Lake Michigan Mass Balance Study Results and Predictions

Introduction to the Study

U.S. EPA
Great Lakes National Program Office
ORD-Large Lakes Research Station

Lake Michigan Mass Balance Participants

U.S. EPA

- **Great Lakes National Program Office**
- **Region 5 Water and Air Divisions**
- **Office of Research and Development**
  - **National Health and Environmental Effects Research Laboratory, MED – Grosse Ile**
  - **National Exposure Research Laboratory – RTP**
- **Office of Air and Radiation – OAQPS**
- **Office of Water**

Lake Michigan Mass Balance Federal and State Cooperators

- United States Geological Survey
  - Biological Research Division (formerly NBS)
  - Water Resources Division
- U.S. Fish and Wildlife Service
- U.S. Department of Energy – Battelle NW
- National Oceanic and Atmospheric Administration
- Environment Canada
- Illinois Department of Natural Resources
- Michigan Department of Environmental Quality
- Michigan Department of Natural Resources
- Indiana Department of Environmental Management
- Wisconsin Department of Natural Resources
- Illinois Water Survey
- Wisconsin State Lab of Hygiene

Lake Michigan Mass Balance Project Committee and Workgroup Structure

Program Steering Committee
Horvatin – USEPA/GLNPO

Technical Coordinating Committee
Horvatin – USEPA/GLNPO

Modeling Workgroup
Richardson – USEPA/ORD/NHEERL/MED/LLRFRB

Air Monitoring Workgroup
Bode – USEPA/GLNPO

Biota Workgroup
Bertram – USEPA/GLNPO
Gannon – USDOI/USGS/GLSC

Chemistry Workgroup
Anderson – USEPA/GLNPO

Data Management Workgroup
Klewin and Strobel – USEPA/GLNPO

Lake Monitoring Workgroup
Warren – USEPA/GLNPO

Tributary Monitoring Workgroup
Kohlhepp – USEPA Region 5 Water Div.
Robert Day - MDEQ

Quality Assurance Workgroup
Blume and Papp – USEPA/GLNPO

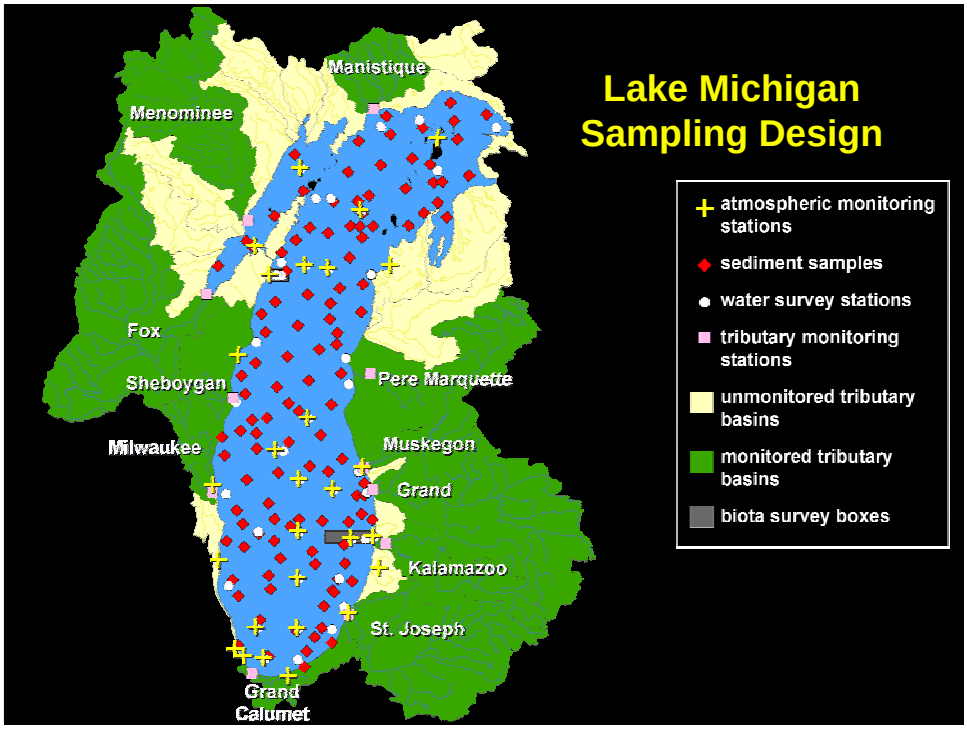
Sediment Monitoring Workgroup
Eadie – USDOC/NOAA/GLERL

Lake Michigan Mass Balance Contaminants

- Nutrients: concern for over-production of algae, and other symptoms controlled by nutrients
- Atrazine: potential concern for human and ecological effects; current use – herbicide
- PCB Congeners: concern for fish consumption and ecological effects; manufacturing banned
- Total Mercury: concern for fish consumption and ecological effects; multiple sources and uses

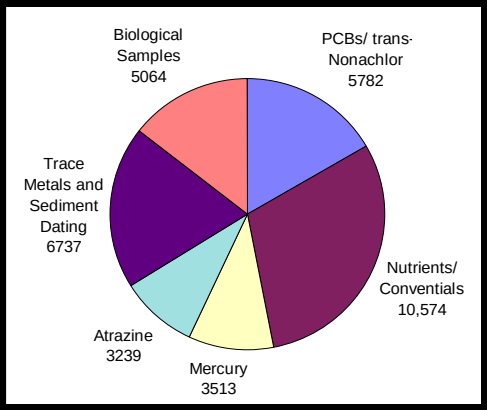
Measured Ecosystem Components

- Water Column
  - Open Lake and Major Tributaries
- Fish
  - Top predators and Forage Base for Diet Analysis and Contaminant Burden
- Lower Pelagic Foodchain
  - Species Diversity, Taxonomy, and Contaminant Burden
- Sediments
  - Cores and Burden Traps for Contaminants and Sedimentation Rate
- Atmospheric
  - Wet and Dry Deposition in particulate, vapor, and precipitation



Total Number of Samples

- 38,146 samples with over 1 million resulting data points



Enhanced monitoring program

Organics	Metals	Others
PCB Congeners	Total Mercury	Flow
DDT/DDD/DDE	Arsenic	TOC/POC/DOC
oxychlordane	Cadmium	Phosphorus
a-chlordane	Chromium	TSS
b-chlordane	Copper	Nitrate
trans-nonachlor	Lead	Ammonia
cis-nonachlor	Zinc	pH
toxaphene	Fe, Ni, Al, Si,	Chloride
hexachlorobenzene	Ti, Br, Se,	Silica
atrazine/DEA/DIA	Mn, K,	Chlorophyll a
Lindane, Dieldrin	Ca, Na	
PAHs		

key

Atmosphere Only
Water Only
Atmosphere and Water

Peer Review

- **Mass Balance Study Plan**
- **Modeling**
- **Database and Quality Assurance**
- **Tributary Load Methods**
- **Modeling Reports**

Lake Michigan Mass Balance Project Project Documentation

- Work Plan
- Enhanced Monitoring Program Quality Assurance Program Plan
- Quality Assurance Plan for Mathematical Modeling
- Methods Compendium (3 volumes)
- Data Reporting Formats and Data Administration Plan
- Principal Investigator Reports
- Project Data Reports
- Publications and Presentations

Lake Michigan Mass Balance Project PCB Modeling Peer Reviews and QA Audits

- Quality Management Systems Review – 1997
- Science Panel Review – Southgate, Michigan 1998
- Science Peer Review – Romulus, Michigan 2000
- Quality Management Systems Review – 2000
- PCB Modeling Peer Review – Romulus, Michigan 2004
- Quality Management Systems Review – 2004

* Numerous laboratory, data, and PI QA audits throughout the project