RMP Contaminant Fate Workgroup Meeting
June 7th, 2010
San Francisco Estuary Institute
Meeting Summary
DRAFT

Attendees:

Carrie Austin (SFB RWQCB)
Barbara Baginska (RWQCB)
Joel Baker (Univ. of Washington)
Nic Duffort (Anchor QEA)
Arleen Feng (ACCWP representing BASMAA)
Tom Grieb (Tetra Tech)
Ed Gross (Bay Modeling)
Holger Hintelmann (Trent Univ.)
Jim Hunt (UC Berkeley)
Dave Krabbenhoft (USGS)
Trish Mulvey (SFEI Board)
Thomas Mutunga (San Jose State Univ.)
Chris Sommers (EOA)
Rachel Allen (SFEI)
Jay Davis (SFEI)
Ben Greenfield (SFEI)
Michelle Lent (SFEI)
Lester McKee (SFEI)
John Oram (SFEI)
Don Yee (SFEI)

Via conference call:
Joel Blum (Univ. of Michigan)
Keith Stolzenbach (UCLA)

1. Introductions and Review of Agenda

Jay Davis began the meeting with introductions and an overview of the goals of the meeting.

Arleen Feng commented on the summary from the January 2010 CFWG meeting, stating that the distinction between SFEI and the RMP needs to be clearer in the minutes, as parties involved with SFEI or the RMP are often confused. She added that a quote attributed to her, on page 8 of the meeting summary, is incomplete.

The minutes were revised to reflect these changes.

2. RMP Planning Update

Jay Davis updated the committee on the RMP planning process for 2011. Currently, the SC has requested proposals in specific areas for 2011, as shown in the handout from this item, including a synthesis report of mercury work. The reports from Joel Blum and Holger Hintelmann at this meeting will serve to share the new information with the CFWG on the work done so far, and help the projects to reach closure. Future work in these areas may not be funded in 2011; however, possible projects for future years may be identified through today's discussions.

In addition to a mercury synthesis report, the SC requested a PCB synthesis in 2011. The goal of the synthesis is to summarize the state of knowledge and identify and prioritize remaining data gaps, with more project proposals to be developed at the completion of the synthesis.

Items listed with an "F:" on the handout fall in the realm of the CFWG. The margins conceptual model is a priority for the group, and will be discussed later in the meeting. Jay Davis mentioned that the project is not far enough along to recommend specific studies for next year, but a request will be made at the TRC meeting for funding for modeling activities in 2011 . The CFWG should decide at this meeting if $100,000 is an appropriate allotment.

Jay Davis added that current proposals for 2011 are largely aimed at filling empirical data gaps such as characterizing loads from small tributaries and understanding effects of copper on migratory fish. In 2011, a substantial amount of funding is going into small tributary loading studies ($340,000).

Discussion:

Dave Krabbenhoft asked if small tributary studies were focused hydrology, contaminants, or nutrients. Arleen Feng clarified that the studies first characterize the hydrology, and then focus on contaminants. The modeling work is dependent upon the Small Tributary Loading data, and information from these studies will be useful for increasing the resolution of the forecasting.

Jay Davis added that small tributaries are the focus of the mercury and PCB TMDLs, and that though we are starting to get data on loading, more data are needed to characterize the different types of watersheds. Arleen Feng noted that while there is very little hard information to evaluate the effectiveness of stormwater management, stormwater monitoring is part of the permits, and therefore must be conducted for the short term. Historically, the RMP has focused more on stormwater influence on receiving waters (such as loads) than collecting information on stormwater management, which has been the purview of the stormwater agencies.

Jay Davis informed the committee about the joint SCCWRP's Technical Advisory Group (CTAG) – RMP May meeting, which focused in part on stormwater. While few decisions were made at this meeting, it was agreed that an all-day meeting would be held in the near future to coordinate on stormwater work between North and South California.

Barbara Baginska asked about the dioxins special study, and how the air deposition work fits into the strategy that is being developed. Jay Davis noted that the first round of dioxin data (from cores and surface sediments) are coming in, and will be analyzed before further work is undertaken. In 2010, the RMP set aside $10,000 for the development of an atmospheric deposition strategy, and the strategy team believes that they can perform a synthesis with existing funds. The details will be discussed later in this meeting.

Jim Hunt asked how feedback from the workgroups is carried up to the TRC and SC. Jay Davis noted that meeting summaries, SFEI staff, and stakeholders through their TRC and SC reps make this connection.

3. Mercury Strategy – Completion of the Mercury Isotope Study

Joel Blum gave the workgroup a summary of the final results from the Mercury Isotope study, and outlined areas for future study.

The study shows clear isotopic variability in the Bay from the south to the north in both sediment and small fish. The results of the study reflect a mercury mining source in the south that is mixing with gold mining and/or industrial sources of mercury in the north. The study can not rule out the possibility of additional sources of mercury with intermediate isotopic compositions entering the Bay; however, it is unlikely that they would be dominant sources of Hg to the sediments.

Mass independent fractionation, which indicates photochemical reduction and loss of mercury to the atmosphere, is greater in wetlands, where there is more exposure to sunlight and air than in subtidal sediments.

A strong correlation was observed between the isotopic composition of co-located small fish (i.e., Mississippi Silverside and Topsmelt). The strong correlation indicates that there is a common source of mercury to both species. The correlation between fish and sediment is tightest in the South Bay and more scattered in the North Bay, suggesting more complex bioaccumulation processes in Suisun Bay and the Carquinez Straight. The greater variability between sediment and fish Hg isotope composition may be due to 1) a larger variety of mercury sources in the Delta area and less mixing of sediment leading to small scale heterogeneities in isotopic composition or 2) methylation that occurs in the nearby wetlands, which could be a significant contributor of methyl mercury to the fish. More photochemical reduction at sites with more water clarity, such as Kirker Creek, Point Isabel, and Oyster Bay, is also supported by the strong correlation between the two mass independent isotopes.

Joel Blum mentioned that the he anticipates publishing three articles: a sediment piece that has been submitted and accepted to Geochimica; a fish and sediment article which will be submitted to ES&T, and a third piece, on mercury isotopes of atmospheric deposition, which is in preparation.

In an effort to determine the isotopic composition of mercury from air deposition, rainwater and tree moss samples were analyzed and compared. While the literature indicates that tree moss should be a good natural archive of atmospheric mercury, the two sample types had very different isotopic compositions. Two possible explanations are 1) that wet deposition is accessing a different reservoir of atmospheric mercury than dry deposition (which would affect the moss more) or 2) some sort of fractionation is occurring in the moss. Joel Blum's group is currently developing new methods for assessing the isotopic composition of atmospheric mercury in Florida. Joel Blum also mentioned that the concentrations of atmospheric mercury detected so far in the Bay Area are comparable to unpolluted areas in the Great Lakes region, rather than industrialized urban areas.

Dave Krabbenhoft asked if the shift of composition seen between tree moss and precipitation would be expected based on a moss-fractionation interpretation of the effect. Joel Blum indicated that it would be hard to predict a priori.

Jay Davis asked what the difference in isotopic composition of atmospheric mercury between the Bay Area and other polluted areas could indicate. Joel Blum indicated that this is difficult to

characterize, because the current "polluted areas" measured thus far, such as those in Florida near a coal power plan, may not be characteristic of all polluted areas.

The distance from the coast is not correlated with changes in the mass dependent fractionation for both precipitation and tree moss, indicating that there is no large input of mercury to the atmosphere with a difference composition than the background.

In comparing the isotopic composition of all sample types, an offset between sediment and fish becomes apparent. This offset is due methylation from sediment microorganisms, demethylation from biological systems, and photochemical reduction processes that fractionates the mercury before it is taken up into the food web. The combination of these processes produces the noticeable offset, which occurs in a consistent direction, though at an unpredictable magnitude. The effect of atmospheric deposition on the sediment isotopic composition is still unknown; however, because the composition of atmospheric mercury is still unclear. Finally, Δ^{200}, the mass independent fractionation of Hg^{200}, is 0 for all sample types except precipitation samples, which indicates that atmospheric deposition cannot be a dominant source of mercury to the sediment.

Jim Hunt asked if there was mercury isotope data from Cache Creek, but Joel Blum responded that they do not currently have this data, though a proposal to gather it will be presented.

Tom Grieb asked about the sampling difficulties in obtaining precipitation samples. Joel Blum stated that that because the concentrations were so low, they did not have enough mercury from the sample volumes collected to determine the isotopic composition. To get a good sample, 1-4 liters of water is needed. Tom Grieb suggested that the difference between the isotopic composition of sediment and fish samples could also be accounted for by preferential uptake of the heavier isotope by the fish, or lower in the food chain. Joel Blum agreed that a trophic transfer could be producing this effect.

Joel Blum presented five potential projects for continuing mercury isotope work in San Francisco Bay.

1) Hg isotope analyses of reactive inorganic mercury extracted from sediments.
   Reactive inorganic mercury may be indicative of the bioavailable portion of mercury. Understanding the isotopic composition of reactive mercury could tighten the link between sediment and fish, and start identifying where fractionation is occurring.

2) Hg isotope analyses of sediment from additional sample sites in the Sacramento River Delta region.
   Additional sampling in the Sacramento River Delta region could elucidate the local variability, and better identify the different sediment inputs, such as Cache Creek.

3) Hg isotope analysis of large-volume urban run-off samples.
   Urban run-off samples have not yet been analyzed for isotopic composition, and would provide another indicator of source compositions to the bay.

4) Hg isotope analysis of co-located samples of dry deposition, wet deposition and gaseous elemental mercury at a single location in the Bay area.

Joel Blum's group is already working on this in Florida, but an additional site for the co-located samplers in the Bay Area (such as the roof of SFEI) would give a better indication of the range of concentrations and compositions.

5) Hg isotope analyses of sport fish and sea-bird egg shells to gain information on Hg sources to these organisms.

Investigating other organisms would indicate how much of their mercury is acquired from similar sources.

Discussion:

Joel Baker asked why the slope between fish and sediment mass dependent fractionation is not 1. Joel Blum stated it is statistically indistinguishable from 1, due to the scatter in the data, however if it is a real artifact, then it might result from a difference in processing mercury between the North Bay and the South Bay.

Joel Baker also asked how different the isotopic composition of an additional source, such as stormwater, would have to be in order to characterize it as an important source. Joel Blum confirmed that a source with the same isotopic composition as the sediment would be impossible to characterize. A source with a different composition would require a mixing calculation.

Dave Krabbenhoft asked:
1) Why reactive mercury would be an indicator of bioavailable mercury, since the extraction process does not simulate environmental conditions
2) Why bird shells, and not feathers or tissue, are proposed for future studies
3) Why the Astroturf precipitation sampler is necessary, rather than a simpler pump.

Joel Blum responded to each:
1) Although reactive mercury is not a perfect proxy for bioavailable mercury, there is no better technique around.
2) Eggshells would be studied because they are being used by other researchers in the Bay, and there is a large archive collection that they could access for historical samples.
3) A direct comparison between pumping and the Astroturf precipitation sampler side by side may be the best approach, because they may reveal different fractions of atmospheric mercury.

Dave Krabbenhoft agreed that a side by side approach would be appropriate, since it might indicate if fractionation from photochemical reduction could affect the turfgrass samples.

Jay Davis suggested that egg contents would also be interesting to analyze, as the RMP studies them in its monitoring. Joel Blum agreed that the side by side analyses would perhaps indicate where fractionation occurs in birds.

Trish Mulvey reminded the workgroup that the RMP is intending to perform a synthesis of mercury results during 2011, and that future work should fit in to the synthesis conclusions,

though they are willing to be flexible with start dates in order to produce the best science. She asked Joel Blum how much lead time he would need to begin working on a project, once he learned that it was requested. He believed that a quick start would be possible, on the order of a few months. Trish Mulvey confirmed that by the end of the meeting, the workgroup would prioritize the proposed projects, and that by mid-summer of 2011 the RMP should know what work it would like to move forward on. Approved projects could potentially be able to start in the fall of 2011.

Carrie Austin asked:

1) Which of the proposed projects would most likely not be completed in one study, and need follow up work?
2) Which types of mine waste are bioavailable?

Joel Blum responded:

1) Studies 1 through 4, as proposed, would likely not need follow-up work, given what is currently known. Study 5, however, is brand new, and could result in as many questions as answers.
2) In general, sediment samples with high mercury concentrations also have high δ^{202}, and because fish compositions are correlated with sediment compositions, it is clear that this mercury is getting into the fish. So mine waste such as calcine with high δ^{202} does have bioavailable mercury.

Carrie Austin asked that a focus on bioavailable mercury from specific mines be added as proposed study #6, and confirmed that the Water Board would ensure that the researchers have any access needed at New Almaden mine.

Dave Krabbenhoft suggested that mercury be extracted with DOM in a side-by-side in the reactive mercury proposal, to demonstrate the relevance of the reactive mercury extraction. Joel Blum agreed that understanding the composition of the two extractions would be worthwhile. Don Yee noted that Mark Marvin DiPasquale had conducted previous work in the Delta aerating anoxic sediments to release mercury.

Action Items:

- Add study proposal #6: Which mines are contributing bioavailable mercury to the bay?

4. Mercury Strategy – Completion of the DGT Study

Holger Hintelmann summarized the goals of the diffusive gradient thin-film (DGT) study, which were to use DGTs to identify sources of bioavailable methyl mercury in the Bay, and to compare the DGT results with the mercury in small fish biosentinel study. While it is debatable if DGTs accurately capture the bioavailable methyl mercury, it is known that they measure only dissolved methyl mercury.

The sampling sites from 2008 and 2009 for DGTs and small fish were sorted by type: open, enclosed, industrial, legacy, Wastewater Treatment Plant (WWTP), and Tomales Bay. The open sites, not near likely sources of mercury or protected by nearby shorelines, were intended to

show the background conditions in the Bay, and had the lowest DGT measurements, except for a sample from Suisun Bay. The enclosed sites, located in protected embayments, had higher amounts of methyl mercury, and higher variability in the measurements. The four industrial sites, near outflows from industrial watersheds, had similar concentrations to the enclosed sites, but less variability. Legacy sites, identified as sites known to be high in inorganic mercury, had higher DGT measurements, but very large variation in the values. Although there was known high concentrations of inorganic mercury in sediment at the legacy sites, it is unknown how much of that is bioavailable. WWTP sites, located in channels receiving WWTP effluent, produced the highest DGT measurements. Ben Greenfield clarified that these sites were not receiving 100% WWTP effluent, though, depending on the site, it could constitute a large portion of the ambient water. It is still unknown if there is methyl mercury that is discharged from the treatment plant, or if it is created in the channel, enhanced by the WWTP discharge. Don Yee mentioned that WWTP effluent tends to have low methyl mercury concentrations, so the latter is more likely.

Barbara Baginska noted that there were similar signals from three very different WWTPs. Holger Hintelmann added that in 2008, of the two plants studied, one was on the same order as the three from 2009, however one was much lower.

Holger Hintelmann showed the Tomales Bay results, which were variable, yet high. Carrie Austin asked why the "HAMLT" site was high, and Holger Hintelmann clarified that its exact location was in fact closer to the mouth of Walker Creek than at Hamlet.

Because all sampling was done in the fall, Holger Hintelmann considered variations in water conditions to be very low.

Lester McKee suggested that the large variation in some of the site types suggests that we have not classified enclosed and legacy very well, but that the other sites may be better classified. Holger Hintelmann added that the classification of legacy sites could be modified to include biologic activity at the sites, which would likely give a better indicator of the amount of bioavailable mercury.

Jim Hunt asked about the spatial variability for DGTs. Holger Hintelmann indicated that spatial variation had been evaluated at the Martin Luther King Jr. Regional Shoreline park (MLKRS). DGTs were placed 5m apart, and very little variation was seen. However, it is believed that larger variation on a small spatial scale is seen in the Delta region. Joel Baker noted the impressive spatial variability that is maintained over the course of the 30 day deployment of the DGT. Future work will need to carefully evaluate the hydrology and currents in the region.

Holger Hintelmann also compared the results based on regional patterns, stating that San Pablo Bay had the lowest DGT measurements, while the South Bay had the highest.

Arleen Feng asked if there was noticeable growth or fouling on the DGTs after deployment. Colonizing on the samplers could affect methyl mercury results; however, no biofouling was observed on the samplers.

John Oram asked if the site types could affect the spatial comparison, if all the legacy sites were located in the South Bay, for example. Holger Hintelmann said they could remove the type classification from the spatial analysis; however there is not a sufficient quantity of data to resolve this confounding effect.

A seasonal study at MLKRS produced the lowest results in August, with the highest levels in April. The dramatic seasonal variability corresponded with weather patterns and biologic activity. This same pattern was noticed in small fish mercury levels, in a recent paper in ES&T by Eagles-Smith and Ackerman. The RMP seasonal small fish study at MLKRS also showed seasonal variation in methyl mercury concentrations. Dave Krabbenhoft mentioned that a very pronounced springtime buildup of mercury is also seen at Twitchell Island.

A correlation between methyl mercury from small fish and the DGT is seen only if the high levels at Alviso Slough are included in this data set. If that one driving point is removed, there is no significant correlation. However, DGTs do present a more sensitive measure of local concentrations, with a factor of 20 between low and high results. The small fish measurements vary only 2-3 times between the lowest and highest concentrations. This smaller variation in fish could be linked to the spatial mobility of fish, and the larger composite size (20 fish vs. 3 DGTs). Arleen Feng suggested that fish may also be self selecting towards higher or lower detected concentrations.

Ben Greenfield noted that though small fish and DGTs do not match up, many other biosentinels, such as invertebrates, small fish, and birds, from one contained ecosystem, often do not match up, so the uncorrelated results are not unexpected. Jay Davis added that the two methods are also sampling different types of methyl mercury: small fish concentrations represent the bioavailable methyl mercury that makes its way through the food chain, while DGTs sample dissolved methyl mercury in the water column.

Holger Hintelmann mentioned that in lab studies, DGT, fish, and mussel results did show a good correlation; however the forced spatial constraint of the lab study is removed in the open system, and with it the correlation breaks down.

Dave Krabbenhoft suggested that DGTs could be spiked with a mercury isotope, such as Hg^{201}, to determine if there is mercury lost while they are deployed.

Holger Hintelmann summarized the results to date:

- DGTs can help identify sites with high methyl mercury, detect regional variations, and detect seasonal variations;
- the method has also been refined to determine that 4 week deployments are optimum for the Bay Area; and
- their intrinsic advantage lies in the fact that they can be deployed almost anywhere.

Discussion:

Dave Krabbenhoft noted that because DGTs detect only methyl mercury that is actually present in the water column, they are revealing wide ranges in methyl mercury concentrations, which needs to be studied further. While they do not show the same patterns as small fish, they are revealing an additional piece of the mercury process.

Holger Hintelmann clarified that DGTs can be used to investigate pore water, and while they are too large to accurately measure flux, they can be useful for estimating formation (concentrations) of methyl mercury in pore water.

Joel Baker compared the results from the two studies, noting that because sediments seem to be the main source of mercury (isotope study), but there is very large spatial variability (DGT study), either the system is not well mixed, or there are large variations in methyl mercury production on a small scale. Either way, the system will be difficult to model.

Since all the areas are tidal, and therefore undergo a large amount of mixing during the month deployment of a DGT, Ben Greenfield considers that large sources and error inherent in the method, may account for the DGT variation detected. Other possibilities include proximity to marshes, varying benthic fauna at the deployment location (Mark Marvin-DiPasquale's results), and a combination of production with transport.

To date, the focus has been on comparing DGTs with small fish, which may not be their best use. Holger Hintelmann suggested a few possibilities for future work:

1) Source Tracking I

Comparing the Sacramento River region with the Guadalupe River region, with a focus on the hot spots in Suisun Bay and combining the work with methyl mercury loading data from the rivers.

2) Source Tracking II

Do WWTPs promote production of methyl mercury in their discharge channels, or are there higher methyl mercury concentrations being directly discharged?

3) Methyl mercury Source Budget

This proposal may need a larger timeframe than a single year. It would include 12 months of sampling at mining sources, wetlands, and WWTPs, among other potential sources, and would require hydrology and discharge volumes to determine a budget estimate.

4) Sediments as methyl mercury sources

Sediment DGTs could be used to determine methyl mercury production in sediments, such as marshes, mudflats, and WWTP channels.

5) Unresolved questions

Methyl mercury in salt ponds
Point Isabel (unaccounted for high results)

Jim Hunt asked if there was a WWTP that would permit monitoring of its discharge, to carefully quantify methyl mercury at all stages. Arleen Feng and Trish Mulvey suggested that this would be very possible at some of the South Bay WWTPs, with the support of the Water Board. (Note: San Jose has already conducted a mass balance of MeHg of their treatment process). However, the WWTPs are already very regulated, so even if a mass budget could be created, it might not

be possible to lead to management action. Dave Krabbenhoft added that because the total WWTP effluent volume is a small portion of the total water inputs to the Bay, as a mercury source it is likely negligible, when compared with sediment flux.

Barbara Baginska added that the DGTs are now part of the tool box of mercury methods; however, they need to be connected with management questions, which will help with interpreting DGT information, and designing future DGT studies.

Lester McKee suggested that the small spatial and temporal variations would be a very interesting future investigation, but there are few appropriate areas for an enclosed system to study.

Arleen Feng added that there is still a lot of large picture information gaps about mercury, and filling in these gaps, with mass budget information or similar projects, could be very useful.

5. Closure on Coring

Don Yee provided a brief summary of the coring project (results were presented at previous WG meetings). He reminded the WG that one core was taken per segment plus one more in Alviso to capture contributions from the Guadalupe River. He noted that the coring results fit our conceptual model of Bay. For example, he saw the expected erosion/deposition signals for each Bay segment (based on Jaffe's work). The wetland cores exhibited a clear depositional signal. Additionally, the Cesium (Cs) dating results and the pollutant concentrations are consistent with our understanding of depositional history. In general, coring data are useful for improving estimates of the Bay pollutant inventory, as well as model development and model validation.

Don summarized several additional projects including: assessing dioxins in Bay cores and potentially analyzing PBDEs in more cores (to date only three wetland cores have been sampled). He noted that the lab currently has the samples that could be analyzed for PBDEs, but will only keep them as long as they have storage space.

Don discussed the possibility of longer term study elements. He noted that a very limited number of cores have been advanced in the Bay (i.e., 11 cores collected by the RMP/CEP and 2-5 cores collected by USGS. This level of coverage is adequate for baywide scale, but it is not high enough resolution for specific bay segments. Moreover, we have no coring data in shallow water.

Don discussed lessons learned in terms of project logistics. In the future, he suggested doing incremental efforts (e.g. 2 cores/year, to not overwhelm the analysis lab, which has the added benefit of spreading out the cost). However, the downside to the incremental approach is that it takes more time to develop a comprehensive picture.

Discussion:

Jim Hunt asked what did we gain from this massive effort? He noted that the data has not been fed back into the Bay model. Arleen Feng stated that the old multi-box Bay model is being retired, and that we are waiting for new Bay model before going through effort of feeding core data in.

Jim Hunt brought up the question of uncertainty analysis, and noted that Cs and Pb dating didn't agree. He asked Don if he was planning to use one or another or both? Don said both since they each provide useful information.

Joel Baker asked about subsurface contaminant concentration peaks. Don responded that we didn't see many.

John Oram explained the timing behind using the multi-box model (TMDL deadline) that led to the new core data not being used to update the model.

Barbara asked about the point of taking wetland cores in purely erosional areas like the North Bay. Don said there are specific areas that are not purely erosional, like the location in San Pablo Bay where USGS took their core.

Barbara asked about defining needs before going out and collecting cores. The WG started to discuss anticipation of needs, and Jay Davis asked that this discussion be deferred until the closed session.

Action Items:

- Feedback on report due ASAP
- Final report will be distributed in October

6. Modeling Strategy – Margins Conceptual Model

Jay Davis updated the workgroup on the project and indicated that the project had been somewhat delayed. SFEI will be focusing on this project over the next few months. He noted that there have been weekly internal project meetings. He put forth the invitation for external stakeholders to be more involved. He stated that SFEI will have monthly meetings about this project and also about the Bay Model that they can attend.
He gave the target date of Sept. 30th for a draft report.

Jay went through the Draft Outline handout, which contained three main sections:

- Review of existing information
- Summary of present conceptual understanding
- Recommendations for next steps

Discussion:

Jim Hunt pointed out that just the review of local information will be a large task. As an example, he mentioned the wealth of available for the Navy sites. Jay responded that we'll inventory what is available, but that the budget may limit the depth and breadth of the review (the budget is $40,000). Jim asked about post-clean up monitoring and whether we could potentially leverage this activity. Jim also asked about whether modeling occurs for the Navy sites. The WG consensus was that the Navy site remediation projects probably do not involve modeling.

Barbara Baginska asked about the monthly external meetings. Jay said that he's hoping for some volunteers from the group; for example, Arleen Feng, since she suggested this idea and hopefully someone from the Water Board. Barbara asked about timeframe. Don and John Oram said they'd expect to have two-hour meetings. Lester McKee explained how STLS has been doing its external stakeholder meetings and suggested that this could be a good model to follow.

Action Items:

- Identify workgroup members to be involved in the monthly meetings on the project.
- Complete draft by September 30th.

7. Modeling Strategy – Progress on South Bay Hydrodynamics Model

John Oram provided background information on the SUNTANS model and introduced Ed Gross, a consultant who is working on model development. John also explained the rationale behind using the South Bay as model development starting point, noting that there are lots of data available.

Ed noted that he is skipping the context and jumping directly into technical details and basically providing a status report on a work in progress. He explained base model information requirements, namely, shoreline, desired grid resolution, and bathymetry. The currently available bathymetry data consists of: USGS bathymetry study in Lower South Bay and USACE sections surveys up into sloughs and rivers. LiDAR mapping data can also be used, but it is not ideal. Available shoreline data consists of: SFEI's Modern Baylands polygons and vegetation maps (using vegetation with well-defined and limited elevation ranges of habitat). Then Ed briefly explained using anisotropy interpolation to create high resolution interpolated contours from soundings and surveys, noting that this method is preferable to inverse weighting interpolation since it takes into account direction of slough and expected shape of slough. He showed how contours based on different source data were blended. He stated that the final product will be 1-meter DEM using best available data or averaged data.

Discussion:

Dave Krabbenhoft asked about grid resolution. Ed said 5 to 10 meters in highest resolution areas, like shorelines. John Oram pointed out that reporting isn't necessarily at that scale, but to get physics right, the model needs to run at this resolution. Dave also asked if this base model data is available for other sections of the Bay. Ed and John said that it is, but not necessarily at as a high a resolution.

8. Modeling Strategy – Recommendations for 2011

John Oram briefly discussed fieldwork needs to support the Bay model. The main study needs in terms of model component were:

- Physics
    - tidal flux studies (Dumbarton & Alviso), plume studies, bathymetry
- Chemistry
    - sediment cores, surface sediment chemistry
- Biota
    - bed roughness near tributary mouths, biota chemistry

Discussion:
Jay Davis put forth a suggested annual allocation of $100,000 – an "earmark" for a study plan to be refined.

Joel Baker asked what the biota portion would look like; for example, would it look like the Gobas food web model at Bay margins? John responded that essentially it would. Joel then noted that most water quality models miss the shoreline, where a lot of the biological activity occurs, and he raised the concern that knowing the margins food web will be a major data need and he doesn't see on John's current data needs list.

The WG asked about the timeline for model development. John said they have a roughly 5 year timeline to have a full Bay model. WG would like to see a more detailed timeline. Ed pointed out that Stanford University is funding the model development and so the timeline will be dependent on Stanford's priorities.

Arleen Feng asked about a Plan B and noted that this was supposed to be an action item of the previous CFWG meeting.

Lester McKee bought up the difficulty of dealing with nonpoint sources at the margins.

Arleen Feng asked about the distribution of $100,000, since whole list is going to cost more than $100,000. John suggested that $100,000 could cover entire data needs list for one site; however, the actual distribution of funds will depend on how model progresses. John mentioned leveraging other studies; for example, Dave Schoellhamer is already conducting a tidal flux study at Dumbarton.

Joel Baker asked about what will be gained from high resolution bay margins model. John and Lester said that it will allow for identification of high leverage pathways. Jay noted that it will allow us to predict recovery for margins contaminated sites, perhaps related to management actions.

The WG discussed how money will be allocated. Jay said that he envisions at least 50 percent being dedicated to fieldwork and lab costs. Barbara Baginska expressed some concern at not having a more refined and defined list of activities. She said she is okay with generally earmarking money but she wants to see a more developed plan. Arleen Feng pointed out that this project will be competing with more concrete proposals from other WGs at the Steering Committee meeting. Jay said that since Tom Mumley is very supportive of this work, the Steering Committee might accept this "earmarking" approach.

Joel Baker asked about the biological end points for model. He noted that knowing the end points will help guide the model development and determine necessary resolution. Jay stated that small fish and sport fish are definite biological end points for model, and that determining other end points will be assisted by the margins biota conceptual model (slated for development later this year).

The Modeling team will hold a status update in mid-September, and will discuss the plans for the future. Given that the RMP did not approve funding for the project for 2011, Plan A is to put a hold on the project until 2012, when funding may be approved. Plan B is to apply for funding to the RMP from the reserve, to continue work in 2011.

9. Atmospheric Deposition Study

Don Yee presented a summary of the development of the Atmospheric Deposition Strategy. He discussed the process of determining which pollutants matter in terms of air sources and impacts. He presented the rankings:

High - Known impairment and air sources: dioxins, Hg
Moderate - Unknown impairment and/or air sources: PAHs, Se, PCBs
Low - Known small impairment and air sources: PBDEs, Cu, legacy pesticides

Don discussed the difficulties of developing loads from deposition estimates, as deposition amount is not equal to the load. He noted that pervious surfaces have low yields relative to impervious surfaces. He compared ball park figures of watershed loads versus ranges of air deposition (including both wet and dry) loads to show which pollutants merit additional study.

Don noted that a major information gap is local variation (unknown for most pollutants), and additionally, an information need for air pollutants is evaluating local versus distant sources using BAAQMD emissions inventories, spatial patterns in ambient concentrations, and other methods.

Discussion:

Barbara Baginska pointed out that the selenium loads were too high. Don acknowledged that the Se values used were from the Tetra Tech report on the North Bay for the TMDL, which may have included a location next to a known source in its range. Barbara stated that Se should be low priority from an air deposition perspective.

Jim Hunt asked about using Pb as a case study since we have well-established data and a known decline when leaded gas was banned. Jim proposed, “Can we recreate this?” Don said he will look into this possibility.

Trish Mulvey brought up that the Air Board does not currently have any mandate to protect water quality, so this study could push toward this type of regulation. The WG discussed whether this falls under the RMP. General consensus was no one else is doing this work, and it is important work.

10. Closed Session: Recommendations for Pilot and Special Studies for 2011

Candidate studies include:
1. DGTs
2. Isotopes
3. 3D Model Development Allocation
4. Atmospheric Deposition Synthesis

The CFWG advisory group recommended that the 3D South Bay model receive consideration from the TRC for funding in 2011. Given that the RMP will be funding a synthesis report on mercury in 2011, the group suggested waiting until next year to fund more mercury studies, including DGT, isotope, and air deposition studies, so that the study foci can be informed by conclusions from the synthesis report.

Action Items:

- Jay to bring the WG funding recommendations to the Steering Committee.

Next CFWG Meeting: The date for the next CFWG has not been set yet and will be chosen via email.

Action Items

#	**Action Items – June 2010**	**Who?**	**When?**	**Status 8/30/2010**
1	Develop a Hg isotope study proposal to investigate which mines are contributing bioavailable mercury to the bay	Joel Blum		
2	Give feedback on coring report	CFWG members	June	Almost all feedback has been received.
3	Final Coring Report	Don Yee	October	In progress
4	Identify workgroup members to be involved in the monthly meetings on the margins conceptual model.			Barbara Baginska and Naomi Feger have participated in meetings
5	Complete draft by September 30th.			The deadline has been pushed back to December. Craig Jones will contribute to the project, and is not available until fall.
6	Bring the WG funding recommendations to the Steering Committee.	Jay Davis	August SC meeting	The South Bay model was not funded for 2011, but the SC will consider funding it with available reserve in December.