NEW TOOLS FOR MERCURY TMDL SUPPORT – BASIC PROJECT INFORMATION

September 2008

WHY EPA UNDERTOOK THIS PROJECT

In order to support development and implementation of TMDLs for mercury in areas impacted by atmospheric deposition, EPA's Office of Water in cooperation with State and Regional partners has completed deposition modeling which facilitates attribution among top sources in each State in a first-of-its-kind GIS environment.

BACKGROUND

+ *Impairment Problem*: Over 8700 waterbodies in 43 States plus the District of Columbia and Puerto Rico are listed as impaired under section 303(d) of the Clean Water Act due to excessive amounts of mercury in fish tissue or in the water column.

+ *Atmospheric Deposition*: Atmospheric deposition is believed to be the dominant avenue by which mercury loads are delivered to most watersheds, although some waters have significant inputs from sources such as historic mine tailings and/or enriched minerals.

+ *Water Program Information Needs*: In order to address these problems via the TMDL Program and related watershed planning activities, States, Tribes, and EPA Regions need fine-scale information which both quantifies the magnitude of atmospheric mercury loadings to waterbodies and allocates the relative contributions of those loadings among key emission sources.

WHAT THIS PROJECT PROVIDES

+ *Deposition Modeling Overview*: Several deposition models provided inputs to this analysis. The Regional Modeling System for Aerosols and Deposition (REMSAD) was the primary model relied upon in this analysis because it has already been used in EPA-approved, peer reviewed, TMDL settings, e.g. the December 2007 Northeastern States Mercury TMDL. The Community Multi-scale Air Quality Model (CMAQ) was also used to provide a "second opinion" of key REMSAD findings. In addition, three different global models were used in order to provide a range of likely impacts from foreign sources.

The domain of this modeling was the lower continental US and the spatial resolution was a network of 12km by 12km grid cells throughout the domain; prior EPA nationwide mercury deposition modeling had used 36km grid spacing. The baseline mercury emission inventory was the same one used by EPA in the 2005 Clean Air Mercury Rule (CAMR). Meteorological inputs were used for the 2001 calendar year.

+ *Tagging of Sources*: "Tagging" is a feature in REMSAD which allows one to track emissions from a given source or group of sources and determine that source's relative contribution to deposition at a given location. Approximately 300 sources across the US were "Tagged" in the model runs comprising this study. The determination of which sources to tag was made in consultation with EPA Regional Water and Air staffs in order to leverage ongoing and anticipated TMDL and related Water Program activities. In many cases, Regional staff further engaged their States and Tribes in order to seek their input on which sources to tag and to obtain updates to the emission inventory.

+ *Contractor Report*: A report from the modeling contractor, ICF International, entitled *Model-Based Analysis and Tracking of Airborne Mercury Emissions to Assist in Watershed Planning,* has been completed which details the modeling methodology, inputs, and performance. In addition, the contractor report contains a deposition map for each State and graphics which provide source attribution information for the single grid cell in each State where sources in that State contributed the most to in-state deposition. The contractor report does not contain statewide average source attribution information or deposition analysis for any watershed.

+ *GIS Tool*: In order to provide States, Tribes, and Regions with the ability to derive deposition analyses for specific watersheds or other areas of interest, a companion Geographic Information System (GIS) tool was developed by ESRI. Named the *AggreGATOR,* this tool, which will be available to ESRI licensees at no cost, allows a user to overlay the 12km gridded deposition modeling output onto any polygon, e.g., the counties that border a waterbody of interest, and obtain mercury deposition loading information for that polygon along with attribution graphics derived from the tagged sources. The *AggreGATOR* will be available in the fall of 2008.

+ *No Future Emission Projections*: The study does not project emissions into the future. As such, the findings cannot be used to judge the likely impact of anticipated controls on specific sectors.

+ *Information Quality Guidelines*: The contractor report which documents the modeling methodology was reviewed and confirmed to comply with the Information Quality Guidelines.

Commonly Asked Questions

Why is mercury a concern and how widespread is the problem in US waters?

Mercury reaches our waterways through both natural sources such as volcanoes and geologic deposits and anthropogenic sources. Anthropogenic sources include atmospheric emissions from facilities such as municipal waste combustors, coal-fired utilities, and the processing of some ores as well as land- and water-based sources such as mercury from historic gold mining operations and wastewater dischargers. Although mercury exists in various forms, and people are exposed to each in different ways, the most common way people in the US are exposed to mercury is by eating fish containing methylmercury. A discussion of the adverse effects of mercury on human health, especially for unborn children, as well as ecological impacts can be found at http://www.epa.gov/mercury/about.htm. While not all US waters have been assessed for mercury, based on information available in June of 2008, there are over 8,700 known waterbodies in the US listed as impaired for mercury. These occur in 43 States, plus the District of Columbia and Puerto Rico.

What is a TMDL and how does the deposition data available through this project help to develop a TMDL?

A TMDL is a calculation of the amount of pollutant a waterbody can receive (loading capacity) and still meet water quality standards. TMDLs should contain both a wasteload allocation, the portion of the loading capacity allocated to point sources such as wastewater treatment plants discharging to a waterbody, and a load allocation. A load allocation is the portion of the loading capacity allocated to non-point sources. The atmospheric deposition component is considered to be part of the load allocation. Thus, deposition data such as that developed in this project can be used to develop estimates of the atmospheric loadings component of the TMDL's load allocation.

It should be noted that a TMDL is not self-implementing. States use the information in TMDLs to identify and implement activities to address loads and allocations. These activities span multiple programs that reflect Federal controls where appropriate and typically include air, water, and waste media.

Aside from helping develop a TMDL, how else can the results of this modeling be used to achieve water quality standards?

In addition to aiding the development of mercury TMDLs, the findings of this project can be used to:

- **Focus and inform TMDL implementation plans by identifying areas where local and regional sources contribute significantly to deposition in targeted watersheds**
- **Promote opportunities for States and Tribes to work together to solve water quality problems by identifying areas affected by cross-border transport**
- **Help identify areas where additional water and fish tissue sampling may be needed**
- **Help States and EPA evaluate Category 5m qualifications ("5m" refers to an option available to States for listing their mercury impaired waters in circumstances where a comprehensive mercury reduction program is in place – see http://www.epa.gov/owow/tmdl/mercury5m/mercury5mfactsheet.html for more details)**

Does this modeling assess human health risks?

The modeling data available through this project addresses only atmospheric deposition. It does not assess the fate and transport of mercury once it is deposited onto a land or water surface and thus does not provide a direct estimate of human exposure to mercury via bioaccumulation in fish tissue. In addition to mercury loadings, the concentrations of mercury in fish are a function of numerous physical, chemical, and biological factors within each waterbody. Thus, areas shown as receiving relatively high amounts of atmospheric deposition are not necessarily co-located with high fish tissue concentrations of mercury. Such a comparison was beyond the scope of this study.

What does this modeling tell us about the contributions of US vs. global sources of atmospheric mercury deposition across the US?

The modeling identifies contributions from numerous sources to deposition across the US. When averaging over the entire US, it was found that global sources dominate deposition – accounting for approximately 82% of overall deposition. However, virtually every State had areas within them where local sources of mercury emissions were found to be significant contributors – sometimes exceeding 80%. Thus, the modeling suggests that while achieving significant mercury deposition reductions in all parts of the US will require other countries to also lower their emissions, there are nonetheless many US waterbodies that could achieve significant reductions in mercury loads by controls on local sources beyond the levels used in this modeling.