

Mercury releases and tribal lands, what's in your backyard? *Using GIS to study Mercury emissions.*

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Main points

1. Determine on reservation populations that live near point sources emitting 'large' quantities of Mercury
2. Disseminate Mercury data to tribal entities for environmental education purposes



Why worry about Mercury?

- Mercury (Hg) is a neurotoxin that affects the nervous system.
 - Impairs the mental development of fetus' and children.
 - Can cause tremors and other nervous disorders in adults.
 - May increase the risk of cardiovascular diseases in adults.



Where does it come from?

- Primary sources:
 - Coal combustion
 - Ore processing
 - Medical waste incinerators
 - Chemical processing plants (Chlor-Alkali)



Pathway (Source to Sink)

Atmospheric residence – →

Entrance to atmospheric budget

Oxidation → water soluble state (transport 10's to 100's of miles)

Transport 1000's of Miles

Wet and dry deposition



Soil Incorporation

Runoff into watersheds

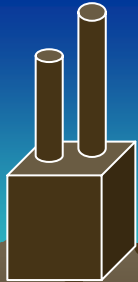
Incorporation into Stream Sediments and methylation process

Bioaccumulation in food web

Fishing and eating of fish

Health effects

Emissions



- The main pathway to humans is ingestion
 - typically fish tissue.
- Highest risk to fetus' and developing children
- There are effects from inhalation and dermal absorption



Why important to tribes?

- Subsistence / traditional diets can be rich in seafood
 - Surveys of tribes in Great Lakes regions show diets with consumption rates of 190-390g/day with treaty protected subsistence quantities of 227g/day (NTEC 2006).
 - EPA suggests 12 oz (336g) *per week* of low Hg fish.
 - shrimp, canned light tuna, salmon, pollock and catfish



Generally ...

- The closer you are to a point source, the higher the likelihood of Hg deposition
 - Meteorology dependant



Tribal Population

- Use existing data
 - GIS shapefiles (BIA, ITEC)
 - Emissions ('99 & '02 NEI, CEC)
 - Population ('03 BIA estimates)
- Determine geo-statistics



Pathway (Source to Sink)

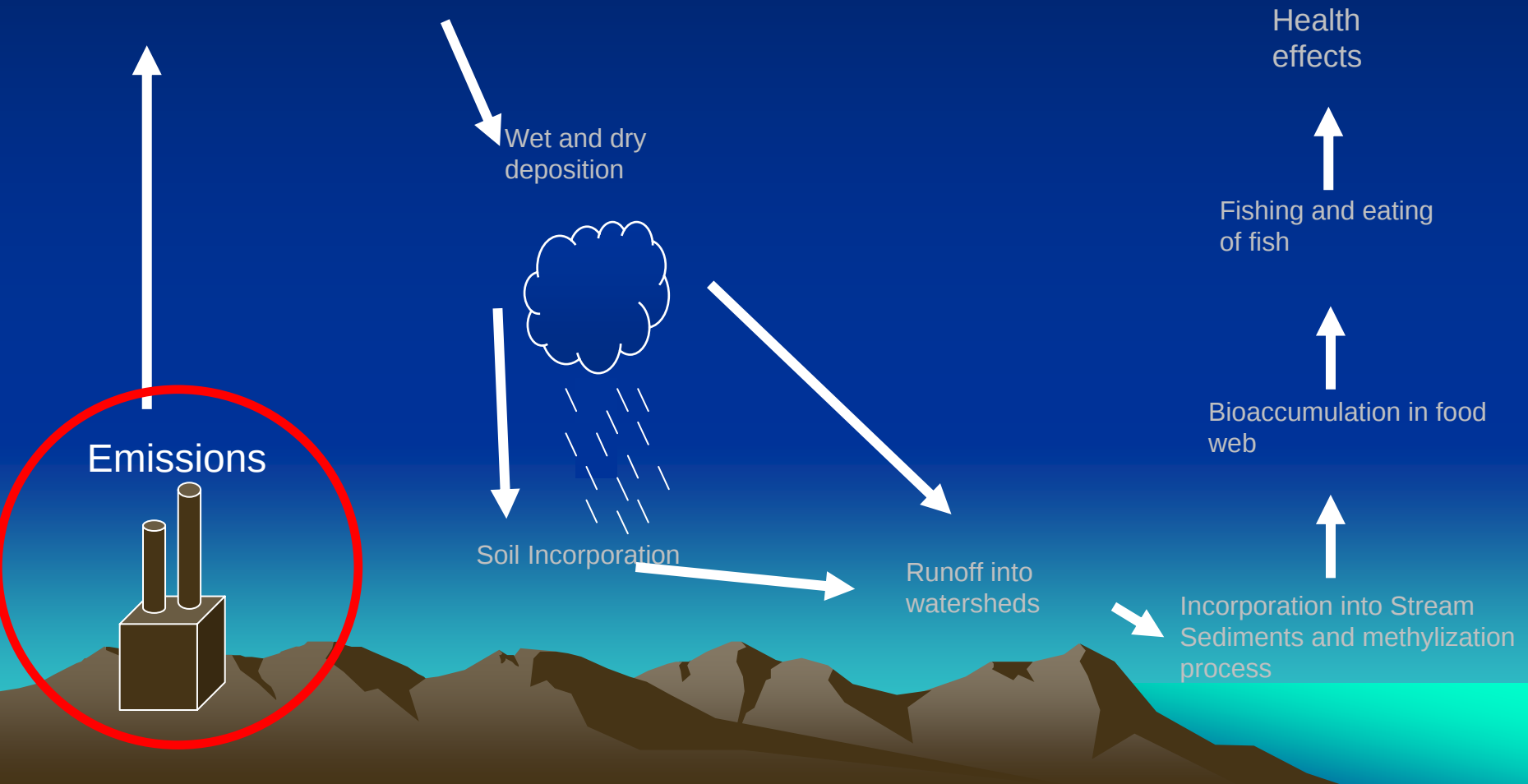
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Entrance to atmospheric budget

Transport 1000's of Miles

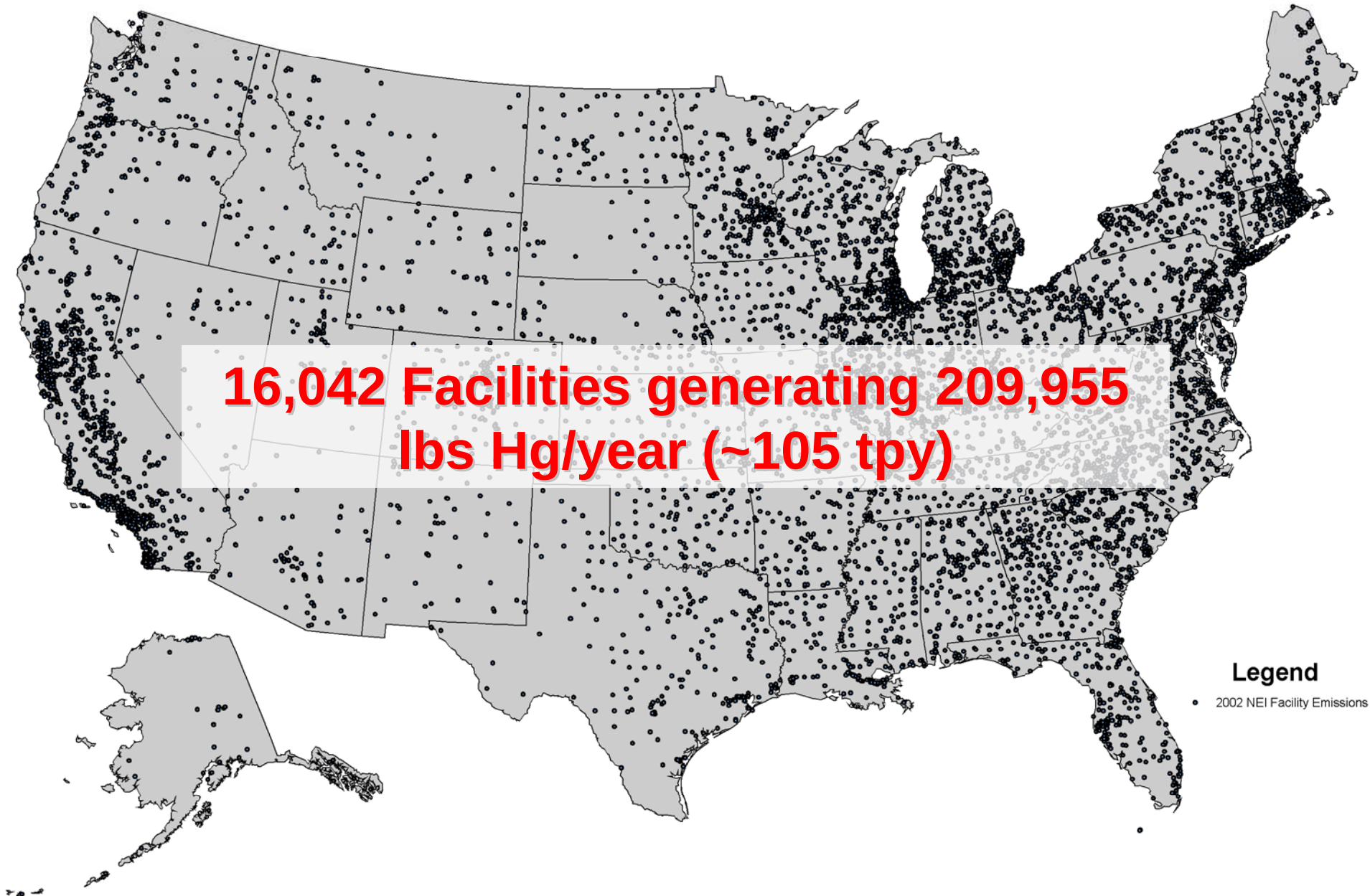


All US Mercury Emission Points
2002 NEI

**16,042 Facilities generating 209,955
lbs Hg/year (~105 tpy)**

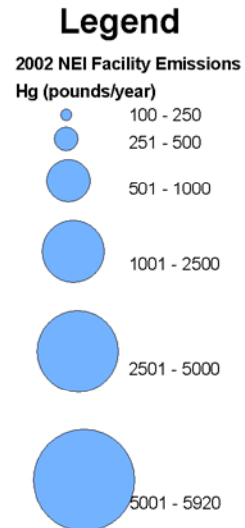
Legend

• 2002 NEI Facility Emissions

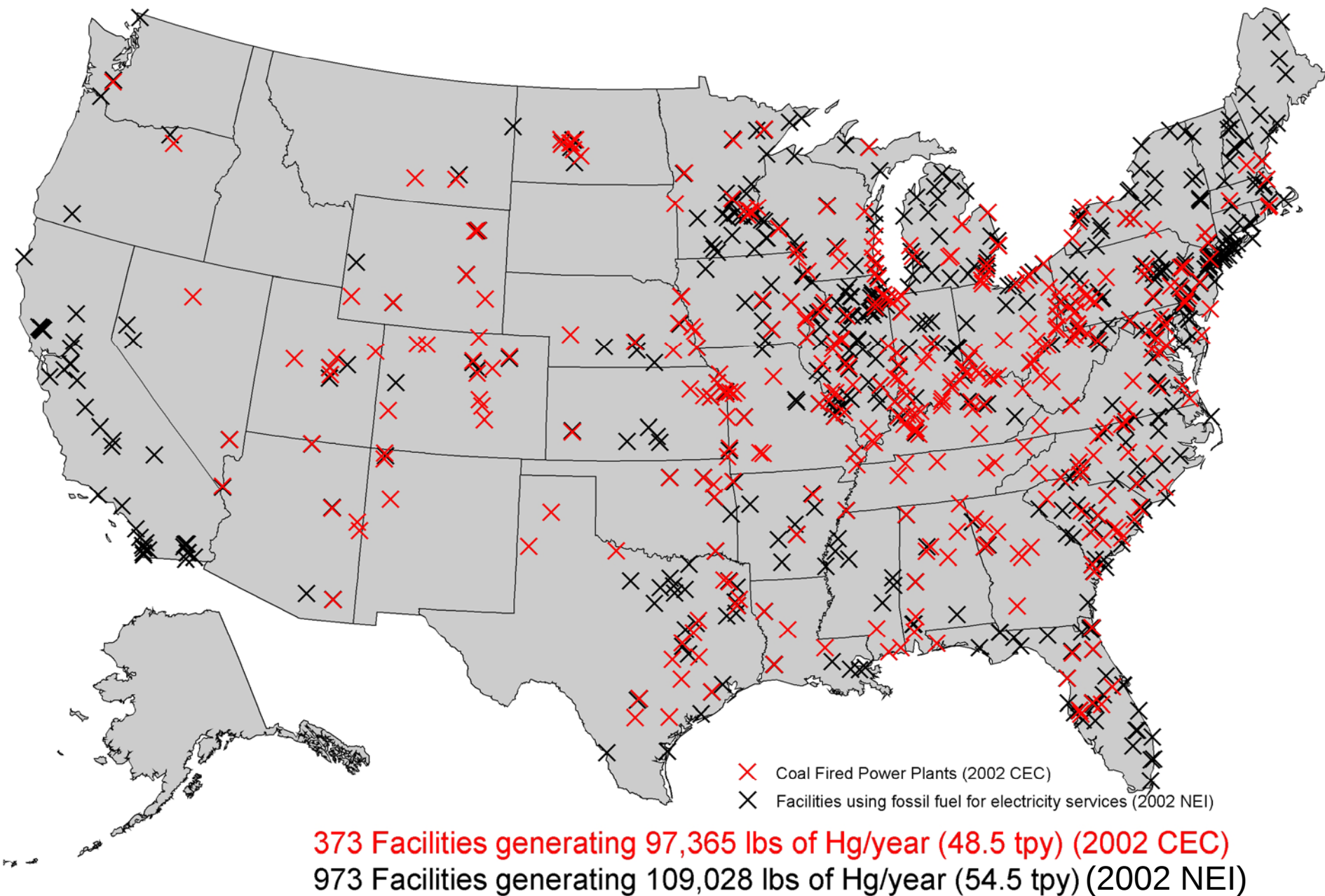


"Major" sources of Hg
emissions (> 100 lbs/year)
2002 NEI

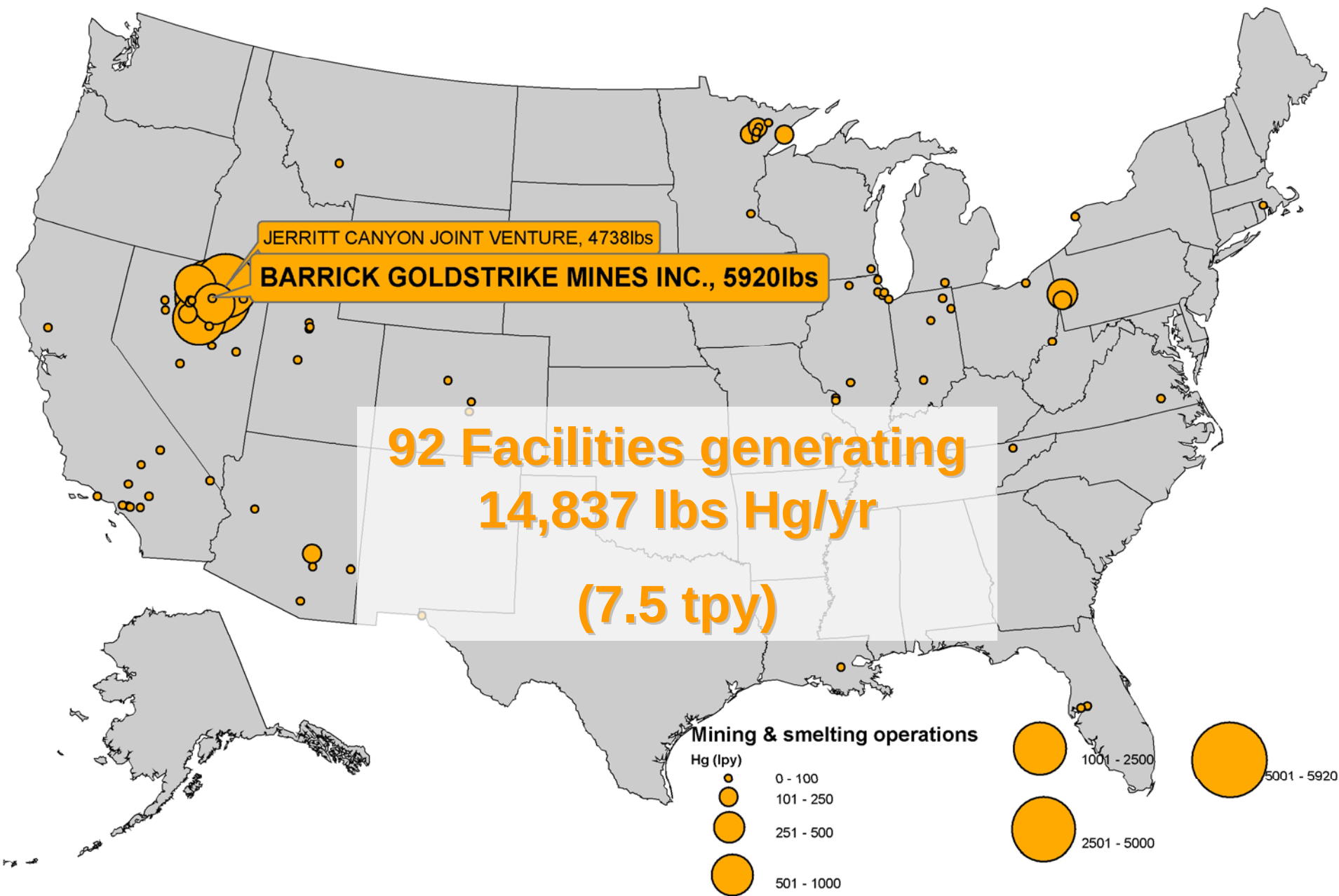
**475 Facilities generating
182,058 lbs Hg/yr
(91 tpy)**



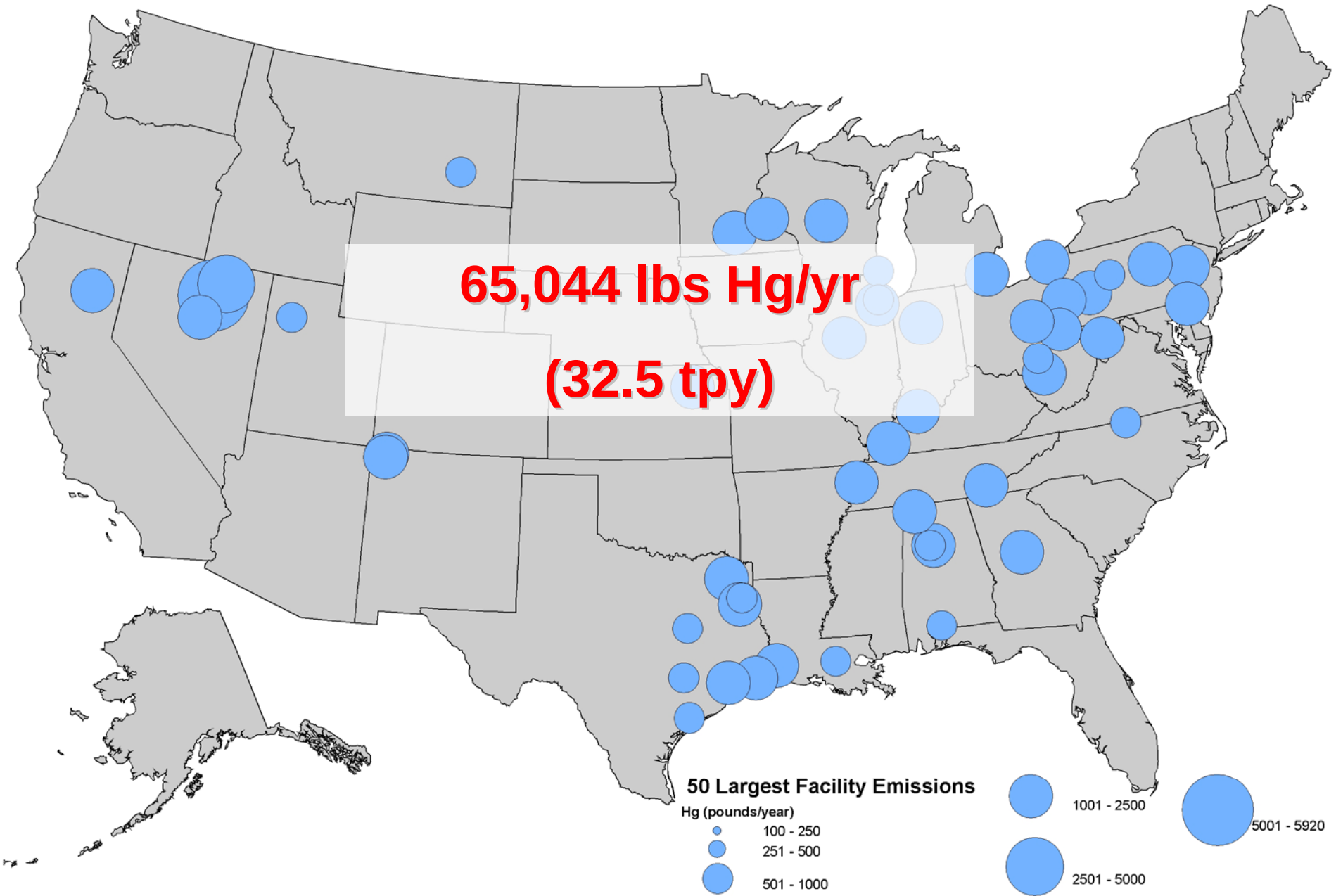
Facilities Burning Fossil Fuels for Electricity Generation



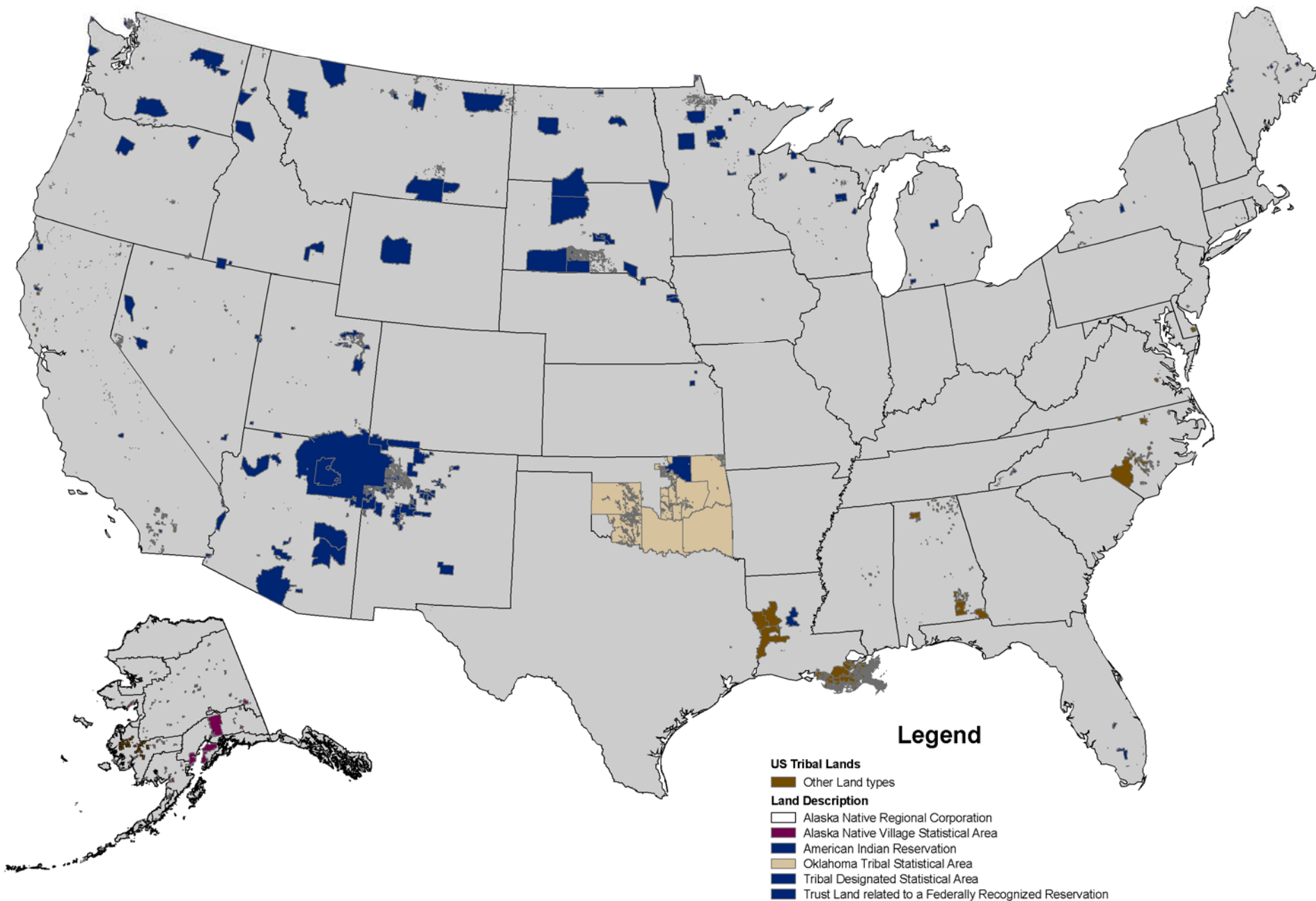
Mining and Smelting operations



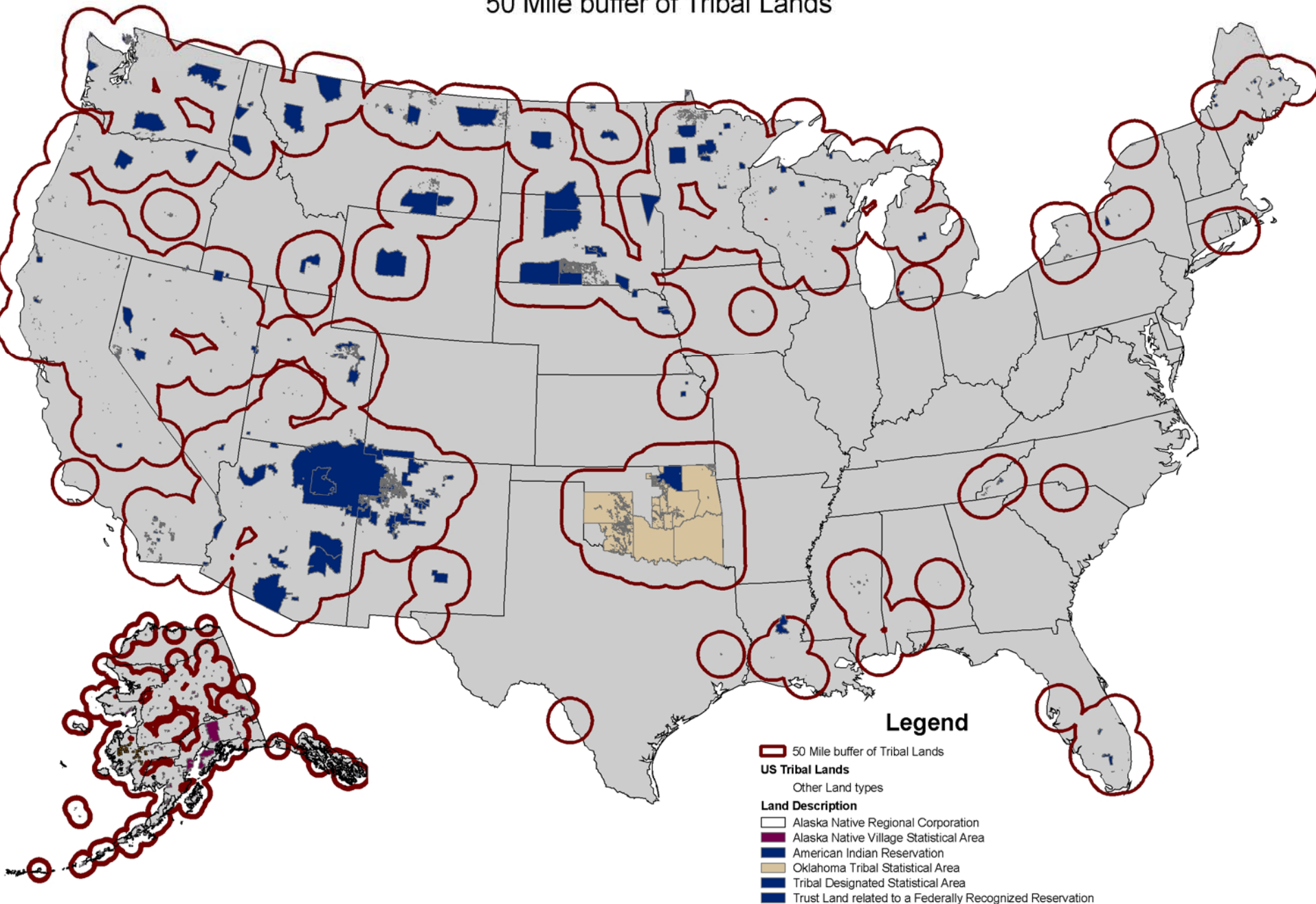
50 Largest Hg Emitting Sources in the US



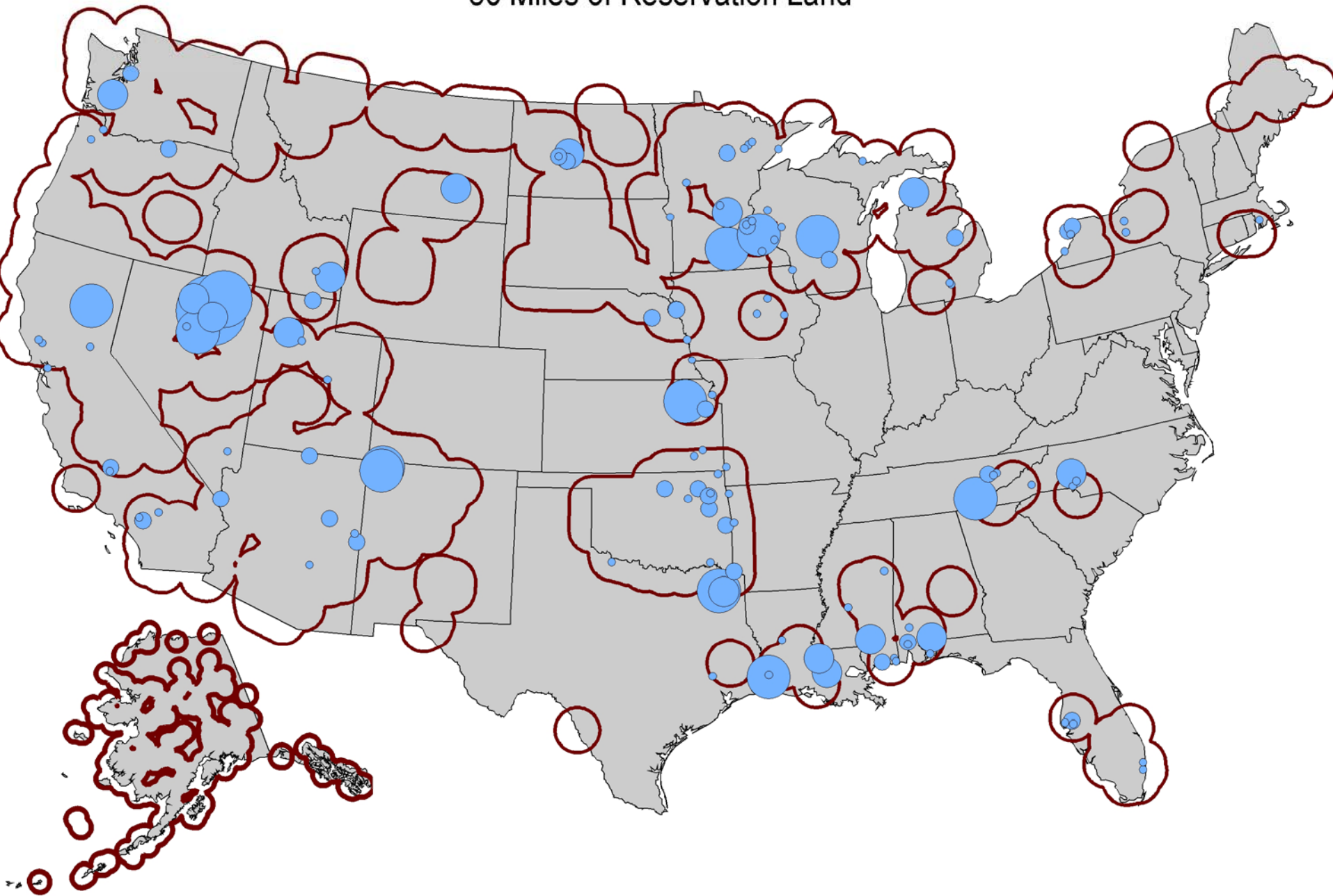
Tribal Lands of the US



50 Mile buffer of Tribal Lands



'Major' Hg Source Within
50 Miles of Reservation Land

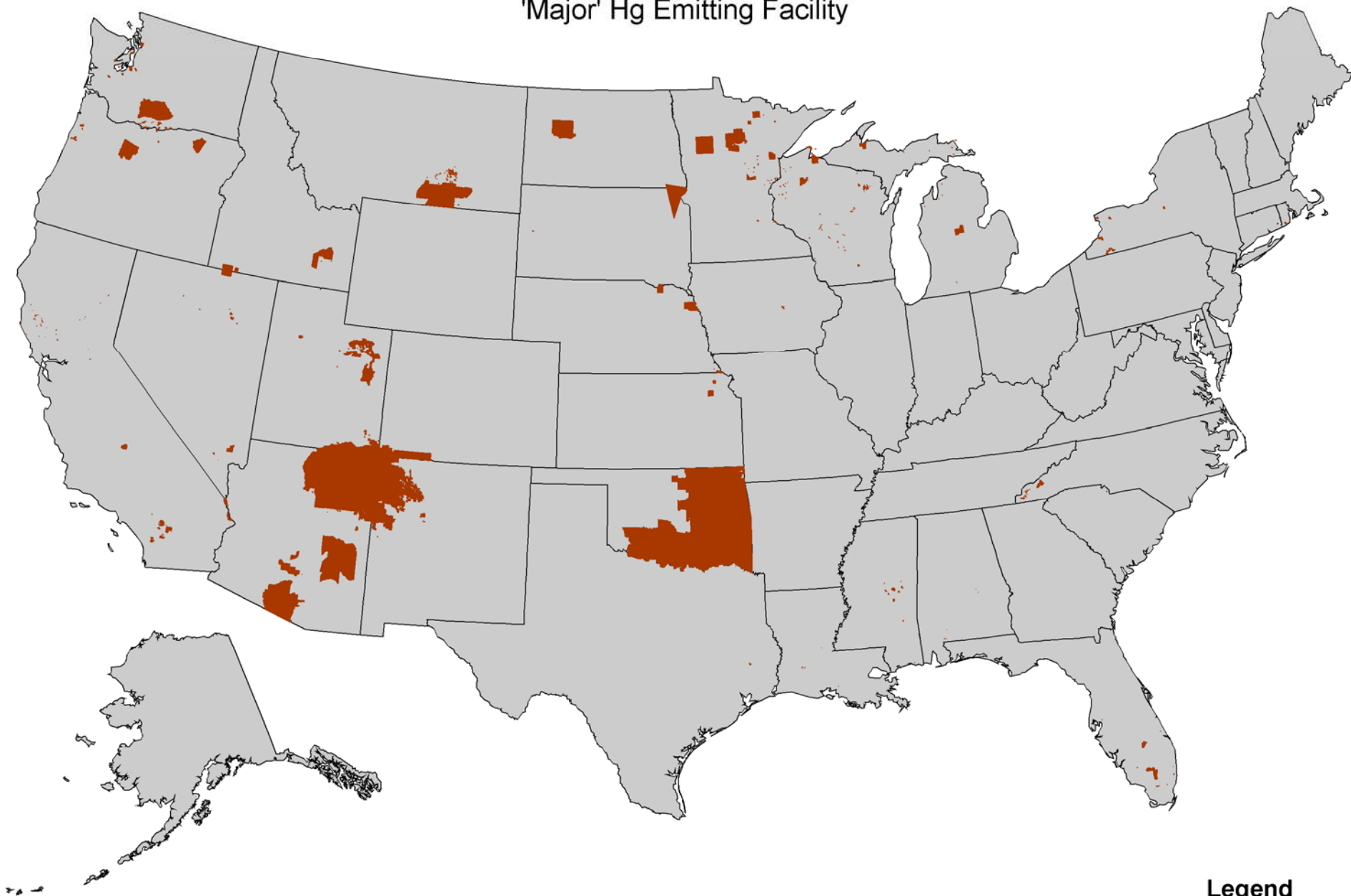


Statistics

- Hg emissions within xx distance of tribe
 - (based on 2002 NEI data)

Distance to 'Major' source (miles)	Number of facilities	Hg emissions (lbs/yr)	% of Total Major US source emissions
5	22	7,659	4%
10	36	13,503	7%
25	77	Was 38% with 1999 data	15%
50	135		32%
100	228	92,775	51%
Total 'Major' sources	475	182,058	100%

Tribal Lands Within 50 Miles of 'Major' Hg Emitting Facility



Legend

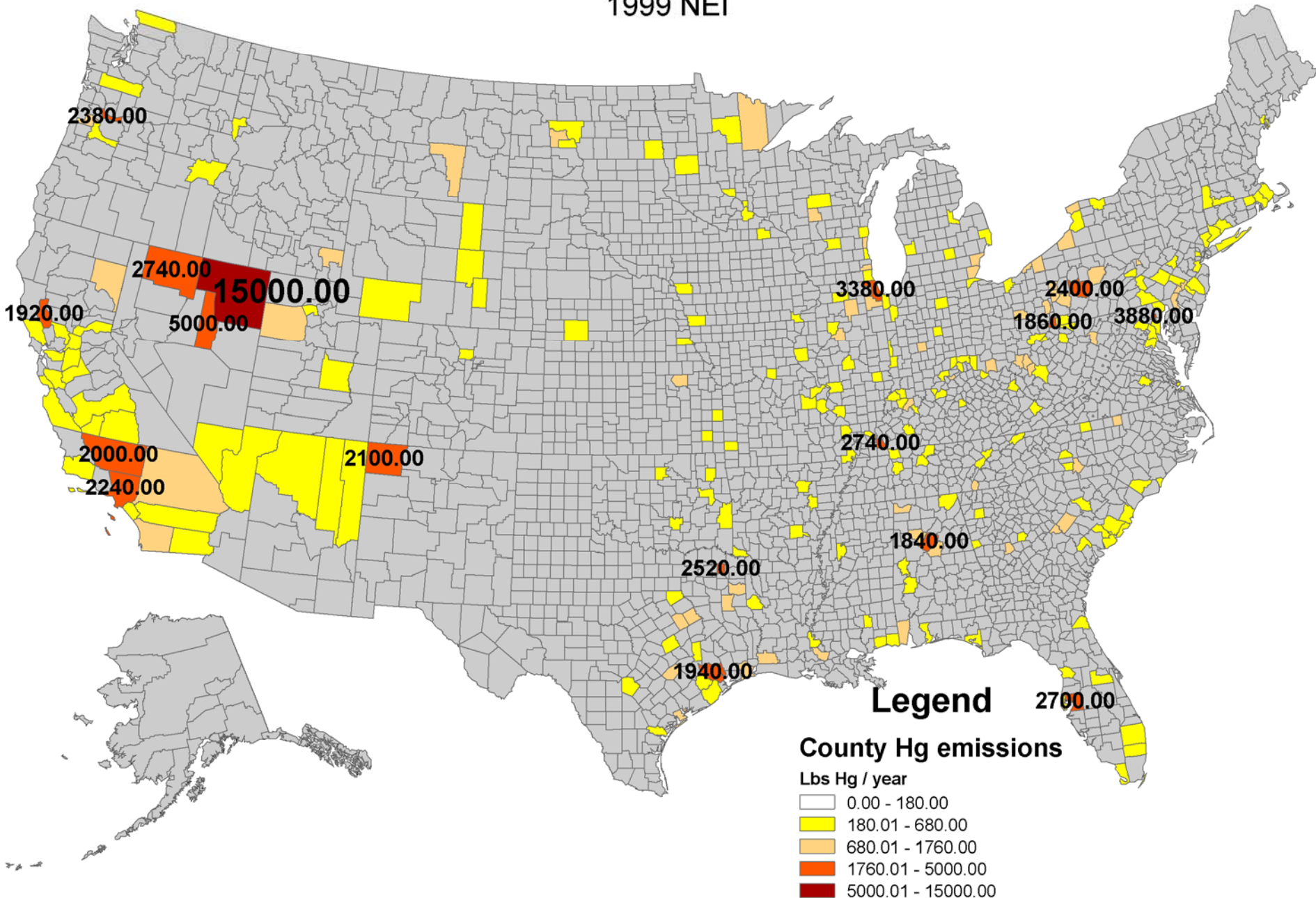
■ Tribes_w-in_50_mi

Statistics

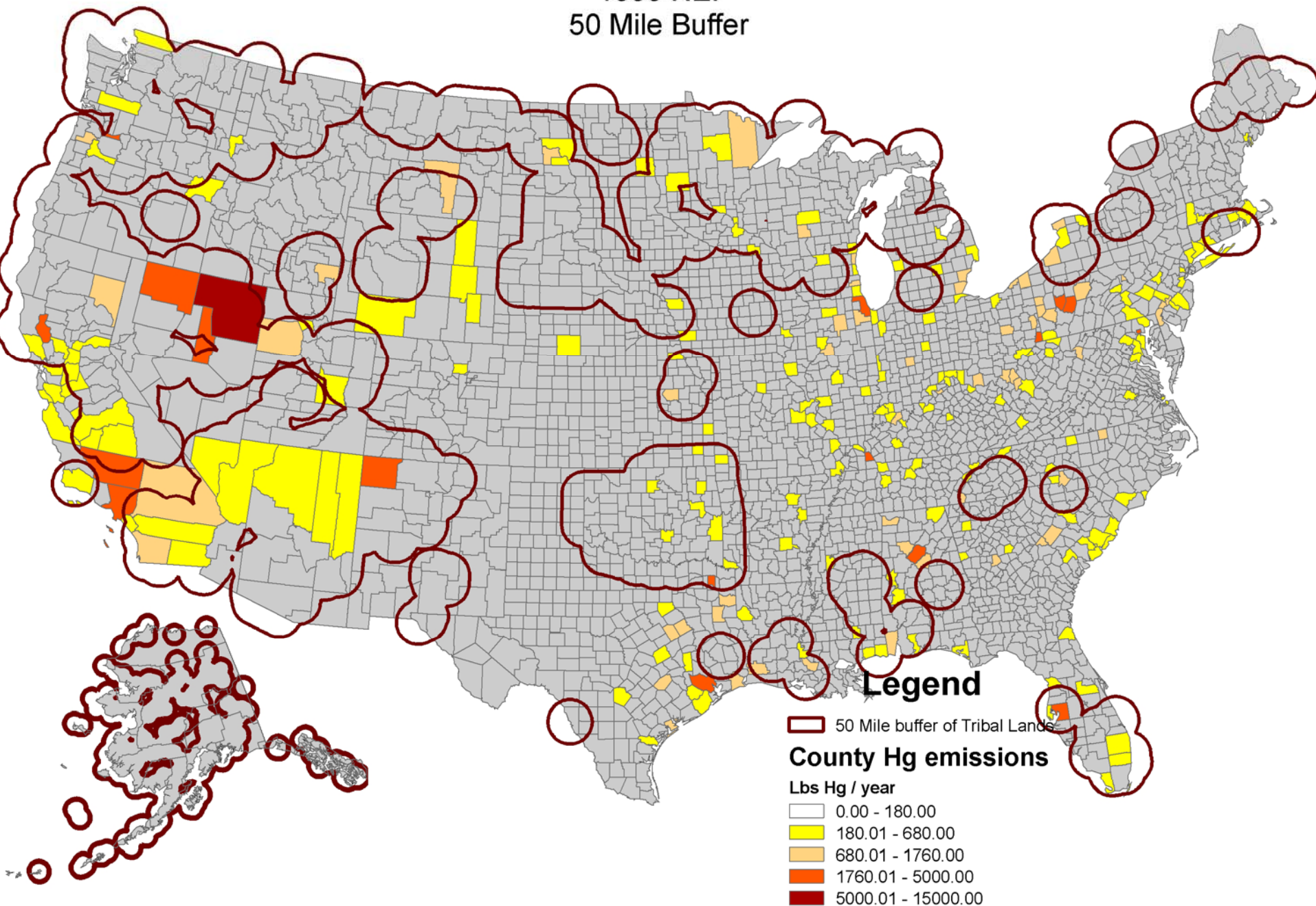
- Population of reservations within distance of Hg source
 - Federal Reservations, OK Statistical Areas, AK Statistical Areas
- 2003 BIA population estimates

Distance from Major source to Reservation	Number of Reservation lands	Reservation Population	% of Total US Reservation Population
5	19	209,609	27%
10	35	233,173	30%
25	76	331,986	43%
50	144	412,286	53%
100	247	516,409	67%
All reservation lands*	559	774,227	100%

County Hg emissions 1999 NEI



County Hg emissions
1999 NEI
50 Mile Buffer



Pathway (Source to Sink)

Atmospheric residence

Entrance to atmospheric budget
Transport 1000's of Miles

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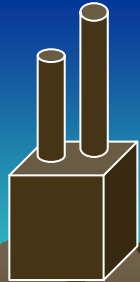
Wet and dry
deposition

Health
effects

Fishing and eating
of fish

Bioaccumulation in food
web

Incorporation into Stream
Sediments and methylation
process

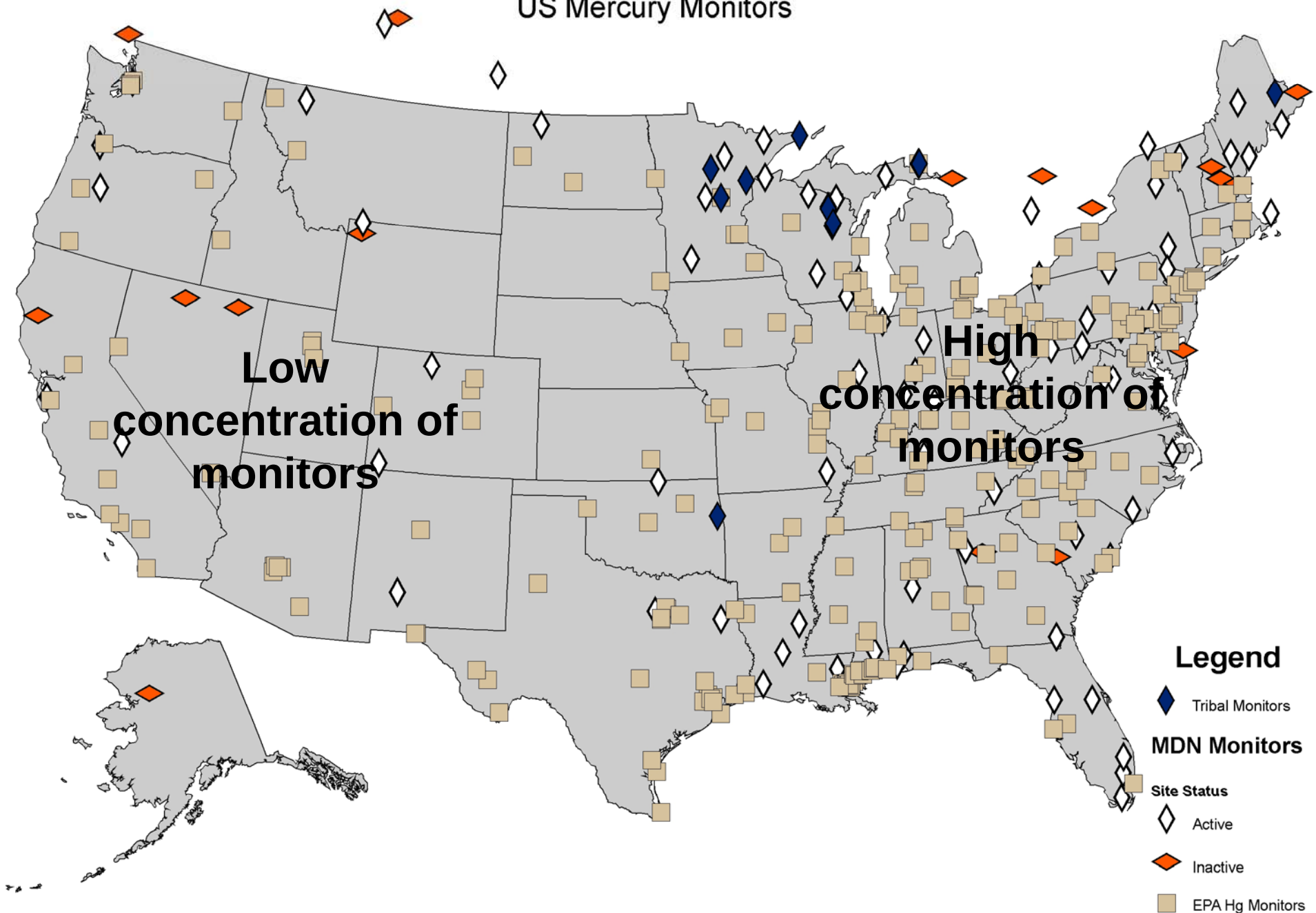


Emissions

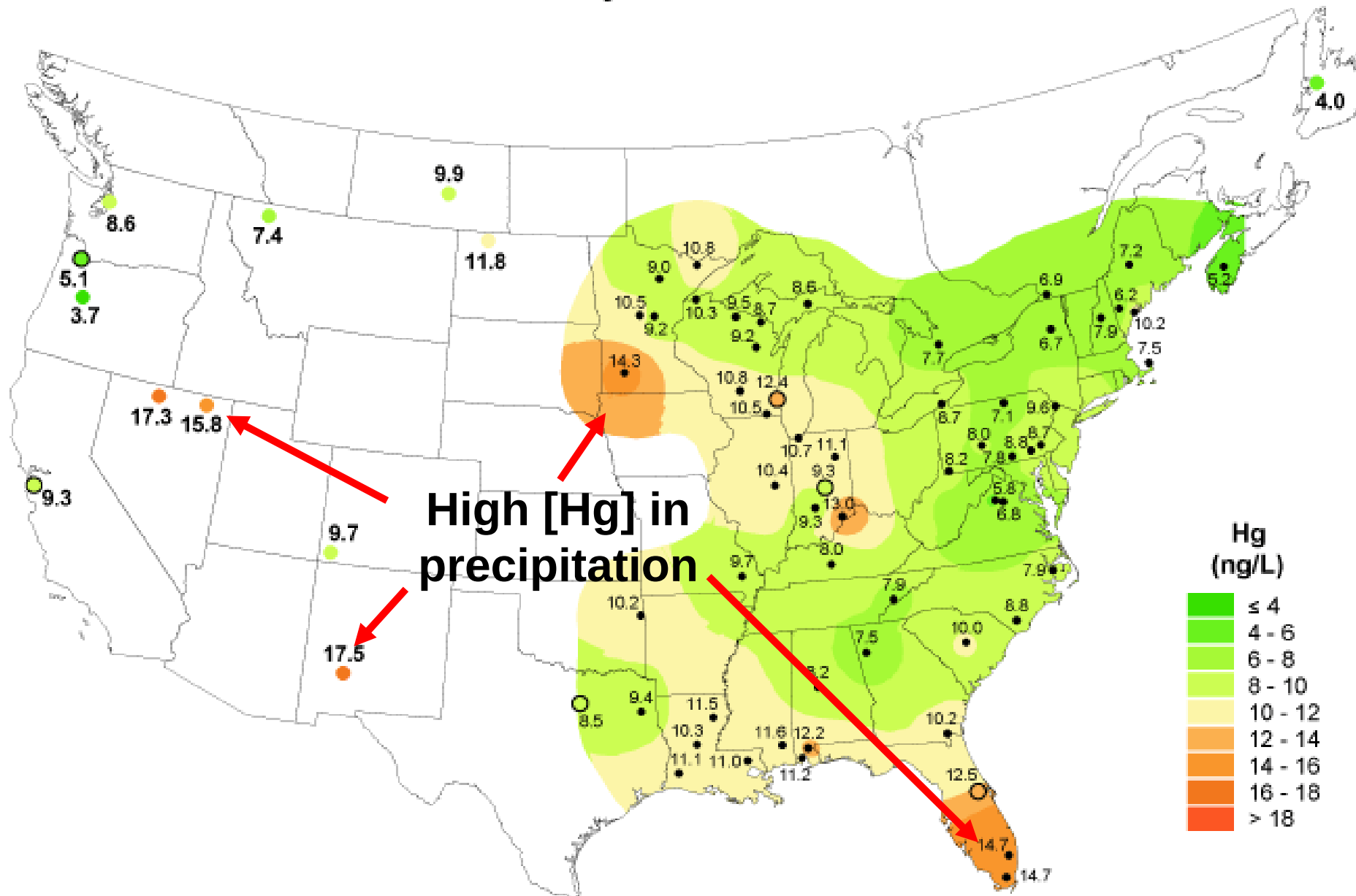
Soil Incorporation

Runoff into
watersheds

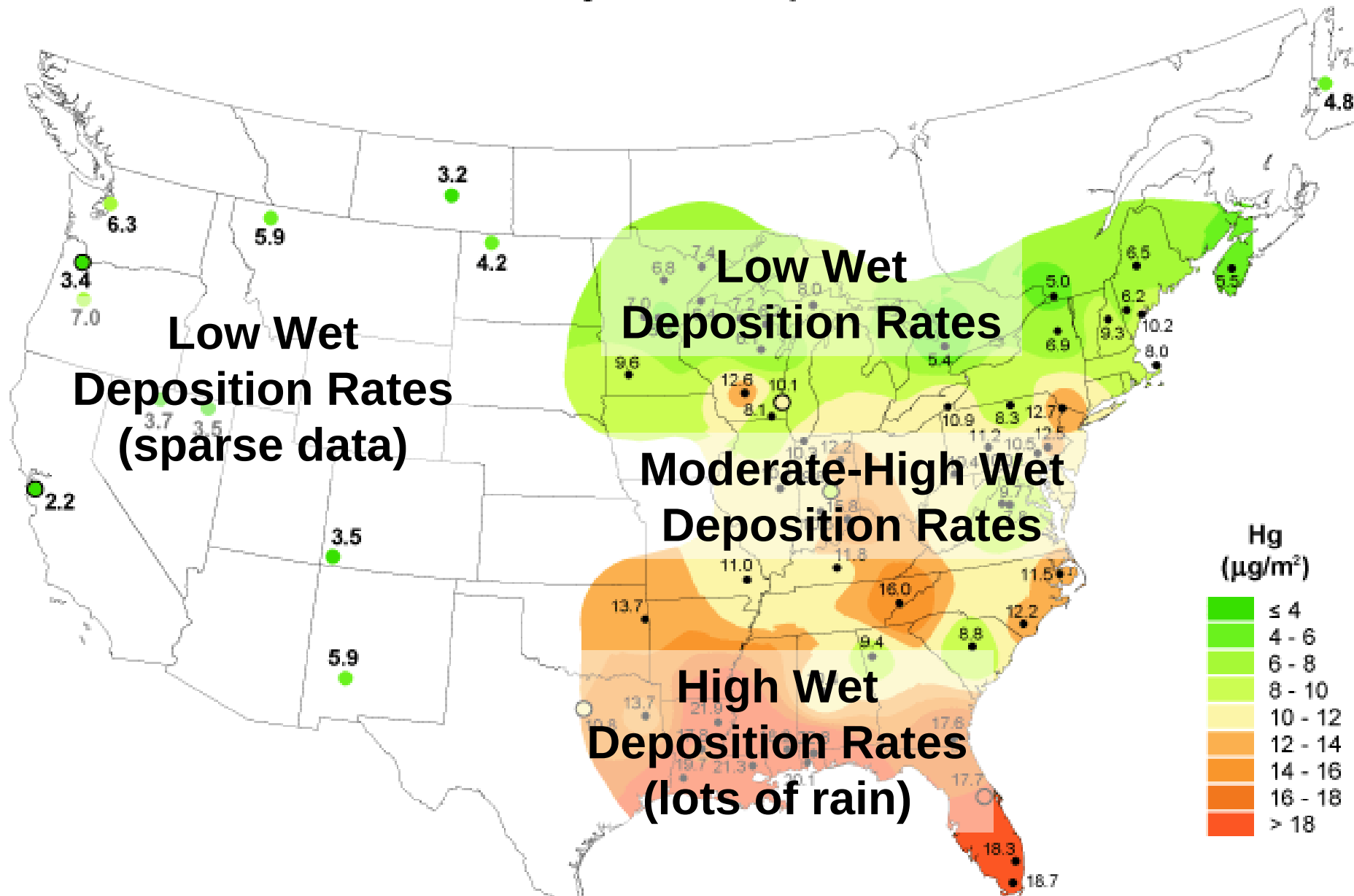
US Mercury Monitors



Total Mercury Concentration, 2004

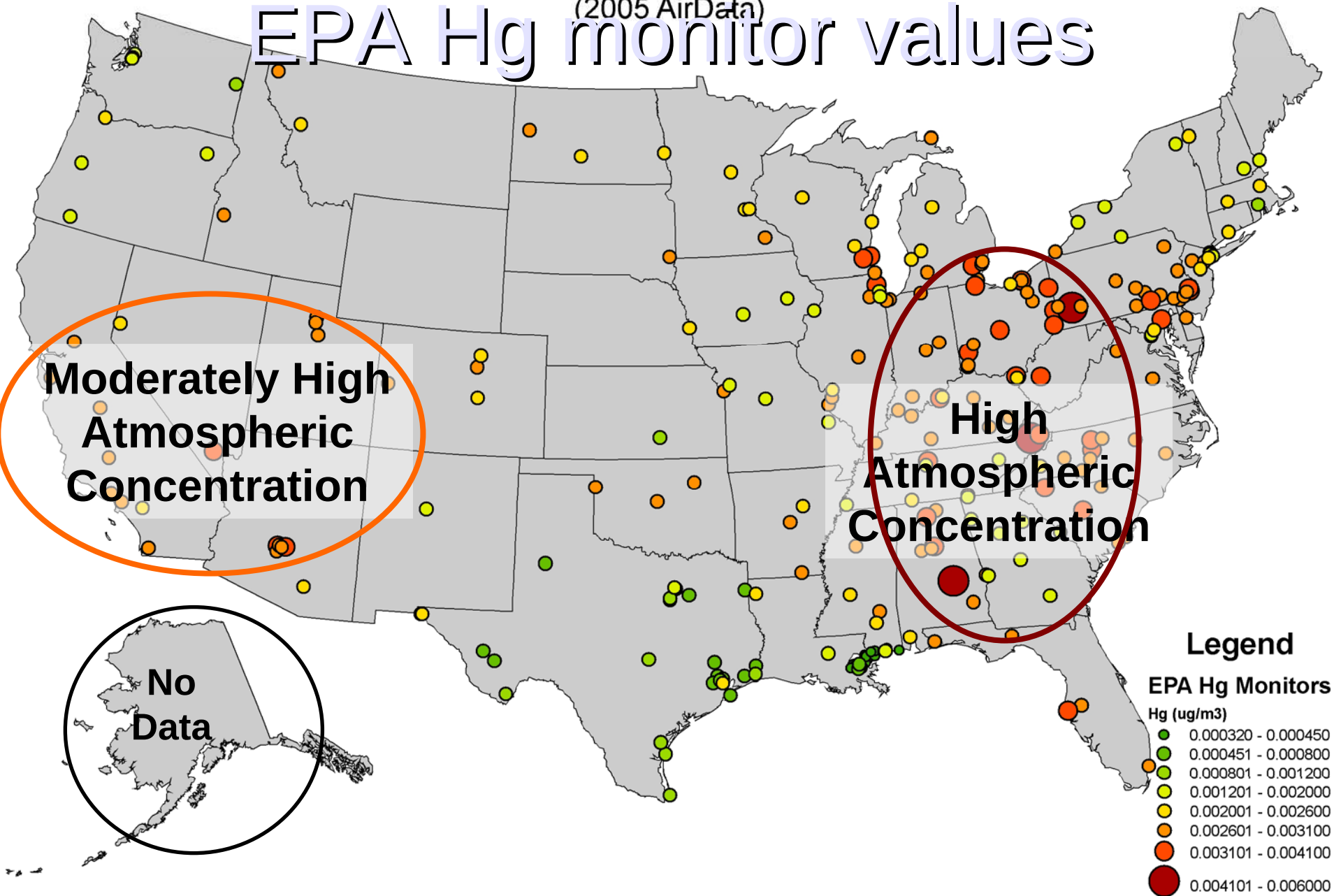


Total Mercury Wet Deposition, 2004



EPA Air Monitor Values
(2005 AirData)

EPA Hg monitor values



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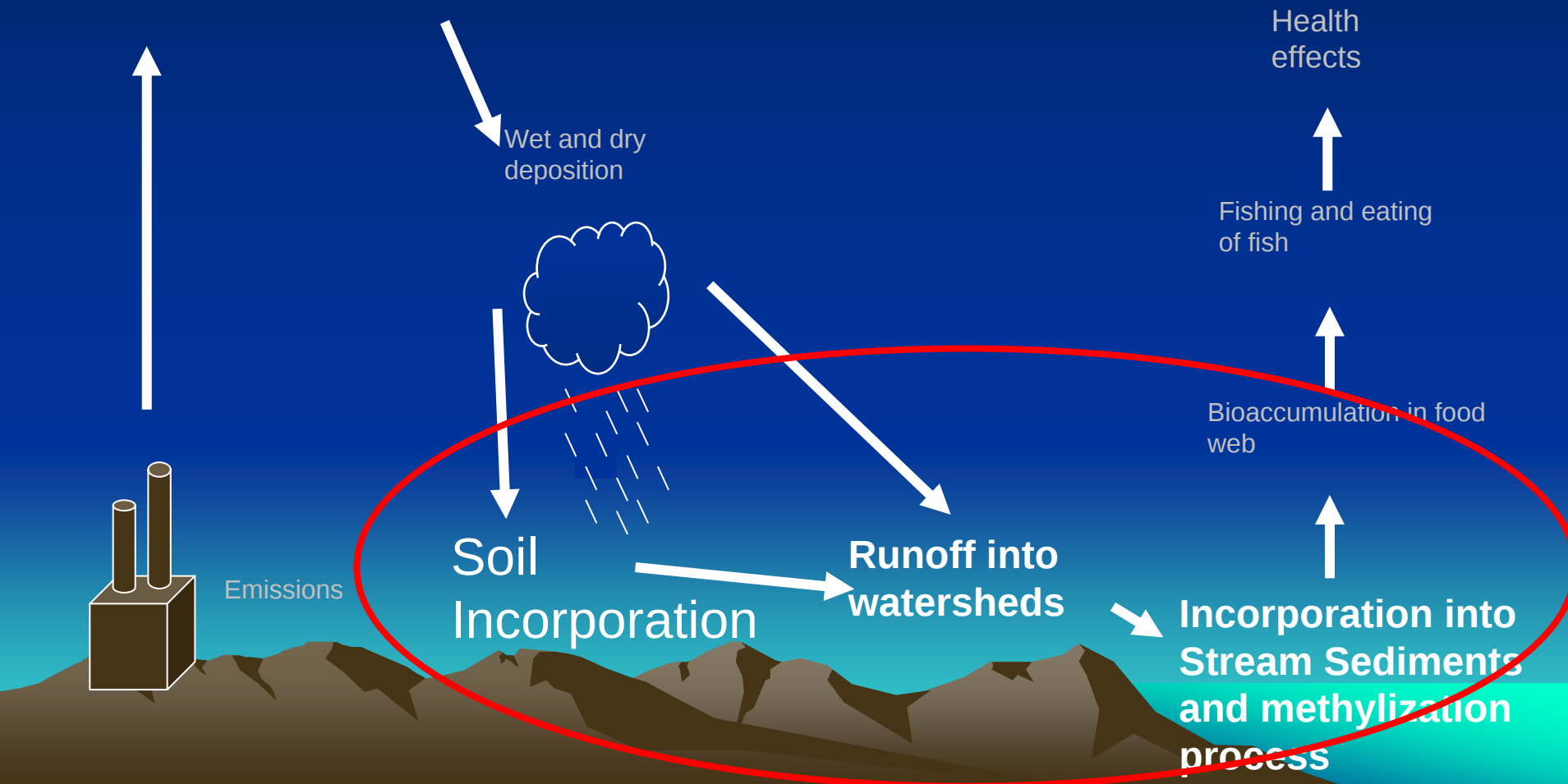
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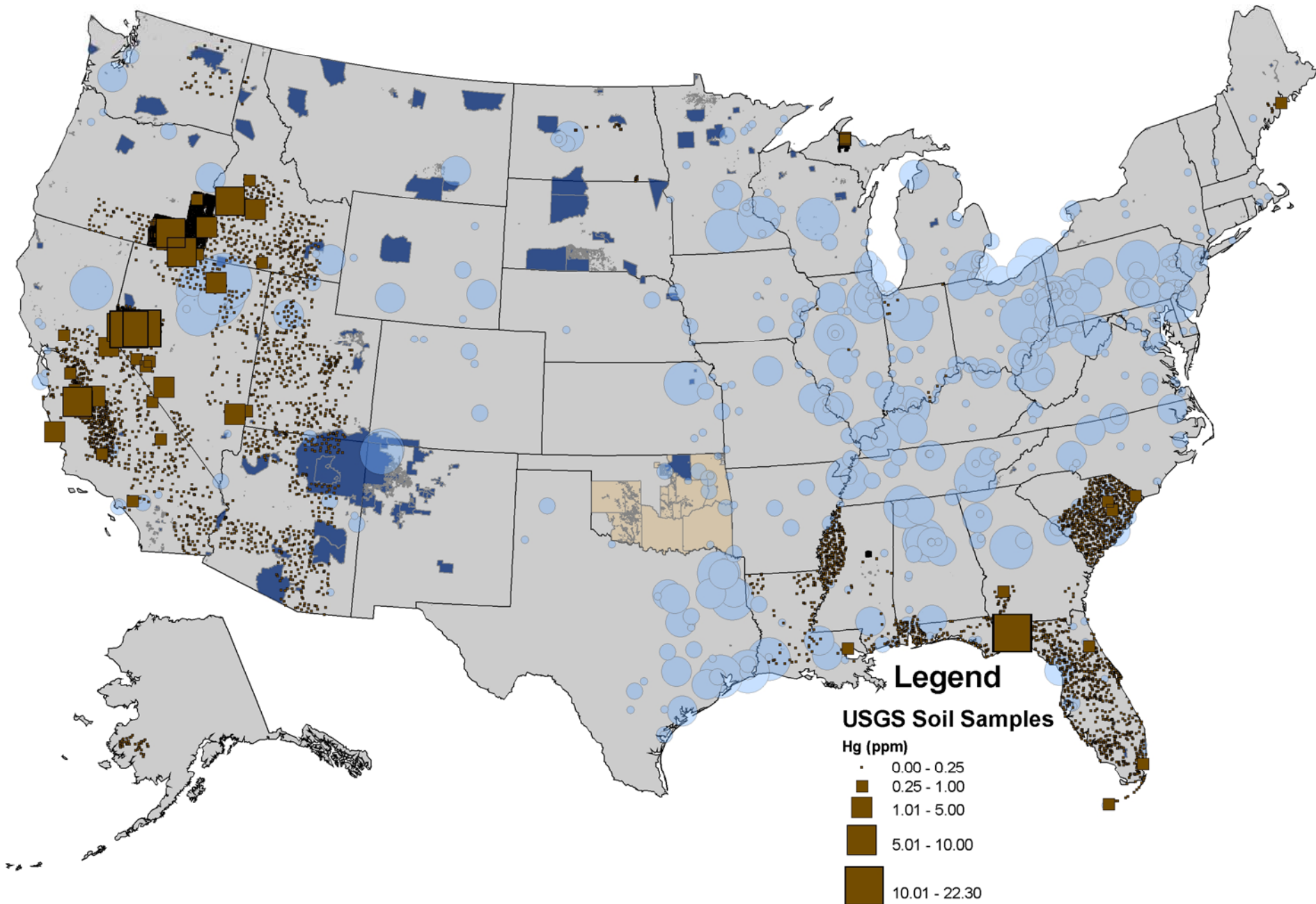


Entrance to atmospheric budget

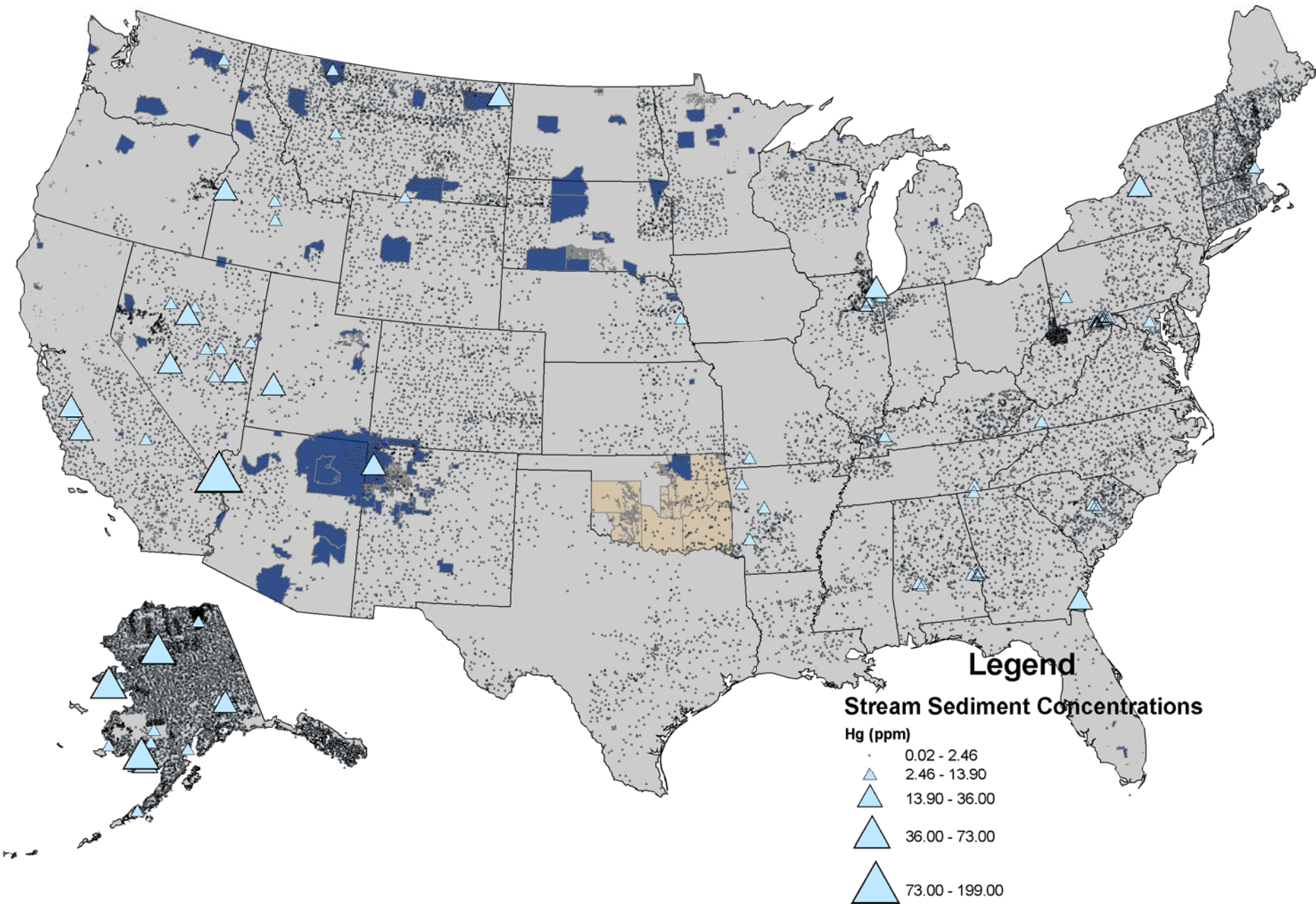
Transport 1000's of Miles



USGS Soil Samples (NGS 2004)



USGS Stream Sediment Samples (NGS 2004)



Pathway (Source to Sink)

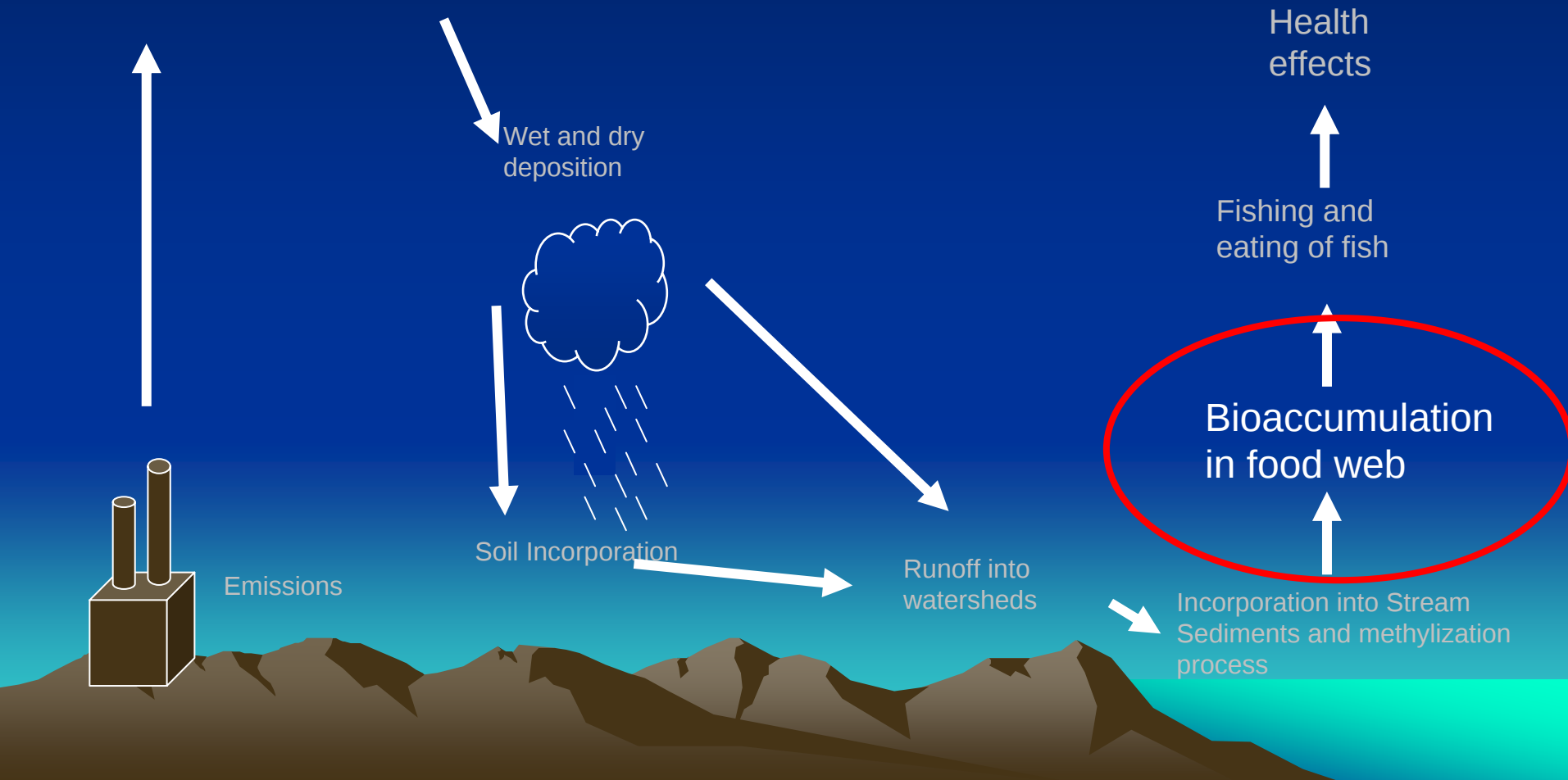
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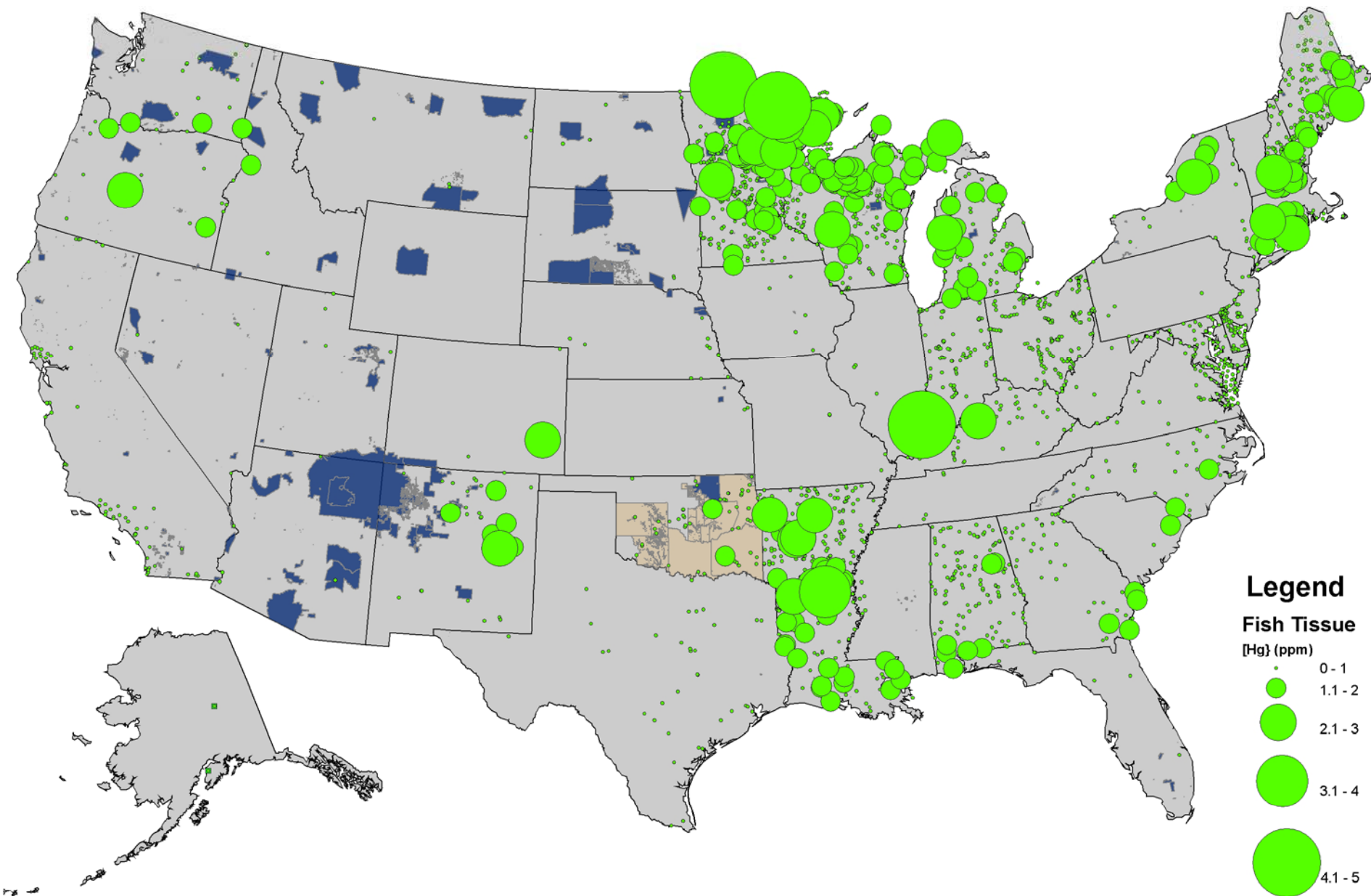


Entrance to atmospheric budget

Transport 1000's of Miles



Fish Tissue Hg Concentrations (USGS 2005)



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Entrance to atmospheric budget

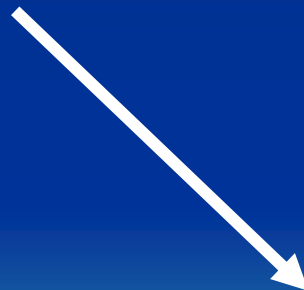
Transport 1000's of Miles



Wet and dry deposition



Soil Incorporation



Runoff into watersheds

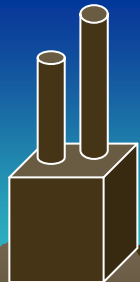
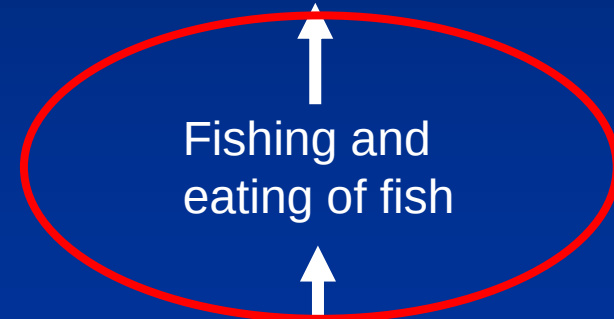


Health effects

Fishing and eating of fish

Bioaccumulation in food web

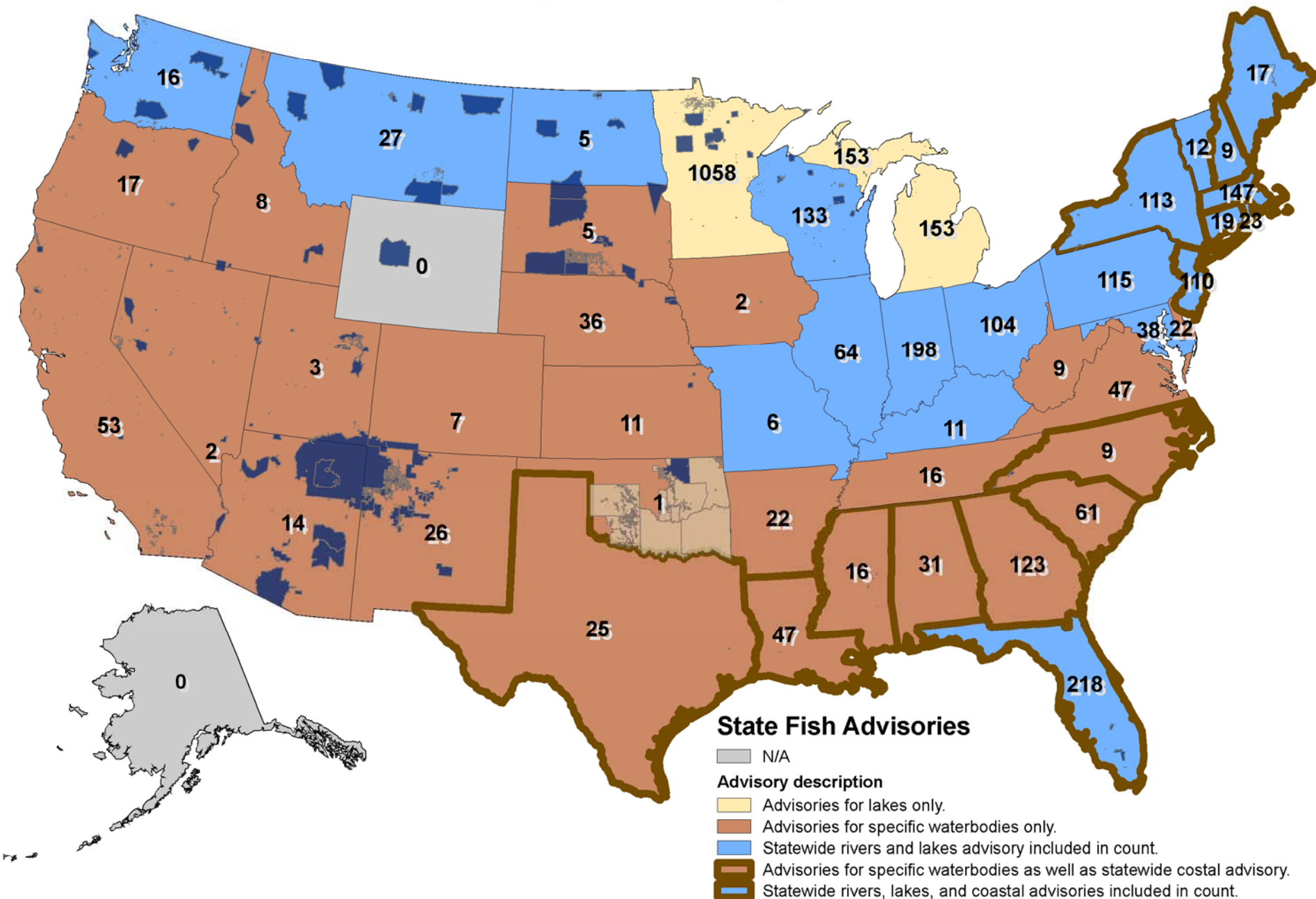
Incorporation into Stream Sediments and methylization process



Emissions



State Fish Advisories (EPA - NLFA 2004)



Summary

- For tribes:
 - Hg is an issue that is worth investigating more.
 - Western tribes have large sources nearby
 - Upper Midwest and Northeast have high fish tissue concentrations



Future study

- Tribal census data
 - Recalculate statistics based on census tract information
- County emissions and tribes
- International budget?
 - Canada
 - Mexico

