

## **STAFF REPORT**

### **Delta Mercury Control Program Status Report**

#### **Introduction**

Staff has been developing a mercury control program for the Sacramento-San Joaquin River Delta Estuary (Delta) through the total maximum daily load (TMDL) program. The control program addresses Federal requirements for a TMDL and state requirements to amend the Water Quality Control Plan (Basin Plan) to implement a program to reduce mercury pollution in Delta fish. This status report reviews the problem of mercury in the Delta, provides a summary of the proposed Basin Plan amendment to control mercury, and provides a timeline summary of TMDL development activities. Attached to this status report are the most recent version of the proposed Basin Plan amendment as well as three attachments that describe TMDL development, the Basin Planning process, and an overview of mercury chemistry.

The Delta TMDL is one of a series of TMDLs to address mercury in the Central Valley Region. Mercury contamination in the Central Valley is widespread. Due to significant differences in sources, local hydrology, wildlife and human exposure, and varying degrees of available information, staff decided to complete a series of several interrelated TMDLs. The Central Valley Water Board adopted the Clear Lake TMDL in 2002 and the Cache Creek TMDL in 2005. After the Delta TMDL is completed, staff will begin development of mercury TMDLs to address the major mercury sources in the largest tributaries to the Delta.

#### **Background**

The Federal Clean Water Act (CWA) requires states to identify water bodies that do not meet their designated beneficial uses and to develop programs to eliminate impairments. The control program typically consists of conducting a TMDL analysis and amending the Basin Plan to implement a load reduction program for all the sources. A TMDL is the total maximum daily load of a pollutant that a water body can assimilate and still attain beneficial uses, such as the protection of humans and wildlife consuming locally caught fish. The Central Valley Regional Water Quality Control Board determined in 1990 that the Delta was impaired because fish had elevated levels of mercury that posed a risk for human and wildlife consumers. In 1998, the State Water Board identified the Delta mercury impairment as a high priority water quality issue.

There is a human health advisory warning against the consumption of mercury-contaminated striped bass from the Delta. In addition, monitoring indicates that several more species, including largemouth bass and white catfish (two commonly-caught local sport fish) have elevated concentrations of mercury in their tissue. Over 95% of the

mercury in large fish is methylmercury. Bacteria in mercury-enriched sediment methylate the mercury and form methylmercury. The methylmercury fluxes into the overlying water where it is adsorbed by phytoplankton, where it subsequently increases in concentration in aquatic life through successive levels of the food web. Large fish have methylmercury concentrations that can be five to six million times higher than that of the water in which they live.

Methylmercury is a potent neurotoxicant. Methylmercury exposure causes multiple effects in humans, including tingling or loss of tactile sensation, loss of muscle control, blindness, paralysis, and in very high concentrations, birth defects, and death. Wildlife species may also experience neurological, reproductive or other detrimental effects from mercury exposure. Humans and wildlife are exposed to methylmercury through consumption of contaminated fish.

There is a need to focus on both mercury and methylmercury reduction. The mercury control program seeks to address reducing both sources of mercury and methylmercury to eventually reduce fish tissue contamination. Most of the mercury that has contaminated the landscape came from mercury mining and gold mining activities that began in the 1850s. This widespread mercury contamination is now contributing to the generation of methylmercury. Based on available information, a 2006 Delta TMDL report describes a statistically significant relationship between methylmercury concentrations in water and methylmercury concentrations in fish tissue. It is expected that by reducing methylmercury in water, fish tissue methylmercury concentrations will be reduced. In general, methylmercury concentrations in sediment and water are related to inorganic mercury concentrations in sediment; however, certain environments, such as some seasonal wetlands, are highly efficient at producing methylmercury.

Sources of methylmercury to the Delta include discharges from wetlands and irrigated agriculture, municipal wastewater treatment plants, municipal storm water runoff, water management activities, and watersheds tributary to the Delta. Sources of mercury include municipal wastewater treatment plants, municipal storm water runoff, and watersheds that contain mercury and gold mines. The proposed mercury control program addresses these sources in the Delta. Most of the total mercury load to the Delta comes from the tributary watersheds that will be the subject of future TMDLs.

### **Summary of Proposed Basin Plan Amendment**

The goal of the proposed Basin Plan amendment is to lower fish mercury levels in the Delta so that the beneficial uses of fishing and wildlife habitat are attained, and humans and wildlife can safely consume Delta fish without harm from mercury. Methylmercury concentrations in water are the single most important factor in determining fish tissue concentrations. Therefore, the proposed amendment focuses on the reduction of methylmercury concentrations in Delta waters. There are two ways to do this:

- (1) reduce the amount of total mercury available to be converted to methylmercury and
- (2) control activities that enhance the production of methylmercury.

The proposed amendment focuses total mercury reduction efforts on the Cache Creek Settling Basin, which discharges approximately one-half of the total mercury entering the Delta. The proposed amendment also defines minimum total mercury watershed reductions for tributaries that discharge the most mercury-contaminated sediment (Feather River, American River and Putah Creek); these tributaries will be the subject of future TMDLs. Even with aggressive cleanup of mine sites and control of other total mercury sources, it may take several centuries to lower total mercury concentrations to a point where safe fish mercury levels are achieved because so much total mercury is already deposited in stream beds and banks. As a result, in addition to reducing watershed sources of total mercury, staff is recommending a methylmercury reduction strategy that focuses on interrupting the methylation cycle by first identifying sources of methylmercury, then developing a combination of (a) on-site methylmercury management practices and (b) control actions for the specific, upstream inorganic mercury sources that supply the methylation sites. This strategy is expected to shorten the time to see fish tissue improvements from centuries to decades.

Proposed Basin Plan Amendment. The proposed Basin Plan amendment (attached) includes:

- Addition of the commercial and sport fishing (COMM) beneficial use for the Delta. The current beneficial uses do not clearly require protection of humans consuming Delta fish.
- Numeric fish tissue objectives for methylmercury in Delta fish. Staff based the fish tissue objective upon assumptions of fish consumption by humans and wildlife. How much human and wildlife protection to require is a significant policy decision.
- A water column methylmercury goal that will guide methylmercury source reductions to achieve fish tissue objectives.
- An implementation strategy to (a) reduce methylmercury and total mercury loading to the Delta to enable compliance with the proposed fish tissue objectives for the Delta and the total mercury allocation assigned to the Delta by the San Francisco Water Board mercury TMDL program and (b) reduce methylmercury exposure to the fish eating public.
- Methylmercury allocations for NPDES facilities and municipal separate storm sewer systems (MS4s), irrigated lands (including wetlands), and water management (e.g., flood control and salinity management) in the Delta and Yolo Bypass.
- Interim requirements for dischargers to minimize new mercury and methylmercury discharges.
- Requirements for dischargers to conduct methylmercury characterization and control studies, with time schedules for submission of reports.
- Requirements for dredging projects to monitor total mercury and methylmercury to ensure that dredging practices and re-use of dredge material do not increase mercury or methylmercury inputs to the Delta.

- Requirements for the Cache Creek Settling Basin to reduce its total mercury and methylmercury loading to the Yolo Bypass. Approximately one-half of the total mercury entering the Delta passes through the Settling Basin.
- Recommendations for an independent technical advisory committee to review study plans, interim and final study results, and guidance on the implementation of management practices.
- Criteria for pilot mercury offset projects for dischargers who want to evaluate removing mercury from elsewhere in the watershed instead of on-site reductions. The criteria address both total mercury and methylmercury.
- A monitoring section that provides details on monitoring frequency, compliance points, and methods of determining compliance.

Implementation. The proposed implementation strategy is divided into Phase 1 (2008-2015) and Phase 2 (2016-2030). The proposed Basin Plan amendment does not require existing dischargers to implement methylmercury controls during Phase 1. Instead, Phase 1 is a study period for dischargers to collect more data and develop management practices to control methylmercury discharges. Phase 1 allows individual or collaborative studies; dischargers are to submit a report on how they plan to organize the studies by the end of the first year of Phase 1. Study workplans are due in two years and progress reports are required in four years. Final reports, due in seven years, are to include study results, preferred management options, and implementation schedules.

The proposed Basin Plan amendment allows new total mercury and methylmercury discharges during Phase 1. However, new dischargers would be required to conduct characterization and control studies and implement management practices as they are developed to minimize increases in methylmercury and total mercury.

At the end of Phase 1, the Central Valley Water Board would review study results and consider whether to adjust the existing methylmercury allocations and time schedules for compliance. In addition, the Central Valley Water Board would consider the adoption of an offset program at the beginning of Phase 2. Amendments to the Basin Plan would be required to make any adjustments to the methylmercury allocations adopted at the beginning of Phase 1. During Phase 2, dischargers would implement the methylmercury control strategies developed in Phase 1.

### **Timeline and Summary of Delta Mercury TMDL Activities**

**1998-2006:** Development of the information to support the Delta methylmercury TMDL has been a massive effort involving substantial coordination and collaboration with CALFED, San Francisco Bay Water Board staff, USEPA, and numerous researchers and stakeholders to ensure that the best science and policy information has been used in the development of this TMDL.

**August 2004:** The San Francisco Bay Water Board adopted a mercury TMDL for San Francisco Bay that focused on total mercury control. The San Francisco Bay TMDL assigned a total mercury load reduction to Delta outflows from the Central Valley.

**August 2005:** A technical mercury TMDL report for the Delta was submitted to the USEPA and posted on the Central Valley Water Board website. The technical TMDL described the rationale for fish tissue objective alternatives, provided data and calculations for total mercury and methylmercury load estimates and methylmercury allocations, and included a preliminary outline for how the methylmercury allocations could be implemented.

**August 2005:** The State Water Board remanded the San Francisco Bay mercury TMDL and required, among other things, provisions for limiting total mercury discharges and evaluating methylmercury discharges. Recent research (including Delta-specific research) has highlighted the importance of biotic exposure to aqueous methylmercury. Since the remand, staff from the two Regional Water Boards and State Water Board had numerous discussions about consistency between the two regions with respect to total mercury versus methylmercury concerns and selection of water quality objectives.

**September 2005:** Staff held a CEQA scoping workshop to review potential environmental impacts that could be associated with a Delta mercury control program and to identify a range of implementation alternatives.

**November 2005:** Staff held a Central Valley Water Board workshop that included stakeholder panel presentations to discuss the technical TMDL, a range of potential implementation alternatives, and the schedule for amendment development.

**June 2006:** A draft TMDL/Basin Plan amendment staff report was forwarded to scientific peer reviewers and made available for public review. This report built upon the 2005 technical TMDL and included options and alternatives for an implementation plan. The proposed implementation plan incorporated elements that directly reflected input received from stakeholders. The June 2006 draft report can be considered the first draft of the report that will eventually be part of the agenda package at the Basin Plan adoption hearing in 2007.

**July 2006-February 2007:** Staff met with numerous stakeholder groups to obtain feedback on the June 2006 draft TMDL/Basin Plan staff report and amendment. Staff had meetings and conference calls with, or written comments from representatives from the following groups:

- California Department of Health Services & representatives of Delta fish consumers
- California Department of Water Resources
- California Rice Commission
- CALFED staff
- Central Valley Clean Water Association

- Central Valley Joint Venture Group
- Clean Water Action
- Delta Protection Commission
- Delta Protection Commission - Delta Mercury TMDL Collaborative
- Ducks Unlimited
- Mercury Working Group
- Northern California Water Association - Sacramento Valley Water Quality Coalition
- Northern Section of the Sacramento Valley California Water Environment Association
- Sacramento Stormwater Quality Partnership
- Sacramento Regional County Sanitation District
- San Joaquin-Delta Water Quality Coalition
- State and Federal wetland managers
- State Water Board Division of Water Rights
- The Nature Conservancy
- U.S. Bureau of Reclamation
- USEPA Region 9 Dredging & Sediment Management Team
- Wetlands interests in the Yolo Bypass and other wetland groups/managers

**August-September 2006:** Staff received scientific peer review comments on the draft TMDL/Basin Plan amendment report.

**August 2006:** The San Francisco Bay Water Board adopted the revised mercury TMDL for the Bay. The revised Bay mercury TMDL required more stringent controls on mercury discharges from point sources and required dischargers to begin evaluating methylmercury discharges.

**September 2006:** Staff held two public workshops to discuss the June 2006 draft TMDL/Basin Plan amendment report.

**March 2007:** A Central Valley Water Board workshop is scheduled to discuss the proposed Basin Plan Amendment.

### **Proposed Timeline for Future Delta Mercury TMDL Activities**

**Summer 2007:** A Central Valley Water Board hearing is scheduled to adopt the proposed Basin Plan Amendment

**2007-2008:** The Basin Plan amendment is submitted to the State Water Board, Office of Administrative Law, and U.S. Environmental Protection Agency for approvals.

**2008- 2015:** Phase 1 of the Delta Mercury Control Program begins, with dischargers initiating methylmercury studies to develop management practices for methylmercury control. During Phase 1, Board staff will be working with the dischargers and the

technical advisory committee on study plans and results. Also during Phase 1, Board staff will be developing mercury TMDLs for the Delta tributaries.

**2015:** Based on Phase 1 study results, Board staff prepares revisions to the Basin Plan to incorporate study results and discharger implementation plans.

**2016:** Central Valley Water Board reviews the proposed Basin Plan revisions and considers adjustment of the existing methylmercury allocations and time schedules for compliance as well as the adoption of an offset program.

**2017-2030:** Dischargers implement methylmercury control strategies.

Attachments:

1. Total Maximum Daily Loads
2. Basin Planning
3. Mercury and Methylmercury
4. Draft Basin Plan Amendment

## **Attachment 1: Total Maximum Daily Loads**

Section 303(d) of the Federal Clean Water Act requires States to:

- Identify waters not attaining water quality standards (referred to as the “303(d) List”; water bodies on the list are referred to as “impaired”).
- Set priorities for addressing the identified pollution problems.
- Establish a “Total Maximum Daily Load” (TMDL) for each identified water body and pollutant to attain water quality standards.

A TMDL represents the maximum load (usually expressed as a rate, such as kilograms per day) of a pollutant that a water body can receive and still meet water quality objectives. A TMDL describes the reductions of a pollutant that are needed to meet water quality objectives and allocates those reductions among the sources in the watershed. Water bodies on the 303(d) List are not expected to meet water quality objectives even if point source dischargers comply with their current discharge permit requirements. A TMDL thus addresses nonpoint as well as point sources of the pollutant. TMDLs must include the following elements:

- Loading capacity: The greatest amount of loading that a water body can receive without exceeding water quality objectives (also called assimilative capacity);
- Load allocation: The portion of a receiving water’s loading capacity that is assigned to nonpoint sources;
- Waste load allocation: The portion of a receiving water’s loading capacity that is assigned to point-source (NPDES) discharges; and
- Margin of safety within the loading capacity and consideration of the effect of seasonal variation in pollutant loads on the loading capacity.

In addition to the load allocations, a TMDL report typically contains the goals to be achieved in the water body (a.k.a. numeric targets), an analysis of pollutant sources, and a linkage between the sources and numeric targets.

The Clean Water Act requires that TMDLs be incorporated into State planning documents (i.e., California’s Water Quality Control Plans, often referred to as “Basin Plans”). When TMDLs are incorporated into Basin Plans, all the applicable Porter-Cologne Water Quality Control Act requirements for adopting Basin Plan amendments must be fulfilled. The Regional Board’s process for adopting Basin Plan amendments is described in Attachment 2.

In 1990, the State Water Resources Control Board adopted the 303(d) List of Impaired Water Bodies that identified Delta waterways as impaired for mercury because of the presence of a fish consumption advisory. The 1998 edition of the 303(d) List identified the TMDL control program for mercury in the Delta as a high priority.

## **Attachment 2: Basin Planning**

A Water Quality Control Plan, often referred to as a “Basin Plan”, is a legal document adopted by a Regional Water Board that describes the beneficial uses of waters to be protected, the water quality objectives to protect those uses, an implementation program to ensure that actions are taken to achieve objectives in a timely manner, and a monitoring program to document progress.

The Central Valley Water Board has adopted two Basin Plans. One is for the Sacramento River Basin and the San Joaquin River Basin. The other is for the Tulare Lake Basin. Preparation and adoption of Water Quality Control Plans is required by the Porter-Cologne Water Quality Control Act (Section 13240) and supported by the Federal Clean Water Act.

Amending a Water Quality Control Plan document is referred to as Basin Planning. Regional Water Boards adopt Basin Plan amendments in a public hearing after a structured process of public participation and State environmental review. Basin Plan amendments do not become effective until approved by the State Water Resources Control Board and the Office of Administrative Law. In addition, the U.S. Environmental Protection Agency (USEPA) must ultimately approve water quality objectives for surface water for them to become effective.

In California, pollution control programs (e.g., TMDLs; see Attachment 1) are typically enacted by amendment to a Regional Board’s Basin Plan; the Basin Plan amendment language must contain all of the required elements of a TMDL (load and wasteload allocations and margin of safety). After the State’s amendment approval process is completed, the USEPA must approve the required TMDL elements and any new water quality objectives described in the amendment. After the USEPA approves the Basin Plan amendment, dischargers must comply with the new requirements.

An extensive staff report typically supports any type of Basin Plan amendment to provide the following:

- Description of existing conditions;
- Confirmation of applicable beneficial uses;
- Proposed water quality objectives if not yet adopted for the water body;
- Recommended plan of implementation of the TMDL and allocations;
- Consideration of reasonable alternatives to the implementation plan;
- Evaluation of environmental impacts in accordance with the California Environmental Quality Act (includes an Environmental Checklist and a description of mitigation measures if any proposed implementation action is likely to cause significant environmental impact); and
- Consideration of economics.

The Delta mercury TMDL and draft Basin plan amendment will be presented to the Board in a March 2007 workshop to obtain Board and public input on the proposed mercury control program and alternatives. Board members have been provided a summary staff report and the most recent draft of Basin Plan amendment language in the agenda package for the Board workshop. Staff will use comments provided by the Board members and public to guide revisions to the mercury control program proposed in the draft Basin Plan amendment language. Prior to the public hearing at a Board meeting scheduled later this year, Board members will receive the complete Basin Plan amendment staff report with all the components listed in the previous paragraph and a draft Resolution to adopt the amendment.

### **Attachment 3: Mercury and Methylmercury**

The Delta is impaired by mercury because fish in the Delta have mercury concentrations high enough to pose a health threat to both humans and wildlife that consume these fish. Methylmercury is the most toxic form of mercury. Eating fish with high levels of methylmercury is a problem because methylmercury impairs nervous, reproductive, and immune systems in both humans and wildlife species. Fetuses and young of humans and wildlife are most sensitive to its harmful effects.

Methylmercury accumulates within organisms more than inorganic mercury because inorganic mercury is less well absorbed and/or more readily eliminated than methylmercury. The proportion of mercury that exists as the methylated form generally increases with the level of the food chain, and is typically greater than 95% in top trophic level fish. For example, largemouth bass in the Delta have more than six million times the methylmercury as the water in which they swim. As a result, human and wildlife exposure to methylmercury is primarily through consumption of fish and shellfish, rather than drinking water. Humans and wildlife species that eat fish from the top of the food chain are at the greatest risk for adverse effects of methylmercury.

Methylmercury is produced by naturally occurring bacteria (primarily a group called sulfate-reducing bacteria) that transform inorganic mercury to the organic form. Important factors controlling the conversion rate of inorganic to methylmercury include temperature, presence of organic matter (carbon) as food source for the bacteria, salinity, pH, and inorganic mercury concentration. Maximum methylmercury production occurs within the top few centimeters of sediment. Methylmercury moves from the sediment into the overlying water, where it may be absorbed by organisms at the base of the food chain (e.g., algae), transported downstream, or converted to inorganic mercury (termed "demethylation"). The conversion of inorganic mercury to methylmercury can take place in a variety of aquatic environments in the Delta region – primarily in sediments in wetlands, open-water channels, and agricultural areas and drains, as well as wastewater and urban runoff conveyance systems.

The Delta mercury TMDL program addresses the sources of two constituents, methylmercury and total mercury. The program focuses on methylmercury because in the Delta and elsewhere, researchers have found statistically significant, positive relationships between concentrations of methylmercury in fish and methylmercury in water. Sources of methylmercury in the Delta include tributary watersheds, flux from sediment in wetlands and open water habitat, geothermal springs, municipal and industrial dischargers, agricultural drainage, and urban runoff.

The program also addresses total mercury because methylmercury production is a function of the total mercury content of sediment. Most of the inorganic mercury entering the Delta comes from historic mercury and gold mining operations in the Coast Range and the Sierra Nevada Mountains, respectively. Many inactive mine sites, as well as the contaminated waterway reaches downstream of the mines, continue to discharge mercury. The Delta program directs the focus of inorganic mercury reduction

efforts to the Delta tributaries that discharge the most mercury-contaminated sediment, namely the Cache Creek Settling Basin, Feather River, American River and Putah Creek. In October 2005, the Central Valley Water Board adopted a mercury control program to reduce mercury contamination from the Cache Creek watershed. The control program focused on establishing cleanup requirements for inactive mercury mines in the upper watershed, erosion control for soils with elevated mercury concentrations, and methylmercury controls in the lower watershed to minimize the discharge of methylmercury. The Delta mercury control program requires additional mercury reduction efforts for the Cache Creek Settling Basin, which is located at the base of the Cache Creek watershed where Cache Creek discharges to the Yolo Bypass. The Feather River, American River, and Putah Creek will be the subject of future TMDLs.