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FINAL COMMENTS ON HOUSATONIC RIVER MODEL CALIBRATION

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Questions for Peer Review Panel

1. Are the comparisons of the model predictions with empirical data sufficient to evaluate the capability of the model on the relevant spatial and temporal scales?

Comparisons between model predictions and observations have been made with some apparent success for a relatively short period of time (i.e. several months). In addition, the smallest spatial scale resolved by the model is on the order of the river channel width (i.e. tens of meters). The model seems capable of reproducing observations made during storm events. However, the capability of the model to predict long-term effects (i.e. years) and small-scale processes (i.e. mass transfer at sediment-water interface, bank erosion) remains to be shown. For example, the model should be capable of predicting sediment depositional patterns as well as PCB distribution in Woods Pond over a time period of decades. The data to test the model is already available in the sedimentary record.

2. Is there evidence of bias in the model, as indicated by the distribution of residuals as a function of the independent variables?

The field observations indicate high variability of PCB concentrations over very small spatial scales. The model is incapable of capturing such variability. Thus if the model has a bias, it is toward the "filtering" of the high variability seen in the field. At the same time, it is not clear how much of the observed variability is indeed natural and/or the result of the sampling protocol. What is clear is that the model will not capture such "randomness" and then the question is if this capability is indeed necessary for the intended use of the model.

3. Does the model, as calibrated, based upon your technical judgment, adequately account for the relevant processes affecting PCB fate, transport, and bioaccumulation in the Housatonic River?

Overall, the model does account for all the relevant processes. One exception is stream bank erosion which is currently not explicitly included and could be a major source of PCB. While the mathematical model does account for such processes, the computational grid used for the main river channel is too coarse and prevents the calibrated model from resolving the spatial scales needed to assess important processes within the channel itself and along its margins.

4. Based upon your technical judgment, have the adequate methodologies been employed to evaluate the sensitivity of the model to descriptions of the relevant processes, and to evaluate the uncertainties of model predictions?

Sensitivity analyses of the PCB transport and fate model seems adequate. However, an evaluation of PCB fluxes between the river and the floodplain during overbank flow conditions is needed. Since stream bank erosion was not included in the calibration, it is not possible to know how sensitive the model predictions will be when such process is included. The uncertainty analysis has been done only for the Food Chain Model (FCM). An uncertainty analysis for the rest of the model components should be conducted, included. the uncertainty once all the models are linked together

5. Is the uncertainty indicated by model-data differences sufficiently inconsequential to permit use of the model to predict differences among remedial options?

At this stage, the model has been used to predict sediment and PCB transport and fate during storm events. So the model-data differences might not be very important for the time and space scales considered for model calibration, but could very well increase in relevance for the scales needed to compare remedial actions.

6. Are the processes in the model calibrated to the extent necessary for predicting future conditions including future concentrations of PCBs in the environment under natural processes and under potential remedial options for sediments and floodplains soils in the Housatonic River in the reach below the confluence? If not, what additional work needs to be done to calibrate the model?

The calibrated model ability to predict future concentrations of PCBs as well as the impact of potential remedial actions in the Housatonic River and its floodplains, will be very limited.
The main issue with the calibrated model is the size of the computational grid employed both for the river and its floodplain as well as the fact that the model has been calibrated for a relatively short period of field observations. While the latter is driven by data availability, the former can be solved with today's computational resources.
My recommendation is to include stream bank erosion in the model since this is a very important process which has the potential for greatly impacting the modeling outcome. While the mechanics of stream bank erosion is not well understood, it is possible to assess how much sediment enters the channel though bank erosion with a simple 1-D model for meandering streams. Such model is described in an attached paper by Abad and Garcia (2005).
There is a clear need for the model to be able to resolve flow and sediment transport within the channel and along its stream banks. To model mass transfer processes at the sediment-water interface fine-scale hydrodynamic (i.e. flow velocity, shear stresses) predictions are needed. As it stands, the calibrated model cannot do this. A 3D hydrodynamic and sediment transport model should be used for in-channel flows and a

2D model (like the one currently employed) for the floodplain. This is computationally challenging but can be done as shown in the attached paper by Rodriguez et al. (2004).