

# ENVIRONMENTAL MERCURY STATUS & TRENDS IN MICHIGAN

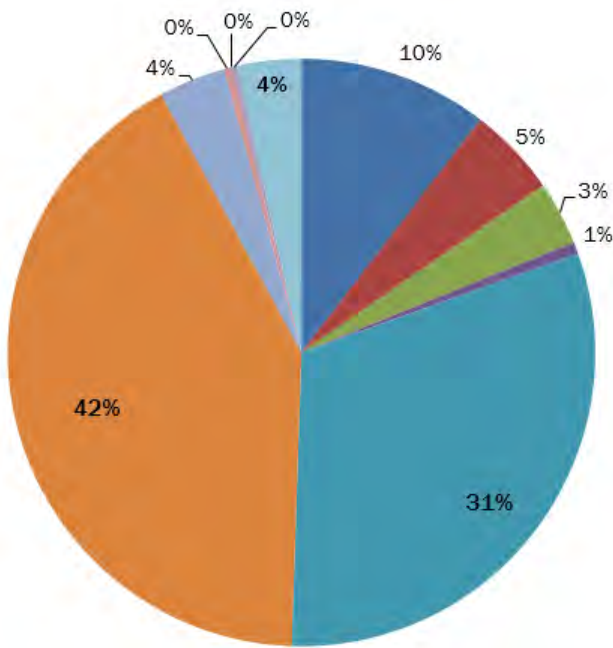
## A COMPREHENSIVE UPDATE OF RELEASES, USAGE AND LEVELS, IN AIR SEDIMENTS & FISH

### INTRODUCTION

Significant progress has been made in Michigan towards reducing all uses and environmental releases of mercury including water discharges, air emissions, biosolids and product use. However, the environmental media and bioindicator data do not necessarily demonstrate consistent temporal trend reductions. The mercury use and release trend data is presented along with temporal environmental trends.

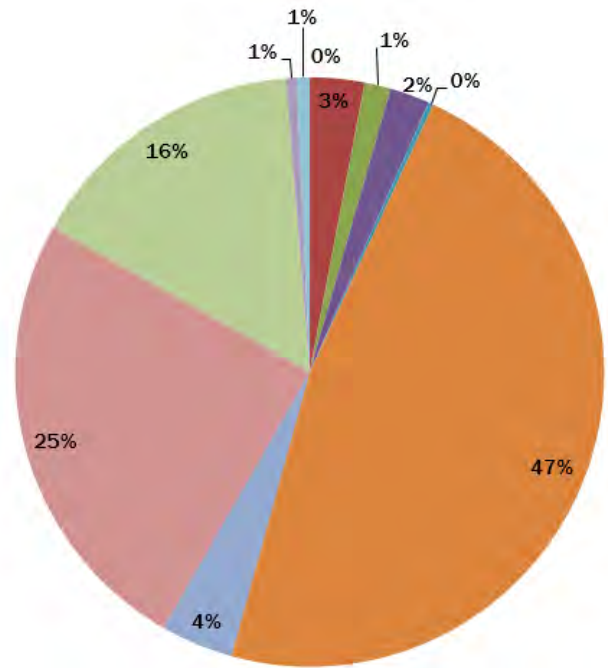
### MERCURY EMISSIONS

1994 MERCURY EMISSIONS BY SECTOR



- Hospital Medical Waste
- Cement Manufacturing
- Lamp Manufacturing/Breakage
- Dental Amalgam Preparation
- Municipal Waste
- Coal Combustion

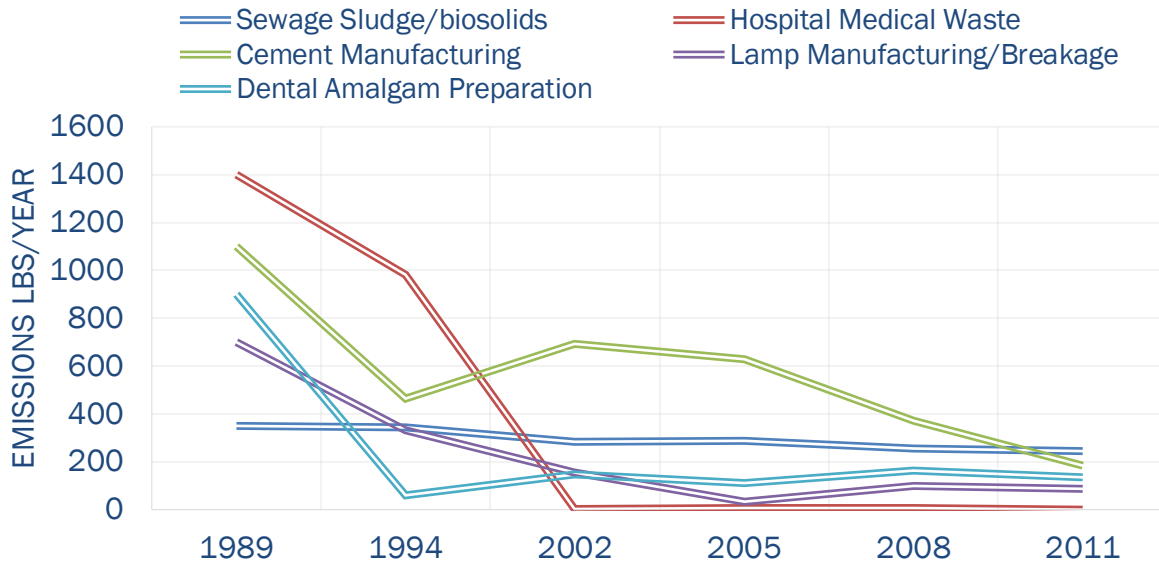
2011 MERCURY EMISSIONS BY SECTOR



- Sewage Sludge/Biosolids
- Other Area Sources\*
- Metals Production
- Other Industrial/Commercial Fuel Combustion
- Other

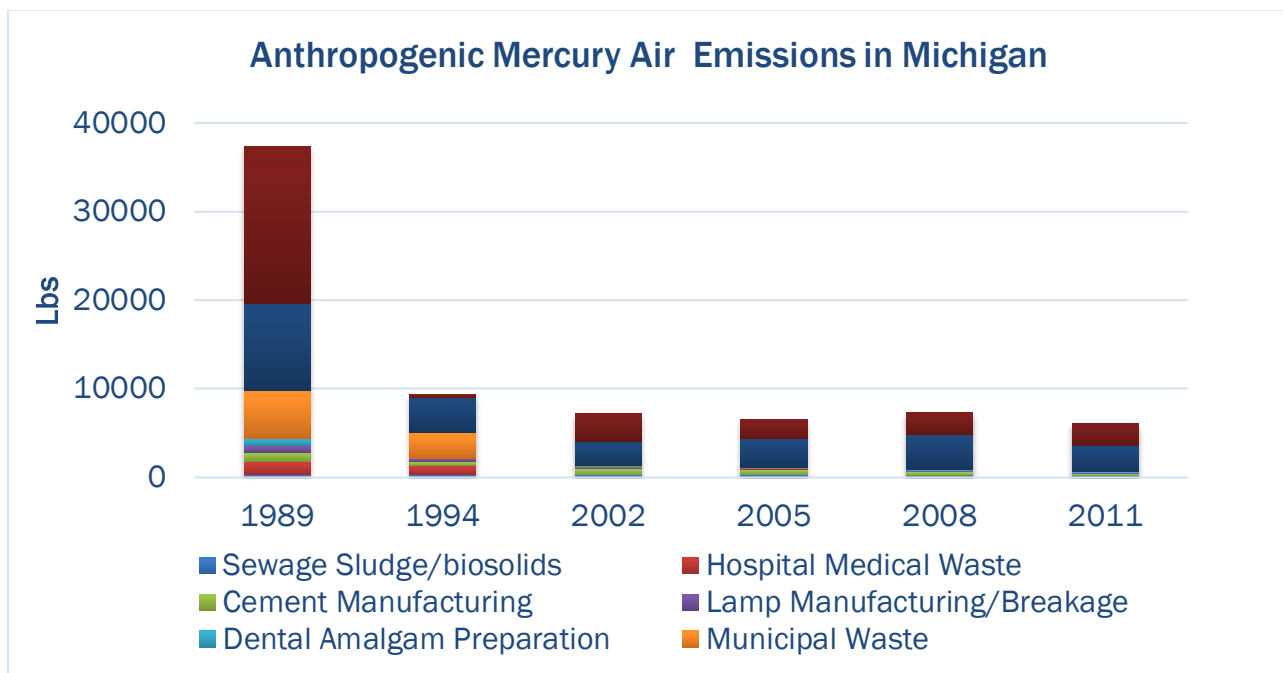
\*Other area sources include--cremation, disposal of products in burn barrels and volatilization during collection for recycling.

Enlarged to show Detail

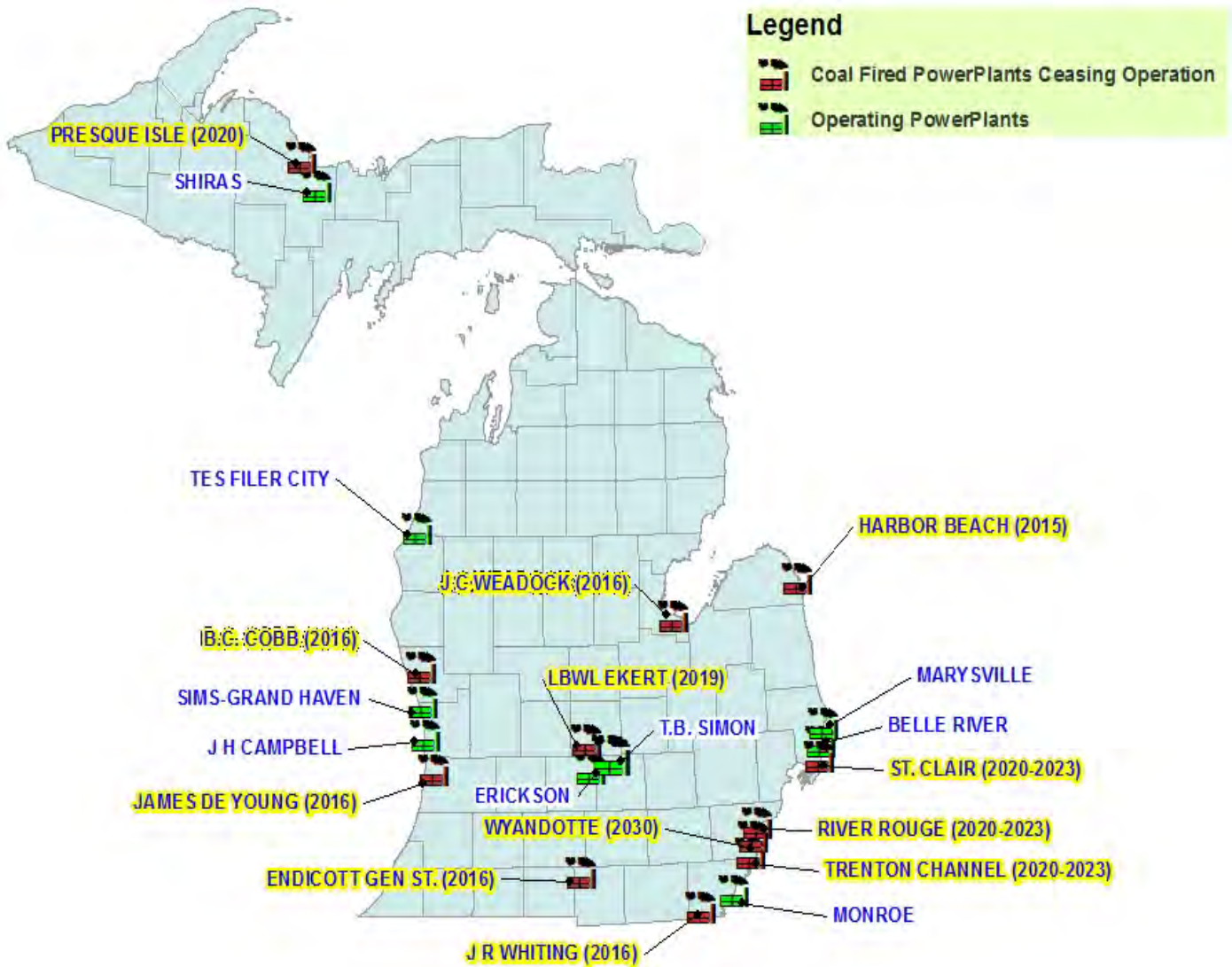


Since 1989, Michigan continues to experience reduction in mercury emissions from municipal waste incinerators and cement manufacturing. Hospital waste incinerators have been eliminated in the state.

- Emissions from dental amalgam usage and sewage sludge incinerators have also been reduced.
- Reduced emissions from fluorescent lamps are expected to continue with the transition to LED lights.
- 84% of the mercury emissions were reduced from 1989 to 2011
- Significant mercury emission reductions occurred from use in batteries and paints and municipal and medical waste incinerators.
- Coal fired power plant mercury emissions decreased by 550 lbs. from 2011 to 2017 (a 20% reduction).



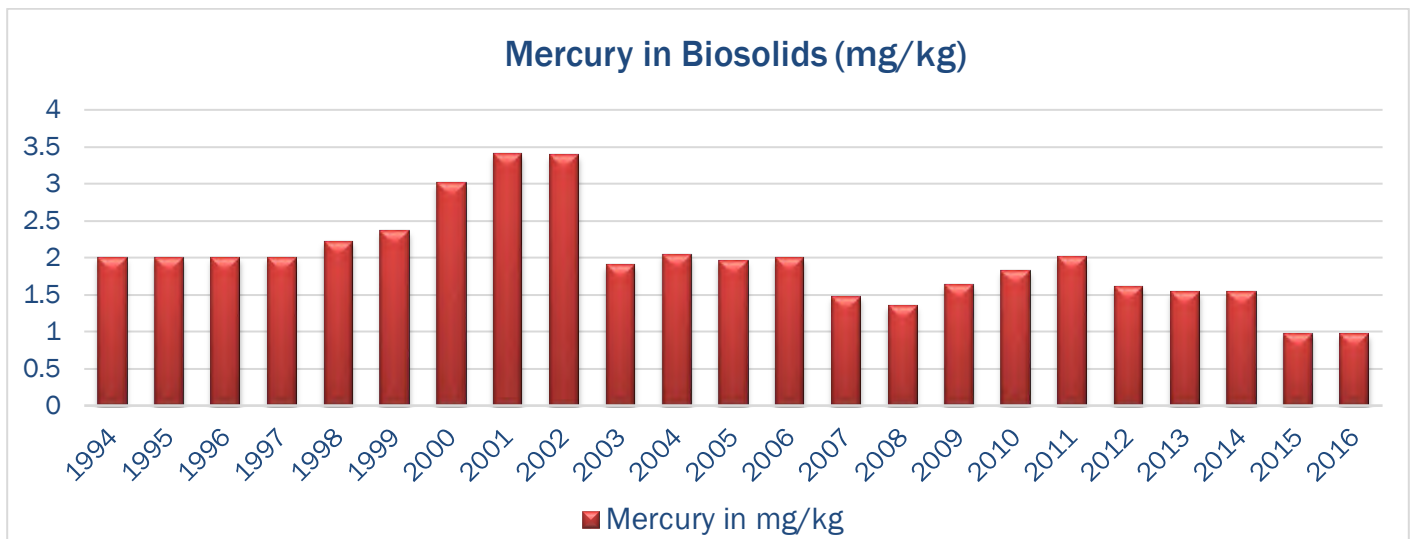
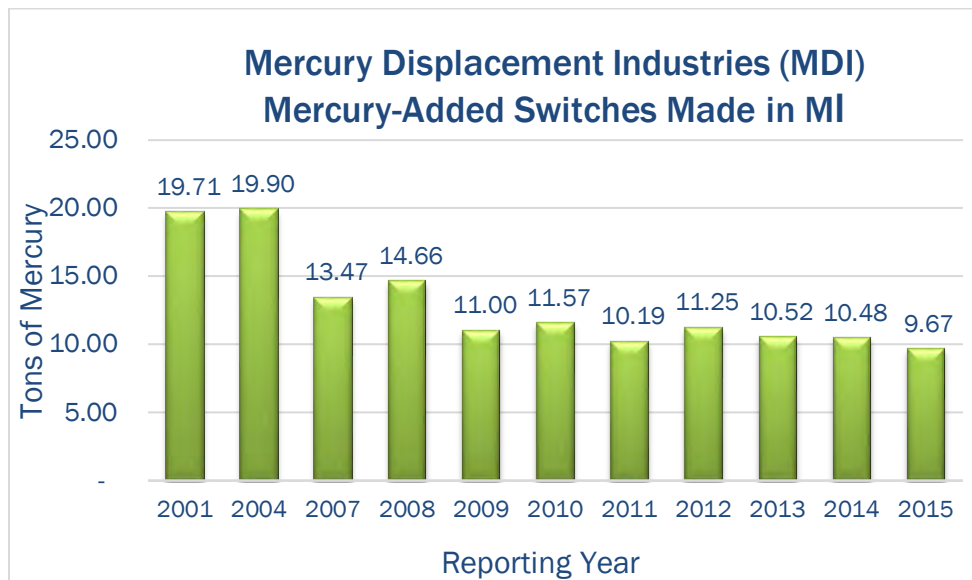
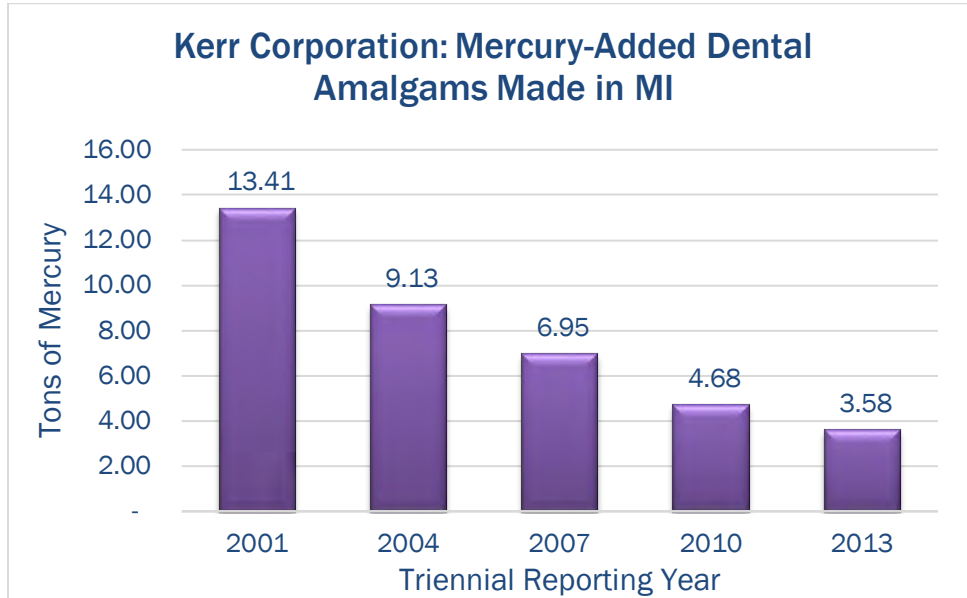
Coal Fired Power Plants in Michigan estimated to be Shut Down or Convert to Burning Natural Gas by 2023



Projected reductions in coal fired power plants Hg emissions from 2005 to 2023 is 67% by 2023.

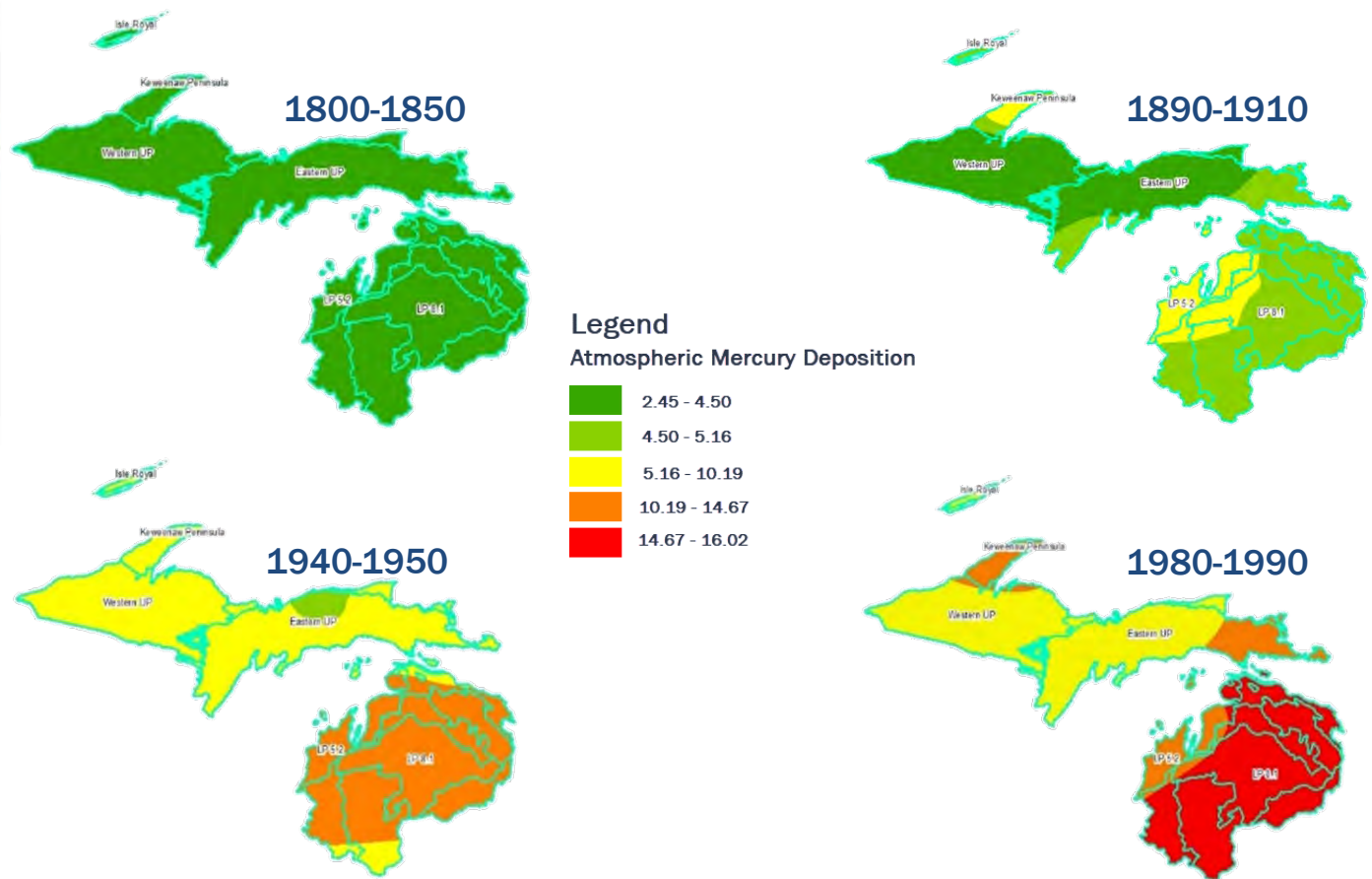
**MERCURY USE**

Michigan’s two largest manufacturers that still use Hg(0) are a dental amalgam manufacturer, Kerr Corporation, and MDI (Mercury Displacement Industries), a Hg-containing switch manufacturer. These manufacturers have made a 73% and 51% reduction in Hg use, respectively.



Hg content in biosolids continues to decline and can serve as an indicator of Hg use and Hg discharge to wastewater.

## ATMOSPHERIC MERCURY DEPOSITION IN MICHIGAN ECOREGIONS



## METHODOLOGY

- Modeled net atmospheric Hg deposition is based on Pb-210 dated sediment cores from lakes, averaged by the regions identified.
- The model used is from Swain et al. (1992): sedimentary mercury accumulation =  $3.7 + 0.83 \times (\text{watershed area}/\text{lake area})$
- Intercept 3.7 represents atmospheric Hg deposition to a lake with no watershed.
- Estimates of atmospheric Hg deposition were made by multiplying the Hg accumulation ratio by 3.7.
- No change in watershed retention of atmospherically deposited Hg was an assumption for this analysis.

## RESULTS

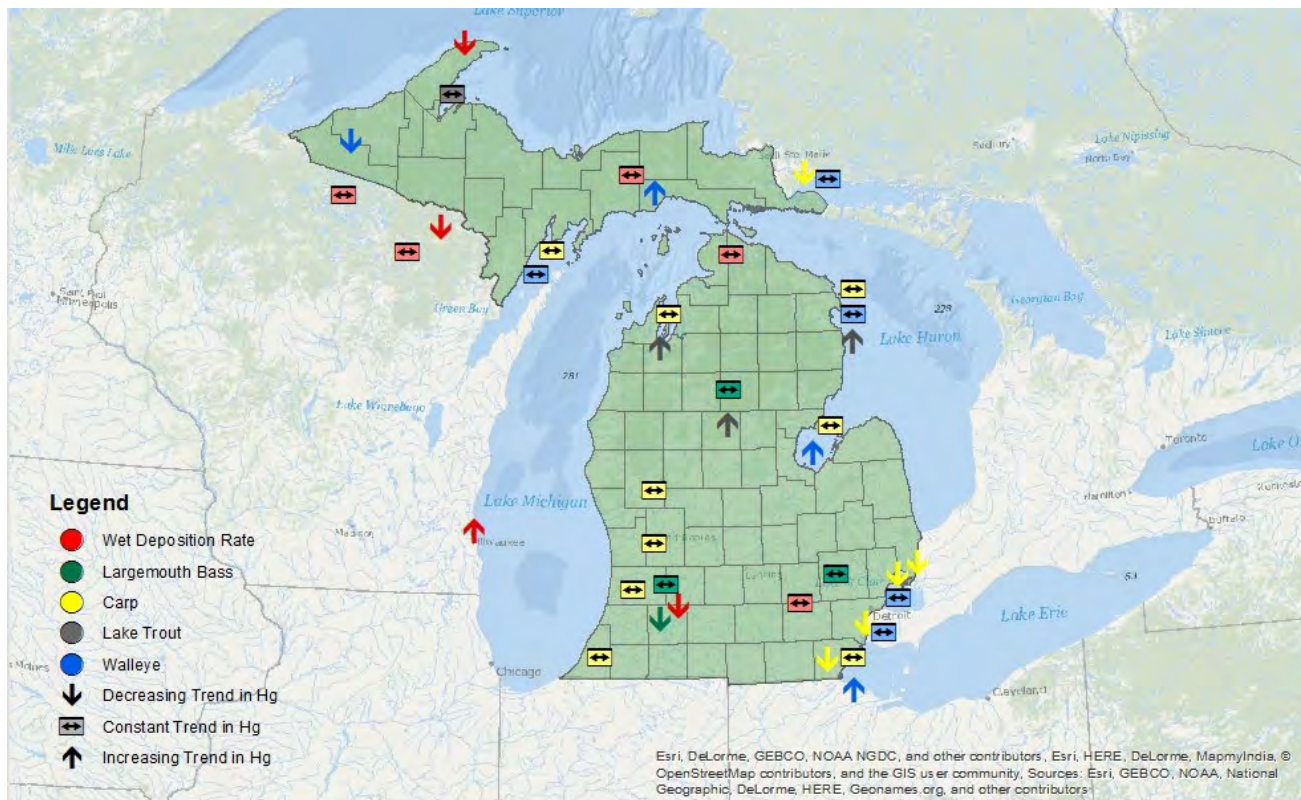
- The magnitude of change depends on location of subregion and the sources within.
- The Keweenaw Peninsula and Western Upper Peninsula experienced atmospheric mercury pollution earliest, likely associated with mining, and there is a legacy effect on the Keweenaw Peninsula to the present.
- The lower peninsula experienced the greatest magnitude of change, associated with industry and fossil fuel consumption.

## MERCURY TRENDS IN FISH TISSUE AND WET DEPOSITION

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) has been monitoring Hg levels in fish from 22 sites in the Great Lakes and inland waters since 1990.

- At least two species were sampled at most of the Great Lakes sites and a total of 31 temporal trend data sets were generated.
- Overall, no change in mercury concentration was detected in 58% of the fish populations sampled.
- 19% had an increasing trend and 23% had a decreasing trend.
- The Great Lakes top predators sampled (walleye and lake trout) showed either no change or an increasing trend in Hg concentration.
- Nearly half of the Great Lakes carp (bottom feeders) populations sampled had decreasing trends.
- Differences in mercury trend signals exhibited by Great Lakes carp and top predators may be due to a disparity in the effects of recent significant ecological disruptions in the Great Lakes on food base for the trophic levels represented.
- Wet deposition of mercury measured at 9 stations in the Great Lakes region has generally declined or remained relatively constant over the period of record.
- The temporal trend in fish tissue mercury is similar to that seen at the nearest deposition monitoring station in some cases.
- There is probably a significant time lag between changes in atmospheric deposition and measurable changes in mercury concentrations in aquatic biota.

### Temporal Trends in Mercury Wet Deposition and Fish Tissue Concentration in Michigan 1990-2015



## CONCLUSION

- Mercury use and emissions continue to decline and by 2023 significant emission reductions will occur due to 15 coal fired power plants shutting down or converting to natural gas.
- Mercury deposition increased 1.5-4X from uniform background (pre-industrial) flux to maximum during 1980-1990.
- The magnitude of change of modeled net atmospheric Hg deposition is related to proximity to local and regional point sources.
- Changes in mercury concentrations in fish are not necessarily reflective of changes in mercury deposition over the same time periods.

## AUTHORS

Joy Taylor Morgan and Dennis McGeen, EGLE Air Quality Division; Paul Drevnick, Alberta Environment & Parks; David Gay, National Atmospheric Deposition Program; Joe Bohr, EGLE Water Resources Division; and Farzana Hannan, EGLE Intern – Poster presented at the 2017 Global Conference on Mercury in Rhode Island.

Inquires: [TaylorJ1@Michigan.gov](mailto:TaylorJ1@Michigan.gov)



EGLE does not discriminate on the basis of race, sex, religion, age, national origin, color, marital status, disability, political beliefs, height, weight, genetic information, or sexual orientation in the administration of any of its programs or activities, and prohibits intimidation and retaliation, as required by applicable laws and regulations.

Persons with disabilities may request this material in an alternative format by contacting EGLE's ADA Accessibility Coordinator. Please visit [Michigan.gov/ADA](http://Michigan.gov/ADA) for a list of state Coordinators."