

Elements for Developing a National Mercury Reduction Strategy to Achieve Water Quality Standards

INTRODUCTION

The Quicksilver Caucus (QSC) was formed in May 2001 by state environmental associations to provide a forum for states to collaborate and coordinate their mercury issues via a multi-media approach. Mercury is a persistent, bio-accumulative toxic substance and is a significant public health threat and source of impairment to our nation's environment. Caucus members who share mercury-related technical and policy information include the Environmental Council of the States (ECOS), the Association of State and Territorial Solid Waste Management Officials (ASTSWMO), State and Territorial Air Pollution Program Administrators (STAPPA), the Association of Local Air Pollution Control Officials (ALAPCO), the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), the Association of State Drinking Water Administrators (ASDWA).

States are concerned about the impacts of mercury related atmospheric deposition on water quality. Legacy mercury from abandoned mines is also an issue of concern. State water programs have focused on the issue through monitoring, assessment, and source identification efforts. Several states have used this information to develop stringent water quality standards, impose mercury limits on wastewater discharge permits, and to require surface water dischargers use newer methodologies to detect low levels of mercury in their effluent. Additionally, 44 states have issued mercury-related fish consumption advisories for their lakes, rivers and streams to inform the public about the potential health risk. However, these efforts will not eradicate legacy sources and atmospheric deposition of mercury, which States have identified as a significant source of water impairment.¹

Under the Clean Water Act, States are required to develop and implement a Total Maximum Daily Load (TMDL) allocation for each impaired water body, including those with mercury-related fish advisories. This requirement poses an intricate policy issue because States lack jurisdictional authority to require air emission controls for mercury in other States and nations. Thus, many state environmental agency representatives believe traditional water body by water body TMDLs may not be appropriate vehicles to address atmospheric deposition of mercury, from both a technology and jurisdictional perspective. ECOS and ASIWPCA members discussed these concerns at their respective 2001 annual meetings, and passed resolutions calling for the formation of a Federal-State workgroup to identify and recommend more effective tools to address this issue. Caucus members have supported that venture through the TMDL Workgroup.

The workgroup identified approaches to address mercury-impaired water-bodies and will provide recommendations to United States Environmental Protection Agency (US EPA). The goal of the framework is to provide an approach to help States attain water quality standards for mercury. The draft document outlines elements for a national mercury strategy to achieve water quality standards. The final document will serve as the QSC Mercury TMDL Workgroup's recommendation to US EPA. The draft identifies a goal, provides objectives, and includes strategy components and principles as well as a proposal for developing atmospheric mercury TMDLs, as appropriate.

This document will constitute a recommendation from the states to US EPA on the need for a national strategy as a more effective approach than TMDLs to address the complicated issue of atmospheric

¹ The QSC also formed a Stewardship Workgroup whose efforts served as a companion to the TMDL Workgroup. The Stewardship Workgroup documents regarding best management practices, storage and mercury markets are available at <http://www.ecos.org>

deposition of anthropogenic mercury into our nation's waters. The QSC held a public listening session in Chicago, Illinois, on March 7, 2003, to hear comments on an earlier draft of this document. Another public meeting was held on June 17, 2003, in Chicago, Illinois, to discuss comments on a revised draft. Additionally, written comments were received and reviewed by the Caucus following both meetings. However, it is recognized and anticipated that this is only the beginning of opportunities for interested entities to provide comments on a national strategy. Should US EPA agree to move forward with developing a national strategy, there will be many opportunities for additional public review and comment. States will work with EPA and other interested parties to develop and implement the strategy.

BACKGROUND

- *Fish Advisories and Environmental Impacts* - Surface waters impaired by mercury are widespread across the nation, with advisories recommending limiting fish consumption now in place in 44 states.² The National Academy of Sciences and the Centers for Disease Control have determined that in sufficient concentrations, mercury may be a potent neurotoxin, and a significant public health concern, particularly for young children, and for individuals who depend on fish for a significant portion of their diet. These advisories may also negatively impact recreational opportunities and can adversely affect local economies. Mercury may have an impact on wildlife. Because methyl mercury bioaccumulates in the tissues of aquatic organisms, small amounts of mercury at the base of the food chain can become progressively concentrated in organisms at higher trophic levels. It is now clear that anthropogenic sources of mercury need to be reduced to the greatest extent practicable in order to help restore many of the currently impaired waters nationwide and achieve applicable water quality standards.

The US Food and Drug Administration (US FDA) and many State Public Health Departments warn families to be careful about the seafood they eat due to mercury contamination. The US FDA warns pregnant women, women of childbearing age who may become pregnant, nursing mothers, and young children to avoid eating shark, swordfish, king mackerel and tilefish, all of which contain elevated levels of mercury because fetuses and children are particularly at risk. The US FDA advises that these populations eat a variety of other fish such as smaller ocean fish and farm-raised fish instead. Several State Public Health Departments also recommend that these groups limit their consumption of canned tuna to no more than 1-2 meals per week.

- *Sources of Mercury* - Often the primary contributors of mercury to surface waters are air sources of local, regional, national, and global-scale. These include natural as well as anthropogenic sources. Analyses of sediment and ice cores demonstrate mercury in the environment as a result of human activity. Legacy mercury (i.e. mercury that was previously released from man-made activities) is also a contributor to present day mercury loadings in the environment. In many cases, there are mercury sources that states have the authority to address. However, controlling interstate and global sources of mercury is largely beyond the ability of individual states. Further, programs other than those under the Clean Water Act must be engaged to address air emissions. Domestic and international controls on mercury releases from various environmental media will be necessary to ultimately reduce mercury loadings to surface waters.

² The presence of a fish advisory on a water body does not necessarily mean it is an impaired 303 (d) listed water (US EPA Fish and Shellfish Consumption Advisory Memorandum, October 24, 2000).

- Federal Actions - The potential impact of any pending federal actions, legislation and program changes needs to be considered. Several bills, including the President's Clear Skies Initiative, have been introduced in Congress that propose reducing mercury emissions as well as other pollutants from electric utility steam generating units (EGUs) over various timeframes. At the same time, US EPA is under a settlement agreement to promulgate a utility MACT (maximum achievable control technology) standard by December 2004 that would also reduce mercury emissions from EGUs.
- TMDLs – Under the Clean Water Act, impaired waters must be individually listed and Total Maximum Daily Loads, or TMDLs, developed. TMDLs identify the amount of loadings of a particular pollutant that can be present in a specific waterbody without exceeding the applicable water quality standard and include a maximum allocation to each source of pollutants. If the allocations in a TMDL are achieved, the water body should attain the applicable water quality standards.

If the loading of mercury to a water body is mainly the result of atmospheric deposition, then fish tissue concentrations should decrease only when the atmospheric loading of mercury is decreased. However, atmospheric loading of mercury to surface waters is often caused by long-range transport of mercury on a regional, national, and global scale. In these cases, mercury reductions from only in-state sources would not be sufficient to achieve water quality standards. Therefore, even if a statewide TMDL would be developed, there are circumstances where a state would have no authority to fully implement the TMDL and control mercury sources outside its jurisdiction.

The current TMDL rule has provisions for using an alternative management plan approach as a substitute for TMDL development. These provisions may become more explicit if US EPA promulgates the Watershed Rule currently under development. The key to an alternative management plan approach is that it must demonstrate water quality standards will be attained within a reasonable time through the use of appropriate control measures. So, in order to implement this alternative TMDL approach, there must be a basis for determining if water quality standards will be attained for mercury. A goal of significant reduction of anthropogenic sources of mercury within a reasonable timeframe in order to reduce current loadings of mercury to attain water quality standards is critical to implementing an alternative approach to TMDL development for mercury-impaired waterbodies.

- The consequence of not having a national strategy for the reduction of mercury pollution is the continued risk of not achieving water quality standards as well as the potential vulnerability of States and US EPA for failing to establish TMDLs.
- A comprehensive national strategy is needed to provide the foundation for an implementation plan to achieve the reductions in mercury loading to surface waters to attain water quality standards, protect fish and wildlife populations, and eliminate or reduce fish consumption advisories. The strategy could also constitute an alternative to State's adoption of TMDLs for each of the thousands of individual waterbodies currently impaired by mercury. The following represents the elements of such a plan.

ELEMENTS OF A MERCURY REDUCTION STRATEGY:

GOAL: Significant reduction of anthropogenic sources of mercury within a reasonable timeframe in order to reduce current levels of mercury to attain the goals established in the federal Clean Water Act and state Water Quality Standards.

OBJECTIVES

For Air Programs

- Develop and implement the existing and future air programs necessary, which include existing and future maximum achievable control technologies (MACT) standards or any other approach that would reduce air sources of mercury, to achieve significant reduction of mercury emissions to the air in order to achieve Water Quality Standards.
- Conduct residual risk analyses to address all source categories of atmospheric mercury deposition contributing to exceedances of Water Quality Standards.

For Water Programs

- Where water sources contribute to the mercury impairment, States and US EPA may develop TMDLs and control sources to meet water quality standards consistent with TMDLs. The non-point source control program may have a useful role in addressing air deposition to land to minimize impacts to water bodies.
- Even where control of air or other non-water source is necessary to achieve water quality standards, states should consider requiring point source wastewater treatment plant discharges with a reasonable potential to discharge mercury to develop and, where feasible, implement cost-effective Pollution Minimization Plans (PMPs).
- Address legacy sources (e.g., abandoned mines and contaminated sediments) using economically feasible approaches (e.g., Superfund, RCRA corrective actions), where discharge is greater than water quality standards.

For Waste Programs³

- Limit or prevent mercury in products where alternatives exist.
- Promote the development of alternatives for remaining essential uses.
- Limit or prevent mercury waste from being released into the environment (e.g., efficient waste collection, household hazardous waste programs).
- Promote and assist state or local governments in implementing mercury reduction programs such as source identification and reduction programs, pollution prevention programs and mercury waste management and collection programs.

For International Programs

³The QSC Stewardship team has developed four documents, which address, in greater detail, these goals. A copy of those documents, which include *Best Management Practices*, *Options for Storage of Mercury*, *Assessment of Mercury Market Policy Options* and a *Review of Mercury Commodity Markets*, can be found on the ECOS web page. A copy of the QSC letter to the Defense Logistics Agency regarding the disposition of the Department of Defense's mercury stockpile is also available on the ECOS web page.

- Advocate similar reductions of international sources through multi-nation and international programs and processes

INTERIM GOALS: In consultation with States, and other interested entities, US EPA should:

- Set common baselines for mercury emissions and loadings.
- Set stretch interim goals for reducing mercury loadings within the United States by 2010 and 2020 in the form of multimedia mercury releases and specific program goals

JOINT FEDERAL AND STATE ACTION

- ***Federal:*** Adopt and implement programs to achieve the national goal of significant reduction of anthropogenic sources of mercury within a reasonable timeframe in order to reduce current levels of mercury to attain the goals established in the federal CWA and state Water Quality Standards. (See Figure 1 at end of document.)
- ***Regions and States:*** Adopt and implement programs to support the national strategy consistent with the conceptual approach for the significant reduction of sources of mercury within a reasonable timeframe in order to reduce current levels of mercury to attain the goals established in the federal CWA and state Water Quality Standards. (See Figure 2 at end of document.).

STRATEGY COMPONENTS AND PRINCIPLES

- **Appropriate Water Quality Standards** - Water quality standards are meant to be protective of public health and wildlife. However in some cases current-water quality standards are not sufficient to protect against the consumption of fish (i.e. many states still have water column-based standards in place for mercury, which do not take into account the bioaccumulation of mercury in fish). States should be encouraged to consider water quality standards (e.g., the 2001 methyl mercury national guidance criterion) that are explicitly based on fish-tissue concentrations of mercury that are protective of human health.
- **Quantify Progress** – Measures are needed to quantify progress towards achieving mercury reductions at the state, national, and international levels and provide assurances that implementation of actions to reduce mercury sources are aggressively pursued and effective in outcome.
- **Regulatory And Non-Regulatory Approaches** - To achieve reductions, innovative approaches should be considered that offer promise in expediting progress towards achieving the significant reduction within a reasonable timeframe goal.
- **Multi-media** – Mercury reductions should include sources from air, water, solid waste, sediments (legacy loads), as well as mercury in products. With a substantial amount of mercury loadings from atmospheric sources, a key component of the strategy must be the reduction in loadings from air sources, considering the relative toxicity of the various forms of mercury.

- **Multi-scale** - Actions at the international, national, regional, state and local levels are needed to reduce mercury.
- **TMDLs** - In many cases, states could rely on the adoption of a national mercury strategy to eliminate the need for development of a TMDL for waterbodies affected by long-range transport of mercury. Where small, localized sources of impairment are significant, a state may choose to adopt the national strategy or modify it to meet their needs or use the traditional TMDL process. A state that adopts the national strategy would commit to its' implementation including establishing control requirements for sources within its borders to achieve the goal of the strategy. In some cases a state may choose a combination of strategies to achieve water quality standards for its mercury-impaired waters. But, states do not have to wait for a national strategy to be implemented before addressing local and in-state sources. A discussion of the unique issues facing development of TMDLs for mercury impairments is included as Attachment A.
- **Assessment** – Tools such as Mercury Maps, Mercury Deposition Monitoring Network, US EPA Region 1 GIS-based mercury model, atmospheric models, and existing fish tissue monitoring programs should be considered in analyses to help gauge the effectiveness of existing and potential mercury controls and determine what effect various additional efforts will have on attaining the goals. Clean sampling techniques and clean lab facilities are important to accurately measure mercury and States should be given resources to support this effort. However, implementation of the national strategy to significantly reduce mercury sources within a reasonable timeframe in order to reduce current levels of mercury to meet federal CWA goals and State water quality standards should not be delayed pending finalization of these analyses.
- **National Data Gathering** – US EPA, United State Fish and Wildlife Service (US FWS), and other federal agencies should work with States and private partners to set up coordinated regional monitoring and data collection networks. Data gathering consists of three principal components:

Source Monitoring - A national inventory of mercury sources and annual loadings from these sources for purposes of quantifying progress in eliminating source loadings (e.g., landfills, mercury recyclers, coal-fired boilers, incinerators, etc.).

Air Deposition - A national network of air deposition monitoring sites to quantify progress in reducing the deposition of mercury from air sources. This data could be used in combination with the existing surface water quality monitoring system to evaluate progress in reducing environmental loading of mercury to individual watersheds. The Mercury Deposition Network (MDN) that is part of the National Air Deposition Program (NADP) has a 54-site network in the U.S. and Canada that measures mercury in wet deposition. US EPA should consider whether this network is as extensive as necessary to implement this strategy. Better dry estimates are also needed.

Fish Tissue - A standard protocol for collection and analysis of fish tissue samples should be used to develop a national database of fish tissue contamination. This data could be used to quantify progress in reducing fish mercury levels and comparing levels across the country, based on state-specific historical information or attainment of promulgated fish tissue-based water quality criteria.

- **Research** to support mercury source reduction efforts:

Transport - Improve our understanding of mercury chemistry and its fate and transport in the environment, including interactions between atmospheric mercury and oxidants.

Methylation – Investigate aquatic processes and atmospheric deposition chemistry affecting mercury methylation and accumulation in fish.

Inventory - Identify and quantify global, regional and local sources of mercury including "natural," legacy and international. Improve information and data on mercury speciation from various source categories.

Technology - Develop cost-effective treatment control and reduction technologies.

- **Adaptive / Iterative Approach** - Take into account current technology and affordability, as well as current air, land, and water statutes and regulations. For example, recognize what is achievable under current technology, but at the same time identify long-term research needs to improve technology. Include provisions for review, revision, and re-adoption of appropriate intervals (e.g. five years). This process would ensure that the strategy is revised as new information becomes available and the rate of progress is maximized.
- **Resources / Funding** - Provide resources sufficient to implement and achieve the goals of the strategy.

Attachment A

Strawperson Proposal: **Developing TMDLs for Atmospheric Deposition Mercury Impaired Waters**

The purpose of this proposal is to identify and briefly discuss changes to the current federal TMDL program – both guidance and regulations– that would alleviate implementation problems and concerns associated with developing a TMDL for waters impaired by atmospheric deposition of mercury. In some cases, a TMDL may be appropriate to address a mercury impaired water body. This proposal was developed for those instances and presumes that the TMDL may be different than conventional TMDLs. Simple but well-grounded TMDLs for atmospheric mercury should be encouraged.

A parallel task of the QSC TMDL Workgroup is to develop a companion proposal on one or more alternatives to developing and implementing TMDLs for waters impaired by atmospheric mercury. The preceding “Elements for Developing a National Mercury Reduction Strategy to Achieve Water Quality Standards” constitutes the QSC’s proposed alternative strategy.

1. Waters with impairments caused by atmospheric deposition of mercury should be placed in a separate category of the 303(d) list or 305(b) report.

The expectation of US EPA and the general public with regard to the timeframe for attaining water quality standards should not be the same for these waters.

A separate category provides a better opportunity to explain the importance of the mercury issue and the different nature of the approach to address the water quality concerns. A separate category potentially allows special provisions to be identified that apply only to these waters (e.g. special definition of reasonable assurance). (The option of using the proposed section 4.b. of the integrated list is not available when TMDLs are developed.)

Proposals to assign a low priority to TMDL development for these waters and place them at the end of a 13-year TMDL development schedule may send the wrong message to the general public and belies the importance of the concern. For many states, the structure of the 303(d) list may result in these waters being scattered throughout the list. An independent listing category should make it clear that the problem is environmentally significant, but that a TMDL as required for other waters may not be the right tool for addressing the problem at this time. As part of their lists, States can explain that other approaches to addressing the problem are being evaluated.

Rates of TMDL development over a specified number of years (e.g., 13 years) should not be based on waters with impairment caused by atmospheric deposition. Under current US EPA policies, states should make progress on completing TMDLs in proportional manner (i.e. X% per year). If a state has many waters on the 303(d) list due to atmospheric sources, it is difficult to make proportional progress year-by-year.

2. The present “reasonable assurance” test for nonpoint source implementation must be redefined and supported by US EPA as States strive to carry out those TMDLs because the current regulatory framework does not provide an appropriate reasonable assurance test for air sources. The current “reasonable assurance” test is not suitable for air sources.

US EPA currently provides three scenarios governing reasonable assurance:

a. For Point Sources Only

Under US EPA's guidelines issued in May 2002, reasonable assurance is described, as when a TMDL is developed for waters impaired by point sources only, the issuance of a National Pollutant Discharge Elimination System (NPDES) permit(s) provides the reasonable assurance that the wasteload allocations (WLA) contained in the TMDL will be achieved. This is because 40 C.F.R. 122.44(d)(1)(vii)(B) requires that effluent limits in permits be consistent with "the assumptions and requirements of any available wasteload allocation" in an approved TMDL.

b. For Both Point and Non-Point Sources

When a TMDL is developed for waters impaired by both point and nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur, US EPA's 1991 TMDL Guidance states that the TMDL should provide reasonable assurances that nonpoint source control measures will achieve expected load reductions in order for the TMDL to be approvable. This information is necessary for US EPA to determine that the TMDL, including the load and wasteload allocations, has been established at a level necessary to implement water quality standards.

c. For Nonpoint Sources

US EPA's August 1997 TMDL Guidance also directs Regions to work with States to achieve TMDL load allocations in waters impaired only by nonpoint sources. However, US EPA cannot disapprove a TMDL for nonpoint source-only impaired waters, which do not have a demonstration of reasonable assurance that load allocations will be achieved, because such a showing is not required by current regulations.

With air deposition of mercury potentially being a result of air emissions from other states or nations, it is very difficult to meet the present "reasonable assurance" test. It is also unknown if implementation of mercury reductions in air emissions within the United States alone can meet the present reasonable assurance test.

The current reasonable assurance test doesn't take into account the global reservoir of atmospheric mercury, relative toxicity and transformation of mercury into soluble forms with oxidation.

An alternative is to apply the test to only those sources that the state can control in a manner consistent with a national approach.

Another alternative is that a national mercury strategy could serve as the means to meet the "reasonable assurance" test.

3. Regional TMDLs or screening level TMDLs should be encouraged. US EPA may have a lead role in this process and should emphasize simple approaches.

The expectation of a single TMDL being developed for each impaired-water is unreasonable and not cost effective. States lack the staff resources to develop even "look alike" TMDLs for each lake or stream.

The level of technical rigor also needs to be considered. The pilot projects in Wisconsin and Florida point out the knowledge and data gaps that make mercury TMDL development difficult at the present time. Modeling of mercury sources, transport and deposition is not well refined at this time.

A screening level of assessment could be similar to the approach used in the Mercury Maps project. (US EPA points out that any screening level TMDL or regional TMDL would still need to meet the statutory and regulatory requirements for a TMDL.)

Another option is to create provisions allowing for State(s) to ask US EPA Region(s) to take the lead for developing the TMDL where the majority of the sources of the deposition loadings are outside the State(s) boundaries. US EPA could assist with modeling and technical analyses to determine the loadings from within a state or region, as compared to outside (e.g., globally). States and US EPA need to conduct an analysis of the sources of mercury (e.g., locally, statewide, or regionally) and the load reductions needed to achieve water quality standards. Such an analysis would provide the basis for determining the appropriate state and federal management actions.

4. Reasonable interim goals need to be developed and strategies developed to meet those goals

For most waters impaired by atmospheric deposition of mercury, it is possible that the majority of the mercury deposition is from sources beyond a State's borders. Reliable estimates of what percent of atmospheric deposition to waters in a State from sources within that same State are not yet available. Based on early modeling exercises used in the 1995 Report to Congress, US EPA estimated that 97% of the air emissions of mercury occur outside of the United States (U.S.). In that same report, US EPA includes the results of one model analysis that estimated that 60% of the atmospheric deposition of mercury in the U.S. is from domestic sources. The other 40% includes re-emission of mercury from U.S. sources as well as natural sources and sources that were emitted in other countries. In the northeast, deposition from current U.S. sources makes up a higher percentage (around 75%) of deposition. Locally, mercury emissions from nearby sources can be much more significant than the national total reflects, as well.

Given the potential reduction level of atmospheric deposition of mercury needed to achieve water quality standards in many locations, reduction of air emissions in the U.S. alone may not allow attainment of water quality standards in the short-term. Attainment is more likely in terms of many decades.

With a relatively long time period for anticipated changes to be realized in impaired waters, full elimination of fish consumption advisories does not serve as a good measure for gauging progress or for development of an action plan for actions over the next 10 to 15 years.

Interim milestones relating to the development and implementation of mercury minimization controls and strategies, or attainment of mercury emission reduction targets, could be used. Air monitoring, especially through a coordinated regional or national network, could be an important measure of progress, as well as water monitoring and coordinated efforts to fill gaps. Presently, coverage is inadequate with large areas of the country having little or none.

Other measures could include implementation of pollution prevention efforts, such as reduction in use of mercury (e.g. thermometers); elimination of mercury in automobile switches, etc.

A national, long-term water monitoring effort, involving United States Geological Service (USGS) could also be considered. US EPA, USGS, United States Department of Agriculture (USDA) and other partners in the National Atmospheric Deposition Program could also discuss how to best address gaps in the national mercury deposition network. As national and

international efforts are considered, it is important that momentum continues and is supported at the State level.

Strategy to Achieve Water Quality

Goal Significant reduction of anthropogenic sources of mercury, within a reasonable timeframe, in order to reduce current levels of mercury to attain CWA goals and state Water Quality Standards

EPA will

- Adopt national reduction goal
- Promulgate air standards to achieve goals
- Promulgate watershed rule that enables strategy
- Assist states in developing consistent and protective water quality standards
- Identify storage and retirement options
- Seek international/global mercury reductions
- Develop assessment tools
- Develop national inventory of mercury
- Use adaptive management to achieve goal
- Increase sediment and mine remediation activities

Figure 2. Regional and State Responsibilities



