

Ad Hoc Committee on Mercury Studies

Report to TEC Committee
June 7-8, 2016



Committee Background Charge

- Chairman Easterly established committee June, 2015.
- Charge:
 - Evaluate what is known about the sources that impact the Ohio River & make recommendations to the Commission on the need for additional information and proposed means to obtain such information.
 - Identify what is known and unknown about mercury sources.
 - Determine the value and costs of addressing the unknowns.
 - Make recommendations for studies to the Commission.

Committee Members

Stuart Bruny

George Elmaraghy

Erich Emery

Tom FitzGerald

Madeline Fleisher

Toby Frevert

Tim Henry

John Kupke (Chair)

Paul Novak

Eric Nygaard

Ron Potesta

Rob Reash

Martin Risch

Mike Wilson

OH Commissioner

Federal Commissioner

US Army Corps of Engineers

Federal Commissioner

Environmental Law & Policy Center

IL Commissioner

USEPA

IN Commissioner

IDEM/TEC

OEPA

WV Commissioner

Power Industry Advisory Committee

USGS

NY Commissioner



Committee History

- Inaugural call on 9/21/15.
- Subsequent calls:
 - Nov. 2015 Jan. 2016
 - Apr. 2016 May 2016
- Work Completed
 - Literature review.
 - Identification of available mercury data from outside sources.
 - Development of background paper on mercury based on literature review & summary of ORSANCO work products.
 - Identification & prioritization of information needs.



Science Information Needs

- Priority #1:
 - Mass Balance to quantify sources and apportionment.
 - Which sources are having an impact and what is the magnitude of the impact?
 - These questions would lead towards development of appropriate management scenarios.
- Other Science Priorities:
 - Transport, fate, methylation & bioaccumulation.
 - The end point is fish tissue contaminantion.



Management Issues

- What is the appropriate water quality criterion?
- What methodologies best characterize impairment?
- Are mixing zones needed to protect the fish consumption use?
- Are there trends?
- What are the appropriate management approaches?
- Is mercury the problem that seems to be perceived by the public?



Cincinnati Meeting Objectives

- Priority #1: To address the mass balance question and source apportionment. Begin development of studies necessary to generate necessary information.
- As time allows, address methylation and other science questions.
- Final objective is to bring a recommendation to Commission in October, 2016, but no later than Feb. 2017.

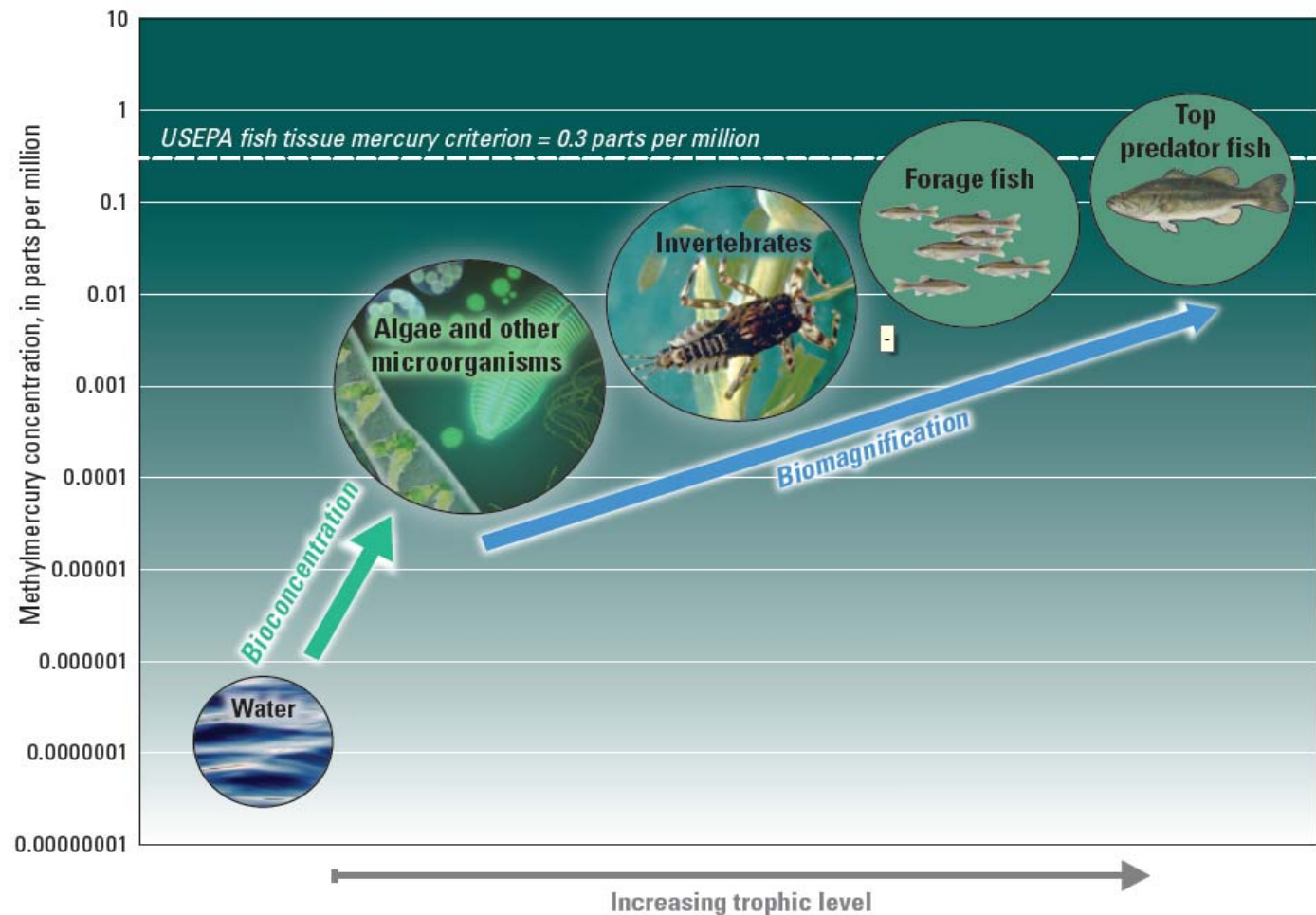


Several Basic Considerations Relevant to Understanding Mercury in the Ohio River

- Mercury (Hg) is a global pollutant
 - In the USA fish consumption advisories for mercury have occurred in all states
- Deposition from the atmosphere is the primary source of Hg in aquatic systems....but-----!
- Hg exists in different forms, which influence its transmission and other characteristics.
- Hg reaches the atmosphere from three (3) categories of sources , which can be broadly quantified
- The above are important considerations associated with considering a Hg Mass Balance evaluation within the Ohio River.

Bioaccumulation and Magnification in Aquatic Food Chains (from Wentz et al.)

MeHg
concentration
in ppm





Mercury Exists in Different Forms in the Air and Water

- Airborne

- Hg^0 : elemental mercury (Can travel thousands of miles)
- Hg (II) : divalent mercury/reactive gaseous mercury
- PHg : particulate-bound mercury

- Waterborne

- Above airborne Hg species
- MeHg : methylmercury



Hg Moves in a Continuous Cycle in Gaseous and Reactive Forms Between Air, Land, and Water.

- Hg emitted to atmosphere from three (3) sources
 - Primary Natural (volcanic, geothermal)
 - Primary Anthropogenic
 - Coal combustion
 - Precious metal extraction
 - Chlor-alkali plants
 - Commercial products: electrical switches, batteries, paints
 - Re-emissions of Secondary Sources
 - Return to atmosphere of prior natural and anthropogenic sources deposited to land, vegetation, and water. Termed “legacy” Hg.

Broad Hg Quantification of Sources

- Measured Hg annual atmospheric loads in megagrams or metric tons

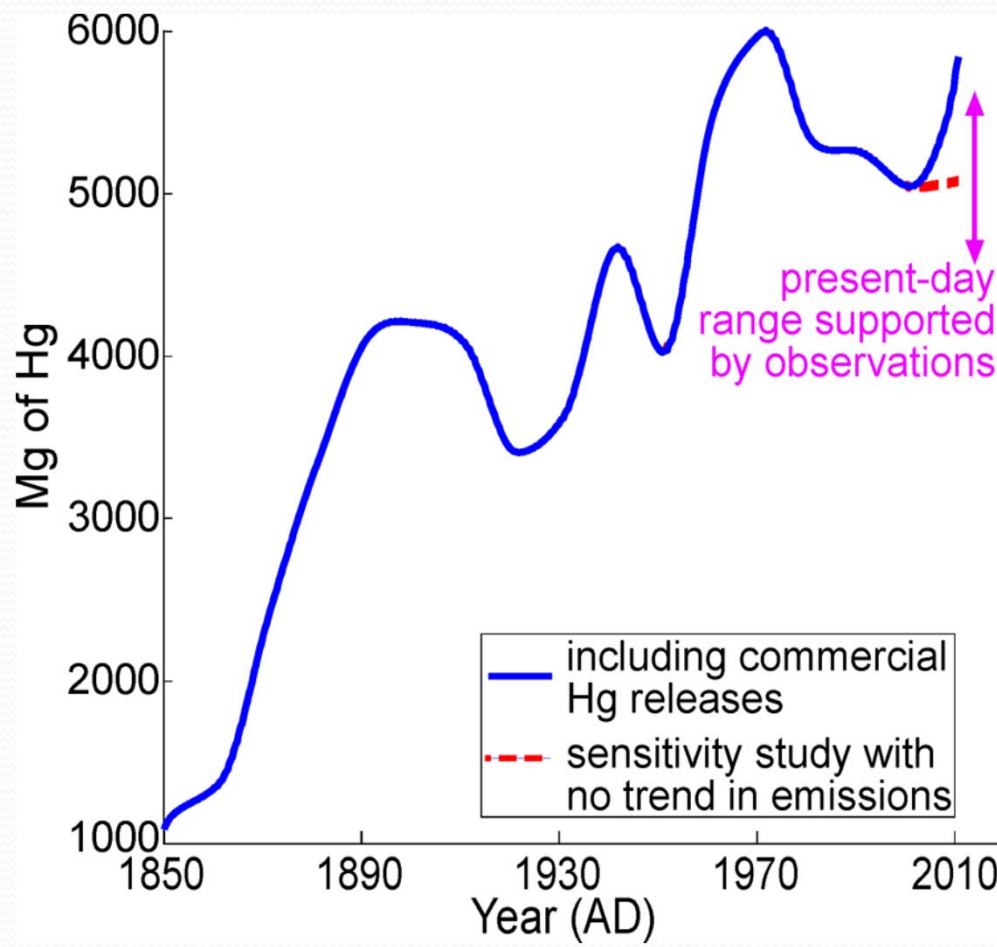
1 metric ton = 1 megagram [Mg] = 1.1 US tons

- Total annual Hg loads from natural, anthropogenic, and re-emission is about 6,500-8,200 Mg/yr.

- Approximate Apportionment

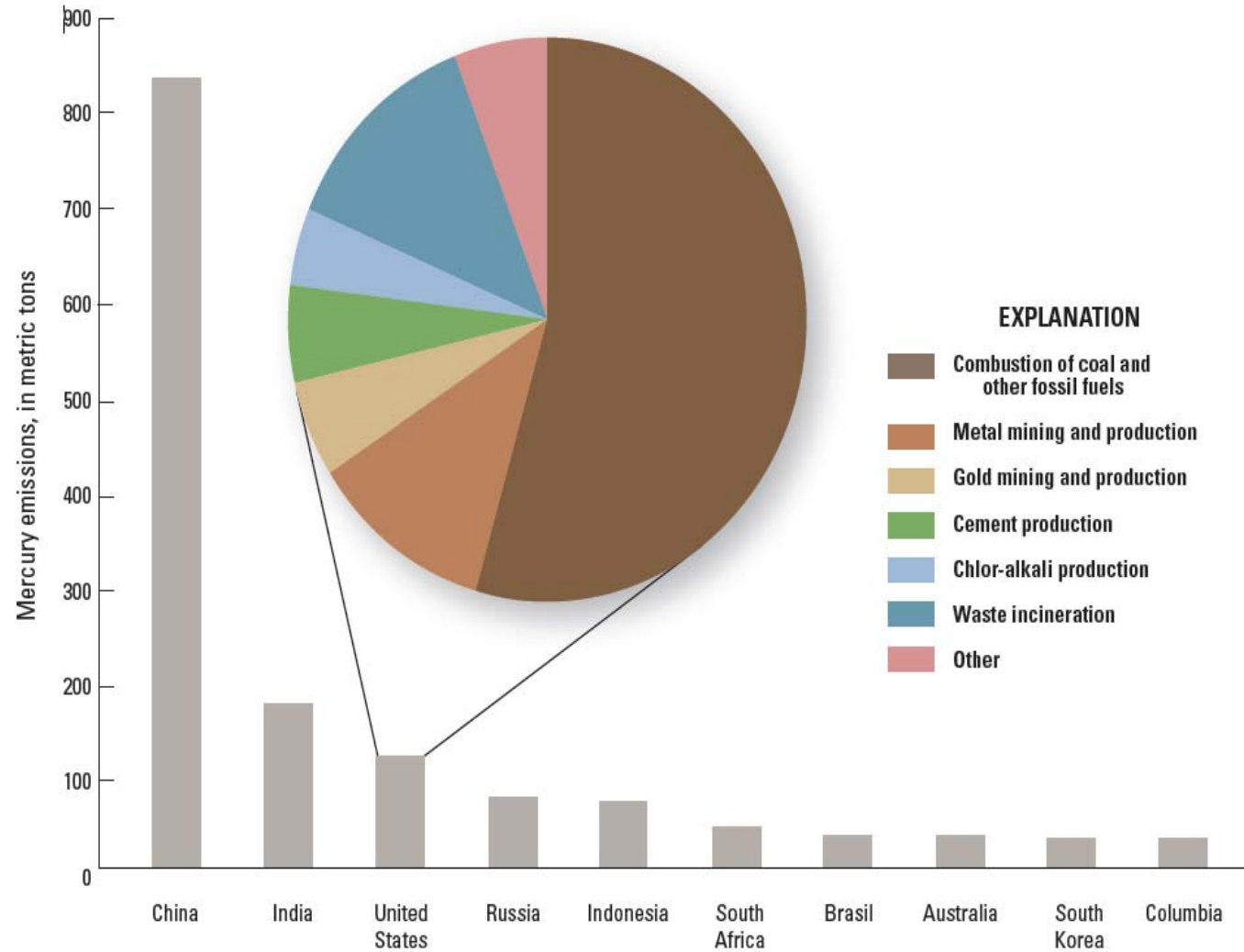
• Primary Natural	800
• Primary Anthropogenic	2,300
• Re-emissions (Legacy)	<u>4,400</u>
Total Approximate Annual Metric Tons	7,500

Model of global atmospheric reservoir of Hg from 1850 to 2010 (modified from Horowitz et al.)



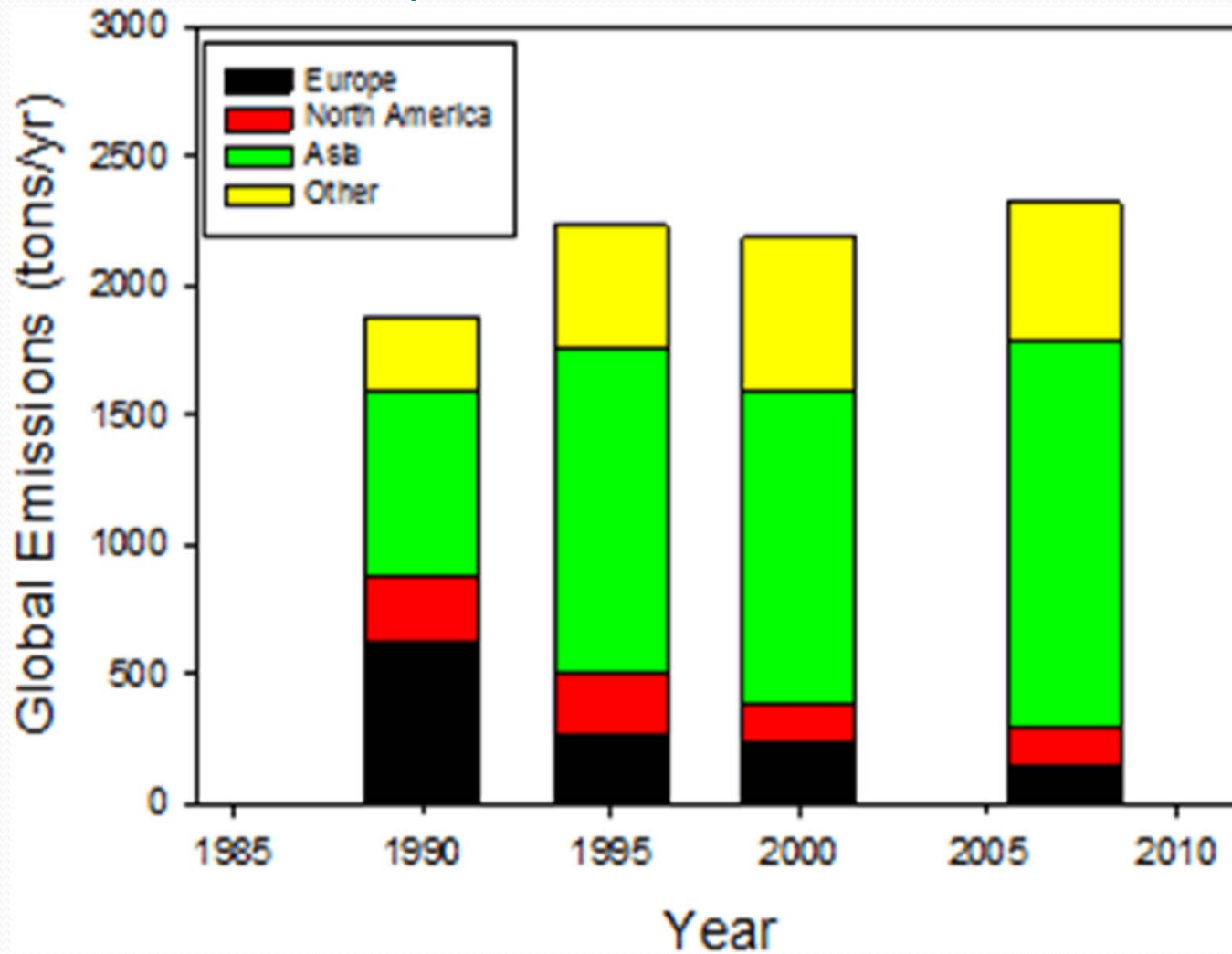
2005 Mercury Emissions (modified from Wentz et al.)

Mercury
emissions
(metric tons)



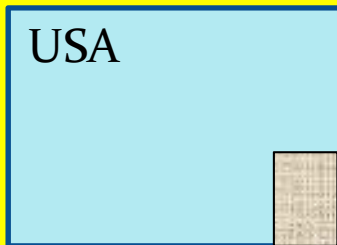
Trends in Global Emissions of Mercury

(from Driscoll 2013)



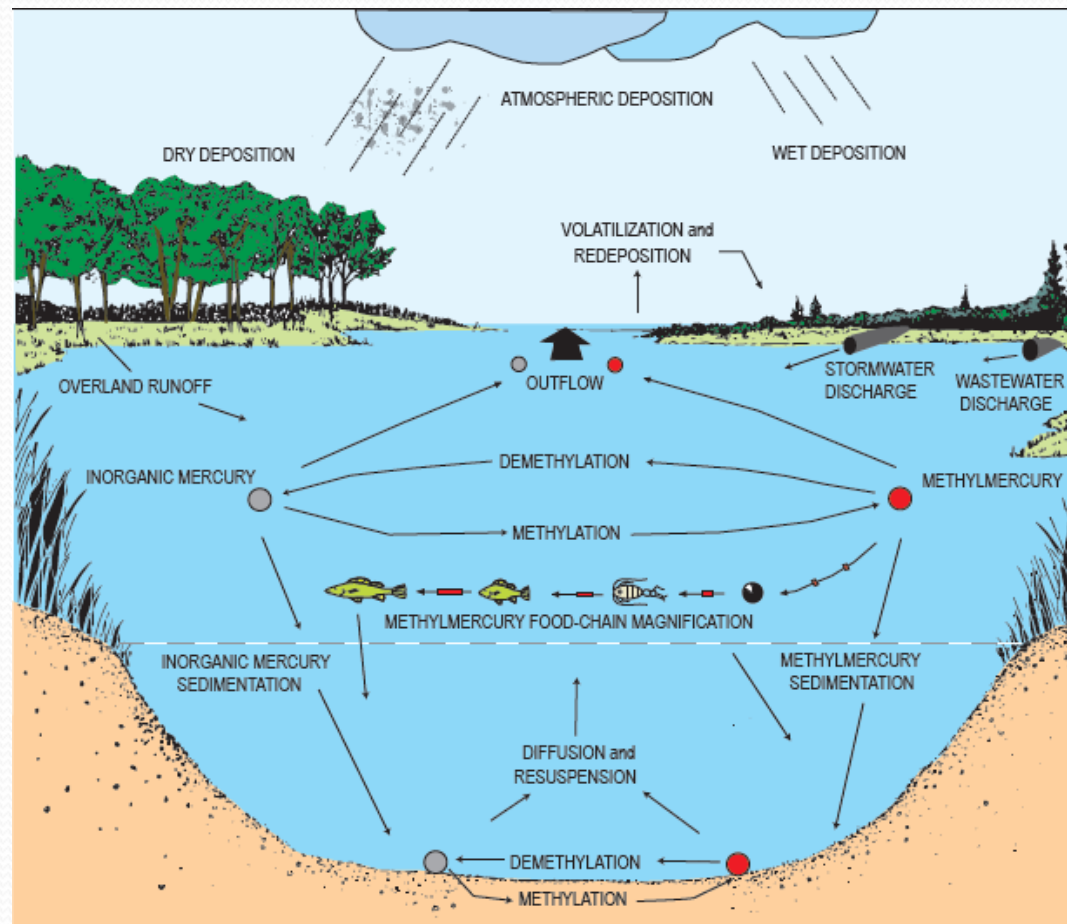
Overview of Mercury Loadings within Global to Regional Context

Global Hg
Atmospheric Loads

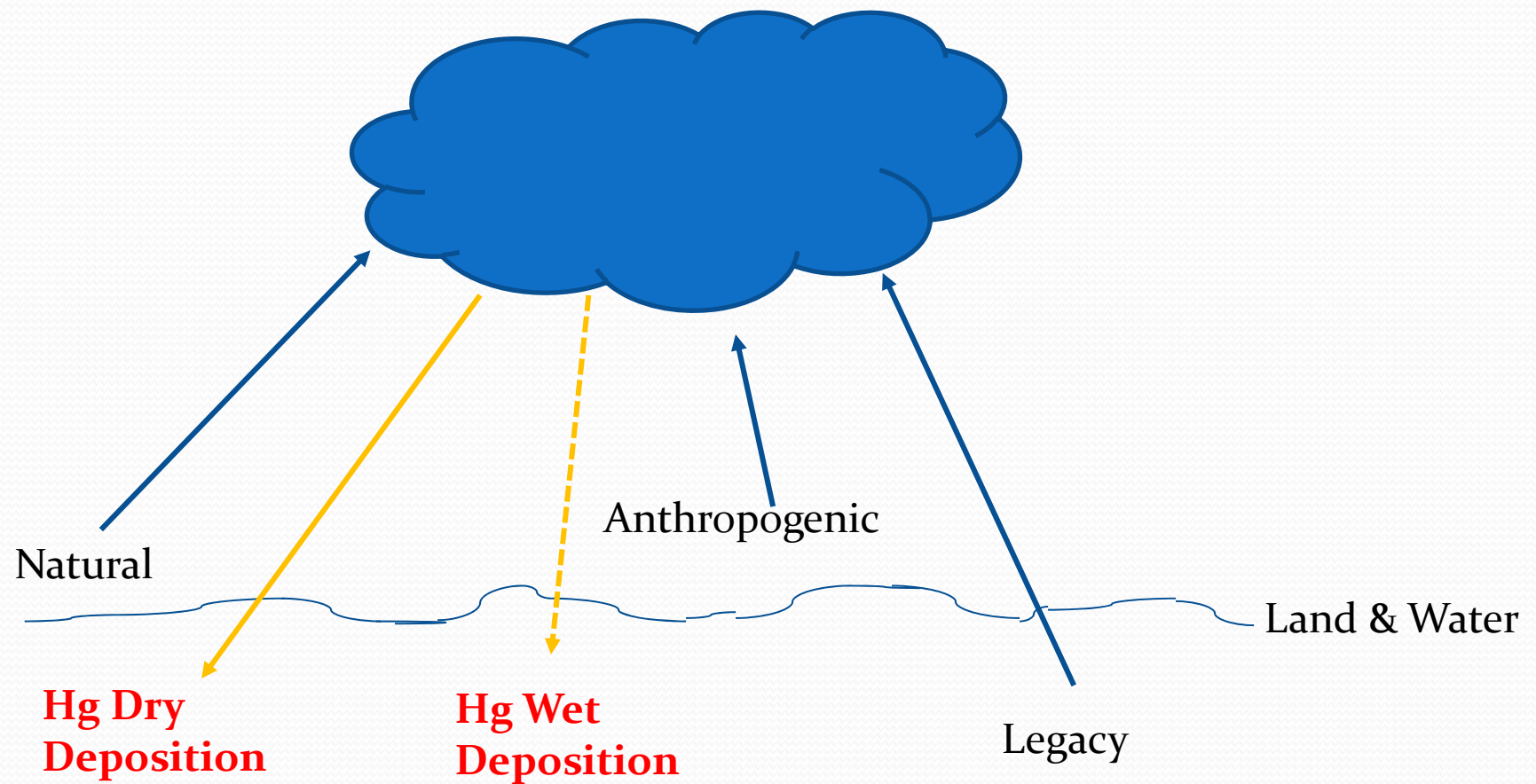


Ohio River
Basin

The mercury cycle in aquatic ecosystems (from Risch et al.)



Simplified Hg Cycle Emissions and Deposition Cycle



Rough Estimate of Hg Annual Deposition over Ohio River Drainage Basin

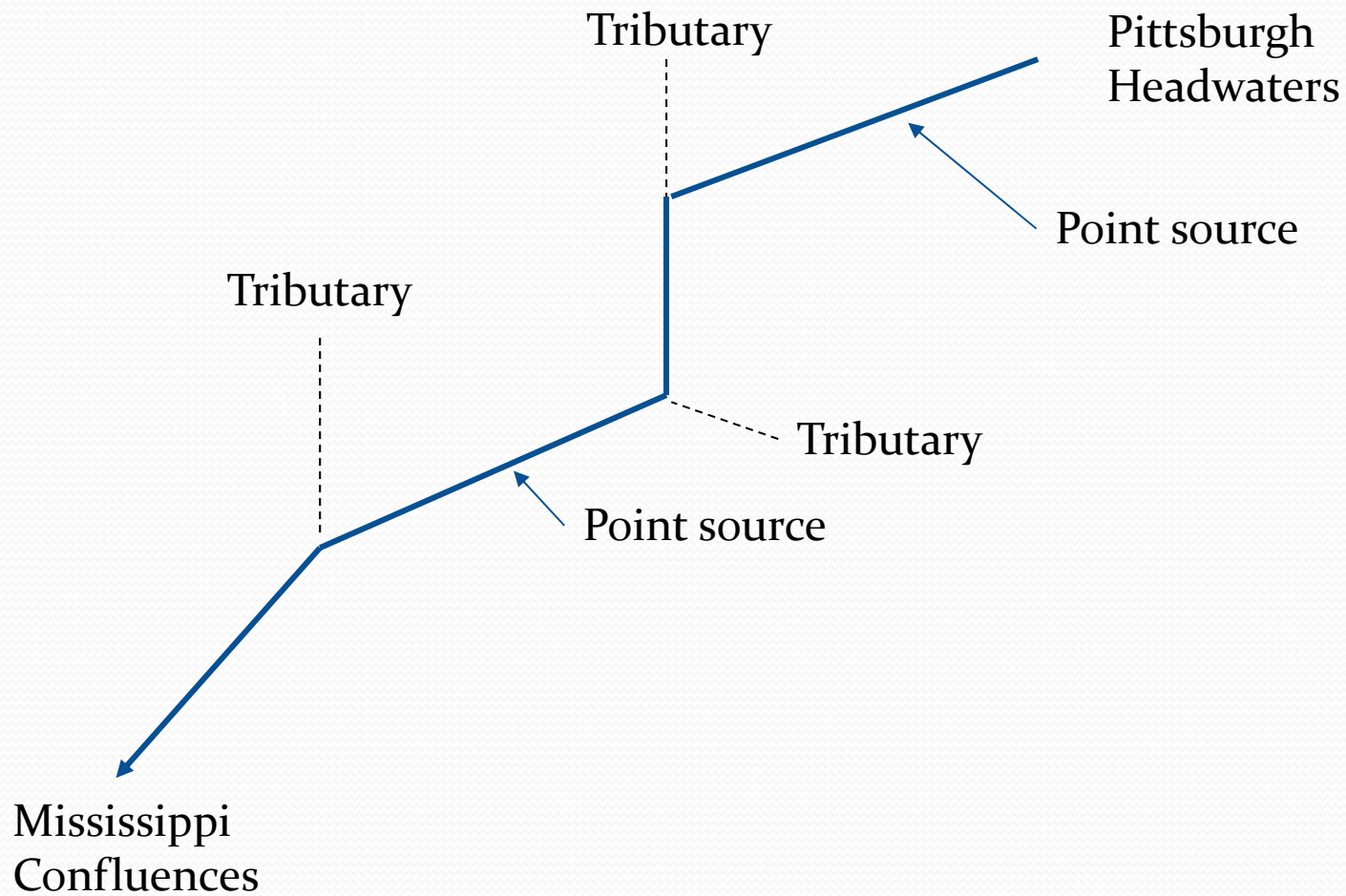
- Ohio River Basin 202,000 Mi²
- Approximate annual wet and dry deposition rate 21 ug/m²/yr
- Calculated annual Hg basin load 12 Mg/yr
- Considering Ohio River Basin area as % of contiguous US ~ 7%
- Rough associated extension to US overall ~ 170 Mg



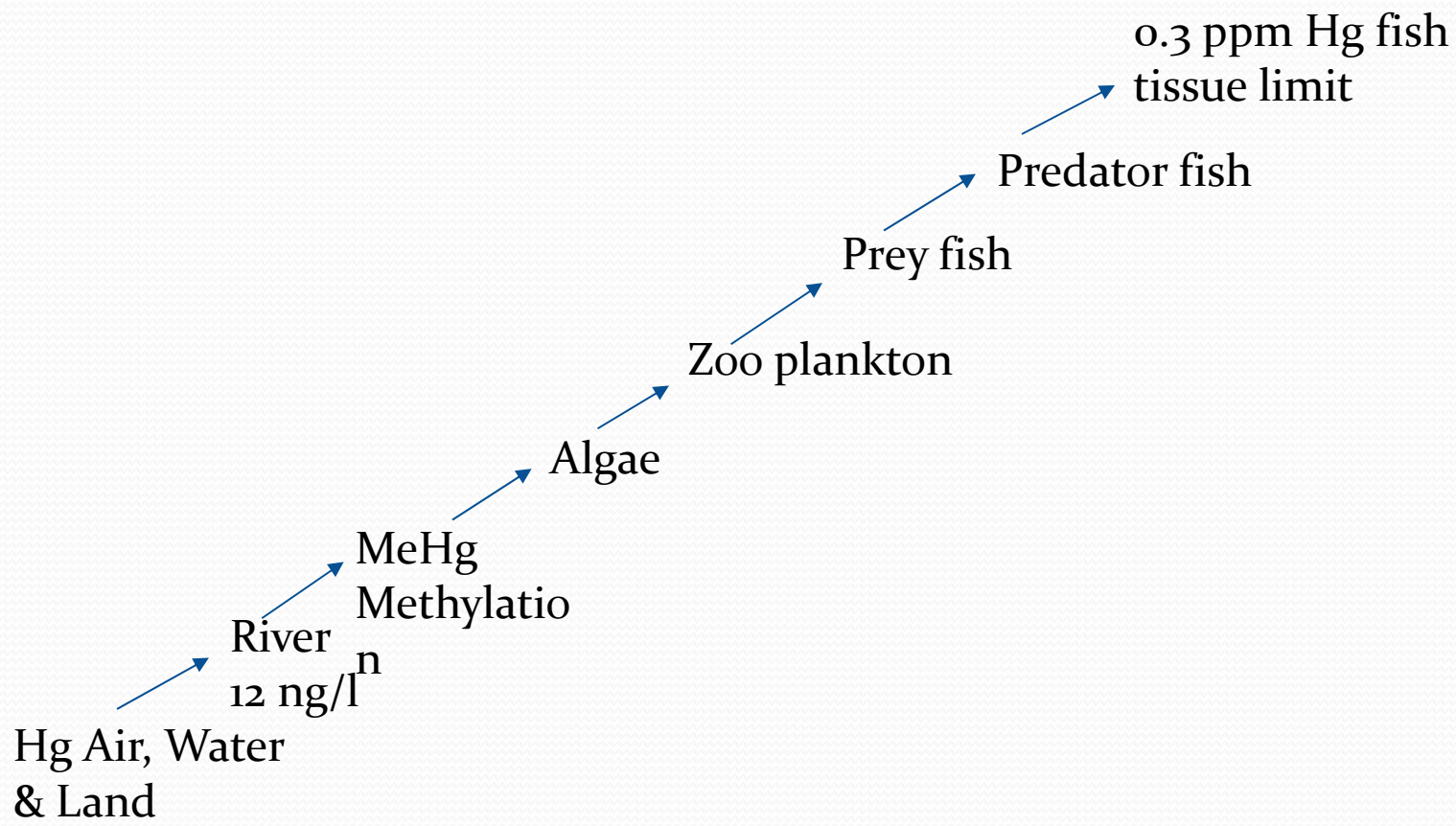
Mass Balance Objective

- To quantify Hg entering the river (poundage) and compare it with measured in-river poundage (dependent on flow and Hg concentrations).
- Consider the mass balance concept at various points along the river.
- Evaluation Approaches
 - Watershed Hg atmospheric deposition and tributary yields
 - Hg Modeling
 - Point source and related in-river relationships
 - Other

Mass Balance Considerations



Mercury Bioaccumulation





Conclusions of Mercury Discussion

- The mercury issue in the Ohio River Basin and globally is an inter-connected and complex subject.
- The Ad Hoc Committee purposely has no definitive recommendation at this time. However, from their considerations to date, they are focusing on how an Hg mass balance for the Ohio River Basin could best be derived.
- Hg Ad Hoc Committee appropriately positioned to provide Hg recommendation to Commissioners at October 2016 meeting.

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Questions?