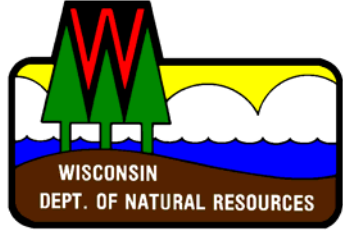


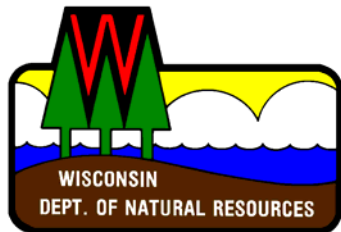
Do Wisconsin Power Plants Significantly Contribute to Mercury Deposition in Wisconsin?

*Presentation to the
Natural Resources Board
June 25, 2008*



Presentation Outline

- ◆ Review Transport and Transformation of Mercury in the Atmosphere
- ◆ Weight-of-Evidence Approach to Answer the Contribution Question



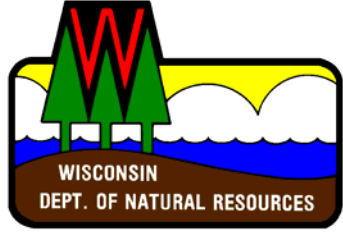
Review of Hg Species, Transport and Transformation

◆ Mercury Species

- ◆ Reactive Gaseous Mercury (RGM), also called Divalent Hg
- ◆ Elemental Mercury (Hg⁰)
- ◆ Particle-Bound Mercury (HgP)

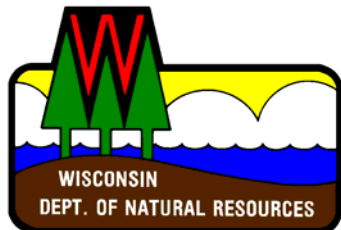
◆ Transport and Transformation

- ◆ Reactions
- ◆ Wet Deposition
- ◆ Dry Deposition



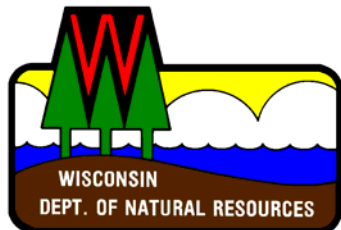
Do Wisconsin Power Plants Significantly Contribute to Mercury Deposition in Wisconsin?

- ◆ Yes
- ◆ Weight-of-Evidence Approach
 - ◆ Data Analyses
 - ◆ Observation Based Models
 - ◆ Chemical Transport Models



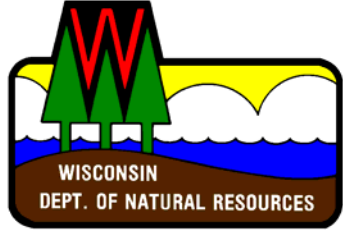
Historic Use of Hg Deposition Models

- ◆ Systematic Underestimation of Local Source Contribution
 - ◆ Underestimation of dry deposition velocity
 - ◆ Top of the modeling boundary set too low
- ◆ Poor Representation of Thunderstorms
 - ◆ Most chemical transport models use large grid structure
 - ◆ Analysis of event data at Devil's Lake show thunderstorms are important
- ◆ Many Other Uncertainties with Hg Chemistry and Physics



Fate of Hg in the Atmosphere

- ◆ Atmospheric Hg cycle is more dynamic than previously thought.
- ◆ Rapid exchanges of mercury between air and earth surfaces may give the appearance of homogeneous air concentrations, explaining the over-estimation of residence times in early studies.
- ◆ Leads to an underestimation of local source contribution.



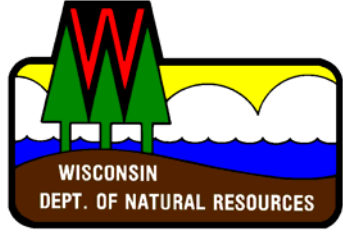
Using Sulfate Ion as a Tracer for Hg

- ◆ Why does this work?
 - ◆ Power plants are the principal source of Hg and sulfate in Wisconsin.
 - ◆ The CAMx model performs very well at simulating sulfate concentrations.
 - ◆ The PSAT algorithm in CAMx allows one to trace sulfate back to its source.



Using Sulfate Ion as a Tracer for Hg

- ◆ Wisconsin power plants contribute 6 to 10% of sulfate at Wisconsin receptors
- ◆ 10% is the lower limit of Hg contribution of WI power plants at WI receptors.
 - ◆ Sulfate more stable than divalent Hg
 - ◆ Divalent Hg more readily deposited



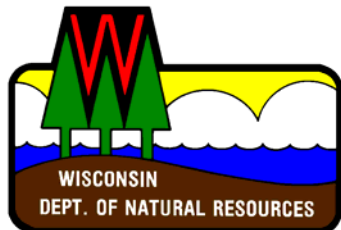
Assessment of Hg Deposition Data

- ◆ National MDN data indicates significant regional and site-specific differences in mercury deposition.
- ◆ These differences occur despite the fact that MDN sites are typically in rural areas.
- ◆ Therefore, Hg deposition cannot be dominated by global sources.



Analysis of Hg Monitoring Data

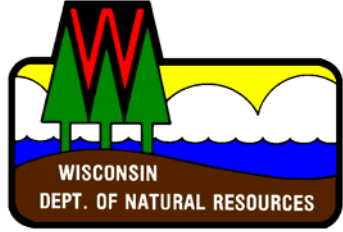
- ◆ Analysis of Ambient Hg Data at Devil's Lake and Milwaukee
- ◆ Spikes in Concentration Indicate Contribution from Local Sources
- ◆ Local Sources Contribute 48% of Divalent Hg at Devil's Lake and 64% in Milwaukee
- ◆ Very High Concentration Events at Devil's Lake Traced to Power Plant in Columbia County



Weight of Evidence

Contribution from In-State Power Plants

- ◆ Evidence of Significant Contribution from WI Power Plants on Hg Deposition in Wisconsin
 - ◆ Ambient monitoring data
 - ◆ Sulfate tracer analysis
- ◆ Problems with Historic Modeling Studies
 - ◆ Underestimate of local contribution in historic modeling
 - ◆ New research on the fate of atmospheric Hg indicates deposition occurs closer to the source of emission than previously thought.



Weight of Evidence

Contribution from In-State Power Plants

- ◆ No Evidence that Mercury Deposition in Wisconsin Dominated by Global Sources
 - ◆ Data analysis consistent with regional and local source contributions to Hg deposition.