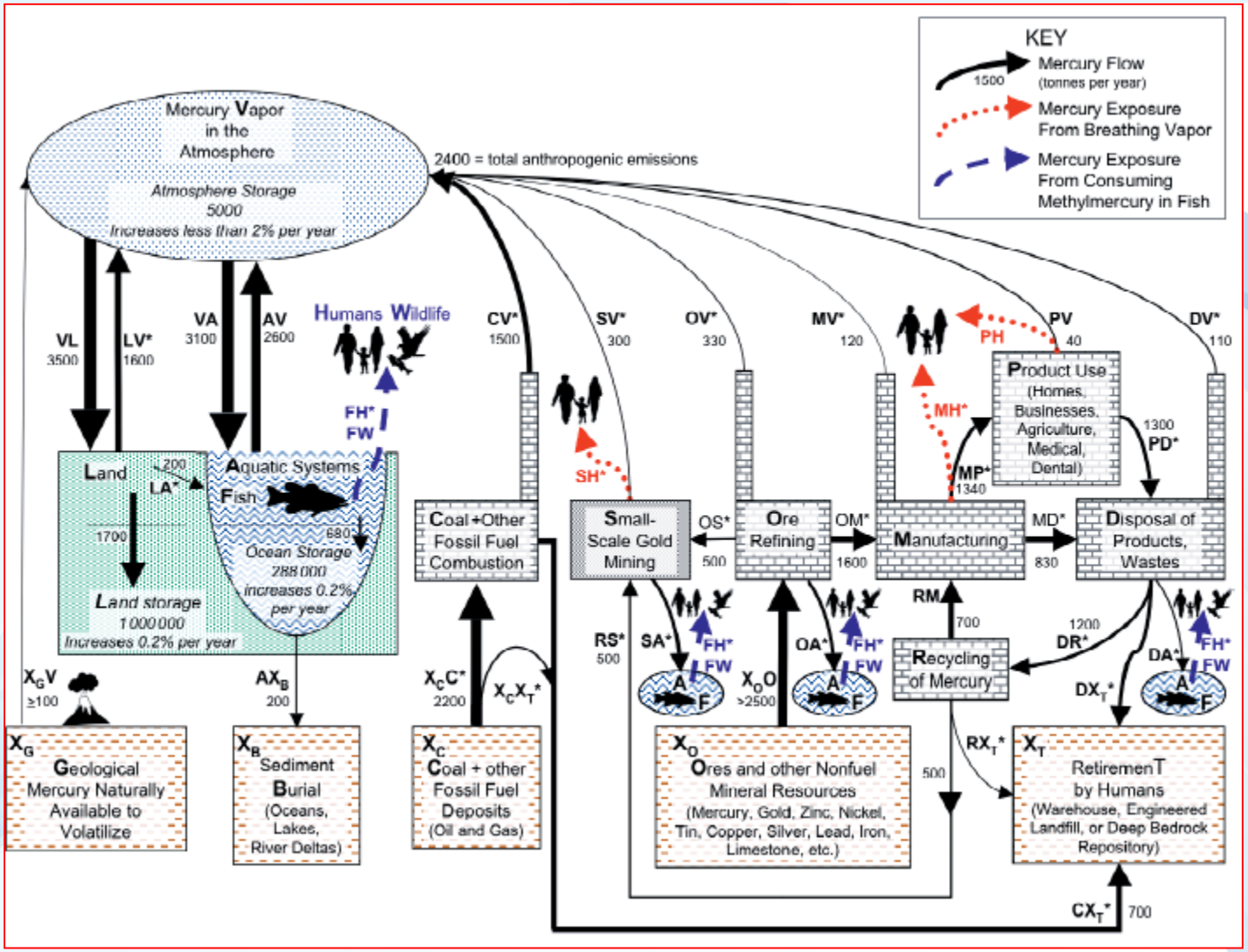
Current anthropogenic releases resulting from mercury used intentionally in products and processes, due to releases during manufacturing, leaks, disposal or incineration of spent products or other releases;

Re-mobilization of historic anthropogenic mercury releases previously deposited in soils, sediments, water bodies, landfills and waste/tailings piles.

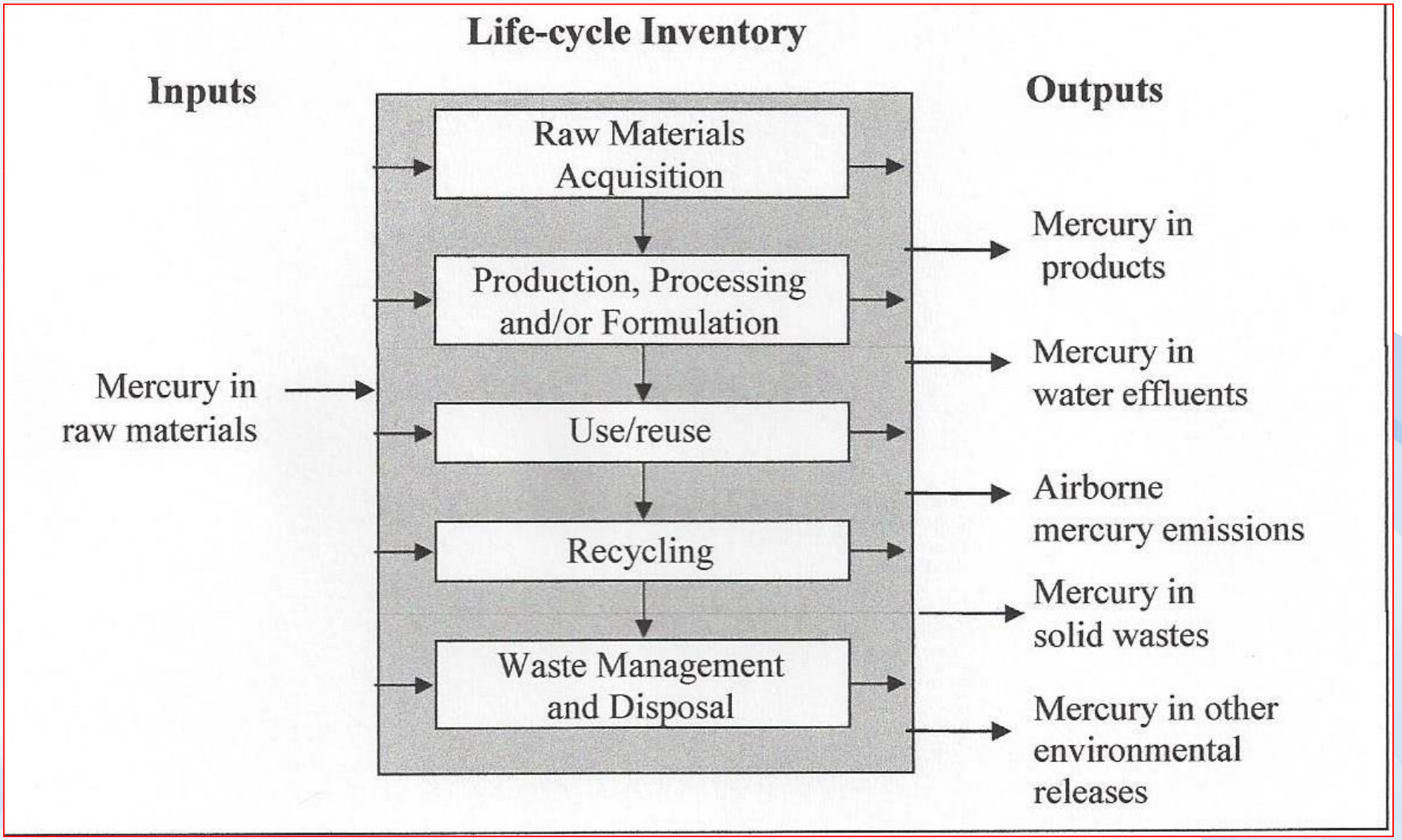
Emission source types and remobilisation processes affecting mercury distribution in the environment



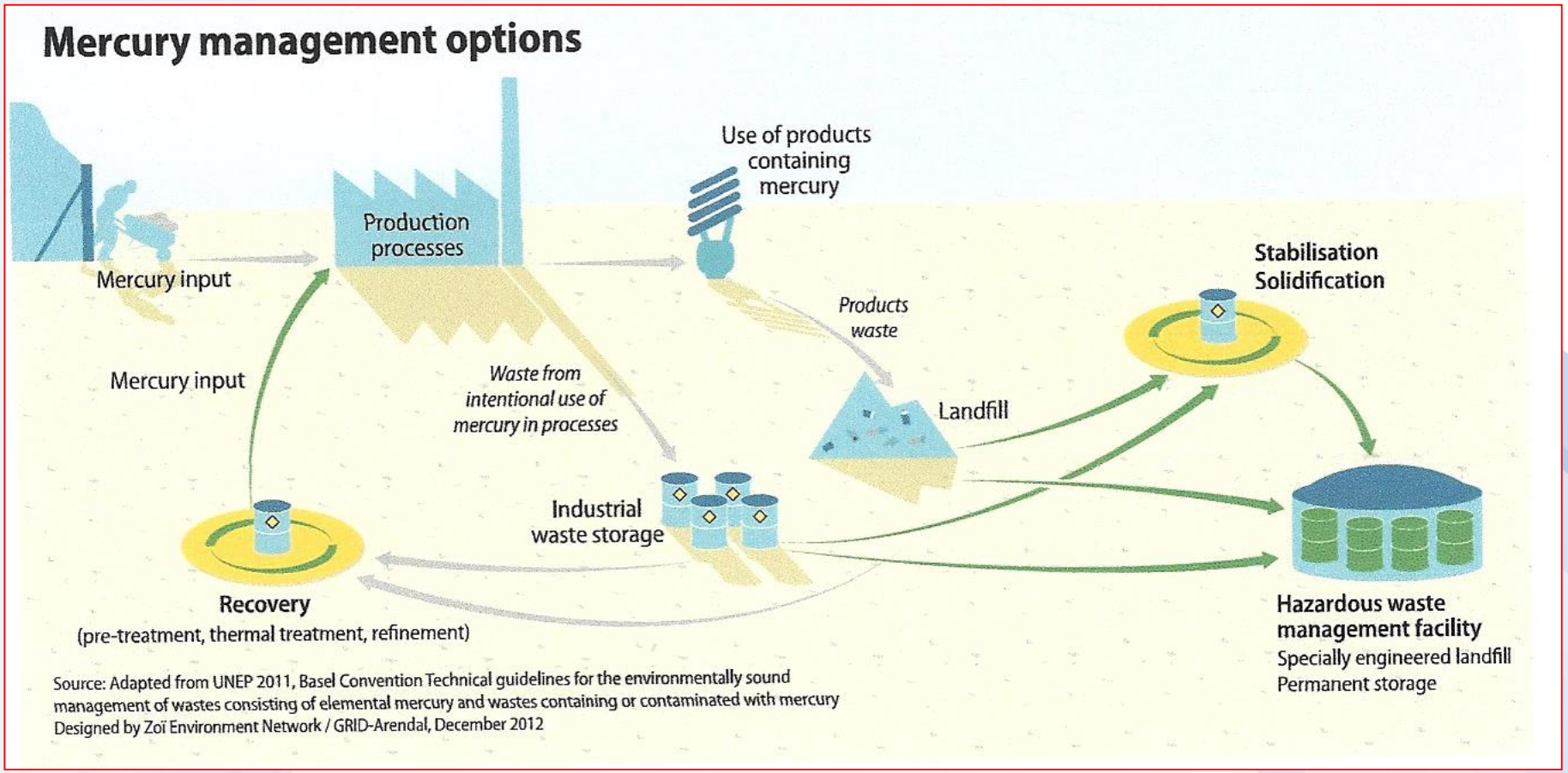
Important global pathways of mercury in commerce and the environment



Life-cycle of Hg product or processs



Mercury management options



Sources – Toolkit Level 1

Step 2: Energy consumption and fuel production;
Step 3: Domestic production of metals and raw materials;
Step 4: Domestic production and processing with intentional mercury use;
Step 5: Waste treatment and recycling;
Step 6: General consumption of mercury in products, as metal mercury and as mercury containing substances;
Step 7: Crematoria and cemeteries;
Step 8: Miscellaneous mercury sources not quantified on Inventory Level 1;

Examples of anthropogenic mercury releases to the environmental media

Destinations of releases to the environment and types of releases to each receiving environmental medium:

Air - the atmosphere: Point sources and diffuse sources from which release may be spread locally, regionally and hemispherically/globally with air masses.

- Emissions from major point sources such as coal fired power plants, metal extraction, waste incineration, chlor-alkali facilities, secondary scrap recycling/smelting, cement production, industrial inorganic chemicals production and diffuse sources such as housing (fossil fuel combustion);
- Emissions from artisanal gold mining;
- Emissions from cremation, primarily due to dental fillings containing mercury;
- Emissions from mercury-containing paints;
- Diffuse releases from uncollected waste products (fluorescent lamps, batteries, thermometers, mercury switches, lost teeth with amalgam fillings etc.);
- Evaporation of previous discharges to soil and water;
- Evaporation of mercury disposed of on landfills.

Examples of anthropogenic mercury releases to the environmental media

Water – aquatic environment: Point sources and diffuse sources from which mercury will be spread to marine environments (oceans), and freshwaters (rivers, lakes etc.).

- Direct discharges from industry and households to aquatic environments;
- Emissions from artisanal gold mining;
- Indirect discharges via waste water treatment systems;
- Surface run-off and leachate from mercury contaminated soil and landfills without leachate collecting membrane and leachate water cleaning system;
- Wash-out of mercury previously applied or deposited on land.

Examples of anthropogenic mercury releases to the environmental media

Land/soil – terrestrial environment: General soil surfaces and ground water.

- Diffuse releases from uncollected waste products (batteries, thermometers, mercury switches, lost teeth with amalgam fillings etc.);
- Local releases from industry: On site materials and waste storage, broken/unused pipes, and equipment and building material contaminated with mercury;
- Spreading of sewage sludge with mercury content on agricultural land (used as fertilizer);
- Application on land, seeds or seedlings of pesticides with mercury compounds;
- Use of solid residues from waste incineration and coal combustion for construction purposes (slag/bottom ash and fly ash);
- Burial of persons with dental amalgam fillings.

Sources – Toolkit Level 1

Source category	Source present?
	Y/N/?
Energy consumption	
Coal combustion in large power plants	
Other coal uses	
Combustion/use of petroleum coke and heavy oil	
Combustion/use of diesel, gasoil, petroleum, kerosene	
Biomass fired power and heat production	
Charcoal combustion	
Fuel production	
Oil extraction	
Oil refining	

Sources – Toolkit Level 1

Source category	Source present?
	Y/N/?
Extraction and processing of natural gas	
Primary metal production	
Mercury (primary) extraction and initial processing	
Production of zinc from concentrates	
Production of copper from concentrates	
Production of lead from concentrates	
Gold extraction by methods other than mercury amalgamation	
Alumina production from bauxite (aluminium production)	

Sources – Toolkit Level 1

Source category	Source present?
	Y/N/?
Primary ferrous metal production (iron, steel production)	
Gold extraction with mercury amalgamation - without use of retort	
Gold extraction with mercury amalgamation - with use of retorts	
Other materials production	
Cement production	
Pulp and paper production	
Production of chemicals and polymers	
Chlor-alkali production with mercury-cells	
VCM production with mercury catalyst	
Acetaldehyde production with mercury catalyst	

Sources – Toolkit Level 1

Source category	Source present?
	Y/N/?
Production of products with mercury content	
Hg thermometers (medical, air, lab, industrial etc.)	
Electrical switches and relays with mercury	
Light sources with mercury (fluorescent, compact, others: see guideline)	
Batteries with mercury	
Manometers and gauges with mercury	
Biocides and pesticides with mercury	
Paints with mercury	
Skin lightening creams and soaps with mercury chemicals	

Sources – Toolkit Level 1

Source category	Source present?
	Y/N/?
Medical blood pressure gauges (mercury sphygmomanometers)	
Other manometers and gauges with mercury	
Laboratory chemicals	
Other laboratory and medical equipment with mercury	
Production of recycled of metals	
Production of recycled mercury ("secondary production")	
Production of recycled ferrous metals (iron and steel)	

Sources – Toolkit Level 1

Source category	Source present?
	Y/N/?
Waste incineration	
Incineration of municipal/general waste	
Incineration of hazardous waste	
Incineration of medical waste	
Sewage sludge incineration	
Open fire waste burning (on landfills and informally)	
Waste deposition/landfilling and waste water treatment	
Controlled landfills/deposits	
Informal dumping of general waste *1	
Waste water system/treatment	
Crematoria and cemeteries	
Crematoria	
Cemeteries	

Sources – Toolkit Level 1

Source category	Source present?
	Y/N/?
Combustion of oil shale	
Combustion of peat	
Geothermal power production	
Production of other recycled metals	
Production of lime	
Production of light weight aggregates (burnt clay nuts for building purposes)	
Chloride and potassium hydroxide produced from mercury-cell technology	
Polyurethane production with mercury catalysts	
Seed dressing with mercury chemicals	
Infra red detection semiconductors	

Sources – Toolkit Level 1

Source category	Source present?
	Y/N/?
Bougie tubes and Cantor tubes (medical)	
Educational uses	
Gyroscopes with mercury	
Vacuum pumps with mercury	
Mercury used in religious rituals (amulets and other uses)	
Mercury used in traditional medicines (ayurvedic and others) and homeopathic medicine	
Use of mercury as a refrigerant in certain cooling systems	
Light houses (levelling bearings in marine navigation lights)	
Mercury in large bearings of rotating mechanic parts in for example older waste water treatment plants	
Tanning	

Sources – Toolkit Level 1

Source category	Source present?
	Y/N/?
Pigments	
Products for browning and etching steel	
Certain colour photograph paper types	
Recoil softeners in rifles	
Explosives (mercury-fulminate a.o.)	
Fireworks	
Executive toys	

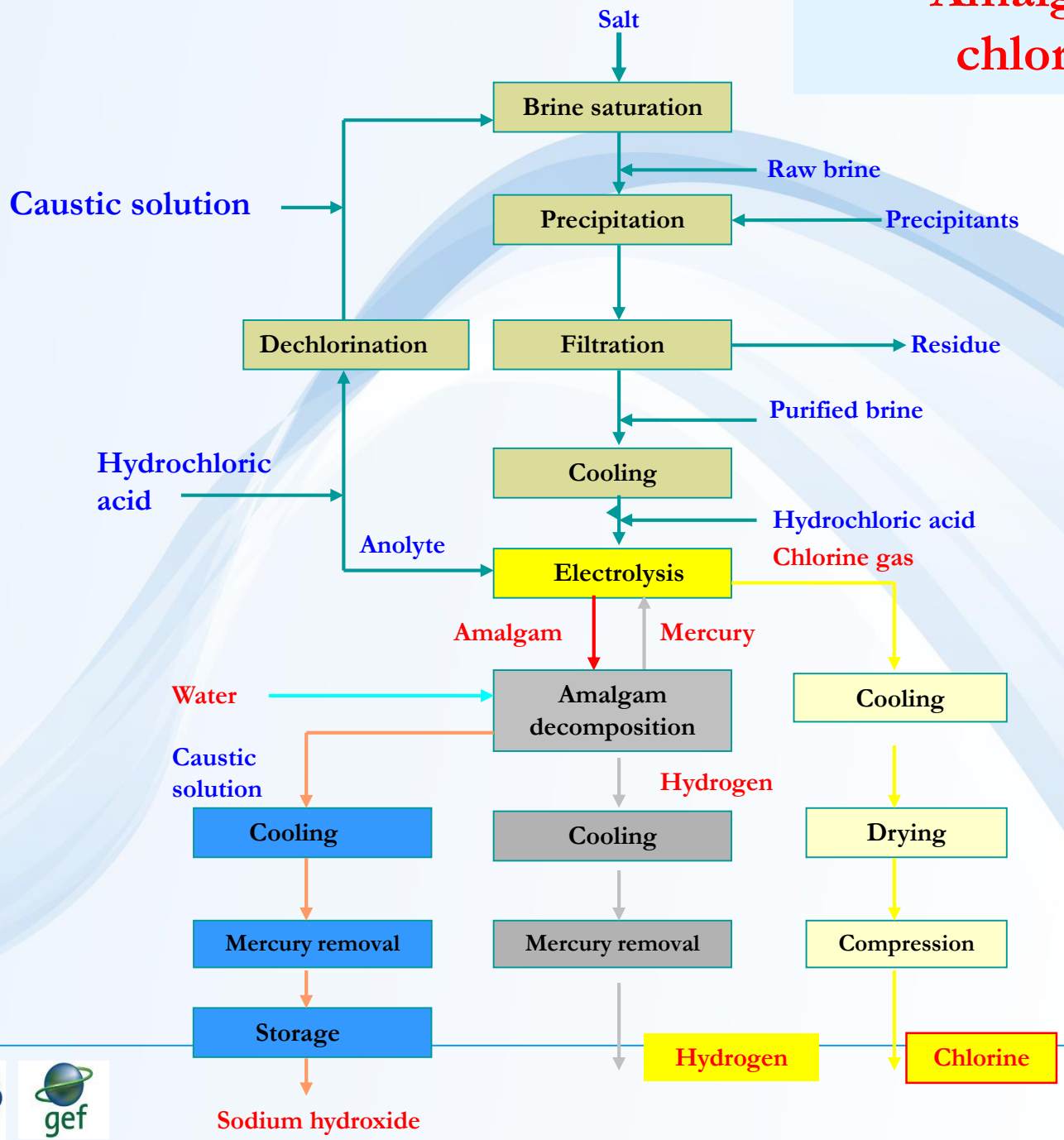
Chlor-alkali production - mercury

- Chlor-alkali industry largest EU user of mercury
- Chlor-alkali industry largest source of mercury exports
- Focus on mercury as a global pollutant
- Mercury process is not BAT

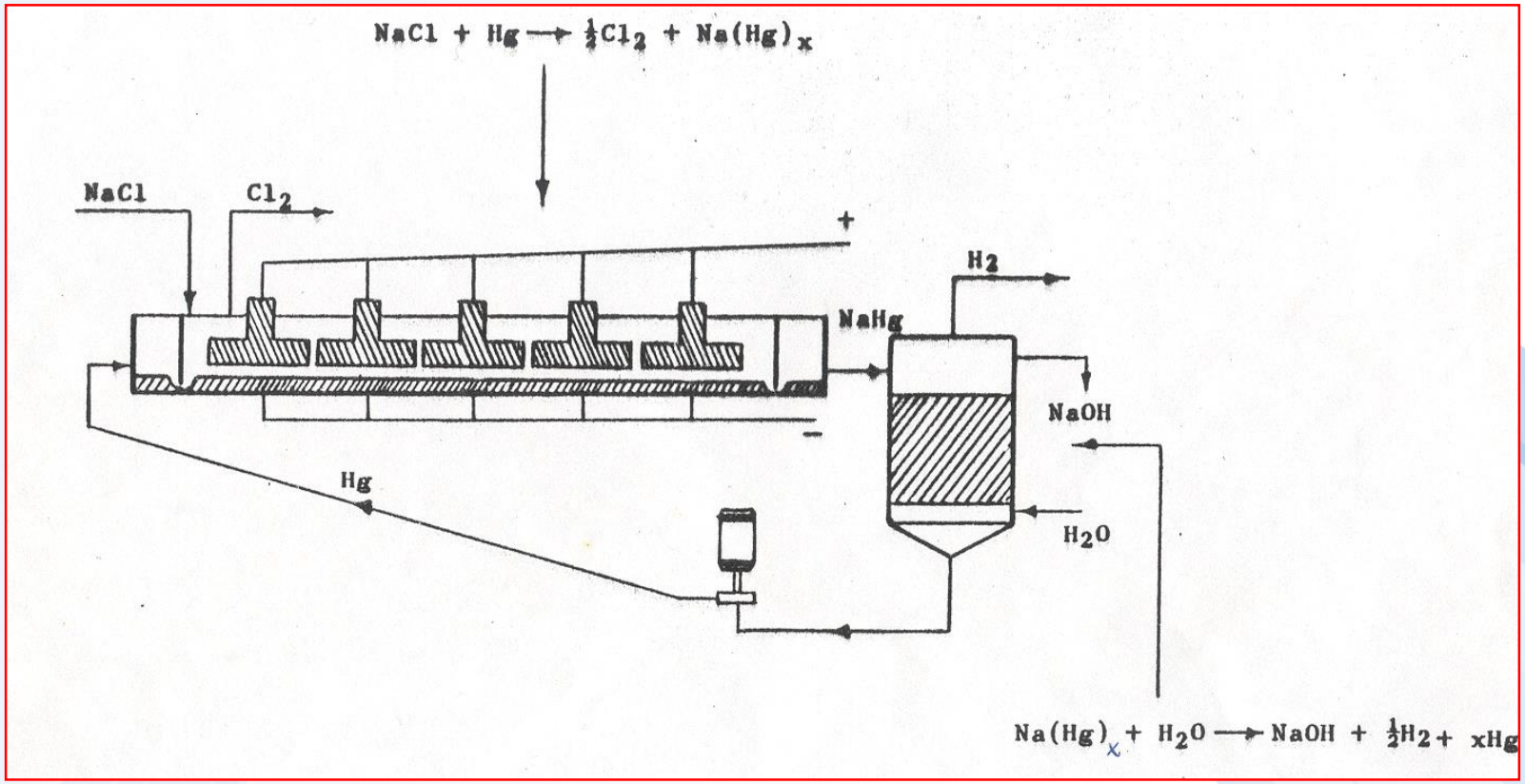
Mercury in the chlor-alkali industry:

- Air and water emissions
- Site contamination
- Excessive concentrations off-site

Amalgam method of chlorine production



Amalgam method of chlorine production



Average losses Hg ≈ 2,1 g Hg/t Cl_2

- 0,1 g Hg/t Cl_2 in waters
- 0,5 g Hg/t Cl_2 in products
- 1,5 g Hg/t Cl_2 in air

New trends of chlorine production

Membrane proces

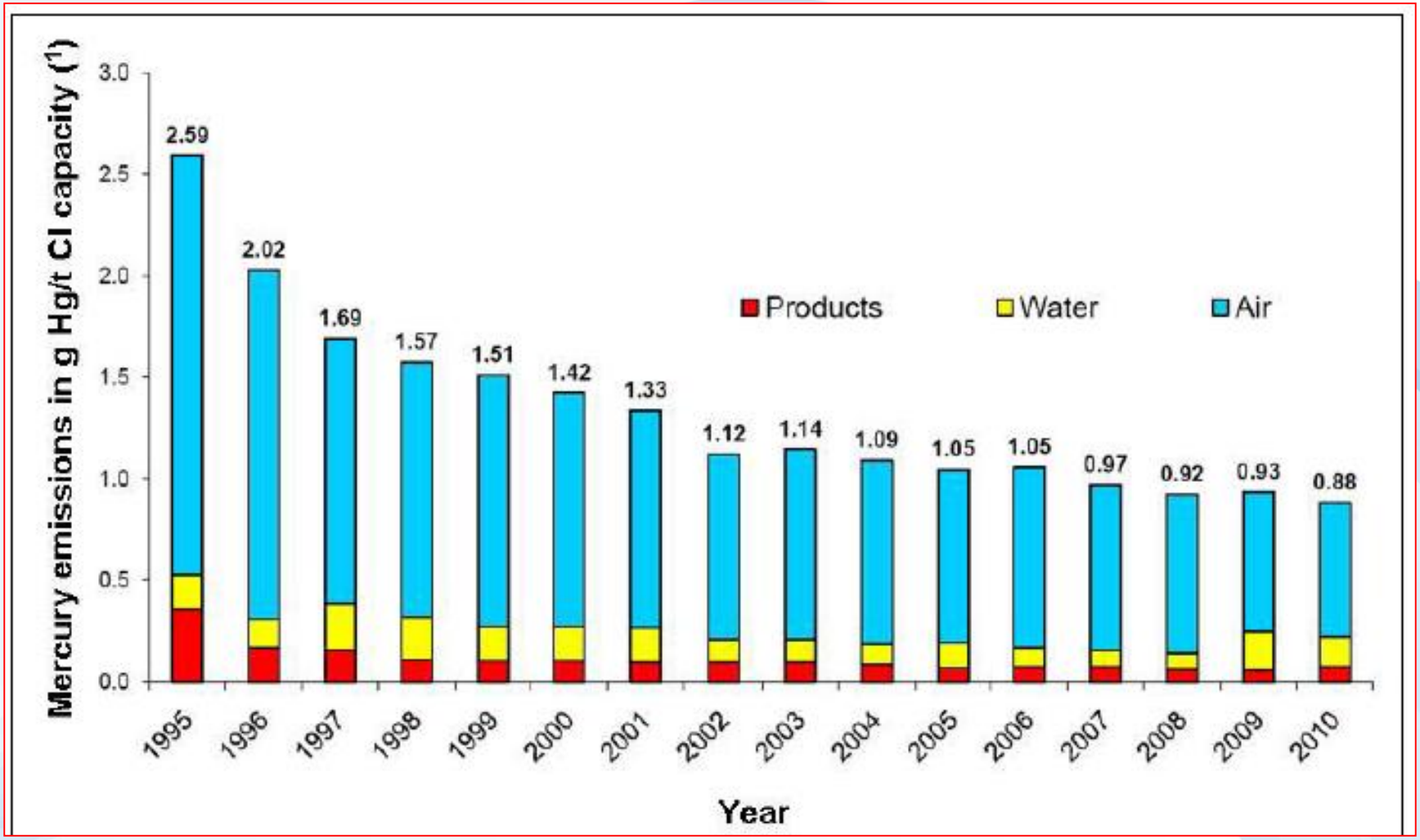
Advantages:

- No Hg process

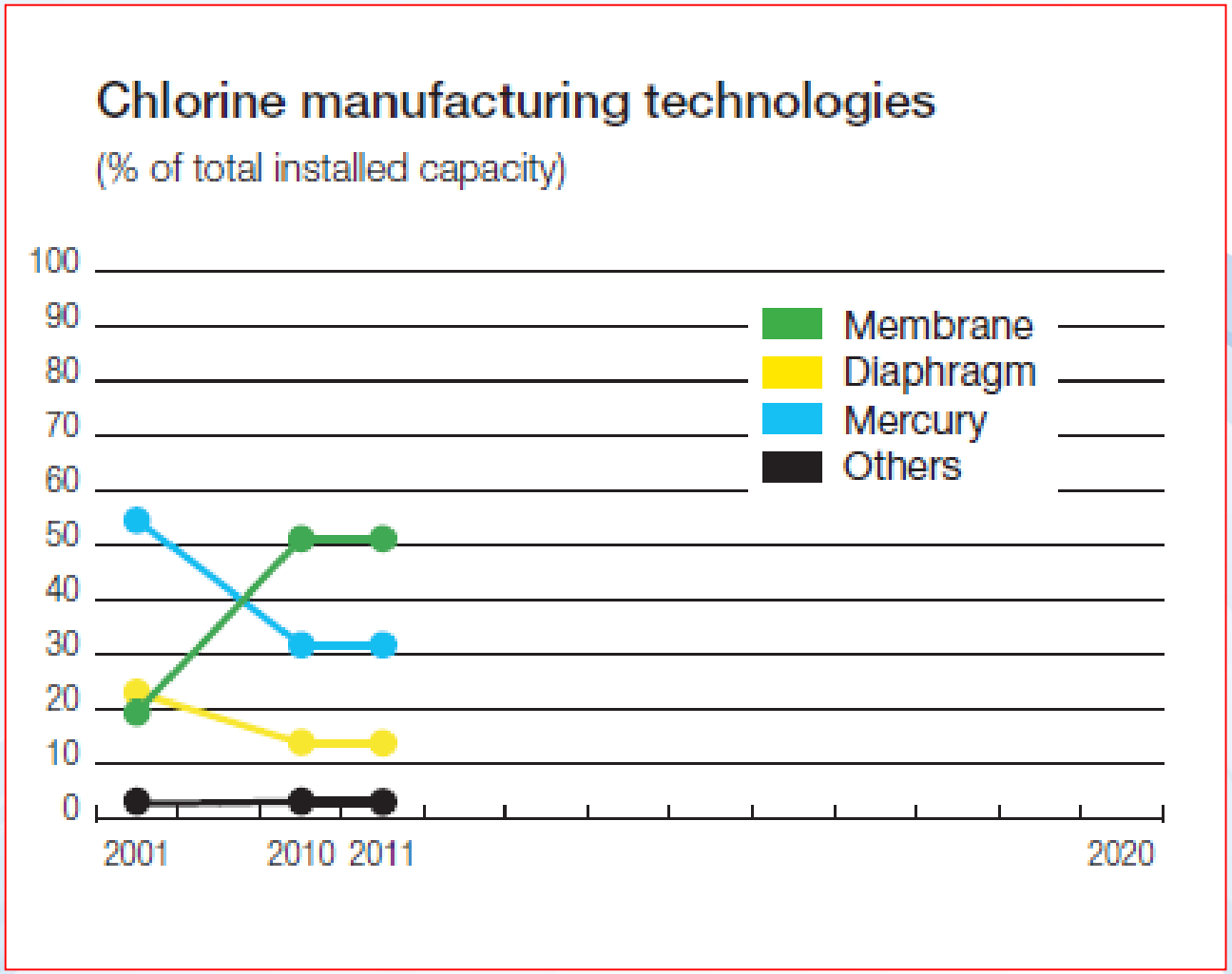
Disadvantages:

- High acquisition costs
- High operating costs

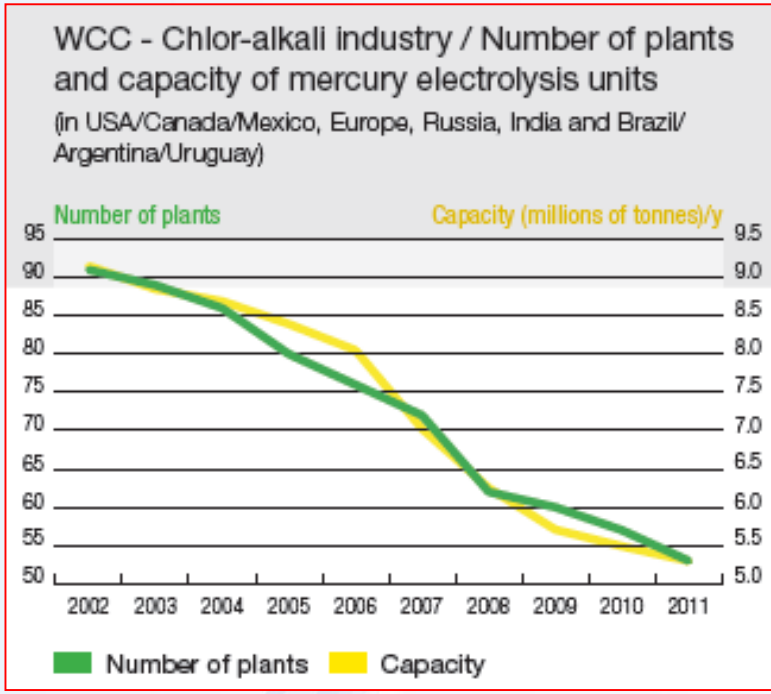
Trend of mercury emissions (weighted averages) from mercury cell chlor-alkali plants in EU-27 and EFTA countries as reported by Euro Chlor

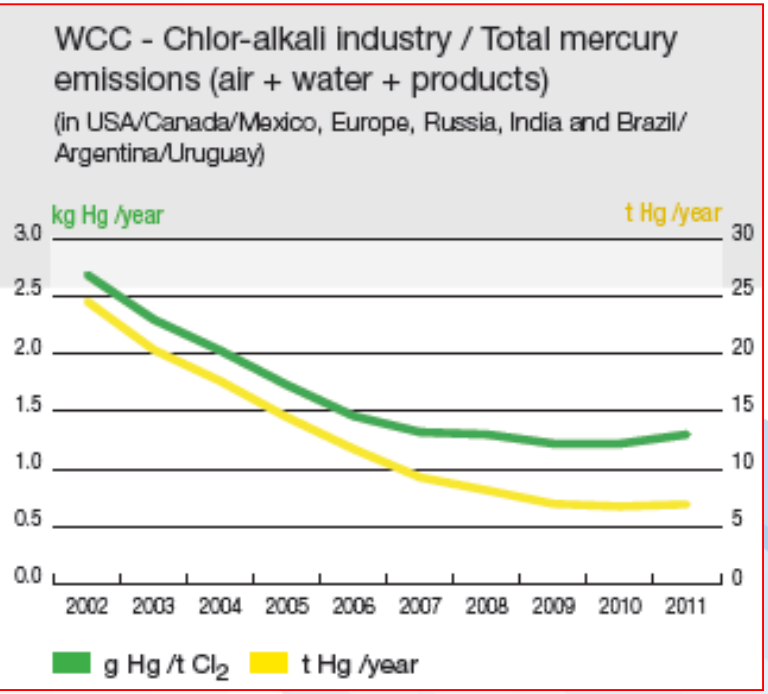


Chlor-Alkali Production in Europe



Chlor-Alkali Production - world





WCC – World Chlorine Council

- The number of plants went down from 91 to 53 over the period 2002-2011 (-42%) and the mercury cell-based capacity from 9.1 million tonnes to 5.3 million tonnes (-42%).
- Global mercury emissions went down from 24.6 tonnes per year to about 6.9 tonnes, or 72 % decrease over the ten years of reporting by WCC. The emissions expressed in g mercury/ tonne annual chlorine capacity show a similar trend.

Mercury waste management in the CR

Waste containing mercury = hazardous waste – 9 catalogue nr.

Production of specific waste containing mercury	
Type of waste	Ton - 2010
Construction and demolition waste containing mercury	150
Waste from inorganic chemical processes	135
Fluorescent tubes and other mercury-containing waste	135
Amalgam waste from dental care	2

Mercury waste production			
year	2009	2010	2011
ton	454,8	440,1	675,8

Visible metallic mercury in alluvial sediments

Mongolia: Technical and Technological Support for Ecological Burden Remediation Caused by Illegal Mining in Central Part of Mongolia, GEOMIN Company;

Zambia - Detail of the surface of the main tailings pond of chemical wastes at the Bwana Mkubwa Locality

Incrustations and efflorescence of toxic salts (light gray) originating through evaporation are wind blown over adjacent areas during the dry season.

Spolana Neratovice – former production of chlorine

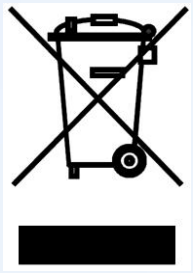
Mercury waste management CR

Waste containing mercury = hazardous waste – 9 catalogue nr.

Production of specific waste containing mercury	
Type of waste	Ton - 2010
Construction and demolition waste containing mercury	150
Waste from inorganic chemical processes	135
Fluorescent tubes and other mercury-containing waste	135
Amalgam waste from dental care	2

Mercury waste production			
year	2009	2010	2011
ton	454,8	440,1	675,8

Collection in the Czech Republic

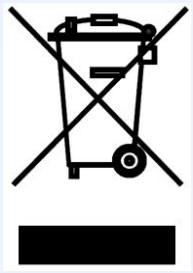


Compact fluorescent lamps

Straight fluorescent lamps

+ Gas discharge lamps

Collection in the Czech Republic



- Mercury is included in a white CaO powder
- Lapms are collected in in cardboard boxes, which are specially designed to prevent smash of lapms

Treatment - feeding

- Inside special machines
- Staff feeds lamps into special grips by lamp cap

Straight fluorescent lamps

Gas discharge lamps

Treatment - depollution

- The machine breaks off lamp caps
- Shredding of glass, milling

- Milled glass is feeded into furnace, mercury is converted into gas, exhausted into condenser and coolled
- Glass is afterwards cleaned
- Viable market for mercury: producers of fluorescent lamps
- In line with Basel guidance

Teşekkür Ederim