RMP Contaminant Fate Workgroup
10/30/06 Meeting Minutes

Attendees
Jay Davis (SFEI), John Oram (SFEI), Chris Sommers (BASMA), Joel Baker (Univ of Maryland), Bryce Johnson (UCB), Mike Connor (SFEI), Tom Mumley (SFRWQCB), Tom Grieb (TetraTech), Bill Mills (TetraTech), Frank Gobas (SFU), Toby Garfield (SFSU), Ben Greenfield (SFEI), Chris Werme (Consultant), Dave Schoellhamer (USGS), Andy Gunther (AMS), Trish Mulvey (SFEI Board), Don Yee (SFEI), Meg Sedlak (SFEI)

Items 1 and 2: Introduction and Review of Agenda, Review of September 2005 Meeting
Jay Davis opened the meeting with a brief explanation of the day's agenda and a review of the September 2005 meeting. Introductions were made.

Item 3: Review of Reports and Progress on Multi-Box PCB Model
John Oram presented the model documentation report (v2.0b) written February 2006 (updated March, 23 2006). The document includes both narrative and mathematical representations of all key physical and chemical processes of the PCB model. Salinity and sediment transport models were not documented in this report, as they are (or will be) documented elsewhere.

The report was written to document the current state of the PCB model so that Tetra Tech could proceed with uncertainty analysis. It includes an appendix that explicitly addresses review comments made on the model draft report issued February 2005 and preliminary findings of Tetra Tech's independent testing.

Also included in the model documentation is a discussion of model calibration. The model was calibrated in early 2006 to improve the hindcast predictions of PCBs in water and sediment. Three key parameters were altered to improve results: 1) spatial distribution of loads from local watersheds was adjusted using % industrial landcover as a proxy, 2) the magnitude of PCB loads from local tributaries was reduced to 20 kg/yr, and 3) the rating curve used to calculate PCB loads at Mallard Island was changed to a log form. Calibrated results were documented in the report. Forecast predictions were not included in the model documentation report.

Question to WG: *Is model documentation adequate and technically sound?*

Frank Gobas – documentation is quite good. Sediment mass balance seems reasonable, but sediment model needs to be similarly documented.

Andy Gunther – CEP appropriated $40k for USGS (D. Schoellhamer) to document sediment transport model. Unable to find contracting mechanism. Still working on getting the funds transferred to USGS.

Tom Mumley – Do they have to wait for cash in hand?

RMP Contaminant Fate Workgroup
10/30/06 Meeting Minutes

Joel Baker – good description of modeled processes. Calibration seems reasonable. Water column calibration is improved, but could be better. How good do we want the water column to be? PCBs are in sediments, but action is in water. Concerned that we get sediment right and water wrong. And there is a spatial pattern to this disconnect (figure 15). Water concentrations are important for food web modeling.

Don Yee – Timescales different for field data and model output.

Frank Gobas – could include disequilibrium between water/particles. Water and particles are rarely in equilibrium. Use observed Koc.

Joel Baker – total PCBs a good start. Maybe now calibrate to penta congeners and scale up.

Frank Gobas – SF Bay is so data rich that it can be done.

Joel Baker – run model for one homologue group and calibrate. Delaware model used penta and scaled to sum of PCBs.

Chris Sommers – A question for managers is how good do we need this to be? Should we move in congener direction? Merits more discussion. Should note that there is not a lot of faith in original estimates of external loads from tribs.

Tom Greib – How did we use Guadalupe River PCB data?

John Oram – Guadalupe River data were scaled to represent the load from all local tribs bay-wide based on watershed area and population.

Bill Mills then gave a presentation on Tetra Tech's uncertainty analysis of the PCB model. Presentation began with a discussion of performance indices and performance criteria used for testing. 16 performance indices were for PCBs, 9 were for sediments (see document in meeting agenda package for specifics). 10,000 model runs were executed and analyzed. Of these, using the PCB-based criteria, 389 were able to beat the 'gold standard' (i.e., the calibrated results).

Joel Baker – Comparison of model predicted Kd to observed Kd would be good to check.

Frank Gobas – Regarding the high correlation between Kow and OC content of suspended sediment. Model uses product of these two, hence the high correlation with performance in the model runs.

John Oram then presented plans for completion of draft/final reports. Some preliminary forecast results were shown. Results were not as sensitive to changes in tributary loads as previous forecasts. The same could be true for attenuation – this needs to be investigated further. John acknowledged forecast results are preliminary and will be revisited.

John Oram - Would like to be able to put error bars on forecast. *What is the best way to do this? Use all 10,000 runs? Use subset?*

Group suggested that an outline of the draft/final report be circulated. Include table of potential management scenarios.

Jay Davis – Would like to receive workgroup comments on the Tetra Tech report and outline for final report. Suggest **4 weeks** for review.

Frank Gobas – Uncertainty of model calculations is an important product.

Chris Sommers – does model need tweaking? More field data?

Bill Mills – Sediment model is a big question. Were unable to test completely. Changing sediment parameters too much led to mass balance errors. What about reduction in future sediment loads?

Joel Baker – Internal processes drive model. Contaminated sediments came is, now clean sediment supply is cut off. Future depends on erosion and depth profile of PCBs. Should calibrate model to cores.

Frank Gobas / Joel Baker – PCB model produces reasonable output. Fits surface data and cores pretty well.

Jay Davis – The final report should evaluate forecast sensitivity to depth profiles.

Tom Mumley – how this plays out for decision making is still a question. TMDL uses the one-box model. There remains a large degree of uncertainty associated with urban runoff loads. Still, significant reductions called for. Based on preliminary forecast results seen here, why? Politically, no action won't sell. What observations should we be making so we can make call in 5 years regarding the effectiveness of management action?

Chris Sommers – conceptual model is important. Where are PCBs? What should we do? Not sold that Bay-wide model will really detect improvements. Smaller spatial scale may be more appropriate. The present model is really not a watershed model for inputs. Doen't help in focus on particular watersheds. Cannot handle hot-spot strategy.

Andy Gunther – what is the impact of large instantaneous release (spill from a barrel)? This scenario should be examined in the final report.

RMP Contaminant Fate Workgroup
10/30/06 Meeting Minutes

Lunchtime Presentation by Bryce Johnson on Estuarine Sediment Core Analysis

Bryce Johnson (UCB) presented his research analyzing sediment cores from the Alameda Naval Air Station (Sea Plane Lagoon). Cs(137), Ra(226), Cu, and Zn profiling was performed on cores . 2D maps of contaminant accumulation were constructed and used to estimate annual rates of release. Contaminants didn't move very far from source.

Sediment Coring Study Update

Don Yee presented preliminary results of a sediment coring project in SF Bay. Cores were sampled in May and July 2006. Still planning on taking wetland cores. Some issues arose during sampling: core compression, sediment resuspension. A few samples were sectioned at 2.5cm and analyzed. No clear pattern of sedimentation.

Bryce Johnson – should plot DPM/g sed for Th and compare to Fuller.

Dave Schoellhamer – will you doing model like Fuller did? Recommend you do so. Would help decide where to cut cores.

RMP Remote Sensing Pilot Study

John Oram presented information on a recently funded pilot project to use remote sensing to characterize the even-scale sediment transport patterns in the Bay. The project aims to combine moderate resolution (250m) multi-spectral satellite imagery with field observations to estimate the fraction of sediment entering the Bay from the Delta that is exported within a few tidal cycles to the ocean.

Toby Garfiled (SFSU Romberg Tiburon Center) offered use of the RTC pier and instrumentation for this project. RTC, and Mitch Craig (CSEB) have optical sensors that could be useful for calibrated remotely sensed data.

Tom Greib – How about India's satellite? Buzz Bernstein? See Raf Kudella UCSC website.

Frank Gobas – How does this help the PCB model?

John Oram – This won't specifically feed the PCB model. Will help understand event-scale contaminant loads.

Should contact Willie Lich (UCSB) – expert on this topic.

Dave Schoelhamer – need to know date and tidal stage (time). How about variations with depth? Concentration increases with depth, generally. Also must consider reversing bottom flows. Can maybe couple with models of flow, or USGS/RMP sites.

PBDE Conceptual / One-Box Model

John Oram presented a draft of the PBDE conceptual model currently under development by SFEI and the CEP. Preliminary results indicate PBDEs might be nearing steady-state levels in Bay water and sediment. Loads are 10x PCB loads. However, sediment mass is on the order of 100-200kg. PCB mass is ~2500kg. Faster degradation of PBDEs seems to be the influential factor.

Questions to workgroup – *Do you believe the degradation rates?How about other parameters? Do you believe quick response time?*

Joel Baker – there may be more recent info on degradation rates. 209 degrades to 47. No one has done this for PBDEs yet. There is a temptation to model like PCBs, but can't do PBDEs as one congener. 10 years ago all penta, then rapid shift to 209 (deca). See virtually no BDE-47 in Chesapeake. Homologues have different production histories. BDE-47 is thought to burn off pretty quickly. No one knows BDE-209 inputs in Chesapeake. These are strange compounds. 10^{10} Kow = 'past the hockey stick'. Break down to lower brominated congeners. POTWs don't see BDE-47 anymore. 5-6 ppm BDE-209 in tribs. Two totally different pollutants, similar to DDTs. Don't have BDE-209 degradation rates. There is an ES&T paper on marine sediment, but don't know if it was in the same range of sediment types. Haven't seen good analysis of how BDE-209 gets into polar bears.

Frank Gobas – PBDE model for Georgia Basin, degradation must be coupled with formation/transformation to lower brominated congeners. Huge challenge.

CFWG 5 Year Plan

Jay Davis began a discussion of the CFWG 5 year plan being developed. This topic will be discussed in detail at the next CFWG meeting. For the past two years we have been operating under a joint RMP-CEP multi-year plan. A plan for the next few years needs to be developed. Potential elements of the 5 year plan include:

1. Further refinement of the multibox model for PCBs
    a. Improving the model
    b. Obtaining additional data on key parameters
2. Application of the model to other pollutants (e.g., total mercury, selenium, DDTs)
3. Additional coring work
4. Characterizing losses from outflow
    a. Remote sensing for short time scales (events)
    b. Addressing longer time scales is a challenge

5. Characterizing losses from degradation – this is an important loss pathway where we are sorely lacking information.

Jay then solicited input from workgroup.

Andy Gunther – How good is this model? What are realistic targets for measuring/modeling use in decision making? Very difficult to track impact of management actions on storm runoff. Need to understand why model is doing what it is doing. Important to understand sediment model.

Tom Mumley – (sent via email the following day) Thinking about how we characterize runoff and wastewater loading in the model and how that affects model predictions, Tetra Tech's analysis only addresses the average magnitude of runoff loads. My main concern is that we shouldn't continue to spend time on the PCBs model or generate other pollutant models until we are satisfied with the integrity (validity) of the sediment transport model.

Tom Mumley – drivers of interest are:

Hg - Improve understanding of fate and transport to build a better TMDL. Use observations, empirical and mechanistic models (mass balance and food web).

PCBs – mass balance and food web models used in TMDL. Focus on terrestrial hot-spots.

Se – short term challenge building Se TMDL, extremely simple model so far. Can improve mass balance and food web.

PBDEs – set of conceptual models being developed., lots of data gaps and information needs. Keep eyes open to emerging contaminants.

PAHs – maybe on list…

Andy Gunther – Interplay between monitoring and modeling is important. Models help identify the areas we do / don't understand. Modeling and monitoring build on each other and improve over time. Try to capture this for the TRC – even if we can't build predictive models, they can still have value.

General Comments

Frank Gobas –

Recommends move to smaller spatial scales. This also came up for the food web model. There is also a sampling/monitoring issue where we need more information from the locations where species are residing. Integrate food web models. Also, a sampling/monitoring issue – need more info on where species are. Still surprised that we don't know PCB Kow. Should be able to characterize PCBs better with our dataset. May also look at PBDEs in more detail. Congener specific. Look at broader range of congeners.

Regarding model uncertainty analysis: not sure we are doing this yet. Tetra Tech work looks more like calibration exercise. Leads to questions we cannot answer. Need to look more at key parameters. Still some uncertainty in key parameters. They

are using some of the right tools, but not sure if the analysis really describes the uncertainty of the model. Sediment mass balance errors are not a good sign.

Joel Baker -

Agrees Tetra Tech testing is more of a calibration exercise than an uncertainty analysis. Describes the uncertainty in parameters more than the uncertainty in the model. Values chosen seem reasonable. Allowing spatial variability of parameters could help. Concerned error of model is not quantified, although can't always assess this.

Frank Gobas –

Focus on certain management questions (eg., time response - Home in on property driving time response).

Joel Baker –

Make sure we understand the forecast load scenarios, initial conditions and boundary conditions.

In situ monitoring – should tie into OOS. But how would this help fate and transport? Are there surrogates for contaminant monitoring? Remote sensing is useful.

Running the multibox model for other contaminants may be illuminating. Maybe DDTs. Could lead to more confidence in model. Great calibration point.

Better sediment transport understanding is needed. Are there other tracers? Other pollutants? One example is PCB 11 in NY Harbor. Vanadium. Special industries may be one source of tracer molecules.

Mike Connor –

How to get small improvements to model? Model Hg or Se?
PBDE loads fit with inventory. What is Chesapeake doing?

Frank Gobas –

Did Hg in Bay of Fundy. Speciation rate is key. NY Harbor model for Hg by Hydroqual ($2.5million) Seems to work pretty well in estuaries.

Tom Mumley –

Constraints in terms of input (load) information. Magnitude and spatial distribution.