



CAPCA 2008 Fall Conference

Mercury Impacts on Watersheds

A Brief Overview

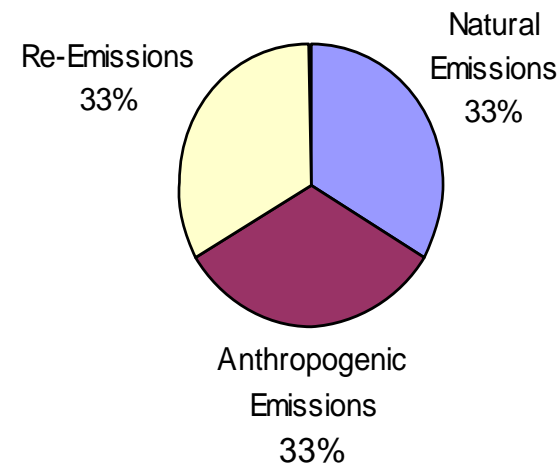


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Contributions to Global Mercury Emissions

- **Contributions to background include worldwide anthropogenic, natural, and re-emitted (recycled) emissions**
- **Total estimated global emissions ~4,400 - 7,500 metric tons/yr**
 - U.S. anthropogenic emissions ~ 5% of total anthropogenic emissions
 - U.S. anthropogenic emissions ~ 3% of global pool (U.S. coal-fired power plants are less than 1%)



Source: United Nations Environment Programme Global Mercury Assessment, 2002 and US EPA, Mercury Study Report to Congress, 1997



Three Main “Forms” of Atmospheric Mercury

- **Metallic Mercury (Hg^0)**
 - not very water soluble
 - long atmospheric lifetime (~ 0.5 - 1 yr); globally distributed
- **Oxidized Mercury (Hg^{2+})**
 - very water soluble
 - short atmospheric lifetime (~ 1 week or less)
 - more local and regional effects
- **Particulate Mercury**
 - not pure particles of Hg (Hg compounds associated with atmospheric particulate)
 - species largely unknown
 - moderate atmospheric lifetime (perhaps 1 - 2 weeks)
 - local and regional effects
 - bioavailability?

Source: Mark Cohen, NOAA Air Resources Lab

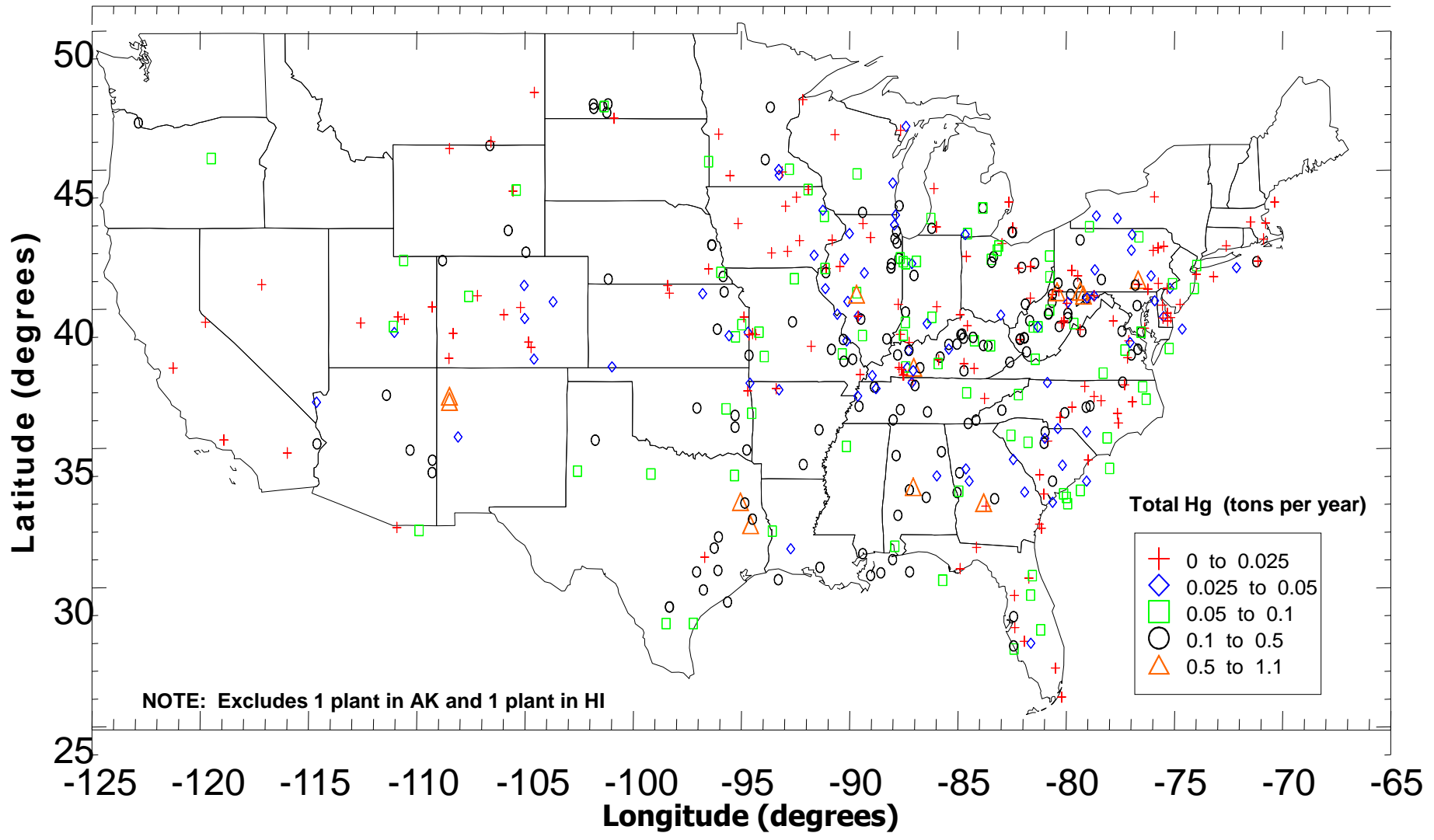


National Emissions Inventory Tons Mercury Per Year, 1990-2002

Source category	1990 NEI emissions (tpy)	1999 NEI emissions (tpy)	2002 NEI emissions (tpy)
Municipal waste combustors	56.7	5.1	4.2
Medical waste incinerators	49.7	2.8	0.3
Industrial boilers	12.0	12.0	11.0
Chlorine production	10.0	6.5	5.4
Hazardous waste combustors	6.6	6.6	4.6
Coal-fired electric utility boilers	51.1	47.9	50.3
Gold mining (poss. underestimated)	3.4	11.5	6.5
Other categories	23.5	22.2	20.8
Total (all categories)	219.9	113.2	113.8



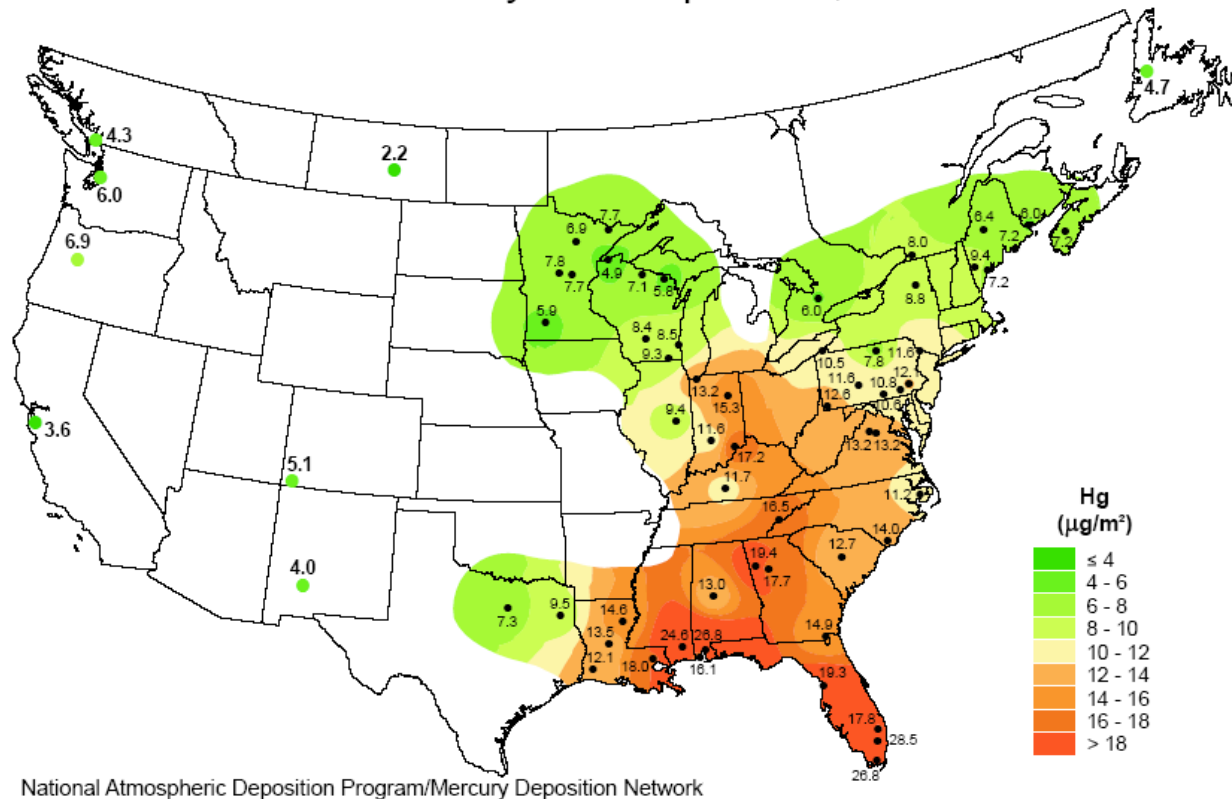
Total-Mercury Emissions: 1999 ICR Power Plants



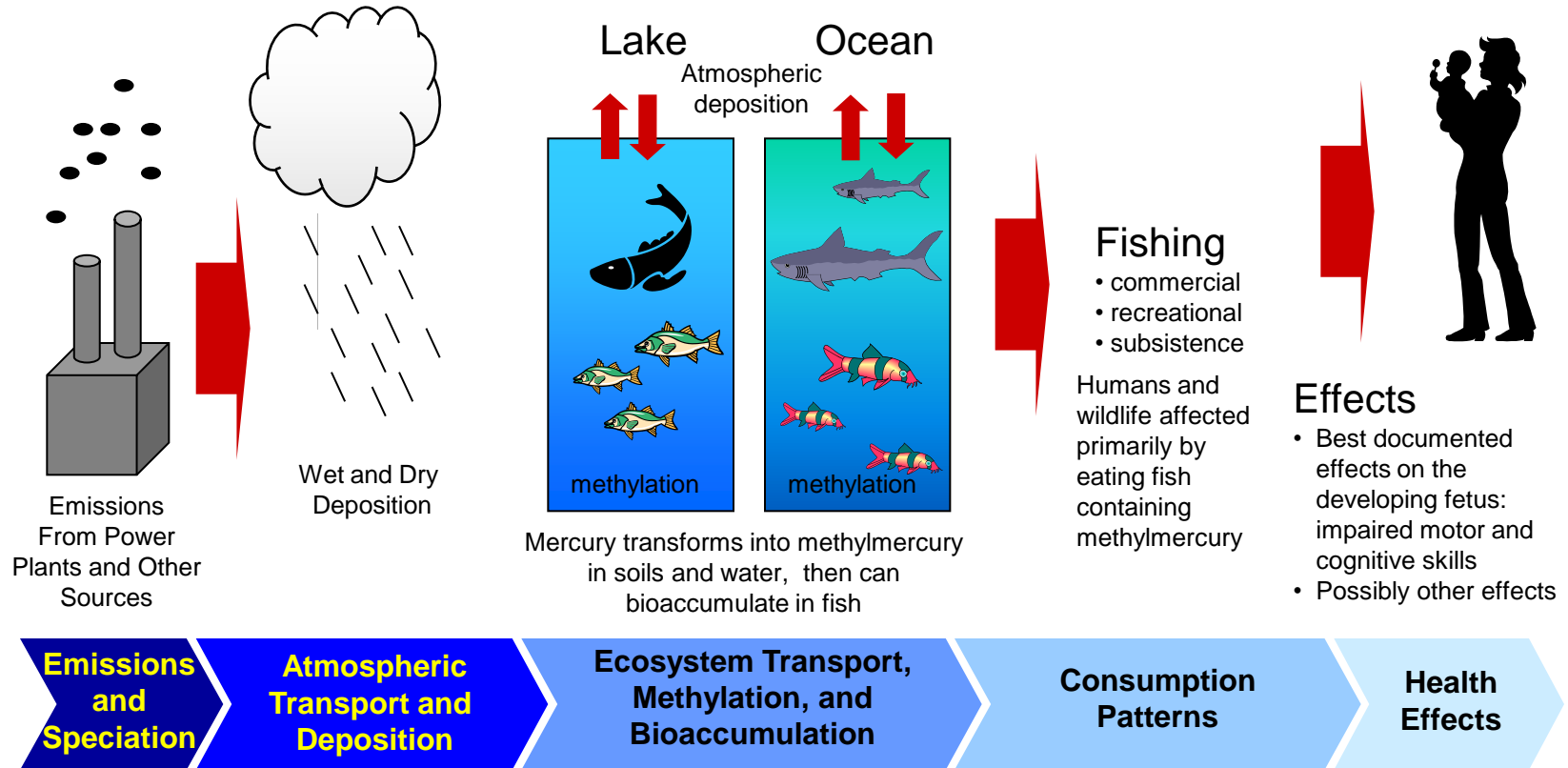


Estimated Wet Deposition (Monitoring)

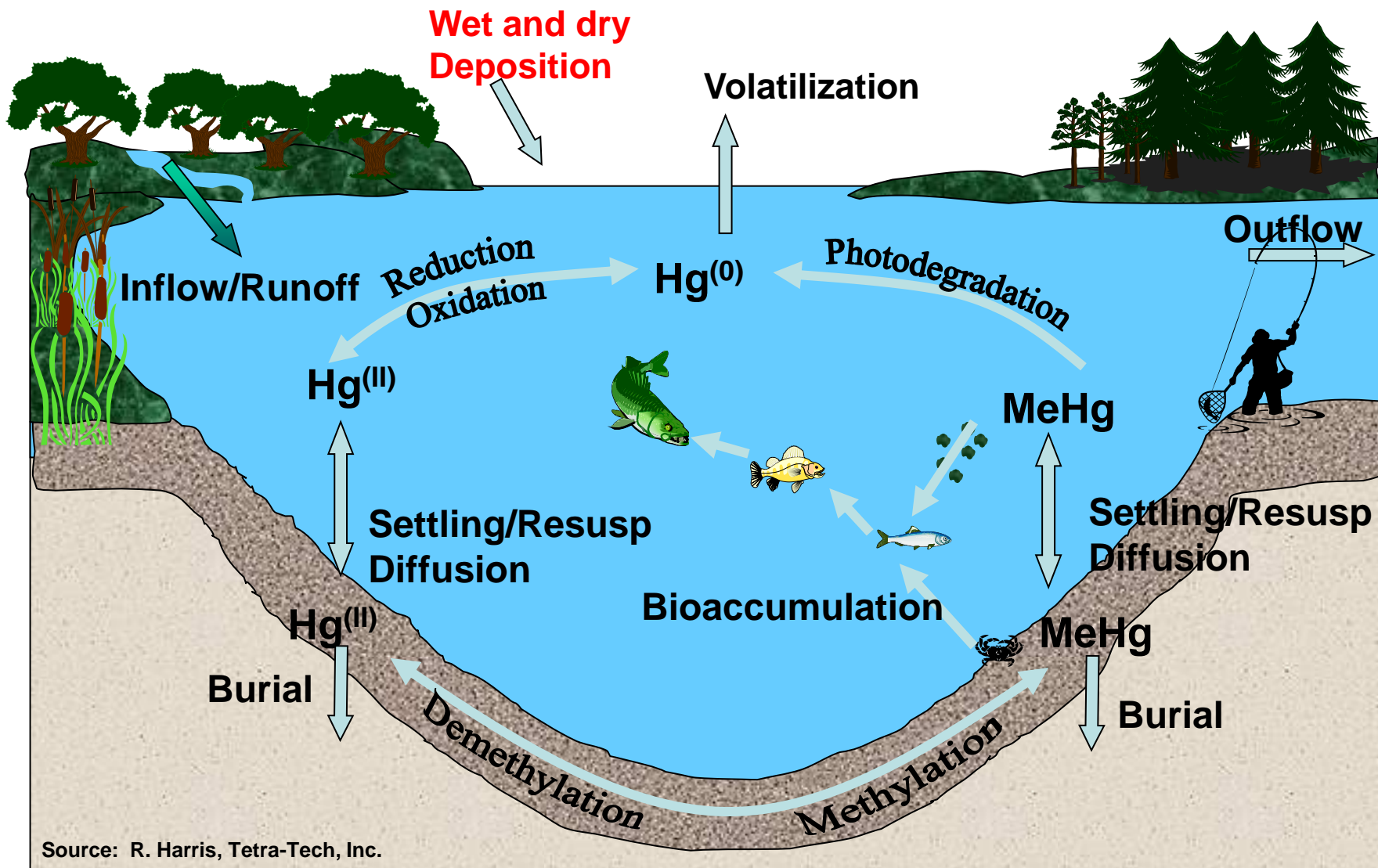
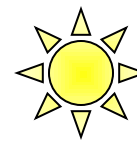
Total Mercury Wet Deposition, 2003



Mercury Exposure Pathway



Aquatic Mercury Cycling Model

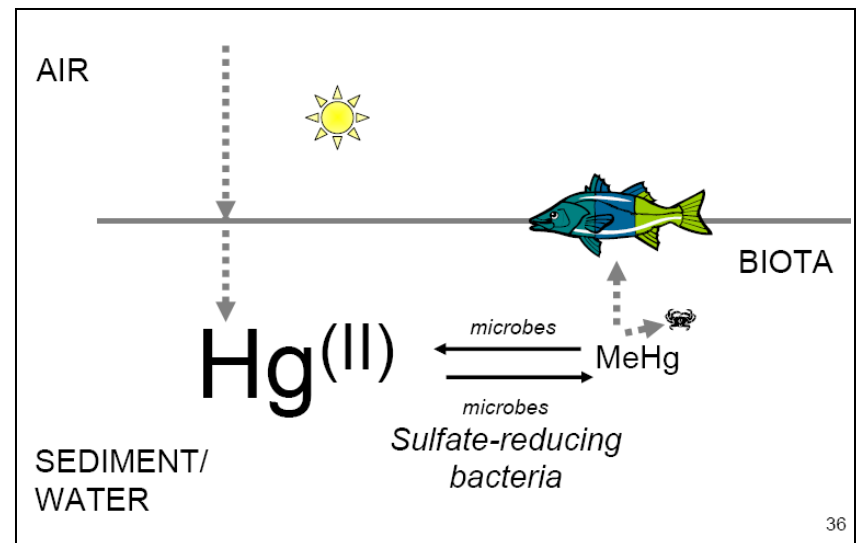


Source: R. Harris, Tetra-Tech, Inc.



Summary: Factors Affecting Methylation

- **Mercury bioavailability in different ecosystems**
 - Sulfide
 - Chemistry (dissolved organic carbon, pH)
 - Amount and types of solids in water and sediments
- **Microbial activity producing methylmercury**
 - Temperature
 - Suitable environments (oxygen, resuspension)
 - Sulfate
 - Organic matter
 - Other biological processes that affect chemistry (sulfide oxidizers; iron reducers)





There Is a Spectrum of Methylmercury Health Effects

- **Effects of exposure during development or to adults range from mortality at very high levels through subtle effects on ability to learn at lower levels**
- **Children born to mothers exposed during pregnancy at high doses exhibited cerebral palsy-like symptoms, delayed walking/talking; at lower doses, delayed startle responses, subtle neurological effects, effects on tests related to ability to learn and process information**
- **Not likely to be a human carcinogen (Tumors are seen in animals only at extremely toxic doses)**
- **Developing nervous system is a sensitive target for low dose methylmercury exposure**
- **Human and animal evidence of cardiovascular effects – from adult and in utero exposure**
- **Animal evidence of immune and reproductive effects**

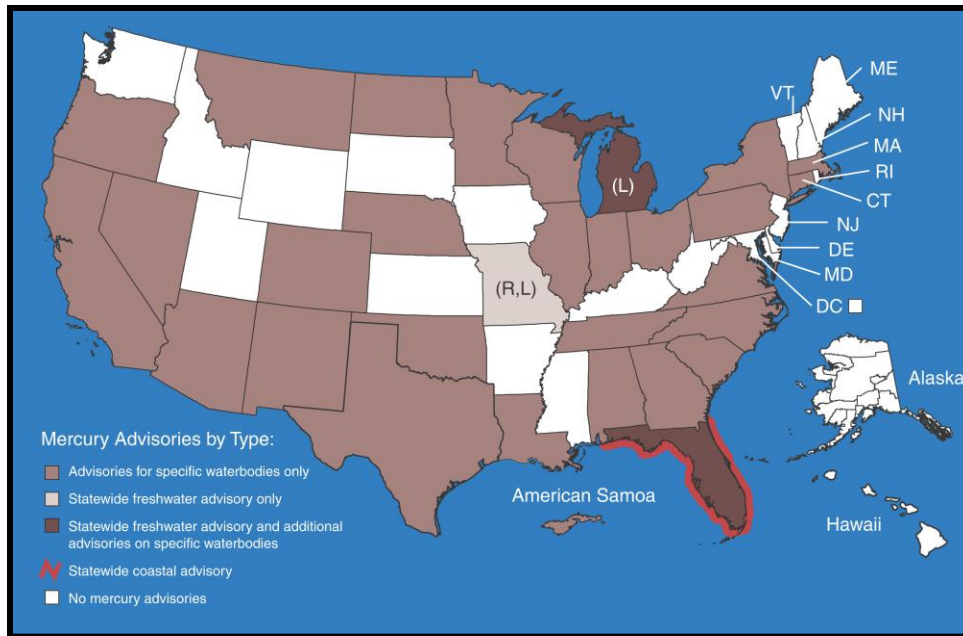




States with One or More Mercury Fish Advisories

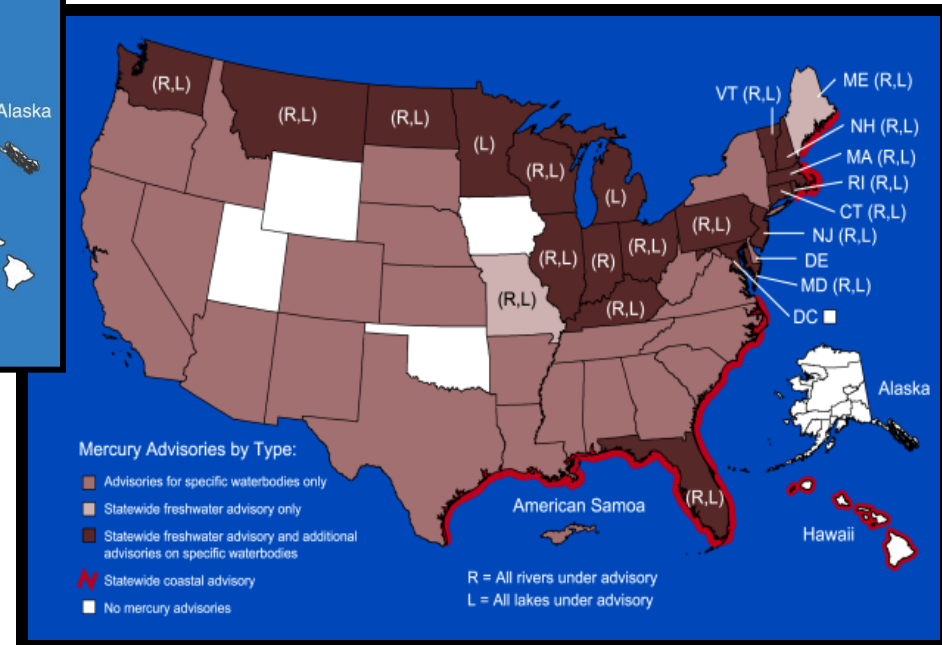
<http://epa.gov/waterscience/fish/advisories/>

1993



899 advisories

2003



2,362 advisories



Questions?

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