

CHARGE FOR THE HYDRODYNAMIC MODELING PEER REVIEW

Background

After negotiations between the General Electric Company (GE) and the US Environmental Protection Agency (EPA), Commonwealth of Massachusetts, State of Connecticut, City of Pittsfield, the Department of Interior, and the National Oceanic and Atmospheric Administration (Agencies), an agreement in principle was reached for the remediation, restoration, and revitalization of the General Electric facility located in Pittsfield, MA and other properties contaminated with PCBs from the facility, including the Housatonic River.

As part of the agreement in principle, EPA will develop a quantitative model of the fate, transport, and bioaccumulation of polychlorinated biphenyls (PCBs) in the Housatonic River system. This model and its predictions will be used by EPA, together with other information, in making decisions regarding potential remedial actions for river sediments and associated floodplains soils for the portion of the Housatonic River beginning at the confluence of the East and West branches of the river (approximately two miles downstream from GE's facility in Pittsfield) and continuing downstream. In general, the model will be used to quantify and compare the amount of time that it will take for PCB concentrations in environmental media (e.g., water column, sediments, biota) in that stretch of the river to reach particular PCB concentrations under various scenarios, including naturally occurring processes and numerous other potential remedial options.

As part of the agreement in principle, GE and the Agencies agreed that EPA's modeling activities will be subject to Peer Review by a Peer Review Panel at appropriate intervals during the modeling process. This document presents the charge for that Peer Review.

It is anticipated at this time that the Peer Review Panel will be reviewing at least three documents developed by EPA: a report on the modeling framework and a description of the data needs for the model; a report on the model calibration; and a report on the final model validation.

At each stage, an opportunity will be provided for General Electric and other members of the public to submit written comments to the Peer Review Panel which are relevant to the charge for the Panel members' consideration. In addition, EPA and GE have established a working group of their technical staffs and contractors to discuss and resolve issues associated with the hydrodynamic modeling, where possible through all aspects of the modeling process. This working group may decide to pose further questions and/or provide additional information to the Peer Review Panel during the process.

Objectives Of Modeling Approach

There are numerous objectives for the modeling effort which are summarized below:

1. Quantify future spatial and temporal distribution of PCBs (both dissolved and particulate forms) within the water column and bed sediment;
2. Quantify the historical and current relative contributions of various PCB sources to PCB concentrations in water and bed sediment;
3. Quantify the historical and current relative contribution of various PCB sources to bioaccumulation in target species.
4. Estimate the time required for PCB-laden sediment to be effectively sequestered by the deposition of uncontaminated material (i.e. natural recovery).
5. Estimate the time required for PCB concentrations in fish tissue to be reduced to levels established during the risk assessment process, that no longer pose either a human health or ecological risk, based upon various response and restoration scenarios;
6. Quantify the relative risk(s) of extreme storm event(s) contributing to the resuspension of sequestered sediment or the redistribution of PCB-laden sediment in the study area.

Summary of Charge

The Peer Review Panel will be convened to review the modeling exercise (including the hydrodynamics component, the sediment transport component, the PCB fate and transport component, and the bioaccumulation component) at a minimum of three intervals during the modeling process: model construction, calibration, and validation. The Peer Review Panel shall focus on the following general issues (more specific questions are identified below):

- Do the modeling frameworks include the significant processes, and are the descriptions of those processes sufficiently accurate to represent the hydrodynamics, sediment transport, and the chemistry, fate and transport, and bioaccumulation of PCBs in the Housatonic River?
- Are the available data sufficient for development of models of the hydrodynamics, sediment transport and the chemistry, fate and transport, and bioaccumulation of PCBs in the Housatonic River?

- Are the processes in the final models calibrated/validated to the extent necessary for prediction of future conditions?
- How sensitive are the models to uncertainties in the descriptions of the relevant processes?

Peer Review Questions

In considering the foregoing general issues and evaluating the EPA documents, the Peer Review Panel shall give specific consideration to the following questions. As modeling activities proceed, additional specific questions may be identified the panel to address.

Modeling Framework and Data Needs

1. Do the modeling frameworks used by EPA include the significant processes affecting PCB fate, transport, and bioaccumulation in the Housatonic River; and are the descriptions of these processes in the modeling framework(s) sufficiently accurate to represent the hydrodynamics, sediment transport, PCB fate and transport, and PCB bioaccumulation in the Housatonic River?
2. Based upon the technical judgment of the Peer Review Panel:
 - a. Are the modeling approaches suitable for representing the relevant external force functions (e.g., hydraulic flows, solids and PCB loads, initial sediment conditions, etc.), describing quantitative relationships among those functions, and developing quantitative relationships between those functions and PCB concentrations in environmental media (e.g., water column, sediments, fish and other biota, etc.)?
 - b. Are the models adequate for describing the interactions between the floodplains and the river?
 - c. Are the models adequate for describing the impacts of rare flood events?
 - d. Are the models adequate for discriminating between water-related and sediment-related sources of PCBs to fish and other biota?
3. Again, based upon the technical judgment of the Panel, are the spatial and temporal scales of the modeling approaches adequate to address the principal need for the model - producing sufficiently accurate predictions of the time to attain particular PCB concentrations in environmental media under various scenarios (including natural recovery and different potential active remedial options) to support remedial decision-making in the context described above in the Background section? If not, what levels of spatial and temporal resolutions are required to meet this need?
4. Is the level of theoretical rigor of the equations used to describe the various processes affecting

PCB fate and transport, such as settling, resuspension, volatilization, biological activity, partitioning, etc., adequate, in your professional judgment, to address the principal need for the model (as defined above)? If not, what processes and what resolution are required?

5. What supporting data are required for the calibration/validation of the model on the spatial and temporal scales necessary to address the principal need for the model (as defined above)? What supporting data are required to achieve the necessary level of process resolution in the model?

6. Based upon your technical judgment, are the available data, together with the data proposed to be obtained by EPA, adequate for the development of a model that would meet the above referenced purposes? If not, what additional data should be obtained for these purposes?

Model Calibration

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?

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

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?

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?

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

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?

Model Validation

1. After review of the model validation report, revisit questions 1 - 5 under Model Calibration.

2. Does the validation indicate that the model can be applied to conditions differing from calibration that could reasonably be assumed to exist in the Housatonic River, without resulting in an unacceptable increase in uncertainty?

3. Has the model and the processes described by it been validated to the extent necessary, in your technical judgment, for use in predicting future conditions, including the concentrations of PCBs in sediments and floodplains soils in the Housatonic River downstream of the confluence? If not, what additional work should be done to validate the model?

4. Upon review of the model projections of changes in PCB concentrations in environmental media under future conditions, are such projections reasonable, using your technical judgment, and are they consistent with historical trends?