



Tremendous volumes of water under high pressure were used as part of mining operations, washing mercury into rivers and streams.

Dealing with Mercury in the Bay-Delta

The mercury problem is a key focus for the CALFED Bay-Delta Program's Ecosystem Restoration Program. CALFED has committed more than \$30 million for mercury research and abatement in the Bay-Delta watershed, using a variety of management approaches and collaborative efforts with many public agencies. This multi-faceted approach provides better management of the problem and ensures the best investment of dollars and resources.

In 2003, a team of independent world-renowned scientists were convened to develop a strategy for investigating and addressing the mercury problem. The final document was issued in early 2004, and many efforts are underway to implement it including: projects to investigate sites for cleanup; research to understand mercury methylation processes; research and monitoring to evaluate effects on fish and wildlife; monitoring; and outreach and education to people who eat fish.

With the guidance of the Mercury Strategy, the California Bay-Delta Authority and participating CALFED agencies are working to achieve Ecosystem Restoration Program Strategy Plan goals and the CALFED Water Quality Program Plan goal (2000) - to "reduce mercury in the water and sediments to levels that do not adversely affect aquatic organisms, wildlife, and humans."



Locations of abandoned gold and mercury mines in California

Map and photo courtesy of U.S. Geological Survey

PAST AND EXISTING PROBLEMS

Mercury from historic mining sites in key California watersheds poses complications for ecosystem restoration in the Bay-Delta system. Although mercury is a naturally occurring metal, it is now much more widespread in rivers and streams as a legacy of California's Gold Rush days. When aquatic conditions are right, mercury can convert to a highly toxic form known as methyl mercury that readily accumulates in the food chain.

Methyl mercury concentrations in some Bay-Delta fish species exceed health guidelines established by the U.S. Environmental Protection Agency, prompting warnings against eating some locally caught fish. High concentrations of methyl mercury can cause neurological damage in humans, particularly children. It also impairs reproductive ability of fish and wildlife.

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EXISTING PROBLEMS (continued)

Mercury is transformed into methyl mercury by natural bacteria, and that change can be accelerated by low-oxygen environments such as wetlands. CALFED agencies are funding studies to better understand how the transformation takes place in order to identify potential management actions that may minimize methyl mercury production. In particular, the Ecosystem Restoration Program is investigating how wetland management or restoration may be accomplished while minimizing methyl mercury production and exposure.

A MERCURY STRATEGY

Written by independent mercury experts from around the country and developed in collaboration with other scientists, managers, and stakeholders, the Mercury Strategy provides a cohesive framework for understanding and responding to mercury issues.

Each core component addresses one or more management goals with specific objectives for scientific activities such as research and monitoring, as well as management actions such as source remediation, risk communication, ecosystem restoration and landscape management.

Other Mercury Information Sources

California Department of Health Services
education materials:

www.oehha.ca.gov/fish.html

U.S. Environmental Protection Agency
"Fish Advisories" web site:

www.epa.gov/waterscience/fishadvice/advice.html

U.S. Geological Survey Mercury fact sheet:

<http://ca.water.usgs.gov/mercury/fs06100.html>

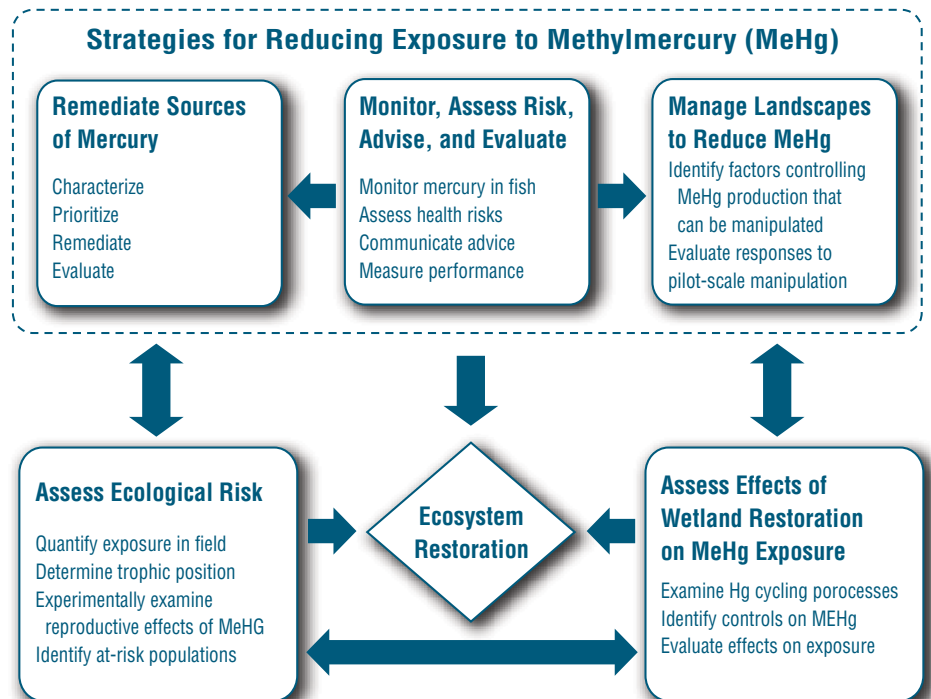
Delta Tributary Mercury Council:

www.sacriver.org/subcommittees/index.php?action=ShowNode&subcommittee=dtmc

CALFED Mercury Information:

www.calwater.ca.gov/Programs/EcosystemRestoration/EcosystemMercuryProject.shtml

CORE COMPONENTS OF THE MERCURY STRATEGY



This figure shows the conceptual model of linkages among components of the Mercury Strategy. Arrows show where information should flow between the components to allow adaptive feedback and refinement of both science and management actions.

BASIC MANAGEMENT APPROACHES

The Mercury Strategy recommends an interdisciplinary program to implement three basic management approaches simultaneously:

Identify sources of bioavailable mercury and remediate them

This first approach is a long-term goal, and given the magnitude and complexity of the problem, a very difficult one to achieve. To begin, the CALFED Ecosystem Restoration Program (ERP) has invested in several projects to try to identify the largest sources of mercury in the watershed and how mercury moves throughout the system.

The ERP also has provided support for the Department of Conservation to do an abandoned mine inventory and site assessments in the watershed. Other efforts supported by CALFED include identifying the greatest sources of mercury and evaluating the technical and legal roadblocks to remediation of abandoned mines. In the future, the ERP expects to solicit for mine remediation projects affecting Bay-Delta water quality with funds from Proposition 13 that were set aside specifically to do mine remediation.

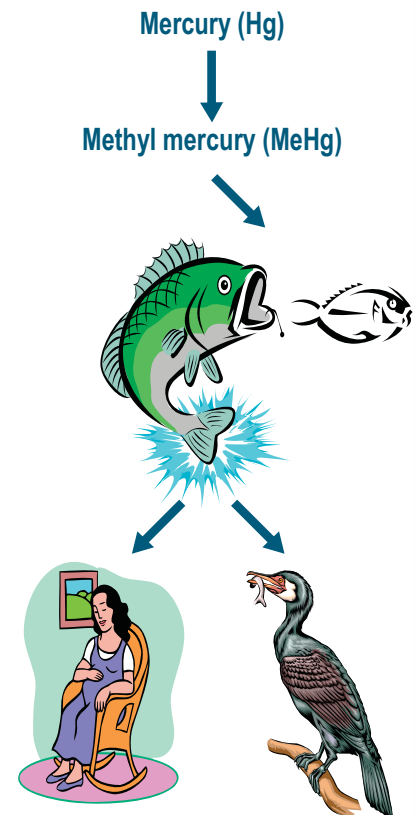
Both of the Regional Boards in this region are developing Total Maximum Daily Loads and implementation plans to use existing regulations to try to get some of the mercury in the system cleaned up. Sacramento Regional Sanitation District is leading an effort to explore “pollutant trading” and is funding a study on determining bioavailability of mercury.

Assess the risks to human health and provide advice to the public on how to reduce the risks

This is the best short-term method for reducing exposure in humans (although it doesn't work for wildlife). There are several components to this: monitoring fish tissue, evaluating the data for risk and formulating advice, identifying populations at highest risk, and finding out how to most effectively educate people about reducing risk.

ERP has provided funds for monitoring of mercury in water, sediment, birds, and fish. A recently funded project is designed to fill in some of the data gaps on mercury in sport fish in this watershed and coordinate with other monitoring efforts. Several agencies are currently collaborating to come up with a standardized database so that all of the fish tissue data collected will be in a compatible format and will be available on the web. The highest priority is to compile the existing data so that it can be analyzed to see if additional advisories are needed and to identify data gaps for the new monitoring effort.

MERCURY CONCEPTUAL MODEL: How mercury moves into the food chain



CALFED is funding studies to: understand what factors in the environment cause mercury to change to its harmful form; identify and clean up mercury sources; and educate people about the risks associated with eating fish with high levels of mercury. All of these efforts will help CALFED break the cycle presented in the conceptual model above.

Mercury and Environmental Justice

CALFED recognizes that the challenges in mercury outreach efforts are, in fact, Environmental Justice (EJ) challenges.

Subsistence fishing, consumption of tainted fish, and related socioeconomic and public health issues are major concerns within many California Tribes and local communities. CALFED agencies actively engage these communities in developing advice and guidance on mercury issues.

Department of Health Services has been working with communities to develop education materials in many languages and appropriate literacy levels, and provide training and grants to health care workers and community-based organizations to implement their own educational programs.

BEST MANAGEMENT APPROACHES (continued)

The Office of Environmental Health Hazard Assessment (OEHHA) is the state agency responsible for evaluating risk and issuing advisories. The Department of Health Services works with counties and community based organizations to identify the highest risk populations and develop appropriate educational materials. CALFED is providing support for both the development of advisories and the outreach and education activities.

◆ Manage the landscape to reduce methyl mercury bioaccumulation and exposure

The ERP has made substantial investments in research to try to better understand the conditions that favor methylation and demethylation, and how methyl mercury moves in the food chain. The research projects in this watershed, and others, have just begun to illuminate the complexities of mercury cycling in the system, and with the studies that have recently been funded, substantial gains in knowledge are anticipated over the next few years.

While it is known that certain factors can affect the methylation balance and how it accumulates, we are still trying to understand how they all interact in the Delta. For example, in the Everglades, controlling sulfate was the key to controlling the rate of mercury methylation. In our own system, it may be sulfate, carbon, temperature, pH, selenium, oxygen levels, or some combination that controls the conversion process. The ERP is funding several large multi-faceted studies to investigate the methylation and demethylation processes. A comprehensive fish monitoring program is underway to monitor the potential small-scale changes due to mercury cleanup or environmental restoration, as well as the overall regional picture of mercury concentrations in fish.

The Mercury Strategy summarizes key information and provides a framework for future research. Coordination is also underway to learn from other mercury research projects, particularly in the San Francisco Bay, and in other areas of the country. In addition, annual review meetings for all CALFED projects are planned and a mercury coordinator will help facilitate linkages between ongoing activities to help link science and management questions.



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