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Contaminant Fate Workgroup Meeting
April 15, 2005
Meeting Minutes

Attendees: Bryan Bemis (AMS), Mike Connor (SFEI), Jay Davis (SFEI), Ben Greenfield (SFEI), Frank Gobas (SFU), Andy Gunther (AMS), Fred Hetzel (SFRWQCB), Jim Hunt (UC-Berkeley), Beth Lamoureux (QEA), Richard Looker (SFRWQCB), Randy McAlister (General Electric Corporation), Tom McKone (UC-Berkeley, LBNL), Aroon Melawani (SFEI), Tom Mumley (SFRWQCB) Bill Mills (Tetra Tech), Trish Mulvey (SFEI Board), John Oram (SFEI), Meg Sedlak (SFEI), Chris Sommers (BASMA), Keith Stolzenbach (UCLA), Don Yee (SFEI)

Introduction and Review of Agenda

Meg Sedlak opened the meeting with a brief explanation of the day's agenda. Introductions were made.

Review of the Multi-box Model

Jay Davis explained that the Multi-box model is part of a larger five-year collaborative effort between the CEP and the RMP to understand the fate and transport of pollutants in the Bay. Dr. Davis presented a schedule of work products for the two programs and how the efforts were integrated. The major tasks for this project include:

- Task 1 Documenting the USGS Model
  - Draft report should be completed shortly
- Task 2 Improving the Graphical Output
- Task 3 Independent Evaluation of the Model
  - Tetra Tech has begun verifying the model and will conduct uncertainty analyses
- Task 4 Fieldwork
  - A draft sampling plan will be prepared based on CFWG input
- Task 5 Apply model to other pollutants
  - Mercury is proposed as the next pollutant to be modeled.

Jay Davis presented the current status of the Multi-box model. Version 1.0 was released in February but has since become obsolete due to improvements in the model as a result of revisions in the USGS sediment model. This improved model will be sent to Tetra Tech for uncertainty analyses. Jay Davis stated that the Multi-box model was to some

extent a "moving target" because improvements that the USGS makes to its sediment transport model will require updates to the Multi-box model. However, Jay indicated that further significant changes to the USGS model are not anticipated. Mr. Mumley indicated that the impetus for improvement of the USGS model was due to the South Bay Salt Pond Restoration Program.

John Oram delved into a very detailed presentation of the model, both version 1.0 that was released in February and the newer model that incorporates the improved USGS sedimentation model (Version 2.0b). Dr. Oram stated that the model is based upon the Uncles and Peterson salinity model, the USGS model and an SFEI PCB transport model. The Multibox model divides the estuary into 50 boxes with two layers (surface 5 meters, and 5m to the bottom of channel). Tom Mumley commented that 5-m depth is too great considering the average depth in the Bay is approximately two meters (six to seven feet). John Oram commented that with the new model (Version 2.0b), the depth of each box is no longer static and sedimentation does occur which affects the velocity and shear forces in the box.

Dr. Oram reviewed how the model (Version 1.0) was developed. A discussion of the use of the PCB data (Breivik et. al. (2001)) in the model ensued. Several members felt that there was too little data in the Breivik article and that it was (inter)national, not region-specific data. John Oram acknowledged this and stated that one of the purposes of the proposed sampling plan was to fill this data gap. Drs. Gobas and McKone suggested incorporating the any available sediment core data (the Bay Bridge project was suggested as one possible source of core data) into the model. Mike Connor suggested looking at another pollutant with similar properties (e.g., DDT) to determine whether the model was able to predict sediment concentrations with some degree of certainty. It was agreed that additional data or methods are needed to assist in the calibration of the model.

Dr. Oram noted that the model had pretty good agreement with one of the USGS cores from Richardson's Bay as well as good agreement with the surficial sediment data from EMAP and the RMP.

The workgroup members discussed the sediment loading to the model. Fred Hetzel indicated that one of the reasons why the USGS had revised its sediment model was that the model substantialy over-estimated the amount of sediment deposited in the South Bay. Tom McKone commented that one way to corroborate the USGS sediment model would be to review data from the Soil Conservation Society which estimates the amount of soil lost by region. Dr. Davis noted that the latest Pulse article had a sediment budget prepared by USGS and approximately 2.3 mmtons/yr are lost from the Bay.

John Oram presented a summary of reviewer comments, many of which have been addressed in the new version of the Multi-box model. One reviewer commented on appropriateness of the degradation rate used in the model (rate is from Gobas model). The degradation rate used in the model is 56 years, which is an estimate of one congener 118. The model is relatively sensitive to the degradation rate assumed. Because the physical/chemical properties of the congeners vary substantial and it is anticipated that

the degradation rates would vary dramatically by congener. Richard Looker suggested using SARs to estimate degradation rates for every congener. Jay Davis requested input from the workgroup on obtaining a better method for characterizing degradation in the model.

A second comment made by the reviewers was that the model should incorporate Koc rather than Kow. Version 2.0b uses Koc based on an average organic carbon content for each Bay segment. Elizabeth Lamourex stated that GE's model in the Hudson River had developed and incorporated an in situ Koc from sediment/water data. SFEI will investigate whether using an insitu Koc for the multibox model is appropriate.

Chris Sommers requested a list of comments on the Multi-box Model version 1.0 and how they had been addressed. John Oram agreed to compile/summaraize and address reviewer comments and distribute to interested parties.

Dr. Gobas questioned why the model needed to have 50 boxes when the information would likely be aggregated for use in the Food Web Model. Several researchers commented that it was easier to check the model on a smaller scale and then if the model performed appropriately, aggregate the results.

Jim Hunt noted that it appeared that in forecast mode, the model comes into a steady state mode in 2060 and that perhaps the model should be started sooner (i.e., the model figures presented suggested that this is an initial condition problem). Dr. Stolzenbach questioned why the model predicted that the Bay was depositional (e.g., what were the reasons for this) and why wasn't steady state achieved years ago? Jay Davis indicated that due to ground water withdrawal there has been ground water subsidence in the South Bay that would result in a depositional environment. Jim Hunt commented that the subsidence was not as great as the model predicted (i.e., model predicted 4 meters of deposition; Alviso slough in the South Bay has subsided approximately 2.5 to 3 m).

Tom McKone suggested using the one-box model to ascertain the validity of the multi-box model. Jay Davis indicated that the one-box model does not currently have attenuation or any loading factors for tributaries. Andy Gunther noted that such factors as loading attenuation and tidal exchange can be incorporated in the one box model. Tom McKone suggested looking into the EPA CREM (Committee on Environmental Models) to ensure the discussions of model calibration/ validation/ verification were described accurately.

Bill Mills of Tetra Tech presented a brief summary of the activities planned for the uncertainty testing of the Multi-box model. Tetra Tech has just received the updated model (v2.0b) and will recompile the program and then conduct uncertainty analyses using Tree-Structured Density Equations. It is anticipated that this work will be completed in 10 weeks. The workgroup requested that before Tetra Tech begins the uncertainty analyses that a list of parameters to be characterized be provided to them. Andy Gunther indicated that the purpose of having Tetra Tech verify the model was to assure that the model is coded properly and can be run on a variety of systems (Linux,

Windows, etc.). In addition, Tetra Tech will provide a list of parameters that are most influential on the model.

Gobas Food Web Model

Frank Gobas gave a brief presentation of the Food Web Model that his group had developed for the CEP. The model relates concentrations in sediment to concentrations in biota by generating a biota sediment accumulation factor (BSAF) from chemical properties and food web structure.

A discussion ensued regarding the use of sediment concentrations (e.g., the location, the number of samples to use, whether to use average or 95 percentile concentrations, etc). Dr. Gobas indicated that the estimated BSAFs for San Francisco Bay are consistent with BSAFs estimated for other similar environments.

Beth L expressed concern that BSAFs develeped from data in water sediment and biota from one area would be used to model expected concentrations in others. Dr. Gobas noted that the BSAFs were not derived from any site specific data. Rather, the BSAFs were derived from chemical properties and used to model anticipated biota concentrations based on sediment (and water) concentrations at a location.

Ben Greenfield commented that his SFEI project, developing Sediment Quality Objectives for the State of California, was also determining (empirical) BSAFs and that there was a potential for comparison between the two projects. Mike Connor indicated that some species had good correlation with the sediment data (e.g., shiner surf perch); others did not (e.g., croaker).

Dr. Gobas will provide a report to the CEP on the model. Workgroup members requested that next steps be identified in the report.

Draft Sediment Sampling Plan

Don Yee gave a presentation on the proposed collection of sediment cores for the summer 2005. Dr. Yee discussed some of the impetuses for the sampling: to better understand of the parameters used in the Multi-box model, to better understand sources of pollution, and to better understand whether management actions are effective.

One of the major issues to be resolved with the 2005 sediment sampling plan was whether cores should be collected using random or stratified sampling plan. Under the random sampling plan, the location of sampling sites would be evenly distributed throughout the Bay. After collection of the samples, the type of regime (erosional, depositional, etc.) would be determined. Under the stratified sampling, an area would be identified a priori and the sample would be used to verify the condition. Dr. Yee noted that within boxes of the model, it is possible to have all three regimes present (e.g., erosional, depostional, or static). Dr Yee proposed that 10 cores be collected each year over a two-year period.

Dr. Stolzenbach recommended that the sampling plan be designed for the long term, even though at present it is only funded for two years. He commented that the Santa Monica and San Pedro Bays have been monitored for several decades by the Department of Sanitation and that having a long-term data set is very useful. Tom Mumley also concurred.

Dr Yee then began to discuss some of the parameters in the model for which sampling data might be obtained to reduce the uncertainties. Dr. Yee discussed erosivity, mixing depth and contaminant profile. Dr. Hunt indicated that his group had collected three cores from Alameda Seaplane Lagoon and had frozen the cores to be segmented and analyzed later. While freezing was not optimum, it preserved the samples so that they could be analyzed at a later date when additional information had been obtained regarding stratigraphy of the core. Dr. Hunt also recommended looking at burrow pits in the Bay as they contain information on deposition in the Bay (e.g., Bay Farm Island). Dr. Yee noted that in consultations with Oram and Schoellhamer that all had concluded erosivity was not an important component to measure, in part because it is difficult to relate lab derived measurments of this parameter to long term field behavior. The workgroup concurred.

With regard to mixing depth, Dr. Yee suggested using isotopes such as lead 210,ceseium 137, or iridium. Iridium was released by the USACE in 1974 as part of a large-scale tracer test in the Bay. Dr. Hunt commented that the concentrations were no longer high enough in open areas of the Bay to be able to use this isotope, but quiet depositional areas like Seaplane Lagoon at Alameda Naval Air Station could have some deposits.

A good understanding of the contaminant profile is necessary for verifying the model and understanding exposure. Don Yee proposed looking at the three regimes – South Bay would be depositional; Central Bay would be static, and North Bay would be erosional. In year one, South and Central Bay would be sampled; in year two, North and Central Bay would be sampled. Six sites would be sampled per strata for a total of nine cores each year. It was recommended that the work by Jaffe be used to identify depositional, erosional, and static areas to collect the samples.

There was some concern about how depositional and erosional conditions would be identified and whether this regime would remain constant over time (e.g., it is possible that an area was erosional then depositional or vice versa). Don Yee suggested that the entire Bay could be split into 3 bins of similar areas by selecting a suitably large range around the no net deposition ("static") stratum, given the uncertainties in the past and current depositional histories. The bathymetric data in most Bay segments is old; the last surveys was conducted approximately 15 years ago.

Through further discussion the WG consensus on the best approach evolved toward a hybrid of stratified and random sampling approaches. Relatively few samples taken from well defined depositional areas could be used to verify loading histories to verify

the general trends indicated by Breivik, whereas more randomized sampling within loosely defined strata could be used to characterize general system behavior.

Various WG members suggested dividing cores as finely as practicable based on the analytical laboratory needs for sufficient sample mass. Rather than composites of 10cm intervals for example, 2 cm slices would be taken every 10cm to analyze (for PCBs, tracer isotopes, metals, etc). Non destructive screening analyses (e.g. XRF?) were also suggested as ways to identify best areas for further analyses. An approach of analyzing a small section midway down a core (~50cm in a 1m core) could at least narrow down the region of interest for further analysis in many of the cores.

Conclusions and Action Items

The following action items were identified:

Multi-box Model

- Consider incorporating the availble core data into verifying the and Brevik loading and attenuation assumptions of the model
- Consider validating the model using a second contaminant such as DDT
- Consider using a threshold concentration for degradation, below which degradation does not occur.
- Consider use of congener specific data or data on homologues
    - Review the Dioxin Reassessment Report by USEPA to determine whether similar techniques could be applied to the multi-box model
- Consider developing site-specific Kocs – the California Sediment Quality objectives effort or other regional data could be used?
- Provide workgroup with reviewer's comments and how each comment was addressed.

Uncertainty Analyses

- Revise program and recompile so that the model can run on Windows (it currently runs on Linux).
- Provide the workgroup with a list of parameters that will be used in the Tree Structured Density Equation. Solicit input from the workgroup on these.

Food Web Model

- Gobas to provide a report that will outline the next steps to be taken.

Sampling Plan

- Don Yee to provide the workgroup with revised draft sampling plan.

The workgroup adjourned at approximately 3:30 pm.