Regional Monitoring Program for Water Quality in the San Francisco Estuary
Contaminant Fate Workgroup
September 14, 2007 Meeting Minutes

Attendees:
Meg Sedlak (SFEI)
Jay Davis (SFEI)
Don Yee (SFEI)
John Oram (SFEI)
Lester McKee (SFEI)
Susan Klosterhaus (SFEI)
Katie Harrold (SFEI)
Sarah Rothenberg (SFEI)
Joel Baker (University of Maryland)
Robert Mason (University of Connecticut)
Kit Conaway (UC Santa Cruz)
Richard Looker (Regional Board)
Barbara Baginska (Regional Board)
Naomi Feger (Regional Board)
Bryce Johnson (former UCB student)
Craig Jones (Sea Engineering)
Paul Koster Van Groos (UCB)
Kit Conaway (UCSC)

1. Welcome and Introductions

Meg Sedlak convened the meeting at 10:00 and discussed the meeting objectives. Meg introduced Robert Mason, the newest member of the workgroup. Rob is an expert in mercury geochemistry and cycling in the environment.

2. Overview of the RMP and Development of a Long-term Mercury Strategy

Jay Davis presented an overview of the RMP, including its purpose, organizational structure, and budget (~3.1 million dollars). Jay noted that the RMP Technical Review Committee (TRC) and the State Regional Water Quality Control Board (Regional Board) recently requested that the RMP develop a comprehensive long-term mercury strategy to prioritize the mercury studies. A 5 year plan for the CFWG is in development and will incorporate the new mercury strategy. Jay presented the five mercury management questions developed by SFEI staff and other stakeholders at a meeting in August. Jay noted that the mercury group will be a separate stakeholder group which will include members of the RMP steering committee (SC), TRC, the Regional Board, and other interested parties. The mercury workgroup will not contain technical experts at this time, but the workgroup will keep the experts informed and seek recommendations from them.

3. CFWG 5 Year Plan

Don Yee provided an update on the development of the CFWG 5 year plan. Don first reviewed previous and on-going work by the RMP and other groups which includes contaminant loadings and distribution, hydrology, sediment dynamics, contaminant speciation and partitioning, transformations and degradation, and biouptake. The WG has

also developed or reviewed mass budgets and conceptual models for various pollutants (e.g., selenium, PCBs, Hg).

Don requested input on whether or not the WG questions and priorities were appropriate and properly identified. Don noted that to date the WG focus has mirrored TMDL needs such as the development of the PCB one-box model and then the multibox model. The discussion then focused on whether or not the PCB multibox model needs to be further refined and if it should be expanded for use with other contaminants (i.e. to support pending TMDLs). The coring results and information on suspended solids (and particle-associated contaminant) export out the Golden Gate, which are expected soon, will improve the model for PCBs and its applicability to other contaminants.

The next priorities presented to the WG were (1) to determine the processes controlling mercury impairment (bioaccumulation), including its sources to the estuary and transport and transformations, and (2) to determine what other contaminant we should be addressing next and if this decision should mirror TMDL development.

General Comments from Workgroup on Contaminant Modeling:

Barbara Baginska- Selenium TMDL for the North Bay is currently in development and more data is needed. The factors driving Se in the North Bay are different from South Bay (e.g. more of a groundwater influence than in the North Bay. Study information would be late for North Bay TMDL schedule but could address Se in the South Bay.

Richard Looker- Not sure whether TMDLs can always drive the decision. For example, a TMDL for PBDEs is not imminent because there are no water quality standards available. Dioxin is listed but complicated. For PAHs there is a question regarding impairment status. For pharmaceuticals there are no water quality standards or listings.

Barbara Baginska- An adoption hearing for the PCB TMDL should occur in the 2-4 months; difficulty in scheduling. Major criticisms of the PCB TMDL were (1) the use of the one- box model may be too simplified (using predictive data rather than empirical data), (2) the need for a better understanding of sediment loads, and (3) more information on differences in bioavailability among the PCB congeners. Board also questioned the natural degradation of PCBs. Development of the multibox model will be a great improvement.

Richard Looker- The Board plans (most likely) to adopt the PCB TMDL. The Basin Plan Amendment will provide language which will allow the TMDL to be adapted as new data become available (e.g. to validate assumptions). Will need PCB re-visitation in ~1-2 years with new data from coring, Golden Gate export, and loading studies. Probably do not need any more information in near future. Multibox likely part of first revision. Still interested in development of multibox model.

Rob Mason / Joel Baker- Need to consider episodic transport of sediment plumes. A mechanistic model was developed to address this in the Hudson River during hurricanes and is good for projections.

Richard Looker- Was the bathymetry of the North Bay considered?

John Oram- The PCB model focuses on the South Bay bathymetry for now. Lateset version improved calibration of South Bay sedimentation. Not much info on North Bay, but not a big PCB problem area.

Barbara Baginska- Multibox model needs more calibration and validation, and can then be used as a tool for future pollutant modeling if can show it works without large uncertainty for PCBs. Would like to see multi-contaminant multibox model "screening tool."

Don Yee- Could use PBDEs or organochlorine pesticide to validate model; however have little core data for PBDEs.

Joel Baker- DDT is a good choice for applying the model to another pollutant since there is a long-term dataset available for model calibration.

Consensus among group to allow the stakeholders to predict the future of the multibox model application (i.e. which pollutant-PBDEs or DDT/Organochlorine).

Craig Jones- Could use multibox model results to develop a 3D mechanistic model, which may allow for understanding important processes in the Bay, if multibox model is insufficient for meeting needs. Mechanistic model for Puget Sound has significantly improved predictive capabilities.

Richard Looker- Mechanistic models generally good at short time scales. Are the mechanistic models sensible for long-term projections?

Barbara Baginska- Agree that a plan B is required in case new data shows a problem with the multibox model or shows that we need something different in order to model other contaminants.

Richard Looker- A 3D mechanistic model would help us understand sources within specific parts of the Bay. Interested in shorter time scales; multibox model will not be able to address hotspots.

Jay Davis- Produce final multibox model report, then make a decision on the mechanistic model development. Will discuss at next meeting and possibly add to the long-term plan.

Rob Mason- (Given interest in Hg and Se, and considering similarities) It's possible to have the Hg and Se model overlap.

WG noted some (potentially) missing items in budget: bathymetry studies and multibox v3.0.

General Comments from Workgroup on Prioritization of Mercury Studies:

Rob Mason- Getting useful information from Hg isotope studies is unknown; based on lab data and may not be applicable to field sediments. If sensitivity information is known, you can decipher the data but interpreting data to get reliable source information is difficult.

Rob Mason- It's not necessary to have the MeHg mass budget resolved in order to start looking at processes controlling MeHg production in-bay. We know that in-bay processes control foodweb accumulation. Use a one-box model to estimate the net source; in situ production in the Bay is much larger than what's coming in from external sources; the internal flux is the key process. Should focus on demethylation processes in addition to methylation processes. Look at Chesapeake Bay MeHg budget. Most came from internal production. "Removal by fishing"could be a vector – Sweden. De-methylation more ubiquitous than mehylation.

Kit Conaway and Rob Mason discussion on relationships between reactive Hg, MeHg, total Hg.

Richard Looker- RFP approach to solicit proposals may help us prioritize Hg questions/studies; more progress may be possible instead of developing questions first.

Rob Mason- Suggest doing a bioavailable Hg and/or reactive Hg conceptual model, similar to the METALLICUS project where atmospheric Hg quickly accumulated in lake fish.

Sarah Rothenberg- Consider atmospheric Hg production by refineries.

Rob Mason and Richard Looker- At sites where accumulation is lower despite high sediment Hg concentrations, there may be toxicity to the methylating bacteria or demethylation may be occurring.

Prioritization of Mercury Pilot Studies for 2008

Don Yee reviewed the Hg process study options for 2008; the major questions are 1) whether all Hg is ultimately bioavailable 2) what cofactors affect Hg transport, transformation, and uptake (e.g. DO, DOC/TOC, sulfide) 3) what food web components are of greatest interest. A MeHg conceptual model (building off the Clean Estuary Partnership Hg conceptual model) could serve as a framework to consider relative importance of these different questions. Some methods to try measure relative availability of Hg sources include reactive Hg measurements, microbial incubation experiments, or a combination of these. Our current understanding of Hg transport factors has large uncertainty associated with turbulent and non-turbulent exchange between sediment-water (resuspension, bioturbation, diffusion). The important limiting factors for Hg transformation are largely those affecting anaerobic microbial processes which might be examined through correlations or incubation experiments. Important Hg uptake factors are linked to the space and time scales of interest and specific ecosystem component(s) of interest (subtidal/wetland/terrestrial). Other measures might provide an integrated indicator of net outcomes of Hg availability/processes (e.g. Hg isotope fractionation).

General Comments from Group:

Barbara Baginska- Need to determine fraction of Hg available for methylation and the causes of methylation.

Rob Mason- To determine fraction available for methylation, correlate ancillary parameters (e.g. TOC, DOC, sulfide) with Hg concentration and use to predict methylation in specific locations. Develop a model using these parameters to determine the concentration of Hg in pore water and extrapolate to predict methylation and uptake by organisms. If you can't model, predictions will be difficult. Doesn't buy relation of carbon and methylation; see Chesapeake Bay as example.

Joel Baker- The New York Harbor CARP(?) model is the only model that has been somewhat successful at predicting Hg methylation; however was all subtidal.

Rob Mason- Desorption of Hg and MeHg from suspended solids is trivial because the Kd is so high (~10^5). MeHg is not coming from water or resuspended sediments, primarily from the benthos.

Joel Baker- Suggest directly quantifying Hg bioavailability by exposing caged organisms to sediments or using SPME, peepers, or other biomimetic devices.

Rob Mason- Data from the Chesapeake Bay shows that pore water Hg does not correlate with MeHg methylation rates. Some Bay high organic carbon sediments have high sulfide, low Hg methylation rate despite higher total Hg. Continental shelf sediments in contrast Hg is more bioavailable with low organic carbon and low sulfide, with low total Hg. Thus when Hg concentrations were high, MeHg methylation was lower, resulting in similar MeHg in both locations.

Rob Mason- May have locations where Hg methylation is occurring but is not accumulating in foodweb.

Rob Mason- Hg can be related back to nitrogen.

Richard Looker- Suggested priorities: (1) Bioavailability study to identify locations/sources of biological uptake in the Bay (i.e. Bay margins/wetlands or the Bay), (2) Determine what fraction of Hg is bioavailable at these locations/sources, and (3) Determine the sources and pathways of Hg to these locations/sources. It would be useful to determine if sediments in the spine of the Bay are a source or not.

Rob Mason-Recommends identifying source waters, using surrogate source organism or other tool to determine bioavailability, quantify Hg in all matrices, and then model it.

Barbara Baginska- We need to understand processes better. Don't measure Hg in algae or lower trophic levels. Instead we need to understand how uptake at these levels affects the bigger picture. Need to identify sources in order to implement management actions.

Jay Davis-Could add abiotic parameters to the small fish study and increase the number of sample sites. (Consensus was that small fish study is good tool and should expand this study).

Rob Mason- Could add a deeper water fish species to the small fish study to get an idea on uptake from the spine of the Bay.

Lester McKee- When you increase the number of sample sites, select sites with similar local sources or to build an understanding of the whole system, select dissimilar source sites.

Unknown- Hg methylation is likely very seasonal.

Group- Need to determine relationships between reactive Hg, MeHg, and total Hg. Accumulation in fish doesn't appear to be related to total Hg in the Bay.

Consensus: Do bioavailability study to determine locations where MeHg is accumulating. Use a surrogate organism. Quantify biogeochemical endpoints.

Action items:

Add Rob Mason to the mercury workgroup.

Jay: Develop an RFP for mercury studies to address processes controlling Hg accumulation in foodweb, relate back to TMDL. SFEI will develop first draft containing a 1 pager of ideas, then send to Richard Looker for comment. SFEI will incorporate comments and distribute to possible PIs.

Highlight to stakeholders (specifically BACWA and BASMAA since not at meeting) that need input on which pollutant (e.g. PBDEs or DDT/other organochlorine) to use to validate PCB multibox model. Note that use of DDT is for model development only.

Revise 5 year plan

Draft a small fish proposal.

Next CFWG meeting is scheduled for Friday, December 7, 2007.