Commodity-Grade Mercury
Global Supply, Demand, and Movement

Commodity-Grade Mercury Stakeholder Meeting
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Purpose

- To provide background on global supply, demand, and the movement of commodity-grade mercury.
- To help facilitate panel discussions on supply versus changing demand.

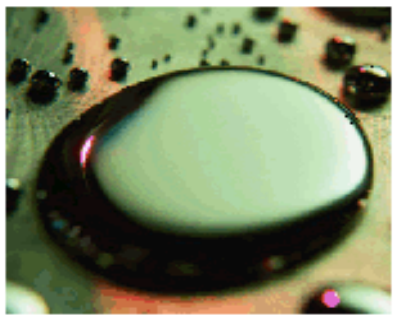
Overview

- Global Supply
- Global Demand
- Movements and Trends
- Difficulties in Analysis

Global Supply

- Primary
  - Industrial Mining
- Secondary
  - Industrial Mining By-Product
  - Natural Gas Extraction and Refining
  - Closed or Converted Mercury Cell Chlor-alkali Production

Industrial Mining



- Active Facilities
  - China
    - Increased production from 203 mt/yr to >700 mt/yr (2000-2005).
    - Increased mining production offsets reductions in imports.
    - Domestic mining production largely – if not entirely – remains in China.
      - Supports booming vinyl chloride monomer (VCM) production industry.
      - Chinese VCM facilities account for 80-90 percent of global market and consume 600 mt/yr mercury.
      - Domestic mining and use trends likely to continue.
  - Kyrgyz Republic
    - Average production of ~534 mt/yr (2000-2005).
    - Until 2004, exported approximately 400 mt/yr to China.
      - Excess yields cannot be traced, but believed to be reaching stockpiles in the former Soviet Union.

Industrial Mining By-Product

- Driven by mercury market forces.
  - High demand → Recovery, separation, sale
  - Low demand → Air emission, waste disposal

- Primary sectors:
  - Zinc
  - Gold (industrial)
  - Other non-ferrous ores

Industrial Mining By-Product (cont'd)

- Zinc
  - European Union
    - Recover 20-75 mt/yr for resale, although sales decline 83 mt/yr to 24 mt/yr (2001-2005).
    - Approximately 45 mt/yr disposed in bedrock depositories.
- Gold (Industrial)
  - South America
    - 80-100 mt/yr
  - United States (*Gold/silver combined)
    - >110 mt/yr
  - Mexico (*Gold/silver tailings)
    - 200 mt/yr
- Other Non-Ferrous Ores
  - EU
    - 200 mt/yr
  - Global Estimate
    - 1,000-1,500 mt/yr

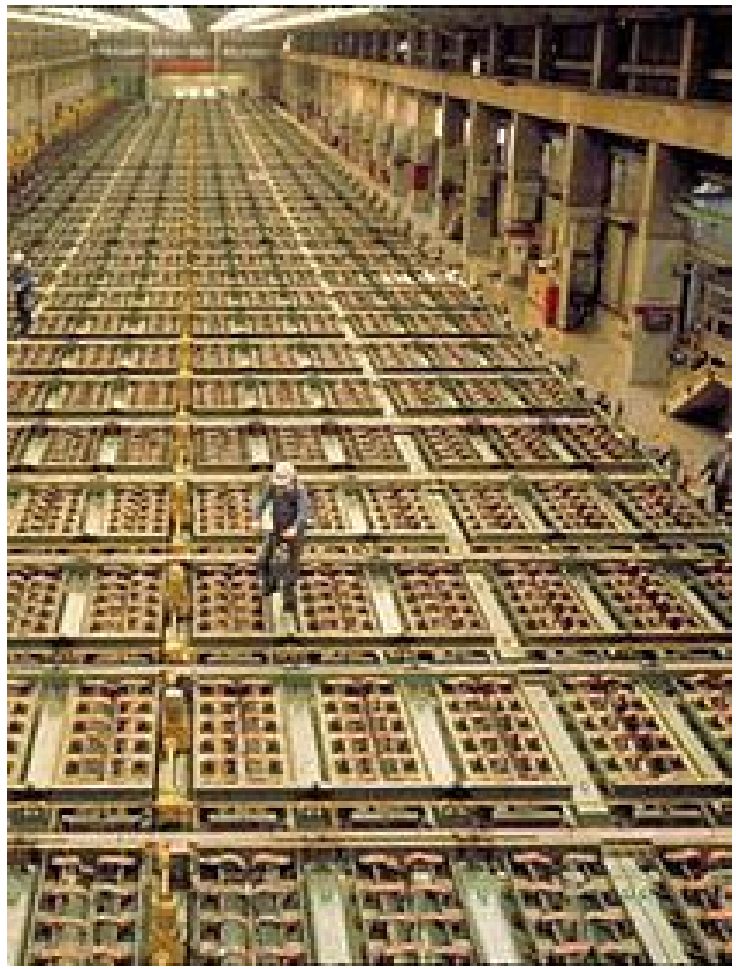
Natural Gas Extraction and Refining

- Natural Gas
  - Czech Republic, Netherlands, and Croatia report recovery of mercury in refining.
    - 12 mt/yr mercury recovered
  - Global Estimate
    - 50-100 mt/yr wastes generated
    - Approximately 10 mt/yr mercury recovered

Closed or Converted Mercury Cell Chlor-alkali Production

- Estimated

  14,000 to 22,000 mt in global reservoir (e.g., mercury electrolytic cells and facilities).
  - European Union
  - India
  - United States



Closed or Converted Mercury Cell Chlor-alkali Production (cont'd)

- European Union
  - Mercury in cells: >12,000 mt
    - 25-75 mt mercury in facilities (e.g., structures, equipment, soils).
      - Varies due to age and design of facility.
  - Anticipated "straight-line" phase-outs.
    - By 2010: 4 nations
    - By 2020: 5 nations
    - Closed/converted facilities: 29
    - Active facilities: 41
  - Proposed export ban would require EU facility operators to sell mercury to each other or to store mercury.

Closed or Converted Mercury Cell Chlor-alkali Production (cont'd)

- India
  - Mercury in cells: 20-30 mt
  - As of 2006:
    - Closed/converted facilities: 1
    - Active facilities: 10 (small-scale)
    - Reported non-binding industrial agreement to close or convert all facilities by 2012.
  - 60 percent reduction in mercury consumption (2002-2005).
    - Not clear what India does with excess stocks of mercury, although data suggest some brokering activities.

Closed or Converted Mercury Cell Chlor-alkali Production (cont'd)

- United States
  - Mercury in cells: 2,400 mt
    - Approximately 1,800 metric tons is recoverable.
  - As of 2003:
    - Closed/converted facilities: 16
    - Active facilities: 8
  - U.S. anticipates retirement of two of eight remaining active facilities by 2008.

Other Supplies

- Spain
  - Almadén facility (closed mercury mining facility) purchases, stockpiles, and sells elemental mercury and cinnabar – from local and international sources.
  - Estimated 1,000-2,000 mt at Almadén facility.
- European Union
  - Port-based facilities in Belgium and the Netherlands.
  - Possible underground salt-mine disposal pending export ban legislation.
- United States
  - DOD: >4,400 mt
    - In storage since 1994.
  - DOE: >1,200 mt
  - Non-federal: ~2,400 mt

Global Demand

- Global estimates:
  - Current demand >3,400 mt/yr
  - Current supply >3,600 mt/yr
    - Maxson allows for variability of 15-20 percent.
  - Current trade value $64 M/yr
    - ($650/flask) x (3,400 mt/yr) x (1 flask/0.0345 mt)
      - $650/flask reflects 2006 USGS estimate.

Global Demand (cont'd)

- Major Global Products
  - Wiring Devices/Switches
  - Measuring and Control Devices
  - Dental Amalgam
  - Electrical Lighting
  - Batteries

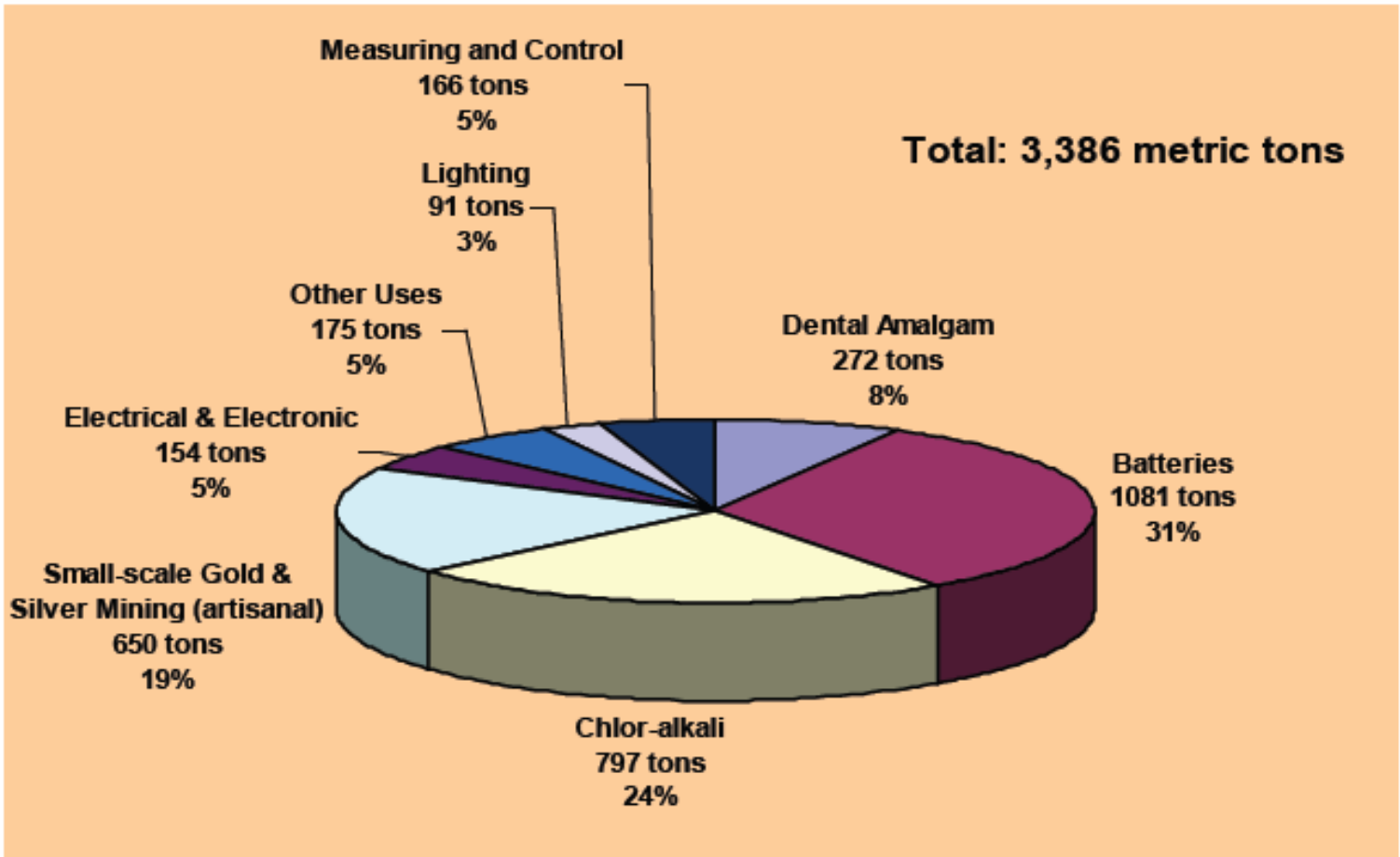
- Major Global Processes
  - Vinyl Chloride Monomer (VCM) Production
  - Artisanal Mining
  - Mercury-Cell Chlor-Alkali Production

Vinyl Chloride Monomer Production (Recycled Catalyst)

- China
  - Estimated that China uses more than 700 mt/yr mercury in catalyst.
- Russia
  - Four facilities in Russia.
- United States and European Union
  - No known facilities.

Global Demand (cont'd)

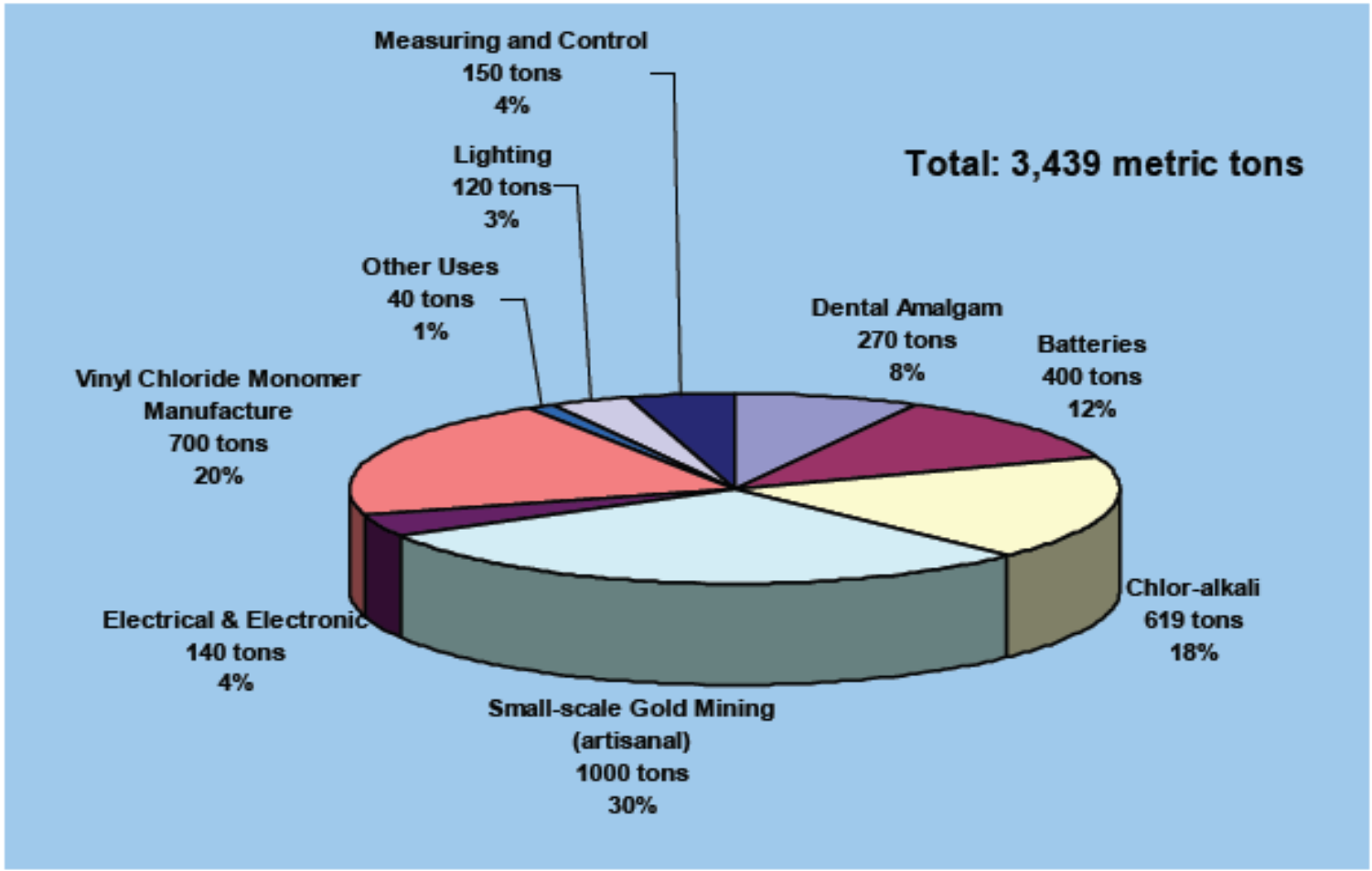
Global Mercury Demand (2000)



Maxson, P.A., 2004, Mercury Flows Report: Mercury Flows in Europe and the World, the Impact of Decommissioned Chlor-alkali Plants. European Commission. Accessible at: http://ec.europa.eu/environment/chemicals/mercury/pdf/report.pdf.

Global Demand (cont'd)

Global Mercury Demand (2005)



Maxson, P.A., 2006, "Mercury Flows and Safe Storage of Surplus Mercury." Accessible at: http://ec.europa.eu/environment/chemicals/mercury/pdf/hg_flows_safe_storage.pdf

Global Demand (cont'd)

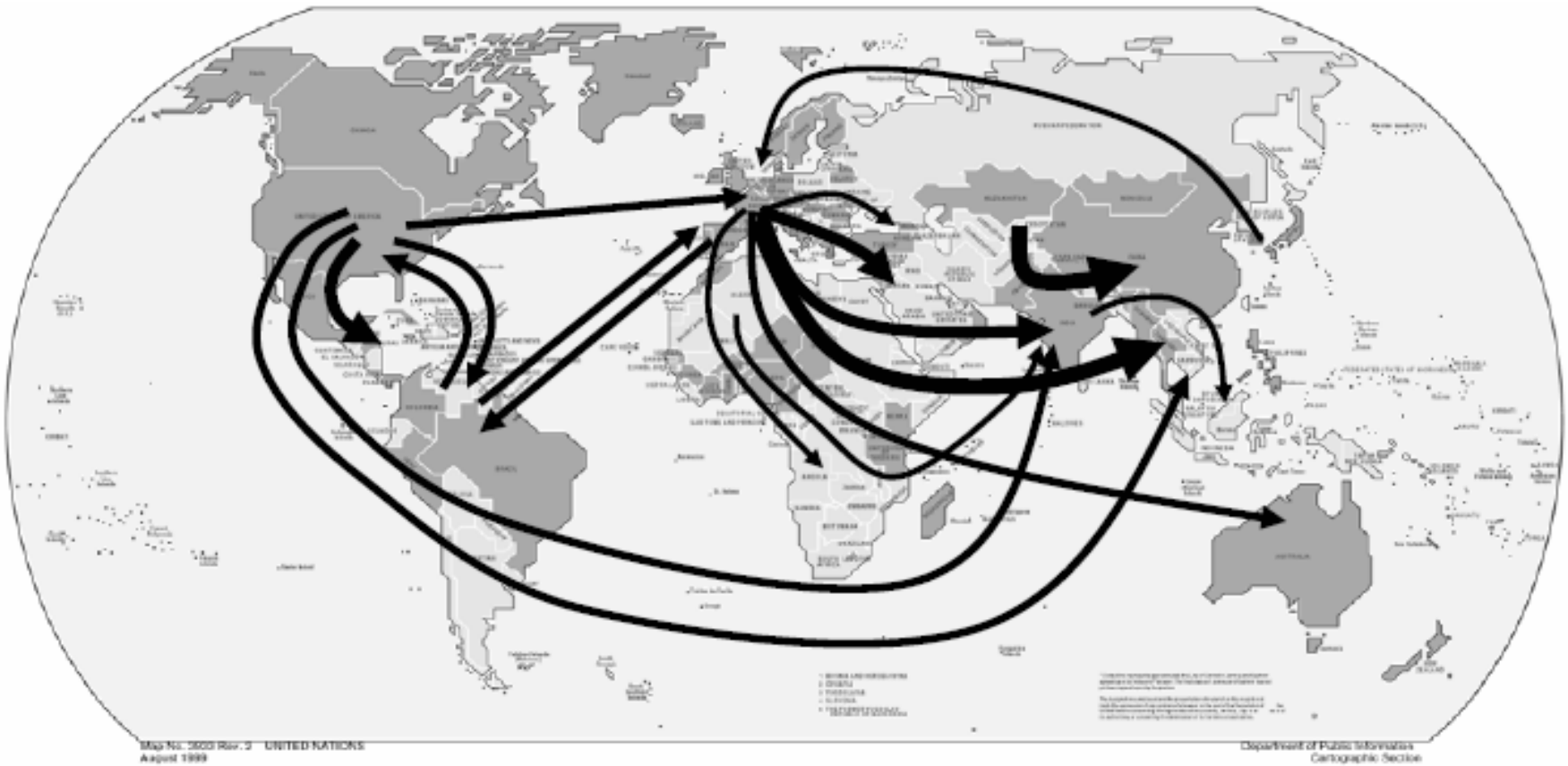
- Percent Change (2000-2005)
  - Decrease
    - Other — 79 percent
    - Batteries — 63 percent
    - Chlor-alkali Production — 22 percent
    - Measuring/Control Devices — 9 percent
    - Electrical/Electronic Devices — 9 percent
    - Dental Amalgam — <1 percent
  - Increase
    - Artisanal Mining — 54 percent
    - Lighting — 32 percent
    - VCM Production — N/A
      - Not listed in 2000; 20 percent of global total in 2005.

Movement and Trends

- Historical Trends
  - Variable demand as products/processes developed or become obsolete.
  - Result is movement of supply/demand from developed nations to developing nations:
    - Developed nations
      - Decreases in supply/demand with increased mercury substitution in products.
      - Chlor-alkali production, electronic/measuring devices, electrical lighting.
    - Developing nations
      - Increases in demand/supply with shifting of product production/end-use from developed nations.
      - Artisinal mining, cosmetics, cultural/traditional uses, paints, agricultural chemicals.
        - » Mercury demand for artisanal mining is influenced by price of gold.

Movement and Trends (cont'd)

Commodity Mercury Shipments Among Global Regions (2004)



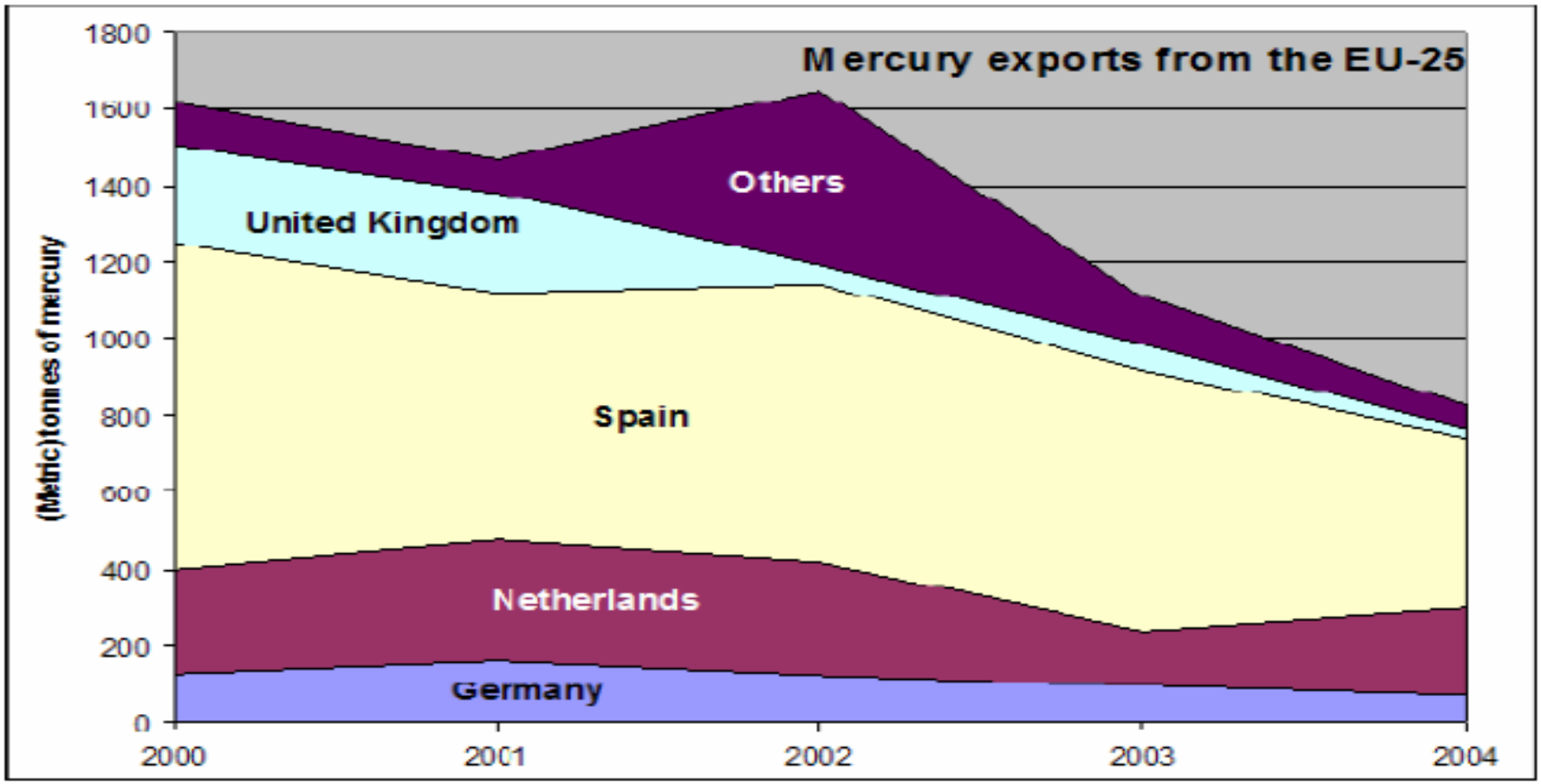
Summary of Supply, Trade, and Demand Information on Mercury (November 2006), *available at* http://www.chem.unep.ch/MERCURY/Trade%20report%20final%20PDF.pdf, p. 13.

Movement and Trends (cont'd)

- Modern Trends
  - Global Demand
    - 1960s 9,000 mt/yr
    - 1980s 7,000 mt/yr
    - 1990s <4,000 mt/yr
    - 2005 3,400 mt/yr
  - Most product categories consumption declining, except lighting.
  - Most process categories decreasing, except VCM production and artisanal mining.

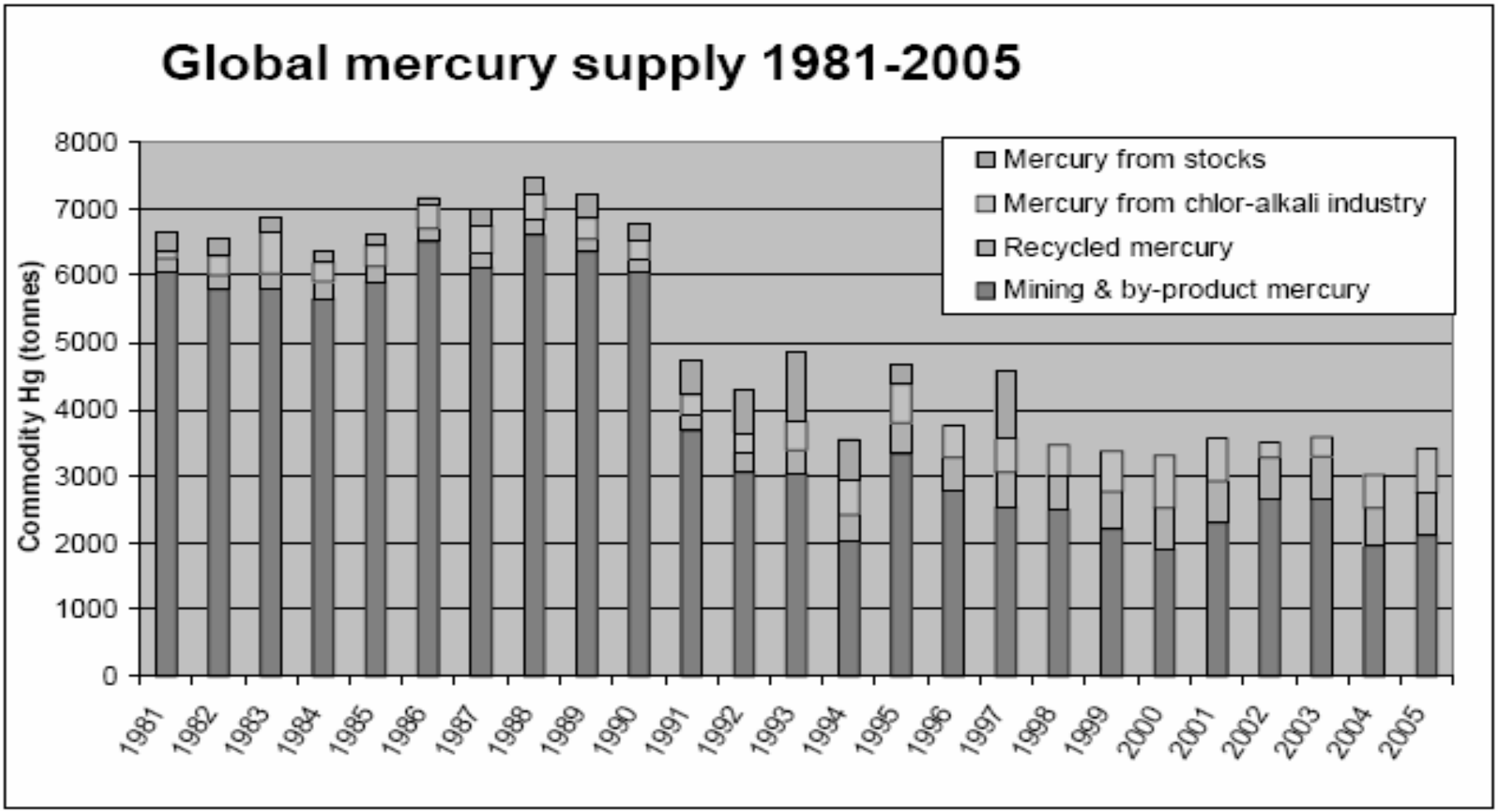
Movement and Trends (cont'd)

EU-25 elemental mercury exports, 2000-2005



Source: European Commission Directorate General for the Environment. Mercury Flows and Safe Storage of Surplus Mercury (August 2006), *available at* http://ec.europa.eu/environment/chemicals/mercury/pdf/hg_flows_safe_storage.pdf, p. 28.

Movement and Trends (cont'd)



Source: UN Governing Council. Summary of Supply, Trade, and Demand Information on Mercury (November 2006), *available at* http://www.chem.unep.ch/MERCURY/Trade%20report%20final%20PDF.pdf, p. 5.

Difficulties in Analysis

- "Price-insensitive" nature of the secondary market.
  - Environmental regulations geared toward recovery override market-balancing forces.
  - Leads to capture and stockpiling of mercury regardless of current market demands.
- Potential efforts to artificially increase the price of mercury.
  - Efforts to reduce widespread and unmonitored use in artisanal mining.
  - Uncertain impacts (e.g., reintroduction of primary mining) as price of mercury increases or fluctuates.
- Data gaps in the global inventory.
  - Difficulties in tracing amounts, origins, destinations, and end-uses/users.
  - Limited or unspecific publicly available trade data.
  - Uncertainty in tracking of origin and destination.
  - Unreliable tracking of timing of shipments or storage.
  - Absent or inconsistent data on mercury contained in compounds.
  - Unreported transactions.
- "Reintroduction" of uses that are discontinued in developed nations.
  - Measuring impact and flow of uses on developing nations.