RMP Joint Meeting of Exposure and Effects and Emerging Contaminants Workgroups

May 15th-16th, 2012
San Francisco Estuary Institute

DRAFT Meeting Summary

In Attendance (May 15th, 2012):

Eva Agus (EBMUD)
Brian Anderson (UC Davis)
David Baldwin (NOAA Northwest Marine Fisheries)
Steve Bay (SCCWRP)
Mike Connor (EBDA)
Joe Dillon (NOAA Southwest Marine Fisheries)
Eric Dunlavey (City of San Jose)
Melanie Harrison (NOAA Southwest Marine Fisheries)
John Incardona (NOAA Northwest Marine Fisheries)
Michael Kellogg (SFPUC)
John Kucklick (NIST)
Naomi Feger (SFB RWQCB)
Arleen Feng (ACCWP for BASMAA)
Jennifer Field (Oregon State University)
Michael Fry (Pacific Island FWS)
Keith Maruya (SCCWRP)
Derek Muir (Environment Canada)
Harry Ohlendorf (CH2M HILL)
Dan Schlenk (UC Riverside)
David Sedlak (UC Berkeley)
Steve Weisberg (SCCWRP)
Don Weston (UC Berkeley)
Ian Wren (SF Baykeeper)
Rachel Allen (SFEI)
Jay Davis (SFEI)
Susan Klosterhaus (SFEI)
Lester McKee (SFEI)
Meg Sedlak (SFEI)
Don Yee (SFEI)

Via Telephone:

Richard Grace (AXYS)

1) Introductions and Review of the Agenda

Meg Sedlak reviewed the agenda for the day, and the group conducted introductions, noting that participants from both the Exposure and Effects workgroup (EEWG) and Emerging Contaminants workgroup (ECWG) were in attendance. In particular, the EEWG panel members Michael Fry, Harry Ohlendorf, Dan Schlenk, Steve Weisberg, and Don Weston, as well as the ECWG panel members Jennifer Field, Derek Muir, and David Sedlak were in attendance for the afternoon discussion of bioanalytical tools.

2) 2012 Special Study Update: Copper and the Olfactory Nerve of Salmon

Arleen Feng noted that existing storm water permits require an update on the progress of the copper (Cu) effects on salmon study by this summer. Meg Sedlak noted that the Water Board has been kept abreast of the status of this project and the delays that were caused as a result of internal NOAA policies. Ms. Sedlak requested that David Baldwin provide a short summary on the progress to date by July 1.

David Baldwin gave an update of studies to date regarding the effects of Cu on the olfactory nerve of salmon. In freshwater, previous studies have shown that Cu impacts salmonid olfactory systems at levels detected in the environment. However, it is unclear if these levels are applicable for Cu in the Bay; since salmon are at a different life stage in the estuarine environment, the increased salinity may affect the copper effect, and dissolved organic carbon (DOC) may mitigate the binding strength of Cu by increased ligand complexation. Therefore, the RMP funded a study to investigate the olfactory toxicity of Cu to seawater phase salmon. Preliminary investigations are suggesting that Cu is much less toxic in seawater (1000 µg/L resulted in few changes from control, vs. significant effects at 5 µg/L in freshwater). David Baldwin indicated that because this was a preliminary study using relatively few individuals, these results need to be confirmed this summer.

The team proposed beginning the next round of investigations with toxicity at low DOC in 32 ppt seawater using the RMP 2012 funds. Additional funding (in the form of a grant from the Copper Development Association (CDA)) was provided to pursue toxicity in brackish waters (10 ppt). If the 32 ppt studies show low toxicity, Dr. Baldwin proposed moving towards the brackish water, low DOC scenarios before continuing to pursue the full seawater cases, as higher levels of DOC are expected to decrease toxicity even further. However, if the full salinity tests show higher levels of toxicity, the group will continue to vary the DOC before moving to lower salinity cases. The RMP studies will begin in July 2012.

Dan Schlenk noted that sodium-potassium ATPase is upregulated in salmonid gills as the fish migrate from fresh water to saltwater, and that copper has a toxic effect on this enzyme. He asked if it was also increased in the olfactory system during this transition, and David Baldwin indicated that he was unsure.

Dan Schlenk asked about the fish origins and their life stage during the tests. David Baldwin indicated that the fish are raised in a hatchery, and put through smoltification. The same size and life-stage fish will be used for the 32 ppt experiments as the 10 ppt experiments. Dan Schlenk

suggested that an earlier life-stage should be used for the 10 ppt experiments, as post-smolt fish would not be found in such a low salinity environment. Meg Sedlak suggested that David Baldwin, Dan Schlenk, Richard Looker, and Joe Dillon discuss this in more detail to determine the appropriate life stage of salmon to use for the low salinity experiments.

Don Weston asked about the type of DOC, and David Baldwin indicated that fulvic acid would be used in the experiments, to keep them more straightforward, although he allowed that the choice of DOC could have large implications for the effect of DOC on Cu.

Action Items:

- Meg Sedlak, David Baldwin, Dan Schlenk, Richard Looker, and Joe Dillon will discuss the appropriate life stage of salmon to use for the low salinity experiments.
- David Baldwin to provide a short summary on the progress on copper studies to date by July 1.

3) Effects of PAHs on Juvenile Flatfish

John Incardona presented results from the two-year study on the effects of PAHs on the development of juvenile California halibut. Previous experiments had established strong relationships between carcinogenic PAHs and activation of the AHR pathway in flatfish embryos. The group has investigated the linkage between a mixture of PAHs found in oil spills (lower molecular weight waterborne PAHs) and development during fish metamorphosis. For the RMP study, the group was particularly interested in the higher molecular weight PAHs that are observed in San Francisco Bay sediments. Sediments used for the RMP analysis were from Kitimat, BC, which is nearly pristine except for PAHs from coal tar pitch, mixed in different proportions with clean sediment from Puget Sound. The results showed no large differences in fish development between the control and treatment groups, although there were significant differences in growth. However, there were some laboratory difficulties, including the low temperature at which fish were kept during metamorphosis, that could affect the results.

A few pieces remain to be completed, including verifying the exposure by CYP induction, looking at impacts on the cardiac system, and confirming the growth trend. John Kucklick asked how the fish are exposed to the contaminants, and John Incardona indicated that it is likely dermal absorption, as the fish do not appear to be eating the sediments, and their food source is not contaminated. The patterns of CYP induction should reveal more about the exposure route.

Meg Sedlak indicated that the revised report would be distributed this summer, with additional results from the remaining investigations. Steve Weisberg indicated that he would be interested in performing similar studies in Southern California, as there tend to be different mixtures of PAHs in the sediments. He will speak with John Incardona about giving a seminar on these results in Southern California.

Action Items:

- Meg Sedlak will distribute the revised report with additional results to the EEWG this summer.

4) 2012 Plans for Moderate Toxicity Workshop and Mesohaline Index Development

Moderate Toxicity Workshop
Steve Bay reminded the group of the low levels of toxicity that have been seen across San Francisco Bay year after year. It is consistently observed, and though it does not indicate a severe problem, it is very difficult to understand what is causing the toxicity. RMP efforts so far to understand this have included toxicity identification evaluation (TIE) studies and contaminants of emerging concern (CEC) research, but there is not an obvious path forward. In 2011, the Steering Committee (SC) allocated funds to convene a workshop with experts from across the country to provide ideas and to develop study designs to address this issue.

The proposed workshop would be held immediately following the 2012 National SETAC meeting in Long Beach, CA and would bring together about 20 experts from across the country and many different areas of expertise, with the objectives of assessing current knowledge regarding causes of SF Bay sediment toxicity to amphipods (*Eohaustorius estuarius*) and developing testable hypotheses and study designs to investigate likely stressors. The participants would generally be experts in either stressor identification, contaminants of emerging concern, or non-contaminants stressors and *Eohaustorius* life history.

Dan Schlenk asked why the workshop was not designed as a Pellston, as first suggested by the EEWG. Steve Bay indicated that this question did not seem to require that level of investment of time, resources, and formal structure. Dan Schlenk also asked how this workshop would bring in new ideas, as the people currently proposed to be involved may be less likely to propose new angles or approaches, due to their familiarity with the issues or current level of input. He suggested including experts on nanomaterials and other potentially relevant experts who have not been involved with this particular topic. Brian Anderson supported the idea of including experts on *Eohaustorius* natural history. Meg Sedlak indicated that the group would re-evaluate the list of proposed participants, and look for a wider range of experts. They will also send it out to the EEWG for input.

Naomi Feger pointed out that other coastal regions in California face similar problems, and would likely be interested in the results. She proposed investigating the idea of cost sharing with other regions, and Steve Weisberg indicated that he would discuss this with Chris Beegan.

Mesohaline Index Development
Steve Weisberg outlined the proposed study to develop more robust indices to assess mesohaline benthic community assemblages. The budget for this study is more than what was allocated by the SC for 2012; howeve,r it is an accurate estimate of what the investigators predict the task requires.

Mike Connor suggested that the indices be developed in collaboration with the Interagency Ecological Program (IEP), because they have been studying this and have high quality data. Mike Kellogg noted that he supported this proposal, and that it is important to develop all three of the indices.

Action Items:

- Re-evaluate the list of proposed participants for the Moderate Toxicity workshop, and send it out to the EEWG for input.
- Meg Sedlak, Naomi Feger, and Steve Weisberg will investigate the possibility of getting additional funding from other California regions.
- Look into collaborating with the IEP on mesohaline index development.

5) RMP Planning Overview

Jay Davis introduced the RMP Multi-Year Plan (MYP), and reviewed how the different pieces of the RMP fit together. He indicated that while the "top-down" guidance from the SC is the source for the funding allocations for EEWG projects, some funding was not allocated to specific studies and the SC is looking for input and ideas from the workgroups on how to use these funds over the next few years and into the future. There is therefore some potential for additional funding beyond the allocations listed in the MYP.

Meg Sedlak indicated that this plan provides an opportunity for the RMP to interact with stakeholders and with panel members to determine if there are priority questions for stakeholders, or important information gaps or recent developments, that the RMP should be investigating. Steve Weisberg noted that his priorities for the RMP are 1) nutrients; 2) sediment toxicity; and 3) emerging contaminants, including bioanalytical screening tools. Naomi Feger suggested that the potential effects of microcystin could be an important question for the RMP to address in the near future. Mike Connor suggested that the potential effects of selenium, particularly on sturgeon, may also be of interest. Harry Ohlendorf also suggested revisiting the EEPS conceptual model, and using it to reassess what we've learned about how the Bay operates. Meg Sedlak indicated that she would add this assessment to the upcoming EEPS summary report.

Action Items:

- Revisit the EEPS conceptual model, and incorporate our improved understanding of the Bay into the EEPS summary report.

6) Application of Bioanalytical Tools for CEC Monitoring

Dan Schlenk reviewed the proposed use of bioanalytical tools in monitoring for CECs. This idea is built on a similar proposal from the recycled water policy. The basic concept is to use *in vitro* biological assays to screen for effects of CECs, rather than analyzing for the CECs individually. If the correspondence between the biological assay and CEC presence is good, then this technique provides a comprehensive, low cost means for screening for presence of relevant concentrations of CECs. The technique does have limitations in its ability to link an *in vitro* response to ecological meaning, and will therefore initially be better at establishing exposure than potential for effects. Bioanalytical protocols for drinking water are scheduled to be standardized for drinking water by winter 2012.

Mike Connor asked about investigating a tissue matrix, as opposed to water, to assess the potential for effects in the contaminants that are taken up into organisms. Dan Schlenk indicated

that the procedure is likely to be possible, but the process of extracting CECs from tissue in order to run the bioassay may result in introducing some matrix effects.

7) Pilot and Special Studies 2013: Bioanalytical Tools

Nancy Denslow called in to the meeting to describe a proposal for 2013 RMP funding that will link *in vitro* (cellular level) assay results with *in vivo* (organism level) end points. This proposal focuses on about half of the CECs recommended for monitoring by the statewide advisory panel for CECs in receiving waters – those that have estrogenic endpoints. The study will use *Menidia beryllina* (silverside) as the test species. In using a sensitive estuarine species that is found across the country, including San Francisco Bay, this study will draw on the existing tests developed for this species, and begin linking exposure and effects endpoints for a species that is relevant nationwide. Silversides are appropriate because they are closely related to topsmelt and the USEPA has developed regulatory endpoints for this species.

The total cost of the two-year project will be $168,000; however, only $126,000 is being requested from the RMP, as SCCWRP will be contributing $42,000 to the project. In addition, the project will occur alongside the state-funded ($800,000) project to compare commercially available bioassays in a round robin exercise to develop bioanalytical tools for drinking water. In the first year, laboratory experiments would be undertaken to model exposures; in the second year, field exposures would occur.

David Sedlak noted that the estrogen receptor and estrogenic impacts have been studied widely. It is therefore more straightforward to link bioassays with ecological effects targeting this receptor, however, it is less likely to produce new information, while some of the other CECs with different mechanisms of action might. Dan Schlenk noted that the existing database on estrogenicity will be helpful for Dr. Denslow as the project is developed and put into context. Michael Fry agreed with Dr. Schlenk that the importance of linking *in vitro* and *in vivo* responses outweighs the slightly more limited relevance of using estrogenic receptors.

Eric Dunlavey asked about the selection of WWTPs for effluent testing in year 2 of the study, indicating that the City of San Jose was unaware of this project prior to today's meeting. Nancy Denslow noted that the plants had not yet been identified and that the plants mentioned in the proposal were examples of possible plants. Mike Connor suggested that the City of San Jose WWTP is not comparable to Hyperion WWTP in Southern California, and that EBMUD or EBDA may be a more appropriate choice.

David Sedlak asked if the silversides may be stressed due to the levels of ammonia in WWTP discharge. Nancy Denslow indicated that the estrogenic compounds will be extracted from the water sample and then reconstituted into the experimental set up, to remove external factors. Jennifer Field suggested that some of the studies use whole water, to provide context and a frame of reference.

Derek Muir and Dan Schlenk also pointed out that while a lot of work is being done on fathead minnows in freshwater, little work has been conducted in estuarine waters. The array for

silversides being developed in this study will build off the body of knowledge existing for fathead minnows, and define silversides as the benchmark species for estuaries.

8) Discussion of 2013 Special Study: Bioanalytical Tools

David Sedlak suggested some adjustments to the project and future directions for research. Particularly, he suggested that other matrices, such as fish tissue, may provide more relevant results, as fish tissue will reveal the contaminants that are also able to biaccumulate in organisms of interest. He also noted that this study would likely not pick up on the higher priority CECs, such as flame retardants and perfluorinated compounds.

Harry Ohlendorf suggested that this study be put in context with the ECWG strategy and how managers may use the results. David Sedlak pointed out that embarking on this study implies a long-term commitment to bioanalytical tools from the RMP. Given the state of the research to date, it will be about 10 years before the tools can be applied to management and monitoring. However, Dan Schlenk noted that in the long run, bioassay results will provide data, similar to Dioxin TEQ data, in the form of estrogenic equivalency quotients (EEQs). Eventually, bioassays could be used as a screen for CECs in samples, where only samples surpassing an EEQ threshold would be subjected to further analyses. Harry Ohlendorf suggested that the ECWG create a roadmap from this study to implementation of bioanalytical tools in monitoring.

While it is projected that multiple years and further studies will be required before bioanalytical tools can be implemented in monitoring, the RMP is not committing to funding the remainder of the work. Other agencies and organizations will have an interest in this work and will be able to contribute funding. Steve Weisberg pointed out that the NSF is more likely to fund cutting-edge research, and that Regional Boards and local organizations will be interested in funding the method finalization and implementation. In between, however, organizations such as the RMP will be invaluable to fund the less "cutting edge" work needed to convert good ideas into implementable monitoring tools. Given that the State Board is asking for tools that have not yet been developed (a rare occurrence), he feels confident that they will be willing to fund implementation of these tools once they are further along. Naomi Feger suggested that the study costs for 2013 be split evenly between Northern and Southern California.

Jay Davis asked about using the fathead minnow, rather than silverside, which has been studied in greater detail. However, Dan Schlenk pointed out that the fathead minnow would not reveal important effects endpoints, because it does not exist in estuarine environments. Because this approach treats organisms as a "black box", it is important to select a relevant black box – in this case, the silverside.

Naomi Feger asked what the implications would be if the study was not funded by the RMP for 2013. Keith Maruya indicated that much of the momentum and ability to leverage would be lost, as it would not line up with the drinking water tool development. Steve Weisberg pointed out that the study would likely be funded eventually by other sources, but this is an opportunity for the RMP and Southern California to influence this tool development from the beginning, rather than waiting to see what other organizations, such as the State Water Board, develop, and

attempting to provide input after the tools are already in place. Other potential funders, further down the road, include the Water Environment Research Fund (WERF) and the EPA.

Arleen Feng noted that the ECWG has not yet developed a strategy for CECs in the Bay, and that it seems premature to fund a project of this magnitude without an agreed-upon strategy. She also noted that while it is worthwhile to invest in the future, some organizations such as BASMAA are still scrambling to meet permit requirements, and may not have this flexibility.

Action Items:

- Outline a projected roadmap from the bioanalytical tools special study to implementation of bioassays in monitoring. Determine how this study fits into the broader RMP CEC strategy.
- Outline potential partners, funding agencies, or possibilities to leverage funds for future progression of bioanalytical tool development.

9) Closed Door Discussion of RMP Special Studies

The stakeholders and panel members discussed their support of the proposed special studies:

1) 2012 Moderate Toxicity Workshop
2) 2012 Mesohaline Index Development
3) 2013 Bioanalytical Tools

1) Moderate Toxicity Workshop

The group agreed that the proposed list of participants needs to be revisited, and should include more outside experts who may have new ideas. They also suggested that the SC allocate about $50,000 in 2013 to follow up the workshop with a strategy to implement any new ideas. This number will serve as a placeholder, and will be modified as necessary after the workshop. In moving this proposal to the SC, it is important to emphasize that the outcomes of the workshop are unknown, and there may be many options for use of this funding.

2) Mesohaline Index Development

The group approved of the proposed mesohaline index development, and particularly recognized the need to create three different indices. They asked for clarification on what will be accomplished during each of the two years.

3) Bioscreening

The group was asked to assess the technical merit of this proposal, rather than weigh it against other proposals from the ECWG. One panel member noted that this study is a high priority to the State Water Board, and that it is one of the recommendations from the monitoring chapter of both the drinking water and receiving water reports. Another panel member pointed out that the tools developed (which will likely not be ready for 10 years) will be very powerful for regional monitoring, but that the outcome of this particular study will not feed directly into the RMP. Thus, he approved of funding the proposed study only as part of a longer term commitment by the RMP to this general approach. However, he pointed out that the approach does need development, including expansion into tissue analyses and calibration to potential non-WWTP sourced endocrine disrupters. Another panel member pointed out that once they are

implemented, failing a bioassay will spark essentially a TIE, to determine what is causing the detected effects.

Meg Sedlak noted that the RMP periodically provides seed funds to start a project or keep a good idea moving along. One participant noted that this project could benefit greatly from RMP funds, as few organizations would be likely to fund a study of this type. One stakeholder suggested that the RMP will likely want to get into bioanalytical tools, but not at this point in time, largely because it is focused on the immediate concerns of its regulators and dischargers, and the base work on this development is more appropriately funded by other organizations.

In a poll of participants,

- 2 participants indicated that they DID NOT support funding the bioanalytical tools study. They cited the possibility of other organizations being more appropriate to fund the work at this point in time.
- 2 participants indicated that they PARTIALLY supported funding this study. They suggested funding one year of the study, and reassessing its progress at that point in time. They also noted that the immediate application of this work is currently unclear.
- 7 participants indicated that they DID support funding this study. They recognized the uncertainties in the proposal, but noted that the science is compelling, and that this presents a valuable opportunity to contribute to development of this work. They noted that in supporting this study, the RMP should recognize that it is committing to this idea for the long term. They suggested actively pursuing other partners to contribute funding, and hypothesized that if the work is going well, others will likely want to join in.

Jay Davis indicated that this proposal would be brought to the TRC and SC for consideration, and that the various thoughts of the EEWG and ECWG participants would be relayed as well. One panel member asked that in presenting the idea to the TRC and SC, the case for how this information will eventually be used, and why it is important to investigate now, be more compelling.

Action Items:

- Revisit the list of proposed moderate toxicity workshop participants.
- Request a $50,000 allocation for 2013 to follow up the moderate toxicity workshop with a strategy for implementing new ideas and proposals.
- Clarify the goals and milestones for each of the two years of the Mesohaline Index development project.
- Explain, in a more compelling fashion, how the results of the bioanalytical tools development will be used in the long run, and why it is important to investigate now.

In Attendance (May 16th, 2012):

Eva Agus (EBMUD)
Sabrina Crispo Smith (Department of Toxic Substances Control/Cal EPA)
James Downing (City of San Jose)
Denise Greig (formerly of The Marine Mammal Center)
John Kucklick (NIST)
Naomi Feger (SFB RWQCB)
Jennifer Field (Oregon State University)
Michael Fry (Pacific Island FWS)
Keith Maruya (SCCWRP)
Derek Muir (Environment Canada)
Tom Mumley (SFB RWQCB)
Karin North (City of Palo Alto)
June-Soo Park (Department of Toxic Substances Control/Cal EPA)
David Sedlak (UC Berkeley)
Ian Wren (SF Baykeeper)
Simret Yigzaw (City of San Jose)
Rachel Allen (SFEI)
Jay Davis (SFEI)
Susan Klosterhaus (SFEI)
Meg Sedlak (SFEI)
Don Yee (SFEI)

Via Telephone:

Richard Grace (AXYS)
Kevin Kelley (California State University, Long Beach)

1) **Introductions and Goals**

Meg Sedlak reviewed the previous day's meeting, discussed the agenda for the current meeting, and performed introductions.

2) **RMP Planning Overview**

Jay Davis reviewed the RMP Multi-Year Plan (MYP), and indicated how the ECWG fits into the planning structure. He noted that the SC allocated $100,000 for CEC studies in 2013, with no particular guidance towards how to apply these funds. He asked the panel members to review the proposed studies, but also to think in larger terms and longer time frames to consider broader reaching areas of future development for the RMP.

3) **Non-Target Screening of Bay Wildlife for Anthropogenic Compounds**

John Kucklick gave an update on the progress of the non-target screening analysis for "unknown" CECs. He noted that the study was designed to identify previously unknown compounds, so persistent and bioaccumulative compounds that are currently monitored or known about were not discussed. The team investigated harbor seal blubber samples and compared the results from GCxGC Time of Flight analysis with a NIST library of contaminant spectra. At each of the six sites investigated, between 15 and 35 "non traditional" contaminants were detected (e.g., not DDT, PCBs, PAHs, etc.). Of these, six to ten from each sample were not

identified in the NIST library. The new compounds were generally chlorinated, fluorinated, pesticides, or miscellaneous. Derek Muir pointed out the uses of some of the compounds that John Kucklick and his team identified (e.g., dichlorodiphenyl sulfone is a plasticizer intermediate). The next steps for the project are to verify the unknown compounds, run halogen filters, complete the written summary report, and then proceed to analyzing seal blood and liver as well as mussel tissue.

Eva Agus asked about the home range of the seals, to gauge the site specificity of the data. Denise Greig indicated that the seals tend to move within a 100 km radius, but do spend more time at their haul-out sites. The seals collected for this study were all stranded, but not necessarily sick. Jennifer Field asked if the group would use QTOF to look at polar compounds, but John Kucklick indicated that they will not have the capacity to run those analyses.

David Sedlak asked if the analysis provided any sort of relative concentration. John Kucklick indicated that it is difficult, but they would make every effort to quantify, even roughly, the identified compounds. Keith Maruya asked if any of the DDE metabolites were detected, and John Kucklick noted that all of the samples contained DDE. Meg Sedlak noted that the RMP may follow up with additional special studies on specific compounds identified as part of this work.

4) Monitoring Strategies for CECs in California's Aquatic Ecosytems

Keith Maruya presented the recommendations from the Statewide Advisory Panel for monitoring CECs in receiving waters. As well as identifying an initial list of recommended CECs to monitor, the group developed a framework for monitoring CECs and assessing the data. He noted that the "on ramp" for CECs to monitor is still unclear, as contaminants can only be added to the list if a minimum of occurrence and effects data exists. How to decide when to generate this initial data is not standardized, and the RMP may serve a crucial role in this "on ramp". In response to a question, Keith Maruya noted that fipronil was removed from the final list of compounds to monitor as a result of an error in estimating its risk.

5) CEC Synthesis Repot

Susan Klosterhaus presented the recently completed synthesis of CEC data for San Francisco Bay. It builds off of the statewide panel report on CECs in receiving waters (that Keith Maruya just discussed), and compares information from San Francisco Bay with the recommendations from the panel, placing compounds into five tiers. Tier V, "Very High Concern", represents compounds with a high probability of high or moderate risk to the ecosystem. Tier I, "Low Concern", represents compounds with a high probability of no effects on Bay wildlife. The other intermediate tiers generally denote gradations between these extremes, except Tier II, "Unknown Concern", which denotes compounds with high uncertainty in the level of effect on Bay wildlife. The report places the compounds that have been analyzed (even if they were not detected) or modeled in the Bay into one of these five tiers. Susan Klosterhaus asked the workgroup to comment on whether the categories were appropriately defined, whether the contaminants were accurately assigned to tiers, and if there are other data sets that were not included. She noted that the contaminant category assignments are intended to be reevaluated periodically. The

workgroup members were invited to verbally comment at the meeting, or provide written comments by May 30th.

Tier V: Pyrethroids

Tier IV: PFOS and Fipronil
Keith Maruya suggested that there may not be enough fipronil data to merit inclusion in Tier IV, suggesting that it be assigned to Tier II. Susan Klosterhaus mentioned that a fipronil pilot study was approved by the ECWG in 2009, however the SC decided not to fund it because data would soon be available from a fipronil study in the watersheds. She will look into locating these data.

Tier III: PBDEs and Nonylphenols
Susan Klosterhaus noted that use for both PBDEs and nonylphenols is likely declining. June-Soo Park suggested that use declining may not be a relevant parameter for categorization, because ambient sediment, water, or tissue concentrations may not decline with use.

Tier II: DEHP, butylbenzyl phthalate, other Br and Cl flame retardants, PFCs (except PFOS), short chain Cl paraffins, other pesticides, single-walled carbon nanotubes, bisphenol A
Naomi Feger noted that other pesticides are detected in Suisun Bay and the Delta, and that they should be considered for future monitoring in the Bay. She will track down the information from USGS monitoring of CECs, and pass it along to Susan Klosterhaus for inclusion in the synthesis. Jennifer Field noted that while the carbon nanotubes method development is still in progress, they may be worth monitoring because of their potential use in Silicon Valley applications. Karin North indicated that she would follow up with Lee Ferguson about providing samples for carbon nanotube analysis. David Sedlak noted that there are data sets of current use pesticides in agricultural and highway runoff from Caltrans and the Cal aqueduct. He will pass this information along to Susan Klosterhaus.

Tier I: PPCPs, HBCD, triphenylphosphate, chlorpyrifos, galaxolide
Karin North suggested that the risk of estrogenic compounds is still unknown, and that they should be included in Tier II, rather than lumped with PPCPs in Tier I. June-Soo Park noted that mussel tissue is not a good matrix for detection of triclosan. It should be analyzed in blood or blubber.

In relation to the State Panel report, Susan Klosterhaus noted that the RMP is currently in phases 3 and 4 of the monitoring approach, that is, in the process of reassessing monitoring efforts and developing action plans. For most of the recommended compounds for monitoring, the Bay already has data, although it lacks information on hormones. Following this meeting, the RMP will begin to develop a strategy for CECs in the Bay, which will include targeted monitoring and non-targeted screening, and take into account the recommendations from the state panel.

Michael Fry asked if other water bodies are synthesizing information in this manner. Keith Maruya noted that the Great Lakes does have information of this sort, but not many other places do. Ian Wren asked if there would be a formal schedule for revisiting the contaminant classifications, and Susan Klosterhaus indicated that this would be part of the CEC strategy.

Regarding the tier framework, Karin North suggested that the tiers indicate increasing monitoring priority, rather than management priority. David Sedlak noted that these are two different needs, for example pyrethroids are not a monitoring priority because their concentrations are well understood, but they may be a management priority. Jennifer Field suggested splitting up the table to denote these two different needs. David Sedlak also suggested combining Tiers I and II, into one tier denoting compounds of "low or unknown concern". This would introduce an element of uncertainty into the compounds of low concern, and reinforce the mobility of contaminants to move between tiers as more information is known.

Action Items:

- Workgroup members to provide written comments on the CEC synthesis by May 30th.
- Locate data from the fipronil in urban creeks study.
- Locate data from pesticide monitoring in Suisun Bay and the Delta.
- David Sedlak to pass along information on current use pesticides in agricultural and highway runoff from Caltrans and the Cal aqueduct to Susan Klosterhaus.
- Karin North to speak with Lee Ferguson about providing samples from the City of Palo Alto for carbon nanotube analysis.
- Make adjustments to tiers and contaminant classifications as recommended by the workgroup.

6) Siloxanes

Derek Muir presented information on the presence of volatile methyl siloxanes in environmental samples, and new developments in analytical methods. Interest in these compounds is developing worldwide because of their toxicity (some are endocrine disrupters) in mammals, their hydrophobicity and ability to bioaccumulate, and their extremely high volume use throughout the world. They have been detected in very high concentrations in WWTP influent, and in similar concentrations in WWTP effluent as receiving waters in Canada. Because of their ubiquitous use and volatility, it is easy to contaminate samples, so extreme care needs to be taken during sample collection. Derek Muir indicated that the Environment Canada lab may be able to analyze some SF Bay fish, bivalve or surface water samples. Bivalves were considered a great matrix given that the shells frequently close, reducing potential contamination during sample collection and processing.

Action Items:

- Discuss the possibility of analyzing SF Bay samples for siloxanes with Environment Canada.

7) RMP CEC Strategy

Susan Klosterhaus presented a strawman strategy for monitoring CECs in San Francisco Bay. It is aimed at determining what CECs have the potential to adversely impact beneficial uses in San Francisco Bay. There are currently three strategies for selecting compounds as potential CECs to monitor:

1) existing information (known or suspected use, occurrence or toxicity from other locations, best professional judgement)

2) effects-based (bioassays)
3) occurrence-based (non-target analyses, fate modeling)

She discussed the list of "Unmonitored Candidate CECs" for monitoring – compounds that are currently unmonitored, but are under consideration. It currently includes siloxanes, quaternary ammonia compounds, nanomaterials, estrone, 17-β estradiol, and bisphenol A.

Susan Klosterhaus also addressed the high priority CECs, as identified by the RMP CEC synthesis and the Advisory Panel recommendations. She noted that pyrethroids have been monitored in sediment as part of the RMP Status and Trends since 2008, and she recommended continued sediment monitoring, and expansion to surface water monitoring if the methods become available. Consideration of Current Use Pesticides (CUP) should include others such as fipronil, bifenthrin, permethrin, and chlorpyrifos. David Sedlak suggested that CUP monitoring should be undertaken with an eye towards sesasonal influences. Because they are used primarily in agriculture, there is often a large springtime loading with freshwater runoff, so sampling should not necessarily occur during the summertime water cruise. Jennifer Field noted that USGS is currently prioritizing CUPs, and suggested that the RMP consider consulting with them on this process. Regarding fipronil in particular, Susan Klosterhaus suggested monitoring in surface water and sediments. Tom Mumley noted that the Regional Water Board is working with the Department of Pesticide Regulation, and that there is ongoing monitoring for fipronil in urban creeks. The RMP should hold a focus meeting with other groups who are working on fipronil to get up to date about the current research and consider opportunities for collaboration.

Regarding bisphenol A (BPA), Keith Maruya noted that it was included on the list of compounds recommended by the State Panel because of one very high concentration detected in stormwater. Susan Klosterhaus indicated she would follow up with Keith Maruya to determine where this sample came from, and if it has any bearing on the Bay. She recommended monitoring for BPA only if the commercial analytical methods develop lower detection limits. Karin North offered Palo Alto effluent samples for BPA analysis if the group is looking for South Bay samples.

Jay Davis noted that PFOS and other PFCs will be monitored in sportfish during the 2014 sampling. David Sedlak noted that why PFCs are detected at such high concentrations at the top trophic positions is still unknown, and is a large outstanding question. He suggested putting more energy into understanding food web dynamics, as it will help managers determine whether or not they can affect the concentrations currently detected in biota. Meg Sedlak noted that a 2012 pilot study is looking again at the food web and comparing bird eggs, small fish, and seal concentrations. Denise Greig suggested that all matrices should be investigated together: water, sediments, small fish, birds, and seals, to more firmly establish the foodweb linkage. Meg Sedlak suggested that such a proposal be developed for 2014, after the data from the 2012 study are available. Jennifer Field noted that PFOS is still in the market and there are still allowable urban and industrial sources, despite a voluntary phasing out of production. She noted that AXYS is now offering analyses of the fluorotelomer alcohol precursors.

Michael Fry suggested that metals, such as gallium or palladium, could be considered for monitoring as CECs. Jennifer Field added that nanosilver methods are also coming online.

As a follow up to the discussion of the non-target screening project, Meg Sedlak indicated that John Kucklick would have a list of potential CECs to monitor, based on occurrence in seal blubber, in December. John Kucklick noted that there is not much literature on the toxicity of these compounds. June-Soo Park suggested that he partner with John Kucklick to conduct non-target screenings of human lipid samples.

The group generally agreed that the strategy for identifying potential CECs for monitoring (best professional judgment, effects information, or occurrence information) was acceptable and appropriate. They agreed to be kept up to date on compounds that the RMP is considering for monitoring. Meg Sedlak indicated that the CEC strategy would be prepared during the summer of 2012, incorporating comments from this meeting. Keith Maruya asked that it include a specific "on ramp" strategy for adding compounds to the monitoring list.

David Sedlak indicated that the strategy was well done. On a broader level, he asked if the ECWG can consider how changes in WWTP strategies will affect the Bay as a whole, and how changes in the Bay (such as climate change) will affect contaminant fate. He suggested that the ECWG have a chance to give input to some of the WWTPs as they consider long range planning for WWTP upgrades.

Action Items:

- Consult with USGS about their prioritization process for CUPs.
- Hold a focus meeting with other groups working on fipronil to discuss potential for collaboration.
- Follow up with Keith Maruya to determine the source of the high BPA stormwater data.
- John Kucklick and June-Soo Park will consider partnering to perform non-target analyses of human lipid samples.

8) Pilot and Special Studies for 2013

Susan Klosterhaus presented the PBDE summary report proposal for 2013. The report will summarize 10 years of occurrence data, compare it to available toxicity data, and present a short summary of work on PBDE replacements. James Downing (and Arleen Feng the day before) indicated that this summary will be useful for fulfilling permit requirements as part of the MRP. The project would cost $35,000 in 2013.

Susan Klosterhaus also proposed a focus meeting on current use pesticides, to identify CUPs of concern in the Bay. It would bring together experts such as Kelly Moran, Susan Kegley, and Kathy Kuivila to review available use, fate and toxicity information. The outcomes of this meeting would be used to inform the RMP S&T water sampling (2013) and sediment sampling (2014). It would cost $15,000 in 2013.

A sum of $20,000 per year, starting in 2013, was requested to maintain the CEC strategy and advise the RMP about new information regarding CECs. This project would not entail attending meetings or presenting RMP data, but rather the funding would be used to keep the program as a whole abreast of the newest findings and information.

The Bioanalytical Tools study would be a two-year study requiring $63,000 per year in 2013 and 2014. This study was discussed fully at the May 15th meeting, and will be considered further by the TRC and SC.

9) Closed Door Session

The stakeholders and panel members discussed their support of the proposed special studies:

1) 2013 Bioanalytical tools
2) Annual CEC strategy maintenance and new information tracking
3) Current Use Pesticides focus group
4) PBDE summary report

1) 2013 Bioanalytical Tools

Meg Sedlak noted that this topic was discussed at the May 15th meeting, and the comments and recommendations from that meeting will be brought forward to the TRC and SC.

2) Annual CEC Strategy Maintenance and New Information Tracking

The group supported allocating $20,000 to tracking new information on CEC toxicity and fate, advising the RMP, and updating the CEC strategy. It was noted that a lot of new CEC information comes from grey literature, such as monitoring programs in the Baltic Sea, and it is not trivial to stray abreast of these developments. Susan Klosterhaus will put together a more detailed proposal to move forward to the TRC and SC.

3) CUP Focus Group

The group discussed the current ties between the Water Board and organizations working with pesticides. Kelly Moran is under contract with the Water Board to keep them up to date regarding pesticide work in urban areas. One panel member pointed out that the goal is to determine how much of an issue CUPs may be for the Bay. Given that, this funding may be better allocated towards making connections with pesticide experts and organizations and getting up to date on CUPs in the Bay, rather than holding a meeting. Meg Sedlak and Susan Klosterhaus suggested that a desirable outcome would be to have a prioritized list of CUPs of interest that includes recommendations and comments from Susan Kegley and Kelly Moran. The group agreed to support $15,000 towards a 2013 study to get up to date on CUPs. Susan Klosterhaus will put together a more detailed proposal to move forward to the TRC and SC.

4) PBDE Summary Report

The group discussed the need for a PBDE summary report and synthesis, including developing a repository for 10 years of PBDE data, summarizing work on one of the first compounds added to the RMP S&T program, and acquiring context for future work. The group approved of the study as proposed.

Other Comments

One panel member noted his enthusiasm for following up John Kucklick's work on non-target screening. He emphasized that some degree of quantification is necessary for following up, however, as a single "occurrence" should not be sufficient.

The group agreed to pursue a collaboration on siloxane analyses with Environment Canada. The RMP will look into sending Derek Muir whole mussel samples. Since they come contained in a shell, there is less possibility for contamination through sampling or handling.

Jennifer Field offered to perform analyses of Bay water samples for new fluorochemicals.

Thinking Big
Regarding Jay Davis' request that the panel members "Think Big", one panel member indicated that the Bioanalytical Tools study is an example of this. Another panel member suggested that reducing water and sediment sampling to every other year is perhaps a mistake, as changes in status of CECs may happen at a shorter time scale that could be missed under this regime. Another panel member suggested that the meeting as organized did not facilitate this type of thinking. He suggested holding a pre-meeting brainstorming session to bring forth big ideas.

Action Items:

- Send mussel samples to Derek Muir for siloxane analyses.
- Collaborate with Jennifer Field to analyze Bay water samples for fluorochemicals.
- Consider holding a pre-meeting brainstorming session with panel members to facilitate "thinking big".