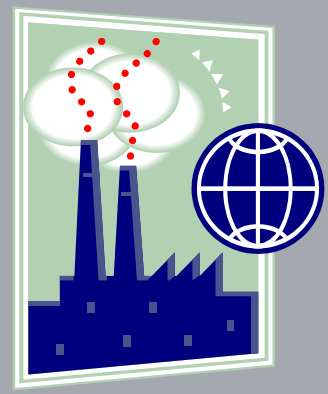
Lead, Cadmium & Mercury:
Global Heavy Metals Pollutants



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Presentation Overview

- Heavy Metals—Invisible Pollutants
- Major emissions & long range transport
- For each heavy metal, overview of:
  - Major uses
  - Global demand
  - Supply sources
- Conclude with NGO Perspective

Lead

Lead – Major Uses

- Batteries largest use by far (78%) for motor vehicles and back up power generators
- Lead compounds (8%)
  - petrol anti-knock additives
  - stabilizers for PVC, crystal glass, ceramic glazes
  - pigments
- Rolled sheets for construction (5%)
- Use of lead in petrol has been largely discontinued and is being phased out where use continues

Lead - Global Demand

- 6.98 million tonnes in 2004, 7.13 million tonnes in 2005
- US largest user (1.47 million tonnes)
- China next largest (1.18 million tonnes) increased by more than 8% over 2004-5, and doubled since 2000
- Rises in demand forecast for Germany, Czech Republic, India

Lead – Supply Sources

- 3.15 million tonnes from primary mining in 2004
- Sources in U.S. Australia, Canada, China, Ireland, Mexico, Peru and Portugal
- Remainder from secondary recycling
- Recycling rates higher for developed countries (60 to 70%) and lower for developing countries (< 30%)

Emissions

- Natural
- Anthropogenic: 120,000 mt
- Varies across countries
  - 800,000 - 1800,000 mt
  - Air: leaded fuel, non-ferrous production, coal combustion.
  - Land to waste deposits. (ammunition lost (120,000 mt - 2003,, mine tailings, smelter slag and waste. Lead pigments, cables with lead sheathings.
  - Aquatic: - direct and air deposition.

Transport and pathways

- Atmospheric, Ocean, River and lakes
- Atmospheric: long distance.
  - Short residence time of lead
  - Re emissions

  Aquatic: Global. Also leads to oceanic sediments. Concentration decreases with distance from sources.

  Rivers, lakes: national and regional scales.

Cadmium

Cadmium – Major Uses and Demand

- **Nickel Cadmium batteries largest use by far (82%)** & increasing in the following applications:

  -power tools/communication devices/ hybrid vehicles, power storage, solar cells
- 10% for pigments
- 6% for plating
- 2% for other uses
- Rising demand from China and India
- Shrinking demand from developed countries or regions such as the EU

Cadmium – Supply Sources

- 2004 primary production 17,000 tonnes:
  - Asia (41%)
  - The Americas (16%)
  - Europe (15%)
  - Australia (3%)
- By-product of mining, smelting and refining zinc, (to a lesser degree, lead and copper)
- Remaining 25% recovered from recycling and stockpiles.
- Total refined Cadmium- 20,000 tonnes in 2004

Releases

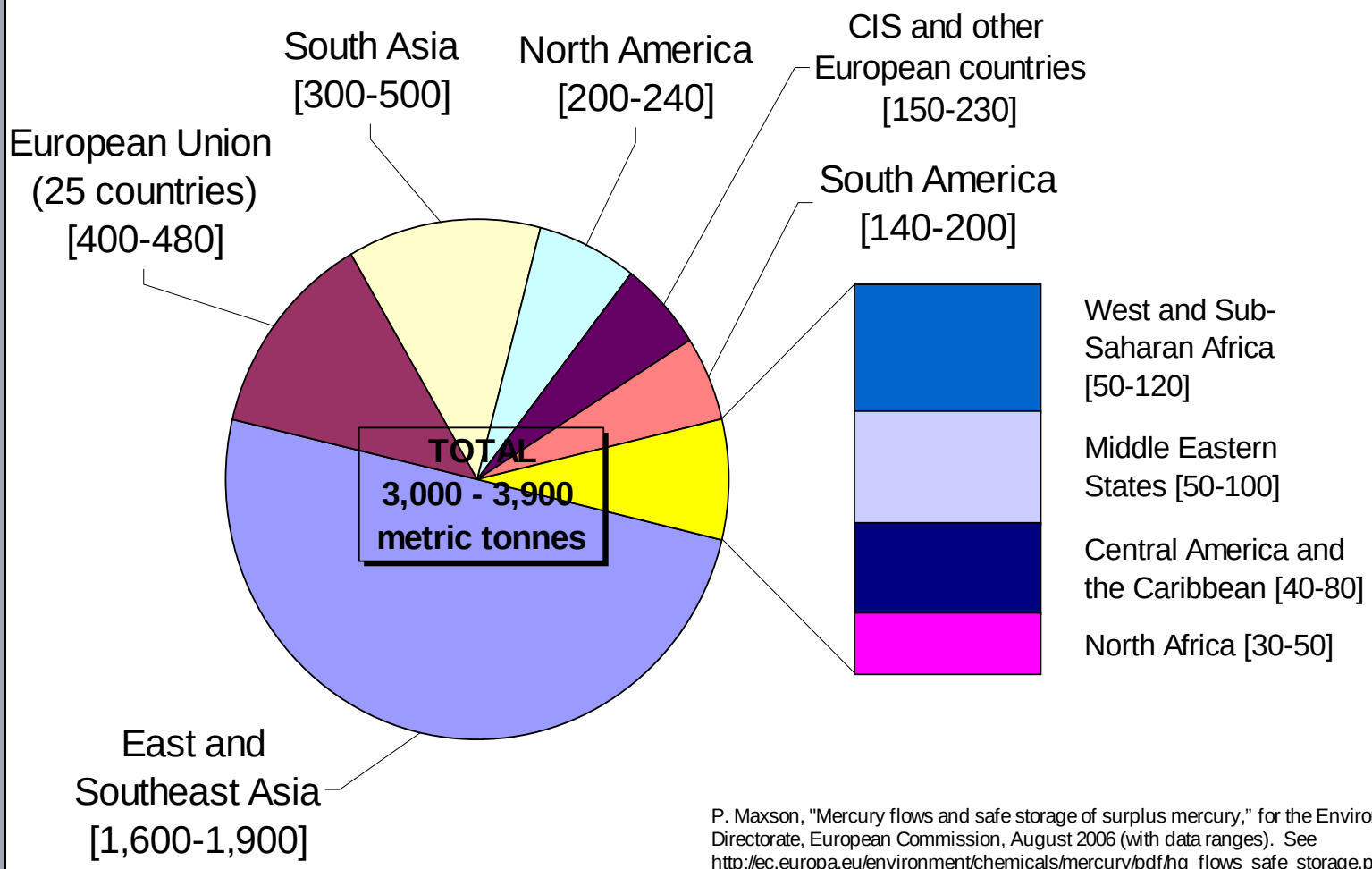
- Natural - Volcanoes etc.
- Anthropogenic: To Air: Industrial combustion and processes. - Non ferrous metal and iron and steel production, fossil fuel combustion, waste incineration, open waste burning.
- To Land (Waste and Soil): 10,000 - 45,000mt/yr (*Nriagu and Pacyna*) : fertiliser, coal ash, sewage sludge, urban refuse, mine tailings, smelter slags.
- To Aquatic environments: 2100 - 17000 mt/yr
- Re-mobilization

Transport and Pathways

- Atmospheric: long distant intercontinental
  (ice cores but specific data lacking)
- Aerosol transport like lead - depends on source, characteristic, atmospheric conditions, precipitation and deposition etc.
- Ocean Transport: Extensive data for specific locations.
- Fresh water transport

Mercury

Mercury demand by region - 2005 (metric tonnes)



P. Maxson, "Mercury flows and safe storage of surplus mercury," for the Environment Directorate, European Commission, August 2006 (with data ranges). See http://ec.europa.eu/environment/chemicals/mercury/pdf/hg_flows_safe_storage.pdf

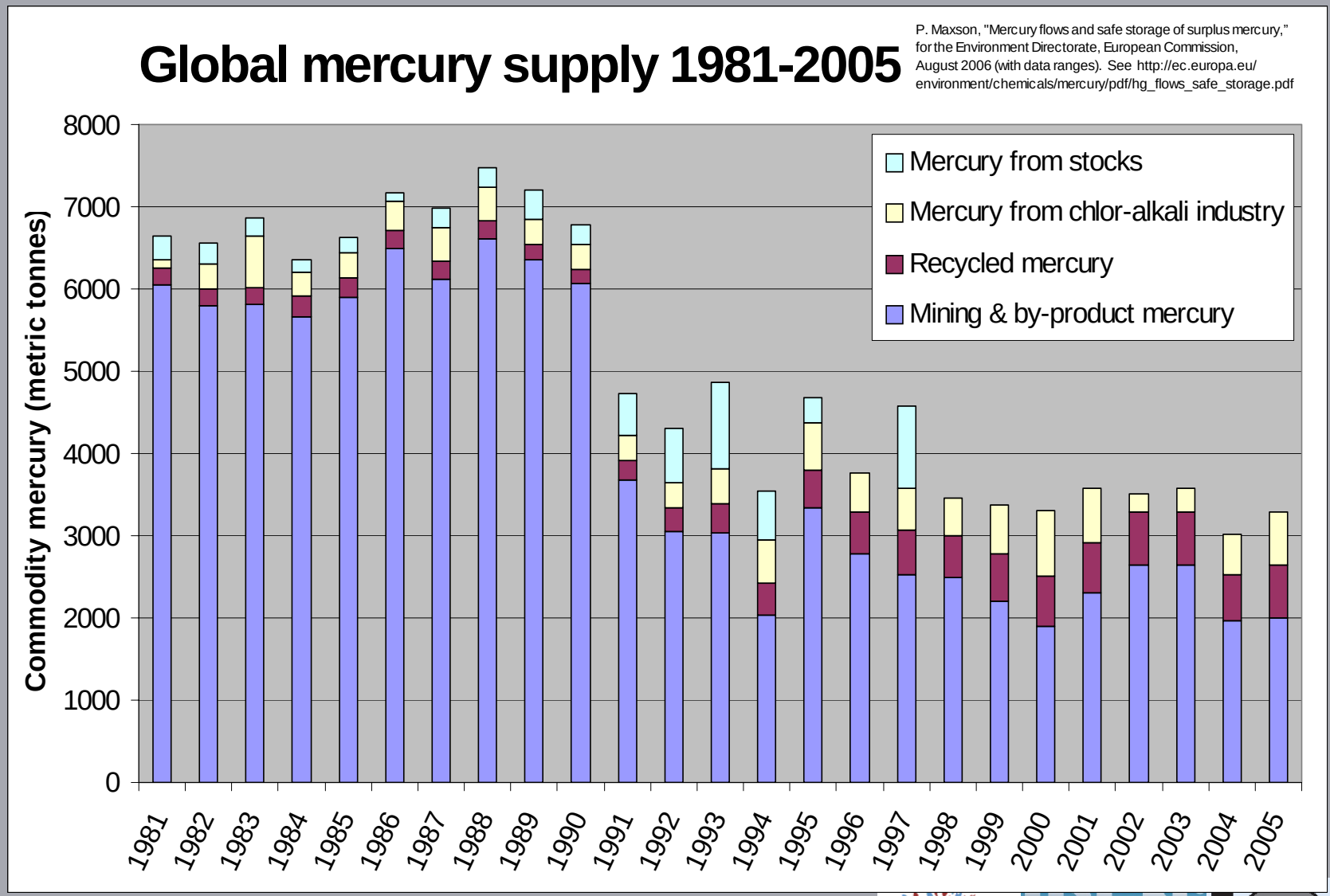
Mercury – Export & Global Demand

- EU and US - net exporters.
- Almost 80% consumed by chlor-alkali plants outside of EU and US - though such plants supply only 50% of mercury cell global production
- EU to phase out nearly 50 Hg chlor-alkali units by 2020, freeing12,000 metric tonnes of Hg
- Small scale mining - estimated 800+ tonnes consumed annually
- Global annual trade approx. between 100-150 million USD in value
- China less clear - recent reports - increasing use in VCM production.

Mercury - Principal Supply Sources

- Primary mercury mines
- By-product recovery from other mining
- Decommissioned chlor-alkali plants
- Recovered mercury from wastes and products
- Government stockpiles (only U.S. stockpile remains)

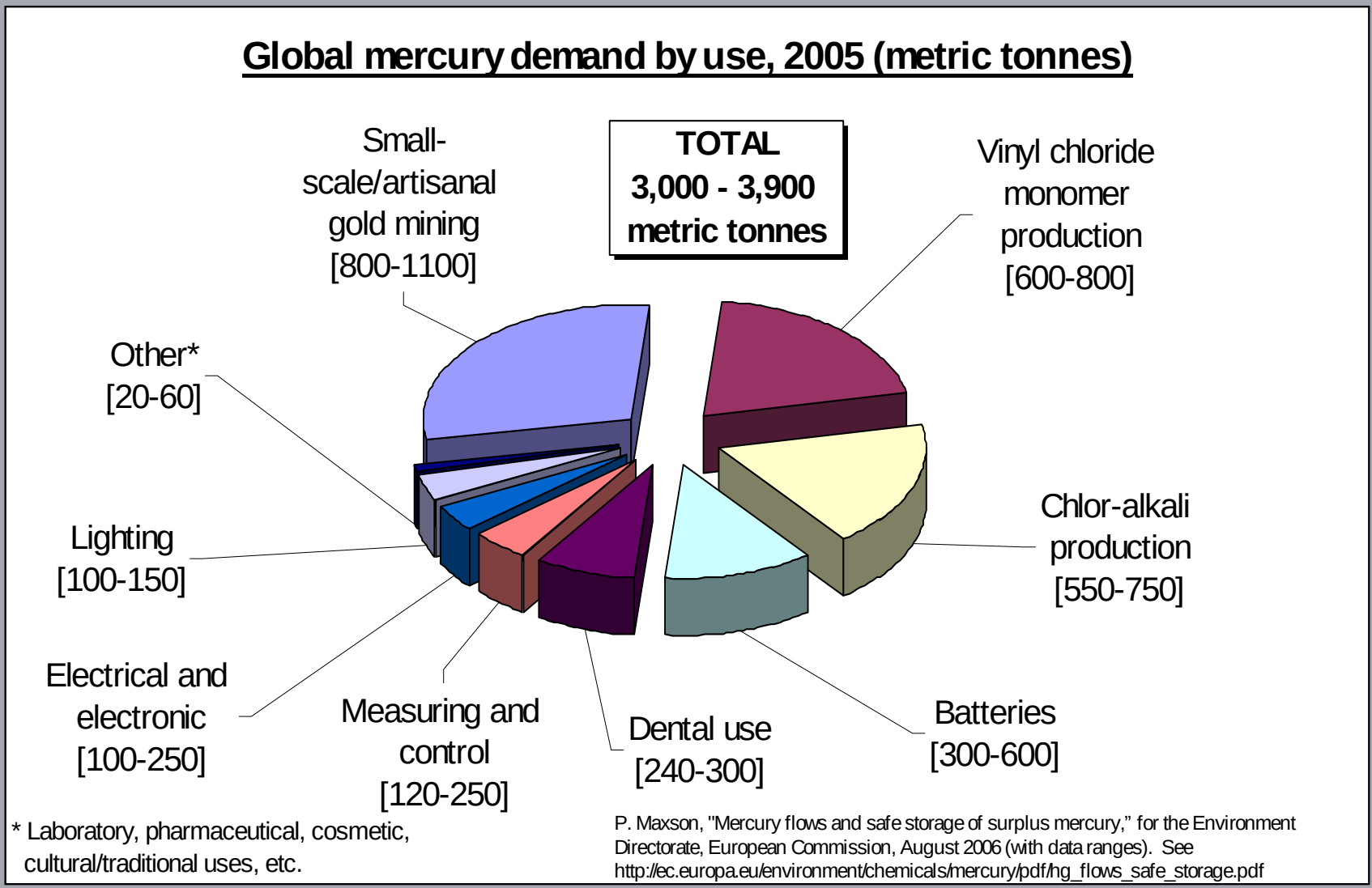
Mercury – Global supply



Mercury - Supply

- Spain (recycled only) and Kyrgyzstan (mining), previously also Algeria
- Secondary supply from Finland and Peru and others
- In-use Hg worldwide > 24,000 to 30,000 mt in chlor alkali : half in the EU
- Recoverable in waste and products > 20000 to 30,000 metric tonnes
- China – mining for internal demand

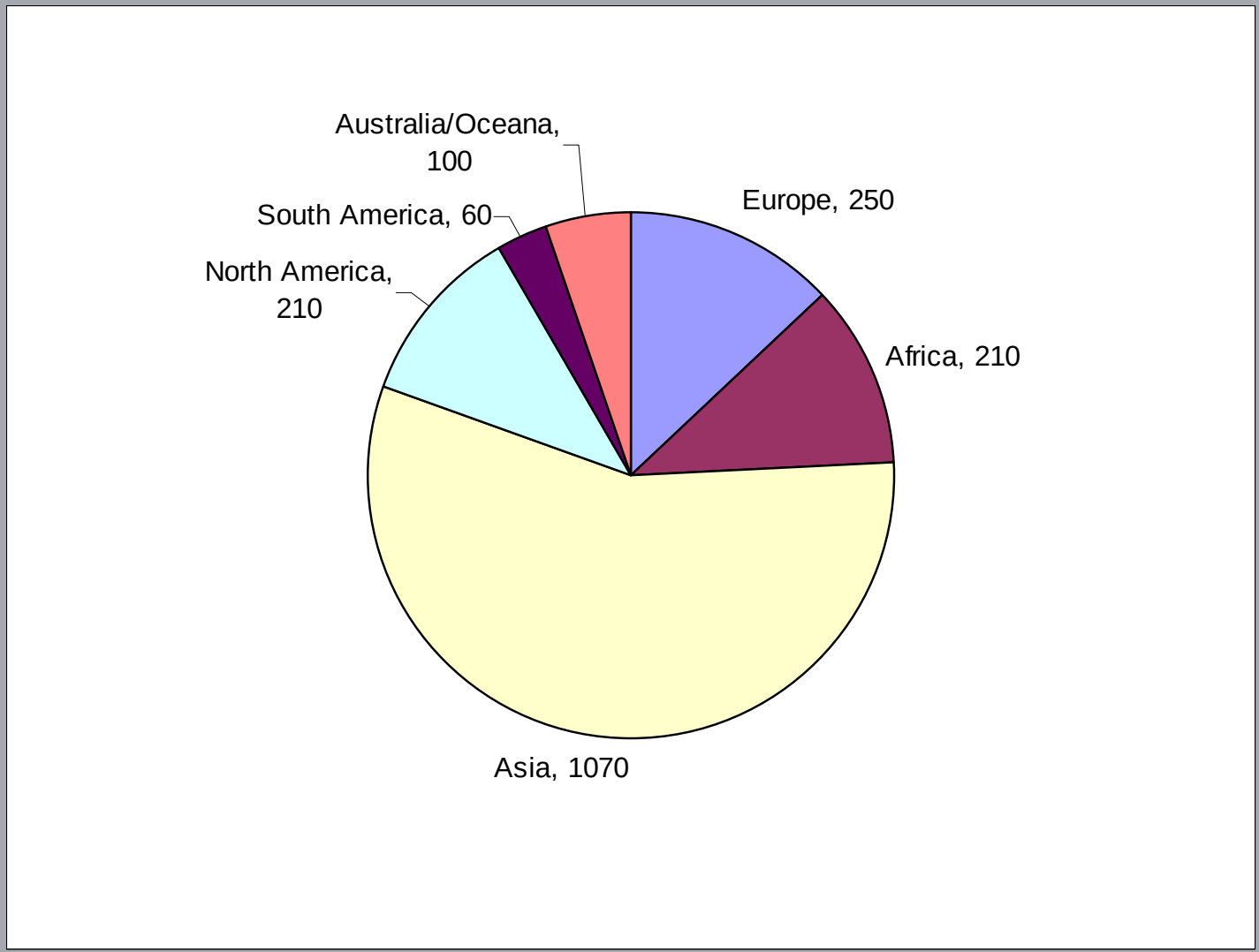
Mercury – Global Demand by Use



Mercury - Emissions

- Combustion of coal for power - significant source of atmospheric mercury emissions.
- Also emitted to air from basic industrial activities
  - - metal production, crematoria, mercury-cell chlor-alkali, cement kilns, other point sources.
- Incinerators - products and waste

Mercury - Global Air Emissions By Region



Transport and pathways

- Present throughout the environment
- Persistent and cycles globally - between air, water, sediments, soil and biota in various forms
- air emissions - gaseous elemental mercury
- remaining emissions - gaseous inorganic ionic mercury forms (such as mercuric chloride) or bound to emitted particles. - shorter atmospheric lifetime, deposit to land or waterbodies within roughly 100 to 1000 km of their source.
- Elemental mercury can undergo transformation into ionic mercury- significant pathway for deposition.
- form can change to methyl-mercury - collect in organisms (bioaccumulate) and up food chains (biomagnify) -aquatic food chain (fish and marine mammals).

(*Global Mercury Assessment Report - UNEP)*

Mercury - Recent Landmarks

- UNEP Global Assessment Report & GC Decisions
- US decision to stockpile surplus mercury
- EU Community Strategy on Mercury
  - Export ban proposal by 2011, resulting in closing of primary mine
  - Storage of surplus mercury
  - Legislation phasing out mercury uses
- Work in developing countries
  - HCWH
  - Country-based initiatives (ex. Toxics Link in India)
  - UNIDO & Others Work-Artisanal/Small Scale Gold Mining

Conclusion: NGO Perspective

- Mercury, lead and cadmium are all global pollutants
- UNEP Assessment on mercury confirms need for immediate and long term global actions
- Establish mercury global demand reduction goal of 50% by 2012 and 70% by 2017
- Achieve demand reductions through phase-out of mercury use in products and processes, such as button cell batteries, switches, measuring devices, and chlor-alkali facilities
- Curb introduction of excess mercury into commerce through phase-out of primary mining, storage of mercury from closing chlor-alkali facilities, and restrictions on exports from developed countries
- Develop financial assistance plan with international development organizations and donor nations to facilitate transition from mercury cell chlor-alkali facilities to more energy efficient membrane technology in developing nations

Toxics Link
for a toxics-free world

IPEN
zero Hg
mercury working group

BAN
HG-WG

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