

# Mercury In Utah

**Presentation to the Natural Resources, Agriculture and  
Environment Interim Committee  
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# Mercury (Hg) Basics

- Naturally-occurring as elemental mercury and mercury minerals
- Anthropogenic (man-made) sources:
  - Coal combustion
  - Hospital and municipal waste incinerators
  - Thermal treatment of gold and mercury ores
  - Geothermal heat recovery
  - Historic mercury and precious metals mining releases

# Five Problems with Mercury

- Biomethylation – organisms change mercury from inorganic to organic form
- Bioaccumulation – organic form is concentrated in the food chain, e.g., fish and waterfowl
- Global Transport – airborne
- Local Deposition – from local and regional sources and global transport
- High Toxicity – vapor and organic forms

# Mercury – 2 Key Forms

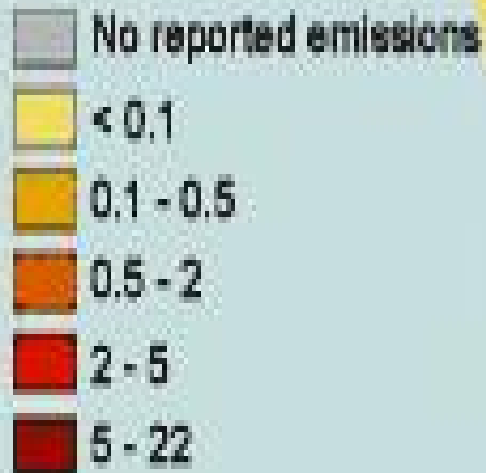
- **Elemental Mercury** – Inorganic ( $\text{Hg}$ )
  - Less toxic form; poorly absorbed if ingested
  - Non-bioaccumulative
  - Higher exposure if inhaled
  - Mercury in dental fillings
- **Methylmercury** – Organic ( $\text{CH}_3\text{Hg}$ )
  - Much more toxic; easily absorbed if ingested
  - Very slowly eliminated; half-life of 2-3 months
  - Bioaccumulative - fish and waterfowl tissue
  - Toxic to the nervous system and kidneys
  - Sensitive populations include pregnant women, infants and young children

# Mercury Toxicity Chronic Effects

- Birth defects
  - Visual problems, convulsions, cerebral palsy
- Mood and mental disorders
- Nervous system damage
- Memory loss
- Allergies
- Gum deterioration
- Hallucinations
- Skin irritation

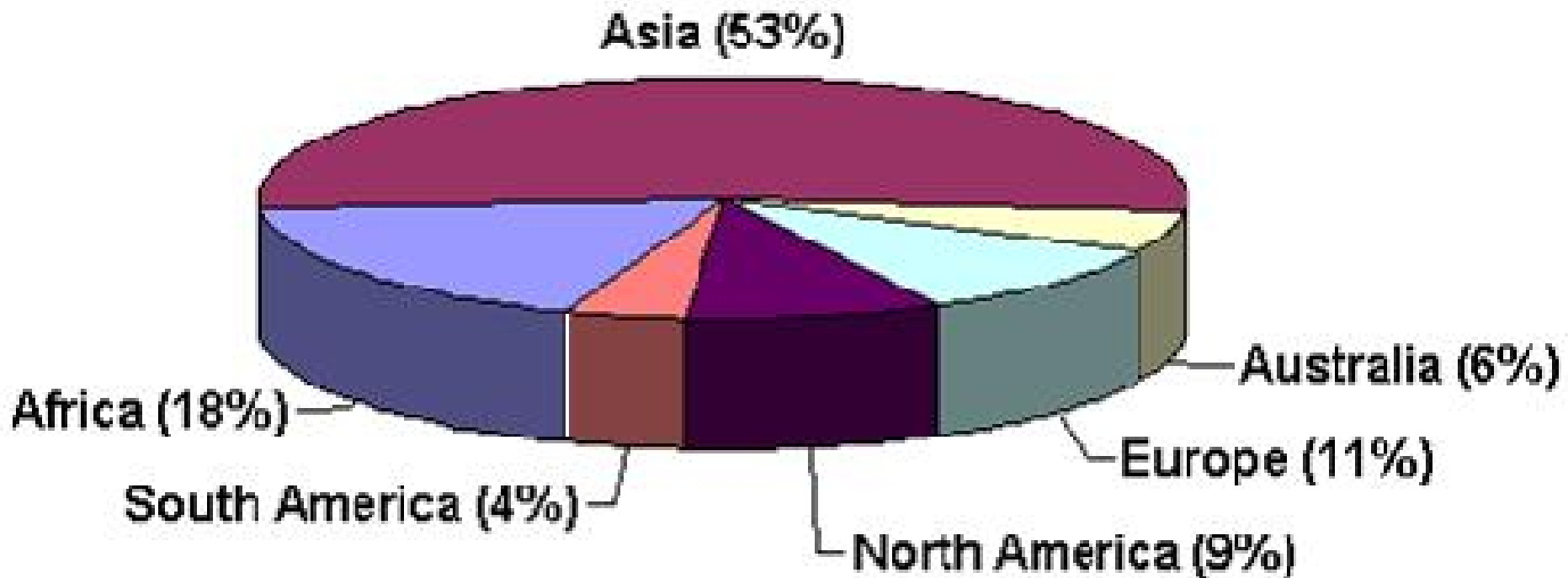
# MERCURY EMISSIONS

Mercury  
metric tonnes per year

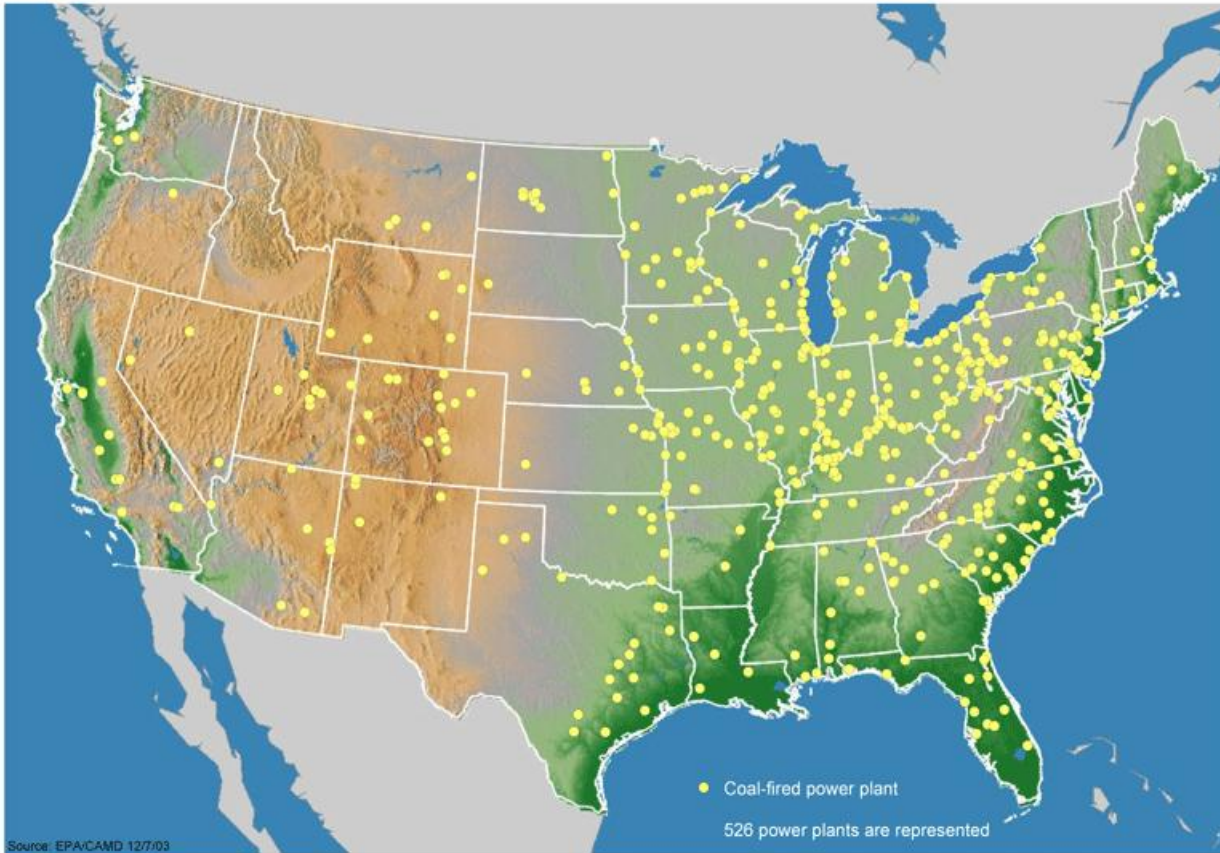


Source: United Nations Environment Programme Global Mercury Assessment, 2002, using J. Pacyna 1995 data, as presented by the Arctic Monitoring and Assessment Programme [www.epa.gov](http://www.epa.gov)

# Mercury Emissions by Region



# Coal-Fired Power Plants



U.S. Coal-Fired Power Plants

Coal-fired plants generate the vast majority of *power sector emissions*

100% Hg

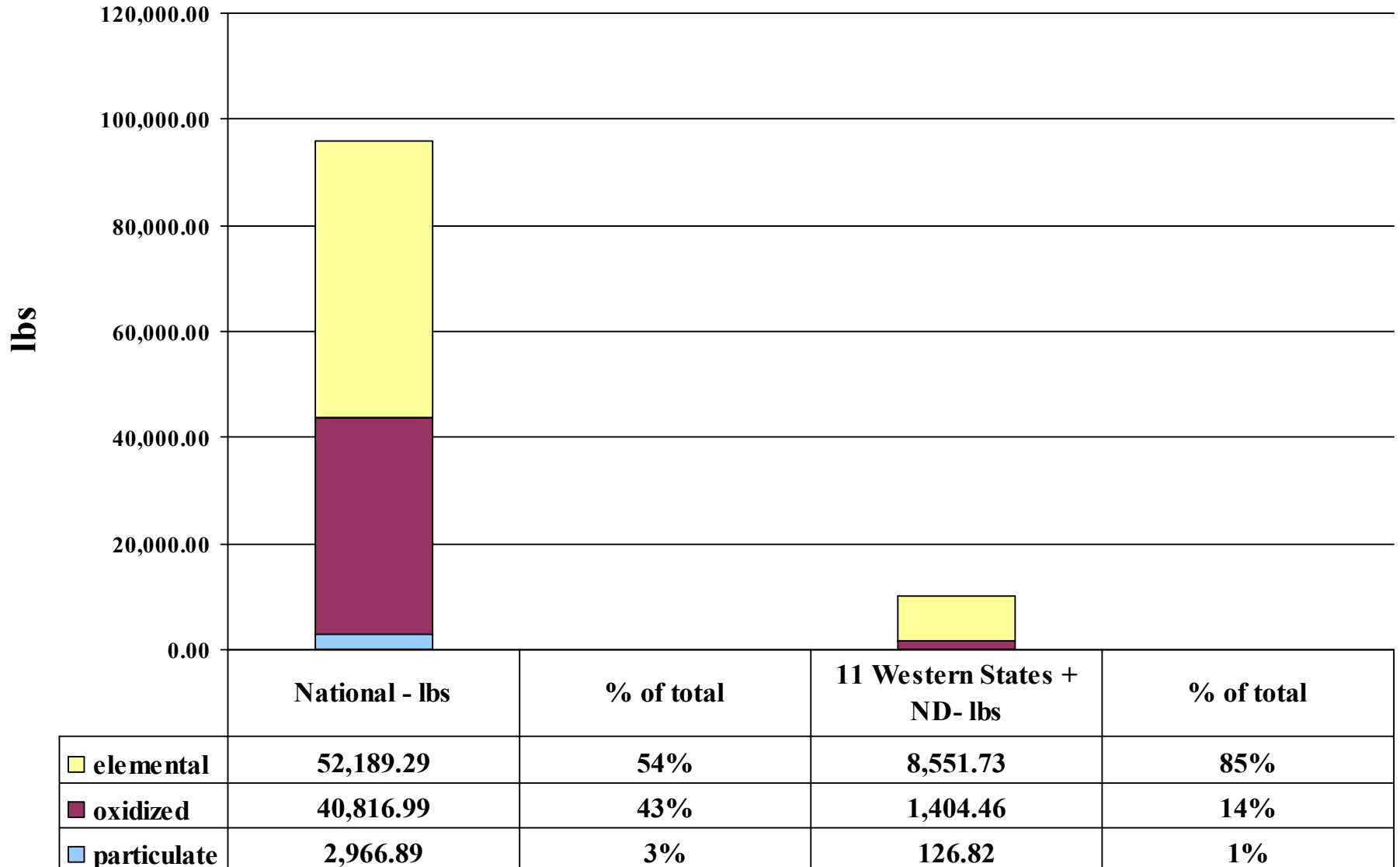
95% SO<sub>2</sub>

90% of NO<sub>x</sub>

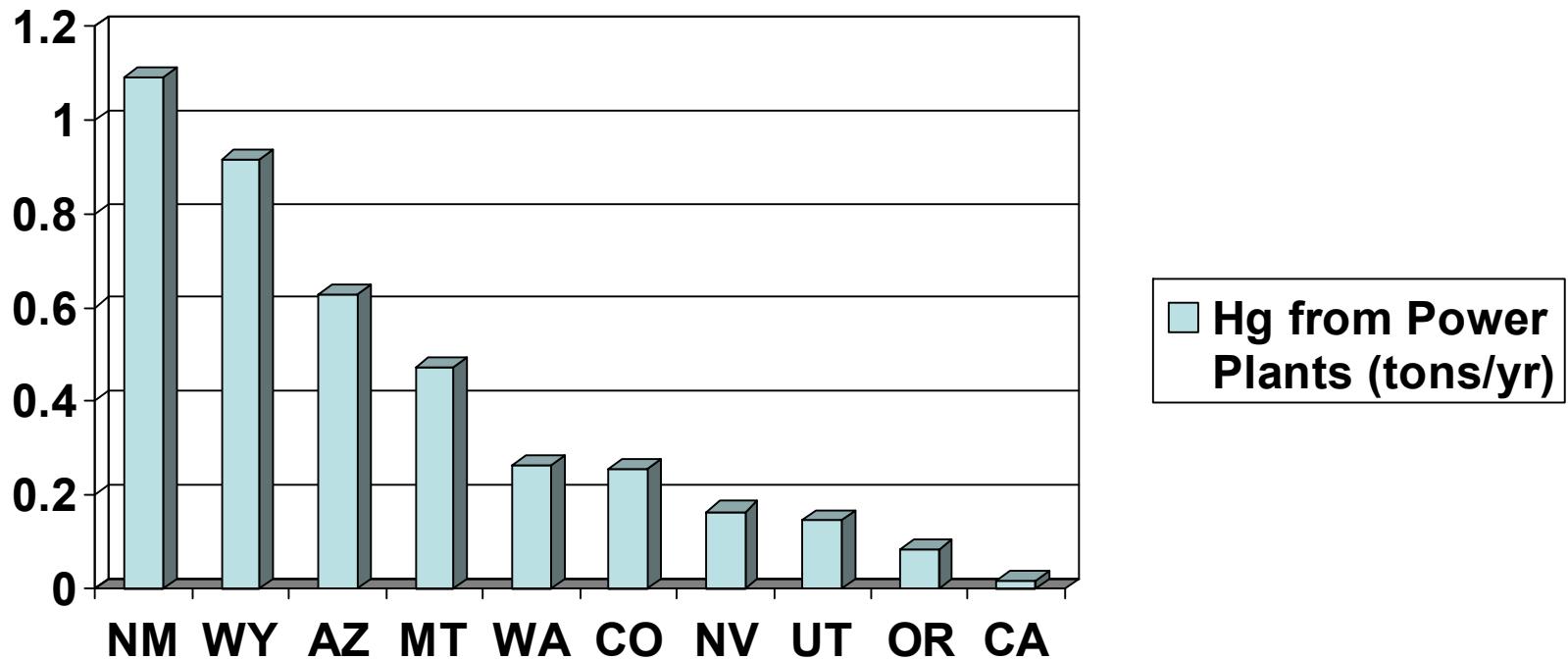
83% of CO<sub>2</sub>



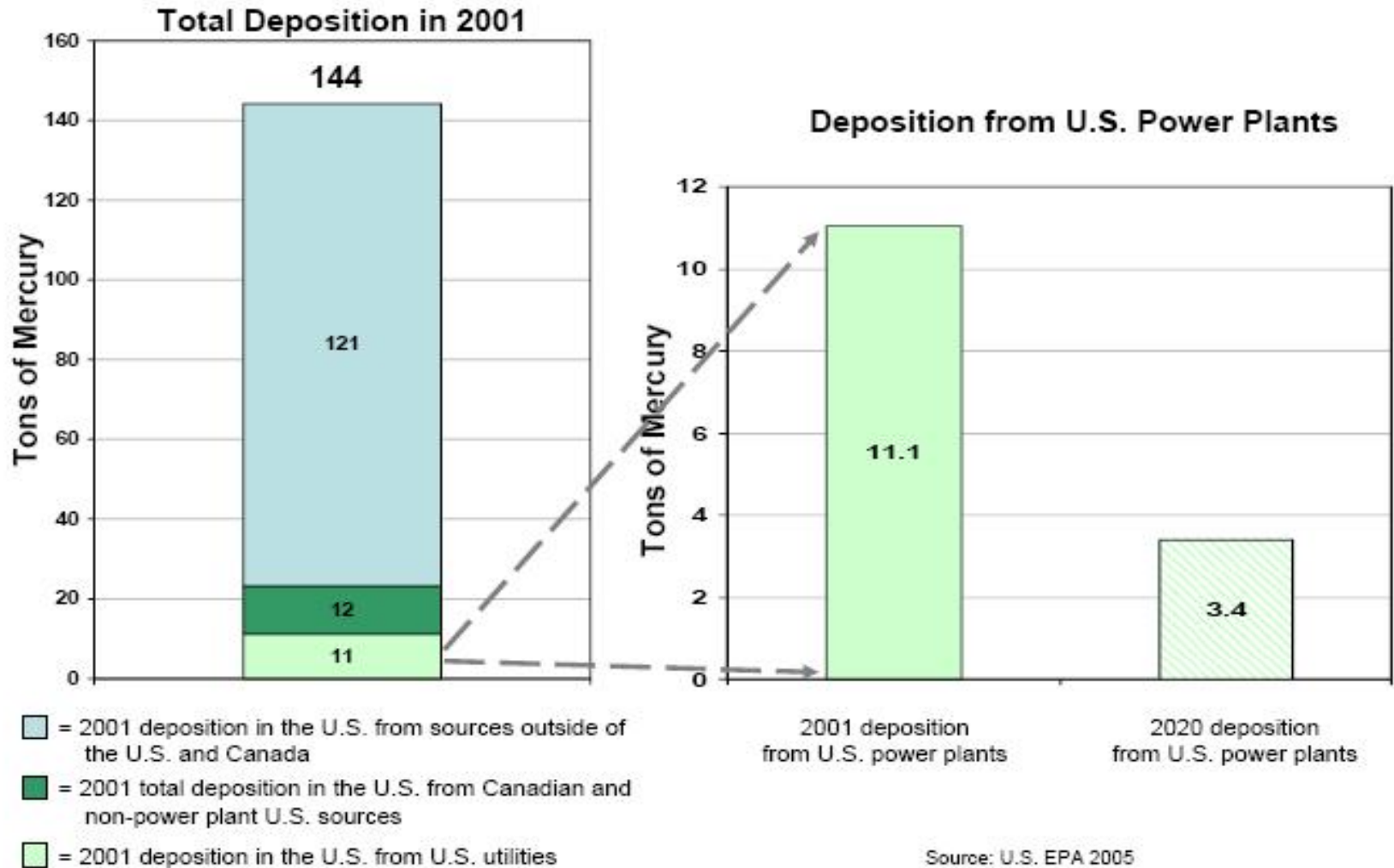
# Mercury Emissions from Power Plants: 1999



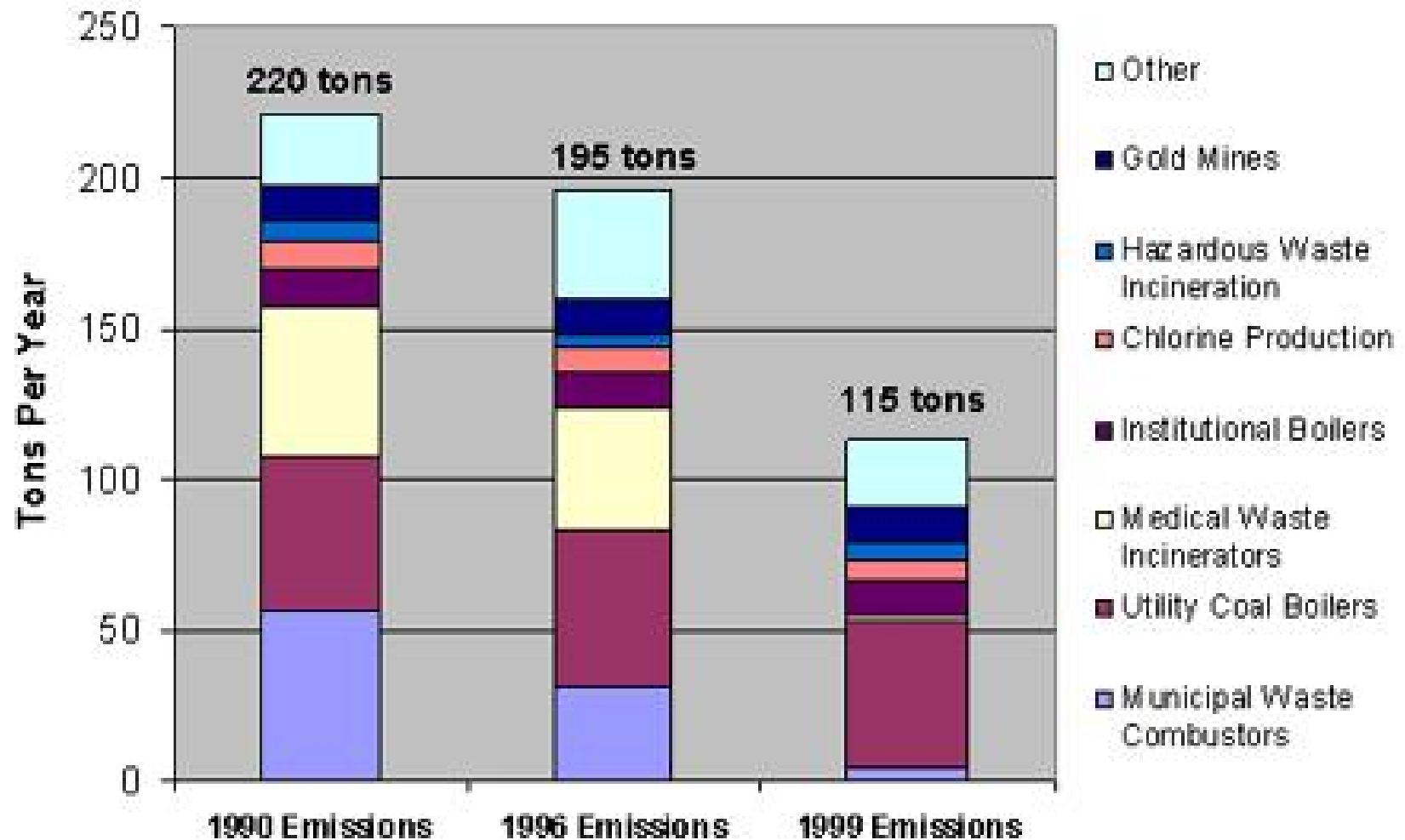
# Western Coal-fired Power Plant Hg Emissions



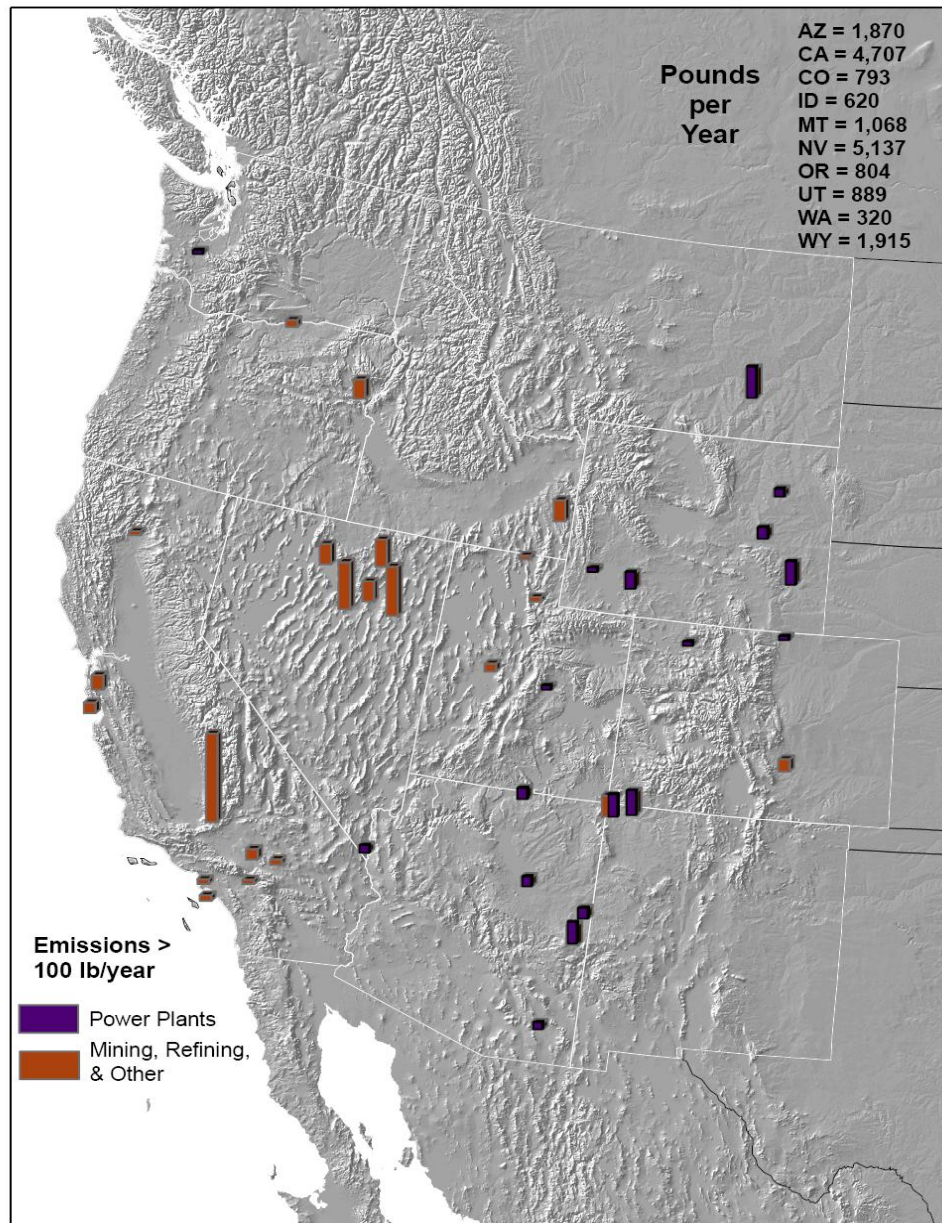
## Mercury Deposition in the U.S.



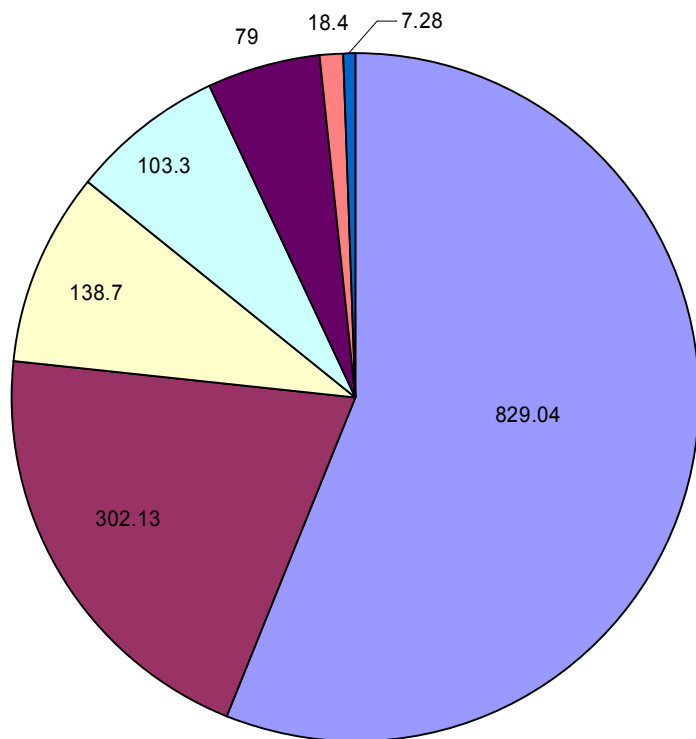
# U.S. Emissions of Human-Caused Mercury



# 2003 TRI Mercury Emissions in the Western US



### Utah 2002 Mercury Emissions (lbs/yr)



- Coal Fired electric generating units
- Incinerators
- Electric Arc Furnaces
- Cement/Lime Plants
- Industrial Boilers
- Landfills
- Other

# **Actions Reduce Utah's Mercury Emissions and Deposition**

- **HB138 - Implement Mercury Switch “Bounty” Program for Scrap Vehicles**
- **Clean Air Mercury Rule -Cap Mercury Emissions at Power Plants Nationally**
- **Continue to Work with the State of Nevada to reduce emissions at gold mines**
- **Voluntary Collection Programs**
- **Develop and Implement Mercury Reduction Plan in Utah**

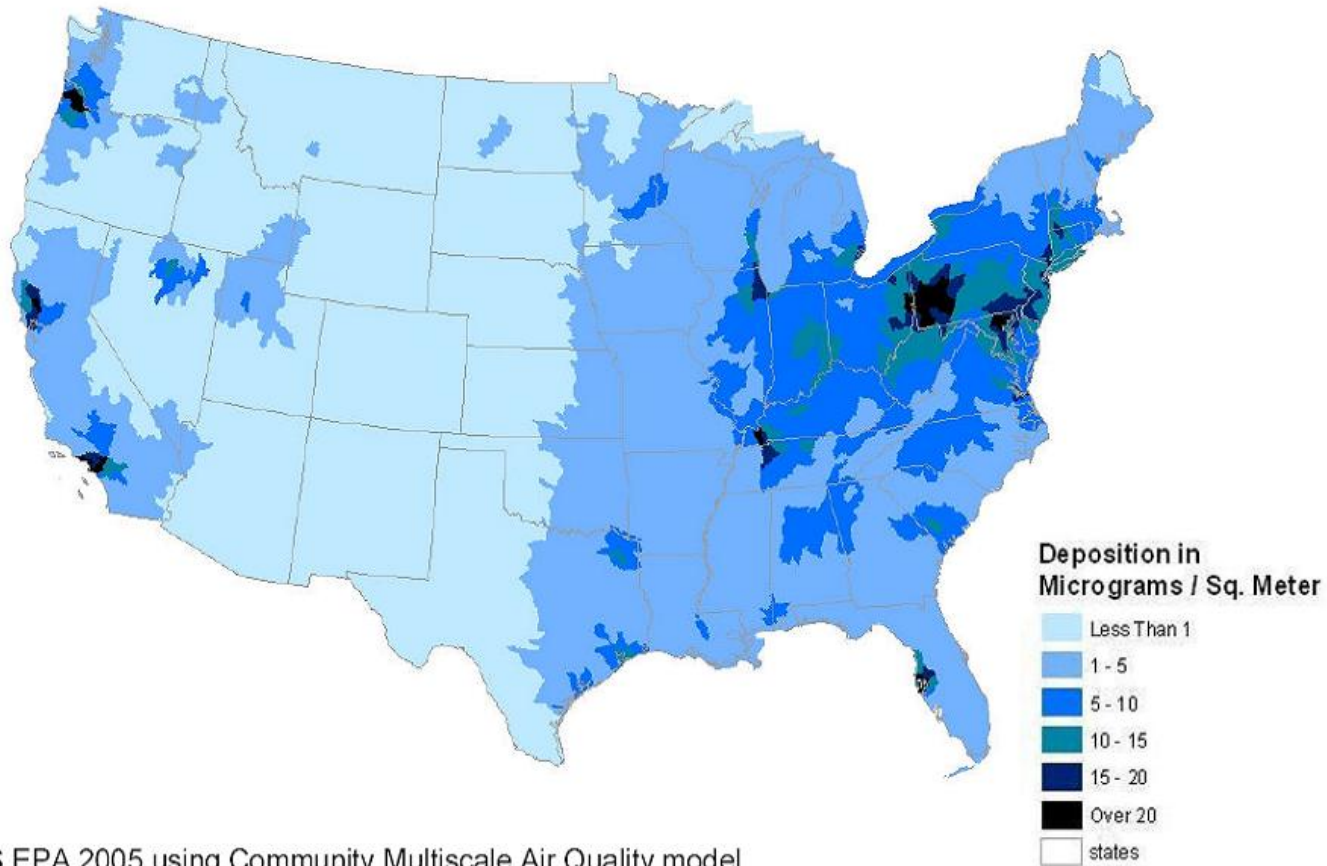
# Mercury Deposition

## A National Problem

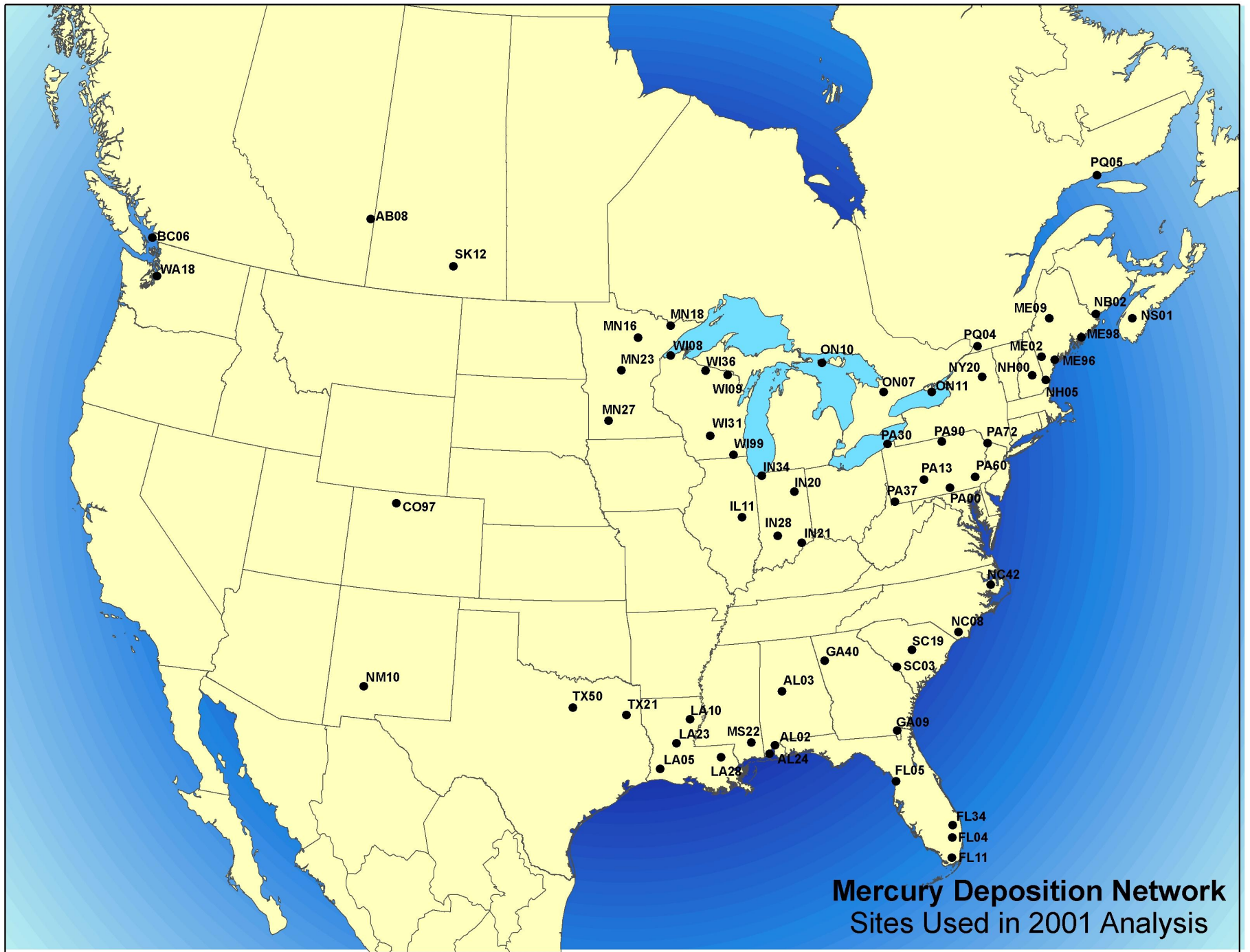
- 46 states have issued mercury fish advisories
- Mercury deposition from air pollution an increasing concern
- Areas with no mercury sources are being impacted
- Center for Disease Control estimates 1 in 6 women in the United States have high mercury levels and 600,000 infants/year at risk



# Mercury Deposition from All US and Canadian Sources in 2001



Source: US EPA 2005 using Community Multiscale Air Quality model.



**Mercury Deposition Network  
Sites Used in 2001 Analysis**

# Cost of Recommended Initial Mercury Air Deposition Monitoring

## 3 Wet deposition Sites

Salt Lake City

St. George

Vernal

**Initial Cost - \$27,300** (one time equipment costs, 3 sites)

**Annual Cost - \$42,000** (annual costs for analysis, 3 sites)

**Total Cost 1<sup>st</sup> Year = \$69,300**

# Cost of Mercury Monitoring

**Wet Deposition – \$23,100**

(Equipment - \$9,100)

(Annual operation \$14,000)

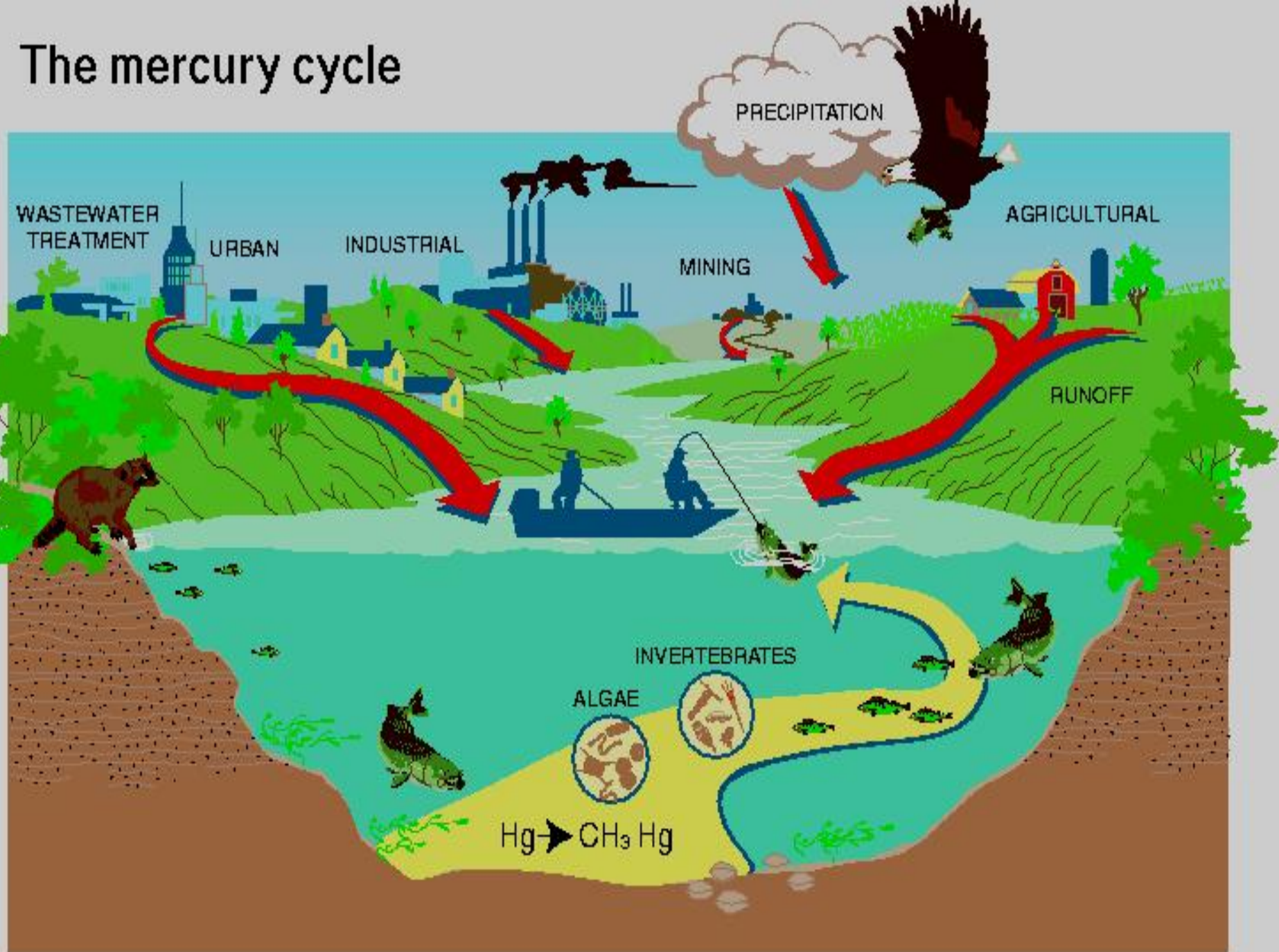
**Ambient Gaseous Mercury – \$120,000**

(Equipment \$90,000)

(Annual operation \$30,000)

**Dry Deposition – Currently being developed**

# The mercury cycle



(Illustration by Connie J. Dean, U.S. Geological Survey)

# Methyl Mercury Exposure

- Elemental mercury is biotransformed by bacteria into methyl mercury; the bacteria are eaten by algae, mollusks, crustaceans, fish, etc.
- Mercury is poorly eliminated, so it concentrates up the food chain - biggest and oldest predators (fish) at the top of the food chain have the highest concentrations
- Methylmercury is distributed evenly throughout the fish and is not changed by cooking

# **Fish Consumption Advisories Collections and Analysis**

**Department of Environmental Quality**

**Division of Water Quality**

**Department of Health**

**Department of Natural Resources**

**Division of Wildlife Resources**

# EPA Health Advisory

- Limit consumption of fish with a mercury concentration of greater than 0.3 mg/kg (ppm)
- Fish Consumption Advisories have also be issued in Utah for arsenic, selenium, and PCBs



# Sample Fish Consumption Advisory

- Adults should limit their consumption of largemouth bass taken from Gunlock Reservoir to no more than two 8-ounce servings per month, and
- Women who may become pregnant, pregnant women, nursing mothers, and young children should not eat more than one 4-ounce serving per month.

# Fish Tissue Sampling in Utah ( Prior to mid-2005)

- Smattering of results from Federal Agencies
  - USGS, USFWS, BOR; 13 locations 196 fish
- 179 samples in 36 locations 2000 – 2002 (EMAP Sampling)
- 157 samples in 45 locations in 2003 – 2004 (EPA analytical lab backlogged until early 2006)

# Results from Sampling (through 2002)

Mercury Values  $> 0.3\text{mg/kg}$  (ppm) in 5 locations

- Mill Creek near Moab (2 fish)
- Gunlock Reservoir (5 fish composite sample)
- Green River - Desolation Canyon (1 fish)
- East Canyon Reservoir (2 fish)
- Lake Powell (8 fish)

# 2005 DWQ Sampling in Prior Hot Spots

- Gunlock Reservoir 6-29-05
  - 8 Largemouth Bass, 3 Bluegills
- Mill Creek (near Moab) 6-30-05
  - 5 Brown Trout
- East Canyon Reservoir 7-6-05
  - 11 Rainbow Trout
- Lake Powell 7-12-05
  - 11 Striped Bass
- Desolation Canyon; Green River 9-15-05
  - 10 Channel Catfish

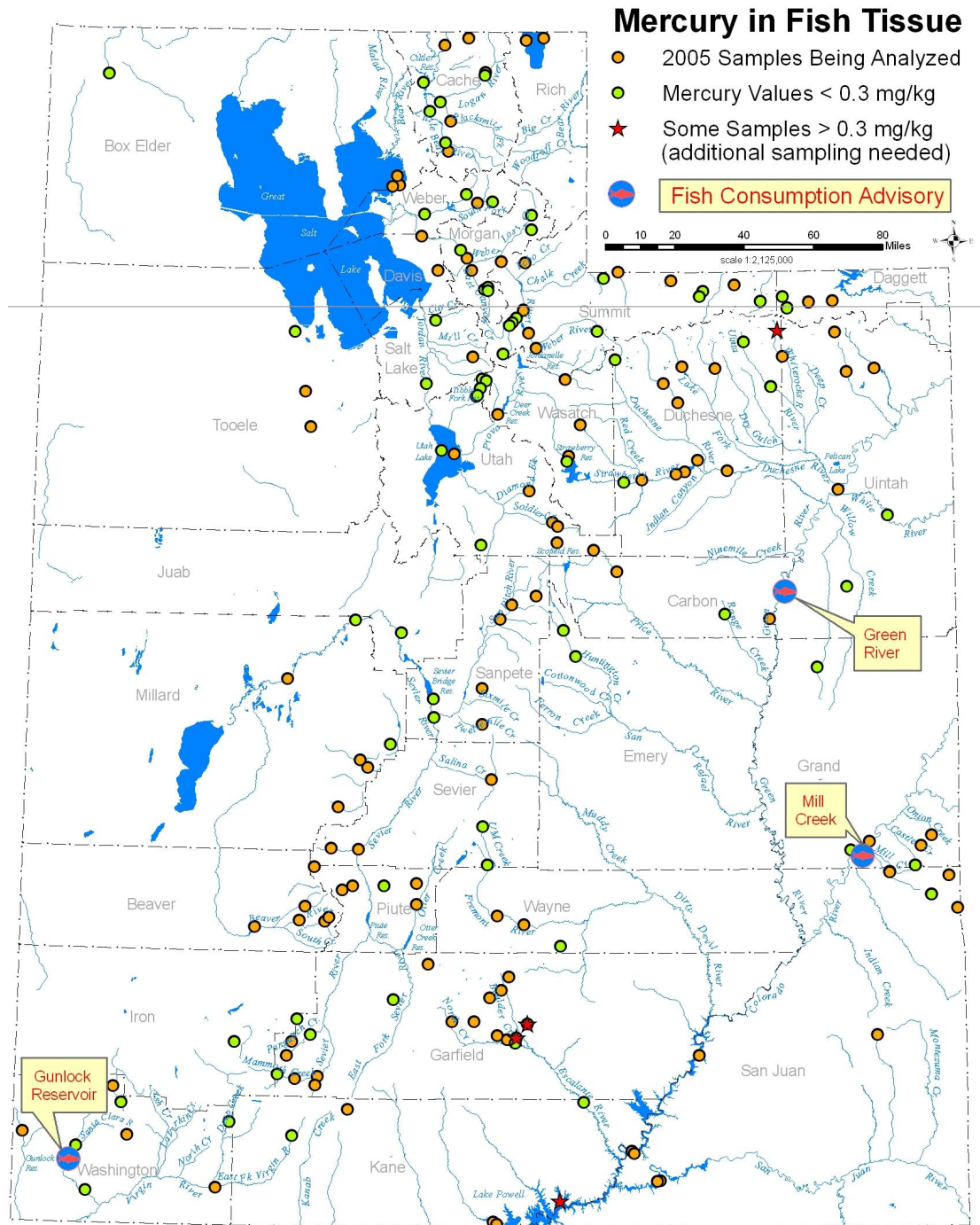
2002-2004

-342 Fish in  
81 Locations

2005

-640 Fish in  
115 Locations

Four Locations need  
further sampling



# Fish Consumption Advisories for Mercury Issued

- Gunlock Reservoir
  - Largemouth Bass
- Mill Creek near Moab
  - Brown Trout
- Green River – Desolation Canyon
  - Channel Catfish

# Problem – Analytical Bottleneck

- State Lab not adequately equipped for the volume of fish tissue samples
- EPA cannot provide timely analyses
- Out-of-state labs expensive and time consuming
- More sampling needed to characterize Utah's waters

# Direct Mercury Analyzer State Health Lab (Fall 2005)





# Analytical Costs for 2006

- Ongoing Fish Tissue testing for mercury
- 1,500 samples needed for 2006
- Estimated Analytical Costs
  - \$17 per sample for materials & supplies
  - \$ 28 per sample for labor
- Projected Analytical Costs \$67,500

# High Mercury Levels in the Great Salt Lake

- USGS Samples on South Arm of the Great Salt Lake
  - Total Hg values of up to 45 ng/liter (ppt)
  - Methyl Hg over 25 ng/liter (ppt)
    - Highest values measured by USGS lab
    - From deep brine layer in S. Arm GSL
- Values confirmed by Kennecott Sampling

# Utah's Mercury Waterfowl Advisory

- Issued in Fall 2005
- 2 Species of Duck had mercury values of > 0.3 ppm
  - Northern Shovelers
  - Goldeneye
- Ongoing sampling by Utah Division of Wildlife Resources

# Mercury in the Great Salt Lake

## Further Study Needed

- Nature & Extent of Mercury in GSL should be characterized
- Cost estimate approximately \$1.5 million (water, sediments, biota); initial work in conjunction with current selenium study of the GSL is \$340,000
- Interagency approach recommended
- Workplan being developed
- Funding needed

# DISPOSAL OF MERCURY FROM INDUSTRIAL SOURCES

- Send to mercury recycling facility
- Disposal at approved hazardous waste facility

# Voluntary Statewide Mercury Collections – Car Switches

- DEQ worked with Auto-Salvage Sector
- Environmental best management practices
- Trained operators how to remove mercury switches
- Conducted month-long voluntary removal effort
- Paid for proper disposal
- Collected 68 lbs of mercury

# Response to Mercury Spills

- UDEQ/DERR provided technical support to local and county public health agencies responding to mercury spills. 12 incidents in FY06.
- Resources provided:
  - Lumex Mercury monitoring instrument & operator
  - Toxicological support from DERR staff toxicologist
  - Guidance documents (EPA, ATSDR), industrial hygiene standards (CDC/NIOSH), cleanup protocols, and other technical references

# Voluntary Statewide Mercury Collections – Households

- “Get the Mercury Out” campaign sponsored by DEQ and Local Health Departments for residents; no businesses
- Many household products contain mercury such as thermometers, fluorescent light bulbs, old chemistry sets
- Mercury thermometer exchange



# Voluntary Mercury Collections Households

Mercury Collected* April 1 - May 15:	145 lbs
• Utah Co	33 lbs
• Tooele Co	40 lbs
• Southeast Dist	14 lbs
• Wasatch Co	4 lbs
• Uintah Basin Dist	20 lbs
• Central Dist	1 lbs
• Summit Co	2 lbs
• Salt Lake Co	21 lbs (incl. 1,000 thermometers)
• DEQ	10 lbs

\* Davis, Weber/Morgan, and Southwest Pending

# Additional Mercury Collection and Prevention Efforts

- Hospitals for Healthy Environment (H2E) Grant
- School Chemical Clean-Out Pilot
- Local Health Departments “Get The Mercury Out” Campaign extended through the Environmental Services Delivery Plan

# Utah Statewide Mercury Workgroup

19 Members representing:

- Fishing & Waterfowl Groups
- Mining & Power Generating Industries
- Environmental Advocacy Groups
- State, Federal, & Local Agencies
- Utah Medical Association
- Academic
- Tribal

# Mercury Work Group

## Purposes & Objectives

- To provide Utah's current, accurate, and understandable information on the human and ecological concerns posed by mercury.
- To develop ongoing systematic, logical, and defensible mercury monitoring program to assess mercury in fish and waterfowl.
- To share technical information, data, and results of any investigations on mercury.
- To coordinate and collaborate efforts by entities researching mercury issues in Utah.
- To provide the citizens of Utah with access to mercury data, advisories, and information.
- To accomplish these objectives so as to avoid duplication of effort.

# For More Information

[www.deq.utah.gov](http://www.deq.utah.gov)

[www.epa.gov](http://www.epa.gov)

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