Delta Mercury Control Program and the Yolo Bypass

Fishery Enhancement Planning Team Meeting
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Why is mercury a problem?
What is the Delta Mercury Control Program (DMCP)?
The Delta Mercury Control Program and the Yolo Bypass.
Why is Mercury a Problem?

- Human Health Effects
  - Neurological
  - Developmental
  - Cardiovascular disease

- Wildlife Health Effects
  - Reproductive
  - Developmental
  - Hormonal
  - Behavioral
  - DNA alteration

C. N. Alpers, DRERIP Hg conceptual model, 2008
Why is Mercury a Problem?

“The primary problem with mercury in the Delta’s aquatic ecosystems can be defined as biotic exposure to methylmercury” (Delta MeHg TMDL Report, April 2010)
Why is Mercury a Problem?

Diagram illustrating the sources, reactions, and sinks of mercury in the environment, including atmospheric, aquatic, and terrestrial pathways.

- **Coast Ranges**: Atmospheric exchange, Reservoirs $\text{Hg(II)} \rightleftharpoons \text{Hg(0)}$
- **Sierra Nevada**: Gold Mines, Atmospheric exchange, Reservoirs $\text{Hg(0)} \rightarrow \text{Hg(II)} \rightleftharpoons \text{CH}_3\text{Hg}$
- **Agricultural Fields**: $\text{Hg(II)} \rightleftharpoons \text{CH}_3\text{Hg}$
- **Drainage**: Atmospheric exchange, $\text{Hg(0)} \rightarrow \text{Hg(II)}$
- **Irrigation**: $\text{Hg(0)} \rightarrow \text{Hg(II)}$
- **Groundwater**: $\text{Hg(II)} \rightleftharpoons \text{CH}_3\text{Hg}$
- **Benthic and Pelagic Food Chains**: Biomagnification, Pore Water Exchange & Diffusion, Particle Resuspension, Particle Deposition, Burial

Reactions:
- $\text{CH}_3\text{Hg} \rightleftharpoons \text{Hg(II)} \rightleftharpoons \text{Hg(0)}$
- $\text{Hg(II)} \rightleftharpoons \text{Hg(0)}$
- $\text{SO}_4^{2-} \rightarrow \text{S}_2^2$
Why is Mercury a Problem?

- 47,000 abandoned mines in California
- Legacy gold and mercury mine waste continues to enter the Delta through tributaries
What is the Delta Mercury Control Program?
DMCP Background

- April 2010, Central Valley Regional Board adopts amendments to their Basin Plan to establish the Delta Mercury Control Program (DMCP).

- October 2011, the USEPA approves the amendments and DWR receives official notice to comply.
DMCP Background

• Designed to protect people eating one meal/week of trophic levels 3 and 4 Delta fish (plus some commercial species).

• Uses a phased, adaptive management approach to gather additional information about MeHg production and source control methods to determine how regulated entities can attain load and waste load allocations.

• Report to Regional Board on first phase study results due Oct. 2018.
How does the DMCP relate to the Yolo Bypass?
DMCP & the Yolo Bypass

- Methylmercury (MeHg) load allocations assigned to point and nonpoint sources. The DMCP requires reductions in annual loads. *Reductions required for:
  - NPDES facilities
  - Municipal storm water
  - Agricultural lands
  - Wetlands
  - Open Water

*partial list
DMCP and the Yolo Bypass

- Open water allocations assigned to:
  - California State Lands Commission
  - Central Valley Flood Protection Board
  - Department of Water Resources
  - US Army Corps of Engineers
  - US Bureau of Reclamation
Open water control studies focus on studies in two areas:

- Delta
- Yolo Bypass

Agencies are required to characterize existing MeHg discharges to open waters from lands immersed by managed flood flows and evaluate their activities to determine whether *operational changes or other practices could be implemented to reduce ambient MeHg concentrations.

*Note that reservoir operations are not included!
DMCP and the Yolo Bypass

- **Phase I-**
  - Workgroups formed of regulated entities.
  - Create workplans.
    - Open water workplan approved by Regional Board Feb. 2014.
  - Workplans focus on:
    - Characterizing existing MeHg discharges to open waters during flooding.
    - Examining operational activities—present and future, their impacts, and possible MeHg control approaches.
  - Difficult to do either one of these activities in the field. Solution?
Modeling

- 2 Models
  - Delta Open Waters
  - Yolo Bypass flood waters

- Dynamic Mercury Cycling Model (D-MCM)

Highlighted area is approximate
Models key factors

- Hg cycling and bioaccumulation
- Wet/dry cycles
- Major sources and sinks for total mercury and MeHg
- Aquatic vegetation

*Partial list
Information Sources:

**Hydrodynamics**
from models and field data (e.g. Tuflow)

**Particle dynamics**
from literature, field data and models (e.g. TuFlow)

**Water and sediment quality**
from literature, field data and models (to be determined)

**D-MCM**

**Mercury Modeling - Abiotic**
Total mercury and methylmercury in water and sediments

**Mercury Modeling – Biota**

**Food web**
from literature
Modeling

Scope

• Calibration and Validation
• Existing Conditions
  • Provide a working model of MeHg transport and fate.
  • Determine most important drivers
• Scenarios and management practices*
  • Reduction of tHg in sediment entering the Yolo Bypass
  • Impact of increasing or decreasing vegetation cover.
  • Impacts associated with duration changes to wetting/drying patterns or changes in flow and residence times.

* Proposed
Modeling

What can we expect?

Trends

Will MeHg production increase?

Will MeHg production decrease?
Modeling

• What can we expect?
  • Diamond in the rough.
  • First cut at a Hg model for the Yolo Bypass.
  • Serves as a jumping off point for other users to refine inputs and ask their own questions.
Schedule

Oct. 2011
Promulgated

Feb. 2014
Workplan
Accepted

Oct. 2015
Interim Report

Oct. 2018
Final Report
Questions?

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