Appendix A

List of Peer Reviewers

United States
Environmental Protection Agency
Region 2

Peer Review of EPA's Draft Engineering Performance Standards for the Hudson River PCBs Superfund Site

Gideon Putnam Hotel - Saratoga Springs
Saratoga Springs, NY
January 27-29, 2004

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Appendix B

Charge to the Peer Reviewers and Pre-Meeting Comments, Alphabetized by Author

Note: The first 181 pages of this appendix contains the reviewers' pre-meeting comments that appeared in the bound booklets that were available at the peer review meeting. One peer reviewer (Tim Thompson) submitted additional pre-meeting comments after the booklets were bound. Those additional comments appear at the end of this appendix.

As was stated at the peer review meeting, the pre-meeting comments in this appendix are preliminary and do not necessarily reflect the final reviewer opinions, conclusions, and recommendations. Therefore, the pre-meeting comments should not be quoted or cited.

Peer Review Workshop for
EPA's Engineering Performance Standards For
The Hudson River PCBs Superfund Site

Reviewers' Premeeting Comments

January 20, 2004

Note: These are preliminary comments only and do not reflect the final reviewer opinions, conclusions, or recommendations, which will be determined at the meeting. Therefore:

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Note: Comments have been reproduced as received

Peer Review Workshop for
EPA'S Engineering Performance Standards
For The Hudson River PCBs Superfund Site

CHARGE QUESTIONS FOR PEER REVIEWERS

Dredging Resuspension Standard

1. Framework: The Resuspension Standard was developed with a routine (i.e., baseline condition) water quality monitoring plan and three tiered action levels (Evaluation, Concern, and Control) leading up to a maximum allowable concentration of PCBs in river water. Exceedence of an action level would trigger additional monitoring requirements beyond the routine monitoring, as well as operational or engineering steps (studies and operational or engineering improvements and, if necessary, temporary halting of operations). The Resuspension Standard was developed with this framework to accommodate the project need for both protection and production (i.e. upon an exceedence of an action level, appropriate steps can be taken to identify and address remediation-related problems before dredging operations would need to be halted temporarily) (see, for example, Section 2.3: Rationale for the Standard).

    - Please comment on whether this framework provides a reasonable approach for developing the Resuspension Standard.

2. Near-Field Analyses: Development of the Resuspension Standard considered the potential effects of resuspension in the near-field and in the far-field[1] (see, Section 2.1.2: Definitions). The near-field work was performed to help identify the locations of the near-field water column monitoring stations, to estimate the loss from the dredge, to estimate the nature of the release (i.e., dissolved vs. suspended) to provide an estimate of the solids transported into the far-field, and to estimate the effects of settled material on PCB concentrations in near-field sediment. Relevant sections of the document include, but are not limited to, Section 2.2.7: Near-Field Modeling, Section 2.2.8: Relationship Among the Resuspension Production, Release and Export Rates, and Attachment D: Modeling Analysis.

    - Please comment on the technical adequacy of the near-field analyses, in particular the linkage from the resuspension production rate (at the site of dredging), to the resuspension release rate (reflecting PCB transport in the water column in the immediate vicinity of the dredging operations) and finally to the resuspension export rate (essentially equilibrium conditions reflecting long-distance transport of PCBs in the water column).

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[1]The far-field work was performed to evaluate the long-term effects of dredging on PCB concentrations in the water column and in fish tissue of the Upper and Mid-Hudson. The linked fate and transport and bioaccumulation models of the Upper Hudson (HUDTOX and FISHRAND, respectively), which were used to evaluate far-field effects, as well as the input parameters used to evaluate the long-term effects on human health and ecological receptors, were the subject of prior peer reviews. As such, they are not the subjects of this peer review.

3. <u>Evaluation Level:</u> The Evaluation Level of the Resuspension Standard can be reached by exceeding criteria for net (i.e., over baseline) PCB load (mass loss) measured at far-field locations or criteria for net suspended solids concentrations measured at either near-field or farfield locations (see, Table 1-1). The Evaluation Level was specifically developed for Phase 1 to provide the site-specific information necessary to understand the mechanisms of PCBs release from dredging in the Upper Hudson, which in turn is needed to guide the selection of appropriate engineering controls, as necessary. As stated in the Resuspension Standard, EPA anticipates that sufficient data may be collected in Phase 1 to justify eliminating the Evaluation Level in Phase 2. Also, the Evaluation Level is well above the best estimate of dredging release alone. Some of the public comments that EPA received suggested that the dredging operations should not be allowed to increase PCB concentrations in the water column above baseline conditions (i.e., that the Evaluation Level should be the threshold level that results in the temporary halting of dredging). Other comments suggested that the requirements of the Evaluation Level and Concern Level should be reduced and combined into one level prior to the Phase 1 dredging. Relevant sections of the document include, but are not limited to Section 3.1.1: Evaluation Level).

   - Please comment on the appropriateness of the Evaluation Level as a component of the standard applied to for Phase 1.

4. <u>Resuspension Threshold:</u> Under the Resuspension Standard, the maximum allowable concentration (i.e, threshold) in the water column is 500 ng/L Total PCBs, which is the maximum contaminant level (MCL) for potable water under the federal Safe Drinking Water Act. This threshold concentration was selected in consideration of the goals of the cleanup, which include protecting downstream public water supplies that draw from the river, and minimizing the long-term transport of PCBs in the river, both from one section of the Upper Hudson to another and from the Upper Hudson to the Lower Hudson. Relevant sections of the document include, but are not limited to, Section 2.2.9: Review of Applicable or Relevant and Appropriate Requirements, Section 2.3.1: Development of Basic Goals and Resuspension Criteria. The threshold addresses the *resuspension export rate*, which describes the rate of PCB mass transported in the water column when particle settling is unlikely to further reduce the level of PCBs in the water column (see, Section 2.1.2: Definitions). The Resuspension Standard requires that the threshold be applied to the nearest far-field sampling station that is at least 1 mile away. Moreover, to reduce the possibility that a short-duration anomalous "spike" or laboratory error could temporarily halt the dredging operations, the standard requires that the concentration be confirmed by an average of four samples collected the next day with 24-hour laboratory turnaround time.

   - Please comment on the reasonableness of the 500 ng/L Total PCBs threshold concentration developed for the Resuspension Standard.

5. Monitoring Program: The 2002 ROD states (see, p. iii), "Beginning in phase 1 and continuing throughout the life of the project, EPA will conduct an extensive monitoring program." Section 3.3: Monitoring Plan and Attachment G (and related tables and figures) describe the attendant monitoring program for the Resuspension Standard.

- Please comment on whether the monitoring program reasonably can be expected to provide adequate data in Phase 1 that will allow EPA to evaluate necessary adjustments to dredging operations in Phase 2 or to the Resuspension Standard. Also, please identify any necessary improvements to the monitoring program.

Dredging Residuals Standard

6. Framework: EPA's 2002 ROD calls for removal of all PCB-contaminated sediments (i.e., to non-detection levels) in areas targeted for dredging, with an anticipated residual of approximately 1 mg/kg Tri+ PCBs prior to backfilling (Tri+ PBCs are the subset of PCBs with 3 or more chlorine atoms). The Residuals Standard builds on the requirements in EPA's 2002 ROD as well as case studies and regulatory guidance (see, Section 2.1: Background and Approach). It requires comparison of PCB concentrations in post-dredging sediment samples within a given area (i.e., ~ 5-acre certification unit) to statistically-based PCB concentrations (i.e., action levels), which then guide appropriate actions (see, for example, Figure 1-1). The Residuals Standard was developed with this framework to accommodate the project need for both protection and production, in that post-dredging sampling can proceed directly upon EPA verification that the design cutlines have been attained and the options for appropriate next steps are known and, to the extent possible, pre-approved during design.

- Please comment on whether this framework provides a reasonable approach for developing the Residuals Standard.

7. Statistical Analyses: The supporting analyses for the Residuals Standard, in particular the statistical analyses of sites-specific sediment data collected in the Upper Hudson and the sediment data from case studies of environmental dredging projects, are presented in Section 2.2 (and associated tables and figures) and in Attachment A of the Residuals Standard.

- Please comment on whether the statistical analyses are technically adequate and properly documented.

8. Post-dredging Confirmatory Sampling Program: Section 2.2.9 and Section 3.0 of the Residuals Standard present an evaluation of available sampling techniques and describe the procedures for establishing the post-dredging confirmatory sampling grid, collecting and managing the samples, and evaluating the sample data and required actions. In certain circumstances identified in the Residual Standard, a certification unit can be evaluated by considering the sediment data in three previously dredged certification units within 2 miles (i.e., a 20-acre evaluation).

- Please comment on the adequacy of these aspects of the Residuals Standard, in particular the concept of a 20-acre evaluation area for Phase 1.

9. Re-dredging and Engineering Contingencies: Consistent with the 2002 ROD, the Residuals Standard is clear in describing EPA's preference for dredging over capping as a means of sequestering PCB inventory (mass). The standard also addresses the expectation that some targeted areas of the Upper Hudson river bottom may be difficult to dredge effectively, such as rocky areas. For these special circumstances, the standard addresses re-dredging and the number of additional re-dredging attempts, how the extent of the non-compliant area is to be determined, and the use of engineering contingencies to address recalcitrant residuals (e.g., alternative dredge, cap). Relevant sections of the document include Section 2.3.5: Determining the Number of Re-Dredging Attempts, Section 2.3.6: Engineering Contingencies for the Residuals Standard, Section 3.5.1: Re-dredging and Required Number of Re-dredging Attempts, Section 3.5.2: Determining the Extent of the Non-Compliant Area, and Section 3.6: Engineering Contingencies.

   - Please comment on the reasonableness of the Residuals Standard with respect to re-dredging and engineering contingencies.

Productivity Standard

10. Framework: The requirements of the 2002 ROD inform the overall parameters of the Productivity Standard (e.g., dredging of an estimated 2.65 million cubic yards in 6 years, with the first dredging season [Phase 1] at a reduced rate of dredging) (see, Section 2.1: Background and Approach and Section 2.3: Rationale for the Development of the Performance Standard). Within this context, the Productivity Standard requires compliance with minimum cumulative volumes of sediment for each dredging season and targets larger cumulative volumes for the first five dredging seasons. In requiring cumulative annual volumes, the standard accounts for the expectation that some areas will be faster to dredge than others, and thus provides an opportunity to carry over the benefit of this faster dredging from one year to the next as a "cushion" against when dredging more difficult areas. In setting targeted cumulative annual volumes, the standard provides for the dredging to be designed to attain a somewhat faster rate of dredging, so that a reduced volume remains in the sixth (final) dredging season and additional time is available to address any unexpected difficulties. The Productivity Standard was developed with this framework to ensure that the dredging design and implementation meets the schedule called for in the ROD.

   - Please comment on whether this framework provides a reasonable approach for developing the Productivity Standard.

11. Example Production Schedule: As part of the development of the Productivity Standard, an Example Production Schedule was developed based on site-specific information and case studies of other environmental dredging projects to demonstrate that the Productivity Standard can be met. Relevant sections of the document include Section 2.2: Supporting Analyses, Attachment 1: Productivity Schedule, Attachment 2: Productivity Schedule Backup, and Attachment 3: Evaluation of Applicable Dredge Equipment for the Upper Hudson River.

   - Please comment on the Example Production Schedule, including the reasonableness of the underlying assumptions for equipment selection and efficacy, as well as the time necessary to deploy, use, and move equipment.

12. <u>Action Levels:</u> The Productivity Standard includes two tiered action levels (Concern and Control) prior to any determination of non-compliance with the standard, as well as their respective required actions and monitoring and recordkeeping requirements. Relevant sections of the document are Section 1.1: Implementation and Section 3.3: Monitoring, Record Keeping and Reporting Requirements.

- Please comment on appropriateness of the action levels and the required actions, as well as the reasonableness of the monitoring and record keeping requirements.

Questions Related to All Three Engineering Performance Standards

13. <u>Interactions Among the Standards:</u> Because the Engineering Performance Standards for Resuspension, Residuals and Productivity be applied in conjunction with one another, the standards must be considered as a whole as well as individually. In developing the standards, their points of interaction were balanced to allow flexibility during design and implementation, while ensuring that human health and the environment are adequately protected. Thus, the standards contain self-correcting features (e.g., the requirements for additional re-dredging attempts in the Residuals Standard must consider the requirements for dredging production in the Productivity Standard). The interactions among the standards are discussed in the Executive Summary, Introduction, and Section 3.2 of the Productivity Standard.

- Please comment on whether the main interactions among the standards are properly documented and taken into account.

14. Section 4.0 presents the plans for refinement of each standard.

- Please comment on whether there are any additional aspects to effectively accomplish the refinement that EPA should consider in evaluating the Phase 1 data.

15. Please provide any other comments, concerns or suggestions, involving both strengths and weaknesses, with respect to the October 2003 Draft Engineering Performance Standards – Peer Review Copy that may not be fully covered by the above charge questions.

Dag Broman
Preliminary Comments

CHARGE QUESTION –PRELIMINARY COMMENTS FROM DAG BROMAN

Dredging Resuspension Standard

1 Framework: The Resuspension Standard was developed with a routine (i.e., baseline condition) water quality monitoring plan and three tiered action levels (Evaluation, Concern, and Control) leading up to a maximum allowable concentration of PCBs in river water. Exceedence of an action level would trigger additional monitoring requirements beyond the routine monitoring, as well as operational or engineering steps (studies and operational or engineering improvements and, if necessary, temporary halting of operations). The Resuspension Standard was developed with this framework to accommodate the project need for both protection and production (i.e., upon an exceedence of an action level, appropriate steps can be taken to identify and address remediation-related problems before dredging operations would need to be halted temporarily) (see, for example, Section 2.3: Rationale for the Standard).

Please comment on whether this framework provides a reasonable approach for developing the Resuspension Standard.

I am in general pleased with the overall framework of the dredging resuspension standard and the technical support for the standards seem appropriate. Several action levels are established so that remediation problems can be identified and corrected before criteria are exceeded which would stop the dredging operation. The design with near field stations to monitor the direct impact of the remedial operation and the far field sampling areas to monitor the resuspension export rate is satisfactory and well elaborated in the description. The object no 1 of the water column concentration criteria and object no 2 i.e. the primary criteria for the loads, are setting the whole baseline for the recommendations on the fluxes and concentrations of PCBs and suspended solids. From these the water column concentration criteria and primary criteria for loads were developed. They are well justified in section 2.3 in Part 1. The tiered approach seems at first a bit excessive and confusing, but penetrated I agree that it is a good strategy for facilitating the remediation project while environmental protection issues are kept in front.

2. Near-Field Analyses: Development of the Resuspension Standard considered the potential effects of resuspension in the near-field and in the far-field[1] (see, Section 2.1.2: Definitions). The near-field work was performed to help identify the locations he near-field water column monitoring stations, to estimate the loss from the dredge, to estimate the nature of the release (i.e., dissolved vs. suspended) to provide an estimate of the solids transported into the far-field, and to estimate the effects of settled material on PCB concentrations in near-field sediment. Relevant sections of the document include, but are not limited to, Section 2.2.7: Near-Field Modeling, Section 2.2.8: Relationship Among the Resuspension Production, Release and Export Rates, and Attachment D: Modeling Analysis.

Please comment on the technical adequacy of the near-field analyses, in particular the linkage from the resuspension production rate (at the site of dredging), to the resuspension release rate (reflecting PCB transport in the water column in the immediate vicinity of the dredging operations) and finally to the resuspension export rate (essentially equilibrium conditions reflecting long-distance transport of PCBs in the water column).

The near field analysis is based on two theoretical models (CSTR-Chem and TSS-Chem) to predict the resuspension within l mile downstream of the dredging activity. The results from this modeling form the basis of the recommendations. Even if I have only gone though the principles of theses models (attachment D in Part 1) and not all functions and equations etc. I have no problem in accepting the outputs presented and therefore the conclusions drawn. On the issue of "truly free" PCB fraction input to the water from sediment pore water leakage, I also find the calculations described in Section 2.2.5 reliable which indicate that a significant desorption without resuspended particles is unlikely. The theoretical analyses of the two and three phase partitioning indicating a minor significance of free fraction PCB export which is of importance and further supports the sampling strategies.

3. Evaluation Level: The Evaluation Level of the Resuspension Standard can be reached by exceeding criteria for net (i.e., over baseline) PCB load (mass loss) measured at far-field locations or criteria for net suspended solids concentrations measured at either near-field or farfield locations (see, Table 1-1). The Evaluation Level was specifically developed for Phase 1 to provide the site-specific information necessary to understand the mechanisms of PCBs release from dredging in the Upper Hudson, which in turn is needed to guide the selection of appropriate engineering controls, as necessary. As stated in the Resuspension Standard, EPA anticipates that sufficient data may be collected in Phase 1 to justify eliminating the Evaluation Level in Phase 2. Also, the Evaluation Level is well above the best estimate of dredging release alone. Some of the public comments that EPA received suggested that the dredging operations should not be allowed to increase PCB concentrations in the water column above baseline conditions (i.e., that the Evaluation Level should be the threshold level that results in the temporary halting of dredging). Other comments suggested that the requirements of the Evaluation Level and Concern Level should be reduced and combined into one level prior to the Phase 1 dredging. Relevant sections of the document include, but are not limited to Section 3.1.1: Evaluation Level).

Please comment on the appropriateness of the Evaluation Level as a component of the standard applied to for Phase 1.

An idea to reduce and combine the evaluation and the concern level has been put forward together with suggestions on the use of automated composite PCB samplers at far-field stations for all levels of monitoring. This can be a rational approach if Phase 1 shows that it can be justified. However, during Phase 1 a combination of the evaluation and the concern level will limit the possibilities of taking fast actions (to correct problems during dredging before good routines have been implemented) if the criteria of the evaluation level are exceeded, as far as I see it. Another thing, which should improve the possibilities to evaluate the dredging activities, is to speed up the time between PCB sampling and analytic result output (today 24 h).

4*. *Resuspension Threshold: Under the Resuspension Standard, the maximum allowable concentration (i.e, threshold) in the water column is 500 ng/L Total PCBs, which is the contaminant level (MCL) for potable water under the federal Safe Drinking Water Act. This threshold concentration was selected in consideration of the goals of the cleanup, which include protecting downstream public water supplies that draw from the river, and minimizing the long-term transport of PCBs in the river, both from one section of the Upper Hudson to another and from the Upper Hudson to the Lower Hudson. Relevant sections of the document include, but are not limited to, Section 2.2.9: Review of Applicable or Relevant and Appropriate Requirements, Section 2.3.1: Development of Basic Goals and Resuspension Criteria. The threshold addresses the *resuspension export rate*, which describes the rate of PCB mass transported in the water column when particle settling is unlikely to further reduce the level of PCBs in the water column (see, Section 2.1.2: Definitions). The Resuspension Standard requires that the threshold be applied to the nearest far-field sampling station that is at least 1 mile away. Moreover, to reduce the possibility that a short-duration anomalous "spike" or laboratory error could temporarily halt the dredging operations, the standard requires that the concentration be confirmed by an average of four samples collected the next day with 24-hour laboratory turnaround time.

Please comment on the reasonableness of the 500 ng/L Total PCBs threshold concentration developed for the Resuspension Standard.

Since the figure 500 ng/L PCB is the only one not regularly exceeded in the water concentrations in Upper Hudson River stations downstream of Rogers Island I have difficulties to understand what other "applicable or relevant and appropriate requirements" one can use when dredging the upper parts. However, during dredging further downstream in Phase 2 other threshold concentration could be discussed. For resuspension export, the situation is similar as far as I see it. Considering the historical variability observed in the existing data, a PCB export below 300 g/day cannot be differentiated from baseline conditions.

5*. *Monitoring Program: The 2002 ROD states (see, p. iii), "Beginning in Phase 1 and continuing throughout the life of the project, EPA will conduct an extensive monitoring program." Section 3.3: Monitoring Plan and Attachment G (and related tables and figures) describe the attendant monitoring program for the Resuspension Standard.

Please comment on whether the monitoring program reasonably can be expected to provide adequate data in Phase 1 that will allow EPA to evaluate necessary adjustments to dredging operations in Phase 2 or to the Resuspension Standard. Also, please identify any necessary improvements to the monitoring program.

The design of the monitoring Phase 1 approach is rigorous and well thought through. Monitoring and sampling will be performed using equal discharge increment or equal width increment sampling techniques. A question for me is whether the distance from the dredging station to the far field station has an influence on the PCB concentrations and thereby the possibilities of making accurate PCB mass balances from the resuspension export at the near field sampling stations.

Further, an idea is to make a significant number of PCB analysis on both dissolved and particulate (before and after filtration) water samples in Phase 1 so that the desorption modeling scenario of CSTR-Chem and TSS-Chem models are fully confirmed.
The strategy of the near field station using turbidity measured in real time as a surrogate for suspended solids to give direct feed back to the dredgers is fine. However I have problems understanding why a laboratory study on the correlation of continuous turbidity readings and suspended solids can't be done prior to dredging. Another point is that the positioning of the near field suspended solids sampling sites, especially the ones 150 and 300 meters (with and without curtains respectively), should be flexible and decided in situ by the dredgers.

Dredging Residuals Standard

6. Framework: EPA=s 2002 ROD calls for removal of all PCB-contaminated sediments (i.e., to non-detection levels) in areas targeted for dredging, with an anticipated residual of approximately 1 mg/kg Tri+ PCBs prior to backfilling (Tri+ PBCs are the subset of PCBs with 3 or more chlorine atoms). The Residuals Standard builds on the requirements in EPA's 2002 ROD as well as case studies and regulatory guidance (see, Section 2.1: Background and Approach). It requires comparison of PCB concentrations in post-dredging sediment samples within a given area (i.e., ~ 5-acre certification unit) to statistically-based PCB concentrations (i.e., action levels), which then guide appropriate actions (see, for example, Figure 1-1). The Residuals Standard was developed with this framework to accommodate the project need for both protection and production, in that post-dredging sampling can proceed directly upon EPA verification that the design cutlines have been attained and the options for appropriate next steps are known and, to the extent possible, pre-approved during design.

Please comment on whether this framework provides a reasonable approach for developing the Residuals Standard.

Yes, I think the framework described in section 2.0 provides a reasonable approach for developing the Residuals Standard based on the presented statistical evaluations, previous case studies, regulatory guidance on sampling, and application of backfilling etc. It seems also quite conservative because I find it unlikely that the backfill material (clean soil) will have average Tri+ PCB concentrations of 0.25 mg/kg. On the other hand it can't be excluded, as described in section 2.1.1, that the filling material can disturb and displace residuals, allowing them to resettle on top of the filling. Also I assume, situations would likely occur when areas (not only the navigational channels which are not going to be backfilled) will be poorly or patchy covered. A good suggestion is obviously to rigorously evaluate if the assumptions are valid during the sampling program of the backfilled areas after Phase 1 as indicated in 2.1.1.

7. Statistical Analyses: The supporting analyses for the Residuals Standard, in particular the statistical analyses of sites-specific sediment data collected in the Upper Hudson and the sediment data from case studies of environmental dredging projects, are presented in Section 2.2 (and associated tables and figures) and in Attachment A of the Residuals Standard.

Please comment on whether the statistical analyses are technically adequate and properly documented.

The statistical analysis is clearly and thoroughly presented in section 2.2.1. It is well motivated and straightforward. I have no need to get this further elaborated and have no specific comments or difficulties with this topic.

8. Post-dredging Confirmatory Sampling Program: Section 2.2.9 and Section 3.0 of the Residuals Standard present an evaluation of available sampling techniques and describe the procedures for establishing the post-dredging confirmatory sampling grid, collecting and managing the samples, and evaluating the sample data and required actions. In certain circumstances identified in the Residual Standard, a certification unit can be evaluated by considering the sediment data in three previously dredged certification units within 2 miles (i.e., a 20-acre evaluation).

Please comment on the adequacy of these aspects of the Residuals Standard, in particular the concept of a 20-acre evaluation area for Phase 1.

The alternative techniques for the sampling methodology are comprehensive. I agree that a methodology using core sampling preserves the depositional sequence of the sediment sample and disturbs the sediments less that most other techniques. Another strong argument put forward is that core sampling maintains comparability with historic data sets and the sampling being conducted by GE. A question for me however, is on the recommendations for sampling methodology in areas which cant be sampled with core or box sampling e.g. areas with boulders, cobbles, gravel or debris.
I also agree with the recommendation to store some of the below 6 inches sediment for future evaluation even though its not mandatory in the Standards. Core frequency, grid

and the standards behind this are satisfactory and well motivated as commented above. The concept of a 20-acre evaluation to allow backfilling without requiring re-dredging, provided that the 20-acre arithmetic average is l mg/kg Tri+ PCBs or less, is fine for me. The motivation that "this option is included in the Residuals Standard because the HUDTOX model used to assess the adverse impacts of PCB contamination in the sediments is based on 20-acre (Thompson Island Pool) and 40-acre (remainder of the Upper Hudson) river segments. Therefore, no adverse impact from local concentrations up to the 95% UCL is forecast if the 20-acre arithmetic average is controlled at l mg/kg Tri+ PCBs" is trustworthy as I see it. But I agree as suggested, that sampling and analysis of the placed backfill to demonstrate that the surface concentration is 0.25 mg/kg Tri+ PCBs or less, would be recommend in Phase 1.

9. Re-dredging and Engineering Contingencies: Consistent with the 2002 ROD, the Residuals Standard is clear in describing EPA's preference for dredging over capping as a means of sequestering PCB inventory (mass). The standard also addresses the expectation that some targeted areas of the Upper Hudson river bottom may be difficult to dredge effectively, such as rocky areas. For these special circumstances, the standard addresses re-dredging and the number of additional re-dredging attempts, how the extent of the non-compliant area is to be determined, and the use of engineering contingencies to address recalcitrant residuals (e.g., alternative dredge, cap). Relevant sections of the document include Section 2.3.5: Determining the Number of Re- Dredging Attempts, Section 2.3.6: Engineering Contingencies for the Residuals Standard, Section 3.5.1: Re-dredging and Required Number of Re-dredging Attempts, Section 3.5.2: Determining the Extent of the Non-Compliant Area, and Section 3.6: Engineering Contingencies.

Please comment on the reasonableness of the Residuals Standard with respect to re-dredging and engineering contingencies.

I agree that the number of required re-dredging attempts shall be limited to two referring to experience from engineering judgments and previous case study findings. (It seems that it is not much help to continue after that – won't get cleaner). It is also satisfactory that the choice of techniques is left open in the re-dredging procedure for possible use of alternative methods. Logically, the experience gained from Phase 1 work will also guide all future recommendations. The engineering contingencies are described in general recommendatory terms and it is stated that USEPA will review the design so that it conforms to the requirements of the ROD and the engineering performance standards. A quite detailed and tough specification on the capping characteristics is also presented, which is fine for me.

Productivity Standard

10. Framework: The requirements of the 2002 ROD inform the overall parameters of the Productivity Standard (e.g., dredging of an estimated 2.65 million cubic yards in 6 years, with the first dredging season [Phase 1] at a reduced rate of dredging) (see, Section 2.1: Background and Approach and Section 2.3: Rationale for the Development of the Performance Standard). Within this context, the Productivity Standard requires compliance with minimum cumulative volumes of sediment for each dredging season and targets larger cumulative volumes for the first five dredging seasons. In requiring cumulative annual volumes, the standard accounts for the expectation that some areas will be faster to dredge than others, and thus provides an opportunity to carry over the benefit of this faster dredging from one year to the next as a "cushion" against when dredging more difficult areas. In setting targeted cumulative annual volumes, the standard provides for the dredging to be designed to attain a somewhat faster rate of dredging, so that a reduced volume remains in the sixth (final) dredging season and additional time is available to address any unexpected difficulties. The Productivity Standard was developed with this framework to ensure that the dredging design and implementation meets the schedule called for in the ROD.

Please comment on whether this framework provides a reasonable approach for developing the Productivity Standard.

The general framework of the production standards is reasonable. However, I can agree with the opinion that the production standards during Phase 1 should be somewhat more flexible. For me it is difficult to evaluate how flexible the meaning of the standard is when Section 2.1.1 states that: "Dredging during Phase l will require the removal of about 240,000 cubic yards of sediment with a target for removal of 265,000 cubic yards". Also, as I have expressed above and below, it is most important to utilize the experience gained from the production rates accomplished during Phase 1, when finalizing the cumulative figures during the whole six-year period.

11. Example Production Schedule: As part of the development of the Productivity Standard, an Example Production Schedule was developed based on site-specific information and case studies of other environmental dredging projects to demonstrate that the Productivity Standard can be met. Relevant sections of the document include Section 2.2: Supporting Analyses, Attachment 1: Productivity Schedule, Attachment 2: Productivity Schedule Backup, and Attachment 3: Evaluation of Applicable Dredge Equipment for the Upper Hudson River.

Please comment on the Example Production Schedule, including the reasonableness of the underlying assumptions for equipment selection and efficacy, as well as the time necessary to deploy, use, and move equipment.

On the issue of production during Phase 1, see my comments above. Judging from the underlying assumptions described in section 2.2 and given in the comprehensive information in Appendix 1 the production seems well thought through and quite well motivated. However, this issue is difficult to evaluate in detail because of my incomplete knowledge of the local environment and unknown production problems associated to this. Here, as for other related issues, a review during or preferably after Phase 1 will give much information.

12. Action Levels: The Productivity Standard includes two tiered action levels (Concern and Control) prior to any determination of non-compliance with the standard, as well as their respective required actions and monitoring and recordkeeping requirements. Relevant sections of the document are Section 1.1: Implementation and Section 3.3: Monitoring, Record Keeping and Reporting Requirements.

Please comment on appropriateness of the action levels and the required actions, as well as the reasonableness of the monitoring and record keeping requirements.

The action levels summarized in Table 1-2 and the steps which shall be taken to erase the cumulative shortfall in productivity is clear. The monitoring, record keeping and reporting requirements are also clearly specified and will give EPA information on the causes of problems. However, the question of whether this mandatory reporting can solve undesired delays for the whole project is difficult to fully judge before the system is evaluated in reality. It will be clearer after Phase 1 is completed, but problems might anyway arise later when the production reaches its maximum in phase 2.

Questions Related to All Three Engineering Performance Standards

13. Interactions Among the Standards: Because the Engineering Performance Standards for Resuspension, Residuals and Productivity be applied in conjunction with one another, the standards must be considered as a whole as well as individually. In developing the standards, their points of interaction were balanced to allow flexibility during design and implementation, while ensuring that human health and the environment are adequately protected. Thus, the standards contain self-correcting features (e.g., the requirements for additional re-dredging attempts in the Residuals Standard must consider the requirements for dredging production in the Productivity Standard). The interactions among the standards are discussed in the Executive Summary, Introduction, and Section 3.2 of the Productivity Standard.

Please comment on whether the main interactions among the standards are properly documented and taken into account.

There are obviously inbuilt conflicts/contradictions between some aspects of the engineering performance standards for resuspension, residuals and productivity. This has also been put forward by some stakeholders and is correct as I see it. However, my opinion is that this is how it shall be. The standards for productivity must be "guided" and "balanced" by those of resuspension and residuals for example. If these suggested draft standards work when applied in Phase 1 I see no problem with them as a whole as well as individually.

14. Section 4.0 presents the plans for refinement of each standard.

Please comment on whether there are any additional aspects to effectively accomplish the refinement that EPA should consider in evaluating the Phase 1 data.

The plans for refinement of the standards in response to peer review recommendations is specified to the time before and during Phase l, and between Phase l and the start of Phase 2. Many of the comments above require experience of "how things work out" during the initial work in Phase 1. Therefore, I think it is preferential for me as a reviewer to be given the opportunity to receive information and give feedback when a thorough evaluation of the Phase 1 work has been carried out.

***15. Please provide any other comments, concerns or suggestions, involving both strengths and weaknesses, with respect to the October 2003 Draft Engineering Performance Standards* –** Peer Review Copy that may not be fully covered by the above charge questions.

First, my opinion is that the Draft Engineering Performance Standards are well thought through and in general precise and clear even though some sections are formulated in an over-complicated way. Secondly and more important, as stated above, will be to benefit from the experience gained during Phase 1 and thereafter review how well the problems in reality can be solved by the now suggested Standards, or if they need to be complemented or corrected.

William Creal
Preliminary Comments

To: John Wilhelmi, ERG January 14, 2004

From: William Creal

Subject: Hudson River PCBs Superfund Site
Draft Engineering Performance Standards
Preliminary Peer Review Comments

This document presents my preliminary comments on the fifteen questions regarding the Hudson River PCBs Superfund Site Draft Engineering Performance Standards that were presented at the Briefing Meeting on October 15-16, 2003. I would like to preface these preliminary comments on the fifteen questions with a few general comments.

First, I appreciate the opportunity to be part of this portion of the remediation project. The planning of a remediation project of this size is critical to successful implementation. EPA has done a commendable job in this regard. The quality of planning is shown in many ways and exemplified in the support for this portion of the project. The format of the review, the logistics provided and the support of ERG and EPA have made it much easier for me to focus my efforts on the review of the Draft Engineering Performance Standards.

Second, EPA has made a major decision in proceeding to address this large area of PCB contamination. I applaud EPA in this regard, and recognize the many difficulties they will face as the remediation project proceeds. Over the past 20+ years, I have been involved in many sediment remediation projects. Each project has its own set of unique circumstances and difficulties encountered as it is implemented. However, in all cases, we have been able to address the difficulties successfully and complete the remediation projects. In several cases, this was a true test of patience and perseverance for those involved in the projects. I am certain that EPA will encounter difficult situations as this project is implemented, and urge them to be patient and persevere.

Finally, I am impressed with the level of involvement and technical knowledge of the communities, companies and citizens engaged with this project. This level of involvement and input makes for a better sediment remediation project. I have found that the input received from the communities and citizens before and during these projects has always improved the project, and helped to address local issues as the project proceeds. Again, I urge the communities and citizens involved to continue their dialogue with EPA as this project proceeds, and to exercise patience as EPA works to deal with the various issues that will be encountered in the implementation of this project.

Dredging Resuspension Standard

1. **Framework: Please comment on whether this framework provides a reasonable approach for developing the Resuspension Standard.**

Comment: EPA identified five remedial action objectives in the 2002 Record of Decision (ROD). One of these is directly applicable to the Resuspension Standard: "Minimize the long term downstream transport of PCBs in the river", as discussed on page 51 of the ROD. The framework proposed for the Resuspension Standard does not meet this remedial action objective of the ROD. Therefore, the framework does not provide a completely reasonable approach for developing the Resuspension Standard. However, I believe the framework can be easily modified to achieve the remedial action objective, and this proposed modification will be presented.

EPA as an agency has been very clear on their approach with programs designed to minimize the occurrence of PCBs in surface waters. The presence of PCBs in surface waters at levels greater than Water Quality Standards is well documented and occurs quite often. EPA has recognized this and adopted an approach to deal with this issue until PCB levels in surface waters can be brought down to appropriate levels, such as Water Quality Standards. This approach has been especially evident in relation to NPDES permits for point source discharges. In these instances, for existing discharges, the limit for PCBs in a point source discharge is established at the Water Quality Standard (WQS), since the receiving waters typically do not meet the WQS. This limit has always been below the concentrations of PCBs found in the receiving waters, and also below the quantification level of the analytical method for PCBs. Therefore, recognition is then given to this, and compliance with the permit limit is acknowledged if the discharge is both less than the quantification level for PCBs and a program is implemented to minimize the discharge of PCBs. The minimization program serves to assure that the discharge of PCBs remains below the Quantification Level and continues progress toward attaining the WQS. This framework has been used for many NPDES permits over the past 20 years. EPA has codified this approach recently for the Great Lakes basin in its regulation adopted under the Great Lakes Guidance (40CFR132).

In addition, EPA has been very clear on the addition of PCBs to surface waters from new activities. This is typically controlled by the antidegradation portion of the Water Quality Standards that are applied to surface waters. As mentioned previously for PCBs, the surface waters typically do not attain the Water Quality Standards. Therefore, no further reduction in water quality for the pollutant causing the nonattainment is allowed.

Considering the approach that EPA has consistently applied for PCBs over the past 20 years for surface waters, the framework for the Resuspension Standard needs to be modified to be consistent with this approach. EPA has shown that the Hudson River does not attain the Water Quality Standard for PCBs. This is presented in summary on page 40 of Part 1. Therefore, no further reduction in the Hudson River water quality for PCBs should be allowed. In addition, the proposed remediation will result in resuspension activities over a period of 6 years. Considering that the first year of remediation will be a reduced year, this length of time (in particular the 5 years for full production) is consistent with the length of time associated with the usual NPDES permit, which is also 5 years. Therefore, a framework similar to the approach used for NPDES permits would be appropriate.

The proposed modified framework would be to establish an approach similar to that used for PCB limits in NPDES permits. This approach would set the resuspension standard at a level that would be equivalent to the Water Quality Standard. Recognition would be made that this is not measurable, and then a level established that is measurable, similar to the quantification level approach used for point source discharges. Finally, a set of measures would be prescribed and implemented to minimize the release of PCBs.

To accomplish the first step, it would be appropriate to consider the best engineering estimate for controlling resuspension during the remediation as a minimal level that would be equivalent to the Water Quality Standard. This is described on page 46 of Part 1, and estimated to be 86 grams/day (18 kg annually). This should be set as the goal for the Resuspension Standard for the remediation, and then an approach described as to how to achieve this goal (the minimization program), and how to monitor compliance with this standard (the quantification level). This would be consistent with the approach EPA has required for other sources of PCBs to surface waters.

For the minimization program, the framework would prescribe the use of containment (such as sheet piling and/or silt curtains) in the areas where appropriate (non navigation dredging areas). To monitor the effectiveness of the containment, real time turbidity measurements would be used to make sure the loss of sediment from the contained area is minimized. Using the near field turbidity monitoring described Section 2.3 to provide real time feedback on the dredging operations would do this. The Part 1 document summarizes this nicely on page 58:

"The near-field monitoring program provides the best opportunity to obtain real time results that can be used to guide the dredging operations as well as to identify those activities that may result in unacceptable releases of PCBs from the sediments. While PCB monitoring is the ultimate measure of downstream impacts, the real time turbidity and suspended solids monitoring provides the best means of minimizing suspended solids and PCB release."

This approach is in alignment with the remedial action objective. And since the PCB monitoring is restricted in use by the inability to measure a change at a level corresponding to a minimal increase, the use of alternate measures (like requiring containment of the dredge area and using turbidity to measure containment effectiveness) to assure minimal release are appropriate.

This approach would be coupled with far field monitoring of PCBs to assure that conditions have not declined, and that the human health concentrations for drinking water intakes are still achieved. This sampling would be analogous to the requirement typically put in NPDES permits to be less than the quantification level. This rationale is well presented in Section 2.3 as to how the baseline release of PCBs limits the measurement sensitivity. Specifically, on page 47, a level of 300 g/day (65 kg annually) is identified as the minimum level that can be differentiated from baseline conditions.

Employed together, these requirements are consistent with EPA's approach that has been used to deal with PCBs for the past 20 years. The use of far field monitoring of PCBs to detect a change over baseline is equivalent to analyzing a discharge at the quantification level. The near field requirements to minimize the release of PCBs are primarily based on the requirement of the use of containment where possible, with real time turbidity monitoring to assure that the containment is working as well as possible. There should also be recognition that the overall PCB release will diminish as the remediation proceeds over the course of the six year project. This would also be consistent with the implementation of minimization plans as typically found in NPDES permits.

With the use of this approach, there is the ability to reduce the Action Levels from four to two to be consistent with EPA's approach to dealing with PCBs in the water program. Under this approach:

- The first Action Level would be set at the proposed Evaluation Level, which would indicate that the project is not performing to expectations and that resuspension is a problem. In response, an engineering evaluation would be conducted and engineering controls consistent with the proposed Control Level would be required. Monitoring would also be increased when this level is exceeded, primarily in the far field sampling.
- The second Action Level would be set at the proposed Resuspension Standard. Exceedance of this standard would result in the actions as proposed for the Resuspension Standard in the Part 1 document.

In addition to these two Action Levels, the use of the near field turbidity monitoring would provide immediate feedback to the dredge operator so a rapid response to any release of sediment can be made.

2. **Near-Field Analyses: Please comment on the technical adequacy of the near-field analyses, in particular the linkage from the resuspension production rate (at the site of dredging), to the resuspension release rate (reflecting PCB transport in the water column in the immediate vicinity of the dredging operations) and finally to the resuspension export rate (essentially equilibrium conditions reflecting long-distance transport of PCBs in the water column).**

Comment: The technical adequacy of the near-field analyses presented in the various sections is very good. EPA has done a fine job of compiling and reviewing the various information sources available regarding this. The concern regarding dissolved PCBs is addressed very well in these sections and attachments. The conclusion that dissolved PCBs will be a minor component of PCB loss from dredging operations is well supported and plausible.

The conclusion made in section 2.2.7 on page 37 supports the use of sheet piling and/or silt curtains for containment. This conclusion states “silt barriers may be needed to prevent the spread of contamination to areas downstream if the target areas have already been dredged or are not selected for remediation. This settled material is likely to be unconsolidated and may be easily resuspended under higher flow conditions.”

In addition, the overall conclusions support the use of containment, and the use of the Evaluation Level as the minimum level to control the dredging operation. Especially important in this regard is the conclusion on page 39: “Based on these analyses, compliance with the Resuspension Standard appears to be attainable, including the lowest action criteria.” which would be the Evaluation Level criteria.

The near field monitoring should be used to identify unacceptable releases from the confined dredge area and inform the dredge operator so a rapid response to this condition can be made. This strongly supports the use of real time turbidity measurements to accomplish this. This will provide rapid information to the dredge operator to make the dredging operation more effective.

3. **Evaluation Level: Please comment on the appropriateness of the Evaluation Level as a component of the standard applied to for Phase 1.**

Comment: As presented in my comments on Question 1, I believe that the Evaluation Level is a very important and appropriate level, in that it is the minimum level that can be differentiated from baseline levels. Several public comments were presented to us that stated the release from the dredging operations should not be allowed to increase PCBs in the water column above the baseline conditions, and that containment should be used to minimize the downstream transport of PCBs (Clean Ocean Action, HR Sloop, Scenic Hudson, and Seaway). Specifically, I suggest that the framework should be modified, as presented above in my comments on Question 1, to be consistent with the approach regarding PCBs in surface water that EPA has supported for the past 20 years. As a part of this approach, the Evaluation Level criteria would be used coupled with the responses proposed for the Control Level. In this approach, the Evaluation Level is equivalent to the Quantification Level used in the NPDES permit limit framework for PCB discharges. This modified framework would eliminate two (Concern and Control) of the three action levels, simplify this process, and make it very understandable and protective.

For the responses, I would propose that the engineering responses be the same as what EPA has proposed for the Control Level. In regards to monitoring, eliminating two of the Action Levels would require reevaluating the monitoring requirements. In my suggested framework, the near field monitoring is being done to assure that the release of PCBs is minimized. This is primarily accomplished using continuous turbidity readings, which does not change as the Action Levels change in the EPA proposal. For the far field monitoring, the proposed monitoring should be reevaluated if this proposed framework is adopted. I can see arguments for using either the Evaluation Level monitoring or the Control Level monitoring. Realistically, I believe the Evaluation Level monitoring is adequate. However, I can also support the Control Level monitoring for Phase 1, with a commitment to reduce this monitoring after Phase 1 to the Evaluation Level monitoring except where the Phase 1 monitoring demonstrates that additional monitoring will be necessary.

4. **Resuspension Threshold: Please comment on the reasonableness of the 500 ng/l Total PCBs threshold concentration developed for the Resuspension Standard.**

Comment: Section 2.2.9 of Part 1describes the process EPA has used to develop the Resuspension Standard of 500 ng/l. I don't agree with the rationale presented as to why the other ARARs are not appropriate. The rationale presented is that it is technically impractical to reach these levels in the

Hudson River with the continuing input from the upstream sources. While this may be true, it is no different than any other river that EPA has dealt with yet for PCBs. For these situations, EPA requires that additional loadings be maintained at the Water Quality Standard since there is no assimilative capacity in the receiving water body. This approach is applied frequently in the NPDES permit process, and more recently in the Total Maximum Daily Load (TMDL) process. This leads to the logical modification of the framework as presented in Comment 1.

This approach is further supported by the derived goal of the Resuspension Standard, as presented on page 44:

"Minimize PCB losses during dredging to reduce risks to human and ecological health by controlling PCB exposure concentrations in drinking water and fish tissue."

Section 2.3.1.2 presents the rationale for developing the load criteria for the standard, examining several perspectives. The rationale discusses the ideal situation as no PCB release at all, and then presents the actual release rates from two documented studies, concluding that export at these levels is unlikely to have any discernable impact on fish tissue concentrations, given the baseline variability. This is the level that could be established as representative of the Water Quality Standard.

Following this, a presentation is made on page 47 of the Minimum Detectable PCB Load Increase. This is equivalent to the Quantification Level established in numerous NPDES permits. This is presented as 300 g/day (65 kg/year), as the minimum observable PCB export rate or load. Additionally, the conclusion is presented on page 47 that "From a monitoring perspective, the target for dredging is no observable increase in PCB load above baseline".

However, I do support the use of the 500 ng/l as the Resuspension Standard that results in the dredging project being suspended. This is a reasonable level where such drastic action is needed. However, I also support the modification of the Action Criteria to use the Evaluation Levels to result in a response equivalent to that presented for the Control Level, as described in my comments on Question 1. This applies to the Suspended Solids Criteria also, except that the use of the 700 mg/l concentration level seems way too high. I would recommend consideration of a criterion that is based upon the upstream value and an allowed increase over the upstream value. This has been set at other sites, and found to work quite well, as a 50% increase over the upstream value. This could be applied to the suspended solids criterion, or also be applied as a turbidity criterion, and would be especially useful for the near field monitoring.

EPA as an agency needs to address the dichotomy of approaches that exist for dealing with PCBs. It is increasingly evident that the Water Program and the Superfund Program are not on the same page when dealing with PCBs. Since the Hudson River project will be one of the largest projects undertaken by EPA, it would be a fitting example if the two approaches could be reconciled here.

5. Monitoring Program: Please comment on whether the monitoring program reasonably can be expected to provide adequate data in Phase 1 that will allow EPA to evaluate necessary adjustments to dredging operations in Phase 2 or to the Resuspension Standard. Also, please identify any necessary improvements to the monitoring program.

Comment: The proposed monitoring program will likely provide more than adequate data in Phase 1 to allow EPA to evaluate necessary adjustments to the dredging operations in Phase 2 or to the Resuspension Standard. The monitoring program is described in Section 3.3, and Attachments F and G.

In fact, the monitoring program could probably be simplified, and the Action Levels condensed consistent with my comments on Question 1. Attachment G presents a nice conceptual model of the decision making process proposed by EPA on page 12 of the attachment. In this model, discussion of the 300 g/day level is presented as "indicative of problems with the dredging operation and warrant further study". Similar discussion is presented for the proposed next two Action Levels (the 600 g/day and 350 ng/l levels), noting for all that they do "not constitute an immediate risk to human or ecological health but rather will delay the recovery of the river if allowed to continue for long periods of time". Inherent in these statements is that there is no real basis for selecting these values as Action Levels. Condensing the Action Levels to just the Evaluation Level will allow for a simpler approach, and be consistent with the approach EPA has used for PCBs in surface waters (see Comment 1).

Some additional comments include:

1. The Baseline Monitoring Program being implemented during the remedial design period (2003-2005) should also be used to evaluate a relationship between turbidity and suspended solids. However, when considered in the my suggested framework in Comment 1, this relationship is not necessary in order to provide feedback on how the containment is working to contain the sediments. In this suggested framework, the turbidity readings themselves would be compared to an upstream value, and an action level is set based on the upstream value, plus an allowance, typically set at an additional 50%.

2. Attachment G provides additional support for using continuous turbidity monitoring over occasional suspended solids sampling. The discussion on page 18 of the attachment provides additional reasons as to why near field monitoring should be done using continuous sampling with a turbidity meter.

Dredging Residuals Standard

6. **Framework: Please comment on whether this framework provides a reasonable approach for developing the Residuals Standard.**

Comment: Taken in their entire context, the framework provides a very reasonable approach for developing the Residuals Standard. However, the rationale for this is not presented in a complete and straightforward manner in any of the presentations of the Residuals Standard. This is primarily because any discussion of the mass of PCBs removed is minimized in favor of a statistical analysis to develop the Residuals Standard. Using both approaches in the explanation of the Residuals Standard would lead to a robust and understandable explanation of the standard.

As a background, the EPA 2002 ROD requires removal of all PCB contaminated sediments in areas targeted for dredging. The PCB mass in the areas targeted for dredging is referred to as the inventory. After removal, there will be an anticipated residual sediment concentration of approximately 1 mg/kg Tri+ PCBs prior to backfilling. This removal and residual concentration is based on EPA modeling of the fish tissue recovery in the Hudson River system. Leaving higher levels in the residual sediments resulted in an elongated (slower) fish tissue recovery period. The modeling assumes 1 foot of backfill, with a final PCB concentration of less than 0.26 mg/kg of Tri+ PCB. This is based on 4 inches of residual sediments at 1 mg/kg mixing with 1 foot of clean backfill, and/or also approximates the sediment concentration likely to result from recontamination due to upstream sources continuing after remediation is completed. Bioturbation is assumed for only the top 6 inches of the backfill layer. For the navigation channel, the EPA modeling assumed a concentration of 1 mg/kg Tri+ PCB due to the inability to add the clean backfill in these areas. These are all reasonable expectations that have been used with success in other environmental dredging projects. These expectations establish the basic framework that EPA built on to set the Residuals Standard.

The approach used by EPA to detail the Residuals Standard was to statistically derive action levels to trigger specific responses. Since there was no site-specific data to use to do this, EPA reviewed other similar environmental dredging projects and used this information in their statistical analyses. Regulatory guidance was used to establish the sampling grid pattern, coupled with additional statistical analyses to ensure that it was not a biased approach. Certification units up to five acres in size were established for comparison with the Residuals Standards, with allowance for averaging over a combined 20-acre area. The 20-acre area was used to be consistent with the fish tissue modeling assumptions. All of this is premised on achieving the initial cut lines and verifying that the targeted inventory (PCB mass) has been removed.

Following this approach, the targeted PCB mass is removed in this remediation process. Assuming this, the issues remaining are:

1. Did the remediation leave environmentally significant amounts of PCB mass behind relative to the original PCB mass?
2. Was there additional PCB mass that should have been removed that was not targeted?

The mass of PCBs in the system is a very important component of this remediation. The models are essentially tracking the movement of the mass of PCBs in the Hudson River system over time. And the models usually have relatively large confidence intervals around their predictions. Models may not always be accurate absolute predictors, but they typically do indicate the relative response expected for different scenarios. In addition, empirical evidence in many contaminated sediment situations has shown the need to remove a substantial mass of PCBs from the aquatic system and confine them appropriately. In essence, removal of the PCB mass from the aquatic system is the next step in a progression toward eventually achieving the PCB Water Quality Standards in the Hudson River.

Considering this, I would propose that the framework for the Residuals Standard becomes two questions:

1. How do we identify the poor removal of a targeted mass of PCBs?
2. How do we identify a significant mass of PCBs that was not originally targeted that now needs to be removed to achieve the fish tissue goals?

To answer these two questions in an efficient sampling manner requires a balancing between PCB concentration and mass considerations. PCB mass can be determined by examining PCB concentrations over a spatial area. This would be used to indicate in general poor removal of targeted mass. PCB concentrations from the same sampling results can also be used as an indicator of additional untargeted mass that may need to be removed. These concentration results would be used to trigger additional sampling to identify the untargeted mass that would need to be removed.

I believe this is precisely what EPA has done with their Residuals Standard, although they have not explained it as such. The use of a 5-acre area for averaging coupled with a 20-acre total averaging framework has the same effect as using the consideration of the PCB mass in this system. The consideration that logically follows is whether the removal of the PCB mass is sufficient to meet the fish tissue goals. Since these areas are consistent with the areas used in the fish tissue models, they are appropriate to use to identify areas where there has been poor removal of the targeted mass of PCBs.

In addition, the use of the concentrations of PCBs by themselves provides an appropriate backstop for general poor removal of targeted mass. This is necessary in itself to set an upper bound for acceptable levels in any area of the targeted removal area, but must be set at a level that does not trigger excessive additional actions. Here again, EPA has established absolute levels that are extremely reasonable in this regard.

Finally, the PCB concentrations over an area need to be considered to determine if they indicate that additional untargeted PCB mass is present that may need to be removed. The consideration here would be to use the data to indicate where additional sampling is needed to identify if there is a mass of untargeted PCBs, the extent of the PCB mass, and if it needs to be removed to achieve the fish tissue goals. Once again, EPA has accomplished this in the Residuals Standard by requiring additional core sampling in these types of situations to recharactarize the vertical extent of PCB contamination, and determine if there is a mass of untargeted PCBs that will need to be removed.

In addition to these considerations, I believe that the absolute level of the Residuals Standard should be compared to that used in other environmental remediation projects. In this case, EPA is proposing to use a variety of action levels based on Tri+ PCBs. Other environmental remediation projects have typically used Total PCBs as their endpoint. As stated by EPA, to convert Tri+ PCB levels to Total PCB levels requires using a multiplier in the range of 2.2 to 3.0. Converting the Tri+ PCB Residual Standard levels to Total PCB levels yields the following table:

Tri+ PCB level	Total PCB level	
	(X2.2)	(X3.0)
1	2.2	3
(1.49)*	(3.3)	(4.5)
3	6.6	9
6	13.2	18
15	33	45
27	59.4	81

* EPA is proposing rounding PCB concentrations to the nearest whole number (see page 36, Section 2.3.4). Therefore, the Residual Standard of 1 mg/kg is actually 1.49 mg/kg, which equates to either 3.3 or 4.5 mg/kg Total PCB.

When considered as action levels based on Total PCBs, these levels are among the higher levels typically set for environmental remediation projects. As a comparison, for environmental remediation projects in Michigan, a residuals target level of no more than 1 mg/kg for Total PCBs has typically been set. This has usually been found to be achievable, primarily because the PCB contaminated sediments are associated with fine sediments that have been relatively easy to remove in the situations found in Michigan. Recent PCB sediment data for the Saginaw River indicate that the remediation project conducted readily achieved the remediation goal of 1 mg/kg Total PCBs in the top six inches of exposed sediments (Taft, 2004). In the Hudson River project, a Residuals Standard target of 2.2 to 4.5 mg/kg expressed as Total PCBs appears very reasonable, and, if dealing with fine sediments, should be readily achievable.

In summary, I conclude that EPA has established a framework that provides a reasonable approach for developing the Residuals Standard. In addition, I also conclude that the Residuals Standard will address the relevant questions dealing with the PCB mass in the Hudson River system. However, I do have a few recommendations for this particular standard:

1. EPA should consider explaining the connection between the Residuals Standard and the PCB mass in the Hudson River system. This would increase the appearance of the robustness of this standard, and allow an easier interpretation of how the standard relates to environmentally desired results.
2. EPA should clarify in all instances in the presentation of PCB data whether the results are in Total or Tri+ PCBs. For example, the results in Table 2-1 are not identified as Total or Tri+ PCBs, but I believe they are Total PCBs.
3. The framework allows for some discretion, based on PCB concentration, to backfill/cap when redredge passes will add little or no benefits. I would recommend that EPA be closely involved in these decisions in Phase 1, and then consider modifications to the process for Phase 2, based on their experiences in Phase 1.
4. The framework essentially requires two redredging attempts before decisions are made for backfilling or capping. I would recommend again that EPA be closely involved in these decisions in Phase 1, and then consider modification to this for Phase 2, based on their experiences in Phase 1.

Reference: Taft, W. 2004. Sediment sampling results from the Saginaw River, 2003. Michigan DEQ report.

7. **Statistical Analyses: Please comment on whether the statistical analyses are technically adequate and properly documented.**

Comment: Overall, the statistical analyses are technically adequate and well documented. I would recommend that the discussion be expanded to include how these levels will relate to achieving the goals of the ROD, in particular the PCB mass removal and fish tissue goals. The premise for developing the statistical analyses is presented on page 12 (2.2.1.3.1). The entire statistical approach is based on a statement in the ROD that the anticipated Residuals concentration will be approximately 1 mg/kg Tri+ PCBs. From this statement, an implication is made that this is the arithmetic average concentration, and that individual data points may exceed the 1 mg/kg level. Further, it was then deemed appropriate to develop statistical action levels to evaluate the degree to which the ROD objectives have been achieved. Action levels are then proposed based on the expected statistical behavior of the residuals around the arithmetic mean of 1 mg/kg. No consideration is presented on how the 1 mg/kg level for the residuals relates to the goals of the ROD. On page 19, a description of how the action levels were chosen is presented. The process is described as to how the statistical analyses didn't yield any single common result, and that judgments were applied in choosing the action levels. This would be an opportune time to discuss the action levels in their relationship to the goals of the ROD, especially in terms of the expected mass removal of PCBs from the targeted areas if the action levels are used. The ROD does use mass removal as the basis for targeting areas in River Sections 1 and 2. In these river sections, mass removals of 3 g/m^2 and 10 g/m^2 were used respectively. River Section 3 used a hybrid approach in that areas with high PCB concentrations and high erosional areas were targeted for remediation.

Specific comments on Section 2.2 and Appendix A include:

1. I could not tell if the Case Study data were presented as Total or Tri+ PCB concentrations.
2. The Tri+ PCB action levels aren't equivalent to Total PCB concentrations. The document refers to a conversion factor of at least 2.2, meaning that the goal of the remediation of 1 mg/kg of Tri+ PCBs is equal to at least 2.2 mg/kg of Total PCBs. A residual level of 2.2 mg/kg of Total PCBs is likely readily achievable.

3. There is no linkage between the statistical analyses and the underlying modeling done for the ROD, especially in regard as to how the PCB mass is considered.
4. The action levels need to be discussed in the context of the mass of PCB that is being removed. If 95% of the mass has been removed in a target area, does the remaining concentration level make an environmental difference? On the other hand, small areas with high concentrations are "hot spots" that are desirable for removal. Discretion is needed here to determine if the mass is "easily" removed and/or makes a difference.

Appendix A presents the mass comparisons needed to make proper judgments on the numbers presented. In this case study, New Bedford, 97% of the mass was removed, even though some fairly high levels of PCB concentrations remained in the surface layer. Appendix A also details what level of PCBs could be in the top 2 cm and still achieve the 1 mg/kg goal (about 5 mg/kg), and presents the mass associated with this. The mass presented for the entire 266 acre Thompson Island Pool would be 114 kg of PCB left behind, out of an estimated 26,000 kg to begin with. This equates to 0.44% of the original mass, or a 99.5% reduction, which is outstanding!

In Section 2.2, the Case Studies were well chosen from those that were found available. They appear most comparable to the Hudson River situation at hand.

The majority of the target areas in the Hudson River are likely to be fine-grained sediments. This is consistent with most PCB contaminated systems. Fine-grained sediments are also conducive to removal actions. The recent experiences in Michigan in the Saginaw River, White Lake (Tannery Bay) and White Lake (Occidental Chemical) cleanups have demonstrated that removal goals can be accomplished with desired results. In these three cases, only one redredge attempt at a maximum was needed to achieve the desired goals in the residuals.

On page 21, the redredge estimates and calculations seem very reasonable. I agree that the cut line selection will be very important. This is a balancing between minimizing the amount dredged and minimizing the redredging attempts. I have found that using a 1 foot over dredge tends to minimize the redredging needed. As this is being considered, it would be useful to remember that 6 mg/kg Tri+ PCBs is being used to indicate that inventory was missed that should have been targeted. This is appropriate as a significant mass of PCB will be left in these areas, and the remedy is geared toward removing the mass from the river system.

Using the Prediction Limit (PL), the estimate for redredging was well presented. The conclusion of 33 acres (8%) for redredging seems very reasonable based on the calculations, and somewhat conservative.

On page 22, the presentation of the likelihood of achieving the goal of 1 mg/kg Tri+ PCBs is well presented. Again, it is emphasized that this is achievable if the cut line design is set for a significant over cut. Also presented is the consideration that the majority of PCBs are located within a foot or so of the sediment surface. The discussion provides a good documentation of why the goal is achievable. A fair portion of this rationale is based on the average levels in River Sections 1 and 3 of 27 mg/kg Total PCB, and River Section 2 of 60 mg/kg Total PCB, and how a 96% reduction will bring these levels down to 1.4 mg/kg Total PCBs (0.6 mg/kg Tri+ PCBs) and 2.4 mg/kg Total PCBs (1 mg/kg Tri+ PCBs).

On page 24, the document explains how the 5-acre Certification Unit was chosen. This appears to be based on 45 target areas with a mean size of 5 acres, and a range in size from 0.5 to 122 acres. Note that the Hudtox modeling used 20-acre river segments for the Thompson Island pool.

On page 25, the range for the number of samples in Table 2-7 is stated to be 15 to 41, yet the GM Massena Pass 2 is asterisked and this has 70 samples indicated. A correction needs to be made somewhere. The choice of 40 samples per 5 acre area is well supported for Phase 1. However, the average number of samples is indicated to be 34, with the Hudson River specific data indicating that 28 samples may be enough. This is an area that should be evaluated for changing after Phase 1, and is indicated as such on page 56.

8. Post-dredging Confirmatory Sampling Program: Please comment on the adequacy of these aspects of the Residuals Standard, in particular the concept of a 20-acre evaluation area for Phase 1.

Comments: (Note: The sections referenced don't seem exactly right. I believe they should be 2.2.9, 2.3.1-4, and 3.1, 3.2, 3.3, and 3.4. Ask ERG about this. I did on November 7, 2003, and the response was to add these sections to the review.)

Overall, this section is explained well and appears adequate. I would recommend additional details be added as described below in regards to the rationale for using the 7.5 acre areas, and the analytical method to be used for PCB homolog determinations. Specific comments on the sections reviewed include:

On page 30, the choice of using core sampling over other samplers like petite ponars is well explained and appropriate for this project. Also, the use of a six-inch surficial core sample is a good choice, in that this represents the biological active zone in freshwater sediments.

On page 32, there is a discussion on discrete vs. composite sampling. Michigan uses a variation on this, with 3-sample composites taken at each station to represent that station. This is done in an attempt to deal with the heterogeneity typically found in sediment concentrations. In the Hudson River situation, this would not change the use of discrete stations, but add a 3-sample composite at each discrete station.

On page 33, I agree that the Inferential and Supplementary Techniques would be good to explore or pilot in Phase 1, and then decide if and how to use these techniques in Phase 2 of the remediation project.

On page 34, the use of a 7.5-acre size for Certification Units is presented here for the first time. It is not explained where the 7.5 acre size comes from, and what the rationale is for using this size. Also, the first two rules seem to conflict - less than five acres are to be a single certification unit in rule 1, while rule 2 says that areas less than five acres in size can be "lassoed" into a single certification unit if the sum is less than 7.5 acres total. This conflict should be clarified and/or corrected. I don't have a problem with this process, except that it is not well explained and no rationale is given for the 7.5-acre size used.

On page 35, there is a nice discussion and analysis of the "waiting period" and sample management.

On page 36, under Sample analysis in Section 2.3.3, the PCB analytical method to determine homolog concentrations is not given. EPA should identify this, and the turnaround time needed should be determined so this will not become a bottleneck in the process.

On page 36 in Section 2.3.4, the use of the average Tri+ PCBs concentration both in the certification unit under evaluation and in a moving 20-acre area consisting of up to four units is explained well. The use of the 20-acre area is good and based on the modeling done to estimate resulting fish tissue concentrations. This type of averaging appears appropriate for this remediation project. The types of actions resulting from this are also appropriate.

On page 37, testing of the backfill should be done for Phase 1, and then considered for revision in Phase 2. Based on the results from Phase 1, testing may not be needed in Phase 2. Again, EPA should identify the analytical method.

On page 38, I would recommend that EPA approval be required for all capping done in Phase 1, and then consider revising this for Phase 2 of the project. The last full paragraph on this page explains the concept and purpose of the capping alternative. This is a good explanation, and forms the basis of a performance standard for these caps. Here again, a discussion of the PCB mass removal would be appropriate in determining when to allow capping, and in determining any maintenance requirements for these caps.

9. **Redredging and Engineering Contingencies: Please comment on the reasonableness of the Residuals Standard with respect to redredging and engineering contingences.**

Comment: Overall, this section is explained well and appears reasonable with respect to redredging and engineering contingencies. I would recommend the changes and additional details be added as described below. However, these changes and details do not substantially alter this portion of the Residuals Standard.

In general, when the Residuals Standard is considered as Total PCBs, this standard is among the higher levels typically set for environmental remediation projects. As a comparison, for environmental remediation projects in Michigan, a residuals target level of no more than 1 mg/kg for Total PCBs has typically been set. This has usually been found to be achievable, primarily because the PCB contaminated sediments are associated with fine sediments that have been relatively easy to remove in the situations found in Michigan. In the Hudson River project, a Residuals Standard target of 2.2 to 4.5 mg/kg expressed as Total PCBs appears very reasonable, and, if dealing with fine sediments, should be readily achievable. The majority of the targeted areas in the Hudson River are likely to be fine-grained sediments. This is consistent with most PCB contaminated systems. Fine-grained sediments are also conducive to removal actions. The recent experiences in Michigan in the Saginaw River, White Lake (Tannery Bay) and White Lake (Occidental Chemical) cleanups have demonstrated that removal goals can be accomplished with desired results. In these three cases, only one redredge attempt at a maximum was needed to achieve the desired goals in the residuals. On page 22, the presentation of the likelihood of achieving the goal of 1 mg/kg Tri+ PCBs is well presented. It is emphasized that this is achievable if the cut line design is set for a significant over cut. Also presented is the consideration that the majority of PCBs are located within a foot or so of the sediment surface. The discussion provides a good documentation of why the goal is achievable. A fair portion of this rationale is based on the average levels in River Sections 1 and 3 of 27 mg/kg Total PCB, and River Section 2 of 60 mg/kg Total PCB, and how a 96% reduction will bring these levels down to 1.4 mg/kg Total PCBs (0.6 mg/kg Tri+ PCBs) and 2.4 mg/kg Total PCBs (1 mg/kg Tri+ PCBs).

Specific comments on the sections reviewed include:

On page 39 (Section 2.3.5), this section describes that residual samples will be collected after the design cut is achieved, after each successive redredge, and within 7 days after dredging is completed. This is very reasonable and should be protective, especially if containment is used around the dredge area.

A contingency is provided due to the diminishing returns expected from more than two redredging attempts, and the impact on the productivity rate for the project. This would be a good opportunity to discuss the relationship to the expected PCB mass removal. This discussion would provide a very good justification for the contingency action.

The redredge limit is set at two times based on case study results and engineering judgment. It is not clear at all what is meant or considered in the “engineering judgment” portion of this decision. This should be explained, or deleted in favor of a discussion of the PCB mass removal aspects achieved already by this time. This would then relate favorably to the goals of the ROD.

There is mention of a condition where the Construction Manager would determine that additional redredging attempts could provide a desired reduction in contaminant concentrations. There should be some discussion of what condition this would be expected in, and what considerations would be made here.

The statement that modifications can be made after Phase 1 is excellent and is what should be evaluated. I further recommend that EPA approve all Phase 1 capping, so they will be intimately involved in these decisions, and be able to make the appropriate changes timely for Phase 2.

On page 40, the use of alternative dredges will be explored in the design of the dredging project. This would also be appropriate to explore in the Phase 1 portion of this project.

On page 41, the design of sub-aqueous capping systems is to consider impacts to habitat, but not monitoring of cap effectiveness and long-term monitoring of capped areas in this document. I question this, because these will determine if the sub-aqueous capping system will help the remedy achieve the goals of the ROD. All of these factors need to be considered in some context in this document, even if in a qualitative fashion. There needs to be linkage between PCB mass removal, residuals, capped areas, and the need for monitoring of cap effectiveness and cap maintenance. I can foresee a scenario where PCB mass removal will be sufficient to achieve the goals of the ROD, and cap monitoring and maintenance would therefore be minimal.

On page 41, there is mention of some areas that will need to be abandoned, subject to EPA approval. This would be after “all practical redredging attempts have failed”. There should be some additional discussion and evaluation of the effect of these areas on meeting the goals of the ROD. This would be along the lines of considering whether the targeted PCB mass of an area has been removed or not. These areas may also be opportunities for piloting the use of alternatives dredging techniques, especially if encountered in Phase 1.

For capping, this document settles on Aquablok, which was the only capping technique retained in the Feasibility Study. Other capping alternatives considered were activated carbon, sealing agents, and immobilization. These other alternatives were all recommended for only limited application, for a variety of reasons. One of the primary reasons was the consideration of habitat for aquatic life. In conclusion, there appears to be one type of cap that has been determined to be suitable for this project – capping with Aquablok. I recommend that this be applied in Phase 1 only with EPA approval. And then evaluate modifying the use of capping in Phase 2 based on the results of Phase 1.

On page 51 in Section 3.5.1, the discussion switches back to terms like "97.5% PL" after using the actual numbers (15 mg/kg) in the previous section (3.5). This should be consistent throughout the document. I would recommend the actual number be used, as this simplifies the document. Otherwise, this section appears very reasonable, as was 3.5.2.

The discussion in Section 3.6 on pages 53-55 regarding Engineering Contingencies is very confusing when compared to Section 2.3.6. These two sections have considerable overlap, and yet seem to ignore each other. It doesn't appear that the conclusions from Section 2.3.6 are carried forward into Section 3.6. It also doesn't appear that the two sections were considered together in this document, even though there should be extensive overlap. I especially like the write-up in Section 3.6, as it essentially establishes the performance standards for capping, even if in a qualitative sense. And it clarifies the relationship between backfill and an isolation cap. I recommend that sections 3.6 and 2.3.6 be reversed, since Section 3.6 establishes the performance standard for capping (except for habitat, which it overlooked), and Section 2.3.6 reviews the specific technologies for implementation to meet these standards. If this was done, and the two sections were written to build on each other, this would make a reasonable outcome.

On page 54, there is reference to restricting cap construction in areas of shallow water. In this context, shallow water needs to be defined.

Productivity Standard

10. **Framework: Please comment on whether this framework provides a reasonable approach for developing the Productivity Standard.**

Comment: The framework outlined in the performance standard seems very simplistic, but it does follow the ROD. The framework relies heavily on an assumption that a transition to full production can be accomplished in Year 2. This assumption seems overly optimistic to me, in that there will be proposed adjustments from Year 1 (Phase 1), review of these proposed adjustments, and uncertainties encountered that will need to be compensated for after Year 1 (Phase 1). I recommend making some adjustments to the framework to account for Year 1 (Phase 1) being a trial period, and recognizing that the first year of Phase 2 (Year 2) may be difficult also. This would be an adjustment of the minimum required to be dredged to lower amounts in the first two years.

I would also recommend that the target amounts to be dredged be based on the example production schedule. The example production schedule is the best accounting of the site-specific factors that I have found, and provides a realistic expectation for the targeted amounts. There is a need to use an approach like this that relies on site specific factors, especially since most of the remediation is targeted in one area (the Thompson Island Pool). Making these two adjustments results in the following Productivity Requirements and Targets:

Dredging Season	Minimum (Cumulative)*	Target (Cumulative)
Phase 1 Year 1	150,000 (150,000)	268,977 (268,977)
Phase 2 Year 2	240,000 (390,000)	529,440 (798,417)
Year 3	565,000 (955,000)	601,910 (1,400,227)
Year 4	565,000 (1,520,000)	564,533 (1,964,760)
Year 5	565,000 (2,085,000)	447,387 (2,412,147)
Year 6	565,000 (2,650,000)	237,860 (2,650,000)

*The cumulative amount represents the minimum cubic yards required to be removed by the end of that season.

This revised schedule allows the contractor to make adjustments and changes within and after Phase 1 and into the first year of Phase 2 without being penalized. This should also allow the contractor to build a buffer with the cumulative yardage as an annual requirement. The penalties for not meeting the minimum need to be explained. EPA should also consider incentives for meeting the targets, perhaps contingent upon meeting all applicable standards.

The concept behind these suggested changes is to allow for the usual difficulties encountered when a remediation project first begins. In this case, the remediation project is very large, and has a very involved public. The fact that this project is also split into two phases essentially makes for two separate project startups. This should be accounted for in both Years 1 and 2. Reducing the minimum required removal volume for Year 2 also accounts for the evaluation of Phase 1, development of proposed changes for Phase 2, public comment and peer review of the proposed changes, and then adjustments by the contractor to account for any changes. The timeframe to accomplish all this will be very tight between Year 1 and Year 2. Further, after several construction seasons on this project, the remediation process should be very efficient. The final years should be the most productive. Therefore, considering all these factors leads to the proposed changes in the Productivity Requirements and Targets.

Some specific comments on Sections 2.1 and 2.3 include:

On page 5, the high daily production rates will affect the requirements for the transfer, processing and transportation of the sediments. I would recommend that the rate be increased from the average daily production rate to a higher rate for design purposes, and propose a rate at about the 75th percentile be used to avoid any bottleneck being formed here. To avoid bottlenecks being formed at this stage of the operation, the conditions of the Water Quality Certification (and/or any associated NPDES permit like document) need to be known prior to design. I would also recommend that strong consideration be given to simplifying this project by requiring mechanical dredging with containment in non-navigation areas, unless EPA approves alternative technologies. This simplifies the design of the transfer, processing, and transportation facilities, especially in regards to the wastewater treatment system.

On page 7, regarding the capacities of the transfer, processing and transporting facilities, the assumption is made in this document that they will be adequate. This assumption may be all right, but the minimum and desired capacities need to be detailed in this document to allow the minimum and targeted amounts of sediments to be handled properly.

The approach taken to develop the Productivity Standard is outlined on Page 7 in Section 2.1.5. Overall, this approach is very reasonable for developing this standard. However, the rationale presented in Section 2.3 on page 24 needs the adjustments as described above. I do agree with the concept of setting the minimum and targeted amounts of sediment to be removed each year, and relying on the cumulative amount removed to judge overall success in meeting this standard.

11. **Example Production Schedule: Please comment on the Example Production Schedule, including the reasonableness of the underlying assumptions for equipment selection, and efficacy, as well as the time necessary to deploy, use, and move equipment.**

Comment: Overall, the Example Production Schedule is very good. I would recommend that this be used to set the target amounts to be dredged each year. Some specific comments on Section 2.2 and Attachment 1 include:

In Section 2.2 on page 8, the choice of mechanical buckets with GPS, and containment structures is a good conservative choice. Regarding redredging, please note that recent experience in Michigan has been that only one redredge has been needed to accomplish project goals. We haven't had to deal with boulders in the dredge areas, but have encountered numerous saw logs in one situation (Saginaw River) and had to change buckets, as the environmental dredge did not work well for removing saw logs.

On page 10, the silt barrier assumptions appear good. I recommend that these be carried through in the design of the project, and required as part of the Performance Standards as shown in the example.

On page 11, the redredge analyses will be conservative in my opinion, based on my experience with these types of projects in Michigan. This discussion is nicely expanded on page 16 in Section 2.2.2.3.

On page 12, the use of one treatment/processing site at the north end of the project is a good assumption for this analyses.

On page 13, the discussion on the thickness of the cut doesn't seem to be very effective or meaningful in this analysis. However, the points raised regarding the presence of boulders and debris are good points to consider. This needs to be developed further for the bid specifications. Some up front work should be done to identify areas where this will be problematic and provide an estimate of the actual time and debris to be removed. This will avoid unpleasant surprises and change orders as the project proceeds.

On page 14, it is not clear how the presence of bedrock will be dealt with in the analysis.

On page 15, the interference with navigation is a good point to consider.

Regarding the length of dredging season, as written, the canals are open 28 weeks of the year, without extensions. The potential of extending this season needs to be confirmed before using it in the Example Production Schedule.

Regarding the daily schedule, as written, the canals are open from 7am to 7pm. This is the same issue as the previous comment – any extension of these hours needs to be confirmed before using the extension in the Example Production Schedule.

On page 16, it is not clear on what type of backfill will be used in this project, or how this will be determined. I would assume that the majority of the backfill would be clean sand. Using clean sand should not create the turbid conditions discussed here.

Regarding sediment dewatering and water treatment, I agree that the bottleneck is likely to occur here. Much more analyses needs to be done here, especially to find out what the requirements will be for wastewater discharged back to the Hudson River, and how to design to meet these requirements. This is absolutely critical to any production schedule. I strongly recommend mechanical dredges be used to minimize the amount of water to be treated. The hydraulic dredge example given on page 18 results in about 13 million gallons per day of water needing Activated Carbon treatment, which is a lot of water to be treated in this fashion. Using mechanical dredging would minimize the water to be treated, resulting in less PCB being discharged back into the Hudson River.

On page 19, there is a discussion on dewatering mechanically dredged sediments. Please note that in White Lake, we had no water to deal with from mechanical dredging. We used a dewatering agent on the barge, and hauled the dredged material directly from the barge to the landfill.

On page 20, there is a discussion on the quality of life issues. These issues typically impact operations, but need to be addressed. We have found these issues are very important locally, and actually not too difficult to adjust the remedial operation to address them. I would have an expectation for the Hudson River project that there will be issues, which will take some time and effort to address, but I would also expect that the issues will be resolvable.

On page 23, there is a discussion on post dredging sampling. There is no mention of the labs to be used for the PCB analyses, and their expected sample turnaround time. This is going to be a factor once the initial inventory is removed.

In Attachment 1, on page 6, please note that we have left some silt barriers in place over winter in Michigan with some success. I believe the winter weather in both areas is similar. We found that we did not have to replace most of the silt barriers the following year.

In addition, there was a comment that was submitted by General Electric in their November 18, 2003 letter that I would like to address. This is in regard to the length of the construction season and the interference from ice and freezing temperatures. We have not found this to be a problem for mechanical dredging. In fact, we have had mechanical dredging operations conducted throughout the winter, and even specified this in one project (in order to reduce odors and their perception in a highly populated area). However, we have found this to be a particular issue for hydraulic dredging, because of the equipment used, and the amount of water associated with this type of dredging. The main issue is usually with the pumps and the water treatment facilities freezing and/or performing poorly. This is another reason why I would recommend that mechanical dredging be used in this project. If mechanical dredging is used, I would not see an issue with the length of the construction season as General Electric has represented.

12. **Action Levels: Please comment on appropriateness of the action levels and the required action, as well as the reasonableness of the monitoring and record keeping requirements.**

Comment: The monitoring and record keeping requirements are very reasonable. I would suggest setting a date for the monthly reports to be submitted to EPA. This date could be something like the 10^{th} of the following month (i.e. the report for June would be due by July 10).

The proposed Production Schedule for each year is due in the document on March 1. I would recommend moving this date up to February 1 to allow time for review and any adjustment in the schedule before potential mobilization.

The concept behind the action levels needs to be defined. There is no clear explanation as to why there is a concern level and a control level, and how these levels relate to the standard. As I have read the document, this is my understanding of these levels:

Concern Level: At this level of production, EPA is beginning to become concerned about the level of production, but is willing to allow the contractor the freedom to make adjustments and take whatever actions the contractor deems appropriate to increase production. EPA will not require any reports, or other documentation of the actions taken, but will continue to watch the level of productivity.

Control Level: At this level of production, EPA concludes that the contractor actions are not adequate to raise the production level without EPA involvement. EPA will work with the contractor to raise productivity to erase the shortfall, meet the production minimum targets, and make sure all other standards are met as production is increased. This may include financial penalties.

The concept presented above is based on meeting the production schedule over 6 years. If this is being met, the contractor can make adjustments without involving EPA. If not, EPA will be involved in making the adjustments. By following this concept, I would recommend expanding the action levels to account for a very bad single month, and allow consideration of how the progress has been overall in meeting the production schedule. This would include consideration of situations where it will be unlikely to meet a multi-month production level, and will jeopardize meeting the yearly and cumulative requirements.

Here is an example of how a single month criterion can be used with the proposed criteria:

Month	Goal	Actual	EPA Proposed Response	My Suggested Response
1	100 units	50	concern	control
2	100	130	ok	ok

The reason for involving EPA after one month in my suggested response is that the contractor is going to be taking some extraordinary measures to increase production, and there would be a need to be sure the other performance standards and quality of life issues were also considered. The example above used a criterion of 50% attainment of the minimum goal for production to trigger this response after a single month. This may be an appropriate level for a single month control level response.

I would also propose that consideration be given to how the production levels will affect the yearly and cumulative production goals. If these were revised as proposed earlier in my comments on Question 10, the contractor would likely be able to make the adjustments in the first two years, and have a cushion for production in future years. If there was a cushion for production in future years, then EPA would not need to be as concerned about how any particular month would affect meeting the overall standard of project completion in six years. However, if there is no cushion after the first two years, EPA will and should be very concerned about the production levels achieved each and every month until the end of the project. This concept should be reflected in a narrative statement regarding the cumulative minimum requirement, the seasonal target, and EPA ability to require action if the project is falling short of the cumulative target.

In addition, EPA needs to explain what sort of actions will be taken if the contractor fails to erase a shortfall at the end of the dredging season. Here again, I would recommend a tier of considerations be made, including comparison to the cumulative requirement, before actions are taken.

Questions Related to All Three Engineering Performance Standards

13. **Interactions Among the Standards: Please comment on whether the main interactions among the standards are properly documented and taken into account.**

Comment: Overall, the interactions among the standards are only qualitatively described in the Executive Summary, Introduction, and Section 3.2 of the Productivity Standard. The discussion does not describe what will happen if the interaction among the standards results in one or more not being met. There is no indication of how EPA will consider the standards, and make decisions regarding them when they interact and potentially conflict. This could be explored as part of the Phase 1 process, and then evaluated for modification prior to Phase 2.

An example of this would be allowing the flexibility in productivity to be extensive in Phase 1, while evaluating the ability to achieve the standards set for resuspension and residuals during this time period. This could be accomplished by setting the minimum amount required to be dredged at the lower end of the range required in the ROD (150,000 cubic yards) while retaining a higher goal as a targeted amount. After Phase 1, modifications and estimates would be made, with projections as to how and where the interactions among the standards would be occurring as the project moves ahead, with the intent on defining and meeting all three standards.

Additional discussion should describe how EPA would make judgments to balance the standards as the project moves ahead. For example, this could include how production could be increased to meet a shortfall and still meet the other standards. And the discussion should present how conflicts between two standards will be resolved. In addition, the discussion should present how the Quality of Life Standards will be considered and balanced with the Performance Standards.

14. Please comment on whether there are any additional aspects to effectively accomplish the refinement that EPA should consider in evaluating the Phase 1 data.

Comment: In general, the plans for refinement are well constructed, especially the Residual Standard evaluations discussed in Part 2. One of my major concerns is that there will be a short period of time to accomplish these evaluations and then ensure that they can be implemented as Phase 2 begins. This is one of the reasons that I have proposed modifying the required amount of dredging to be performed in Years 1 and 2. Allowing a lower amount of dredging in both years will account for the unforeseen issues that will need to be addressed in Phase 1, and provide some additional time for the evaluations to occur and be implemented as Phase 2 begins.

For the Resuspension Standard, I have a few recommendations:

1. Use the baseline water sampling to establish a relationship between turbidity and suspended solids prior to commencing Phase 1. This relationship can be further evaluated under actual dredging conditions as Phase 1 progresses.
2. Consider using a near field turbidity limit for a dredge site to limit sediment loss from each site. This would provide real time data and can be evaluated after Phase 1. A limit could be constructed simply based on a change from background conditions. In other situations, this has been accomplished using a standard for turbidity not to exceed the background level plus 50 percent.
3. Consider prescribing containment for each non-navigational dredge site, and reducing the Action Levels to just the Evaluation Level (with a Control Level response if exceeded). This would simplify the operation, and provide the environment with the level of protection consistent with that prescribed by EPA in other situations in the water program.
4. Evaluate the use of automated samplers for water column sampling of PCBs at far field stations to provide an integrated 24-hour average PCB concentrations.

For the Residuals Standard:

1. EPA should evaluate using the mass of PCB in their development or modification of the standard. This would be used as a percent PCB mass removal requirement at each Certification Unit as part of the decision process as to when the residuals are adequately addressed. Expressed another way, if a certain PCB mass removal was achieved in a Certification Unit (for example, 99%), then EPA could waive the requirements based on the PCB concentration levels for the Certification Unit. This would allow discretion under certain circumstances, including both those where there is little to gain from further removal of sediments, and those where a localized hot spot should be addressed by additional removal efforts.
2. EPA should consider the possibility of reducing or eliminating testing of the backfill based on Phase 1 results.
3. Due to the concerns about the use of "capping" here, EPA should approve all caps on a site-specific basis for Phase 1, and then consider revising this for Phase 2.

For the Productivity Standard:

1. Careful evaluation of the transfer and processing facility will be needed to make sure this is not going to be a bottleneck when full production is reached.
2. Related to this, an evaluation of the wastewater treatment facility capabilities will also be needed to make sure that this facility can meet the discharge requirements and not cause a bottleneck when full production begins. This will be especially critical if hydraulic dredging is used, as this generates large quantities of water that will need special treatment.

Finally, EPA needs to identify specifically how they will evaluate the interaction of these three Performance Standards after Phase 1. An example of this would be allowing the flexibility in productivity to be extensive in Phase 1, while evaluating the ability to achieve the standards set for resuspension and residuals during this time period. This could be accomplished by setting the minimum amount required to be dredged at the lower end of the range required in the ROD (150,000 cubic yards) while retaining a higher goal. After Phase 1, modifications and estimates would be made, with projections as to how and where the interactions among the standards would be occurring as the project moves ahead, with the intent on defining and meeting all three standards.

15. Please provide any other comments, concerns or suggestions, involving both strengths and weaknesses, with respect to the October 2003 Draft Engineering Performance Standards – Peer Review Copy that may not be fully covered by the above charge questions.

Comment: Regarding the relative strength of the three Performance Standards, I would rate the Residuals Standard as strong, the Resuspension Standard as moderate, and the Productivity Standard as weak. My comments on the Residuals Standard primarily dealt with strengthening the rationale. Regarding the Resuspension Standard, this standard should be changed to be consistent with the EPA Water Program approach to these situations. The Performance Standard is the weakest of the three, but the Example Production Schedule is well developed.

The Performance Standards should also require identification of the failure points and likely remedies. Once this is done and where likely remedies are agreed to, appropriate equipment and materials should be on site when remediation begins. This will allow rapid response to any such failures, if they occur.

This concludes my comments. Please feel free to contact me with any questions or clarification requests at either 517-335-4114 or creal.bill@acd.net. I appreciate the opportunity to be involved in this remediation project and hope these comments provide assistance as this project moves forward.

Richard Fox
Preliminary Comments

PEER REVIEW COMMENTS
HUDSON RIVER ENGINEERING PERFORMANCE STANDARDS
RICK FOX, NATURAL RESOURCE TECHNOLOGY, INC.

RE: Comments for Charge Questions for Peer Reviewers

Dredging Resuspension Standard

1. Please comment on whether this framework provides a reasonable approach for developing the Resuspension Standard

   Comment: The framework provides a reasonable approach for developing the Resuspension Standard except for the inability of the consultants to consider the New York State Water Quality Certification, which is yet to be completed at the time of these comments. The tiered action levels provide warnings for potential problems and require increased monitoring prior to engineering controls, but there are too many tiers. The standard is too complicated, due to the fact that concentrations and loads must be considered. The standard is adequate for Phase 1, however it should be stated that a goal is for the standard to be simplified for Phase 2. The standard should allow for maximum flexibility, yet be protective of water supplies and excess downstream loading of PCBs.

2. Please comment on the technical adequacy of the near-field analyses, in particular the linkage from the resuspension production rate (at the site of dredging), to the resuspension release rate (reflecting PCB transport in the water column in the immediate vicinity of the dredging operations) and finally to the resuspension export rate (essentially equilibrium conditions reflecting long-distance transport of PCBs in the water column.

   Comment: The near-field analysis linkage from the resuspension production rate to release and export is reasonable. Models approximate and do not consider all inputs that can affect actual releases. Further heterogeneity of sediments being dredged can cause variations on a smaller scale than the model predictions. It is critical to reevaluate information after Phase 1 dredging has occurred. Results from Phase 1 dredging should allow for better prediction of far-field affects based on near-field observations and hopefully simplification of this Standard.

3. Please comment on the appropriateness of the Evaluation Level as a component of the standard applied to for Phase 1.

   Comment: The Evaluation Level is appropriate for Phase 1 for both the far-field and near-field. This level is set to indicate that the resuspension levels exceed predicted levels for the project but are not of concern. Additional monitoring to determine the reasons for the cause of the resuspension will likely allow corrective actions (if necessary and prudent) to be implemented prior to exceeding the 500 ng/L Theshold Standard.

4. Please comment on the reasonableness of the 500-ng/L Total PCBs threshold concentration developed for the Resuspension Standard.

   Comment: The 500-ng/L Total PCB threshold is reasonable and appropriate to assure downstream drinking water supplies are protected regardless of water treatment applications.

5. Please comment on whether the monitoring program reasonably can be expected to provide adequate data in Phase 1 that will allow EPA to evaluate necessary adjustments to dredging operations in Phase 2 or to the Resuspension Standard. Also, please identify any necessary improvements to the monitoring program.

   Comment: Phase 1 monitoring will very likely provide adequate data for refining the Resuspension Standard for Phase 2.

   A primary goal for Phase 1 of the Resuspension Standard **should be** to gather enough data to simplify the standard for implementation during Phase 2. There are research aspects to Phase 1 activities that are valuable to refinement of the standard but not necessary for protecting human health or the biota. These include, but are not necessarily limited to the number and locations of near-field monitoring stations, collection of TSS and turbidity, and measuring dissolved and particulate-bound PCBs. Elements of the monitoring program that are part of Phase 1 that will provide correlative data for refinement of the Standard should be identified as such. Because sampling is very costly, it would be prudent to provide GE with this as the rationale for requiring information that does not directly relate to increased losses of PCBs due to dredging activities that are of a level that will affect the public or biota.

   Much of the information used to provide the framework for the Resuspension Standard is based on modeling activities. There will very likely be aspects of the project that do not fit the predictions of the models or follow the case studies. Case studies do not provide sufficient data on what releases are likely (especially since processes and equipment have not yet been finalized in remedial design). This project is unprecedented in scope. The site-specific measurements collected during Phase 1 are necessary to refine the Standard for Phase 2.

Dredging Residuals Standard

6. Please comment on whether this framework provides a reasonable approach for developing the Residuals Standard.

   Comment: The overall framework for determining the Residuals Standard is reasonable.

   A 5 Acre Certification Unit (CU), though arbitrary, is reasonable. The statistical basis for requiring 40 samples is valid if individual samples must be averaged. However, compositing should be allowed. Compositing will allow for determine whether the goal is removal of materials above 1 ppm Tri+ along with the goal is an average concentration target of 0.25 ppm Tri+. If the overall remediation goal is to attain an average surficial sediment concentration of 0.25 ppm Tri+ after dredging, the method to determine this concentration should be flexible. Compositing will allow for considerable savings on analytical costs.

The following is a proposed compositing scheme. 40 individual samples should be collected. An aliquot of each should be composited and analyzed. Further, 20% or 8 individual samples should be analyzed separately. If the composite result is 1 ppm Tri+ or less, the CU should pass as long as none of the individual sample results is greater than the PL of 15 ppm Tri+. If a single sample exceeds the PL or the composite result is greater than 1 ppm Tri+, all samples should be reanalyzed to determine where to re-dredge.

The same sampling nodes should be used for confirmation as were used for pre-design characterization. A considerable investment has been made in the pre-design sampling to adequately characterize the distribution of PCBs in the system. Eight samples per acre is a higher rate of sampling than is being performed on the Fox River for their pre-design characterization (four samples per acre). Sampling the same nodes for residual characterization will provide direct information on whether the target dredge elevations have been achieved based on PCB concentrations and one less variable for to account for when determining effectiveness of dredging.

7. Please comment on whether the statistical analyses are technically adequate and properly documented.

   Comment: The 40 cores per 5 acres are based on a statistically valid data set. The analyses also appear to be documented properly. However, there should be an allowance for compositing of samples (see above).

8. Please comment on the adequacy of these aspects (in Sections 2.2.9 and 3.0 along with Sections 2.3.1-4 and 3.1-4) of the Residuals Standard, in particular the concept of a 20-acre evaluation area for Phase 1.

   Comment:

   2.2.9: There are advantages and disadvantages for each of the types of equipment discussed in this section. Coring will allow for collection of more 6 inch layers that could be archived for future analysis if necessary. Disallowing the use of composite samples was rejected because if a CU fails then too much re-dredging will be required. The Residual Standard should allow the RP determine whether they want to risk having to perform cleanup passes over a larger area, perform additional PCB analyses on individual samples as long as the schedule is not adversely affected. Further, aliquots of individual samples (used to create a composite) could be archived and analyzed if a composite sample failed.

2.3.1-4: The ability to "lasso" areas to create areas up to 7.5 acres allows for flexibility and helps ensure that there will not be many sub-five acre areas requiring 40 samples each. The grid should not be offset for confirmation sampling. Sample nodes should be the same for pre- and post dredging. Site variability should be duly accounted for during the pre-design characterization. The "fluff" issue was clearly and succinctly addressed.

The moving 20-acre CU analysis of the Residuals Standard requirement allows for flexibility. This is commendable. It meets the overall goal of adequately removing sediment inventory to reduce the surface concentrations of PCBs in the sediment surface. Further this flexibility is reasonable due to placement of the backfill after dredging is complete. The effectiveness of "lassoing" should be evaluated after Phase 1.

It is unclear why there are additional constraints of no sample greater than 27 ppm Tri+ and only one sample between 15 and 27 ppm Tri+. If the average concentration meets the goal, then the CU should pass. If not, it should not. It is unlikely that a CU will pass the 1 ppm Tri+ standard if samples are exceeding these values. The ROD does not impose these additional constraints. Further, there must be an acknowledgment that this project will have areas that exceed the 1 ppm Tri+ level and areas that will be well below it. The backfill will ensure that "micro-hotspots" are not biologically available and significant.

9. Please comment on the reasonableness of the Residuals Standard with respect to re-dredging and engineering contingencies.

Comment: It is not reasonable to pre-determine the number of dredging attempts required. If the target elevation has been achieved, then the pre-determined inventory has been removed. There can be several reasons for non-attainment of the residuals standard in an instance when the inventory has been removed. These reasons include:

- Insufficient characterization of inventory prior dredging design;
- Variability in PCB distribution within the sediments; and
- Physical difficulties removing inventory (*e.g.*, difficult substrate, proximity to structures).

Additional dredging passes could improve the PCB concentrations in the first two cases. Additional passes would likely not improve the concentrations in the last case.

The Residuals Standard should err on the side of being flexible as far as re-dredging during Phase 1 and refining the standard based on Phase 1 results for implementation of Phase 2.

Productivity Standard

10. Please comment on whether this framework provides a reasonable approach for developing the Productivity Standard.

Comment: The framework provides a reasonable approach to developing the Productivity Standard as a stand-alone standard. It does not adequately consider the other standards, however.

The framework used to generate the Productivity Standard is based on assumed reductions in the capacity or rates of unit pieces of equipment or steps in the process (*e.g.*, dredging, handling, and transportation). It is reasonable to make such assumptions and there is an adequate base of experience to determine reasonable capacities and rates. However, many problems are encountered during dredging projects. Often these problems lead to zero-production days. Further, individual problems are typically encountered at different times, rather than concurrently. If such problems are encountered for the Hudson River remediation (and likely they will be) the solution to simply ramp up production could be incongruent with meeting the Resuspension and Residuals Standards.

As an example, the 2000 Fox River 55/57 project (2nd Phase) had a target daily removal rate of 833 cubic yards (CY) so approximately 50,000 CY could be removed in 60 days. An average of 574 CY per day was removed. On the highest production day, 1,599 CY was removed. The dredging rate was increased by providing additional dredging and dewatering equipment (presses). Additional dredges were necessary because a dredge had to sit idle pending results of confirmatory sampling to verify cleanup levels were obtained (which will likely occur in the Hudson River).

SMU 56/57*

Total PCB's removed from river ('99 and '00)	2,111 Pounds
Contaminated sediment removed from river (in situ)	50,316 Cubic yards (CY)
Average CYs of sediment removed per day	723 tons / 574 CY
Highest daily production rate	1,599 CY
Highest weekly production rate	1,265 CY per day
Treated water returned to river	66.3 million gallons
Dewatered sediment transported to landfill	51,613 tons / 41,000 CY
Truckloads of sediment transported to landfill	2,484

*Data taken from Wisconsin Department of Natural Resources web site URL:
http://www.dnr.state.wi.us/org/water/wm/lowerfox/sediment/56_57update.html

The information above shows that in order to meet scheduling requirements for the Fox River, the system had to be modified to be able to provide almost double the anticipated daily dredging capacity (anticipated average daily production rate = 833 CY, highest daily production rate 1,599 CY). Further the average daily production rate for a week was 1.5 times the anticipated rate (1,265 CY vs. 833 CY).

When a project must be ramped up to make up for lost dredging days, a corresponding increase needs to occur with sediment handling, dewatering, and transportation. It is not possible to determine which unit processes are rate limiting until design is completed. Further, each unit process must be assessed to determine if increasing the capacity or rate will have a corresponding affect on the Resuspension or Residual Standard. Many, if not most of the problems that affect productivity will be encountered during Phase 1. This will allow attempts to overcome these problems while assessing their practicality and affects on the Resuspension and Residuals Standards. The Productivity Standard should be a target during Phase 1 and modified for Phase 2.

If adding dredges is necessary for the Hudson River, there will likely be a corresponding increase in the resuspension of materials during the project. This if resuspension is too high due to increasing dredging production, a decision must be made to allow flexibility in the production schedule or take further steps to decrease resuspension.

The standards should be ranked in importance; the Productivity Standard should be the least important.

11. Please comment on the Example Production Schedule, including the reasonableness of the underlying assumptions for equipment selection and efficacy, as well as the time necessary to deploy, use, and move equipment.

Comment: The Example Production Schedule is a reasonable estimation of how the project could proceed. The assumptions are reasonable based on some of the example dredging projects that have been conducted. However, each dredging project is unique. Perhaps the most unique aspect of this project is the size. It is conceivable, if not probable, that unique problems related to the size of this project will be encountered. It is the unforeseen problems that will cause the biggest delays to the schedule of a project. If there are difficulties attaining the Residuals Standard beyond what is budgeted for, re-dredging could preclude maintaining the Production Standard. If there are difficulties attaining the Resuspension Standard, the Production Schedule will likely not be subject to accelerating by adding equipment. While this example Production Schedule is reasonable, it must be verified during Phase 1.

12. Please comment on appropriateness of the action levels and the required actions, as well as the reasonableness of the monitoring and record keeping requirements.

Comment: The action levels and required actions are appropriate and likely necessary to keep to a schedule. However, there must be some allowance for slipping the schedule due to circumstances beyond control (*e.g.*, inability to meet the Residual or Resuspension Standards), especially during Phase 1.

Much of this may be avoided if there is allowance for the 2nd Phase of dredging to be deferred up to a year if Phase 1 results require significant changes that cannot be engineered for over a winter period. However, if refinement of the Engineering Standards can be accomplished in less than 6 months, Phase 2 dredging should begin in Year 2. If even a half season production level can be attained in the 2nd year, the project can still be completed in six years.

Questions Related to All Three Engineering Performance Standards

13. Please comment on whether the main interactions among the standards are properly documented and taken into account.

    Comment: The main interactions are not properly documented and taken into account for all of the Standards. They are interdependent and therefore must be prioritized. This is especially true since design has not been completed. There are no models that accurately predict the interaction of the standards. Further, there are no dredging projects that have required three such standards to be met.

    The Productivity Standard should be considered secondary to the Residual and Resuspension Standards, as the timeliness of the project is much less critical than the level of PCBs left behind and the amount of PCBs transported downstream as a result of the remedial efforts. This does NOT mean that the Productivity Standard is unimportant or cannot be achieved. It does mean that if the best efforts to achieve the other Residual and Resuspension Standards mean delaying the schedule, this should override the attainment of the Productivity Standard.

14. Please comment on whether there are any additional aspects to effectively accomplish the refinement that EPA should consider in evaluating the Phase 1 data.

    Comment: There should be strong consideration given to allowing up to one year between Phases 1 & 2 if necessary. This is particularly important for refining the Resuspension Standard, as there are monitoring requirements for this Standard that seem to be included to obtain information and/or data to provide a basis refinement of the Standard. Further, the Resuspension Standard is too complicated and the stated goal of Phase 1 should be to refine and simplify this Standard during Phase 2.

    The frameworks for these standards are reasonable based on modeling and case studies. However, there are aspects to this project that significantly differ from the case studies. Further Remedial Design has not yet been completed. Phase 1 should be considered a Full Scale Demonstration phase. All data collected for the Engineering Performance Standards should be viewed as providing a basis for refinement of each standard. Based on the Phase 1 data and information, the stakeholders will be able to determine whether it is reasonable to consider all standards of equal importance or whether the Productivity Standard should be considered secondary to the Resuspension and Residuals Standards. However, during Phase 1, the Productivity Standard should definitely be of lesser importance than the Resuspension and Residuals Standards.

15. The Performance Standards should not be given equal weight. It is far more important to obtain the Residuals Standard within the constraints of the Resuspension Standard than to meet the Productivity Standard, **regardless** of what is stated in the Record of Decision, even if this requires modification of the ROD.

Thomas Kenny
Preliminary Comments

Charge to Peer Reviewers

In February 2002, the United States Environmental Protection Agency (EPA) issued a Record of Decision (ROD) for the nearly 200-mile long Hudson River PCBs Superfund site. The remedial action objectives identified for the site are as follows (see, ROD, pp. 49-51):

1) reduce the cancer risks and non-cancer health hazards for people eating fish from the Hudson River by reducing the concentration of PCBs in fish;

2) reduce the risks to ecological receptors by reducing the concentration of PCBs in fish;

3) reduce PCB levels in sediments in order to reduce PCB concentrations in river (surface) water that are above surface water standards set for other environmental laws (applicable and relevant requirements, or ARARs);

4) reduce the inventory (mass) of PCBs in sediments that are or may be bioavailable; and

5) minimize the long-term downstream transport of PCBs in the river.

EPA's cleanup decision calls for, among other things, environmental dredging and off-site disposal of about 2.65 million cubic yards of PCB-contaminated sediments to remove some 150,000 pounds of PCBs from the 40-mile long Upper Hudson. The ROD also calls for Monitored Natural Attenuation of PCB contamination that remains in the river after dredging. The dredging will occur in two phases over six years and is scheduled to begin in 2006. The first phase will be the first year of dredging and the second phase will be the remaining five years of dredging. Phase 1 will occur at a reduced rate of dredging that will allow comparisons of operations with pre-established performance standards and evaluation of necessary adjustments to dredging operations in the succeeding phase or to the standards.

EPA's cleanup decision requires performance standards for dredging resuspension, PCB residuals after dredging, and dredging production rates as well as the attendant monitoring program (collectively, the Engineering Performance Standards). The ROD requires that these performance standards be developed in the remedial design phase of the project with input from the public and in consultation with state and federal natural resource trustees. The performance standards will be based on objective environmental and scientific criteria. Beginning in Phase 1 and continuing throughout the project, EPA will conduct extensive monitoring. EPA will use the monitoring data, as well as the Agency's ongoing evaluation of the dredging operations with respect to the performance standards, to evaluate the project to determine whether it is achieving its objectives to protect human health and the environment.

The ROD further requires two independent external peer reviews related to the Engineering Performance Standards. This peer review, on the October 2003 Draft Engineering Performance Standards - Peer Review Copy, is the first peer review. The Engineering Performance Standards that are finalized after this first peer review will be applied during the first dredging season (i.e., Phase 1). EPA will then prepare a report that evaluates the Phase 1 dredging with respect to the Engineering Performance Standards, which will be the subject of the second peer review. Following the second peer review, EPA will finalize the Engineering Performance Standards that will be applied during Phase 2.

Consistent with EPA's Peer Review Handbook, the peer reviewers are asked to determine whether the October 2003 Draft Engineering Performance Standards - Peer Review Copy is technically adequate, competently performed, properly documented, satisfies established quality requirements, and yields scientifically valid and credible conclusions. The reviewers are not being asked to determine whether they would have conducted the work in a similar manner.

It is important to keep in mind that the Engineering Performance Standards do not encompass other important aspects of the project, such as:

- the quality-of-life performance standards being developed by EPA (e.g., limits on noise, odor, lights);
- the substantive water quality certification requirements for the dredging project being developed by New York State pursuant to the federal Clean Water Act;
- the community health and safety plan for Remedial Action (e.g., community notification of ongoing health and safety issues), which will be developed by General Electric Company (GE) pursuant to an EPA Administrative Order on Consent for Remedial Design (RD AOC);

- the engineering design being developed by GE pursuant to the RD AOC, including the pre-dredging baseline monitoring program, the habitat delineation and assessment work, and the environmental monitoring program for the dredging project;

- specifications in the construction contract for the dredging operations, including the specific means and methods, and

- the long-term monitoring program that will be conducted after the dredging project is completed, to help evaluate the Monitored Natural Attenuation component of EPA's 2002 cleanup decision for the Site.

Peer Review Documents

The following documents are being provided to the peer reviewers as the focus of the peer review:

- Draft Engineering Performance Standards - Peer Review Copy, October 2003 (4 volumes)
- Part 1: Performance Standard for Dredging Resuspension
- Part 2: Performance Standard for Dredging Residuals
- Part 3: Performance Standard for Dredging Productivity
- Appendix: Case Studies of Environmental Dredging Projects; and
- This Charge for peer review

Background Information

EPA also is providing the peer reviewers with electronic copies of the documents listed below, which contain background information relevant to EPA's development of the October 2003 Draft Engineering Performance Standards - Peer Review Copy. The reviewers are not being asked to peer review any of the background information.

- EPA's October 10, 2003 responses to public comments received during the public comment period (May 14 to July 14, 2003), as well as the comments themselves.
- Suggested charge questions submitted to EPA from interested parties (General Electric Company, the National Oceanic and Atmospheric Administration, Saratoga County Environmental Management Council, and Scenic Hudson, Inc.)

- EPA's February 2002 Record of Decision; and
- Excerpts from Responsiveness Summary (Part 3 of ROD), specifically:
  - White Paper - Resuspension of PCBs During Dredging
  - White Paper - Relationship Between PCB Concentrations in Surface Sediments and Upstream Sources
  - White Paper - Metals Contamination
  - White Paper - Dredging Productivity and Schedule
  - White Paper - Delays and Downtime
  - White Paper - Model Forecasts for Additional Simulations in the Upper Hudson River
  - White Paper - Rail Operations
  - White Paper - Post Dredging PCB residuals
  - White Paper - Example Sediment Processing/Transfer Facilities
  - White Paper - Relationship between Tri+ and Total PCBs

The background information listed above, as well as other documents related to the Site, are available on EPA's website for the Hudson River PCBs Site (www.epa.gov/hudson) or by request.

CHARGE QUESTIONS FOR PEER REVIEWERS

DREDGING RESUSPENSION STANDARD

1. Framework: The Resuspension Standard was developed with a routine (i.e., baseline condition) water quality monitoring plan and three tiered action levels (Evaluation, Concern, and Control) leading up to a maximum allowable concentration of PCBs in river water. Exceedence of an action level would trigger additional monitoring requirements beyond the routine monitoring, as well as operational or engineering steps (studies and operational or engineering improvements and, if necessary, temporary halting of operations). The Resuspension Standard was developed with this framework to accommodate the project need for both protection and production (i.e. upon an exceedence of an action level, appropriate steps can be taken to identify and address remediation-related problems before dredging operations would need to be halted temporarily) (see, for example, Section 2.3: Rationale for the Standard).

QUESTION 1

Please comment on whether this framework provides a reasonable approach for developing the Resuspension Standard.

RESPONSE

No comment at this time

2. Near-Field Analyses: Development of the Resuspension Standard considered the potential effects of resuspension in the near-field and in the far-field[1] (see, Section 2.1.2: Definitions). The near-field work was performed to help identify the locations of the near-field water column monitoring stations, to estimate the loss from the dredge, to estimate the nature of the release (i.e., dissolved vs. suspended) to provide an estimate of the solids transported into the far-field, and to estimate the effects of settled material on PCB concentrations in near-field sediment. Relevant sections of the document include, but are not limited to, Section 2.2.7: Near-Field Modeling, Section 2.2.8: Relationship Among the Resuspension Production, Release and Export Rates, and Attachment D: Modeling Analysis.

QUESTION 2

Please comment on the technical adequacy of the near-field analyses, in particular the linkage from the resuspension production rate (at the site of dredging), to the resuspension release rate (reflecting PCB transport in the water column in the immediate vicinity of the dredging operations) and finally to the resuspension export rate (essentially equilibrium conditions reflecting long-distance transport of PCBs in the water column).

RESPONSE

No comment at this time.

3. Evaluation Level: The Evaluation Level of the Resuspension Standard can be reached by exceeding criteria for net (i.e., over baseline) PCB load (mass loss) measured at far-field locations

[1] The far-field work was performed to evaluate the long-term effects of dredging on PCB concentrations in the water column and in fish tissue of the Upper and Mid-Hudson. The linked fate and transport and bioaccumulation models of the Upper Hudson (HUDTOX and FISHRAND, respectively), which were used to evaluate far-field effects, as well as the input parameters used to evaluate the long-term effects on human health and ecological receptors, were the subject of prior peer reviews. As such, they are not the subjects of this peer review.

or criteria for net suspended solids concentrations measured at either near-field or far-field locations (see, Table 1-1). The Evaluation Level was specifically developed for Phase 1 to provide the site-specific information necessary to understand the mechanisms of PCBs release from dredging in the Upper Hudson, which in turn is needed to guide the selection of appropriate engineering controls, as necessary. As stated in the Resuspension Standard, EPA anticipates that sufficient data may be collected in Phase 1 to justify eliminating the Evaluation Level in Phase 2. Also, the Evaluation Level is well above the best estimate of dredging release alone. Some of the public comments that EPA received suggested that the dredging operations should not be allowed to increase PCB concentrations in the water column above baseline conditions (i.e., that the Evaluation Level should be the threshold level that results in the temporary halting of dredging). Other comments suggested that the requirements of the Evaluation Level and Concern Level should be reduced and combined into one level prior to the Phase 1 dredging. Relevant sections of the document include, but are not limited to Section 3.1.1: Evaluation Level).

QUESTION 3

Please comment on the appropriateness of the Evaluation Level as a component of the standard applied to for Phase 1.

RESPONSE

No comment at this time.

4. Resuspension Threshold: Under the Resuspension Standard, the maximum allowable concentration (i.e,, threshold) in the water column is 500 ng/L Total PCBs, which is the maximum contaminant level (MCL) for potable water under the federal Safe Drinking Water Act. This threshold concentration was selected in consideration of the goals of the cleanup, which include protecting downstream public water supplies that draw from the river, and minimizing the long-term transport of PCBs in the river, both from one section of the Upper Hudson to another and from the Upper Hudson to the Lower Hudson. Relevant sections of the document include, but are not limited to, Section 2.2.9: Review of Applicable or Relevant and Appropriate Requirements, Section 2.3.1: Development of Basic Goals and Resuspension Criteria. The threshold addresses the resuspension export rate, which describes the rate of PCB mass transported in the water column when particle settling is unlikely to further reduce the level of PCBs in the water column (see, Section 2.1.2: Definitions). The Resuspension Standard requires that the threshold be applied to the nearest far-field sampling station that is at least 1 mile away.

Moreover, to reduce the possibility that a short-duration anomalous spike or laboratory error could temporarily halt the dredging operations, the standard requires that the concentration be confirmed by an average of four samples collected the next day with 24-hour laboratory turnaround time.

QUESTION 4

Please comment on the reasonableness of the 500 ng/L Total PCBs threshold concentration developed for the Resuspension Standard.

RESPONSE

No comment at this time.

5 Monitoring Program: The 2002 ROD states (see, p. iii), Beginning in Phase 1 and continuing throughout the life of the project, EPA will conduct an extensive monitoring program. Section 3.3: Monitoring Plan and Attachment G (and related tables and figures) describe the attendant monitoring program for the Resuspension Standard.

QUESTION 5

Please comment on whether the monitoring program reasonably can be expected to provide adequate data in Phase 1 that will allow EPA to evaluate necessary adjustments to dredging operations in Phase 2 or to the Resuspension Standard. Also, please identify any necessary improvements to the monitoring program.

RESPONSE

No comment at this time.

DREDGING RESIDUAL STANDARD

6. Framework: EPA's 2002 ROD calls for removal of all PCB-contaminated sediments (i.e., to non-detection levels) in areas targeted for dredging, with an anticipated residual of approximately 1 mg/kg Tri+ PCBs prior to backfilling (Tri+ PBCs are the subset of PCBs with 3 or more chlorine atoms). The Residuals Standard builds on the requirements in EPA's 2002 ROD as well as case studies and regulatory guidance (see, Section 2.1: Background and Approach). It requires comparison of PCB concentrations in post-dredging sediment samples within a given area (i.e., ~

5-acre certification unit) to statistically-based PCB concentrations (i.e., action levels), which then guide appropriate actions (see, for example, Figure 1-1). The Residuals Standard was developed with this framework to accommodate the project need for both protection and production, in that post-dredging sampling can proceed directly upon EPA verification that the design cutlines have been attained and the options for appropriate next steps are known and, to the extent possible, pre-approved during design.

QUESTION 6

Please comment on whether this framework provides a reasonable approach for developing the Residuals Standard.

RESPONSE

No comment at this time.

7. Statistical Analyses: The supporting analyses for the Residuals Standard, in particular the statistical analyses of sites-specific sediment data collected in the Upper Hudson and the sediment data from case studies of environmental dredging projects, are presented in Section 2.2 (and associated tables and figures) and in Attachment A of the Residuals Standard.

QUESTION 7

Please comment on whether the statistical analyses are technically adequate and properly documented.

RESPONSE

No comment at this time.

8 Post-dredging Confirmatory Sampling Program: Section 2.2.9 and Section 3.0 of the Residuals Standard present an evaluation of available sampling techniques and describe the procedures for establishing the post-dredging confirmatory sampling grid, collecting and managing the samples, and evaluating the sample data and required actions. In certain circumstances identified in the Residual Standard, a certification unit can be evaluated by considering the sediment data in three previously dredged certification units within 2 miles (i.e., a 20-acre evaluation).

QUESTION 8

Please comment on the adequacy of these aspects of the Residuals Standard, in particular the concept of a 20-acre evaluation area for Phase 1.

RESPONSE

No comment at this time.

9. Re-dredging and Engineering Contingencies: Consistent with the 2002 ROD, the Residuals Standard is clear in describing EPA's preference for dredging over capping as a means of sequestering PCB inventory (mass). The standard also addresses the expectation that some targeted areas of the Upper Hudson River bottom may be difficult to dredge effectively, such as rocky areas. For these special circumstances, the standard addresses re-dredging and the number of additional re-dredging attempts, how the extent of the non-compliant area is to be determined, and the use of engineering contingencies to address recalcitrant residuals (e.g., alternative dredge, cap). Relevant sections of the document include Section 2.3.5: Determining the Number of Re-Dredging Attempts, Section 2.3.6: Engineering Contingencies for the Residuals Standard, Section 3.5.1: Re-dredging and Required Number of Re-dredging Attempts, Section 3.5.2: Determining the Extent of the Non-Compliant Area, and Section 3.6: Engineering Contingencies.

QUESTION 9

Please comment on the reasonableness of the Residuals Standard with respect to re-dredging and engineering contingencies.

RESPONSE

No comment at this time.

PRODUCTIVITY STANDARD

10. Framework: The requirements of the 2002 ROD inform the overall parameters of the Productivity Standard (e.g., dredging of an estimated 2.65 million cubic yards in 6 years, with the first dredging season [Phase 1] at a reduced rate of dredging) (see, Section 2.1: Background and Approach and Section 2.3: Rationale for the Development of the Performance Standard). Within this context, the Productivity Standard requires compliance with minimum cumulative volumes of sediment for each dredging season and targets larger cumulative volumes for the first five

dredging seasons. In requiring cumulative annual volumes, the standard accounts for the expectation that some areas will be faster to dredge than others, and thus provides an opportunity to carry over the benefit of this faster dredging from one year to the next as a cushion against when dredging more difficult areas. In setting targeted cumulative annual volumes, the standard provides for the dredging to be designed to attain a somewhat faster rate of dredging, so that a reduced volume remains in the sixth (final) dredging season and additional time is available to address any unexpected difficulties. The Productivity Standard was developed with this framework to ensure that the dredging design and implementation meets the schedule called for in the ROD.

QUESTION 10

Please comment on whether this framework provides a reasonable approach for developing the Productivity Standard.

RESPONSE

The timeframe for completion of the Project has been mandated in the ROD (USEPA, 2002). The Draft Engineering Performance Standards – Peer Review Copy Part 3: Performance Standard for Dredging Productivity enumerates the main elements that influence the Productivity Standards. Essentially, the ROD calls for dredging 2.65 million cubic yards (cy - a cubic yard measured in place) of PCB contaminated material for off-site disposal. It is understood that the work to be done in six years is in-water dredging work including backfilling, as required. The Transfer Facility will be constructed, including excavation to allow access to the unloading dock prior to April of Year 1 (est. to be 2006). For this discussion, the North Transfer Facility (NTF) is anticipated to be at the Moreau Landfill at the north (upstream) end of the Project.

The decision to breakup the work into two phases seems straightforward. Phase 1 will occur at a reduced volume of required dredging that will allow comparisons of operations with pre-established performance standards and evaluation of necessary adjustments to dredging operations in the succeeding Phase 2 or adjustment to the Standards. This Phase 1 allows for a season of data gathering in order to better evaluate the schedule for Phase 2. Thought should be given to selecting areas to be dredged in Phase 1 that will also yield critical production rates. The Productivity Standard has assigned a universal machine production rate to the Project as a whole. This rate is approximately 1066 cy per day, for a 4 cy machine. The Phase 1 dredging cells should be selected to gage the production rates for different types of material - dredging and rehandling. For instance,

the Phase 2 schedule could be enhanced if relevant data can be obtained on digging and rehandling of cohesive vs non-cohesive soils, TOSCA vs non-TOSCA, thick face vs thin face, landlocked, navigation (no silt curtain), dredging over rock, transport through a lock and other dredging with parameters that provide a unique production rate. These cells should be selected to provide data that will be applicable to significant quantities of material to be dredged in Phase 2. These cells must also be selected so a combination can be selected to demonstrate that the full production rate can be achieved during Phase 2 (30 day rule). This is mainly to evaluate the operation of the Transfer Facility.

Regarding the Required Cumulative and Targeted Cumulative Volumes, it may be more productive to assign the Required Cumulative Volume and let the Contractor's profit incentive determine the targeted volumes. This should be well thought out because as mentioned in the Report, some dredging could be significantly harder than the average. It may be necessary to review the Required Cumulative Volume.

11. <u>Example Production Schedule:</u> As part of the development of the Productivity Standard, an Example Production Schedule was developed based on site-specific information and case studies of other environmental dredging projects to demonstrate that the Productivity Standard can be met. Relevant sections of the document include Section 2.2: Supporting Analyses, Attachment 1: Productivity Schedule, Attachment 2: Productivity Schedule Backup, and Attachment 3: Evaluation of Applicable Dredge Equipment for the Upper Hudson River.

QUESTION 11

<u>Please comment on the Example Production Schedule, including the reasonableness of the underlying assumptions for equipment selection and efficacy, as well as the time necessary to deploy, use, and move equipment.</u>

RESPONSE

Key Assumptions

The Productivity Schedule was based on several significant assumptions. The most important are:

1) The Transfer Facility will be able to handle the peak loads without impacting the production of the dredging equipment. This is a critical assumption because failure of the Transfer Facility to maintain the required production level will result in the delay of the entire dredging system.

2) The dredging and transfer equipment will be able to work 6 days/week and 24 hours/day without restrictions that reduce production. Most dredging worldwide is done on a 24-hour basis, 6 or 7 days/week. The most efficient use of transportation equipment, tugs and barges, requires 24-hour/day operation. If necessary, the equipment will be allowed to work 7 days/week.

3) There are no fish windows or other regulatory requirements including quality of life concerns that restrict dredging or other in-water work from April to December.

4) That a Contractor and Construction Manager will be available and that suitable risk management concerns can be agreed to. This may involve some method of cost reimbursement with bonus/penalty incentives.

5) The Canal System will operate, as necessary, to maintain the progress of the work.

Equipment Production Rates

The equipment production rate is volume divided by time. In the Report, the basic unit is cubic yards per hour (cy/hr). First, a couple of definitions, as everyone knows, a cubic yard is a measure of volume which is 3 feet x 3 feet x 3 feet. In the dredging industry, this measurement can be made in situ with before and after dredging soundings, in the barge, by the bucketful, in the disposal area, in the truck by measurement or weight, in the dredge by measurement or weight and several more esoteric ways. Some of these measurements can also be net or gross. Net measurements are to the neat lines and grades as determined by design. Gross measurements include additional dredging in order to insure the design grades are met, such as overdepth and side slopes. An hour is still 60 minutes. In dredging, there are three measurements made by the hour that are of importance. The Rental or Revenue Hour is any hour the equipment is crewed and available for work. The Work Hour is the time the equipment is actually cycling. The Delay Hour is any hour the equipment is available to cycle but is not working. Typical delays are: waiting for barges, weather, moving the dredge, repairing the dredge, repairing curtains, waiting for tests, handling debris, etc. The Time Efficiency of the dredge is the Work Hours divided by the Rental Hours. In this discussion, the unit of measure is the gross cubic yard in situ and the unit of time is the Rental Hour (cy/rh), unless noted otherwise.

Estimating Production

The following information is helpful in arriving at a production rate and schedule:

1) **Physical characteristics of the material to be dug and transported off site,**
2) **Quantity of material to be removed,**
3) **Depth of cut and the area to be covered,**
4) **Distance to the disposal area or transfer site,**
5) **State's clean water requirements,**
6) **Resuspension and residual requirements,**
7) **Additional requirements of the project, such as curtains and backfill.**

The EPA and Malcolm Pirnie/TAMS-Earth Tech have done an excellent job of graphically presenting the parameters of the Project. The purpose of the Production Standards is to set guidelines for the design of the project and give a framework to monitor and review the progress of the program to meet the schedule as stated in the ROD. The Report utilizes a Conceptual Production Schedule to confirm the feasibility of a six-year schedule. This schedule is not necessarily intended to be the most efficient or cost effective method to complete the Work.

Equipment Sizing

The Report reviews the available dredging equipment suitable for dredging in the Hudson River where shallow water in the dredge area is a major consideration. The Report selects mechanical dredges in the 4 cy bucket category and hydraulic dredges in the 12-inch discharge, 600 horsepower class. These dredges are compared to determine the equipment that will yield the more conservative solution. That is, the solution that produces the longer schedule.

Hydraulic Dredging

The Report quotes very optimistic production rates for a 12-inch discharge, 600 horsepower hydraulic dredge. These rates are presented without a reference to actual production on a project similar to the Hudson River. The Report also includes production data from the Grand Calumet River Sediment Remediation Project that claims a production of 543,000 cy dredged in 175 days (24 hours/day - 6 days/week). This would yield a production rate of 3100 cy / day. This is the production rate for one 12 inch and one 8 inch hydraulic dredge combined. This production rate seems more realistic. Prior to dredging, each structure that may have been impacted by dredging was inventoried, as well as slope stability calculations. Debris was removed prior to dredging, as was weed growth.

The Grand Calumet River Project is designed to remove non-native sediments in a five-mile stretch of the Grand Calumet River. The Corrective Action Management Unit (CAMU) is a 38-acre earthen impoundment, designed and constructed to receive the sediments as a permanent storage area. The sediments are passively dewatered with the effluent being treated and returned to the river. The quantity of material to be removed is 750,000 cy which includes 6 inches of overdepth dredging and soft material that sloughs into the cut from the side slopes. Sediment depth ranges up to 20 feet. 125,000 cy of this material is being handled as TSCA and RCRA regulated materials. These materials go to Unit 1 (10 acres) of the CAMU. The remaining material goes to the 28 acre Unit 2 of the CAMU. The water treatment plant treats the water from Unit 2 at approximately the same rate the dredged material is pumped to the facility. The treatment system is rated at 5000 gpm.

The Grand Calumet River Project has some operational advantages that may make its production better than could be expected in the Hudson River. The material to be removed is non-native which probably makes it easy to dig. All the material goes to a single large permanent disposal area with a maximum pumping distance of five miles and ample capacity for the estimated quantity to be dredged.

The authors select the mechanical option to determine the most conservative (longest time) schedule. This seems to be a reasonable decision based on the anticipated larger production rate using the hydraulic dredge. The hydraulic rate, however, is highly dependent on the location and area of the transfer facility. In the final design, a combination of hydraulic and mechanical dredges may be best.

Mechanical Dredging

Having decided to base the Report on the mechanical option, the authors determined a suitable mechanical dredge production rate to develop the Conceptual Production Schedule.

Material Characteristics

Very little information is included in the Report relative to the physical properties of the material to be dredged. The material is stated to be 60% sand and gravel, and 40% silt and clay. This is the breakdown of material for Phase 2 Year 3. The dredge areas are seperated into cohesive and non-cohesive material. It is thought that this breakdown is more a grain size factor for the dewatering

properties than digging properties. As a general rule, contamination is found in unconsolidated soils. These soils do not require a breakout force on the bucket, such as afforded by teeth. A subsequent answer to a question raised during the phone conference, described the cohesive material as fine grained with a specific weight of 0.8 g/cm3 and a bulk density of 1.2 – 1.3 g/cm3. Dredging clay or consolidated material is not anticipated.

Quantities

The schedule is based on a quantity of 2.65 million cy. This quantity includes 0.5 feet of overdepth and approximately 340,000 cy of navigation dredging to facilitate the movement of barges. The quantity does not seem to include side slopes, although the quantity is thought to be conservative. The side slopes may have some significance because the best way to dredge the sediment is from the top of the slope to the bottom. This minimizes the material that falls into a previously dug area. Also, the material is reported to have a high water content, which lowers the slope. Slope stability may need to be investigated.

Depth of Cut and Area to be Covered.

The Report does an excellent job of graphically showing the depth of cut and area to be dredged. The quantities are also broken down by available flotation after dredging, and further by sand and fine - grained material.

Distance to the Transfer Area

The authors of the report have decided to estimate all the material will go to the Northern Transfer Facility (NTF). This decision is thought to be conservative. The EPA is working on additional transfer areas at RM 183.2 and RM 166.5. The graphic layout of the project shows the distance and locks to the Northern Transfer Site {Moreau Site (RM 193.8)}. Approximately 55% (1,500,000 cy) of the total dredging is located within 5 miles of this site. No lockage is necessary to move between RM 189 and the Moreau Site (5 miles). Approximately 80% (2,100,000 cy) material is within 10.6 miles of the Moreau Site (RM 183.2 to RM 193.8). Only one lock (Lock 6 - RM 186), is located between RM 183.5 and the NTF. The remainder of the dredging (550,000 cy) is located from RM 177 to RM 158. The location of the transfer areas may make a combination of hydraulic and mechanical dredging the most efficient method.

Transfer Facility Water Discharge

The effluent water from the transfer site must meet the requirements of the State.

Additional Requirements of the Project

Additional constraints have been placed on the Conceptual Schedule.

1) **All dredge areas will be enclosed in sheet piling and silt barrier except limited areas in the navigation channel.**
2) **Dredge areas will be backfilled.**
3) **All backfilling must be completed before the season ends and the sheet piling and silt barrier cannot be removed prior to backfilling but must be removed before the season ends.**
4) **All material must be shipped from the Transfer Facility before the season ends.**

Production Rates

The authors of the Report estimate a cycle time by estimating the cycles per hour utilizing a 4 cy bucket. This exercise produces a production rate of 82-cy/work hour. This rate is compared to a rate of 90 to 125 cy/hr and deemed to be conservative. The rate is then applied to 13 working hours per day for a production rate of 1066 cy/day (44 cy/rh).

A case study is presented to confirm these rates. The study is based on the New Bedford PDFT (PreDesign Field Test) Project. The Case Study for this project, in Volume 4 of 4, shows this project to be a total of 2308 cy. The dredge was a mechanical dredge (hydraulic bucket) with the material being reslurried and pumped ashore, no barges or tugs are mentioned. The production rate is given as 95 to 125 cys/hr. Another reference gives the performance for this dredge on this project as 41 cy/hr at 48% TE. This would be the equivalent of 984 cy/day. Essentially, this is close to the 1066 cy/day figured above and considering PDFT was a demonstration project, the production is a good comparison but not necessarily conservative. Also, the referenced project is small. A larger project in the Saginaw River, using Cablearm and conventional buckets achieved approximately 1126 cy/day (342328 cy in 304 days). Another evaluation of Environmental Dredging Projects, shows a composite of 1032 cy/day (adjusted for comparison) for depth targeted projects and 456 cy/day (adjusted for comparison) for cleanup level targeted projects.

The daily production rate, for the overall project of 1066 cy/day for production dredging, seems reasonable. It is noted that this is a universal rate. The Hudson River production may vary based on its size alone. The scale of this project is such that there will be more opportunities for innovation than on previous work. The project needs to be broken down into its DMCs, and a

production rate developed for each cell. This exercise may be more complicated than it would seem. Conditions such as the easiest material to dig, fine-grained high water content material, is the hardest to handle in the Transfer Facility. A production rate for a smaller dredge (2 cy bucket) is given as 27-cy/work hour (351 cy/day). No backup is given for this rate. Again, this seems reasonable when compared to the 456 cy/day given above for cleanup level targeted production.

Working Season

The Report assumes a seven-month working season. This would be 30 weeks and at 6 days per week produces 180 working days. Dredging is done on several Great Lakes tributaries during these months. It should be noted these are work days in the water and not dredge days. Dredge days are less because preparatory work, before dredging in the spring and close out work after dredging in the fall, are required by the conditions set for the project. These work items include the installation and removal of the silt barriers, sheet piling, backfill and shipping the material off site before the end of the season.

The authors propose the use of 4 production dredges at 1066 cy/day/dredge and 4 smaller dredges at 351 cy/day/dredge. This combination produces a daily production rate of 5670 cy/day for the eight dredges. Specialty dredges are proposed for certain DMCs. The authors also propose rates for the preparatory and closeout work each season. Installing sheeting is estimated at 90 feet of wall per day for installation and 130 feet per day for removal. Installation of the silt barrier is estimated at 200 lf/day and removal at 300 lf/day. Each of these rates is based on one crew. The backfill is estimated to be placed at 1 acre / day with critical areas being placed at ½ acre/day. The schedule effective production rate is stated to be 0.5 acre/day. These rates seem to be somewhat optimistic but possible.

Conclusion

Given the assumptions necessitated by the circumstances, the authors of the Report have done an excellent job of developing a Conceptual Schedule. They have recognized many of the problems that could be encountered in Project. They have developed realistic, if not as conservative as thought, estimated production rates. The annual production, as determined by the ROD requirement has been met by adding equipment until the required quantity per day is reached. As the saying goes – Works on paper! The difficult part of the Schedule is to scale the Project from the historical projects of one or two dredges to eight or ten dredges working simultaneously on this Project. As recognized by the authors, the project will require superior project management.

The assumptions made above are very important since they affect the entire dredging system. Primarily, the Transfer Facility must be able to handle the maximum daily production in order to achieve the average daily production over time. The authors have developed the Schedule based on the assurance that the Transfer Facility will be designed to handle the material. They mention several times that the production is qualified by the ability of the Transfer Facility to handle the material. Except for the Grand Calumet Project, this Transfer Facility will be required to handle 5 or 6 times the material per day that has been handled at previous projects. The Report authors provided a "back of the envelope estimate" on the design of the NTF. The memo states the estimate is based on a peak daily production rate of 5600 wet tons per day (converted 1 ton/cy). Attachment 4, Issues Associated with Processing 4500 tons/Day at Moreau Landfill Site also addresses this issue. This attachment has several qualifiers to the ability of the area to handle the material. The Attachment 4 Report shows the barges being unloaded by mechanical equipment. The "Comments" provided after the Peer Review phone call states the barges will be unloaded by hydraulic means. A modified 14" hydraulic pump out unit can handle 6000 cy of material on a daily basis but to do so will require the addition of jet water to remove the material from the barge. The barges must be clean to afford maximum carrying capacity due to limited flotation. Hydraulic unloading of the barges will require treatment of significantly more water than mechanical unloading. If the mechanical dredging option is chosen, the Transfer Facility will need structures to moor barges waiting to be unloaded.

12. Action Levels: The Productivity Standard includes two tiered action levels (Concern and Control) prior to any determination of non-compliance with the standard, as well as their respective required actions and monitoring and recordkeeping requirements. Relevant sections of the document are Section 1.1: Implementation and Section 3.3: Monitoring, Record Keeping and Reporting Requirements.

QUESTION 12

Please comment on appropriateness of the action levels and the required actions, as well as the reasonableness of the monitoring and record keeping requirements.

RESPONSE

The key is to allow the Dredging Contractor to set the Schedule based on completing the required annual work by the end of the season. As acknowledged by the authors of the Report, the different DMCs may have significantly different digging rates, so the order the cells are completed will determine the monthly comparison quantity to date.

The Action levels are an interesting concept. Requiring the contractor to explain why they are behind schedule will help clarify the problem. The effectiveness of the concept will depend on the risk allocation, as written in the Contract. Possibly having a significant bonus / penalty clause would be more effective that having the EPA dictate a solution. These debates can get pretty complicated, legally.

The Monitoring Requirements should not be a problem for any dredging contractor being considered for the Work. A qualified Contractor would be keeping these records in the normal course of business, except for the table required to track total PCBs. The dredging contractor could hire a special consultant to keep track of the Total mass of PCBs released to the lower river.

Questions Related to All Three Engineering Performance Standards

13. <u>Interactions Among the Standards:</u> Because the Engineering Performance Standards for Resuspension, Residuals and Productivity be applied in conjunction with one another, the standards must be considered as a whole as well as individually. In developing the standards, their points of interaction were balanced to allow flexibility during design and implementation, while ensuring that human health and the environment are adequately protected. Thus, the standards contain self-correcting features (e.g., the requirements for additional re-dredging attempts in the Residuals Standard must consider the requirements for dredging production in the Productivity Standard). The interactions among the standards are discussed in the Executive Summary, Introduction, and Section 3.2 of the Productivity Standard.

QUESTION 13

<u>Please comment on whether the main interactions among the standards are properly documented and taken into account.</u>

RESPONSE

No comment at this time.

14. Section 4.0 presents the plans for refinement of each standard.

QUESTION 14

Please comment on whether there are any additional aspects to effectively accomplish the refinement that EPA should consider in evaluating the Phase 1 data.

RESPONSE

Clearly, a significant change in quantity, character of the material, location, depth of cut or unforeseen circumstances discovered by the design team should be reviewed and the impact on the production schedule determined.

The Contractor should be required to record considerably more information than enumerated in Section 4 during the Project. The report should be compiled and submitted daily. As a minimum, the daily report should detail day, date, days on project, work hours, delay hours - particularly delays due to resuspension and residual dredging and quality of life restraints and debris removal, additional delays, total hours, TE%, location of digging, material dug, quantity dug - total and by barge load, all the same information compiled and totaled to date, quantity of dredging - ahead or behind - to date, area covered, depth of cut, etc. This information should be compiled for production dredging, cleanup dredging, dredging around obstructions, special dredging as in west of Griffin Island, pile driving, silt barrier work, slope protection, backfilling, predredging debris removal if attempted, and any other significant Work items. This information will capture the parameters that determine production and will be useful data to back up production schedules for Phase 2 work.

15. **QUESTION 15**

Please provide any other comments, concerns or suggestions, involving both strengths and weaknesses, with respect to the October 2003 Draft Engineering Performance Standards - Peer Review Copy that may not be fully covered by the above charge questions.

RESPONSE

The Transfer Facility needs additional design work as soon as possible. Since the Report increases the number of dredges until the needed annual production is achieved the amount of material capable of being handled by the Transfer Facility becomes the critical path. Each addition of a dredge increases the ancillary equipment such as tugs and barges.

The Dredging Contractor needs typical borings, conducted in accordance with standards, to determine dredging production.

The sampling program should determine the bottom of the contaminants, so initial dig elevation can be accurately determined, which should reduce redredging. As can be seen by the dredging production rates, dredging thin faces of material is slow and produces a large percentage of water to material.

The Productivity Schedule proposes that the work proceed from upstream to downstream when possible. With the number of dredges scheduled for this work, it will be necessary for some dredges to be working immediately downstream (possibility within the same DMC) from other dredges. It is hoped the peer reviewers can comment on the ability to estimate the effects of settled material on PCB concentrations at nearby completed dredge sites.

Victor Magar
Preliminary Comments

Hudson River PCBs Superfund Site
Draft Engineering Performance Standards

Responses to Charge
by
Victor S. Magar

DREDGING RESUSPENSION STANDARD

1. *Please comment on whether this framework provides a reasonable approach for developing the Resuspension Standard.*

In general, the approach identified in the standard seems overly complex. The complexity is the result of the use of multiple standards (total flux and concentration), multiple media (turbidity, suspended solids, and PCB measurements), multiple locations (near-field and multiple far-field locations), and multiple PCB analytical methods (whole water, dissolved/solids, congener, Aroclor, total PCB, and tri+ PCB). A more simplified and streamlined approach is strongly recommended. Generally, my comments below follow this theme.

2. *Please comment on the technical adequacy of the near-field analyses, in particular the linkage from the resuspension production rate (at the site of dredging), to the resuspension release rate (reflecting PCB transport in the water column in the immediate vicinity of the dredging operations) and finally to the resuspension export rate (essentially equilibrium conditions reflecting long-distance transport of PCBs in the water column).*

Modeling Analysis

The EPA modeled the suspension and transport of sediments during dredging operations in order to predict near-field and far-field suspended solids (SS) and PCB concentrations. Modeling programs CSTR-Chem and TSS-Chem were used to estimate the near-field conditions within 1 mile of the dredge head. CSTR-Chem was used to estimate SS and corresponding PCB concentrations in the immediate vicinity of the dredge head; TSS-Chem was used to estimate the rate at which solids and corresponding PCBs exit the dredge area.

The models and the model input criteria appear to be reasonably conservative and provide a reasonable approach to estimate the potential suspension and downstream migration of sediments during dredging. EPA's approach to use conservative values helps reduce the possibility that dredging may result in exceedences of the Resuspension Standards. However, the use of what appear to be conservative values on paper does not necessarily guarantee that the standards can be met during dredging; that is, the potential exists that the standards may not be achievable. EPA's provision to revisit the standards after the first year of dredging is an essential component that will help ensure the reasonableness of the model results and the performance standards. Whether the values used by EPA are truly conservative can only be determined once dredging commences.

Specifically, the near-field analysis links the resuspension production, resuspension release, and resuspension export rates. The results will likely shape decisions regarding the type of dredging equipment that will be used and the dredging productivity. Although the models themselves may rely on over-simplified assumptions, they provide an acceptable baseline to predict short-term impacts of dredging on surface sediment and water quality.

The following observations raise questions about the validity of the models and the predicted impacts of dredging on near-field and far-field PCB concentrations. These concerns do not invalidate the models. Instead, they raise questions/concerns about the ability of the models to predict future PCB concentrations, and about whether the resuspension standards can be met under conventional and reasonable dredging/construction practices.

- Several stations already sustain elevated PCB concentrations during various times of the year (Volume 1, Attachment A). The prediction interval is ~120 ng/L in spring for Shuylerville (Attachment A, Figure 23) and ~250 ng/L with a 95% UCL approaching 400 ng/L at TID-West (Attachment A, Figure 19). This leaves a narrow margin for increased PCB suspension during dredging at these peak seasons.
- Volume 1, Attachment D, Table 6. Exiting total suspended PCB concentrations are reported as 6,172 ng/L in Section 1, 15,966 ng/L in Section 2, and 7,483 ng/L in Section 3. These exiting concentrations require 92 to 96% reduction during downstream transport of 1 mile to maintain the 500 ng/L goal, and up to 98% reduction to maintain the 350 ng/L goal. Is it reasonable to expect more than 90% of the SS and corresponding PCBs to settle within 2 acres of the dredge location? Table 2-14 indicates that more than 99% of the PCBs will be deposited within 2 acres

of the dredge location, based on the ratio of the export fraction to the resuspension production rate. This level of deposition also could raise concerns for near-shore deposition and post-dredging surface sediment concentrations outside of the remediation areas.

Near-field Monitoring Analysis

Two goals for the near-field monitoring should be 1) monitor dredging performance such that EPA and the contractor have sufficient data at hand to suggest a remedy if a far-field exceedence occurs; and 2) monitor dredging sufficiently downstream to "provide some level of mixing while still being close enough to provide rapid feedback to the dredging operation." Both goals can be achieved reasonably well using turbidity meters equipped with continuous data-loggers. Telemetry units would permit continuous real-time monitoring off-site, which could facilitate monitoring and operator response to acute sediment releases.

The resuspension standard spends a significant amount of time discussing the reasonableness of turbidity measurements and the need to establish a relationship between turbidity, SS, and PCB concentrations before allowing the contractor to rely on turbidity and SS in lieu of PCB measurements. A correlation between SS and turbidity could be developed in the laboratory before the onset of dredging, using Hudson River water and sediments. If necessary, sediments may be collected from different areas, so that different relationships can be established for different areas that undergo dredging. Establishing the accuracy of the correlation would be less important than identifying relative differences in spatial and temporal changes.

In contrast with turbidity monitoring, SS monitoring will likely be cumbersome and expensive. It could interfere with dredging activities and impose safety concerns for construction workers that need to enter the site to collect samples. EPA and the contractor should rely on turbidity measurements for near-field monitoring in favor of SS measurements. (EPA also recommends using Laser In Situ Scattering and Transmissometry [LISST] in Volume 1, Attachment F. I am not familiar LISST, but the technology sounds promising and may prove very cost-effective for turbidity and SS monitoring. If LISST is effective, then SS combined with LISST should be used in lieu of turbidity for continuous water column monitoring.)

Once turbidity/LISST and PCB relationships are established, the action levels for near-field monitoring (Volume 1, Table 1-1) should be re-evaluated to correlate near-field turbidity levels with far-field t-PCB concentrations. Also, in addition to updating the action levels based on Phase I, action levels also may be updated on an annual basis during Phase II.

3. *Please comment on the appropriateness of the Evaluation Level as a component of the standard applied to for Phase 1.*

The various action levels (Evaluation, Concern, and Control) combined with multiple metrics (SS and PCBs) and locations (near-field and far-field) make the resuspension criteria somewhat convoluted. According to the framework, the Evaluation Level requires increased monitoring at the IT Dam and Schuylerville locations by doubling PCB analyses; requiring separate suspended and dissolved-phase PCB analyses; and doubling DOC, suspended OC, and SS analyses. It is unclear how this increased frequency will benefit the evaluation to better inform the dredging operator(s). This same concern holds for the Concern and Control Levels.

The Evaluation Level could reasonably be removed without negatively impacting the EPA's ability to evaluate the Resuspension Standard. In the interest of simplifying the overall approach, I recommend its removal.

4. *Please comment on the reasonableness of the 500 ng/L Total PCBs threshold concentration developed for the Resuspension Standard.*

The 500 ng/L threshold concentration appears reasonable as a concentration goal to meet regulatory limits for PCB releases into the Hudson River. ARARs (Volume 1, Section 2.2.9) suggest lower concentration drivers, but those concentrations range from 0.001 ng/L to 90 ng/L, and are below background concentrations, rendering them impracticable. The 500 ng/L goal provides a more practicable and reasonable concentration goal. Whether the 500 ng/L goal can be achieved under reasonable construction practices remains to be seen and must be assessed during Phase I.

Several stations already sustain elevated PCB concentrations during various times of the year (Volume 1, Attachment A), and current background concentrations provide only a narrow margin for increased PCB suspension during dredging at various times of year. For example, the prediction interval approaches

~120 ng/L at Shuylerville during the spring (Attachment A, Figure 23) and ~250 ng/L with a 95% UCL approaching 400 ng/L at TID-West during various times of year (Attachment A, Figure 19). As mentioned above, this leaves a very narrow margin for increased suspension, if the contractor must maintain PCB concentrations below 500 ng/L.

Constructing silt curtains around the highest concentration areas and areas of greatest potential PCB release may reasonably be required to control near-field export; however, silt curtain construction at virtually every construction area will likely constrain production and substantially increase cost and complexity. It will be imperative that the contractor use dredging techniques that minimize sediment suspension while maximizing productivity. It also will be important that the EPA and the contractor remain flexible when applying the Resuspension Standard to maintain dredging productivity and cost efficiency. For example, the 500 ng/L standard should not be so stringent as to require silt curtains for every area. The need for silt curtains should consider the following three criteria that may impact downstream water quality:

- The nature of contamination and maximum t-PCB concentrations – sediments with relatively high concentrations will have greater potential to negatively impact water quality if released into the water column.
- The type of sediment – fine sediment will have a greater potential for suspension and downgradient transport than coarse sediment.
- The size of the area to be dredged – relatively small areas will likely result in short-term acute releases, whereas larger areas will likely result in more sustained releases.

To conclude, maximum protection against near-field PCB export should be provided in areas of highest concentration, highest silt/clay content, and greatest sediment volume. In contrast, vigilance may be relaxed in those areas that do not meet these criteria and consequently impose less risk of PCB export during dredging. Many of these conditions should be determined during the ongoing characterization and design phases.

5. *Please comment on whether the monitoring program reasonably can be expected to provide adequate data in Phase 1 that will allow EPA to evaluate necessary adjustments to dredging operations in Phase 2 or to the Resuspension Standard. Also, please identify any necessary improvements to the monitoring program.*

Near-Field Monitoring Methods

The primary goal for the near-field monitoring should be to monitor dredging performance such that EPA and the contractor have sufficient near-field data to suggest a remedy if a far-field exceedence occurs (e.g., when or where significant resuspension results in the far-field exceedence). A secondary goal should be to collect sufficient data over time that far-field exceedences can be anticipated before they occur. As stated in the Resuspension Standard, monitoring locations should be sufficiently far from the dredging operation to "provide some level of mixing while still being close enough to provide rapid feedback to the dredging operation."

Turbidity and LISST measurements (Volume 1, Attachment F) have the potential to achieve these goals, but the potential for off-site SS measurements to achieve these goals is more limited. By equipping turbidity or LISST meters with continuous data-loggers and telemetry units, EPA and the contractor can collect continuous real-time data in order to monitor near-field performance. A correlation between SS and turbidity can readily be developed in the laboratory using Hudson River solids, where establishing accuracy is less important than identifying relative differences in spatial and temporal turbidity levels during dredging. The benefit of the turbidity and LISST monitoring is that both monitoring approaches will provide real-time data and both can sufficiently inform the EPA and the contractor of the duration and location of releases and the relative magnitudes of the releases.

Conventional SS monitoring cannot provide real-time information and will be of limited utility to the operator. Furthermore, because SS monitoring requires on-site sample collection and processing, its implementation in the vicinity of dredging activity will likely be cumbersome, expensive, and could interfere with dredging activities and impose safety concerns for workers that need to enter the site to collect the samples.

Section 3.1.1 requires a three-hour turnaround time for off-site SS collected from near-field and far-field stations. This turnaround time is optimistic and aggressive, and perhaps unrealistic.[1] Furthermore, because sediment suspension during dredging is likely to be dynamic, often characterized by acute

1 The turnaround time must include the time to collect multiple samples, process/preserve/bottle the samples, complete all chain of custody requirements, deliver the samples to a local laboratory (possibly an on-site laboratory), process the samples in the laboratory (weigh filters, filter the sample, dry the filter, weigh the filter, dry a second time to ensure that the sample is fully desiccated and repeat as needed, record the final weight, burn the sample and weigh to collect volatile suspended solids samples, weigh again, record the weight), record the TSS/VSS values, and report the values to the EPA or contractor.

releases followed by relatively quiescent periods, even a three-hour turnaround time may be insufficient to respond to short-term releases.

To conclude, a relationship between SS and turbidity/LISST should be established before dredging, and the contractor should rely on turbidity and LISST measurements for near-field monitoring in favor of conventional SS measurements.

Near-Field Monitoring Locations and Frequency

Using turbidity or LISST measurements will provide continuous data. Thus, monitoring frequency is enhanced using these methods in favor of conventional, off-site SS analyses.

The stations identified in Figure 1-1 (Volume 1) are reasonable, although Station 2 (side channel) and Station 6 (within the containment barrier) could reasonably be eliminated. For example, sampling from Station 2 (the side-channel monitoring station) assumes that boat traffic could suspend solids, thus influencing sediment suspension; however, boat traffic impacts on SS should be captured by Stations 3 and 4. It is otherwise unclear how information from Stations 2 and 6 will be used (i.e., will the contractor slow down dredging when large vessels pass by? Will EPA relax resuspension requirements if part of the resuspension can be attributed to non-dredging related activities?).

Far-field Monitoring Locations

To monitor downgradient sediment transport potential during dredging, EPA identified a total of nine stations, including four far-field monitoring stations (Thomson Island Dam, Schuylerville, Stillwater, and Waterford); two upstream baseline stations (Bakers Falls and Rogers Island); two lower Hudson River stations (Albany and Poughkeepsie); and one downstream monitoring station (on the Mohawk River at Cohoes). Section 3.3.3 requires spatial and temporal composites. Spatial composites will rely on 5 discrete sample locations per station; temporal composites will be conducted over 24-hour periods.

The Resuspension Standard requires that resuspension be controlled within 1 mile of dredging, yet the six downgradient stations traverse the entire 30-mile watershed. It is easy to recognize the benefit of collecting data at all of the downgradient stations, because such data are scarcely available from other dredging sites, and would be very informative to EPA and to the scientific and engineering practice regarding the downgradient potential for sediment transport during dredging related activities. However, the number of stations exceeds the requirements to meet the resuspension standards set forth in of Table

1-1. The four far-field stations (TI Dam, Schuylerville, Stillwater, and Waterford) could reasonably be reduced to one or two stations. Once the resuspension requirements are met at one station, it is reasonable to assume that they will be met downgradient of the monitoring station. If they are not met within one mile or at a predetermined far-field station, then dredging will have to be modified regardless of the further downstream impact to water quality.

The two lower Hudson River stations (Albany and Poughkeepsie) also could be reduced to one station or eliminated entirely and the Cohoes station could be eliminated. These stations will have little bearing on the ability to meet the resuspension standards. Furthermore, the weekly monitoring schedule and 72-hour turnaround times for PCB analyses (Table 1-3) suggest that the data is not intended for immediate response to dredging practices.

Far-Field Monitoring Goals

The resuspension standard establishes far-field monitoring goals (Volume 1, Table 1-1 and Figures 3-2 and 3-3). The goals are based on various criteria, including net flux (daily or annual) and far-field concentrations. The net flux requirements are 65 kg/yr t-PCBs (22 kg/yr Tri+ PCBs) per dredging season and 600 g/d t-PCBs (200 g/d Tri+ PCBs) per 4-week running average. Concentrations criteria include 350 ng/L (Control Standard) and 500 ng/L (Threshold Standard). Analysis of PCB flux based on the 350 and 500 ng/L criteria, and of allowable PCB concentrations based on the 65 kg/yr and 600 g/d fluxes yields the results shown in Table 1 of these comments (below). The analysis was conducted using Equation 3-1 and was conducted for 2,000 and 8,000 cfs river flows, assuming the plume duration matches the dredging duration (T_{d7} in Equation 3-1, Volume 1) and equals 14 hours per day. The PCB fluxes at 350 and 500 ng/L and at 2,000 and 8,000 cfs exceed the 300 and 600 g/d control levels. Conversely, the 300 and 600 g/d allowable flux values correspond to t-PCB concentrations that are well below 350 ng/L and approach background t-PCB concentrations.

Table 1. PCB flux based on 350 and 500 ng/L t-PCB concentrations, and PCB concentrations based on 300 and 600 g/d fluxes [a]

ALLOWABLE CONCENTRATION	ALLOWABLE FLUX	CORRESPONDING PCB FLUX (G/D)		CORRESPONDING T-PCB CONCENTRATION (NG/L)	
		2,000 cfs	8,000 cfs	2,000 cfs	8,000 cfs
350 ng/L		999 g/d	3,997 g/d	—	—
500 ng/L		1,427 g/d	5,709 g/d	—	—
	300 g/d [b]	—	—	105 ng/L	26 ng/L
	600 g/d	—	—	210 ng/L	53 ng/L

(a) The daily dredging duration (T_{d7} in Equation 3-1, Volume 1) was assumed to equal 14 hours; if monitoring relies on 24-hour composite samples, then the dredging duration should be revised to 24 hours. Corresponding PCB Flux values would increase by ~70% and Corresponding t-PCB Concentrations values would decrease by ~42%.
(b) The 300 g/d corresponds to ~65 kg/yr based on a 7-month operating season.

Managing the far-field PCB load based on both flux and concentration will be difficult, and is complicated further because the only real enforceable criterion is the 500 ng/L concentration threshold. (According to the resuspension standard, only exceedence of 500 ng/L t-PCBs at a far-field station can allow the EPA to shutdown dredging operations.) The 300 g/d, 600 g/d, and 65 kg/yr fluxes serve only as guidelines; exceedences of the fluxes only result in increased monitoring frequency but are otherwise unenforceable with respect to dredging operations. A more streamlined process is recommended.

Far-Field Monitoring Requirements

The resuspension standards require both SS and PCB monitoring at far-field stations. I support the use of turbidity and LISST (if effective) monitoring to obtain real-time monitoring at far-field stations. Monitoring turbidity or real-time LISST could provide EPA and the contractor early warning signs of potential performance-standard exceedences. However, these data should be considered non-critical until a very clear relationship between LISST/turbidity and PCB concentrations are established. A relationship between LISST/turbidity and PCB concentrations will be more difficult to establish than LISST/turbidity and SS, because PCB concentrations will vary with different SS materials and organic content. SS also may be influenced significantly by backfilling, which could release a measurable SS plume that could increase far-field SS concentrations and turbidity without affecting far-field PCB concentrations.

The primary driver for the resuspension performance standard is the PCB concentration in the water column (500 ng/L). The performance standards could be simplified and streamlined to rely primarily (if not solely) on water column PCB concentrations and not turbidity or SS measurements. (Turbidity and LISST should be retained only for qualitative monitoring.) Thus, Figure 3-3 could be eliminated so that the resuspension standard only relies on water column PCB concentrations.

The use of SS was intended to streamline the evaluation process for far-field monitoring and the decision time for dredging management in response to far-field exceedences. Unfortunately, the SS requirements create a layer of complexity without accelerating the decision-making process. The critical path for the Resuspension Threshold requires the confirmed occurrence of a 500 ng/L t-PCB concentration exceedence, which must be confirmed by samples "collected within 48 hours of the first sample" (Section 3.1.4). Assuming a 24-hour turnaround, an exceedence may not be confirmed until 72 hours after the first indication of an exceedence (which could be 96 hours after the first occurrence). As an alternative, a routine whole-water PCB monitoring program can make PCB data available routinely on a 24-hour basis. Confirmation of exceedences can be completed within 24 hours, and EPA and the contractor can respond to an exceedence within less than 48 hours of its first occurrence.

PCB sample compositing: The resuspension standards require 24-hour temporal compositing and spatial compositing at five locations for each monitoring station. The spatial compositing approach is acceptable and will avoid capture of very low or very high PCB concentration outliers in the river. However, the temporal compositing could be revised to require three 8-hour composites over a 24-hour period. Three 8-hour composites are much likelier to capture the acute impacts of dredging, which is expected to occur over ~14 hours per day. This increased sampling requirement and the associated costs may be tempered by reducing the number of sampling stations. An alternative schedule may be to require 12-hour composites twice per day. This increased frequency also could reduce the need to increase sample frequency at the Evaluation, Concern, Control, and Threshold Levels.

The need for increased sampling requirements at the Evaluation, Concern, Control, and Threshold Levels is unclear. The resuspension standards do not explain how additional data will be used, and why they are necessary. Does the increased sampling reflect split samples, to measure analytical precision? Or does the increased sampling reflect replicate field samples collected independently, precision of field sample collection? Furthermore, is precision greatly enhanced by graduating from one sample per day (routine) to two samples per day (evaluation) to three samples per day (concern) to four samples per day (control and threshold) at the IT Dam and Schuylerville locations? If precision is the primary driver, sample requirements should not have to exceed triplicate samples as opposed to four samples per day.

At the concern-control levels, how will the additional samples be collected? Are these also to be composited spatially and temporally? If so, this will require multiple ISCO samplers for each station. Alternatively, if the additional sampling relies on grab samples, grab samples may not be representative of the average temporal conditions at each location. The resuspension standard should explain how the additional samples are to be collected, and how the additional data will be used to better assess dredging performance with respect to sediment suspension and PCB transport.

The need to split samples to analyze SS and aqueous phase PCBs separately is uncertain. Section 2.2.5 (Dissolved Phase Releases) and supporting information in Attachment C exhaustively evaluate the potential for dissolved phase releases, and conclude that it is "highly unlikely that there will be large amounts of dissolved-phase PCBs released as a result of dredging." Despite this conclusion, Table 1-2 requires separation and analysis of dissolved and suspended phases at the evaluation, concern, control, and threshold levels. The only justification for this approach is provided in Section 3.3.4, which refers to Attachment F-3. Attachment F-3 is a memo presents data comparing aqueous plus particulate t-PCB concentrations versus whole water t-PCB concentrations; the data suggest that whole water analyses underestimate t-PCB concentrations by as much as 60%. Unfortunately, the analysis conducted for Attachment F-3 relies on only two samples. An analysis based on only two samples is insufficient to drive the requirement to split samples and thereby increasing analytical efforts, costs, and complexity. EPA should resolve or clarify these conflicting conclusions and the corresponding sample/analytical requirements.

In addition to the contradiction between Section 2.2.5 and the requirements in Table 1-2, it is unclear how the separation of dissolved and suspended phases will enhance evaluation of the resuspension standard. How will the separation of phases help inform the contractor of how to improve dredging performance? The goal identified by Attachment F-2 is to increase accuracy of water column PCB concentration measurements. Further evidence that whole water PCB measurements insufficiently extract PCBs from SS is warranted. The ability of whole water extractions to effectively extract PCBs from SS will depend largely on the nature and concentration of SS. SS with high organic content and strongly bound PCBs may be more difficult to extract, and may justify separate extractions. Conversely, suspended mineral solids will be easier to extract. A laboratory study with various levels and types of

SS, PCB concentrations, and congeners could be used to examine the difference in extraction efficiencies between whole water extractions and separate aqueous and SS extractions. The controlled laboratory study will have to rely on more than just two samples and should be conducted before field monitoring.

Regardless of the results of the laboratory study, it still remains unclear how separate analyses of dissolved and SS phases will be used. Whole water extractions already require separate phase extractions and combining of both phases before GC analysis (Section 2.3.3.1, Footnote 18). Thus extraction efficiency cannot be the goal for separate phase extractions. A single analysis would facilitate more rapid turnaround of analytical results and would simplify interpretation.

Another note on whole water extractions using separate phase extractions: It is important to make sure that extraction recoveries are comparable for both phases before combining the extracts. Alternatively, separate surrogate internal standards for the two phases may be used to identify recoveries of each phase.

The following additional changes to the Resuspension Standards evaluation criteria may be considered (note: some of these suggestions may already be planned):

- The resuspension evaluation process should rely on 24-hour turnaround PCB analyses, and the use of SS should be eliminated as a requirement. SS analyses could be retained as an alternative approach, if the contractor can satisfactorily demonstrate a relationship between SS (or turbidity) and whole-water PCB concentrations.
- Real-time turbidity and LISST analyses are recommended for qualitative support and assessment of dredging progress; the data from these real-time measurements could guide dredging activities but should not be the final driver for decision making on dredging productivity and potential shutdown.
- SS and TOC analyses may be conducted in support of PCB analyses and could accompany all PCB samples. This will allow the EPA and contractor to establish relationships between SS/OC and PCB concentrations. However, off-site SS concentrations should not drive the evaluation program for the resuspension standard.
- PCB analytical results should be posted electronically on a limited-access internet site for immediate use by all members of the project team (GE/contractor/EPA/stakeholders as appropriate).

- ISCO samplers should be refrigerated to minimize biological and volatilization losses. They also should rely on glassware to minimize sorption losses.
- The PCB analytical method should consider a homologue-specific analysis, generally performed by Method 680, which is a low-resolution mass spectrometric (LRMS) method. The analysis determines total PCB concentrations in a sample by grouping PCBs by homologue. Advantages of using Method 680 (HRGC/LRMS) to detect the amount of each homologue group are as follows:
    - Low detection limits
    - Minimal (if any) interferences, thereby providing highly reliable data for the individual homologues and total PCB concentrations; this will be especially effective to separate tri+ PCB concentrations from t-PCBs.
    - Ability to acquire congener data, at little or no cost, in case there may be a need for such information at a later date; this is done by storing chromatograms that can be back-calculated to identify individual congener concentrations
    - Method 680 is relatively inexpensive (~$250 per sample, which should become even more competitive due to the anticipated sample quantity required for the Hudson River cleanup).
- Extractions and analysis of PCBs should be conducted by a laboratory with demonstrated experience. An on-site laboratory may be considered, but this too should be run by experienced operators. A hexane tumbling/agitation extraction method is recommended in favor of DCM/acetone Sohxlet extraction. The performance of the hexane tumbling/extraction method has been demonstrated/verified and can be demonstrated by the contracted laboratory. At Battelle's Ocean Science Laboratory, the extraction efficiency (i.e., target congener recovery) has been demonstrated to be comparable in parallel extractions of (1) wet "real" environmental sediment samples and (2) certified sediment reference materials obtained from NIST.

  The free water should be removed prior to subsampling for extraction, and the sediment is then mixed with sodium sulfate prior to the extraction to "dry" the sample – this reduction in moisture content helps make the PCB more available to the extraction using the non-polar hexane solvent. Advantages using the hexane tumbling/agitation method include the following: 1) greater simplicity and reduced potential for contamination and processing issues because of the added complexity and handling Sohxlet; 2) less potential for contamination from solvents (hexane can generally be obtained more pure than DCM/acetone); 3) more efficient and effective concentration of extracts (hexane alone is more easily concentrated than a DCM/acetone mixture); 4) a more PCB-specific extraction, and a "cleaner" final extract (the hexane is significantly more specific to extracting hexane; DCM/acetone extracts hexane an to a greater degree also a large number of other organic contaminants and organic sample matrix components – which may interfere in the PCB analysis); and 5) lower costs. Extract cleanup is also performed, but the more PCB-specific extract results in less handling of the sample and a better extract for analysis and consequently higher overall data quality.

DREDGING RESIDUALS STANDARD

6. *Please comment on whether this framework provides a reasonable approach for developing the Residuals Standard.*

The approach is designed to create incentives to achieve the 1.0 mg/kg Tri+ PCB concentration goal while also providing flexibility to achieve this goal. The developers of the standard clearly understood that a achieving a 1.0 mg/kg goal does not imply that all samples collected from the treated area would measure exactly 1.0 mg/kg, and that statistically 1.0 mg/kg would be represented by a wide range of existing and measured concentrations. The standards do well to create an incentive to achieve the 1.0 mg/kg goal, but it is important that the standards not become punitive when they are not met.

The following comments are aligned with the response actions

A. Backfill (where appropriate) and demobilize

This response action is reasonable insofar as it does not require re-dredging if the certification unit meets the statistical criteria defined by the 95% and 99% UCLs, and 97.5% and 99% prediction limits (PL). However, the requirement for backfilling with 1 ft of clean media "where appropriate" is ambiguous. Throughout the document, I was unable to determine the meaning of "where appropriate." Only on page 60 of the ROD, when discussing Alternative 4 (REM-3/10/Select - Removal followed by MNA, with Upstream Source Control), does the ROD begin to define when backfill will be applied, as follows:

> "During remedial design, the appropriateness of eliminating the placement of clean backfill in certain targeted areas will be assessed… EPA will remain flexible regarding the most appropriate means for restoring dredged areas and will provide the State, other natural resource trustees and the public opportunity to provide input on this issue." (ROD, Section 10.1, page 60)

This criterion remains very open-ended and provides insufficient guidance on how and when to apply backfill. When all statistical criteria defining the 1.0 mg/kg average are met (i.e., the UCL and PL values are not violated), is no backfill possible? Also, the backfill depth remains undefined. The standard should better define when and how backfill will be placed, and the criteria for requiring backfill should be clearly defined.

Further, the ROD specifies that the purpose for backfill should not be to act as a "cap" but instead should be to "[reduce] the available PCB concentration at the surface and providing an appropriate substrate for biota [and to] help stabilize bank areas after dredging and minimize hydraulic changes to the river." (ROD, Section 10.1, page 60). However, in my opinion, these two criteria should be clearly separated: that is, providing benthic substrate should be distinguished from bank stabilization. Creating substrate for benthic biota may require only 2 to 6 inches of backfill, while shoreline stabilization requires more significant geotechnical design and construction.

Also, although a thin layer of fill could serve to reduce immediate surface sediment concentrations, it is also possible that foreign backfill material will not be immediately suitable for benthic recolonization, and that time and natural processes (e.g., natural siltation and colonization) will be the strongest drivers for ecosystem recovery. If this is the case, than backfill should not be necessary and the site can recovery naturally after dredging. The backfill requirement also could create a significant obstacle to the contractor's ability to achieve the dredging productivity and resuspension standards. Backfilling could significantly hinder productivity when multiple vessels are required in the same unit and backfilling also could negatively impact productivity standards.

The footnote on Page 7 of the Dredging Residuals standard (Section 2.1.1) provides an explanation for basis of the 1-ft backfill. The basis is predicated on the goal to achieve 0.25 mg/kg Tri+ PCBs in the surface sediments, and assumes mixing of the 1-ft backfill with four inches of 1.0 mg/kg Tri+ PCB residual surface sediments, to average 0.25 mg/kg. The footnote states that "this means of estimating the surface concentration of the remediated areas was a reasonable assumption that is not related to the selection of a residual sediment interval (0-6 inches) or the requirements of the standard for the PCB concentration in that layer." The reasoning in this statement is speculative. For example, had a 1-inch surface contaminated layer been identified instead of 4 inches, the backfill depth could be 4 inches instead of 12.

Page 7 footnote states “bioturbation will be limited to the upper 6 inches of the backfill layer.” What data are available to support a 6-inch bioturbation depths?

B. Jointly evaluate a 20-acre area

The ability to average 20-acre areas is reasonable and provides greater flexibility for the contractor to be able to achieve the residuals standard. This level of flexibility should be retained.

C. Re-dredge or construct subaqueous cap

The flexibility to re-dredge or cap appears to provide flexibility to meet the residuals standard. However, the capping design requirements remain unclear. Furthermore, the description of capping alternatives appears overly simplistic and perhaps unrealistic. What is the distinction between 1-ft backfill and capping? Is a 1-ft sand cap reasonable and possible?

The following comments pertain to the capping materials discussed and evaluated in the performance standards:

- <u>Capping using inert materials</u>: Only AquaBlok™ was retained in the FS. AquaBlok™ is a promising technology, and yet warrants pilot testing in the Hudson River before its broad application at this site. Upwelling or significant gas production could negatively affect the performance of AquaBlok™ which creates a relatively impermeable layer.

- <u>Capping using active materials</u>: The use of active materials such as activated carbon to sequester PCBs remains unproven. Use of this technology is being advanced by Dr. Richard Luthy (Stanford University), Dr. Upal Ghosh (University of Baltimore), and Drs. Todd Bridges and Rod Millward (U.S. Army Corps of Engineers, Waterways Experiment Station [USACE/WES]). Activated carbon is very promising, and EPA’s interest in considering this approach should be encouraged. However, because this approach has not yet been field tested and has not yet been engineered (how do we place activated carbon on the sediment surface without losing it downstream), it should be considered an innovative approach requiring pilot testing and evaluation before full-scale field application.

- Capping using sealing agents: To date, I know of no site that has used sealing agents for capping. Although interesting theoretically, this approach seems very impractical. In fact, Page 42 states "capping using sealing agents should only be applied on a limited basis."

EPA is encouraged to consider and test innovative capping approaches to advance these technologies in the marketplace. However, currently these innovative technologies are untested and it is unclear how EPA anticipates that they will be used. Thus, capping will likely rely on conventional approaches.

The most conventional cap is a sand cap. A slightly more complicated cap is an armored sand cap (sand with some gravel or heavier stone to consolidate and restrain the cap material). A conventional cap can be as simple as a layer of clean sediment that meets the basic requirements for a cap (e.g., sediment containment, contaminant retardation, and creation of a clean benthic habitat). For this reason, EPA should consider a simple sand cap as a potential capping remedy. As mentioned above, a simple sand cap may be indistinguishable from the backfill, except possibly for depth of application.

It is recommended that EPA rely on a conventional sand cap, with armoring requirements as suited. This approach is not only reasonably inexpensive but also would minimize impacts on the productivity performance standard (sand caps should be relatively easily deployed). Thus, conventional capping should form the basis of the performance standards. Later, if the contractor can demonstrate that an innovative cap can be cost effective and protective of the environment, such caps should be considered. Such innovation should be viewed as complementary to the cleanup effort and should not negatively impact the contractor's ability to meet the performance standards.

Section 3.6, Determining the Extent of the Non-Compliant Area (Page 54), discusses using isolation caps for areas that "cannot be effectively dredged due to rocky conditions." Because high flow conditions favor rocky conditions, the flow field in a rocky area may be equally unsuitable for an isolation cap. A flow field analysis of shear forces is required to determine whether capping can be effective in such areas. If not, remediation in some areas may be impracticable.

D. Additional sampling and re-dredging required

Page 3 states that "characterization…is required only in the areas within the certification unit that are contributing to the non-compliant arithmetic average concentration." Some additional clarification is warranted to clarify whether circumstances exist when non-compliant areas would require re-dredging.

E. Contingency actions

This response action could be revised to include conventional sand capping among the capping alternatives. Options after three consecutive dredge attempts should be re-dredging or capping, where capping can include a conventional sand cap, or an armored sand cap if necessary. An armored cap should be required only in areas where cap stability is at risk without armoring.

7. *Please comment on whether the statistical analyses are technically adequate and properly documented.*

1 mg/kg Averaging

The performance standards relied on a statistical analysis of historical data from previously dredged Superfund sites to establish the performance criteria for dredging residuals. Statistically, achieving an average surface sediment concentration of 1 mg/kg means that a range of concentrations will exist. The EPA uses historical data from other sites to establish an expected distribution of contaminant concentration about the mean. The 3 mg/kg and 6 mg/kg concentrations are the 95% and 99% upper confidence levels of the data, respectively, such that for 100 certification units averaging 1.0 mg/kg, 95% of the time the measured average will actually be less than 3 mg/kg and 99% of the time it will be less than 6 mg/kg. The 97.5% and 99% prediction limits (15 and 27 mg/kg, respectively) predict how individual samples will be distributed, such that 1% of the time the measured sample concentration will be greater than or equal to 27 mg/kg and 2.5% of the time (1 in 40 samples) the measured sample concentration will be greater than or equal to 15 mg/kg.

This understanding of the potential distribution of contaminant concentrations gives the contractor flexibility to achieve a 1.0 mg/kg average surface sediment concentration, and is consistent with the record of decision (ROD).

Arithmetic vs. Geometric Means

The case study data used for the statistical analysis had to be log-transformed to ensure that the data was normally distributed, and the log-normal data were used to establish the statistical bases for the UCL and PL values. Arithmetic values were determined by back-calculating the log-transformed results. Because the statistical analysis was based on the log-transformed data, it is curious that the performance standards are based on arithmetic means. If data is positively skewed, arithmetic mean values will be greater than geometric mean values. Use of geometric means would provide a slightly more conservative monitoring and evaluation approach, and would be more consistent with the way the statistics were calculated and the way the UCL values were determined. However, establishing a more conservative approach may not be desirable.

The statistical analysis predicts the distribution of the Hudson River data based on case study data from other dredged sites. If the 1.0 mg/kg goal is achieved and the distribution of the Hudson River data are comparable to the case study data, then the confidence intervals of the Hudson River data will be comparable to those calculated in the performance standard. Because site-specific dredging data are unavailable, the use of case study data from other sites to estimate statistical data variability is reasonable. However, the assumption remains that 1.0 mg/kg can be achieved, and the reasonableness of this assumption cannot be tested until dredging begins. In fact, Table 2-1 shows that only two of the six PCB sites (Fox River and Massena) approached the 1.0 mg/kg Tri+ PCB goal, assuming the 2.2 correction factor to convert total PCB concentrations to Tri+ PCB values (Massena = 3 mg/kg t-PCB/2.2 = 1.4 mg/kg Tri+ PCB; Fox = 2 mg/kg t-PCB/2.2 = 0.91 mg/kg Tri+ PCB). Notably, only one of the six PCB sites (Massena) had a target PCB concentration of 1.0 mg/kg.

The performance standards could benefit from a statistical analysis of the probability of achieving a 1.0 mg/kg Tri+ PCB goal, and the probability of doing so in one, two, or three dredge passes. This analysis also will affect the productivity standard: The productivity standard assumes re-dredging will be required on 50% of the river, and presents this as a conservative estimate of the amount of dredging and dredging time that will be required to achieve the 1.0 mg/kg Tri+ PCB goal. However, if re-dredging and capping is more frequent than 50%, such an assumption may no longer be conservative. This analysis also should consider starting t-PCB concentrations, dredging depths and environmental conditions, sediment type and particle size distributions, and other factors that may have influenced the dredging residuals concentrations or that may influence their concentrations in the Hudson River.

Assuming that the 1.0 mg/kg Tri+ PCB goal is achieved, the 97.5% and 99% prediction limits (15 and 27 mg/kg, respectively) provide an acceptable approach for predicting how individual samples will be distributed. However, as discussed above, these values assume that 1.0 mg/kg Tri+ PCB can and will routinely be achieved. If these values are accepted, and it is assumed that the 1.0 mg/kg Tri+ PCB average concentration goal is achieved, then 1 in 100 samples (two out of every five certification units) will exceed the 99% PL and will require re-dredging. Thus, under routine, optimal conditions, the contractor can anticipate needing to re-dredge twice for every five certification units. (Although the probability of exceeding the 97.5% PL is 1/40, or once per certification unit, the probability of exceeding it twice within a single certification unit is much lower.)

8. *Please comment on the adequacy of these aspects of the Residuals Standard, in particular the concept of a 20-acre evaluation area for Phase 1.*

The 5-acre certification unit and the ability to average four certification units (20 acres) appear reasonable. The requirement for 40 equally spaced samples also is reasonable.

How will the EPA and contractor define the areas that define each certification unit? The success of achieving the 1.0 mg/kg goal could depend on the subsurface sediment distribution, geology, and contaminant concentration profile, and consequently also could depend on the distribution of the 5-acre and 20-acre units. For example, if a single node violates the dredging residual performance standard and requires re-dredging, and only the node itself is re-dredged, then is it correct to assume that only that node requires re-sampling and the new value can be averaged with the original surface sediment sample concentrations?

Page 32, Section 2.2.9.4 (Discrete vs. Composite Sampling, paragraph 3) states: "Composite sampling is not appropriate for the purposes of the Residuals Standard, primarily because if discrete samples are combined to represent larger dredged areas, re-dredging (if required) would have to be applied to the larger area or additional sampling would be needed." It is difficult to understand why these actions would not permit composite sampling, which could save significant costs and could help expedite the confirmatory sampling process. Composite sampling should be considered under the following conditions:

- *Re-dredging would have to be applied to the entire certification unit or additional sampling would be required*. Re-dredging the entire unit would be a very unlikely choice, and re-sampling or re-analysis would be required. If the contractor chooses to composite the 40 samples, EPA could require storage of discrete samples until the results are analyzed, thus eliminating the need to re-sample. EPA also could require that composite samples be analyzed in duplicate or triplicate, thereby improving the analytical statistics and quality assurance of these samples. If the analyses fall within 1 mg/kg (with no major outliers beyond a predetermined upper confidence limit), then no additional analyses would be required. If not, then the discrete samples would have to be analyzed. (An alternative also could be to composite samples in groups of 5 or 10 samples.)
- *Compositing samples would risk violating the Prediction Limit statistical criteria, because a single sample could be greater than 27 mg/kg while still maintaining an average of 1.0 mg/kg for the 40 samples*. The risk for compositing a single set of 40 samples seems small, compared to the increased speed and reduced analytical requirements for each certification unit.

Section 3.2, Sample Collection (Page 45). The use of the SPI camera, its outcome, and how the results of the SPI camera will be used and interpreted is insufficiently explained. Why is EPA requiring the SPI camera and how will the data be used?

Section 3.3, Sample Management (Page 47). Wood chips will be "pulverized or chopped, as necessary, to allow their…inclusion in the sediment samples submitted for analysis." This requirement creates unique challenges to the field or laboratory staff, to adequately homogenize samples. It requires materials or equipment to pulverize woodchips; this equipment would require routine decontamination between samples. If a sample is very woody, it may be reasonable to pulverize the entire sample. Otherwise, woodchips or other large debris could be removed from samples before analysis, focusing primarily on the granular sedimentary material.

Page 34, sampling grids. As stated on Page 34, not all certification units will necessarily have the same numbers of samples (e.g., some may have as many as 60 cores), so averaging the certification unit average values will not equal the averaging all the data. How will unequal areas be averaged?

Sampling approach: Page 34 requires that the "residual sampling grid will be offset from the pre-design sampling grid" and the average distance between the design and residual grids will be "between 40 and

60 percent of the design grid nodal spacing." This criterion will be difficult to follow and is probably unnecessary. The approach assumes greater accuracy with respect to sampling locations and establishing a sampling grid than will likely occur. Flexibility is recommended to enable the contractor to increase sampling efficiency and to minimize field time on the water. Flexibility also will reduce on-site risks to workers associated with field sampling.

Certification after backfilling (Section 2.3.4, Data Evaluation and Required Actions, Page 37): For certification units with a mean greater than 1 mg/kg but less than or equal to 3 mg/kg (95% UCL), the performance standard offers the option of placing backfill without re-dredging. If backfill is placed, the contractor is required to "demonstrate that the surface concentration is 0.25 mg/kg Tri+ PCBs or less. The backfill must be sampled using the same grid spacing as the residual sediment samples…" Concerns with this requirement are as follows. First, the ROD establishes a 1.0 mg/kg cleanup requirement, but under the backfill option the contractor is required to achieve a more stringent cleanup level. Second, considering the fact that the surface concentration is less than 3 mg/kg in the surface six inches, the need for further testing seems expensive and time consuming. Third, if the contractor is able to demonstrate less than 1.0 mg/kg after backfilling, it seems reasonable to allow the new values to be averaged within the 20-acre certification unit. I would recommend that a certification unit that receives backfill does not require re-sampling, unless the contractor wants to average the backfilled certification unit with a 20-acre unit. Conversely, if the Residual Standard requires confirmation sampling for backfilling it seems reasonable to allow the backfilled area to be averaged within a 20-acre unit.

The performance standard requires that the entire unit be resampled if the certification unit average exceeds 6 mg/kg (page 39). This seems excessive if the violation is due to a focused area and to clearly identifiable nodes. The standards should allow flexibility to assess whether an entire unit requires re-sampling or just the nodes that cause an exceedence.

Section 3.1, Sample Grid Establishment (Page 44). It may be very difficult to meet the requirements of this section, as discussed below:

- Establishing a regular grid (i.e., regular spacing) may be challenging and requires flexibility among all parties.
- Requirement to offset the grid from the design support sampling grid may be difficult to achieve.

9. *Please comment on the reasonableness of the Residuals Standard with respect to re-dredging and engineering contingencies.*

The re-dredging and engineering contingencies attempt to balance re-dredging requirements and limitations on excessive re-dredging. Maintaining re-dredging requirements creates an incentive for the contractor to achieve the 1 ppm goal in the first dredging run. Limiting re-dredging demonstrates an understanding that repeated re-dredging will have diminishing returns.

EPA limits dredging to a total of three consecutive runs (two re-dredging attempts). Nonetheless, if the residual surface sediment concentrations do not meet the 1 ppm average performance standard goal, additional remediation is still required. After two re-dredging attempts, the contractor is given the option of additional re-dredging or capping.

Limiting re-dredging requirements is commendable. However, it is unclear that two re-dredging attempts are warranted. The performance standards may benefit from a statistical analysis of the benefits of multiple re-dredging attempts, to justify more than one re-dredging attempt. A single re-dredging requirement should be considered, reducing the total dredging requirement to two attempts. This contingency still requires further dredging or capping if the first re-dredging attempt fails to meet the performance standard. This change may help expedite dredging and limit repeated re-dredging requirements.

Engineering contingencies with respect to capping requirements are discussed above.

PRODUCTIVITY STANDARD

10. *Please comment on whether this framework provides a reasonable approach for developing the Productivity Standard.*

Is the silt barrier design (Figure 1-1, Attachment 1, Volume 3) compatible with Hudson River weather and high flow conditions?

Is it reasonable to assume that all stabilization of shorelines and backfilling are "completed by the end of the work season," including removal of all sheet piling? Productivity could be maximized by dredging until the end of the season. However, this would limit the contractor's ability to complete all backfilling and silt barrier removal by the end of each season. EPA could consider relaxing the requirement to complete work in selected, predetermined areas before winter.

Section 2.1.2, Page 5, Volume 3: EPA assumes that "transfer, processing and transportation (for disposal) facilities will be available to manage dredged sediments at the rate implied by the productivity standard." This is a very broad assumption has limited support in the documentation provided to the review team. EPA should undertake a more extensive analysis of the transfer, processing, and transportation requirements which ultimately may prove to limit productivity. Alternatively, flexibility should allow the full-scale design team to uphold this assumption.

Section 2.2.2.5 (transportation requirements, Page 20) states: "the ability of the Canadian Pacific Railroad to transfer the loaded cars to a local rail yard for assembly onto a train needs to be confirmed." Who will do this?

The production schedule often assumes that dredging and backfilling can occur concurrently. This may not always be possible. Both construction practices require heavy equipment and large staging and operating areas and the two operations may be incompatible. This concern should be resolved at the design stage.

Section 2.2.2.2, Page 14, and elsewhere: Under the heading "Presence of Bedrock and Highly Compacted Sediments" the production standard states that "diver assisted dredges should be expected in such areas if the target cleanup level is to be met" in problem areas over a hard base material. The health and safety concerns to divers would seem to outweigh the human health gains of the dredging itself. Diver assisted dredging will be expensive and will impose unique construction worker hazards that seem unwarranted to meet the cleanup goals of a specific area. Diver-assisted dredging should be eliminated from consideration in the Hudson River.

Section 2.2.2.2, Page 15, Interference with Navigation. Is it possible (or even reasonable) to restrict commercial and/or recreational traffic in the river during dredging?

11. *Please comment on the Example Production Schedule, including the reasonableness of the underlying assumptions for equipment selection and efficacy, as well as the time necessary to deploy, use, and move equipment.*

Section 2.2 (page 24) includes the following statement:

> "[Re-dredging] should take place while the production dredges continue to work downstream. If the dredging is stopped to await post-dredging sampling, analysis and evaluation, and a decision as to whether re-dredging will be necessary in a given area, the project will not be completed on time."

This statement creates a very aggressive requirement. A substantial portion of the total construction time will be associated with mobilization and demobilization. Is it reasonable to expect that dredging equipment can be demobilized from a site while surface confirmation sampling and analysis are conducted, and then remobilized to the site in the event of an exceedence? A more reasonable strategy is to leave dredging equipment in the same general vicinity of the river, before being remobilized to a new location. However, this criterion to meet the dredging productivity standard should be evaluated closely during design.

12. *Please comment on appropriateness of the action levels and the required actions, as well as the reasonableness of the monitoring and record keeping requirements.*

No comment.

QUESTIONS RELATED TO ALL THREE ENGINEERING PERFORMANCE STANDARDS

13. *Please comment on whether the main interactions among the standards are properly documented and taken into account.*

The EPA has made a concerted effort to ensure that the three sets of performance standards (i.e., Resuspension; Residuals; Productivity) are balanced, and that they allow sufficient flexibility to maintain dredging productivity while ensuring that dredging residual goals are met and Resuspension Standards are not exceeded. Implementation of all three plans will require flexibility, close supervision, and open communication between EPA, GE, stakeholders, and the on-site contractors. EPA has taken a reasonable approach to use the first year of dredging (Phase I) to evaluate the project's progress compared to the assumptions in the ROD and the three standards, and to determine whether "any necessary adjustments to the dredging operations in the succeeding phase (Phase 2)" will be required. This level of flexibility and willingness to revise the standards will be essential for the success and eventual completion of this project.

14. *Please comment on whether there are any additional aspects to effectively accomplish the refinement that EPA should consider in evaluating the Phase 1 data.*

No additional comments.

15. Please provide any other comments, concerns or suggestions, involving both strengths and weaknesses, with respect to the October 2003 Draft Engineering Performance Standards — Peer Review Copy that may not be fully covered by the above charge questions.

The performance standards would benefit from a better description of the site layout, areas of contamination, and maps that identify the various stations, remediation areas, sources, and other relevant site features. This information was available only by close reading of into attachments of the various volumes. (For example, the only site map was Figure 1 of Attachment A, Volume 1. The plans would benefit from more maps like this, built into the main body of the standards).

Nancy Musgrove
Preliminary Comments

REVIEW OF THE ENGINEERING PERFORMANCE STANDARDS (October 2003 version) FOR THE HUDSON RIVER PCB CLEANUP

The following represents technical comments prepared by Nancy Musgrove of MER Consulting Inc. in response to the Peer Review charge regarding the Hudson River Engineering Performance Standards. Comments and suggestions have been prepared for discussion at the technical workshop to be held January 27th through the 29th, 2004. These comments should be considered preliminary in advance of the workshop.

General comments are provided first. Responses to the specific peer review questions follow and are organized according to the written charge given to the Peer Review Team. The explanation regarding each potential question included in the charge has not been repeated with the charge. Recommendations for project consideration are provided as part of the final question. Requests for clarification (perhaps discussion points for the workshop) are also included in this document, following recommendations.

General Comments

It is evident from the documents that a great deal of thought and technical work went into development of the engineering performance standards and how they would be implemented. Scientifically, the proposal is valid and well documented. However, the resulting program is likely to be difficult to implement from a practical standpoint and be very costly due to its complex nature. The monitoring program to evaluate compliance with the standards, as currently proposed, seems most appropriate for an initial performance evaluation phase, rather than a long-term program. The Phase 1 dredging program should be designed to yield sufficient site-specific information to streamline the approach to determining compliance with performance standards.

Response to Specific Questions

Dredging Resuspension Standard

1. *Please comment on whether the framework provides a reasonable approach for developing the Resuspension Standard*.

   A tiered approach to determining compliance with the resuspension standard is a typical approach to monitoring. However, routine monitoring plus three additional action levels seems excessive with respect to determining compliance with the resuspension standard. In particular, the routine monitoring and evaluation levels are somewhat redundant.

2. *Please comment on the technical adequacy of the near-field analyses, in particular the linkage from the resuspension production rate (at the site of dredging), to the resuspension release rate (reflecting PCB transport in the water column in the immediate vicinity of the dredging operations) and finally to the resuspension export rate (essentially equilibrium conditions reflecting long-distance transport of PCBs in the water column).*

   The analysis of rates of resuspension, release, transport, and export reflect the science currently available to predict the behavior of contaminants and particles in flow conditions. While not all variations in conditions can be accounted for in the models, they reasonably predict what happens during dredging and subsequent transport of suspended solids.

   I was surprised at the selection of the definition of farfield, where compliance with the PCB standard in water will be measured. This definition implies that water quality impacts (to ecological receptors in particular) could be occurring over a larger area of the river, without ever triggering a response action, due to the distance from the source. In most sediment remediation projects (including riverine environments), compliance is required (and is achieved) 300 feet from the dredging activity. Simple techniques are used to track the location of the plume, so that the effects of the dredging on water quality are accounted for. Complete mixing (or equilibrium) is not assumed prior to sampling. Ambient conditions are typically measured concurrently with conditions at compliance boundaries, such that large data sets do not have to be developed to account for the effects of seasonal and inter-annual variability in monitoring parameters. The difference between ambient and compliance samples are interpreted to be from the dredging activities, since many other variables are accounted for using this "background" approach. It is unclear to me at this point why this approach would not be applicable to the Hudson River cleanup.

3. *Please comment on the appropriateness of the Evaluation Level as a component of the standard applied to for Phase 1.*

   Use of routine monitoring <u>and</u> the Evaluation Level to determine if additional monitoring is required seems excessive, given two other action levels plus a threshold value. The function of the routine monitoring and evaluation levels could be combined to streamline the data evaluation process. Alternatively, elements of the concern and control levels could be combined. Even with reduction of the number of action levels, Phase 1 monitoring will provide sufficient information for evaluating the monitoring approach.

4. *Please comment on the reasonableness of the 500 ng/L Total PCBs threshold concentration developed for the Resuspension Standard.*

   Basing the Resuspension Standard on protection of municipal water supplies during dredging is a reasonable approach to addressing a public health concern. One consideration to potentially modifying this threshold is that the annual load limit occurs before this standard is likely to be exceeded. It may be more reasonable to use a lower concentration (350 ug/L?) to reflect more reasonable export scenarios.

5. *Please comment on whether the monitoring program reasonably can be expected to provide adequate data in Phase 1 that will allow EPA to evaluate necessary adjustments to dredging operations in Phase 2 or to the Resuspension Standard. Also, please identify any necessary improvements to the monitoring program.*

The currently proposed monitoring program is fairly extensive and should provide adequate data to evaluate the overall program. Some additional sampling may be useful to validate some of the assumptions made in development of the standards.

- It is recommended that some dissolved and particulate phase PCB samples be analyzed to confirm that dissolved phase transport of PCBs released through dredging is negligible.
- Analysis of PCBs and TSS in samples between the point of dredging and the first farfield station may help to confirm the appropriateness of the farfield definition and release rates in the vicinity (downstream) of the dredge
- Some samples should be collected outside the certification unit boundaries where non-target areas are adjacent to dredging areas. If possible, non-compliant certification units that have been or will be redredged should be the focus of this type of evaluation.
- EPA may want to consider some *in situ* bioaccumulation tests to quantify the potential short-term increases in body burdens in fish.

Dredging Residuals Standard

6. *Please comment on whether this framework provides a reasonable approach for developing the Residuals Standard.*

Overall, the framework for development of the Residual Standard is reasonable. Comparison of chemical characteristics (individual concentrations, mean, median) within a certification unit (or units) to statistically-derived action levels that lead to specific decisions is scientifically valid and implementable. However, the implementation of the standard needs to be more clearly laid out in the text. For example, the use of the median to determine when additional subsurface samples (other than top 6 inches) will be collected needs some emphasis (this switch from mean to median could be easily missed). Comparison of the certification unit median to the 99% UCL to require re-evaluation of the certification unit in its entirety (as in Figure 1-1) instead of individual nodes needs to be identified as part of the description of the standard in Section 1-1.

7. *Please comment on whether the statistical analyses are technically adequate and properly documented.*

   The statistical analyses are appropriately applied to case study data for development of the action levels. It is my understanding that these analyses (trigger levels, number of samples required to document sediment quality in the CU) will be applied to the Phase 1 data. If not, I would recommend doing so.

8. *Please comment on the adequacy of these aspects (sampling techniques, sampling design, data evaluation, response to action level exceedances) of the Residuals Standard, in particular the concept of a 20-acre evaluation area for Phase 1.*

   It may be reasonable (if not desirable) to consider a biased sampling approach in some dredging units to document the post-dredge sediment quality. If a dredge operator encounters unusual conditions within a dredging unit, such that not all material was likely removed as planned, some of the initial confirmational samples should be placed in the problematic area, even if they don't fall on pre-planned sampling nodes. An alternative approach would be to divide the dredging unit into several smaller units, such that the problematic area could be evaluated as its own unit.

   The reliance on a specific acreage to represent a certification unit should be tested in Phase 1. Expansion of a certification unit size (from 5 to 20 acres) to achieve compliance with the ROD standard is an attempt to deal with units with residual concentrations that do not meet the standard. In effect, it is areal compositing. Overall, the decision to combine certification units for comparison to the standard and the frequency of combining units over the life of the project should be risk-based (was is the risk of leaving additional inventory in a particular section of the river?)

9. *Please comment on the reasonableness of the Residuals Standard with respect to re-dredging and engineering contingencies.*

   The justification of requiring two re-dredging attempts following an initial pass is not clear. The case study data (Table 2-3) suggests that only a single attempt at re-dredging may provide any benefit. The incremental change in sediment concentrations with additional passes thereafter appears to be negligible.

   The selection of a response action needs to take into account the site-specific conditions in a given non-compliant certification unit. Some areas of the river will require restoration to grade (needs elaboration in the document), which may result in placement of enough material to provide chemical isolation and other confining cap functions. In this example, it may not make sense to try to remove a thin veneer of contaminated material. In other areas where physical characteristics of the unit (e.g., presence of boulders or other geologic features) limit the effectiveness of dredging, backfilling may still be the appropriate response action because it provides some isolation (or at least dilution) of the contaminated material.

Productivity Standard

10. Please comment on whether this framework provides a reasonable approach for developing the Productivity Standard.

Overall, I am uncomfortable with applying performance standards to dredging production rates. The engineering analysis performed to date has demonstrated that it should be possible to meet the removal goals, while minimizing residual production, resuspension, and export from the system. However, there are many things that can adversely affect production rates and few are within the operator's or project manager's ability to control.

Given that, a cumulative approach to attaining the final required removal volumes seems reasonable. However, trying to set annual volume requirements in advance of Phase 1 is premature. Phase 1 (at least in part) should be designed and implemented to test the full range of conditions and constraints that are likely to be encountered during the entire program. Production data from Phase 1 (in combination with residuals and resuspension data) should then be used to set the production goals for the remainder of the program, using a cumulative approach.

11. Please comment on the Example Production Schedule, including the reasonableness of the underlying assumptions for equipment selection and efficacy, as well as the time necessary to deploy, use, and move equipment.

The example production schedule seems fairly (overly?) conservative; however, it demonstrates that the production goals for the project can be achieved.

With respect to other details, I leave that to the experts on the Peer Review Panel.

12. Please comment on appropriateness of the action levels and the required actions, as well as the reasonableness of the monitoring and record keeping requirements.

Applying an action level and requiring a response is generally reasonable. However, the action levels for this project should be set based on the range and variability in the production rates experienced in Phase 1. The types of information that EPA has required for dredging and handling operations are adequate to set the action levels and support long-term management of the program.

With respect to the actions that may be required, I believe EPA should take a collaborative approach to developing response actions, should production fall behind. In the performance standard, the dredging contractor is asked to identify the cause of a monthly shortfall, and then make up that shortfall by adding equipment, working more hours, etc. Dredgers have a lot of experience in maximizing dredging production; however, many of these response actions may have a negative impact on residuals production or resuspension that could result in failures of other performance standards. EPA needs to work closely with the contractor to monitor the impact of any response actions and develop potential modifications to dredging operations. Over the course of the remediation, it should become clear as to what responses are effective and which cause greater problems.

Questions Related to All Three Engineering Performance Standards

13. *Please comment on whether the main interactions among the standards are properly documented and taken into account.*

The major interactions among the standards have been documented to the degree possible. However, the predicted interactions have relied on data from other projects or theoretical understandings of how things “should” work. It will be critical to validate the technical work conducted to date as part of the Phase 1 dredging.

It would be helpful to identify earlier in the document that there is an absolute limit to the mass lost during remediation, because this affects all of the standards.

14. *Please comment on whether there are any additional aspects to effectively accomplish the refinement that EPA should consider in evaluating the Phase 1 data.*

The current approach to determining compliance with the residual standards does not appear to address how to monitor impacts from local resuspension/residuals production on non-target areas adjacent to certification units. If residuals with elevated concentrations have been produced within a dredging unit such that the various tiered criteria are exceeded and redredging has been performed, there is a likelihood that those residuals have been transported to adjacent non-target areas (due to the unconsolidated nature of the residuals, and perhaps the original material). However, compliance will only be determined within the certification unit. It is recommended that additional sampling outside of certification areas be conducted as part of Phase 1 (where non-target areas adjoin initially non-compliant units) and a trigger be developed for when confirmational samples will collected outside of a certification unit.

15. *Please provide any other comments, concerns or suggestions, involving both strengths and weaknesses, with respect to the October 2003 Draft Engineering Performance Standards—Peer Review Copy that may not be fully covered by the above charge questions.*

- The depth of contamination varies from 1 to 8 feet below mudline, based on information in the ROD. According to the Engineering Performance Standards, 1 foot of backfill will be placed in compliant dredging units. This results in highly variable final elevations that will alter the patterns of erosion and deposition within the river. Given the additional sources of PCBs within the watershed, this will potentially lead to recontamination of some remediated areas (particularly those lower than the surrounding areas), where material tends to accumulate because of the variable bottom bathymetry.

- It is recommended the sediment profile imaging (SPI) be used throughout (i.e., at 100 percent of the sampling nodes that will be used to confirm the remaining sediment quality) the certification units dredged early in Phase 1 to help establish was the potential rate of residual production is for different sediment types and dredging rates.

Request for Clarification

In developing the conceptual production schedule, it looks as though re-dredging is assumed to occur everywhere. Wouldn't it be more reasonable to assume a percentage will be re-dredged based on the analysis performed in the Residuals Performance Standard document (see Figure 2-7)? Why wasn't this done?

The conceptual production schedule doesn't quite seem to track with some the assumptions reported in the document (please clarify, where possible). For example:

- Re-dredging is assumed for each site; however, it is not clear that two attempts following the initial dredging will be made.
- The stated assumption that silt barriers will be used at all locations (which is very conservative) doesn't seem to agree with the backup table that identifies units that will not require curtains.
- Ten dredges (4 primary; 6 alternative) were identified as being needed to meet the production schedules, but the number of dredges varies by site and year in the schedule. This makes the management/mobilization of dredges seem overly complex.
- Confirmational sampling and testing overlaps with the dredging schedule for a "site" and it looks like re-dredging is occurring before testing is complete.

According to the production evaluations, approximately 10 dredges will be operational at any one time in the river (4 primary and 6 alternative). Did the analysis of dredging resuspension, release, and export take into account that many active areas within a section of the river?

There appears to be an error in Table 2-3 (Vol 2: Summary statistics for all sites and estimation of the UCL and PL). The uncapped areas at GM Massena had a CV of 0.8, which should have indicated use of the arithmetic mean, but it looks like the MVUE was used. Is this correct? Please confirm that this is unlikely to change the estimated variables.

Table 2-7 (Vol 2: Estimate of the number of samples/target area). Footnote 2 states that results with an * were included in the summary statistics, but it looks like GM Massena Pass 2 and Grass River were not included. Are the asterisks in error for these two studies? (This doesn't change the decision to use 40 samples/20 acres).

What was the justification for selecting a 50% error rate for estimating the median when calculating the number of samples per certification unit (see top of page 25-Vol 2)?

Ken Reimer
Preliminary Comments

Hudson River PCBs Superfund Site

Draft Engineering Performance Standards

Peer Review Report

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January 14, 2004

INTRODUCTION

The United States Environmental Protection Agency (USEPA) has issued a record of decision (ROD) for the Hudson River PCBs Superfund Site. This decision includes the environmental dredging of approximately 2.65 million cubic yards of contaminated sediments containing about 150,000 pounds of PCBs. The project will begin in 2006 and will take place in two phases over a period of six years. The first year constitutes Phase 1 during which there will be a reduced rate of dredging that 'will allow comparisons of operations with pre-established performance standards and evaluation of necessary adjustments to dredging operations in the succeeding phase or to the standards (Peer Review Charge, USEPA 2003).'

In accordance with EPA's decision, performance standards have been developed for dredging resuspension, PCB residuals after dredging and dredging production rates – collectively referred to as the Engineering Performance Standards. The ROD requires that there be two independent peer reviews related to these standards. The first deals with the October 2003 Draft Engineering Performance Standards – Peer Review Copy, and is the subject of this report.

The following sections address each of the charge questions provided to the peer review panel. The responses specifically deal with the following documents –

- Draft Engineering Performance Standards – Peer Review Copy, October 2003
    - Part 1: Performance Standards for Dredging Resuspension
    - Part 2: Performance Standard for Dredging Residuals
    - Part 3: Performance Standard for Dredging Productivity
    - Appendix: Case Studies of Environmental Dredging Projects.

It should be noted that in preparing this report, numerous other documents were also consulted, including EPA's October 10, 2003 responses to public comments, several White Papers that provide supporting documentation, as well as relevant sections of previous studies. It was noted that the Hudson River Project will be the largest environmental dredging project ever conducted in the United States. The decision to conduct the project in two phases, and to use information gathered in the first year to validate assumptions and to improve the standards, is wise. EPA's requirement to conduct significant monitoring during Phase 1 was considered during the development of the following responses. It cannot be forgotten, however, that even at a reduced rate, the volume of sediments targeted for removal during Phase 1 appears to be greater than the collective total volume cited in any of the provided case studies. The extent of monitoring must therefore be practical and implementable as well as based on sound science.

In accordance with the direction provided to the peer review panel, this report constitutes my initial responses to the charge questions. Although each answer has been carefully considered and is based on professional judgment and experience, each will be further considered during the actual peer review (January 27-29, 2004) and all responses are therefore subject to revision.

RESPONSE TO CHARGE QUESTIONS

Dredging Resuspension Standard

Q1. ***<u>Framework:</u>*** *The Resuspension Standard was developed with a routine (i.e., baseline condition) water quality monitoring plan and three tiered action levels (Evaluation, Concern, and Control) leading up to a maximum allowable concentration of PCBs in river water. Exceedance of an action level would trigger additional monitoring requirements beyond the routine monitoring, as well as operational or engineering steps (studies and operational or engineering improvements and, if necessary, temporary halting of operations). The Resuspension Standard was developed with this framework to accommodate the project need for both protection and production (i.e. upon an exceedance of an action level, appropriate steps can be taken to identify and address remediation-related problems before dredging operations would need to be halted temporarily) (see, for example, Section 2.3: Rationale for the Standard).*

- *Please comment on whether this framework provides* a reasonable approach for developing the Resuspension Standard.

Response, R1 –

The introduction of PCBs to the water column can occur during dredging operations as a consequence of the resuspension of contaminated sediments. Unlike the other performance standards, the ROD is not proscriptive in specifying the resuspension standard. The approach described in section 2.3 cites the requirement to meet the environmental and human health protection objectives of the ROD, and also recognizes that it is likely that there will be a 'localized temporary increase in suspended PCB concentrations in the water column and possibly in fish PCB body burdens.' (ROD 11.5, page 85). The framework sets an upper allowable concentration of Total PCBs in the water column (the Resuspension Standard) which, if exceeded (and confirmed) will halt dredging activities. It also defines a series of Action Levels that result in increased monitoring activity – designed to identify potential problems and possible responses. These are, in order of increasing PCBs in the water column, the Evaluation, Concern and Control Levels. Engineering responses are recommended for the first two of these and required at the Control Level. While the tiered approach appears to be reasonable, consideration should be given to three points: 1) are the Action Levels based on appropriate information/assumptions, 2) is there a correct number of levels, and 3) do they trigger an appropriate response. Issues 2 and 3 will be addressed in greater detail in response to Charge Questions 3 –5, while the first point is dealt with here.

The framework includes PCB concentration and PCB load criteria. The Resuspension Standard of 500 ng/L is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act and represents the absolute maximum allowable value since exceedance of this concentration results in cessation of dredging activities. The criterion of 350 ng/L is set at 70% of the MCL and is included in both the Control and Concern Levels. An exceedance of this value for four weeks (based on a four-week average) triggers the application of engineering controls (Control Level) while a one-week exceedance (based on a seven-day average) initiates increased monitoring and a recommendation for engineering improvements. In terms of providing adequate warning to downstream water treatment plants, this approach seems reasonable.

The load-based criteria were derived from case studies that provided an engineering estimate of the rate of PCB release from dredging operations. These values are reported a percent of the PCB mass removed in each instance. This information was applied to the Hudson River project (with 69,800 kg targeted for removal) and estimates made of the hourly, daily and annual loads. A summary of these data is provided as Table 1. Greater emphasis was placed on the 0.13 and 0.36% export values and an argument presented that suggests that the Fox River result was artificially high. Given that the first two export rates are negligible compared to the baseline daily flux, nominal resuspension rates of approximately three times these values were used for further analysis. This approach seems reasonable and provides an appropriate buffer, provided, of course, that the interpretation of the Fox River data is correct. (The limited Fox River information provided in the Appendix is not adequate to perform a detailed independent evaluation).

Further analysis of the delivery of Total PCBs and Tri+ PCBs to the Lower Hudson River indicated that sustained operations at 350 ng/L will deliver an unacceptably high load of PCBs (340 kg/year) while a 600 g/day load standard (130 kg/year) compares favorably to (i.e. is less than) the Monitored Natural Attenuation (MNA) scenario just after the completion of dredging. This analysis set an upper limit of 650 kg load loss over the course of the project (and 65 kg in Phase 1 assuming 1/10 of the volume will be dredged). The ability of the models to forecast these outcomes is not the focus of this peer review and has been dealt with in earlier sessions; consequently, my comments will deal with the application of these outputs.

Table 1 – Loadings based on various resuspension rates

	Case Studies			**Comments**
Losses Based on Case Study Information	New Bedford	GE Hudson Falls	Fox River SMU 56/57	
Percent of PCB mass removed	0.13	0.36	2.2	Information obtained from sections 2.2.4 and 2.3.1.2 and Table 2-2 of the Part 1 report dealing with the Resuspension Standard.
Expressed as g/hr	6	17	104	
Expressed as g/day	86	240		
Expressed as kg/year	18	50	320	
Baseline flux	**Years 1996-2002**			Load in g/hr cited on page 21 as typical of conditions in TI Pool in June and July: 3000-5000 cfs, 75-150 ng/L. Annual load cited on page 46 and Figure 7 of Attachment B.
Expressed as g/hr	20-80			
Expressed as kg/year	260-400			
Nominal Resuspension Rates for Hudson River Dredging				For the first two instances these represent a three-fold increase over the ‘best engineering estimate of load loss.
Percent of PCB mass removed	0.5	1.0	2.5	
Expressed as g/hr	24	47	119	
Expressed as g/day	300[a]	600[a]	1600	300 g/day and 600 g/day represent the Evaluation and Concern Levels. A loss of 130 kg/year represents 650 kg over the course of the project. Modeling indicates that this is the acceptable upper bound loss.
Expressed as kg/year	65	130	345	
Resuspension related to concentration based action levels	**Action Level**			
	Control		Standard	Control is set at 70% of 500 ng/L. It is also effectively equivalent to the 2.5% export rate and represents an unacceptable loss of PCB mass over the course of the project.
Concentration value, ng/L	350		500	
Expressed as g/day	1600		2300	
Expressed as kg/year	340		500	

a. Calculation of dredging export rate, F_{dredge}, (as per page 20) appears to have used 14 hr/day but the subsequent conversion to g/day seems to have used a 13 hour dredge day.

Setting an upper limit on the amount of PCB load that can be lost during the course of the project is reasonable. It is important, however, that the Action Levels provide adequate response to ensure that this loading is not exceeded. It is therefore curious that an exceedance of the 600 g/day (the Concern Level) does not have a mandatory engineering response. Examination of Table 1 also indicates that if the resuspension export rates mimic those of Fox River, the PCB load will be similar to the unacceptable amount (≈340 kg/year) associated with the 350 ng/L criterion. Although not stated, or not obviously so, one wonders if this analogy played a role in the selection of the 350 ng/L criterion. Regardless of the reason, it does support the requirement for an engineering response at the Control Level. The inclusion of the 350 ng/L criterion in the Concern Level will provide an 'early warning' of potential problems and EPA might wish to consider a more aggressive response to exceedances. The only argument against this are the seasonal high baseline concentrations, but the following statement (at least regarding the Control Level, page 52) suggests that this may have been considered – 'Notably months with high baseline concentrations will have relatively little "room to spare" and may require tight controls on the dredging operations to comply with this criterion. Exceedance of the Control Level may prompt temporary cessation of operations as deemed necessary by EPA.' This underlines the relationship between the Resuspension and Productivity Standards.

In summary, the framework is based on reasonable assumptions and arguments. It will be important to determine during Phase 1 if the load associated with 600 g/day operations can be met without compromising the Productivity Standard. Phase 1 will provide valuable information in this regard and the tiered approach to incremental response and monitoring seems appropriate.

Q2. ***Near-Field Analyses***: *Development of the Resuspension Standard considered the potential effects of resuspension in the near-field and in the far-field (see, Section 2.1.2: Definitions). The near-field work was performed to help identify the locations of the near-field water column monitoring stations, to estimate the loss from the dredge, to estimate the nature of the release (i.e., dissolved vs. suspended) to provide an estimate of the solids transported into the far-field, and to estimate the effects of settled material on PCB concentrations in near-field sediment. Relevant sections of the document include, but are not limited to, Section 2.2.7: Near-Field Modeling, Section 2.2.8: Relationship Among the Resuspension Production, Release and Export Rates, and Attachment D: Modeling Analysis.*

- *Please comment on the technical adequacy of the near-field analyses, in particular the linkage from the resuspension production rate (at the site of dredging), to the resuspension release rate (reflecting PCB transport in the water column in the immediate vicinity of the dredging operations) and finally to the resuspension export rate (essentially equilibrium conditions reflecting long-distance transport of PCBs in the water column).*

R2 -
EPA has developed models that evaluate the transport of sediment and PCBs released as a consequence of the dredging operations. These models (CSTR-Chem and TSS-Chem) estimate conditions within 1 mile downstream of the dredge head, including suspended solids and Total PCB plumes. Key findings of these models indicate that there is a significant amount of settling within 1 mile – i.e. the amount of Total PCBs is reduced by approximately 80% and 70% in River Sections 1 and 2/3 respectively. In addition, the total amount of bulk sediment that needs to be suspended to achieve the far field PCB action levels is quite significant relative to the solids naturally transported by the Hudson on a daily basis. It is stressed that the 'downstream export of PCBs (at one mile beyond the dredge operation) is unlikely to exceed the 300 g/day Total PCB action level on a regular basis' (page 53). Overall, the modeling appears to have been carefully conducted. There are, however, some key points that need to be clarified.

An important part of the analysis suggests that the resuspension process controls PCB release within the dredging region and that other contributions to dissolved phase releases of PCBs are unlikely. A three-phase partitioning model determined that very little of the PCB mass was contained in the sediment porewater. (It is not clear, however, why this was only modeled when direct measurement of porewater samples would provide a simple and useful confirmation of assumptions). The Fox River case study concluded that there was a large dissolved phase release of PCBs independent of any suspended solids. It is argued in Attachment C that this is unlikely, in part because (page 2) 'A dissolved-phase PCB contribution from the sediments, either by porewater displacement or sediment-water exchange, should yield a gain whose pattern is similar to the filter supernatant' whereas the congener pattern is unchanged across the study area. It is not clear what is meant by 'filter supernatant' – it is certainly not a chemistry term that I am familiar with.

This leaves desorption of PCBs from material suspended by dredging activities as the main source of the downstream dissolved phase. Estimates of this contribution were reasonably calculated, and in a conservative manner, using the fastest desorption rate in the literature. What is not as apparent from the analysis is the possible influence of differing PCB concentrations on material of different grain sizes. Literature reviews cited as Attachment C-1 offer some contradictory conclusions regarding the influence of grain size, leading EPA to conclude (see paper 13, page 11) that 'further study is needed to address the roles played by different sized particles in this contamination contribution to shallower water systems.' My own experience has shown dramatically different PCBs concentrations amongst grain sizes, with significantly enhanced concentrations on the finest material – exactly the material that will remain suspended for the longest period of time. This point was raised by GE and discussed in the EPA's October 10, 2003 response to them. GE cites data for sediments in River Section 1 in which the PCB concentrations were 62 and 7 ppm for the clay/silt and sand fractions respectively. GE obtained significantly different PCB export rates when these data were substituted into EPA's models. EPA's response used published results from a 1994 GE study to refute these conclusions. Given the considerable number of samples that have been collected from the Hudson, it would seem that this matter could be resolved using representative, rather than modeled, data. Furthermore, given the importance of this issue, it should be addressed more directly in the Resuspension Standard report and not just in the responsiveness statements.

A related issue is that of PCB deposition immediately downstream of the dredging. It is calculated (page 37) that 'in the two acres below the target area in River Section 2 for example, the concentrations range from 2 to 9 mg/kg.' Surprisingly, little else is made of this observation other than to support an upstream to downstream approach to dredging. This result was calculated, however, using the average PCB concentration in the sediments and does not take into account any differences of PCB loading amongst grain sizes. It is agreed that the coarse material will settle out more quickly. Depending how far downstream it is from the dredge head, this material could have a lower PCB concentration than the mean or that of the associated fines.

The near-field suspended solid action levels were derived using the TSS-Chem model. It is curious (section 2.3.2, page 54) that for the Evaluation and Concern Levels, 'suspended solids thresholds represent an average suspended solids concentration 300 m downstream of the dredge that would yield a Total PCB concentration exceeding 350 ng/L at the far-field station.' This seems to be a strange mix of criteria. A comparison to suspended solid concentrations reported for case studies is made in Attachment D. 'Assuming that the suspended solids concentrations in the Hudson River during dredging are similar to these two projects, the action level corresponding to the 600 g/day of total PCBs at the far-field stations exceed too frequently and possibly cause unnecessary contingencies. Therefore the SS action level criteria are not based on the numbers determined by the 600 g/day of total PCBs, but are based on the numbers corresponding to the 350 ng/L at the far-field stations' (page 38). Such a statement reduces one's confidence in the validity/application of the near-field suspended solids criteria.

Q3. ***Evaluation Level**: The Evaluation Level of the Resuspension Standard can be reached by exceeding criteria for net (i.e., over baseline) PCB load (mass loss) measured at far-field locations or criteria for net suspended solids concentrations measured at either near-field or* *farfield locations (see, Table 1-1). The Evaluation Level was specifically developed for Phase 1 to provide the site-specific information necessary to understand the mechanisms of PCBs release from dredging in the Upper Hudson, which in turn is needed to guide the selection of appropriate engineering controls, as necessary. As stated in the Resuspension Standard, EPA anticipates that sufficient data may be collected in Phase 1 to justify eliminating the Evaluation Level in Phase 2. Also, the Evaluation Level is well above the best estimate of dredging release alone. Some of the public comments that EPA received suggested that the dredging operations should not be allowed to increase PCB concentrations in the water column above baseline conditions (i.e., that the Evaluation Level should be the threshold level that results in the temporary halting of dredging). Other comments suggested that the requirements of the Evaluation Level and Concern Level should be reduced and combined into one level prior to the Phase 1 dredging. Relevant sections of the document include, but are not limited to Section 3.1.1: Evaluation Level).*

- *Please comment on the appropriateness of the Evaluation Level as a component of the standard applied to for Phase 1.*

R3 –

Consideration of the data provided in Table 1, suggests to me that the Evaluation Level will be marginally above baseline conditions, if at all, and will in effect represent a routine monitoring condition. It appears to represent less than 20% of the baseline loading – an amount that could easily be masked by both river and analytical variability. I therefore support the combination of the Evaluation and Concern Levels. The 600 g/day load represented by the Concern Level represents the overall acceptable PCB loading over the course of the project. Together with the associated measurement of PCB concentration (and comparison to the 350 ng/L criterion) for the protection of downstream water supplies, these values represent the operational requirements for the project and simplification of the action levels will make them more practical to implement.

It is also recognized that dredging will take place at a reduced rate during Phase 1 and that one of the key goals is to gain a better appreciation of PCB release mechanisms and potential problems. However, if the levels are combined and accompanied with a reasonable amount of monitoring, then the data acquisition objectives of Phase 1 need not be compromised.

Q4. ***<u>Resuspension Threshold:</u>*** *Under the Resuspension Standard, the maximum allowable concentration (i.e, threshold) in the water column is 500 ng/L Total PCBs, which is the maximum contaminant level (MCL) for potable water under the federal Safe Drinking Water Act. This threshold concentration was selected in consideration of the goals of the cleanup, which include protecting downstream public water supplies that draw from the river, and minimizing the long-term transport of PCBs in the river, both from one section of the Upper Hudson to another and from the Upper Hudson to the Lower Hudson. Relevant sections of the document include, but are not limited to, Section 2.2.9: Review of Applicable or Relevant and Appropriate Requirements, Section 2.3.1: Development of Basic Goals and Resuspension*

Criteria. The threshold addresses the resuspension export rate, which describes the rate of PCB mass transported in the water column when particle settling is unlikely to further reduce the level of PCBs in the water column (see, Section 2.1.2: Definitions). The Resuspension Standard requires that the threshold be applied to the nearest far-field sampling station that is at least 1 mile away. Moreover, to reduce the possibility that a short-duration anomalous A spike@ or laboratory error could temporarily halt the dredging operations, the standard requires that the concentration be confirmed by an average of four samples collected the next day with 24-hour laboratory turnaround time.

- *Please comment on the reasonableness of the 500 ng/L Total PCBs threshold concentration developed for the Resuspension Standard.*

R4 -

I support the use of the MCL of 500 ng/L as the Standard. It is protective of human health and conservative in that it is the maximum concentration for raw water intake even though the treatment plants have the capability of reducing the concentration of PCBs in the treated (potable) water supply. The analytical requirements for confirmation are reasonable and, given the time it takes for a parcel of water to travel, protective. It is important, however, that EPA will revisit the sampling requirements when work is being conducted in River Section 3 where the distance to water intakes may be reduced.

Q5. ***Monitoring Program:*** *The 2002 ROD states (see, p. iii), Beginning in phase 1 and continuing throughout the life of the project, EPA will conduct an extensive monitoring program.@ Section 3.3: Monitoring Plan and Attachment G (and related tables and figures) describe the attendant monitoring program for the Resuspension Standard.*

- *Please comment on whether the monitoring program reasonably can be expected to provide adequate data in Phase 1 that will allow EPA to evaluate necessary adjustments to dredging operations in Phase 2 or to the Resuspension Standard. Also, please identify any necessary improvements to the monitoring program.*

R5 -

There is no question in my mind that the currently designed monitoring program will provide an adequate amount of information for any adjustments that might need to be made for Phase 2. While it is understood that the primary objectives are to be protective of environmental and human health, it must be recognized that there is a tremendous opportunity to acquire important scientific information that can be used in the implementation of this, and other, dredging projects. It is, however, important to ensure that the monitoring program is practical.

Given the importance of PCB measurements in determining actual exceedances of Action Levels, the level of monitoring seems appropriate. Similarly, the analysis of dissolved and particulate bound PCBs will provide confirmation regarding dissolved phase releases and desorption phenomena. There does, however seem to be an excessive amount of suspended solids monitoring. The requirement, for example, of a station within a containment system is not supported by any of the case studies, nor is it clear how the information would be used. It is recognized that a proven relationship between turbidity measurements and suspended solids will be invaluable during Phase 2 and that it will be important to ensure that this relationship is not influenced by season (e.g. algal blooms etc). Given that such a relationship (with R^2 values of 0.98 and 0.43) was only accomplished in one (and marginally a second) case study, it is understood that this is by no means a given, nor can such a relationship be expected to provide quantitative information regarding PCB loading. It is hoped, however, that if early results obtained during Phase 1 prove that reasonable relationships exist, then the frequency of SS monitoring be reviewed.

It is noted that monitoring will include several additional parameters (e.g. DO, temperature, pH etc) but it is not obvious how the contract manager will use such information. Given the complexity of the project and the amount of information that will need to be assimilated in a rapid fashion, it would be advantageous to have definitive outcomes based on specific observations. For example, if there was an unexpectedly significant suppression of dissolved oxygen during the dredging operations, one would assume that there would at least be a temporary cessation of activity. What is not clear is where the authority for such a decision would reside – given that DO is not part of the standard. Such issues could be dealt with in the design phase, but I strongly recommend that they be captured in a definitive manner.

A related issue deals with the data quality objectives. Attachment F (Part I) describes various Measurement Technologies but it is difficult to assess if these are recommendations that are to be considered during the design phase or that they are intended to be proscriptive. Certainly, there has been less attention to detail in this section and that following. An unedited statement in the middle of Attachment F-2 (item 4) is indicative of this. Neither Attachments F nor G were included in the electronic version provided to the Peer Reviewers – is this an oversight or were these recent additions to the documentation? Attachment G provides supporting information regarding the statistical treatment of data and the need to control the number of false negatives/positives. There is no question that this is important but I remain unconvinced that the authors have taken into account analytical variability in their deliberations. There appear to be several contradictory statements on this subject throughout the Part 1 report. Attachment A, page 5, states, in reference to water column PCB concentrations, that ‘previous sampling results indicate that the variability can to some extent be due to the uncertainty of lab analysis…but is actually primarily the result of variability in the river system.’ It is agreed that the river shows considerable seasonal variability but what are the requirements for the laboratory data? Table 3-5 provides information on the Far-Field Monitoring – Analytical Details. Here there is a stated requirement for PCB analytical precision of 40% RPD (relative percent difference). No mention is made of accuracy and precision requirements in Attachment F-2, and the DEFT calculations in Attachment G use a variability of 25%. The discussion of gray areas in Attachment G, as values that are 'too close to call' does not provide sufficient guidance to the people supervising the dredging operations. The document would greatly benefit from a detailed discussion of analytical requirements. In addition to typical laboratory blanks, replicates, accuracy and precision measurements, there needs to be clear direction as to how the field personnel are to evaluate the data that are received from the lab (i.e. are the results believable) as well as how they are to treat results close to the criterion. In my experience, lack of such specific direction can lead to frustrations in the field and to potential delays in the project.

Dredging Residuals Standard

Q6. ***<u>Framework</u>**: EPA=s 2002 ROD calls for removal of all PCB-contaminated sediments (i.e., to non-detection levels) in areas targeted for dredging, with an anticipated residual of approximately 1 mg/kg Tri+ PCBs prior to backfilling (Tri+ PCBs are the subset of PCBs with 3 or more chlorine atoms). The Residuals Standard builds on the requirements in EPA=s 2002 ROD as well as case studies and regulatory guidance (see, Section 2.1: Background and Approach). It requires comparison of PCB concentrations in post-dredging sediment samples within a given area (i.e., ~ 5-acre certification unit) to statistically-based PCB concentrations (i.e., action levels), which then guide appropriate actions (see, for example, Figure 1-1). The Residuals Standard was developed with this framework to accommodate the project need for both protection and production, in that post-dredging sampling can proceed directly upon EPA verification that the design cutlines have been attained and the options for appropriate next steps are known and, to the extent possible, pre-approved during design.*

- *Please comment on whether this framework provides a reasonable approach for developing the Residuals Standard.*

R6 –

In contrast to the Resuspension Standard, the ROD is proscriptive in the numerical value to be achieved for the residuals, although it is noted that the insertion of the word 'approximately' provides some measure of flexibility. It is understood that the anticipated 1 mg/kg residual (Tri+ PCBs) is based on modeling of fish recovery which included: field data for PCBs in areas not targeted for dredging, concentrations of 0.25 mg/kg in backfill after dredging, and 1 mg/kg in areas like navigational channels that are not be to be backfilled[1]. It is therefore important that there be a

1 The 10 Oct 2003 EPA Response to the NY DEC (item #2) indicates that there may be areas that are not backfilled in order to facilitate habitat recovery. In such instances, NY DEC indicates that it will take into account the residual PCB levels when determining if backfilling is appropriate or not. It will be important to

practical and effective approach to achieving these targets – in particular in ensuring that the bioaccessible PCB concentrations are consistent with these objectives. It has also been noted from several documents that there is a clear requirement for a reduction in PCB mass inventory rather than capping, and that capping is intended to deal primarily with areas where dredging is problematic.

Similar to the resuspension issue, the development of the Residuals Standard was based on case studies. There were seven studies for which there were post-dredging PCB data; notably only four of these had target post-excavation concentrations, only two of these were able to achieve that goal, and, in no cases was a target of 1 mg/kg accomplished. Nevertheless, EPA presents an argument (section 2.2.5, pages 23-24) that based on a mass reduction (96%) similar to the case studies, the Hudson River Total PCB residual concentrations will be 1.4 mg/kg in River Section 1 and 2.4 mg/kg in River Section 2. Conversion to Tri+ PCB concentrations gives residuals of 0.6 mg/kg and 1 mg/kg in River Sections 1 and 2 respectively. Collectively, this information underlines the challenge in meeting the required residual but does not imply that it will be impossible.

The framework develops two types of action levels for the Hudson River project. The first is based on the arithmetic average and defines an acceptable upper limit (upper confidence limit, UCL) below which an area can be backfilled and an unacceptably high limit (99% UCL) that requires further action to be taken. The second deals with individual sample results and specifies numerical action levels – one (the 97.5% prediction limit, PL) that can only be exceeded at one sampling node, and another (the 99% PL) that cannot be exceeded at any node. This approach leads to a tiered set of responses. This application of UCLs and PLs is reasonable and consistent with the project goals. Given that the PL action levels are individual sample results that have a low probability of occurring if the true population mean is compliant, the resulting action associated with exceedance of these values is appropriate. Comments regarding the size of the certification unit, the number of samples to be collected, and capping are presented in the following sections.

Q7. ***Statistical Analyses**: The supporting analyses for the Residuals Standard, in particular the statistical analyses of sites-specific sediment data collected in the Upper Hudson and the sediment data from case studies of environmental dredging projects, are presented in Section 2.2 (and associated tables and figures) and in Attachment A of the Residuals Standard.*

- *Please comment on whether the statistical analyses are technically adequate and properly documented.*

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ensure that the extent of areas influenced by such a decision be within the variability allowed by the fish recovery model.

R7 –

I am not familiar with each of the statistical tests but the overall approach appears to be thorough and, most important, leads to similar conclusions. There are, however, some inconsistencies and/or absence of detail in this section that reduces one's confidence in the results. For example, Figure 2-5 provides an important correlation between the mean and standard deviation for selected case study values. There is an excellent linear regression with $R^2 = 0.92$. Substitution of 1 mg/kg into the equation $y=1.0814x + 1.9243$ yields a value of 3, not 6 as reported in section 2.2.1.3.3, page 18. If the value of six is substituted into the Chebyshev nonparametric UCL equation (page 14) values of 5.14 and 10.4 are obtained for the 95% and 99% UCLs respectively. Either a there is a typographical error or there has been an unspecified conversion of Total PCB concentration to Tri+ although this is not obvious: using the factor of 2.2 reported on page 22 yields 5.14/2.2 = 2.3 and 10.14/2.2 = 4.6; alternatively, 6/2.2 = 2.7 which may have been averaged to 3 and substituted into the Chebyshev equation. Similarly, the first paragraph on page 19, last line references Table 2-3 as giving the average 99% PL as 25 mg/kg Tri+ PCBs; whereas the tabulated value is, in fact, 27.

Q8. ***Post-dredging Confirmatory Sampling Program**: Section 2.2.9 and Section 3.0 of the Residuals Standard present an evaluation of available sampling techniques and describe the procedures for establishing the post-dredging confirmatory sampling grid, collecting and managing the samples, and evaluating the sample data and required actions. In certain circumstances identified in the Residual Standard, a certification unit can be evaluated by considering the sediment data in three previously dredged certification units within 2 miles (i.e., a 20-acre evaluation).*

- *Please comment on the adequacy of these aspects of the Residuals Standard, in particular the concept of a 20-acre evaluation area for Phase 1.*

R8 –

Several approaches were used to identify the number of samples required to characterize a certification unit. USEPA's DEFT Software indicated that 310 samples are needed in order to achieve a false rejection rate of 10% and a false acceptance rate of 5%. It is agreed that this is an unreasonable number of samples but the adoption of 40 samples with a corresponding false acceptance/rejection rate of 30% seems to occur with very little comment other than to state that the restrictions on the prediction limits provides the needed added certainty. Given this relatively arbitrary adoption of the sample number, it is surprising that for areas less than 5 acres there is still a requirement for 40 samples while for larger areas (e.g. 7.5 acres) the number is increased to 60. It would seem that proportional representation should work in both directions.

It is interesting that, unlike the Resuspension Standard where a partial attempt was made to identify the analytical chemistry requirements (see R5 above), this volume (section 2.2.10, page 33) simply indicates that EPA will review and approve appropriate analytical and data validation methods and that a standard operating procedure for data validation will be developed. I once again stress the importance of this requirement and suggest that this information become part of the documentation associated with the Engineering Performance Standards. It seems inconsistent to develop refined models with specific numerical targets without being explicit as to how the relevant measurements are going to be made and interpreted. It is not clear why this is not included whereas other details – such as how to handle the water in each sediment core (section 3.3, page 47) – are. The Standards documents should either document the development of such project critical items or specifically indicate the requirement to do so during the design phase.

Discrete sampling has been adopted rather than composite sampling. This seems reasonable given the reliance on information for individual sample points in decision making. There are, however, benefits in a combined approach whereby discrete samples used to prepare the composite are retained and can be analyzed if the composite results exceed action levels. EPA has suggested that turn around times argue against this approach. This might not be the case and this issue should be considered during the evaluation of the Phase 1 data. Other methods to be considered during Phase 1 include underwater photography or visual surveys by divers as well as sediment profile imaging (SPI). I am not familiar with the SPI method, but I concur that underwater photography and visual inspection will provide useful information during Phase 1, after which a decision can be made as to the applicability/usefulness during Phase 2.

The basis for the 20-acre evaluation area is not obvious from the Residuals Standard report. The first instances where I could find specific comments were in the Executive Summary (page ES-16), a single sentence in section 2.2.6 and then again near the end of the document (section 4.0, page 57) where it is indicated that the 'joint evaluation concept was based on the approximate size of the HUDTOX segments used to model recovery of the Hudson River.' This section further states, for the first time, that the 20-acres was used for the TI Pool whereas 40 acres was used for River Sections 2 and 3. It is therefore suggested that the Standard may be modified (during Phase 2) to include 40-acre joint evaluation areas in those other River Sections. While I support the concept of joint evaluation units, it would have been preferable to provide more detailed justification in the body of the report. Given that the HUDTOX model forms the basis for many of the project requirements (e.g. maximum PCB load to be delivered to the Lower Hudson) I can only assume that 20 acres is reasonable.

Q9. ***Re-dredging and Engineering Contingencies:*** *Consistent with the 2002 ROD, the Residuals Standard is clear in describing EPA=s preference for dredging over capping as a means of sequestering PCB inventory (mass). The standard also addresses the expectation that some targeted areas of the Upper Hudson River bottom may be difficult to dredge effectively, such as rocky areas. For these special circumstances, the standard addresses re-dredging and the number of additional re-dredging attempts, how the extent of the non-compliant area is to be determined, and the use of engineering contingencies to address recalcitrant residuals (e.g., alternative dredge, cap). Relevant sections of the document include Section 2.3.5: Determining the Number of Re-Dredging Attempts, Section 2.3.6: Engineering Contingencies for the Residuals Standard, Section 3.5.1: Re-dredging and Required Number of Re-dredging Attempts, Section 3.5.2: Determining the Extent of the Non-Compliant Area, and Section 3.6: Engineering Contingencies.*

- *Please comment on the reasonableness of the Residuals Standard with respect to re-dredging and engineering contingencies.*

R9 –

The requirement for re-dredging is well documented in section 3.5.1. Re-dredging is required at locations where:

- one sediment sample result is greater than or equal to the 97.5% PL and any results is greater than the 99% PL (all of the area must be re-dredged);
- when the average concentration is greater than the 99% UCL (part or all of the CU).

Re-dredging is an option when the average concentration is greater than 1 mg/kg and less than or equal to the 99% UCL, depending on the 20-acre evaluation area.

The above direction seems reasonable given the requirement to remove the PCB inventory and is consistent with the framework. Less obvious is the requirement to re-dredge *twice* (i.e. a total of three times including the initial activity). Section 2.3.5 provides some basis for this, citing various case studies and concluding that ‘Based on case study data and engineering judgment, a limit of two re-dredging attempts following the initial residual sampling event was established for the Residuals Standard…’ My review of the case studies, as summarized in the Appendix, does not convince me that a total of three attempts is necessary in all parts of the river. It would seem more reasonable to anticipate challenging areas as part of the design phase and to determine alternative approaches. While one might conclude that particularly difficult areas might benefit from immediate capping, this approach is not consistent with the overall preference for dredging over containment. Instead, it would seem practical to identify such areas early, dredge once or at most twice, and then have a predetermined capping design that would be consistent with the river characteristics. Pre-planning would permit thoughtful evaluation and discussion, reduce the number of unproductive dredging attempts, and minimize the number of decisions that would have to be made during the actual fieldwork. Furthermore, a maximum of two dredging attempts (initial plus one re-dredge) during Phase 1 will still provide the site-specific information necessary for Phase 2 planning/modifications.

Productivity Standard

Given that my expertise is more appropriate to a review of the Resuspension and Residuals Standard, my review of the charge questions in this section will be limited. I look forward to the comments by other members of the Peer Review Panel.

Q10. ***Framework:*** *The requirements of the 2002 ROD inform the overall parameters of the Productivity Standard (e.g., dredging of an estimated 2.65 million cubic yards in 6 years, with the first dredging season [Phase 1] at a reduced rate of dredging) (see, Section 2.1: Background and Approach and Section 2.3: Rationale for the Development of the Performance Standard). Within this context, the Productivity Standard requires compliance with minimum cumulative volumes of sediment for each dredging season and targets larger cumulative volumes for the first five dredging seasons. In requiring cumulative annual volumes, the standard accounts for the expectation that some areas will be faster to dredge than others, and thus provides an opportunity to carry over the benefit of this faster dredging from one year to the next as a cushion against when dredging more difficult areas. In setting targeted cumulative annual volumes, the standard provides for the dredging to be designed to attain a somewhat faster rate of dredging, so that a reduced volume remains in the sixth (final) dredging season and additional time is available to address any unexpected difficulties. The Productivity Standard was developed with this framework to ensure that the dredging design and implementation meets the schedule called for in the ROD.*

- *Please comment on whether this framework provides a reasonable approach for developing the Productivity Standard.*

R10 –

The overall concept of establishing minimum cumulative volumes for each dredging season seems important in order to meet the timelines required by the ROD. The volumes (240,000 cy minimum and 265,000 cy target) for Phase 1 are certainly ambitious given the total volumes cited in the case studies. It is understood that Phase 1 will be used to validate assumptions and will effectively confirm or modify the assumptions from the modeling efforts. Thus, it will be important to operate at a reduced level but also at a level that will provide maximum information for Phase 2. There may need to be some flexibility in these initial targets so that there can be an adequate response to unforeseen events.

A review of the factors that might influence productivity (sections 2.1.2, 2.1.3 and Attachment 1) seems to be reasonably comprehensive. It is interesting to note the comments that ‘achieving low cleanup levels (e.g. 1 mg/kg) has proven difficult…’, ‘…necessary to re-dredge at least some areas to achieve the target cleanup level…’ and ‘…on some projects the target cleanup level was not reached in limited, extremely difficult areas despite multiple passes of the dredging equipment’ (section 2.2.1, page 9). This comment may be more appropriate to a discussion of the Residuals Standard but it does confirm the challenging nature of this project. It does, however, underline the importance of the time that will be required for dredging and highlights the apparently arbitrary assumption that re-dredging will take about half as much time as needed to achieve the original design cuts (page 22). As noted in the Executive Summary (page ES-23), this could be a critical factor given the statement that significantly greater time required for re-dredging could affect the ability to meet the overall Productivity Standard.

It is interesting that (page 21) the '…effective time available for dredging will average 13 hours per day.' This contradicts the assumptions made in the Resuspension Standard document (which cites 14 hours per day) but is consistent with my own conversion of PCB loads from grams per hour to kg/day (see comment in Table 1). It would be useful to determine which value was used and to ensure consistency amongst the Standards' documentation.

Q11. ***Example Production Schedule**: As part of the development of the Productivity Standard, an Example Production Schedule was developed based on site-specific information and case studies of other environmental dredging projects to demonstrate that the Productivity Standard can be met. Relevant sections of the document include Section 2.2: Supporting Analyses, Attachment 1: Productivity Schedule, Attachment 2: Productivity Schedule Backup, and Attachment 3: Evaluation of Applicable Dredge Equipment for the Upper Hudson River.*

- *Please comment on the Example Production Schedule, including the reasonableness of the underlying assumptions for equipment selection and efficacy, as well as the time necessary to deploy, use, and move equipment.*

R11 –

No comment at this time.

Q12. ***Action Levels**: The Productivity Standard includes two tiered action levels (Concern and Control) prior to any determination of non-compliance with the standard, as well as their respective required actions and monitoring and record keeping requirements. Relevant sections of the document are Section 1.1: Implementation and Section 3.3: Monitoring, Record Keeping and Reporting Requirements.*

- *Please comment on appropriateness of the action levels and the required actions, as well as the reasonableness of the monitoring and record keeping requirements.*

R12 –

No comment at this time.

Questions Related to All Three Engineering Performance Standards

Q13. ***Interactions Among the Standards**: Because the Engineering Performance Standards for Resuspension, Residuals and Productivity be applied in conjunction with one another, the* *standards must be considered as a whole as well as individually. In developing the standards, their points of interaction were balanced to allow flexibility during design and implementation, while ensuring that human health and the environment are adequately protected. Thus, the standards contain self-correcting features (e.g., the requirements for additional re-dredging attempts in the Residuals Standard must consider the requirements for dredging production in the Productivity Standard). The interactions among the standards are discussed in the Executive Summary, Introduction, and Section 3.2 of the Productivity Standard.*

- *Please comment on whether the main interactions among the standards are properly documented and taken into account.*

R13-

It is noted that there is a very brief summary of the main interactions between the standards – best presented in the Executive Summary. It appears to identify the major factors but it is surprising that a section of the main body of the report is not devoted to this subject. It might be worthwhile to summarize the interactions in a Table so that the consequences of a given event might be unambiguously linked to one of the other standards.

Q14. ***Section 4.0 presents the plans for refinement of each standard***.

- *Please comment on whether there are any additional aspects to effectively accomplish the refinement that EPA should consider in evaluating the Phase 1 data.*

R14 –

It is noted that there will be a considerable amount of information that will come available prior to Phase 1. This includes: additional baseline water column monitoring data, information regarding sampling methodologies, more accurate forecasts of locations and volumes of sediment to be remediated, and the actual extent of dredging operations (hours/day etc). Phase 1 itself will provide a considerable amount of monitoring data. Section 4.0 in Parts 1 and 2, dealing with the Resuspension and Residuals Standards respectively provide extensive detail on how this information is to be used. I find these to be well-written and sufficiently detailed. The analogous section in Part 3 is considerably less detailed – one would have thought that elaboration could have been provided on certain aspects - equipment selection, daily dredging rates, etc – so that the reader might see how, during a very tight timeframe, the information is going to be utilized.

Q15. ***Please provide any other comments, concerns or suggestions, involving both strengths and weaknesses, with respect to the October 2003 Draft Engineering Performance Standards B***

Peer Review Copy that may not be fully covered by the above charge questions.

R15 –

Overall the Draft Engineering Performance Standards are comprehensive and appear to deal with all aspects of the project. Apart from the comments in preceding sections, they represent a thorough analysis of the project. The results obtained during Phase 1 will be very interesting and will ultimately determine if the assumptions and modeling exercises are correct. There are a few issues that were not dealt with by the charge questions that might warrant consideration.

The issue of other contaminants, for example metals present in sediments and the potential release of these to the water column has only received limited attention. A White Paper (ID 253002 as part of the Responsiveness Summary to the ROD) concludes that historical release of metals coincided with the input of PCBs and that the main inventory of such contaminants will be removed together with the PCBs. The Leachability of the metals was found to be an order of magnitude lower than the TCLP criteria – while this will influence waste disposal after the sediments have been dewatered, it does not necessarily reflect the potential for significant porewater concentrations and dissolved phase release during dredging. It is noted that a sampling and evaluation plan will be implemented during the remedial design. Direct measurements of porewater concentrations are recommended – this could include a confirmation of the PCB porewater concentrations that were modeled – and the results should be considered in terms of any potential downstream impacts.

It is presumed that there will be ample sources of suitable backfill to support the dredging program. The calculations assume that the PCB concentrations in such material will be zero, but this may not be realistic depending on the source and the global pervasiveness of PCB contamination. Some comment on the availability of clean fill would be useful.

It is further noted that the NY DEC is developing water quality certification requirements and it is not clear how these might impact on the project. The standard for surface water discharge of PCBs is currently 0.065 parts per billion. The Standards documents imply that there will be no problem meeting this criterion but my own experience with the treatment of a much smaller quantity of water indicated challenges in regularly meeting a criterion that was an order of magnitude higher (i.e. 0.50 parts per billion).

Lastly, questions have been raised during the peer review process regarding the release of oil slicks during sampling in the Hudson River and during current remediation activities at Hudson Falls. I am not certain from the responses whether such 'slicks' involved natural organic matter or free product PCBs. The release of liquid PCBs during dredging would certainly impact on the resuspension criteria. Clear resolution of this issue is needed.

Tim Thompson
Preliminary Comments

Pre-Peer Review Comments of Timothy Thompson on the Hudson River Draft Engineering Performance Standards

This memo comprises my pre-meeting comments to the Peer Review of EPA's *Draft Engineering Performance Standards for the Hudson River PCBs Superfund Site*. Per instructions provided to the peer reviewers, my comments follow the format and Charge Questions provided to us by the Eastern Research Group.

I would also like to take the opportunity to note that a tremendous amount of good thought and effort was expended on these standards by the EPA team. It is also clear that the GE team has contributed substantively to the process. Finally, several public agencies, private groups and concerned individuals put an equal amount of work and thought to their comments and suggestions. To the degree possible and practicable, I have also tried to consider those efforts in my responses, below.

My comments below are predicated on a very important assumption: that the performance standards presented in these documents are intended to serves as targets within the first year of removal actions, and do not carry the onus of consequences if those standards are not achieved. Section 13.1 of the ROD states that (with my emphases highlighted):

> "These performance standards will be ***enforceable*** and based on objective environmental and scientific criteria. The standards will promote ***accountability*** and ensure that the cleanup meets the human health and environmental protection objectives of the ROD."

My read of the ROD's description of the phasing of dredge operations, and within the performance standards documents themselves, is that these are intended to be guidelines or targets that the Agency believes can be achieved, and that they will be modified after Phase 1 is complete. What is missing in my read is whether *enforcement* and *accountability* are incurred in these Phase 1 standards. I don't think that is what EPA intended, but it is not clear.

Therefore, my first recommendation is that the Phase 1 Performance Standards include an explicit statement by the EPA that these do not carry legal or regulatory consequence during the first year of implementation. I would also recommend that EPA acknowledge that it is willing to use the Explanation of Significant Difference process to modify these standards, if conditions outside the expectations of the ROD are encountered. This would go a long way to eliminate what otherwise appears to be an onerous standard that could be used for imposing penalties if conditions are not met, or alternatively, legal challenges from private organizations or citizens if the Phase 1 performance standards are not achieved. The standards documents I review do in fact reflect that is the intent, but an explicit statement in the opening section would be helpful. Alternatively, I would recommend that EPA consider leaving the performance standards as “draft” until after incorporation of the first year’s results can be incorporated into a final set of standards.

Within the assumption described above, the Phase 1 Performance Standards offered in these documents are generally appropriate guidelines that could be tested within the first year of operations. There are certain technical elements of the Standards that I believe are not well documented and/or supported. These are described I each of the respective charge questions. If these standards are considered to be enforceable and will result in accountability (legal and/or financial) then the standards, as articulated, contain too many uncertainties to be used, as drafted.

Dredging Resuspension Standard

Deviating slightly from the charge question format, I have first listed the specific items that I believe need to be incorporated into the overall standard. Each of these is in turn articulated under the appropriate charge question, below.

- An explicit statement of the reuspension threshold in terms of concentration, confidence limits around that numeric standard, the point of compliance, and time interval (e.g., instantaneous, 24 hour) is lacking in the document, and should be the first priority addressed. (Charge Question 1 and 4).
- Confidence intervals (both alpha and beta) should be set for the 500 ng/L threshold, based upon site-specific tPCB variability within the water column, and incorporating laboratory variability. The thresholds within the framework for increased sampling also be based upon a statistical estimate on those CIs. (Charge Questions 1, 3 and 4)
- Measures of total PCBs (tPCB) must be incorporated into the near-field standard and sampling. The assumed relationship between Total Suspended Solids (TSS) and

tPCB resuspension is at best weakly supported by the studies cited in the standard. Site and regional-specific data indicates otherwise. The linkage from the resuspension production rate (at the site of dredging), to the resuspension release rate (reflecting PCB transport in the water column in the immediate vicinity of the dredging operations) can only correctly addressed by incorporation of tPCB data measurements (Charge Question 2).

- The near-field monitoring program is too intensive, and that the TSS standard will be overwhelmed when multiple remedial activities (i.e., debris removal, dredging, capping) occur in proximity to one another. An alternate recommendation is to made (Charge Question 2)
- The far-field monitoring must either incorporate more frequent tPCB measurements, or should use a 24-hour composite sampler. This will depend upon the Standard defining what is the time-component of the threshold. (Charge Question 5)
- The case for measuring congeners in the monitoring is not supported by the threshold. Given that the threshold is in total PCBs, that should be the sole measure for the monitoring program (Charge Question 5).

1. **Framework:** – *Please comment on whether this framework provides a reasonable approach for developing the Resuspension Standard*

Setting a framework for baseline, upstream and downstream monitoring with appropriately derived trigger values for increase monitoring, and the potential for implementing engineering controls with exceedances of those trigger values, is a well established procedure and practice. I do not have any issues with a Resuspension Standard that "was developed with a routine (i.e., baseline condition) water quality monitoring plan and three tiered action levels (Evaluation, Concern, and Control) leading up to a maximum allowable concentration of PCBs in river water." Where I believe the Standard needs to be strengthened is in setting a statistically-defensible standard of measure for total PCBs, and in relying on actual measurements of tPCBs in the near and far-field framework as the thresholds for increased monitoring and engineering controls.

An over-arching comment to the Resuspension Standard is that there is a lack of a clear, discernible statement of the standard in terms of concentration, the acceptable confidence limits around that standard that are protective of the numeric standard, the specific time element associated with that standard, and the point of compliance of the standard. I have chosen to make this the first item I comment to, because it impacts all five of the charge questions. Specifically to the framework, setting the confidence intervals considering field and lab variability, will likely impact the action levels, and thus the number of levels considered in this standard.

An example standard would be as follows:

> *The Resuspension Standard for the Phase 1 Hudson River Remedial Action is that water concentrations of total polychlorinated biphenyls will not exceed at anytime the EPA Maximum Concentration Limit of 500 ng/L at a point of compliance no greater than 1 mile downstream of any in-water remedial activity. Confidence limits for the numeric threshold are an alpha confidence limit of 95% and a beta confidence limit of 80%.*

In this example what is to be measured is stated (tPCBs), the time component (at no time), numeric criteria (500 ng/L), point of compliance (1 mile downstream of remediation), and an explicit statement of the limits of confidence on that numeric that will be protective of the MCL. The standard is now defined by these limits in one place and becomes a testable hypothesis around which the framework can be constructed. Each of the components of this standard are discussed in the subsequent charge questions.

2. <u>Near-Field Analyses:</u> *Please comment on the technical adequacy of the near-field analyses, in particular the linkage from the resuspension production rate (at the site of dredging), to the resuspension release rate (reflecting PCB transport in the water column in the immediate vicinity of the dredging operations) and finally to the resuspension export rate (essentially equilibrium conditions reflecting long-distance transport of PCBs in the water column).*

My recommendation is that the near-field thresholds should be redeveloped based upon measure of tPCBs in Phase 1. Setting near-field thresholds using TSS as a surrogate for tPCBs is not supported by site-specific data, nor is it consistent with accepted scientific and engineering practices. The argument for using TSS as a monitoring surrogate for total PCBs is implicit and integral to the overall resuspension standard. However, I do not believe that the case made for that relationship is not supported by the analyses presented in the Performance Standard. Measuring tPCBs and TSS in Phase 1 will provide the data necessary to determine if the near-field thresholds can be based upon TSS. However, without the site-specific demonstration for TSS as a surrogate, it will not provide the necessary protection of the human health standard. I support that position in a series of presentations below.

TSS as a surrogate tPCBs is not supported by site-specific data.

In order to support TSS as a surrogate measure, the Resuspension Performance standard should first demonstrate that relationship with the extensive data set collected for the Hudson River. In fact, the Resuspension Document states that "Analysis of TSS and PCB data from a set of GE water column monitoring samples did not yield a correlation between the two parameters" (Attachment F-1). This analysis is critical to the argument, and is certainly not transparent. Even within that, and the thoughtful work conducted in the Water Column Concentration Analysis (Attachment A), the Standard still states that "the TSS concentration will act as an indicator of a possible increase in the PCB concentration in the water column". Yet, Attachment A provides a strong indication that TSS and PCBs vary independently. For example, referring to Figure 11 in Section 3.1 it states:

> "The mean TSS concentration fluctuates for the period July through September, while mean PCB concentration declines over that same period."

Looking at the paired TSS and PCB figures (e.g., Figures 3&4 for Fort Edward, Figures 5 & 6 for TID-West) all show relatively narrow TSS ranges, while having a wide variation in tPCB concentrations.

A second, and very important suggestion that suspended solids measurements are not an adequate surrogate for tPCBs in the Hudson River comes from monitoring data collected by the New York DEC associated with sediment and soil remediation at the GE Fort Edward Plant site. DEC provided observations and data related to the release of PCB oil from the ***river bottom*** adjacent to the plant from in-water activities in the summer of 2003. Relevant in the data the DEC also provided is that (1) the release occurred as a result of in-water activities, (2) there does not appear to be relationship between turbidity measurements and Aroclor 1242 measurements, (3) concentrations of PCBs exceeded the proposed resuspension standard of 500 ng/L by as much as 280 times, (4) that the PCBs escaped the silt curtain used at the site, and (5) that with 1.4 miles (GE Fort Edward Plant Site 004 outfall remediation area to Route 197 Bridge east of Rogers Island) of the release PCB concentrations were all below 100 ng/L.

A subset of the data are presented in the table below. Arguably the DEC data are reported as NTU which do not provide the same level of precision as TSS measurements. However, the general trends are still very apparent – increased tPCBs are not associated with increased solids as measured in NTUs. Comparing PCB oil resuspension to dredging resuspension may at first glance appear to be an "apples to orange" comparison. However, it is highly probably that PCB NAPL, remain within the sediments of the Hudson River, and will be released during dredging. EPA's response to my querry did acknowledge sheens during coring, and appropriately pointed out the infrequency of the occurrence. However, those did occur and I maintain, are likely to occur again during removal actions.

GE/Fort Edward OutFall 004
NYDEC River Sampling Results

Date	SAMPLE ID	Turbidity (NTU)	Result (ug/L)
10-Jul-03	HUD-UP-01	1.58	<0.02
10-Jul-03	HUD-DOWN-01	1.88	0.07
14-Jul-03	HUD-UP-02	1.37	<0.03
14-Jul-03	HUD-P3-01	23.5	1.11
14-Jul-03	HUD-P3-02	7.48	2.24
14-Jul-03	HUD-P3-03	4.3	0.25
14-Jul-03	HUD-P3-04	1.87	0.78
17-Jul-03	HUD-DOWN-08	2.33	0.53
17-Jul-03	HUD-DOWN-09	4.94	140.00
17-Jul-03	HUD-P3-15	6.57	0.38
17-Jul-03	HUD-P3-16	20.1	1.64
17-Jul-03	HUD-P3-17	9.49	0.34
17-Jul-03	HUD-DOWN-10	7.96	0.38
23-Jul-03	HUD-P2-M15	20.7	1.44
24-Jul-03	HUD-P2-M16	2.43	2.93

Release of Dissolved-Phase PCBs during Dredging Do Occur

The USGS conducted an excellent water quality study during the Lower Fox River SMU 56/57 Demonstration Project that included relatively intensive measurements of TSS, NTUs, and both total and dissolved tPCBs. That paper is attached to my comments. Germane to this discussion is that the USGS found that PCB concentrations increased downstream of dredging while suspended solids loadings remained the same or decreased (because of settling) during the dredging operation. Material exposed to or resuspended into the water column during dredging increase the dissolved PCB concentration, as well as the PCB concentration on a given particle. The USGS concluded that ***"…TSS is not a reliable***

indicator of PCB transport during a dredging operation" and that ***"…if one is to monitor PCB transport during a remediation operation, sole reliance on turbidity or TSS measurements is inadequate."*** It is also very important to note that this exact same relationship was observed at the Deposit N demonstration project as well (FRRAT, 2000). That this has been observed at two distinct sites, with two different remedial contractors and equipment is a very compelling argument. TSS is not a suitable surrogate for tPCBs

Section 2.2.5 and Attachment C of the Standard attempts to develop theoretical arguments why this observed phenomenon cannot occur, and in fact in my opinion fails to make a compelling case. In fact, the review provided in Attachment C makes a number of incorrect observations on the water quality monitoring program conducted by the USGS[1]. Given the choice between hard, demonstrated data collected during a PCB sediment removal action and a "theoretical" construct; data rules. This section should be removed from the Resuspension Standard.

Scientific and Engineering Practice Support Collection of tPCBs AND TSS in Phase 1

The New Bedford Harbor Pre-design Field Test and the Lower Fox River Deposit N and SMU 56/57 demonstration projects discussed in the Resuspension Standard had as part of their design and demonstration objectives determining PCB resuspension rates. These projects measured tPCBs for a very good reason: to establish within the greatest degree of scientific and engineering certainty what would be the rates and loads of tPCBs that would be resuspended during full dredging activities. New Bedford Harbor was explicit in stating that an important aspect of their water quality monitoring program was to also ground-truth the predictive modeling. Those site-specific data were collected to inform *and set* the water quality standards. For all practicable purposes, Phase 1 on the Hudson is a "demonstration project", and to not take tPCB data and to not set the standard is not following good scientific and engineering method

[1] As an example, Attachment C incorrectly asserts that sampling occurred during stagnant or flow reversals. In fact, the opposite was true. The document also incorrectly interprets the cross sections, and the influence of the turning basin on flows near where sampling occurs. These issues could have been addressed if someone had taken the time to discuss it with Jeff Steuer of the USGS – no one from the Hudson Team attempted to contact Jeff.

The Resuspension Standard document cites on page 16 removal projects occurring within the Commencement Bay Superfund Site in Washington State stating that .

> *"Many of the Commencement Bay dredging projects, located off the coast of Washington State, also utilized the concept of the mixing zone. No containment was used, due to the tidally influenced waterways; however, monitoring was conducted at the limit of the mixing zone, which was typically established 300 feet from the dredge to ensure compliance with state and federal waterway regulations…"*

Germane to this discussion is that both the U.S. EPA and the Washington State Department of Ecology **require** contaminant monitoring within, and at the edge of the "mixing zone" for all contaminated dredging projects. To my knowledge there are six active environmental dredging programs currently being conducted at this time – one of which I observe outside of my office window each day! All of them measure TSS, dissolved oxygen, and the full suite of contaminants of concern for which the removal action is required. This includes total PCBs (not congeners). It is also of interest to note that none of those programs have far-field requirements.

The net conclusion is that it is standard engineering and scientific practice to monitor for all contaminants of concern that a project is compelled to remove within the near-field.

Observational Comment

Section 2.2.5, page 25 discussed the New Bedford Harbor project, and states that the patterns of particulate PCBs and suspended solids measurements would be closer to what would be expected on the Hudson. Furthermore it discusses PCB concentrations "upstream" and "downstream" of the dredging activity, and then uses that information to argue that the results of that work are consistent with a mechanism of PCB release through the suspension of contaminated solids. This treatment is very misleading in the following ways:

1. A very specific piece of dredging equipment was used at New Bedford Harbor. It was a proprietary bucket developed by the Bean Dredging Corporation. As will be discussed under the Production Standard, the Resuspension Standard by making the statement above presupposes that equipment will be used on the Hudson River.
2. It is not appropriate to describe sampling in this program as "upstream" or "downstream". The water quality monitoring program was designed around tidal flows: ebb and flood. Sampling was done up current, or down current – which is categorically not the same.

3. Very limited data was collected over a 3 day period. While TSS and NTU was collected a discrete up-current and down-current stations, PCB analyses were done on composite samples. There are only 16 tPCB samples collected, or only four for a discrete down-current site. There is little power in these data for the Hudson.
4. Oil sheens during removal were observed. Water quality samples were not taken during this period.

3. Evaluation Level: *Please comment on the appropriateness of the Evaluation Level as a component of the standard applied to for Phase 1.*

Response to this comment is held pending discussions at the Peer Review meeting.

4. Resuspension Threshold: *Please comment on the reasonableness of the 500 ng/L Total PCBs threshold concentration developed for the Resuspension Standard.*

The Maximum Contaminant Level of 500 ng/L tPCBs is appropriate for Resuspension Standard, within the context of applying it one mile downstream of in-water remedial activities, and that time elements and acceptable confidence limits on that standard are defined and applied. The document states, appropriately, that the threshold is *"designed to limit the concentration of PCBs in river water such that water supply intakes downstream of the dredging operations are protected…"* and that *"Remedial activities may proceed only when the ambient Total PCB concentration (PCBs from all sources) is less than 500 ng/L."*

However, the Resuspension Threshold is written as a black and white standard that while addressing some of the variability within historical concentrations in the river, does not address lab variability in a measured sample. I think they have done most of the analysis, but what they should be stating is what range of measured concentration of tPCBs.

The EPA drinking water maximum contaminant level goal is actually zero; the enforceable maximum contaminant level for PCBs in public water systems is 0.0005 ppm (EPA 2001). To be fully protective of downstream water supplies with the resuspension threshold, the desirable statement to be made is that we are confident that a sample taken one mile downstream of remediation area would not encounter a concentration at, or exceeding 500 ng/L with a confidence level of 95 percent. The threshold should address measurement uncertainty and the uncertainty of estimated concentrations around that threshold allow us to make such a statement. The stronger statement is that the threshold is set with 95 percent confidence that none of the series of samples taken one mile downstream of remedial activities would turn up a concentration of over 500 ng/L at the water supply intake. To do so would require that the confidence intervals be established, and that the resuspension threshold be set at the lower 95% CI. Alternatively, probability bounds, as recommended in GE's July 2003 comments (page 2-4) can be developed in this framework.

Confidence Intervals

There is a very good description of interval estimates within Attachment A to the Resuspension Standard that does not receive as much consideration in the main document as I believe it should. For example, Table 2 of Attachment A shows that in the months of May, June, the CI for baseline tPCBs shows that the Concern and Control levels (350 ng/L) at the TID West station. Based upon the standard deviations presented in that Table, there is a 95% probability that a measured concentration of 350 ng/L is within a population of values that would exceed the threshold. In other words, at 350 ng/L there is a distinct statistical probability that the MTC is exceeded. I also note within that table that for May, and October/November baseline measurements for tPCBs exceed 500 ng/L.

Laboratory variability also needs to be considered here. Consider that acceptable lab variability of 30% on a 500 ng/L standard means that within a 350 ng/L measurement, the true standard may have already been exceeded. I suspect that this may have been the in part the intent of the analyses in Attachment A – but lab variability and confidence intervals are not stated. Taking that one step further, on a 350 ng/L threshold, a reported value of ca. 250 ng/L would be within the lab variability estimate.

5. Monitoring Program: *Please comment on whether the monitoring program reasonably can be expected to provide adequate data in Phase 1 that will allow EPA to evaluate necessary adjustments to dredging operations in Phase 2 or to the Resuspension Standard. Also, please identify any necessary improvements to the monitoring program.*

Far-Field Sample Requirements

- The requirement for measuring congener-specific PCBs is not supported by the standard. The Maximum Concentration Limit for polychlorinated bi-phenyls tPCBs, not congener specific PCBs. The case for burdening the sampling program with congener-specific PCBs is not made in the document, and doe not appear to be based upon any requirement.
- One PCB sample per 24-hour period is protective of human health and the environment provided that the near-field monitoring program incorporates appropriate tPCB measures and trigger values.
- Far-field particulate and dissolved tPCB concentrations do not contribute to and are currently not supportable by the Standard.
- Far field TSS measurements do not contribute information to protection of drinking water supplies, and thus are not currently supportable in the Standard.

Monitoring Near-field TSS and tPCBs

For the Phase 1 remedial activities, tPCBs should be measured at the near-field stations. I submit that the final standard will be strengthened by demonstrating the relationships between TSS and tPCBs, allow for more accurate estimation of far-field tPCB concentrations relative to the MCL, and avoid the confounding influence that will occur when multiple operations are occurring within the same vicinity (e.g., debris sweeps, dredging, and residual capping).

The principal argument offered for not monitoring near-field PCBs is that "the availability of PCB data (normally 24 hours even with accelerated turnaround time) preclude the use of PCB measurement as a real time monitor or dredging operations" (Section 2.3.3.2). I submit this is not a substantive barrier for tPCBs. There are numerous examples where EPA and state agencies have required "real time" monitoring of water quality by having an on-site GC/MS. Turn around times can be as little as four hours from submittal of the sample. Given sufficient sample numbers, the costs associated with these on-site analyses would be relatively inexpensive. EPA's requirement that the PCB analysis be based on low-level individual congener measurement is not supported by the stated residual standard, and furthermore is not necessary to assess near-field tPCB concentrations.

In addition, even if tPCBs are not part of the "real time" monitoring program, a substantive effort should be placed towards collecting those near-field data so that Hudson River-specific final standards for near-field tPCB losses can be set. As it stands, the loss estimates are based upon other dredging sites where the specific equipment and conditions are likely to be different from those used on the Hudson. The benefit of having tPCB and TSS data in the near-field sampling set is that without those data it would be possible to accept the Phase 1 TSS near-field standards, but there would not be likely that the TSS standard could be *raised*. A higher TSS Resuspension Standard, demonstrated to have equivalent protection for human health and the environment as articulated in this draft standard, would help meet the dredging performance standard by allowing for either higher dredging rates, or if the final contactor chose to bring in multiple dredges to operate within the same river section.

The near-field TSS standard is very likely to be confounded at the dredge site due to upstream or nearby residual capping ("backfilling" as termed in this document) operations. This is likely to be a very real concern. For example, at the Soda Lake Cap Demonstration Project in Wyoming, TSS concentrations were typically over 100 mg/L during placement operations. I have data for the Eagle Harbor as well, which I will bring to the Peer Review meeting, but these were even greater as I recall. During the Phase 1 dredging it may be entirely possible to stage the different remedial actions so that these do not coincide – but it will not be so easily accomplished during the production years. I submit this will be far more substantive than is currently considered, and should be accounted for in the final standard.

The Standard should consider how multiple operations occurring in close proximity to each other effect the TSS-based near-field monitoring. The Standard does make a reasonable recommendation for accounting for upstream operation contributions to the near-field TSS by requiring two upstream sample locations. However, as pointed out above, TSS contributed by the capping alternatives are likely to overwhelm the near-field standards at the dredge point. Furthermore, the Standard as drafted does not appear to consider multiple operations that will likely occur in close proximity to each other; i.e., debris removal, dredging, and capping.

In a post-ROD engineering analysis for the Lower Fox River, Wisconsin PCB removal [2], two of the same dredge/cap engineers that were part of the Performance Standard review team, as well as two of the largest environmental dredging contractors in North America provided input for the Fox analysis. A relevant point here is that these engineers and contractors noted that all activities, and potentially more than one dredging platform, would have to occur sequentially and in relatively close proximity. I believe this is also envisioned within the Dredge Rate Performance Standard, but an explicit consideration is not given in the Resuspension Standard. Mutliple remedial operations in close proximity will very likely overwhelm the near-field TSS standards (which are applied at each operation), and are going to result in many samples that are going to be expensive to implement and potentially obfuscating the very issues EPA is trying to address.

An alternate consideration is to place the near-field monitoring stations at fixed distance downstream of all removal operations. From Section 3.3.3, modify the near-field stations by (1) require an upstream monitoring station that is 100 m above ***all*** remedial operations, (2) eliminating the 10 m channel side monitoring station, (3) one station 100 m downstream of the furthest downstream remedial activity (expected to be debris removal), (4) two stations 300 m downstream of the furthest downstream remedial activity, (5) elimination of any sampling within silt barriers.

Summary Conclusions for the Resuspension Standard

Based upon these data, I believe the PCB resuspension standard should be resturcuted as follows:

- The standard should be stated solely in terms of tPCB concentrations in water. This includes both near-field and far-field standards.
- The standard needs to be articulated as a single, testable statement
- There is no supportable basis for requiring congener-specific sampling for tPCBs.

[2] WDNR has a *Detailed Analysis of Alternatives* report that provided detailed construction design-level evaluations (construction drawings, dredging and dewatering operations, pre- and post-removal operational considerations, capping, transportation, landfill construction and operation, monitoring, and a long-term monitoring plan).

- The far-field standard need only be measured as whole water samples. Particulate and dissolved fractions add uncessarily to the cost, without added benefits relative to the Resuspension Threshold.
- That the standard at the point of compliance (1 mile downstream) should be stated in terms of lower confidence intervals (alpha and beta) around the 500 ng/L standard
- Further analyses are required to support the 350 ng/L concentration limit.
- The frequency of sampling and the trigger levels appear appropriate, provided these are set in terms of PCB concentrations in water.
- That TSS has not been demonstrated as a reliable surrogate for tPCBs, and as such TSS criterion would not be protective of ecological and human health. The EPA and GE may elect to monitor TSS and establish in the future if this may be used as a surrogate – but that until that has been established, should not be a part of the standard.
- Near-field remedial activities, and in particular “backfilling” or capping will elevate TSS to levels that obfuscate the intended near, and far-field SS standards. While still advocating measuring TSS, it will not serve as a suitable surrogate for PCB downstream transport, nor for the protection of human health.

Dredging Residuals Standard

6. **Framework:** *Please comment on whether this framework provides a reasonable approach for developing the Residuals Standard.*

The framework provides a well-thought out and statistically defensible approach for developing the Residuals Standard. The size of the certification units, estimation of the action levels, sample numbers needed to confirm the action levels, and a process for getting out of a continuous re-dredge loop are reasonably presented and defended. On a technical level, I find this a very sound process.

Practicably, however, this will be a very complicated and expensive process to implement. A modification of the framework and Residual Standard could be made that places greater emphasis on the engineering design (currently absent from the standard), and then focuses on a single certification unit equivalent to the HudTox model segments that were used to set the

ROD-specified limits in the first place. Specifically, I would recommend that the Standard include engineering design requirements for the removal such that the design cut lines (horizontal and vertical) ensure 95% confidence in achieving the ROD-specified of 1 mg/kg Tri+PCBs residuals prior to backfilling, and rigidly specify the tolerance limits on the dredge cut based on elevations. This is possible with the extensive set of data recently collected on the Hudson. In doing so, the 5-acre certification unit may be dropped from the Standard, with focus solely on certification within the 20 acre unit corresponding to the HudTox model segments. All other aspects of the Framework would remain applicable.

7. <u>Statistical Analyses</u>: *Please comment on whether the statistical analyses are technically adequate and properly documented.*

The statistical analyses done to derive the residual standards are technically adequate, sound, and very well documented. While it would help the documentation of the Standard to have a single, explicit statement of the Standard in terms of concentration, and the required confidence limits, it's clear that the authors correctly considered those and incorporated them into their calculations. The only unfortunate aspect of this work was the need to rely on data from other dredging programs, but the authors conducted a thorough and were duly conservative in their application of that information to the residual standard.

Having said that, there I believe that an explicit component of this standard should be a design standard: that the horizontal and vertical cut lines must be developed in a fashion that ensures with at a 95% confidence level (setting the beta at what power is afforded by the current core sample density) that the final removal elevations specified will achieve a residual of 1 mg/kg Tri+PCBs. New York DEC in my opinion appropriately reflected that need in their October 2003 comments to the residual standard; that there needs to be a high level of certainty associated with the targeted depth of removal. By incorporating an engineering design standard into the residual standard that states the level of certainty (95% confidence limits).

These could be developed using a similar analysis conducted for the Standard – but would incorporate the element of design into the Standard. Elevations should be based upon Sediment Management Units – which for the equipment considered in the Performance Standard should be 60 x 120 feet (Greg Hartman, personal communication).

To be clear, an engineering design standard should be developed that specifies that within the 60 x 120 ft. SMU, the final dig-to elevation will have achieved the expected TriPCB concentrations with 95% certainty. In the interest of sharing information, an example of how this is considered for the Lower Fox River is attached.

Thus, the standard could be streamlined so that (1) the first level of confirmation would that that within the 5-acre units, the statistically derived elevations (and horizontal limits) had been achieved, (2) that coring will occur at the same density specified within the current standard, (3) the additional standards (27 and 15 mg/kg Tri+PCBs) are applicable over the 20 acre area, and (4) re-dredging be directed at those areas within the 20 acre unit that would achieve the overall goal of 1 mg/kg Tri+PCBs.

8. **Post-dredging Confirmatory Sampling Program:** *Please comment on the adequacy of these aspects of the Residuals Standard, in particular the concept of a 20-acre evaluation area for Phase 1.*

The post-dredging confirmation sampling is generally adequate for the purposes intended. I suspect that there was an analysis conducted on the statistical power associated with the pre-engineering design and the confirmation sampling to yield a value of ca. 8/acre. If it is in the document, I missed it – if not that discussion would be useful.

As noted in my previous two comments, I believe that the overall confidence in the program could be increased by incorporating a design standard into this document, and then using the 20 acre unit as a basis for confirmation of the residual standard.

As a practical element, I would not recommend incorporation of Sediment Profile Imaging (SPI) into the standard. Having worked with SPI on multiple projects over the last 10 years, I believe that it has great utility in defining baseline conditions, and looking at capping deposition and recolonization, but is NOT a useful tool for looking at post-dredging conditions in freshwater environments. Having been involved in one freshwater project that took several thousand SPI images – all were black and unreadable because of the presence of anoxic sediments. To specify the use of this tool at a specified rate is not appropriate and will not contribute useful information.

As a practical matter, monitoring of placement of backfill or capping material is not discussed in this standard, or in the dredging production standard, but I believe is appropriate to consider. Veneer-capping using hydraulic broadcast methods is very appropriate here, and will result in the least amount of sediment disturbance, mixing, and recontamination. Both myself and John Verduin has considerable experience with this method and it works well. Pertinent here is that when appropriately applied, and monitored, there will be 10 cm or less of remixing of the capping material with the underlying sediments. However, experience with application is that this requires specifying application rates, the close monitoring of those rates, and frequent confirmatory sampling (bathymetry) to ensure that remixing is not occurring. In my opinion, a design standard and monitoring standard for backfilling is required.

9. **Re-dredging and Engineering Contingencies:** *Please comment on the reasonableness of the Residuals Standard with respect to re-dredging and engineering contingencies.*

I cannot find any fault with the intended re-dredging and engineering contingencies in terms of the intent and thought used to develop them. My opinion is that these are going to be difficult and expensive to implement, and do not appear to be constructed in a way that allows flexibility in the construction process. Re-dredging should be based upon what is needed to achieve the 1 mg/kg Tri+PCB weighted average concentration across the 20 acre HudTox-based unit. Allowing decisions to be made in the field with appropriate oversite, is not currently allowed in this document. For example, where materials have been removed to as close to bedrock as possible in the first pass – additional value is not gained by requiring re-dredging unless it can be demonstrated that it is required to achieve the 20 acre-standard.

Productivity Standard

11. Framework: *Please comment on whether this framework provides a reasonable approach for developing the Productivity Standard.*

Response Pending

12. Example Production Schedule: *Please comment on the Example Production Schedule, including the reasonableness of the underlying assumptions for equipment selection and efficacy, as well as the time necessary to deploy, use, and move equipment.*

Response Pending

13. Action Levels: *Please comment on appropriateness of the action levels and the required actions, as well as the reasonableness of the monitoring and record keeping requirements. Questions Related to All Three Engineering Performance Standards*

Response Pending

14. Interactions Among the Standards: *Please comment on whether the main interactions among the standards are properly documented and taken into account.*

Response Pending

15. Refinement of each standard. *Please comment on whether there are any additional aspects to effectively accomplish the refinement that EPA should consider in evaluating the Phase 1 data.*

Response Pending

16. *Please provide any other comments, concerns or suggestions, involving both strengths and weaknesses, with respect to the October 2003 Draft Engineering Performance Standards Peer Review Copy that may not be fully covered by the above charge questions.*

Response Pending

John Verduin
Preliminary Comments

PRELIMINARY PEER REVIEW COMMENTS BY JOHN R. VERDUIN, III, PE
DRAFT ENGINEERING PERFORMANCE STANDARDS
HUDSON RIVER PCBS SUPERFUND SITE

This document presents my preliminary peer review comments on the Draft Engineering Performance Standards for the Hudson River PCBs Superfund site. I reserve the right to modify my responses at the conclusion of the Peer Team meeting and discussions.

DREDGING RESUSPENSION STANDARD

Question #1: Please comment on whether this framework provides a reasonable approach for developing the Resuspension Standard.

Response: I feel that the general concept of the framework—tiered action levels with preset plans of action if a level is exceeded—is appropriate and used on some dredging projects. Below are some specific comments on aspects of the framework:

- Do not measure for net suspended solids concentrations at the far-field locations. The distance between the remedial operations and the far-field monitoring locations present too many opportunities for other factors to impact suspended solids. The net PCB concentrations and loads are the critical issues at the far-field locations.
- Remove one of the action levels—I would suggest the concern level. There is no difference in engineering contingencies required between the Concern and Control levels. The extra level is an increase in monitoring cost without an increase in required engineering contingencies or mitigation measures.
- Use an intensive and moderate monitoring approach for near-field monitoring events. Intensive monitoring would be as generally outlined in the Resuspension Standard (6 hour running average net suspended solids increase). The purpose of the intensive monitoring is to closely evaluate the dredging process and the impacts it is having on water quality. Intensive monitoring would begin with each change in remedial activity and at each new hotspot, after exceedances of moderate monitoring criteria, or dredging in pre-identified specific areas of a hotspot. Intensive monitoring would last for 3 days. A remedial activity would include dredging, capping, or backfilling in each hotspot. Moderate monitoring would begin if intensive monitoring in the near-field consistently met the Evaluation Level criteria during this 3 day period. Routine monitoring would consist of one 6-hour monitoring event per day. The average net suspended solids

concentration during this 6-hour period would need to meet the Evaluation Level criteria. If the average did not meet the criteria, intensive monitoring would be initiated again. The approach of two levels of monitoring (intensive and moderate) has been used successfully on a number of contaminated sediment dredging projects including Eagle Harbor—West Harbor Superfund Site (Hart Crowser 1997); Phase 1 Removal Action Harbor Island Superfund Site (USEPA 2003a); Middle Waterway Remediation: Commencement Bay Superfund Site (USEPA 2003b); Thea Foss Remediation: Commencement Bay Superfund Site (USEPA 2003c); Hylebos Waterway Remediation: Commencement Bay Superfund Site (USEPA 2003d); Duwamish/Diagonal Sediment Remediation (King County 2003); and Sitcum Waterway Remediation Project: Commencement Bay Superfund Site (Port of Tacoma 1993)

- Require the contractor to use acoustic monitoring devices to identify plume locations, if any, at the 300 meter monitoring location prior to sampling. Acoustic monitoring can help the samplers better locate sampling locations without significantly impacting costs or time.
- It is important that the near-field results are real-time so that the Remedial Contractor can modify their operations accordingly. I assume that the monitoring location 100 meters from the dredge would provide real-time monitoring results.
- I would like to hear the opinion of the other Peer Review team members on the established near-field net suspended solids concentrations. Does the "back calculating" process to determine near-field suspended solids concentrations from far-field total PCB concentration goals seem appropriate?
- I would like to hear the opinion of the other Peer Review team members on the established far-field net PCB loads. Do the action level limits and durations appear reasonable given the Record of Decision (ROD) requirement to protect fish and the public water supplies?

Question #2: Please comment on the technical adequacy of the near-field analyses, in particular the linkage from the resuspension production rate (at the site of dredging), to the resuspension release rate (reflecting PCB transport in the water column in the immediate vicinity of the dredging operations) and finally to the resuspension export rate (essentially equilibrium conditions reflecting long-distance transport of PCBs in the water column).

Response: The fate and transport of the PCB load and suspended solids from the near-field to the far-field is not in my area of expertise. One part to the analysis was the dredging losses at the point of dredging. I feel that the ranges of losses used in the analysis, 0.5 percent, 1 percent, and 2.5 percent, are appropriate based on reviewed studies (Anchor 2003).

Question #3: Please comment on the appropriateness of the Evaluation Level as a component of the standard applied to for Phase 1.

Response: I believe the Evaluation Level is appropriate for Phase 1 given my recommended revisions discussed in response to Question #1. At the completion of Phase 1 dredging, the results should be evaluated to determine if further modifications to the Resuspension Standard should be made.

Question #4: Please comment on the reasonableness of the 500 ng/L Total PCBs threshold concentration developed for the Resuspension Standard.

Response: No comment – this is not within my area of expertise.

Question #5: Please comment on whether the monitoring program reasonably can be expected to provide adequate data in Phase 1 that will allow EPA to evaluate necessary adjustments to dredging operations in Phase 2 or to the Resuspension Standard. Also, please identify any necessary improvements to the monitoring program.

Response: I believe in general that the currently outlined monitoring plan should provide adequate data to evaluate the resuspension criteria at the completion of Phase 1. I would like to hear the opinion of the other Peer Review team members more familiar with the near-field suspended solids concentrations/far-field total PCB concentrations relationship to see if they feel enough data are being collected to verify this relationship.

One suggested improvement would be to require fairly detailed construction logs during Phase 1 so that remedial actions can be fairly accurately tied to observed water quality results. For instance, if the dredger is encountering sheen producing sediments or significant debris, the time of the occurrence should be noted. This can then be tied back to near-field monitoring results.

I have a comment related to monitoring of capping or backfilling operations. During cap or backfill placement, turbidity and total suspended solids (TSS) could be an issue even though the suspended solids will likely be non-contaminated solids. I have found that cap/backfill material, even with relatively low fines (less than 4 percent), can produce a turbidity plume during placement. This could produce a false positive during the monitoring process and should be anticipated. I suggest if elevated TSS is observed, that Total PCB monitoring occur during the capping and backfilling operations to confirm that the elevated TSS/turbidity is related to cap material fines being resuspended and not to contaminated sediment being resuspended as a result of capping. I recommend that this monitoring be done initially and then occasionally during the process to confirm the initial results.

I have a comment related to the monitoring locations (Section 1.2.2). I would suggest adding a monitoring location near the sediment offloading facility if mechanical dredging is used. Based on my experience, sediment offloading facilities if not designed properly, can be areas of material loss. I would recommend adding a monitoring location initially 300 meters downstream of the offloading facility and monitoring for the Evaluation Level criteria.

DREDGING RESIDUALS STANDARD

Question #6: Please comment on whether this framework provides a reasonable approach for developing the Residuals Standard.

Response: The ROD has established a residual cleanup target, which given site conditions, appears to be fairly aggressive. Statistically evaluating the data set, versus requiring each sample to meet set criteria, is a very reasonable and protective way to proceed. I do have concerns over using the distribution of residual levels from other projects to statistically derive the action levels. I realize that no site-specific data are available and some initial action levels needed to be defined, and that, for lack of better data, using other sites is a reasonable starting point. However, it is imperative that at the completion of Phase 1 (and possibly part way through Phase 1) that the Phase 1 data be used to determine appropriate action levels, and as work progresses into Phase 2, especially into different portions of the river, that the action levels continue to be reevaluated.

Based on my experience and review of available site physical conditions, I feel that residuals will be a significant issue with dredging (see response to Question #11 below.) The ROD indicates a preference for dredging in order to remove inventory. The mass of PCB contamination is being used as the primary means to target removal areas. I strongly recommend that the effects of re-dredging be evaluated at the completion of Phase 1 to determine the benefit of one or two additional re-dredging attempts. The intent is to determine if one or two additional re-dredge attempts reduce residual concentrations. If additional re-dredging is clearly productive in reducing residual concentrations, then maintain them in the framework. If re-dredging is clearly not productive then modify the framework. Please see response to Question #9 about suggestions to modify the framework based on Phase 1 results.

Question #7: Please comment on whether the statistical analyses are technically adequate and properly documented.

Response: No comment – not within my area of expertise.

Question #8: Please comment on the adequacy of these aspects of the Residuals Standard, in particular the concept of a 20-acre evaluation area for Phase 1.

Response: No comment – not within my area of expertise.

Question #9: Please comment on the reasonableness of the Residuals Standard with respect to re-dredging and engineering contingencies.

Response: I believe it is very reasonable to limit the number of re-dredging attempts. Based on my experience on contaminated sediment dredging projects and review of the Hudson River site conditions, multiple re-dredging attempts will not be productive at this site, especially in areas where rocks are prevalent or hard subsurface conditions are present. However, it is important to critically review the Phase 1 data to determine if the effectiveness of re-dredging at other sites is appropriate to the Hudson River. If the data indicate that one or two re-dredging attempts are productive in reducing concentrations relative to impacts on the schedule, then re-dredging should be retained. However, if the data indicate that additional re-dredging attempts are not productive in reducing concentrations relative to impacts on the schedule, then re-dredging should not be retained. If re-dredging of residuals is not deemed productive, then additional dredging should only be focused on areas where inventory was not adequately characterized prior to dredging, that is, areas where the initial dredge cut did not go deep enough to remove inventory. The action levels and sampling program will need to be adjusted accordingly to determine if the exceedances are due to residuals or missed inventory.

The document evaluates appropriate engineering contingencies to address residuals: alternative dredge types, capping, and in-situ treatment. As described in the report, alternative dredges would significantly impact production rates. I recommend that the conventional dredging equipment being used for production dredging first be used to evaluate effectiveness of addressing residuals during Phase 1. The goal at the end of Phase 1 should be to understand if re-dredging is productive and if so, what is the most productive equipment to accomplish re-dredging.

Different capping materials were presented in the document. The types of cap materials discussed seem appropriate. The performance standards for the isolation cap presented in the report should be appropriate for the design team to design the cap.

I do not have experience with in-situ treatment technologies, but I feel this would be a last resort effort after additional dredging and capping are deemed ineffective.

PRODUCTIVITY STANDARD

Question #10: Please comment on whether this framework provides a reasonable approach for developing the Productivity Standard.

Response: The framework for the productivity standard appears appropriate. Targeting minimum cumulative volumes each year with higher volumes up front is a reasonable framework. Monitoring production on a monthly basis also seems reasonable. Daily production rates will vary by location, water depth, sediment type, obstructions, traffic, river conditions, equipment performance, leverman, cre, and many other factors. Monitoring monthly production rates should “soften” many of the daily variables identified above and give a fairly representative view of overall performance. This is not to say that daily variables listed above and the corresponding daily production rates should not be monitored and studied. This information, especially during Phase I, will be crucial in coming up with production mitigation measures if they are needed.

Question #11: Please comment on the Example Production Schedule, including the reasonableness of the underlying assumptions for equipment selection and efficacy, as well as the time necessary to deploy, use and move equipment.

Response: It was difficult with the limited data available to verify the production schedule presented. It was difficult to match up the schedule with the different dredge volumes presented in the tables with the remedial areas presented. However, I did estimate production rates for the different remedial components based on my experience working under similar situations and made some general comments on tying the whole project together. Given my production rates, I would like to hear the opinion of the other Peer Review team members on the Example Production Schedule.

Production rates. I broke the river into three types of physical conditions similar to the engineering performance standards document:

1. Working in water initially deeper than 6 feet
2. Working in water initially between 3 and 6 feet
3. Working in water initially shallower than 3 feet

Each of the key remedial actions is discussed below:

- **Dredging in Water Initially Deeper than 6 feet**. Given the deeper water draft and the generally wider nature of the river at this depth, I feel that a contractor could use a larger dredge capable of supporting at least a 4-cubic yard (cy) bucket. The haul barge could be ideally located adjacent to the derrick and be moved by the dredge operator to different suitable locations. As the haul barge is loaded it is moved forward or backward to load evenly. Because of the shallow nature of the water and the ideal location of the haul barge I assumed 45 to 60 second cycle times were feasible. I assumed an efficiency of 60 to 70 percent which if fairly common for environmental dredging projects. This efficiency would account for planned and unplanned maintenance downtime, switching of haul barges, moving, and other factors. Assuming the bucket is 75 percent full with each "bite," a production rate of around 110 cy/hour seemed appropriate for a 4-cy bucket. For residual dredging, I assumed a 6-inch cut would be required using a Cable Arm type dredge bucket. Given the typical footprint for a 4-cy bucket this would reduce the bucket load with each "bite" to 33 percent reducing the production rate to 50 cy/hour.

- **Dredging in Water Initially Between 3 to 6 feet of Water**. I assumed that the same type of equipment described above in 6 feet of water would be feasible in water 3 to 6 feet deep. However, the haul barge would likely not be in an ideal location due to the shallower nature of the water. The derrick would have longer swings and the haul barge couldn't be loaded as efficiently requiring the barge to be pulled out and turned around during the dredging operation. Because of this I assumed cycle times of 60 to 80 seconds and efficiencies of 40 to 50 percent. The associated production and residual dredging rates were estimated to be 50 and 20 cy/hour, respectively.
- **Dredging in Water Initially Less than 3 feet Deep**. I assumed that, because of the smaller draft, a smaller crane on a shallower barge would be required to complete the dredging. Therefore, a smaller bucket, likely 2 to 3-cy in size, would be required. Somewhat slower cycle times and efficiencies assumed for the 3 to 6 feet of water dredging were assumed. The associated production and residual dredging rates were estimated to be 20 and 10 cy/hour, respectively.
- **Backfilling and Capping**. I have designed a number of capping/backfilling projects. One recently completed project used a 6-cy rehandling bucket to placed material from a haul barge in 6 to 10 feet of water (Verduin et al 2001). Pro-rating the production rates for the Hudson River conditions produces production rates of 50, 25, and 15 cy/hour when capping in 6, 3 to 6, and less than 3 feet of water, respectively.
- **Sheet piling and HDPE Silt Barrier Installation**. I did not have enough geotechnical information of subsurface conditions to adequately determine sheet piling installation. I assumed the production rates presented in the report were sufficient. I have concerns over the stability and practicality of the sheet pile HDPE turbidity control structure. I would expect fairly high swirling velocities immediately downstream of the sheet pile tending to put high stresses on the HDPE and its connection to the sheet pile, similar to what you see downstream of a structure protruding into a river.

Residual Dredging Thoughts. I feel that residuals will likely have a much greater impact on schedule than currently anticipated. The occurrence of residuals is documented in a number of studies (Alcoa 2000; Database of Major Contaminant Sediment Sites 2002). Means of accurately predicting the concentrations and thicknesses of residuals unfortunately do not exist. However, even though it is nearly impossible to accurately predict residual concentrations, the relative likelihood of residuals can be estimated based on a review of site conditions. Factors common with residuals observed at the Hudson River site include: fine grained sediments, shallow water depths, constant currents (river flow), occasional presence of rocks, debris and hard substrate, and other factors. I typically make conservative assumptions with regards to the likelihood of residuals when designing and costing dredging projects because the occurrence of residuals can greatly impact a project if unexpected. For this project I focused on two of the conditions conducive to residuals:

- **Geotechnical characteristics of the dredged material.** Finer grained material with high water contents (especially when the water content exceeds the liquid limit) tend to be more susceptible to flowing into a dredge cut. I could not find specific geotechnical data on the dredge material other than what is presented in Table 3A-1. I used Table 3A-1 and the assumption of high water content as a guide to estimating where residuals would likely occur.
- **Water depth.** In shallower water, equipment movement such as the dredge and haul barges and support vessels create pressure forces that can induce movement of sediments into dredge cuts. Propeller wash from support vessels are also more likely to induce bottom disturbances in shallower water. I felt that when dredging in water less than 3 feet deep there was a strong likelihood that residuals would occur. Again I used Table 3A-1 as a guide to estimating where residuals would likely occur based on water depth.

Based on my experience and analysis of Table 3A-1, I recommend assuming that on average 80 percent of the dredge areas will require re-dredging. I also recommend that the time for re-dredging be estimated by assuming 6-inch cuts across the dredge surface and the production rates presented above. Until Phase 1 is completed I would assume for scheduling purposes that all re-dredge areas would require two re-dredge passes plus a cap.

Other Factors Affecting Schedule. There are a number of other factors that will affect production rates and schedule including:

- **High flow events will cause dredging to slow down or stop.** High flow events can make movement of the barges more difficult, move the bucket as it is lowered through the water column, reduce the efficiency of the resuspension structures, and cause other hindrances. Typically flow velocities exceeding 3 to 4 feet per second can start to impact production. The report indicated 10,000 cubic feet per second as the critical flow rate. It is not the flow rate that is critical but rather the flow velocity, which is a function of both the flow rate and the river's cross sectional area. I could not find data on frequency of flows and ask the other Peer Team members if they found any data.
- **Cold weather can impact production.** Cold weather can limit access, hamper equipment performance, and produce hazardous working conditions for workers on the barges. Were other members of the Peer Team able to quantify impacts of weather?
- **Traffic can impact barge traffic and movement of the dredging equipment.** Were other members of the Peer Team able to quantify impacts of traffic?
- **The working hours will affect production rates.** The quality of life standards present noise requirements. Construction equipment with appropriate muffler systems could possibly meet these requirements. However, it should be noted that the construction equipment engines for capping and backfilling operations may not be the critical source of noise production. One of my capping projects in a residential area was limited from working at night due to sounds of the bucket scraping on the metal deck of the haul barge (Verduin et al. 1998). It was very noisy and likely exceeded 80 dB. I would build the construction schedule assuming that capping or backfilling will not be permissible at night.
- **The sediment offloading facility could be a significant impact on production**. Recently I was involved with a dredging project that utilized upland disposal. This project was significantly impacted by the offloading and hauling facility. The offloading facility used a 4.5-cy rehandling bucket to offload sediments and shipped the sediment by rail to the landfill (Verduin et al 2000). The offloading facility and landfill limitations limited the dredging production rates up to 50 percent. Proper sizing of the offloading facility is critical. I was not able to find enough data on the

offloading facility to complete my evaluation. Were other members of the Peer Team able to evaluate the offloading facility?

- **There is a limit to the number of dredges that can work effectively in a given area.** This can be evaluated in two manners: evaluating an efficient dredge volume per dredge, and evaluating the working space that a dredge and the necessary support vessels would require. An effective and efficient dredge volume for a smaller size dredge is around 50,000 cy. Assuming a 3- to 4-foot cut, which is typical for the Hudson River hotspots, this would equate to an 8- to 10-acre size area. Dredging equipment and the support vessels needed for work would effectively occupy 5 to 10 acres to work efficiently. Therefore, limiting the working area per dredging/capping unit to 10 acres should be used when building the initial schedule. This can be further evaluated during Phase 1 dredging.
- **If resuspension engineering controls are required they could impact production rates presented above.** Moving equipment into and out of the enclosed area, as well as working around the controls, will impact production rates. This reduction on production rate should be considered.
- **Water quality certification could impact production rates.** When the final certification is issued by the State impacts to production rates need to be reevaluated.

Question #12: Please comment on appropriateness of the action levels and the required actions, as well as the reasonableness of the monitoring and record keeping requirements.

Response: I have a comment related to the 10 percent criteria for monitoring production rates. If the contractor misses the target by 9 percent every year that would require having to dredge 684,000 cy in year 6 to complete the project. This is 42 percent more than the 480,000 cy required per year. If the standard were at 5 percent, the maximum required dredging volume in year 6 would be 585,000 cy or 22 percent more than the 480,000 cy required. I would either reduce the yearly target or add a requirement that the projected dredging volume in year 6, necessary to complete the project, can never exceed 10 percent (528,000 cy).

Specific information I would recommend collecting, in addition to that presented in the report, includes:

- Number of hours of actual dredging time to determine and monitor efficiency and net and gross production rates.
- Monitoring of offloading rates.
- Monitoring of capping and backfilling production rates.
- Monitoring of shoreline work.
- Noting any other delays associated with river flow conditions, weather, traffic, quality of life standards, equipment problems, sampling work, or other activities. I would want to be able to see if there are trends with delays.

QUESTIONS RELATED TO ALL THREE ENGINEERING PERFORMANCE STANDARDS

Question #13: Please comment on whether the main interactions among the standards are properly documented and taken into account.

Response: The requirements set forth in the ROD of completing the work within six years are somewhat troublesome to me. I understand and truly appreciate the public's concern over an extended remediation project. However, I believe the two other performance standards (resuspension and residuals) are more valuable at protecting human health and the environment. When Phase 2 begins, the Responsible Parties are inherently driven to minimize the project duration because of economic concerns—every day they are dredging is more cost to them. Requiring the work to be done at a certain pace, I believe could potentially compromise the other two performance standards. Or if the resuspension and residual standards are being met, impacts to the production standard could occur. For instance, the residual and resuspension standards may necessitate that the dredging, capping, and backfilling be done in more of a time consuming, sequential order limiting the potential for concurrent work. Meeting these standards may limit the ability to be dredging in one area while backfilling in another. This reaction to the residual and resuspension standards could significantly impact production.

However, the interactions of the three standards are speculative at this time and the actual relationship will not be understood until Phase 1 is complete and the results carefully reviewed. I think it is critical that one of the main charges for reviewing the Phase 1 data is assessing the impact of resuspension and residual standards on the production standard.

Question #14: Please comment on whether there are any additional aspects to effectively accomplish the refinement that EPA should consider in evaluating the Phase 1 data.

Response: I have noted my recommended additional data needs in previous responses to questions. It will take considerable effort for EPA and the Stakeholders to effectively review the Phase 1 data and revise the Engineering Performance Standards based on the data. It is important that enough time is given to review the Phase 1 data.

It is also important that the Phase 1 Peer Review team has sufficient time and access to data to complete their peer review. Reviewing actual collected Phase 1 field data to improve the standards will be extremely productive, but time consuming.

Question #15: Please provide any other comments, concerns or suggestions, involving both strengths and weaknesses, with respect to the October 2003 Draft Engineering Performance Standards—Peer Review Copy that may not be fully covered by the above charge questions.

Response: No further comment at this time.

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Tim Thompson

Final

Preliminary Comments

Pre-Peer Review Comments of Timothy Thompson on the Hudson River Draft Engineering Performance Standards

This memo comprises my pre-meeting comments to the Peer Review of EPA's *Draft Engineering Performance Standards for the Hudson River PCBs Superfund Site*. Per instructions provided to the peer reviewers, my comments follow the format and Charge Questions provided to us by the Eastern Research Group.

I would also like to take the opportunity to note that a tremendous amount of good thought and effort was expended on these standards by the EPA team. It is also clear that the GE team has contributed substantively to the process. Finally, several public agencies, private groups and concerned individuals put an equal amount of work and thought to their comments and suggestions. To the degree possible and practicable, I have also tried to consider those efforts in my responses, below.

My comments below are predicated on a very important assumption: that the performance standards presented in these documents are intended to serves as targets within the first year of removal actions, and do not carry the onus of consequences if those standards are not achieved. Section 13.1 of the ROD states that (with my emphases highlighted):

> "These performance standards will be ***enforceable*** and based on objective environmental and scientific criteria. The standards will promote ***accountability*** and ensure that the cleanup meets the human health and environmental protection objectives of the ROD."

My read of the ROD's description of the phasing of dredge operations, and within the performance standards documents themselves, is that these are intended to be guidelines or targets that the Agency believes can be achieved, and that they will be modified after Phase 1 is complete. What is missing in my read is whether *enforcement* and *accountability* are incurred in these Phase 1 standards. I don't think that is what EPA intended, but it is not clear.

Therefore, my first recommendation is that the Phase 1 Performance Standards include an explicit statement by the EPA that these do not carry legal or regulatory consequence during the first year of implementation. I would also recommend that EPA acknowledge that it is willing to use the Explanation of Significant Difference process to modify these standards, if conditions outside the expectations of the ROD are encountered. This would go a long way to eliminate what otherwise appears to be an onerous standard that could be used for imposing penalties if conditions are not met, or alternatively, legal challenges from private organizations or citizens if the Phase 1 performance standards are not achieved. The standards documents I review do in fact reflect that is the intent, but an explicit statement in the opening section would be helpful. Alternatively, I would recommend that EPA consider leaving the performance standards as "draft" until after incorporation of the first year's results can be incorporated into a final set of standards.

Within the assumption described above, the Phase 1 Performance Standards offered in these documents are generally appropriate guidelines that could be tested within the first year of operations. There are certain technical elements of the Standards that I believe are not well documented and/or supported. These are described I each of the respective charge questions. If these standards are considered to be enforceable and will result in accountability (legal and/or financial) then the standards, as articulated, contain too many uncertainties to be used, as drafted.

Dredging Resuspension Standard

Deviating slightly from the charge question format, I have first listed the specific items that I believe need to be incorporated into the overall standard. Each of these is in turn articulated under the appropriate charge question, below.

- An explicit statement of the reuspension threshold in terms of concentration, confidence limits around that numeric standard, the point of compliance, and time interval (e.g., instantaneous, 24 hour) is lacking in the document, and should be the first priority addressed. (Charge Question 1 and 4).
- Confidence intervals (both alpha and beta) should be set for the 500 ng/L threshold, based upon site-specific tPCB variability within the water column, and incorporating laboratory variability. The thresholds within the framework for increased sampling also be based upon a statistical estimate on those CIs. (Charge Questions 1, 3 and 4)
- Measures of total PCBs (tPCB) must be incorporated into the near-field standard and sampling. The assumed relationship between Total Suspended Solids (TSS) and tPCB resuspension is at best weakly supported by the studies cited in the standard. Site and regional-specific data indicates otherwise. The linkage from the

resuspension production rate (at the site of dredging), to the resuspension release rate (reflecting PCB transport in the water column in the immediate vicinity of the dredging operations) can only correctly addressed by incorporation of tPCB data measurements (Charge Question 2).

- The near-field monitoring program is too intensive, and that the TSS standard will be overwhelmed when multiple remedial activities (i.e., debris removal, dredging, capping) occur in proximity to one another. An alternate recommendation is to made (Charge Question 2)
- The far-field monitoring must either incorporate more frequent tPCB measurements, or should use a 24-hour composite sampler. This will depend upon the Standard defining what is the time-component of the threshold. (Charge Question 5)
- The case for measuring congeners in the monitoring is not supported by the threshold. Given that the threshold is in total PCBs, that should be the sole measure for the monitoring program (Charge Question 5).

1. **Framework:** – *Please comment on whether this framework provides a reasonable approach for developing the Resuspension Standard*

Setting a framework for baseline, upstream and downstream monitoring with appropriately derived trigger values for increase monitoring, and the potential for implementing engineering controls with exceedances of those trigger values, is a well established procedure and practice. I do not have any issues with a Resuspension Standard that "was developed with a routine (i.e., baseline condition) water quality monitoring plan and three tiered action levels (Evaluation, Concern, and Control) leading up to a maximum allowable concentration of PCBs in river water." Where I believe the Standard needs to be strengthened is in setting a statistically-defensible standard of measure for total PCBs, and in relying on actual measurements of tPCBs in the near and far-field framework as the thresholds for increased monitoring and engineering controls.

An over-arching comment to the Resuspension Standard is that there is a lack of a clear, discernible statement of the standard in terms of concentration, the acceptable confidence limits around that standard that are protective of the numeric standard, the specific time element associated with that standard, and the point of compliance of the standard. I have chosen to make this the first item I comment to, because it impacts all five of the charge questions. Specifically to the framework, setting the confidence intervals considering field and lab variability, will likely impact the action levels, and thus the number of levels considered in this standard.

An example standard would be as follows:

> *The Resuspension Standard for the Phase 1 Hudson River Remedial Action is that water concentrations of total polychlorinated biphenyls will not exceed at anytime the EPA Maximum Concentration Limit of 500 ng/L at a point of compliance no greater than 1 mile downstream of any in-water remedial activity. Confidence limits for the numeric threshold are an alpha confidence limit of 95% and a beta confidence limit of 80%.*

In this example what is to be measured is stated (tPCBs), the time component (at no time), numeric criteria (500 ng/L), point of compliance (1 mile downstream of remediation), and an explicit statement of the limits of confidence on that numeric that will be protective of the MCL. The standard is now defined by these limits in one place and becomes a testable hypothesis around which the framework can be constructed. Each of the components of this standard are discussed in the subsequent charge questions.

2. <u>Near-Field Analyses:</u> *Please comment on the technical adequacy of the near-field analyses, in particular the linkage from the resuspension production rate (at the site of dredging), to the resuspension release rate (reflecting PCB transport in the water column in the immediate vicinity of the dredging operations) and finally to the resuspension export rate (essentially equilibrium conditions reflecting long-distance transport of PCBs in the water column).*

My recommendation is that the near-field thresholds should be redeveloped based upon measure of tPCBs in Phase 1. Setting near-field thresholds using TSS as a surrogate for tPCBs is not supported by site-specific data, nor is it consistent with accepted scientific and engineering practices. The argument for using TSS as a monitoring surrogate for total PCBs is implicit and integral to the overall resuspension standard. However, I do not believe that the case made for that relationship is not supported by the analyses presented in the Performance Standard. Measuring tPCBs and TSS in Phase 1 will provide the data necessary to determine if the near-field thresholds can be based upon TSS. However, without the site-specific demonstration for TSS as a surrogate, it will not provide the necessary protection of the human health standard. I support that position in a series of presentations below.

TSS as a surrogate tPCBs is not supported by site-specific data.

In order to support TSS as a surrogate measure, the Resuspension Performance standard should first demonstrate that relationship with the extensive data set collected for the Hudson River. In fact, the Resuspension Document states that “Analysis of TSS and PCB data from a set of GE water column monitoring samples did not yield a correlation between the two parameters” (Attachment F-1). This analysis is critical to the argument, and is certainly not transparent. Even within that, and the thoughtful work conducted in the Water Column Concentration Analysis (Attachment A), the Standard still states that “the TSS concentration will act as an indicator of a possible increase in the PCB concentration in the water column”. Yet, Attachment A provides a strong indication that TSS and PCBs vary independently. For example, referring to Figure 11 in Section 3.1 it states:

> “The mean TSS concentration fluctuates for the period July through September, while mean PCB concentration declines over that same period.”

Looking at the paired TSS and PCB figures (e.g., Figures 3&4 for Fort Edward, Figures 5 & 6 for TID-West) all show relatively narrow TSS ranges, while having a wide variation in tPCB concentrations.

A second, and very important suggestion that suspended solids measurements are not an adequate surrogate for tPCBs in the Hudson River comes from monitoring data collected by the New York DEC associated with sediment and soil remediation at the GE Fort Edward Plant site. DEC provided observations and data related to the release of PCB oil from the ***river bottom*** adjacent to the plant from in-water activities in the summer of 2003. Relevant in the data the DEC also provided is that (1) the release occurred as a result of in-water activities, (2) there does not appear to be relationship between turbidity measurements and Aroclor 1242 measurements, (3) concentrations of PCBs exceeded the proposed resuspension standard of 500 ng/L by as much as 280 times, (4) that the PCBs escaped the silt curtain used at the site, and (5) that with 1.4 miles (GE Fort Edward Plant Site 004 outfall remediation area to Route 197 Bridge east of Rogers Island) of the release PCB concentrations were all below 100 ng/L.

A subset of the data are presented in the table below. Arguably the DEC data are reported as NTU which do not provide the same level of precision as TSS measurements. However, the general trends are still very apparent – increased tPCBs are not associated with increased solids as measured in NTUs. Comparing PCB oil resuspension to dredging resuspension may at first glance appear to be an "apples to orange" comparison. However, it is highly probably that PCB NAPL, remain within the sediments of the Hudson River, and will be released during dredging. EPA's response to my querry did acknowledge sheens during coring, and appropriately pointed out the infrequency of the occurrence. However, those did occur and I maintain, are likely to occur again during removal actions.

GE/Fort Edward OutFall 004
NYDEC River Sampling Results

Date	SAMPLE ID	Turbidity (NTU)	Result (ug/L)
10-Jul-03	HUD-UP-01	1.58	<0.02
10-Jul-03	HUD-DOWN-01	1.88	0.07
14-Jul-03	HUD-UP-02	1.37	<0.03
14-Jul-03	HUD-P3-01	23.5	1.11
14-Jul-03	HUD-P3-02	7.48	2.24
14-Jul-03	HUD-P3-03	4.3	0.25
14-Jul-03	HUD-P3-04	1.87	0.78
17-Jul-03	HUD-DOWN-08	2.33	0.53
17-Jul-03	HUD-DOWN-09	4.94	140.00
17-Jul-03	HUD-P3-15	6.57	0.38
17-Jul-03	HUD-P3-16	20.1	1.64
17-Jul-03	HUD-P3-17	9.49	0.34
17-Jul-03	HUD-DOWN-10	7.96	0.38
23-Jul-03	HUD-P2-M15	20.7	1.44
24-Jul-03	HUD-P2-M16	2.43	2.93

Release of Dissolved-Phase PCBs during Dredging Do Occur

The USGS conducted an excellent water quality study during the Lower Fox River SMU 56/57 Demonstration Project that included relatively intensive measurements of TSS, NTUs, and both total and dissolved tPCBs. That paper is attached to my comments. Germane to this discussion is that the USGS found that PCB concentrations increased downstream of dredging while suspended solids loadings remained the same or decreased (because of settling) during the dredging operation. Material exposed to or resuspended into the water column during dredging increase the dissolved PCB concentration, as well as the PCB concentration on a given particle. The USGS concluded that ***"…TSS is not a reliable indicator of PCB transport during a dredging operation"*** and that ***"…if one is to monitor PCB transport during a remediation operation, sole reliance on turbidity or TSS measurements is inadequate."*** It is also very important to note that this exact same relationship was observed at the Deposit N demonstration project as well (FRRAT, 2000). That this has been observed at two distinct sites, with two different remedial contractors and equipment is a very compelling argument. TSS is not a suitable surrogate for tPCBs

Section 2.2.5 and Attachment C of the Standard attempts to develop theoretical arguments why this observed phenomenon cannot occur, and in fact in my opinion fails to make a compelling case. In fact, the review provided in Attachment C makes a number of incorrect observations on the water quality monitoring program conducted by the USGS[1]. Given the choice between hard, demonstrated data collected during a PCB sediment removal action and a "theoretical" construct; data rules. This section should be removed from the Resuspension Standard.

Scientific and Engineering Practice Support Collection of tPCBs AND TSS in Phase 1

The New Bedford Harbor Pre-design Field Test and the Lower Fox River Deposit N and SMU 56/57 demonstration projects discussed in the Resuspension Standard had as part of their design and demonstration objectives determining PCB resuspension rates. These projects measured tPCBs for a very good reason: to establish within the greatest degree of scientific and engineering certainty what would be the rates and loads of tPCBs that would be resuspended during full dredging activities. New Bedford Harbor was explicit in stating that an important aspect of their water quality monitoring program was to also ground-truth the predictive modeling. Those site-specific data were collected to inform *and set* the water quality standards. For all practicable purposes, Phase 1 on the Hudson is a "demonstration project", and to not take tPCB data and to not set the standard is not following good scientific and engineering method.

[1] As an example, Attachment C incorrectly asserts that sampling occurred during stagnant or flow reversals. In fact, the opposite was true. The document also incorrectly interprets the cross sections, and the influence of the turning basin on flows near where sampling occurs. These issues could have been addressed if someone had taken the time to discuss it with Jeff Steuer of the USGS – no one from the Hudson Team attempted to contact Jeff.

The Resuspension Standard document cites on page 16 removal projects occurring within the Commencement Bay Superfund Site in Washington State stating that .

> *"Many of the Commencement Bay dredging projects, located off the coast of Washington State, also utilized the concept of the mixing zone. No containment was used, due to the tidally influenced waterways; however, monitoring was conducted at the limit of the mixing zone, which was typically established 300 feet from the dredge to ensure compliance with state and federal waterway regulations…"*

Germane to this discussion is that both the U.S. EPA and the Washington State Department of Ecology **require** contaminant monitoring within, and at the edge of the "mixing zone" for all contaminated dredging projects. To my knowledge there are six active environmental dredging programs currently being conducted at this time – one of which I observe outside of my office window each day! All of them measure TSS, dissolved oxygen, and the full suite of contaminants of concern for which the removal action is required. This includes total PCBs (not congeners). It is also of interest to note that none of those programs have far-field requirements.

The net conclusion is that it is standard engineering and scientific practice to monitor for all contaminants of concern that a project is compelled to remove within the near-field.

Observational Comment

Section 2.2.5, page 25 discussed the New Bedford Harbor project, and states that the patterns of particulate PCBs and suspended solids measurements would be closer to what would be expected on the Hudson. Furthermore it discusses PCB concentrations "upstream" and "downstream" of the dredging activity, and then uses that information to argue that the results of that work are consistent with a mechanism of PCB release through the suspension of contaminated solids. This treatment is very misleading in the following ways:

1. A very specific piece of dredging equipment was used at New Bedford Harbor. It was a proprietary bucket developed by the Bean Dredging Corporation. As will be discussed under the Production Standard, the Resuspension Standard by making the statement above presupposes that equipment will be used on the Hudson River.
2. It is not appropriate to describe sampling in this program as "upstream" or "downstream". The water quality monitoring program was designed around tidal flows: ebb and flood. Sampling was done up current, or down current – which is categorically not the same.

3. Very limited data was collected over a 3 day period. While TSS and NTU was collected a discrete up-current and down-current stations, PCB analyses were done on composite samples. There are only 16 tPCB samples collected, or only four for a discrete down-current site. There is little power in these data for the Hudson.
4. Oil sheens during removal were observed. Water quality samples were not taken during this period.

3. Evaluation Level: *Please comment on the appropriateness of the Evaluation Level as a component of the standard applied to for Phase 1.*

Response to this comment is held pending discussions at the Peer Review meeting.

4. Resuspension Threshold: *Please comment on the reasonableness of the 500 ng/L Total PCBs threshold concentration developed for the Resuspension Standard.*

The Maximum Contaminant Level of 500 ng/L tPCBs is appropriate for Resuspension Standard, within the context of applying it one mile downstream of in-water remedial activities, and that time elements and acceptable confidence limits on that standard are defined and applied. The document states, appropriately, that the threshold is *"designed to limit the concentration of PCBs in river water such that water supply intakes downstream of the dredging operations are protected…"* and that *"Remedial activities may proceed only when the ambient Total PCB concentration (PCBs from all sources) is less than 500 ng/L."*

However, the Resuspension Threshold is written as a black and white standard that while addressing some of the variability within historical concentrations in the river, does not address lab variability in a measured sample. I think they have done most of the analysis, but what they should be stating is what range of measured concentration of tPCBs.

The EPA drinking water maximum contaminant level goal is actually zero; the enforceable maximum contaminant level for PCBs in public water systems is 0.0005 ppm (EPA 2001). To be fully protective of downstream water supplies with the resuspension threshold, the desirable statement to be made is that we are confident that a sample taken one mile downstream of remediation area would not encounter a concentration at, or exceeding 500 ng/L with a confidence level of 95 percent. The threshold should address measurement uncertainty and the uncertainty of estimated concentrations around that threshold allow us to make such a statement. The stronger statement is that the threshold is set with 95 percent confidence that none of the series of samples taken one mile downstream of remedial activities would turn up a concentration of over 500 ng/L at the water supply intake. To do so would require that the confidence intervals be established, and that the resuspension threshold be set at the lower 95% CI. Alternatively, probability bounds, as recommended in GE's July 2003 comments (page 2-4) can be developed in this framework.

Confidence Intervals

There is a very good description of interval estimates within Attachment A to the Resuspension Standard that does not receive as much consideration in the main document as I believe it should. For example, Table 2 of Attachment A shows that in the months of May, June, the CI for baseline tPCBs shows that the Concern and Control levels (350 ng/L) at the TID West station. Based upon the standard deviations presented in that Table, there is a 95% probability that a measured concentration of 350 ng/L is within a population of values that would exceed the threshold. In other words, at 350 ng/L there is a distinct statistical probability that the MTC is exceeded. I also note within that table that for May, and October/November baseline measurements for tPCBs exceed 500 ng/L.

Laboratory variability also needs to be considered here. Consider that acceptable lab variability of 30% on a 500 ng/L standard means that within a 350 ng/L measurement, the true standard may have already been exceeded. I suspect that this may have been the in part the intent of the analyses in Attachment A – but lab variability and confidence intervals are not stated. Taking that one step further, on a 350 ng/L threshold, a reported value of ca. 250 ng/L would be within the lab variability estimate.

5. Monitoring Program: *Please comment on whether the monitoring program reasonably can be expected to provide adequate data in Phase 1 that will allow EPA to evaluate necessary adjustments to dredging operations in Phase 2 or to the Resuspension Standard. Also, please identify any necessary improvements to the monitoring program.*

<u>*Far-Field Sample Requirements*</u>

- The requirement for measuring congener-specific PCBs is not supported by the standard. The Maximum Concentration Limit for polychlorinated bi-phenyls tPCBs, not congener specific PCBs. The case for burdening the sampling program with congener-specific PCBs is not made in the document, and doe not appear to be based upon any requirement.
- One PCB sample per 24-hour period is protective of human health and the environment provided that the near-field monitoring program incorporates appropriate tPCB measures and trigger values.
- Far-field particulate and dissolved tPCB concentrations do not contribute to and are currently not supportable by the Standard.
- Far field TSS measurements do not contribute information to protection of drinking water supplies, and thus are not currently supportable in the Standard.

<u>*Monitoring Near-field TSS and tPCBs*</u>

For the Phase 1 remedial activities, tPCBs should be measured at the near-field stations. I submit that the final standard will be strengthened by demonstrating the relationships between TSS and tPCBs, allow for more accurate estimation of far-field tPCB concentrations relative to the MCL, and avoid the confounding influence that will occur when multiple operations are occurring within the same vicinity (e.g., debris sweeps, dredging, and residual capping).

The principal argument offered for not monitoring near-field PCBs is that "the availability of PCB data (normally 24 hours even with accelerated turnaround time) preclude the use of PCB measurement as a real time monitor or dredging operations" (Section 2.3.3.2). I submit this is not a substantive barrier for tPCBs. There are numerous examples where EPA and state agencies have required "real time" monitoring of water quality by having an on-site GC/MS. Turn around times can be as little as four hours from submittal of the sample. Given sufficient sample numbers, the costs associated with these on-site analyses would be relatively inexpensive. EPA's requirement that the PCB analysis be based on low-level individual congener measurement is not supported by the stated residual standard, and furthermore is not necessary to assess near-field tPCB concentrations.

In addition, even if tPCBs are not part of the "real time" monitoring program, a substantive effort should be placed towards collecting those near-field data so that Hudson River-specific final standards for near-field tPCB losses can be set. As it stands, the loss estimates are based upon other dredging sites where the specific equipment and conditions are likely to be different from those used on the Hudson. The benefit of having tPCB and TSS data in the near-field sampling set is that without those data it would be possible to accept the Phase 1 TSS near-field standards, but there would not be likely that the TSS standard could be *raised*. A higher TSS Resuspension Standard, demonstrated to have equivalent protection for human health and the environment as articulated in this draft standard, would help meet the dredging performance standard by allowing for either higher dredging rates, or if the final contactor chose to bring in multiple dredges to operate within the same river section.

The near-field TSS standard is very likely to be confounded at the dredge site due to upstream or nearby residual capping ("backfilling" as termed in this document) operations. This is likely to be a very real concern. For example, at the Soda Lake Cap Demonstration Project in Wyoming, TSS concentrations were typically over 100 mg/L during placement operations. I have data for the Eagle Harbor as well, which I will bring to the Peer Review meeting, but these were even greater as I recall. During the Phase 1 dredging it may be entirely possible to stage the different remedial actions so that these do not coincide – but it will not be so easily accomplished during the production years. I submit this will be far more substantive than is currently considered, and should be accounted for in the final standard.

The Standard should consider how multiple operations occurring in close proximity to each other effect the TSS-based near-field monitoring. The Standard does make a reasonable recommendation for accounting for upstream operation contributions to the near-field TSS by requiring two upstream sample locations. However, as pointed out above, TSS contributed by the capping alternatives are likely to overwhelm the near-field standards at the dredge point. Furthermore, the Standard as drafted does not appear to consider multiple operations that will likely occur in close proximity to each other; i.e., debris removal, dredging, and capping.

In a post-ROD engineering analysis for the Lower Fox River, Wisconsin PCB removal [2], two of the same dredge/cap engineers that were part of the Performance Standard review team, as well as two of the largest environmental dredging contractors in North America provided input for the Fox analysis. A relevant point here is that these engineers and contractors noted that all activities, and potentially more than one dredging platform, would have to occur sequentially and in relatively close proximity. I believe this is also envisioned within the Dredge Rate Performance Standard, but an explicit consideration is not given in the Resuspension Standard. Mutliple remedial operations in close proximity will very likely overwhelm the near-field TSS standards (which are applied at each operation), and are going to result in many samples that are going to be expensive to implement and potentially obfuscating the very issues EPA is trying to address.

An alternate consideration is to place the near-field monitoring stations at fixed distance downstream of all removal operations. From Section 3.3.3, modify the near-field stations by (1) require an upstream monitoring station that is 100 m above *all* remedial operations, (2) eliminating the 10 m channel side monitoring station, (3) one station 100 m downstream of the furthest downstream remedial activity (expected to be debris removal), (4) two stations 300 m downstream of the furthest downstream remedial activity, (5) elimination of any sampling within silt barriers.

Summary Conclusions for the Resuspension Standard

Based upon these data, I believe the PCB resuspension standard should be resturcuted as follows:

- The standard should be stated solely in terms of tPCB concentrations in water. This includes both near-field and far-field standards.
- The standard needs to be articulated as a single, testable statement
- There is no supportable basis for requiring congener-specific sampling for tPCBs.

[2] WDNR has a *Detailed Analysis of Alternatives* report that provided detailed construction design-level evaluations (construction drawings, dredging and dewatering operations, pre- and post-removal operational considerations, capping, transportation, landfill construction and operation, monitoring, and a long-term monitoring plan).

- The far-field standard need only be measured as whole water samples. Particulate and dissolved fractions add uncessarily to the cost, without added benefits relative to the Resuspension Threshold.
- That the standard at the point of compliance (1 mile downstream) should be stated in terms of lower confidence intervals (alpha and beta) around the 500 ng/L standard
- Further analyses are required to support the 350 ng/L concentration limit.
- The frequency of sampling and the trigger levels appear appropriate, provided these are set in terms of PCB concentrations in water.
- That TSS has not been demonstrated as a reliable surrogate for tPCBs, and as such TSS criterion would not be protective of ecological and human health. The EPA and GE may elect to monitor TSS and establish in the future if this may be used as a surrogate – but that until that has been established, should not be a part of the standard.
- Near-field remedial activities, and in particular "backfilling" or capping will elevate TSS to levels that obfuscate the intended near, and far-field SS standards. While still advocating measuring TSS, it will not serve as a suitable surrogate for PCB downstream transport, nor for the protection of human health.

Dredging Residuals Standard

6. **Framework:** *Please comment on whether this framework provides a reasonable approach for developing the Residuals Standard.*

The framework provides a well-thought out and statistically defensible approach for developing the Residuals Standard. The size of the certification units, estimation of the action levels, sample numbers needed to confirm the action levels, and a process for getting out of a continuous re-dredge loop are reasonably presented and defended. On a technical level, I find this a very sound process.

Practicably, however, this will be a very complicated and expensive process to implement. A modification of the framework and Residual Standard could be made that places greater emphasis on the engineering design (currently absent from the standard), and then focuses on a single certification unit equivalent to the HudTox model segments that were used to set the ROD-specified limits in the first place. Specifically, I would recommend that the Standard include engineering design requirements for the removal such that the design cut lines (horizontal and vertical) ensure 95% confidence in achieving the ROD-specified of 1 mg/kg Tri+PCBs residuals prior to backfilling, and rigidly specify the tolerance limits on the dredge cut based on elevations. This is possible with the extensive set of data recently collected on the Hudson. In doing so, the 5-acre certification unit may be dropped from the Standard, with focus solely on certification within the 20 acre unit corresponding to the HudTox model segments. All other aspects of the Framework would remain applicable.

7. Statistical Analyses: *Please comment on whether the statistical analyses are technically adequate and properly documented.*

The statistical analyses done to derive the residual standards are technically adequate, sound, and very well documented. While it would help the documentation of the Standard to have a single, explicit statement of the Standard in terms of concentration, and the required confidence limits, it's clear that the authors correctly considered those and incorporated them into their calculations. The only unfortunate aspect of this work was the need to rely on data from other dredging programs, but the authors conducted a thorough and were duly conservative in their application of that information to the residual standard.

Having said that, there I believe that an explicit component of this standard should be a design standard: that the horizontal and vertical cut lines must be developed in a fashion that ensures with at a 95% confidence level (setting the beta at what power is afforded by the current core sample density) that the final removal elevations specified will achieve a residual of 1 mg/kg Tri+PCBs. New York DEC in my opinion appropriately reflected that need in their October 2003 comments to the residual standard; that there needs to be a high level of certainty associated with the targeted depth of removal. By incorporating an engineering design standard into the residual standard that states the level of certainty (95% confidence limits).

These could be developed using a similar analysis conducted for the Standard – but would incorporate the element of design into the Standard. Elevations should be based upon Dredge Management Units (DMUs)– which for the equipment considered in the Performance Standard should be 60 x 20 feet (Greg Hartman, Ancil Taylor, personal communication). DMUs are determined by fitting 60 feet long by 20 feet wide dredge lanes(equal to two 1 m^3

clam-shell bucket lengths) over the dredged depth elevation contours and the aerial footprint. Dredge lanes would be set parallel to the River.

To be clear, an engineering design standard should be developed that specifies that within the 60 x 20 ft. DMU, the final dig-to elevation will have achieved the expected TriPCB concentrations with 95% certainty. In the interest of sharing information, an example of how this is considered for the Lower Fox River is attached.

Thus, the standard could be streamlined so that (1) the first level of confirmation would that that within the 5-acre units, the statistically derived elevations (and horizontal limits) had been achieved, (2) that coring will occur at the same density specified within the current standard, (3) the additional standards (27 and 15 mg/kg Tri+PCBs) are applicable over the 20 acre area, and (4) re-dredging be directed at those areas within the 20 acre unit that would achieve the overall goal of 1 mg/kg Tri+PCBs.

8. **Post-dredging Confirmatory Sampling Program:** *Please comment on the adequacy of these aspects of the Residuals Standard, in particular the concept of a 20-acre evaluation area for Phase 1.*

The post-dredging confirmation sampling is generally adequate for the purposes intended. I suspect that there was an analysis conducted on the statistical power associated with the pre-engineering design and the confirmation sampling to yield a value of ca. 8/acre. If it is in the document, I missed it – if not that discussion would be useful.

As noted in my previous two comments, I believe that the overall confidence in the program could be increased by incorporating a design standard into this document, and then using the 20 acre unit as a basis for confirmation of the residual standard.

As a practical element, I would not recommend incorporation of Sediment Profile Imaging (SPI) into the standard. Having worked with SPI on multiple projects over the last 10 years, I believe that it has great utility in defining baseline conditions, and looking at capping deposition and recolonization, but is NOT a useful tool for looking at post-dredging conditions in freshwater environments. Having been involved in one freshwater project that took several thousand SPI images – all were black and unreadable because of the presence of anoxic sediments. To specify the use of this tool at a specified rate is not appropriate and will not contribute useful information.

As a practical matter, monitoring of placement of backfill or capping material is not discussed in this standard, or in the dredging production standard, but I believe is appropriate to consider. Veneer-capping using hydraulic broadcast methods is very appropriate here, and will result in the least amount of sediment disturbance, mixing, and recontamination. Both myself and John Verduin has considerable experience with this method and it works well. Pertinent here is that when appropriately applied, and monitored, there will be 10 cm or less of remixing of the capping material with the underlying sediments. However, experience with application is that this requires specifying application rates, the close monitoring of those rates, and frequent confirmatory sampling (bathymetry) to ensure that remixing is not occurring. In my opinion, a design standard and monitoring standard for backfilling is required.

9. **Re-dredging and Engineering Contingencies:** *Please comment on the reasonableness of the Residuals Standard with respect to re-dredging and engineering contingencies.*

I cannot find any fault with the intended re-dredging and engineering contingencies in terms of the intent and thought used to develop them. My opinion is that these are going to be difficult and expensive to implement, and do not appear to be constructed in a way that allows flexibility in the construction process. Re-dredging should be based upon what is needed to achieve the 1 mg/kg Tri+PCB weighted average concentration across the 20 acre HudTox-based unit. Allowing decisions to be made in the field with appropriate oversite, is not currently allowed in this document. For example, where materials have been removed to as close to bedrock as possible in the first pass – additional value is not gained by requiring re-dredging unless it can be demonstrated that it is required to achieve the 20 acre-standard.

Productivity Standard

11. **Framework:** *Please comment on whether this framework provides a reasonable approach for developing the Productivity Standard.*

A framework based upon dividing the total dredge volume by the number of years required in the ROD, and then taking ca. ½ of that volume to be dredged in Phase 1, is of itself reasonable. Under the right set of assumptions, removing and disposing the volume of material in the time frame defined by the Feasibility Study, and codified within the ROD, can be done. Recognizing, however, that the assumptions in the FS should be within +/- 50% volume, cost and time. The goal of the Productivity Standard should be to strengthen and narrow those assumptions, and to that effect it requires additional work.

The Productivity Standard makes the implicit assumption that the Standard is based upon ***dredging***; the act of in-water sediment removal. Having worked closely with some of the same senior engineers that were a part of the Quality Review Team, as well as two of the major dredging contractors with whom the author team consulted, I am fairly confident that the consistent message regarding productivity is less about dredging, and more about the downstream management of the dredged materials: transport, dewatering and wastewater treatment, solids treatment, and disposal. Productivity will live, or die, by these issues and the document as drafted does not do an effective job in demonstrating how those will be achieved. Some specific suggestions are made below.

Sediment Volume Estimates. The Standard appropriately notes that one of the most important uncertainties is the overall volume. This includes both the *in-situ* volume, and the *ex-situ* volume, that will be resolved by the on-going sediment sampling program. I assume that both will be part of the re-evaluation process.

The *in-situ* volume is dependent upon the final determination of the horizontal and vertical distribution of Tri+PCBs – i.e., the dredge cut lines. As noted in Charge Question 7, and engineering-design standard requiring that DMUs be constructed in a fashion that ensures 95% confidence that the final elevations specified (and achieved) will ensure meeting the 1 mg/kg Tri+PCB residual concentration. Volumes, and DMUs, should be determined and then the expected Productivity Standard be re-evaluated.

The *ex situ* volume estimates will be dependent upon the physical parameters that I assume were collected in the current sampling program: percent moisture, in situ specific gravity, bulk density, and grain size D_{50}. These values will be especially critical, given that the production bottlenecks will be on the dewatering and disposal end. Once determined, the Standard should be re-focused on the downstream production train using these volumes.

<u>*Dredging Rates.*</u> Based on experience at other sites, there should be no substantive barrier to the physical act of removing sediments. The seasonal dredge volumes stated are probably do-able. I noted that the dredging buckets described, and the dredging production rate is based upon the recent New Bedford Harbor hot spot removal. In discussions with the dredge contractor on that project, 82 cy/h is on the conservative end of what that system is capable of, so the assumption in the Standard is appropriate. Both mechanical and hydraulic production rates for other environmental dredging projects include rates in the 160 – 200 cy/hr range – so this conservative assumption is appropriate.

Having said that, the Standard does make the assumption that the same NBH system will be appropriately applied throughout the River – and assumption that I think is inappropriate and predicates the final system that must be used on the Hudson River. This is inconsistent with what appears to be the intent of the documents: provide standards and allow for a design/build by GE and it's remedial contractor(s). There is no substantive reason, for example, that hydraulic dredging could not be used on the Hudson River – but the document casts a negative pall on that process. Pipeline transport of dredged material is also a feasible options – and should not be so readily discounted. As a test of the Productivity Standard, it would be appropriate to calculate hydraulic production rates using DRDGRATE (Hartman 1984) to determine the appropriate pipeline size (10, 12, or 14 inch). My estimate is that it will be appropriate to use a 14 inch cutterhead and achieve the production goals.

<u>*Transport*</u>. The Productivity Standard is based principally on transport of dredged sediments to a dewatering and unloading facility at the north end of the Thompson Island Pool (TIP). However, the analysis presented is too vague on the issue of barge traffic to truly evaluate whether this will be a bottleneck in production. This is a critical area and a separate memo/analysis should be included as a part of the final standard. Critical for that determination is to include (1) the number of barges of the appropriate size required for the work, with an appropriate overage, (2) the number of barges of that size that are in operation on the eastern seaboard, and an estimate of how many would be available, (3) the number of barge trips per day to, and from, the off-loading facility at the north end of the TIP (4) a detailed presentation of the recreational and commercial boating traffic on the Champlain Canal, (5) how the barge traffic will be affected by the recreational/commercial traffic, (5) what is the capacity (i.e., docking area) at the off-loading facility to accommodate the dredge

barges, and (6) what is the expected cycle time to collect the barge decant water and off-load the barge.

A better analysis of transporting dredged slurry in pipelines is also warranted. Dredged materials are routinely transported as slurry over large distances (upwards of 30 miles on some projects – Ancil Taylor, personal communication), while mining slurries are transported 100s of miles. This is not a barrier to transport, but the Standard implies that it is.

Dredge return water quality. I did not find within the Productivity Standard a discussion of what are the return water quality standards that will be required under by New York under it's NPDES authority. The document acknowledges that water treatment can be an issue, but is silent on how water will be taken from the barge (some settling will occur during transport), how that will be stored until treatment, whether sand filtration followed by GAC will be sufficient. While I am not calling for a design level analysis here, I do believe that it is important to articulate what are the issues and do a complete analysis of whether water treatment will represent a bottleneck.

Dewatering. The document presents a feasibility-study level description of the solidification process. A more thorough treatment is needed.

Off-Site Transport The analysis of rail transport is again not very detailed. The same type of analysis described above for barge transport should be included in the document. The type of railcar required to transport solidified sediments, the number of those types of cars available to the remediation, demonstrated commitment and availability of rail spurs to the TIP site, number of car trips in and out of the facility each day, etc. That this can be accomplished is not an issue – it is a function of demonstrating that each of these has been carefully considered in the development of the Standard.

Backfilling and Capping. This is perhaps the least developed concept within the entire set of Standards. Although there is a specification for 1 ft. of material, no tolerances have been set (e.g., +/- 0.5 feet), no specification for type of materials (sand, soils), consideration of consolidation or shear failure on placement, changes in river hydrology and the need for armoring in some sections, type of placement (bucket vs. hydraulic), TSS release on placement and the impact on the Resuspension Standard, are amongst the areas that have not been even considered in the standard.

Silt Barriers. Silt barriers are assumed in the Productivity Standard, without a real consideration as to their overall cost and effectiveness. There are a number of issues that could be discussed here – but the overall message should be that silt barriers should be considered only if the overall dredging fails to meet and appropriate resuspension standard. If they are to be considered, the Standard should have addressed questions such as whether the type of barrier proposed would standup in the River currents within the specific segment, and if the presence of the barrier would result in a scouring effect that might unintentionally resuspend solids or PCBs in other segments. This might not necessarily be the case for an HDPE barrier, but would indeed be an issue if sheet piles were employed.

12. **Example Production Schedule**: *Please comment on the Example Production Schedule, including the reasonableness of the underlying assumptions for equipment selection and efficacy, as well as the time necessary to deploy, use, and move equipment.*

The document is too vague on the underlying assumptions to make much sense of the Example Production Schedule. I would argue that the schedule is not germane to this discussion, and does not add anything substantively to the Standard.

13. **Action Levels**: *Please comment on appropriateness of the action levels and the required actions, as well as the reasonableness of the monitoring and record keeping requirements. Questions Related to All Three Engineering Performance Standards*

My comments have been recorded previously under the various standards.

14. **Interactions Among the Standards**: *Please comment on whether the main interactions among the standards are properly documented and taken into account.*

My comments have been recorded previously under the various standards.

15. **Refinement of each standard**. *Please comment on whether there are any additional aspects to effectively accomplish the refinement that EPA should consider in evaluating the Phase 1 data.*

No comment at this time

16. *Please provide any other comments, concerns or suggestions, involving both strengths and weaknesses, with respect to the October 2003 Draft Engineering Performance Standards Peer Review Copy that may not be fully covered by the above charge questions.*

Two key concepts in the environmental dredging field are missing from all of the Standards, and should be discussed upfront: "design-build" and "best professional judgment". It appears that it is the intent of these documents to set standards, but allow GE, and/or the selected remedial contractor, the opportunity to design and build the project. This is entirely appropriate (and in my opinion the right choice), but as such the documents must (1) explicitly state this, (2) include design criteria in the Standards (see my discussion under the Residuals Standard), (3) provide the necessary documentation that these criteria are achievable, and (4) not presuppose one engineering method over the other. As present above, the collection of Standards documents strives to do this, but falls short on some aspects. The latter two points are especially critical to the Productivity Standard – which does not make a supportable case that the production rates can be achieved, and pre-supposes the mechanical system used at NBH for the Standard.

The second concept of "Best Professional Judgment", which is fairly typically assigned to most of the successful environmental dredging projects, is clearly missing from this document. This is especially evident in the Residuals Standard, where there is no allowance for BPJ in the field where it will be evident that no additional dredging will cleanup the residual material. The suggestion in the Productivity Standard that these areas could be visited by divers with dredge suction lines reflects inexperience with this method at best. I am not recommending "carte blanche" BPJ for the dredging contractor – appropriate oversight will be required. However, the Standards, as drafted, are too rigid and do not allow any flexibility.

Appendix C

List of Registered Observers of the Peer Review Meeting

Peer Review of EPA's Draft Engineering Performance Standards for the Hudson River PCBs Superfund Site

Gideon Putnam Hotel - Saratoga Springs
Saratoga Springs, NY
January 27-29, 2004

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Appendix D

Agenda for the Peer Review Meeting

United States
Environmental Protection Agency
Region 2

Peer Review of EPA's Draft Engineering Performance Standards for the Hudson River PCBs Superfund Site

Gideon Putnam Hotel - Saratoga Springs
Saratoga Springs, NY
January 27-29, 2004

Agenda

TUESDAY, JANUARY 27, 2004

7:30AM	Registration and Check-in	
8:00AM	**Welcome and Peer Reviewer Introductions**	*Jan Connery* *ERG, Inc.*
8:20AM	**Opening Remarks and Observer Comments**	
9:30AM	**Overview of Pre-Meeting Comments**	*Dr. Ken Reimer* *The Royal Military College of Canada*
10:00AM	BREAK	
10:15AM	**Peer Review of Resuspension Standard**	
12:00PM	LUNCH	
1:00PM	**Peer Review of Resuspension Standard** (Continued)	
3:15PM	BREAK	
3:30PM	**Peer Review of Resuspension Standard** (Continued)	
5:00PM	ADJOURN	

WEDNESDAY, JANUARY 28, 2004

8:00AM	**Observer Comment Period #2**	
8:45AM	**Peer Review of Residuals Standard**	
10:00AM	BREAK	
10:15AM	**Peer Review of Residuals Standard** (Continued)	
12:00PM	LUNCH	

(over)

W E D N E S D A Y , J A N U A R Y 2 8 , 2 0 0 4 (c o n t i n u e d)

1:00PM	**Peer Review of Productivity Standard**
3:00PM	B R E A K
3:15PM	**Peer Review of Productivity Standard** (Continued)
5:00PM	A D J O U R N

T H U R S D A Y , J A N U A R Y 2 9 , 2 0 0 4

8:00AM	**Peer Review of Issues Relevant to All Three Standards**
10:00AM	B R E A K
10:15AM	**Peer Review of Issues Relevant to All Three Standards** (Continued)
11:15AM	**Observer Comment Period #3**
12:00PM	L U N C H
1:00PM	**Peer Reviewers' Conclusions and Recommendations**
3:00PM	B R E A K
3:15PM	**Peer Reviewers' Conclusions and Recommendations** (Continued)
4:05PM	**Closing Remarks** . . . . *Jan Connery*
4:15PM	A D J O U R N

Appendix E

Observer Comments Provided During the Peer Review Meeting

Note: The peer review meeting included three observer comment periods, one on each day of the meeting. This appendix includes verbatim transcripts (to the extent that specific remarks were audible from recordings) of the observer comments, in the order the comments were given.

List of Observers Who Made Comments

Day 1 (January 27, 2004):

John Haggard, General Electric Company

Day 2 (January 28, 2004):

Merrilyn Pulver, Town of Fort Edward
John Connolly, Quantitative Environmental Analysis, LLC
George Hodgson, Saratoga County Environmental Management Council

Day 3 (January 29, 2004):

Paul Doody, Blasland, Bouck & Lee, Inc.
Rich Schiafo, Scenic Hudson
Lisa Rosman, National Oceanic and Atmospheric Administration (NOAA)
George Hodgson, Saratoga County Environmental Management Council
Merrilyn Pulver, Town of Fort Edward
Sharon Ruggi, Town of Fort Edward
Harry Gutheil, Town of Moreau

Day 1, Comments from John Haggard, General Electric Company (GE)

I appreciate the opportunity to make some brief comments to you about the comments we had seen as well as the performance standards and the project. We are in a fairly unique position. We are to design this project. GE and its consultants are designing this project. I think a lot of what the comments you made and what is embodied in the performance standards really go to fundamental design issues, so again I think we have a very unique and important perspective on implementation of this project.

While certainly EPA and its contractors have done a lot of work developing the performance standards, we also have a very large team of design engineers, only a small number I could bring here today. I would like to introduce a couple of people who are actually involved in designing and are responsible for designing the project. If you could view them as a resource during your deliberations, these are folks with many, many years of experience, both with monitoring and design of dredging projects.

Our lead designer is Paul Doody. Paul is a professional engineer from Blasland, Bouck, and Lee, out of Syracuse. It is his P.E. stamp that will be on this design. So, if you have hard questions, he is the person you should really talk to. Paul has a very large team of experts working for him. Allan Fowler, next to Paul, out of their Massachusetts office, is involved and responsible for the actual dredging elements of the project. I would also like to introduce Brad Cushing. Brad Cushing is the gentleman responsible for, among other things, developing the dredging database that we and others have relied upon. I think Brad probably has more knowledge of a broader base of dredging projects probably than anyone else in the world. And he is again a great resource. I would also like to introduce Tom Wilcox. As you are going to hear, rail is a very important aspect of this project. Tom Wilcox is with Thompson Hine out of Washington, DC, and is an expert in contracting and evaluation of rail operations. Tom again is a resource that we can call on during the course of the day. Lastly, I would like to introduce Dr. John Connolly. Dr. Connolly has been involved in the Hudson River project for a decade and a half maybe, something like that. John is the CEO and President of Quantitative Environmental Analysis and they're experts in modeling and monitoring, and John and his group have been responsible for the implementation of, I think what is the unprecedented scale of, the sampling project that we have done, as well as collecting all the data that GE has sponsored on the Hudson River over the last decade and a half. Again, a very good resource for us.

I would like to just make a few points. Since we have met, I think there have been a couple of things that have happened that I would like to bring to your attention. Just to review, I think what we have seen is that there are a number of restrictions placed on this project that are very important to consider in design. Obviously the ones that we are here to talk about today and the next few days are these engineering performance standards, the three of them. The other big constraint is no trucks. There can't be any trucks to transport. Also, there are no local landfills. So, we have added a logistical element to this project that may be somewhat unique from many other projects. We have to get the material out and away from the river in a constrained fashion.

Also, since we have met, the quality of life standards have been issued by EPA. They are standards related to air quality, noise, odor, lighting, and navigation. Now, these standards are important, particularly a couple of them, in that they can affect dramatically the logistics of the project. I will draw your attention to a couple of them. The noise and lighting standards have different standards for daylight and night operations, and how those standards impact the ability to do this project is something that is going to be evaluated. There is no restriction on our operation formally, but, do the standards themselves impact the operations? The answer is going to be yes. To what extent, we don't know. On the navigational side, there is an open question on what priority project vessels will have on the project. If we have a 1,200-ton scow trying to go through six locks to get to a de-watering facility, is that vessel going to have any priority to move through the lock system, or is it going to be queued up and have to wait for pleasure-craft, etc.? That is a very important point and uncertainty when trying to deal with the design of this project that we are trying to work through, and at this point there is not a lot of clarity on what priority these vessels will be given.

Now, if we look at the overall project, I think we all know that it is very complicated from beginning to end. You can't just look at one piece of this: we can't say, yes, we can dredge and we can get the material out and say look we can do this. We really have to be able to look at each component: dredging, we then have to move the material, we have to then de-water it, we have to get it on the rails, and we have to landfill it. If we look at a few of the issues here we have, these are all inter-connected processes, and, I know you know all this, but it is worthwhile to talk about a couple of examples. Let's say we are at the dredge, and we are trying to meet the Production Standard and the Resuspension Standard and the Residual Standard. Well, what happens if we have to slow down because of resuspension? One immediate result is that we are going to have trains and landfill waiting. At some point, the number of trains we are going to have and the number of cars we have stack up, particularly if we are going to need 45 gondola cars a day. Where do you start putting them? How do you have the people there to load and unload them? You can't just have people waiting to do work and have an efficient project.

Another example is the residuals. A concern would be on the residual would be that we would have to try to continue to go back and get the small amount of material—low level concentration material—and in the process, particularly if we are using hydraulic-type dredges, generate a very large amount of water. Now, did we accurately capture the amount of water in our design so that we have adequately designed facilities? Obviously that is a variable that we are going to look at, but how uncertain is it? What do we know about the uncertainty? I would offer that this is very uncertain at this point.

Barges: I mentioned the barges are delayed at the locks. What happens if the barges can't get there? We have a crew waiting not only to unload the barge, but to process material and to load onto the train, and again we have a stall. The other is that when trains don't show up, basically the dredging stops. Yes, we can have some buffering capacity in terms of stockpiling. But, at some point, let's say we have a week of stockpiling: that is two football fields, four-and-a-half foot deep of material. How big of a stockpile can we have at these facilities? Huge design issue, uncertain, and, as I'll talk about, the reliability of rail service is a major issue on this project.

I thought it would be useful to read a quote. I think, as designers, we engineers tend to believe we herd scientists actually, as opposed to the opposite way. I think that is an age-old debate that will go on for a long time. As designers, what we are challenged by are projects like this. We firmly believe that we will be able to figure it all out and will understand the uncertainties and variability. That is what we try to design to. That is what we try to do. I thought the quote, though, was interesting. This relates to the Reynolds project. There is an article written by [names inaudible], and we can provide a copy of this. I think it was presented at [name inaudible] conference recently. And it goes to the Reynolds project up in Massena, New York. Let me read this: "Because of its ambitious schedule, the St. Lawrence project was exquisitely detailed and diagramed. Planning for the project spanned 8 years. In the end, work was driven by contingency plans, as much as it was driven by final design and work plans." From day one, the wheels started coming off these projects, not because the designers didn't do their work, but frankly because the lack of experience in these sorts of projects.

I think that we are going to do our best. We have a tremendous team of people. But we have to recognize the complications that are imposed upon this project by all these other restrictions. It is something to consider that things are going to go wrong, and we are going to try to manage them, but, in the end, we can't foresee every problem. The major problems that we foresee are the following, and these are only the ones that we can foresee. I'm sure others will happen. Can we meet these three standards simultaneously? Very little experience to suggest that we can dredge quickly, have a clean surface, and not resuspend. That is a challenge that you have been grappling with for the last 2 or 3 months. The other is the predictability and reliability of rail service. If the trains don't show up on a predictable schedule, the project is going to fall apart. And lastly is the barging constraints. What priority, if any, are we going to be given on the canal system to operate and actually do this project?

I'd like to talk a little bit more, since we have already talked I think about the challenges with achieving the performance standards, is the rail. If you haven't worked with rail, it is important to understand some of the limitations imposed by this lack of ability to use trucks. In the feasibility analysis, reliable service was assumed to occur. Is that really a very good assumption? We hope it is, but we have serious doubts. A few items to remember. Class 1 rails in the United States are large rail carriers, and we have got a limited number of carriers. We have three that access three different parts of the river. None of these carriers have experience with a clean-up project of this scope. Yes, they haul grain; they haul coal; they haul miscellaneous shipments of material. But, bulk shipment of hazardous-type waste and having to meet design schedules like we've got here is something that these folks don't have the experience with.

We also find that the idea that rail service exists at a piece of property because there is a little track that goes by does not mean you have the infrastructure to actually do this project. In fact, we are finding that you need to have on your facility essentially a very large rail yard in which you can sort, collect, and ship rail cars. With 45 rail cars a day, this is a major project. It is important to realize that the way rails are regulated in the United States: they are quasi-monopolies. They do have to provide service, but they are not required to provide good service. And, in fact, you may not be able to get good service. Sure, the trains may show up when they show up, but do they have to show up every day? Can you force them to give you a contract where they will take penalties if the project fails? Probably not. So, this is a consideration when trying to do this project. And, I think at the end, the question of rail service is one key element to the feasibility of the project.

I would also like to talk briefly about another issue I think that the peer reviewers certainly spent a fair amount of time on, and we certainly have a lot of concerns about, are the monitoring required. At the end, for the near-field monitoring, it really doesn't appear that the purpose for near-field is not compliance. We believe the purpose of the near-field is primarily to provide some real-time feedback to the operations so that changes can be made so that we know the primary health standards are not going to be exceeded. Really, it is only useful if we can get data back in a real-time way. Delays in that are not going to help the operator know that there is a problem. We do not believe that TSS collection and analysis can be done fast enough, and it is very expensive, and frankly it's not necessary to do; and we think turbidity is a better choice. It's real-time; it's simple to collect; it's relatively low cost; and you can do it in a automated fashion.

So, ultimately here, what we believe for the near-field is that we should try to get turbidity data during Phase 1. But the challenge is, during Phase 1, the turbidity data should not be a compliance measure, but the data should be collected to see whether or not we can develop a relationship between what's happening in the near-field turbidity around the dredge project and what's happening at our compliance point far-field with PCBs. Is there a useful relationship that will allow the operator to say: if I have a reading like this, I know I'm going to exceed the standard, therefore let me change my ways. That's what we hope we can do in Phase 1. So, our request would be that, if we are going to do anything near-field, then we try to have it be something useful for the operations, and Phase 1 should be geared toward looking at defining a relationship between the near-field and what we measure in the far-field.

On the far-field, again we firmly believe that automated samplers have to be used here and that we should do 24-hour PCB composites. That's what the standard is based on: a 24-hour average value. So, if we can get a sample that is based on 24 hours, that is a direct measure of compliance. We can detect discrete pulses; we can run composites on whatever interval we want over 24 hours; very much more simplified logistics. We can have quicker response than what was proposed by the Agency, because we will be doing, at all levels of operation—all evaluation and action levels—we will be getting 24-hour composites. So, we can take time out because we will have data more quickly than in the program suggested by EPA. And we have one program for all action levels. Monitoring directly goes to compliance.

The other is that we don't think there is a need for split-phase (particulate and dissolved) as part of the routine sampling. When we look at it, we are seeing that part of the objection to using these automated samplers goes back to the need to get dissolved versus particulate as part of this routine sampling. We really don't believe that, to the extent folks think there is a need for particulate versus split, it should be part of the routine monitoring. Maybe there is a special study, but if it overly complicates what we need to do to test the primary compliance point, then we should consider whether or not we should really do it. Compliance point monitoring should be the number one priority, and efficient and effective monitoring should be a priority.

Another interesting thing that is happened is that recently, in public meeting, EPA stated that there was no scientific basis requiring completion of the project in 6 years. Now, this is the underpinning for the entire Production Standard. So, ultimately here, what we have said earlier to you, and I think what I would like to reiterate here, is that the production rate should be secondary to the other standards. Phase 1 should not have a Production Standard, because there are so many constraints beyond the control of the project. We have the standards; we have rail, etc., things we have talked about before. The design obviously needs to design to some level, and we believe that we could design and should design to meet what the primary production goal estimate is for the Phase 2 project. But, ultimately we know that we might not be able to meet that. So, for Phase 1, we will have a project that is in that range (150–300 cy) as required by the Record of Decision, and we would include a 30-day dredging rate at the rate expected during full implementation during Phase 2. And then let's base the Phase 2 Production Standard on Phase 1 production results.

Ultimately, the review of Phase 1 is critical. Again, we are all hoping that we are very good designers and that we are going to anticipate all the problems, but I think we all realize that we are not going to be perfect in that. And so it really is a test. Phase 1 has to be a test. We need to simulate what we think are the full production rate conditions, which we would do during Phase 1. Also, we need to recognize that, as part of the monitoring, and not just monitoring specified as the performance standard, but the production monitoring that goes on at the dredge and throughput through all the different operations, there is going to be an enormous amount of data generated. So, after Phase 1, we need sufficient time that we have to compile and report the data; it has to be evaluated; and then it all has to be put through an independent review; and to look at necessary changes—changes in the performance standards, which could impact changes in the project design and the project approach. So, Phase 1, I guess, ultimately, we need to recognize it is going to be a very important test and that we should leave enough time to do it correctly.

Just to summarize, and I won't spend a lot of time on this. Production Standard: we believe a standard shouldn't be set for Phase 1 at this point. It should be a goal. Standard versus goal, the terminologies have important different distinctions from a regulatory standpoint. Resuspension: Some of these elements—monitoring—we should look at simplifying. Compliance and protection of the health standards should be number one priority. We think the near-field monitoring, very expensive, logistically difficult, should be looked at carefully. On the residuals, I haven't mentioned before, but again on residuals: flexibility is going to be the key. The longer we spend chasing small amounts of PCBs, the harder it's going to be to meet the production rate requirements. And Phase 1 needs to be a very rigorous test of the standards. With that, I wish you all well and, if you have any questions, we are here during the deliberations.

Day 2, comments from Merrilyn Pulver, Town of Fort Edward

Good morning and welcome to the north country. I am a little disappointed because we did not have quite as much snow as they anticipated, but the trip down here this morning was a little slick in places, so I tried to just take my time and I was sorry that I did arrive late. On behalf of the Town of Fort Edward, I hope that both the e-mail that was sent out to you, the peer reviewers, and the DVD that I hand delivered yesterday to you was helpful in your understanding of our concerns and our commitment and dedication on protecting the community including preserving the historical heritage and our economic viability, as well as, and I think probably most importantly, on protecting the health, safety, and well being of our residents.

The purpose of the video was to show the real face of the community that will be most impacted by the largest environmental dredge project to be ever attempted in recorded history. The video tape included agriculture, the businesses, the hamlets, the many homes, and the historic and economic community that presently exist along that 6.5 mile plus stretch of the river that is called the Thompson Island Pool and where the majority of the dredging will take place according to the ROD. And I have to say, although this was our first attempt at doing a video tape of our community, I can honestly say that the effort became a labor of love and became a real sense of pride of our community and the historical significance of it and just the overall concerns and impacts that this project will have on Fort Edward.

The town board is appreciative that the peer reviewers requested data about the DEC project that has raised so many concerns to the town residents in 2003. The project had 44 hits over 500 ppt of PCBs, including resuspension rates that climaxed over 28,000 ppt—or 56 times the safe drinking water level. And that was at both the point below the site, and there was also three high readings 1.4 miles south of the site at the Route 197 bridge, which coincidentally is where the village water pipe comes across to the residents of the village of Fort Edward and happened to break at a time that was quite significant in relationship to these peaks this past summer.

I have brought with me pictures of the DEC site that I was unable to put on the video tape, and it will visually show some of our concerns. I have one set, and we'll pass those around for you to also look at. EPA has already stated that it would shut the project down if the water column reaches 500 ppt. I really need to know, on behalf of the community, that EPA will actually adhere to these standards and hopefully will not take the same cavalier approach that DEC did at this outfall 4 site. In addition, EPA needs to ensure that the presence of heavy metals is not going to increase as a result of the project. That continues to be a concern of the residents who have lived there all those years, and seen the water turn colors on a daily basis according to what Hercules plant was producing for a paint color that day, knowing full well of all of the other issues—other industries, I should say—that resided along the banks and also deposited material over the years. So, that's something that is of quite a lot of interest to the people of Fort Edward.

We've heard the words demonstration project, pilot project, and Phase 1, and they have all been kind of used interchangeably yesterday, and when discussing the importance of monitoring performance standards in the river, rather than in theory, I have a concern that we need to consider the size of this demonstration/pilot/Phase 1 project. The Town of Fort Edward is on record stating that it is imperative to conduct a very limited demonstration project as a part of the design phase and prior to full-scale dredging. The demonstration project should be used to test standards and would be an opportunity to test equipment. It could be a real time saver to the project time frame, if a smaller project was done to determine all of the areas of concerns. It would allow for the monitoring of performance standards in a real-life situation, instead of using a theoretical model. Because resuspension is critical to the success of this project, a demonstration project would ascertain the resuspension rate in the Hudson. Once that rate is determined, the model should be re-run in order for everyone to clearly see that there would be a quantifiable benefit at the end of the project. Once the demonstration project is completed, the peer reviewers should again convene to review the necessary documents and to make any necessary adjustments so that when full-scale dredging is implemented, the project will be done right the first time.

EPA defines "doing it right" as not leaving high levels of PCBs in the water or in the sediment after dredging, and it means finishing this project in 6 years. As we have stated previously, meeting all these goals at the same time seems like a heavy lift. We know that there has been resuspension at other environmental dredging sites, as much as 10%. And we know that leaving less than 1 ppm residual concentration in the sediment is also very difficult. Add into the mix a very aggressive production schedule, and we are concerned that some serious problems may very well result. It seems that the performance standards set for resuspension, residual PCB concentrations, and time frame for the overall project are simply not compatible.

Now we are not looking for a longer project time frame. Far from it, because a longer project means more noise, lights, odor, and impacts for our residents. But we also don't want to see this project happen again. If it's going to happen now, we want it done right the first time. And instead of mandating a time frame for this project now, when the realistic achievements of the project are still largely unknown, why not get EPA to be honest about how long this project is realistically going to take? We've talked about 6 years. Most recently at the CAG meeting, George Pavlou mentioned 7–8 years. Which is it? Why don't we first develop a reasonable daily production schedule and determine how long the project should take if we are going to successfully minimize resuspension and residual contamination? A small demonstration project would provide that very information, the data, and the ultimate ability to evaluate and develop the performance standards that will ensure that this project is done right the first time, based upon EPA's definition of a successful project.

Once again, I thank you for the opportunity to address you and I remain available either now or at your convenience to answer any questions and, as I said before, I will pass around the pictures of the outfall 4 site to give you a little better idea of what we experienced in Fort Edward this year. Thank you.

Day 2, comments from John Connolly, Quantitative Environmental Analysis, LLC (QEA)

Yesterday, John Haggard introduced me as responsible for the monitoring that GE has been conducting on the river, and that's true. We've been involved in all of the monitoring that GE has conducted on this river since 1991. The comments I want to make here are related to the issues of monitoring, principally. I was really pleased to see that you guys are very much focused on tying all of the monitoring to data quality objectives, and that we only want to do monitoring if we can see a clear objective for it. However, I've noticed that there is much less focus on another layer of issue with regard to the monitoring, and that is whether what has been proposed in the documents, or the monitoring that you have thought should be added to this program, are feasible, practical, and, in some cases, necessary, in order to do what the aims of this program are. What I would like to do is to go through a few of the monitoring programs, specifically looking at these issues of feasibility, practicality, and necessity.

If we look at the near-field monitoring program, and let's look first at what EPA has proposed, which, as I read one of your recommendations, you have affirmed. EPA's program, as it stands right now, requires sampling every 3 hours at 5 to 6 locations around each dredge operation. If there are 6 dredge operations going on, then there are some 30 to 36 samples being collected every 3 hours. Those samples are to be analyzed for TSS. They are to be analyzed for TSS such that we generate data within 3 hours of collection. To get a boat out on the river, get it on station, is actually not an easy thing to do on the Hudson, because the way that we do it is to spud in. So, a boat comes out, it drops spuds. Half the time you drop the spuds, you don't stick. A lot of this river doesn't have a lot of sediment in it. And so you have to pull the spuds up and do it again, until you can get on station. Now you've got to do the sampling—depth-integrated sampling for TSS. So, you've got to drop through the water column and come up. It will take somewhere between 5 and 10 minutes at a minimum to occupy a station. If you have a sampling crew dedicated to each operation, they will be on the river for more than 1 hour. They will then motor back to shore, maybe 15 minutes. They will get the sample to a laboratory. The laboratory will have maybe an hour and a half to meet the 3-hour turnaround to do TSS. I'm sure a number of you are familiar with what's involved in a TSS analysis. It cannot be done in an hour and a half. So, it is not possible to conform to that portion of this program, as it is outlined. And we believe that it is very important that you focus on these issues of whether what has been proposed can in fact be conducted.

Now, you've proposed that we add split-phase PCBs to the near-field program. You have proposed that it would have to be conducted at upstream and downstream. It is not clear to us whether that recommendation means two stations—one upstream, one downstream—or more than two stations—one upstream and two downstream, or three downstream, all sitting at

100 meters. Samples are being collected every 3 hours, according to this program; 7 times a day we will be collecting samples. I've done the math, and it turns out, doing split-phase, that we will be generating somewhere between 170 and 250 PCB analyses a day. The capacity doesn't exist to do that kind of PCB analysis—to turnaround 200 PCB water column analyses a day. We can't do it. It's important that you consider that when you're making the recommendation. Can we do it? And then, is it necessary to do it? The question that we are trying to understand, at least as far as I see, and perhaps I've misinterpreted, is to understand whether there is a relationship between turbidity and TSS and PCB in the near-field. How much of the release is dissolved? And how much of the release is particulate? Well, that's all very interesting. As some of you have indicated, it is not truly relevant to compliance. But, we've now proposed what is a massive effort, a massive data collection effort, to answer a question not necessary for compliance, certainly an interesting question, but a herculean effort for something that perhaps could be addressed as a special study—something done in parallel but independent of the monitoring needed for compliance.

With regard to the far-field sampling, the proposal as it stands right now from EPA is to do manual sampling at the far-field stations. As we increase the frequency of that sampling, we get to a point where it is a requirement to pull samples every hour, 24 hours a day. At each of those stations, we have to sample at 5 or 6 points over the cross section. Each time you sample, it has to be a vertically integrated sample. So, we've got a wench system; we have to drop a sampler; it has to go through the water column at a certain rate; we have to bring it up; and we have to do that multiple times, because we have to collect separate bottles of water for PCBs, for TSS, and for some of the other analytes. So, we are dropping it at each one of those locations several times. EPA's proposal is to do split-phase sampling at that point, which requires us to field filter every one of those samples when it comes up. So, we are sitting on station 24 hours a day, pulling samples from 5 or 6 points every hour, pulling them up, having to field filter them. And we are doing this from bridges. Bridges that if you go out—we went on the tour, and we saw the Schuylerville station. At the Schuylerville station, there is a very narrow walkway. We will have sampling crews out on that walkway 24 hours a day, in the dark, exposed to traffic, pulling samples. That's one of the primary reasons for having recommended automated sampling. It takes that away from this program. It is a huge logistical issue, it is a huge health and safety issue, to recommend the manual sampling. Now, based on everything that you have said, I think we understand that you are leaning towards the idea of composite sampling. We think that composite sampling is the only feasible, practical way to sample at the far-field stations. We cannot, in practical terms, send crews out there to do the kind of sampling that is proposed in the document.

And so, I think it is very important that, as you go through these recommendations and evaluate what EPA has proposed and evaluate what you have proposed in addition, that you really focus on the issues of feasibility, practicality, and necessity, and help those guide you in your recommendations. And I would also ask that, as you are making your recommendations, please make them very clear. In some cases, at least I was and perhaps nobody else, but at least I was not quite sure what you were recommending. The recommendations were very general, subject to a lot of interpretation. I would ask you that please, if you could, be as clear as possible in what you are recommending with regard to sampling. Thank you.

Day 2, comments from George Hodgson, Saratoga County Environmental Management Council

Thanks for the opportunity to comment this morning. My name is George Hodgson. I'm director of Saratoga County's Environmental Management Council. We're a citizen advisory and environmental advisory group to the Saratoga County Board of Supervisors and its PCB dredging committee. We've been involved with the project since 1991 in commenting on the Phase 1 technical reports. You have a copy of a statement in front of you. Some of this I mentioned to you on October 15, when I last addressed the committee. I just want to mention that I want to thank the peer review committee for really sinking their teeth into the Resuspension Standard yesterday afternoon. You've effectively addressed two of the three important comments that we had: the relationship between TSS, turbidity, and PCBs and also the near-field/far-field monitoring.

Maybe we can jump into the second page. I just wanted to mention to you, as Nancy Musgrove brought up yesterday, the Council feels that high concentrations of water-suspended PCBs, even for short distances downstream from the dredging site, can cumulatively, over the course of the project, cause significant PCB increases to occur in local fish populations. We made that comment as part of the Engineering Performance Standards, and the response we got from EPA, we felt, was inadequate. They stated that the PCBs in the sediment that settle out in the vicinity of the dredge operations are expected to be captured as the dredge moves downstream. Well, if any of you have looked at the locations of the "hot spots" and the surrounding non-dredge areas, it is not going to be a river-wide dredging scenario, but we believe this is a very important consideration, if the goal is in fact to keep PCBs out of the food chain, let's keep it out of those surficial deposits immediately downstream from the dredging sites.

And the TSS: one caution here, or observation, with the use of Phase 1 data to assess, and this was hit upon yesterday, at a much reduced dredging rate, although it is supposed to increase up to Phase 2 levels toward the end of that, we do have a concern that this may not be a valid method of determining actual resuspension rates unless this is in fact replicates the Phase 2 dredging characteristics. The TSS surrogate—I certainly appreciate John Connolly and GE's position on the amount of extra monitoring this might involve. That would be great if we could get a valid surrogate and maybe in Phase 1 we can take a close look at that and try to do that. One question that we have is: wouldn't the heterogeneity of the PCB sediment concentrations also be a major factor in possibly confounding the establishment of a valid correlation between TSS, turbidity, and PCB relationship? Just something to throw out there as a consideration. Hopefully, something along those lines could be done so that extensive monitoring is not required.

The first issue back on page 1, and probably the most important issue to the Saratoga County and its Environmental Management Council, is the, really, the remediation of the upstream sources of PCBs as part of this project. The ROD was very clear and it stated: "successful completion of source control near the GE Hudson Falls plant is important to the full realization of the benefits from the remedial action called for in this ROD." Back in October, I shared with you an article from an area newspaper about the quantities of PCBs—nearly pure PCB oil—that amounted to about eight times the amount that is targeted to be removed by the remedial action. The concerns that we have, we feel that upstream sources are significant. As you may be aware, the bedrock in the upstream areas is highly fractured shale. Seeps have been coming out into the river. It was important enough a couple of years ago that GE was proposing a bedrock tunneling method out under the river in an attempt to intercept seepage into the river from upstream sources.

The question I have of EPA, and also to alert the committee, is: where is this going to occur as part of EPA's engineering program here? Personally, we think this should be addressed in the Engineering Performance Standards, on how this is all going to come together. We feel this is a really important issue. We've had a long standing opinion that upstream sources were in fact a considerable contribution and that the "hot spots," being in areas of deposition, continue to receive deposition, cleaner deposition, and were not a primary source of PCB uptake into the food chain. But, nevertheless, all EPA documents to date are silent on this issue, and I would certainly ask EPA to respond this morning on how this is going to be handled. On January 6, I asked George Pavlou this question at our first Community Advisory Group committee meeting, to provide the public with an assurance that these upstream sources were going to be addressed prior to the dredging of the Upper Hudson River and the "hot spots," and he would not provide that assurance. And that does not give one a warm, fuzzy feeling that this is being taken seriously. What it kind of suggests is that EPA is more concerned about completion of this project in a timely manner than perhaps taking a comprehensive approach at addressing all possible sources of PCBs to the Hudson River. In any event, that is Saratoga County's, one of our most important issues, and I would at this time very much like to hear from EPA, or yourselves certainly, regarding this matter. Thanks for the opportunity to comment.

Day 3, comments from Paul Doody, Blasland, Bouck & Lee, Inc.

My name is Paul Doody. John introduced me, I guess it was 2 days ago, as the lead engineer designing the project, so I certainly appreciate the opportunity to be here to provide some comments to you folks, having sat here for a couple of days and I've been able to observe your discussions. Probably the most frustrating piece was having to observe and not being able to participate, but I guess that's a necessity at this point. In any event, I also, I guess, want to thank you folks for obviously had spent an awful lot of time in a very short period of time to get up to speed on the project. I think you've all done a great job of assimilating, if I may use the term, the information that you have been provided. Obviously, the performance standards, when they are set out, are going to have a direct impact on the design. I mean, they are going to formulate pieces, the basis, of design for this project. So, we've got some direct interest obviously in the performance standards.

One of the things that we have continued to look for is flexibility, and that there be flexibility in these standards that obviously provides us the guidelines to form the basis for the design, but provide enough flexibility so that we can be creative in the design. So, I guess I would encourage you folks to keep that in mind as you put together recommendations. And I think what I have heard over the past couple of days, most of you, I think, agree with that: that there needs to be enough flexibility to allow the design to be creative, to be able to accomplish the standards. A couple of good examples, I guess, I'll just throw out. Victor, I think yesterday you were bringing up one, of some flexibility in a backfill option: if you backfill, you don't need to sample the residuals, but if you want to decide not to backfill, then you would sample and verify that you have achieved some number. So, I think those kinds of examples are good areas of flexibility. And also, in reading through a number of your comments—pre-meeting comments—about allowing flexibility in the field for re-dredging decisions. I mean, the people in the field are going to know what's going on. They're going to know these things, and we need to make sure that the flexibility is built in. One of the other things this morning, Tim you brought up, was a cost-benefit analysis, and not just on the monitoring piece is that important, that's just inherent in the entire design process and applies to all aspects of the design, so I think that is good that we built that cost-benefit analysis in.

One of the discussion areas yesterday was on setting, another point I wanted to make, was on setting dredge cut lines and prisms, and where things were going, and I think this kind of fits in with flexibility as well. And certainly we agree that these cut lines need to be set to provide a reasonable certainty that the inventory is going to be removed. However, I did have a little concern that we were seem to be, you folks were going, in a direction that might want to set some numerical, statistical basis behind it, and I would throw some caution at that at this point in time. While statistics and the chemistry and all that plays into it, there are a number of other factors that play into setting your cut lines as well: sediment type, sub-bottom conditions, the bathymetry that we're in. And so there are an awful lot of factors that go into that. And since we don't know the implications of what some statistical approach might mean, I think it's premature to kind of set a number, put a number on that, so I would suggest we not do that at this point in time. I guess just to throw somewhat of a factoid at that: there was some discussion yesterday about, you know, a 1-foot overcut. And I think folks should understand that if we talk about a 1-foot overcut on this project over a 493-acre area, we are talking about 795,000 cubic yards. So, the implication of that is huge. And if you take that and multiply it out at, let's just say, $200 a yard—we don't know what this is going to cost, but $200 a yard—that's $160,000,000 implication. So, it has a huge implication.

My final point was really on productivity. And I think it just seemed like the group was in general agreement that, at this point in time, where we stand today, we can't definitively determine whether we can or we can't achieve the Productivity Standard that's out there. And there are some other factors that play in that aren't even part of these performance standards that you folks talked about: the quality of life standards and the water quality certification as well. And I guess we agree that Phase 1 is going to be an important piece to this. We need to get out in Phase 1 and really see what we can do: actually start moving some material and implementing the project. I agree, I don't think that further paper exercise is an appropriate use of resources at this time to further document whether the standard's achievable or not. I think we ought to focus on getting out and actually doing some work in Phase 1. For that reason, I think it would be premature for us to set a Production Standard, if you will, for Phase 1 or for Phase 2, and that a standard shouldn't be in the document. So, I think I agree with, I think it was Tim, had mentioned that the term "standard" seems to carry an implication of achievability and an implication of other ramifications. Obviously, we need to have a goal, and you know using it as a goal and as a design goal and a basis of design, having a 6-year duration to play into that makes sense, but I think setting an actual standard at this point in time is premature. And I think that was it. I appreciate the opportunity.

Day 3, comments from Rich Schiafo, Scenic Hudson

Hi, my name is Rich Schiafo. I work with an environmental organization called Scenic Hudson based in Poughkeepsie, New York, that's been advocating for this clean-up for some 20 years now. I also represent a coalition of environmental organizations called Friends of a Clean Hudson, which is a national, state, and regional coalition that also advocates for this clean-up. It's made up of groups such as the Sierra Club, Hudson River Sloop Clearwater, Hudson River Keeper, Appalachian Mountain Club, who has also been advocating for this clean-up for quite some time.

And just a few observations: the first one centers around Phase 1 being discussed as a demonstration project or a pilot project, and that's a little disconcerting in the fact that it's really, we see, as a remediation project. And as this whole project is played out, and the need for the standards and to monitor resuspension and so forth, that Phase 1 was really a way to evaluate and monitor how this should be done, not to demonstrate whether it could be done or not. And that is important in terms of that this really needs to be looked at as a remediation project and not as a demonstration project.

Also, the issue in a lot of the discussions of resuspension, and so it should be that the focus of protecting public health and the environment in terms of what is resuspended. I just want to note that this ROD is based on a lot of work that has gone into years in terms of assessing the risks to human health and the environment and that there are significant risks currently as resuspension occurs presently as we look forward to another spring of spring flows carrying more PCBs down the river. So, certainly there has to be some balancing and consideration that resuspension isn't occurring in a vacuum as you go from upstream, downstream dredging that, as you are dredging a "hot spot" upriver that the "hot spots" in this 40-mile stretch are just waiting for the dredge to come along and there's not movement of PCBs currently in the river. And that the ROD is clear in its preference for removal. In this discussion of resuspension and residuals taking precedent over production, while I certainly appreciate that again in terms of protecting public health, we want to see resuspension minimized to the greatest extent possible, and that's why in some of our October comments, we discussed a lot more the need for more up-front planning and a lot more control measures to be put in place for the standards to be more prescriptive, that equipment should be set up and ready to go, that mitigative measures should be used to control resuspension and not wait until we have a problem to figure out how we are going to address it.

In that regard, there was some of the discussion today as well in terms of data gathering and monitoring is certainly important in gathering data, but again this is a remedial project and not a data gathering exercise. And it's, I think, important to monitor what the impacts of the clean-up are, but also to balance that with some of the longer term impacts. Another observation: in terms of the generation of that data and how that's going to be used by the various stakeholders involved, and certainly Leo made a reference to the newly formed Community Advisory Group. I think that group is going to want access to that data and the public needs to be considered as a player in terms of how that data is used and what process, the discussions this morning on how we go from Phase 1 to Phase 2, an evaluation of what we learned in Phase 1, that the other stakeholders need to be considered and how we're going to be kept informed of that data and how it's going to play into Phase 2. And the concern there, too, is in terms of the time lag and the time needed to evaluate the information from Phase 1 that it's important that this project continues to move forward, and that there's not a lag time when we go from Phase 1 and we decide that year 2 we can't dredge because there is so much information. This project is long overdue, and a lot of work has gone into creating what we have at this point, and we can't see any more delays.

And one other comment regarding the Residual Standard. There is a concern over what is going to be left behind. And I understand the difference between isolation caps to try to contain residuals versus capping in general over inventory that isn't going to be removed, but there is a concern that there are potentially high levels of contamination that might be left behind, with some of these residuals. And, to us, it seems reasonable that two re-dredging attempts are built into the standards. That the project is done that multiple passes are not prudent, but two attempts seem reasonable and again that the project has a preference for dredging, and if the capping is used to isolate residuals that are decided that it is not worth going back in to get them that there needs to be some type of long-term assessment, especially when I hear about the possibility that one foot of sand could be used as an isolation cap. That there needs to be some type of long-term monitoring built in so that the integrity of these caps are monitored and maintained in the long term. Thank you for your hard work that was put into this effort. I appreciate that, and I want to thank EPA and ERG for the opportunity to comment.

Day 3, comments from Lisa Rosman, NOAA

Hi. I'm Lisa Rosman from NOAA's Coastal Protection and Restoration Division, and I primarily want to comment on the Residuals Standard and the discussion that you've had in the last couple of days about the framework and whether you are going to streamline the process. And I just wanted to remind the peer reviewers that the ROD speaks to both the inventory and the residuals. On page 95, it states that "the remedy will remove all the PCBs that are targeted for remediation." And so that's speaking to the inventory and it appears to me that in one of your scenarios that you wouldn't be assessing that, and EPA would not have the information to determine whether the inventory specifically has been removed. Also, it says that "the anticipated residual will be 1 ppm Tri+ prior to backfill." And if you're only measuring the concentration in the surface of the backfill, then EPA will not have the information to determine whether the residuals prior to backfill were at 1 ppm Tri+.

And another point I have is the assumption that the backfill will be stable. We won't necessarily know, in some of these scenarios, whether you have removed all the inventory and that you might have a high level of residuals, and then you're making this large assumption that a foot of backfill will remain stable in the river at all these sites and that backfill could be scoured to re-expose these contaminants and the contaminants could also be re-distributed to non-targeted areas, or to areas that have been remediated.

Another suggestion is that it wasn't clear to me how you were going to deal with whether you were going to make the selection to cap or to backfill. In the process where you skip and go right to backfill, how do you determine whether you cap, such as with an engineering cap, or whether you just going to choose the foot of backfill? Some triggers need to be built into that recommendation. And in the areas where you composite, where you might be compositing sediments, some of EPA's triggers are to specific, single data points, and if you are compositing, you won't have that information. And so whether that could be considered.

And then finally, there is a lot of uncertainty in how the dredge cut lines are being developed. There's analytical variability. There's uncertainty in the Tri+, whether the measurements are reflecting the actual Tri+ that's in the system. And that the NPA includes data where there are cores with incomplete core lengths and abandoned stations, and so both the depth of the inventory and the width of the inventory is not completely known and that then there are going to be interpretations as to what those boundaries are going to be, and unless you collect samples to confirm this, you won't really know whether the inventory will be removed. And that each of the different dredge areas may have different levels of uncertainty associated with them, and whether that could be considered in your final determination on the Residuals Standard. Thanks.

Day 3, comments from George Hodgson, Saratoga County Environmental Management Council

George Hodgson, with Saratoga County's Environmental Management Council. This is the third peer review that I've attended in the last couple of years, and I just want to congratulate you all. I think you did an outstanding job, and if I had to rank, you guys come in number 1. In any rate, I've got a question, more than making general observations, and it relates to the method of dredging. And I heard several of you mention yesterday that it's usually conducted from upstream to downstream, which to me makes a lot of sense. But the question is: Is it always warranted? Is there a benefit to conducting downstream to upstream dredging in certain instances?

This may be a design issue. I would suspect it is. I would certainly like to get a reaction from the peer review committee. Obviously, there is a lot of dredging expertise sitting around this table. In the case in point, as an example, if the sediment de-watering and treatment facility is set upstream of most of the PCB mass to be dredged, is there a likelihood or a high probability that PCB re-contamination of the previously dredged areas by the upriver transportation and possible spillage of dredged PCBs over a previously dredged area on the way to the de-watering site might occur? Case in point again: the de-watering and treatment facility sites, the site has not been selected, but there is a site in the upper reaches of the Thompson Island Pool, which is in Saratoga County. And obviously my concern relates to possible barge and hydraulic dredge [inaudible word] and even plant-side transfer from barge to the facility: possible spillage which might occur over the previously clean section of the river on the way upriver to the treatment facility. And I just kind of throw that out and wondered how this issue would be addressed and what contingencies have been built into the remediation plan and the engineering performance standards, if appropriate, to deal with this issue. I don't know if the committee members would care to comment on this at this time or at least consider this information in the formulation of their final recommendations. Thank you.

Day 3, comments from Merrilyn Pulver, Town of Fort Edward

On behalf of the residents of Fort Edward, I want to take this opportunity to thank the peer reviewers for their attention to all of the issues that are so important to our community. We also wish to complement the peer reviewers for recognizing that residual contamination and resuspension need to take priority over production schedules, during Phase 1 in particular. As discussions developed about capping and backfilling yesterday, we questioned how quickly would dredged areas be capped or backfilled. We wondered how long after dredging a spot, then sampling it, waiting for the results, and perhaps re-dredging and re-testing, will it be for the public to learn, not only the PCB exposure, but also more importantly the exposure of heavy metals.

Another concern touched upon yesterday that we feel needs further discussion is the effects of the upstream sources. Common sense would dictate that the upstream sources should be contained and remediated first. EPA recognized the need during the public hearing process, and Richard Caspe of EPA stated that the dredge project would not begin until after the tunneling project had been completed. In view of the fact that there is a recognition of all of the unknowns, we would suggest that the same panel of peer reviewers meet again once the design has been completed and so that you would have the opportunity to assess that entire design process. And I will say, ever since the release of the ROD, it has been our feeling that a document that calls for dredging was the easiest part of that process. Because there is that old saying that "the devil is in the details." And I'm glad that we are finally in the details.

And I'm just going to reminisce for just a minute. I've been involved in this project for 25 years. Initially, it was adjacent to our farm that a landfill was going to be placed, and DEC was the project leader. A group of farmers incorporated and called themselves CEASE, stood up in courts and won. Now, at that time, I was only in my early 30s and didn't think too much about that. And years later it really dawned upon me that that was a pretty unusual thing to accomplish. By 1984, EPA came forth with their Record of Decision that dredging the river would be environmentally devastating. But, by 1985, the project resurrected itself again, and went to the farm and the home of your next speaker, Sharon Ruggi, who is a Town Councilwoman, in the Town of Fort Edward, of which I am the Town Supervisor. That process went on for several years and, by 1997, the state changed its legislative laws, so that original Site 10, which was adjacent to my farm, then became the preferred location one more time. We went through the 1990s, serving on, I was co-chair of the agricultural liaison committee and Sharon was on the environmental committee, and we went through this process through the 1990s: going to meetings, going to peer review meetings, and going through an entire process of public involvement.

We came to the Record of Decision. We didn't agree with the Record of Decision, but we had to assume a new role, and that new role was, as Town Supervisor, I had to find ways to mitigate the negative impacts that this project will have upon our community. And at the end of the day, somehow in my mind, there had to be a benefit to this project. Now the supposed benefit of the project is based upon a model that included very little resuspension, that included a very short time frame for this project to be completed, and that is why there is a 6-year production schedule that is being suggested here today. Once again "the devil is in the details." I still question whether this project can be completed in a 6-year period, can be completed without totally disrupting our community of which the 6.5 miles of the Thompson Island Pool is wholly located in, and I still question if the details will truly show to us that there is any benefit to doing this project.

Now I know, as I sat in the back of the room for the last 3 days, that we have a lot of people here: some are from the principal responsible party; some are here representing EPA; others are here representing the state of New York or a federal department or a state department; and then there's a few of us that are here representing our communities, and representing the concerns of the public safety and health and well being, and representing the need to protect our economic viability of our communities, and of the need for this project to have a benefit at the end of the day to our communities. I do thank the peer reviewers. I do agree with George that I found this peer review group to have a firm grasp on the details, and we're glad to finally be talking about the details. Those are things that we've been wanting to talk about for a very, very long time, and I thank you for your input.

Day 3, comments from Sharon Ruggi, Town of Fort Edward

My comments will be very brief. I, too, want to commend all of you for the effort that you have put into the discussion of these performance standards. As you observed when you toured the dredge area, the Upper River is very narrow. It certainly is not the width that it is, say, that when you get down to New York City. And with the discussion concerning the need to dredge from north to south, we need to look at the number of dredges, the support equipment, and the data gathering boats that will be necessary in order to assess the impact to the recreational use of the river. That recreational use is vitally important to our community: the dollars that are derived from the recreational use. And so I think that we need a realistic discussion of exactly the numbers of boats that will be needed in order to do this project.

So, as we wrap up here today, there is one huge question that I pose to you, and that is: can you sit here and say with any degree of uncertainty that the three standards can be met? We all recognize that these are standards—not goals. They're standards, and the question that we have to answer is: can they be met?

Day 3, comments from Harry Gutheil, Town of Moreau

Thank you and good morning. I found that you're a great group. It's been quite enlightening and it certainly perks our interest in a whole number of areas on things that I certainly had not thought of, and I think the dialog was very good. So, thank you, each and every one of you. I know you put a lot of time and thoughts into it long before you got here.

I'm not going to go through a lot of the items that you people have covered, and I think the dialog amongst you will help us lead to a better project here. My big concern, I think, was the discussion on production, and I'm not sure if the production should be a standard or a goal, but I certainly don't think that we should make sacrifices to the residual goals and standards and to the resuspension. The people in our area are extremely concerned about resuspension, and we wouldn't want to see productivity get in the way, trying to reach those standards, if the sacrifice is in compromising residual and resuspension progress. The other item is I'm afraid if we start looking at the production standards, that it could influence seriously the difference on whether we are going to use a hydraulic dredge or the mechanical dredge. And certainly, you know, we in our town have a not-an-overly-fond impression of the mechanical dredge. We know that there is an awful lot of debris in that river, and we are concerned about the effects that debris would have on a mechanical operation. And one of the other items that was touched on, I think, are very critical, is in case something goes wrong—and there's no question, it's impossible to perceive everything that you're going to have happen out there—but the quickest turnaround time on lab results is very important if we are going to have any kind of serious quality control with this project. So, those are my brief comments, and thank you.

Appendix F

Minutes From the October 2003 Briefing and Site Tour

Minutes From the Briefing and Site Tour for the Peer Review of the "Draft Engineering Performance Standards—Peer Review Copy" for the Hudson River PCBs Superfund Site

On October 15 and 16, 2003, ERG conducted a "Briefing and Site Tour." The meeting was held at the Holiday Inn Hotel in Saratoga Springs, New York. ERG facilitated the meeting, which was open to the public. The meeting was attended by the peer reviewers, representatives of EPA and its contractors, and approximately 55 observers.

The purpose of this meeting was to provide nine independent peer reviewers with background information on the Hudson River PCBs Superfund site, the Draft Engineering Performance Standards (EPS) that the U.S. Environmental Protection Agency (EPA) developed for this site, and selected stakeholder perspectives on the Draft EPS. Specifically, ERG invited the 13 stakeholders who submitted written comments during the public comment period of the Draft EPS to address the peer reviewers at the briefing and site tour.

The minutes below summarize the presentations made at the briefing and site tour. Attachments to these minutes include (1) the meeting agenda, (2) a list of the peer reviewers, (3) a list of EPA and contractor participants, and (4) a list of observers at the meeting.

Ms. Jan Connery (ERG), Meeting Facilitator, Welcome Remarks and Introductions. Ms. Jan Connery opened the meeting by welcoming the peer reviewers and observers and describing the meeting's purpose: to give the peer reviewers background information on the Hudson River PCBs site, to have EPA describe the contents of the Draft EPS, and to allow selected stakeholders to provide comments on the review documents. Ms. Connery noted that the purpose of the meeting was not to peer review the Draft EPS, but rather to give the peer reviewers context for conducting their individual reviews. Ms. Connery indicated that the actual peer review meetings would take place in January 2004. She then reviewed the agenda, after which the peer reviewers, representatives from EPA, and representatives from EPA contractors introduced themselves.

EPA Presentations. As the attached agenda indicates, EPA and its contractors gave several presentations for the remainder of the first day of the meeting. Copies of the presentation materials used by each of the following speakers are available on EPA's Hudson River Web site (www.epa.gov/hudson) and are included in the peer review record, which the public can obtain by contacting EPA Region 2. Brief summaries of the presentations follow:

- *Ms. Alison Hess (EPA), Site History and Background.* Ms. Hess reviewed the history of the Hudson River PCBs site and EPA's involvement with site assessment and proposed remediation activities. First, Ms. Hess showed several maps and photographs of various sites along the Hudson River, focusing primarily on the Upper Hudson River. Ms. Hess identified the locations of the two General Electric Company (GE) facilities that had discharged PCBs to the Upper Hudson River, and she showed photographs of the location of the former Fort Edward Dam, the Thompson Island Pool, and a lock along the Champlain Canal.

Ms. Hess briefly reviewed the activities EPA undertook during the recent site reassessment and noted that the major work products generated during this time were subject to independent peer review. She then presented selected graphs and charts to illustrate trends in PCB levels found in sediments, surface water, and fish in the Upper Hudson River. Ms. Hess noted that EPA issued a Record of Decision (ROD) for the contaminated sediments in 2002. Ms. Hess described the remedial objectives, the selected remedy, and other key features of the ROD. She also listed community concerns that EPA considered when preparing the ROD. Finally, Ms. Hess identified specific aspects of the ROD that EPA changed after receiving public comments.

- *Bruce Fidler (Malcolm Pirnie, Inc.), Introduction to the Standards.* Mr. Fidler opened his presentation by explaining that EPA developed the Draft EPS to address public concerns about the dredging. He explained that the goals of the standards were to have enforceable metrics based on objective criteria that (1) promote accountability and (2) ensure that the remedial activities meet the objectives stated in the ROD. Mr. Fidler then listed several site remediation objectives and the corresponding performance standard goals that were developed to meet them. He identified the three EPS that the ROD specifically requires: a Resuspension Standard, a Residuals Standard, and a Productivity Standard.

  Mr. Fidler described several challenges EPA and its contractors faced when developing the standards. Examples of these challenges include competing public concerns, deciding the appropriate level of prescriptiveness, and weighing the need for comprehensive measures against the need for a simple and flexible approach. After describing several challenges, Mr. Fidler noted that the development team ultimately recognized that the standards should balance the environmental protection needs with the production needs. He acknowledged that this balance involves some inherent tension and interactions, as described later in this section.

  After providing this introduction, Mr. Fidler explained the internal input and review process that EPA used when developing the Draft EPS. He identified the project team members, the project leaders, and the members of the quality review team. Finally, Mr. Fidler identified the documents that ERG was providing to the peer reviewers, which included the Draft EPS and multiple background documents on CD-ROM. Copies of this CD-ROM are available in the peer review record.

- *Ed Garvey (TAMS Consultants, Inc.), Resuspension Standard.* Mr. Garvey opened his presentation by listing the requirements in the ROD that affected the development the Resuspension Standard. He quoted from the ROD that this standard ultimately is intended to “ensure that dredging operations are performed in the most efficacious manner, consistent with the environmental and public health goals of this project." Mr. Garvey explained that, after Phase 1 of the project is completed, EPA plans to reevaluate and, if necessary, revise the Resuspension Standard. Mr. Garvey then listed the objectives of the Resuspension Standard and defined several terms used in the standards (e.g., near-field versus far-field, total PCBs versus Tri+ PCBs, suspended PCBs versus dissolved PCBs).

Mr. Garvey outlined the framework for the Resuspension Standard, explaining that it involves both PCB concentration and PCB load limits, water column monitoring requirements, and engineering contingencies when PCB concentrations or loads exceed certain action levels. He indicated that the standard includes three action levels plus a Resuspension Standard Threshold. For each action level, Mr. Garvey then listed the corresponding near-field and far-field concentration or load limits (whether for total PCBs, Tri+ PCBs, or suspended solids) and the actions that would be implemented if these limits were exceeded. Mr. Garvey also reviewed key aspects of the monitoring program proposed to support this standard. For instance, he specified proposed monitoring locations, monitoring parameters, and sampling frequency. Mr. Garvey described how EPA developed the proposed sampling frequencies out of a desire to minimize false positive and false negative conclusions regarding exceedance of action levels. Finally, he described in general terms the engineering contingencies that may be required if action levels are exceeded, as well as the conditions that must be met for operations to return to lower action levels.

After describing what the Resuspension Standard requires, Mr. Garvey reviewed some of the supporting analyses that EPA considered when developing the standard. First, he reviewed baseline conditions for concentrations of PCBs and total suspended solids (TSS), including how these parameters vary with season, flow, and location along the Upper Hudson River. Second, Mr. Garvey described how EPA developed the quantitative action level triggers given what is known about baseline conditions. He noted, for instance, that the PCB load trigger for the Evaluation Level (300 grams/day) was set at the lowest dredging-related signal that could be reliably distinguished from baseline conditions; he then explained how EPA developed the PCB load and concentration triggers for the Control Level and Concern Level. Third, Mr. Garvey reviewed results of modeling analyses that were conducted to help assess potential water quality impacts. He introduced the near-field (CSTR-Chem and TSS-Chem) and far-field (HUDTOX) models that were used and reviewed their predictions for the long-term recovery of the Hudson River under different scenarios. Finally, Mr. Garvey summarized sampling results from selected case studies, primarily that for New Bedford Harbor, to provide perspective on the proposed Resuspension Standard.

At the end of this presentation, Mr. Garvey discussed anticipated refinements to the Resuspension Standard (both prior to implementing Phase 1 and after completing it), reviewed key aspects of the proposed action levels and corresponding responses, and summarized EPA's responses to several public comments the Agency received regarding the proposed Resuspension Standard. Mr. Garvey then responded to several questions that peer reviewers and observers asked about the proposed standard, the attendant monitoring program, and the remedial design.

- *Ed Garvey (TAMS Consultants, Inc.), Residuals Standard.* Mr. Garvey first quoted the ROD's specific requirements for dredging residuals: "removal of all PCB-contaminated sediments within areas targeted for remediation, with an anticipated residual of approximately 1 mg/kg Tri+ PCBs (prior to backfilling)" and "backfill of dredged areas with approximately one foot of clean material to isolate residual PCB contamination and to expedite habitat recovery, where appropriate." He then linked this requirement to the objectives of the Residuals Standard, which are to detect and manage contaminated residuals and to verify achievement of the required pre-backfill concentrations.

  After defining key terms relevant to the Residuals Standard, Mr. Garvey described key features of this standard's framework. In general, the proposed framework involves a post-dredging sampling program, along with a decision tree to follow based on the sampling results. Mr. Garvey outlined the specifications of the sampling program, explaining how EPA estimated the number of samples that would be needed per certification unit to have confidence that the residual contamination meets the requirements set forth in the ROD. He also described specific aspects of the sampling program, such as the proposed core depth and the use of sediment profile imaging. He noted that sampling will not only help confirm removal of PCB inventory, but will also be used to evaluate the residual contamination levels.

  Mr. Garvey then explained how the post-dredging sediment sampling results will be interpreted. He indicated that post-dredging certification will be evaluated both for 5- and 20-acre certification areas. He identified the PCB residual limits that must be met for the arithmetic mean concentration, the highest concentration, and the second highest concentration. Mr. Garvey then stepped the reviewers through the decision tree that will be used to determine what follow-up actions are needed for certification areas that are initially found not to comply with the 1 mg/kg Tri+ PCBs residual contamination level. He reviewed the specific requirements for re-dredging, capping, and backfilling, and showed how the requirements vary with the arithmetic mean Tri+ PCB concentration found in a given certification unit (i.e., residuals with 1–3 mg/kg Tri+ PCBs, residuals with 3–6 mg/kg Tri+ PCBs, and residuals with >6 mg/kg Tri+ PCBs). Peer reviewers were referred to a flow chart (Figure 1-1 from Part 2 of the Draft EPS) for further information on the decision tree.

  After describing the framework of the Residuals Standard, Mr. Garvey reviewed the technical analyses conducted when developing it. First, he presented data from other remediation projects on the percent PCB concentration reduction achieved by dredging, noting that the proposed goal for the Hudson River (96–98% reduction) should be achievable. Second, he presented data (on the distributions of residual PCB concentrations at other sites) from which EPA found that distributions of PCB levels in residuals are best approximated using log-normal distributions, not normal distributions. Third, he described the statistical analysis that EPA used to derive the concentration thresholds and number of samples per certification area that are proposed in the Residuals Standard. Finally, Mr. Garvey demonstrated typical applications of the Residual Standard for multiple scenarios.

To conclude, Mr. Garvey discussed anticipated refinements to the Residuals Standard. These included evaluating the site-specific data collected during Phase 1 to determine if the action levels, sizes of certification units, depths of sediment core samples, maximum number of re-dredging attempts, or any other aspect of the standard should be revised. Mr. Garvey also briefly reviewed key points for the Residuals Standard and summarized EPA's responses to several public comments relevant to this standard. Mr. Garvey then answered several questions that peer reviewers and observers asked.

- *Scott Thompson (Malcolm Pirnie, Inc.) and John Mulligan (Malcolm Pirnie, Inc.), Productivity Standard.* Two EPA contractors summarized the proposed Productivity Standard. First, Mr. Thompson presented the main objective for the standard, which is to monitor and maintain the progress of dredging in order to meet the 6-year project duration stated in the ROD. Mr. Thompson then reviewed the productivity targets and requirements for both Phase 1 and Phase 2 and identified the responses that will be initiated should the targets or requirements not be met. He also explained differences in the Phase 1 and Phase 2 implementation of the standard. He then presented sample calculations of dredging productivity and a sample production schedule. Finally, Mr. Thompson identified several constraints that might limit dredging productivity. These constraints included the need to generally work from upstream to downstream, obstructions due to navigation, and the need for seasonal close-out before the winter. He also listed production factors (e.g., dredging rates) that EPA considered when developing its sample production schedule and displayed several photographs and illustrations of dredging equipment that may be used in the Upper Hudson River.

  After Mr. Thompson described the standard, Mr. Mulligan reviewed the analyses that were conducted in support of the proposed dredging production rates. Mr. Mulligan reviewed assumptions that were made in determining the feasibility of the sample production schedule. Mr. Mulligan emphasized that the sample production schedule was developed only in support of the proposed Productivity Standard and that the actual production schedule will be specified in the remedial design. He then listed many of the assumptions made when developing the sample production schedule. These assumptions include: use of mechanical dredges only, use of containment at all dredging site, typical times for dredging cycles, months in the dredging season, and the number of hours per day when dredging is expected to occur. Mr. Mulligan reviewed results from two case studies (New Bedford Harbor and Grand Calumet River) to illustrate production rates observed in other environmental dredging applications. Finally, Mr. Mulligan described how on-shore processing of sediment (e.g., de-watering, water treatment) factored into the sample production schedule. Mr. Mulligan acknowledged that many details regarding the on-shore processing facility will be resolved once the facility locations and designs are specified.

At the end of his presentation, Mr. Mulligan displayed public comments that EPA received pertaining to the Productivity Standard. The comments addressed potential interactions between the Resuspension and Productivity Standards. Mr. Mulligan summarized EPA's responses to these comments. (Note that the following presentation addressed the same comments.) Mr. Mulligan then responded to peer reviewers' questions regarding the Productivity Standard. The questions addressed various issues, including assumptions regarding re-dredging, water quality certification requirements, and in-river transportation of sediments.

- *Don Hayes (University of Utah), Interactions Among the Standards.* Mr. Hayes gave an overview of potential interactions among the three engineering performance standards. First, he reviewed the challenges EPA faced when developing the standards. For instance, the individual standards needed to address specific requirements, but all three standards must be able to be implemented. Further, the standards need to have some set limits, yet include flexibility to allow for innovative project design and for the dredging contractor to make certain decisions in the field. Mr. Hayes then noted that the Draft EPS were developed by a Technical Team and critiqued by a Quality Review Team. Mr. Hayes acknowledged that a natural tension exists between the three standards and identified and addressed several "false notions" regarding this tension. Mr. Hayes then reviewed the rationale behind some specific aspects of the individual standards. Finally, he answered several questions that the peer reviewers asked regarding potential interactions among the standards.

Stakeholder Presentations. Prior to the Briefing and Site Tour, ERG contacted the 13 stakeholders who submitted comments to EPA on the public review copy of the Draft EPS and offered these individuals and organizations time slots at the meeting during which they could address the peer reviewers. All 13 stakeholders accepted these offers. Brief summaries of their presentations follow:

- *George Hodgson, Saratoga County Environmental Management Council.* Mr. Hodgson reviewed three main points from the comments his organization submitted to EPA during the public review period of the Draft EPS. First, Mr. Hodgson emphasized the importance of eliminating upriver sources of PCBs before conducting sediment remediation activities in the Upper Hudson River. Second, Mr. Hodgson expressed concern over EPA's evaluation of PCB resuspension during dredging, especially considering findings recently reported by the U.S. Geological Survey for the Fox River. Finally, he questioned the proposed approach for developing relationships between near-field suspended solids and turbidity measurements to far-field PCB levels. A copy of Mr. Hodgson's comments were distributed to the peer reviewers and are included in the peer review record, which can be accessed from EPA Region 2.

- *John Haggard, General Electric Company (GE).* Mr. Haggard commented on several aspects of the Draft EPS, focusing first on the proposed production rates. He indicated that the proposed dredging in the Upper Hudson River is considerably larger than all other environmental dredging projects conducted to date. Mr. Haggard doubted that the proposed production rate could be achieved, given the scope of the project and the many requirements outlined in the Draft EPS. He encouraged the peer reviewers to focus on critical issues pertaining to the feasibility, benefit, and cost-effectiveness of the proposed dredging project. Mr. Haggard suggested that limiting resuspension and dredging safely should be primary goals of the Draft EPS, while achieving production rates should be a secondary goal. After identifying numerous constraints that GE and its contractors must consider when developing the project design, Mr. Haggard emphasized the need for the EPS to be both protective and practical.

  Mr. Haggard reviewed GE's comments on the individual performance standards, starting with the Productivity Standard. Mr. Haggard identified several concerns he has regarding the development of the standard. For instance, he noted that the proposed production rates are unprecedented and that critical design considerations (e.g., locations of processing facilities, transport logistics) have not been addressed. Based on these and other concerns, Mr. Haggard suggested that Phase 1 should be conducted not with a production standard, but rather with a design goal of dredging between 150,000 and 300,000 cubic yards of sediment (i.e., the target range specified in the ROD). He indicated that EPA could then establish production rates for Phase 2 based on the experiences gained during Phase 1.

  Mr. Haggard had several comments regarding the proposed Resuspension Standard. First, he noted that some elements of the monitoring program are unnecessary, are logistically infeasible, and add no benefit to the dredging project. For instance, Mr. Haggard commented that monitoring for the Draft EPS should focus entirely on determining compliance with the standards and should not include "forensic" sampling (i.e., sampling with the intent of investigating sources of specific releases). He then illustrated several difficulties with implementing the monitoring program, both for baseline conditions and for sampling required when certain action levels are triggered. He suggested several revisions to the monitoring program, such as routinely collecting 24-hour average composite samples at far-field stations and analyzing them for total PCBs (without split-phase analysis), using automated samplers to collect the composites, and reducing or removing near-field monitoring requirements for total suspended solids. Mr. Haggard also recommended changes to the framework of the Resuspension Standard, such as a way of combining the proposed evaluation and concern levels.

  Mr. Haggard then commented briefly on the draft Residuals Standard. He noted that this standard should have the flexibility to allow certain decisions to be made by dredging contractors in the field, rather than having an overly prescriptive approach. Flexibility is necessary as conditions in some parts of the river (e.g., rocky areas) might not be conductive to multiple dredging attempts, even if residuals concentrations exceed action levels that would trigger re-dredging under the current framework. Mr. Haggard also suggested that the flow chart that outlines the Residuals Standard should be simplified.

Mr. Haggard concluded his presentation by summarizing key points raised earlier. He reviewed experiences from 39 major environmental dredging projects. Noting that none of these past projects achieved the production rates proposed for the Upper Hudson River, he indicated that Phase 1 would be the best indicator of the feasibility of the proposed dredging production rates. Mr. Haggard gave the peer reviewers copies of his presentation materials and GE's original comments on the public review copy of the Draft EPS. This information is included in the peer review record, which can be accessed from EPA Region 2.

- *Kristen Mulligan, Clean Ocean Action.* After introducing herself and the goals of the organization she represented, Ms. Mulligan informed the peer reviewers that upstream activities at the Hudson River PCBs Superfund site have already contaminated sediments in the Lower Hudson River, the New York/New Jersey Harbor, and near-shore areas of the Atlantic Ocean. She argued that removal of contaminated sediments in the Upper Hudson River will have system-wide, long-term benefits that outweigh the short-term environmental impacts caused by dredging. Ms. Mulligan indicated that her organization supports the comments offered by Scenic Hudson and the Technical Assistance Grant representative, which are reviewed later in these minutes. She then presented specific comments on the Resuspension Standard and its associated action levels and the proposed monitoring program. These comments are included in her presentation materials, which are now part of the peer review record that ERG submitted to EPA Region 2.

- *John Henningson, Technical Assistance Grant Advisor for Scenic Hudson.* Mr. Henningson opened his presentation with an overview of his comments. He asserted that the long-term benefits of the site remedy will outweigh potential short-term impacts, though such short-term impacts should be minimized nonetheless. He also recommended that the performance standards be strict enough to ensure that the remedy is protective of human health and the environment. Mr. Henningson then presented four key issues regarding the Draft EPS; these related to contingency measures, sampling and monitoring, impact of high flow events, and the design for caps and backfill. He also elaborated upon comments that he submitted during the public review period for the Draft EPS. A main comment was that the Draft EPS should have a proactive or preventive approach, where possible, and avoid vague descriptions of engineering contingencies when action levels are exceeded. Mr. Henningson offered several specific comments on the proposed monitoring program to evaluate the Resuspension Standard, the proposed post-dredging confirmatory sampling to evaluate the Residuals Standard, and the framework for the Residuals Standard (e.g., a preference for contamination removal over capping, the need for performance standards for caps). Details on these comments are included in Mr. Henningson's presentation materials, which are part of the peer review record now available from EPA Region 2.

- *Paul Lilac, Saratoga County Board of Supervisors.* Mr. Lilac addressed the three proposed engineering standards separately. First, regarding the Resuspension Standard, Mr. Lilac covered at least the following topics: the Draft EPS does not adequately address protection of water supply intakes, resuspension rates observed at other environmental dredging sites are not fully considered, and focus on far-field effects might cause EPA to overlook re-contamination of sediments in the near field. Second, regarding the Residuals Standard, Mr. Lilac expressed concern about interpretation of case studies, long-term integrity of caps, the significance of upstream sources of PCBs, and the complexity of the proposed standard. Finally, addressing the Productivity Standard, Mr. Lilac suspected that EPA was overly optimistic in its sample production schedule, partly because EPA did not account for potential interactions between the Draft EPS and quality of life standards. A copy of Mr. Lilac's presentation materials is included in the peer review record for this site.

- *Tim Sweeney, Hudson River Sloop Clearwater.* After presenting background information on the organization he represents, Mr. Sweeney presented brief comments on the Draft EPS. He noted that many of his comments are consistent with those provided by John Henningson. Mr. Sweeney first indicated that he strongly supports use of controls (e.g., silt curtains) to minimize resuspension during dredging. He recommended incorporating containment measures into the design of the remediation project, rather than deciding in the field that containment may be necessary after elevated resuspension levels are observed. Mr. Sweeney also advocated the use of hydraulic dredging over mechanical dredging whenever and wherever possible. Next, Mr. Sweeney recommended that the monitoring program include requirements for mobile monitoring of turbidity plumes. Finally, he cautioned against having the standards give too much discretion to field operators and instead suggested that decisions should be made in a fashion consistent with the ROD.

- *Rev. Scott Smith, First Baptist Church.* Rev. Smith opened his presentation by indicating that he supports the requirements of the Draft EPS for PCBs. His comments, however, suggested that EPA should broaden the standards to account for potential resuspension and residuals of other contaminants, particularly metals and selected organic contaminants other than PCBs. Rev. Smith noted that the concern about other contaminants in the Upper Hudson River has been voiced previously at community discussions and Governor's Task Force meetings. The issue—especially lead contamination—also came to the forefront during soil excavation activities conducted in 1999–2000 at Rogers Island. To illustrate this point further, Rev. Smith displayed summary statistics from soil sampling conducted in the late 1990s at selected residential properties on Rogers Island. Rev. Smith also displayed results of dredge spoil samples collected from the Hudson River area in 1992; these samples, he argued, showed evidence of elevated metals contamination. He then reviewed adverse health effects that have been associated with elevated exposures to lead. Rev. Smith presented additional information about other contaminants, namely hexavalent chromium, dioxins, and pesticides. In conclusion, Rev. Smith recommended that the peer reviewers consider the existence of other contaminants in their reviews of the Draft EPS. A copy of Rev. Smith's presentation is included in the peer review record.

- *Warren Chesner, Seaway Environmental Technologies, Inc.* Mr. Chesner commented primarily on the Resuspension and Residuals Standards, focusing on issues of confidence, uncertainty, and risk. First, Mr. Chesner acknowledged that many analyses in the Draft EPS involve considerable uncertainty due to the lack of site-specific data on the impacts of dredging in the Upper Hudson River. Consequently, a question remains as to whether the Draft EPS are feasible. As an example of his concern, Mr. Chesner indicated he knows of no environmental dredging projects that have achieved the PCB clean-up level that EPA proposes. He voiced concern about several additional issues: performance standards being developed before the remedial design is prepared, using sampling results from other river systems to estimate the variability in PCB levels in Hudson River residuals, and ambiguities regarding the amount of capping that will be permitted and the minimum design requirements for these caps. Finally, Mr. Chesner offered several comments on the proposed baseline monitoring program; he raised questions about the monitoring locations, the monitoring criteria, and relationships between turbidity and total suspended solids. These questions and Mr. Chesner's final recommendations are included in his presentation materials, which are part of the peer review record available from EPA Region 2.

- *John Davis, New York State Attorney General's Office.* Mr. Davis' comments focused on how EPA proposes interpreting post-dredging confirmatory sampling under the Residuals Standard. Specifically, he questioned the decisions that would be made when residual PCB contamination reaches "Action Level 3," which allows the field operator to decide whether the residuals should be capped or re-dredged. Mr. Davis noted that there might be some scenarios in which relatively large areas within a certification unit could have residual concentrations greater than 13 ppm Tri+ PCBs, even though the entire certification unit might have concentrations less than 6 ppm Tri+ PCBs. (A copy of the figure Mr. Davis used to illustrate this point is included in the peer review record.) He was concerned that field operators, in cases such as this, might opt for using caps when re-dredging could focus on removing the PCBs in the highly contaminated subset of the certification unit. Such discretion, Mr. Davis argued, might lead the remedy to involve too much capping, with not enough dredging. He suggested that EPA should be involved in making the decisions regarding capping and re-dredging.

- *Rich Schiafo, Friends of Clean Hudson.* Mr. Schiafo voiced concern about inconsistencies between the Draft EPS and the ROD. For instance, he noted that the ROD is clear in its preference that PCBs be removed from the Upper Hudson River, yet the Residuals Standard in the Draft EPS allows capping rather than re-dredging under certain circumstances. Further, he was concerned that proposed increases to the size of certification units creates a possibility of leaving contamination behind in “hot spots,” even though the average concentration levels across the large area might comply with the Residuals Standard. Next, echoing concerns raised by other observers, Mr. Schiafo cautioned EPA against giving the field operators too much discretion, and encouraged EPA involvement regarding decisions about capping and re-dredging. While he acknowledged the benefit of having some flexibility in the standards, Mr. Schiafo recommended that the Draft EPS include a more prescriptive approach with clearly defined contingency measures. Finally, Mr. Schiafo expressed concern about turnaround time for sediment sampling, given the time it has taken to have a public release of GE’s recent sediment sampling study.

- *Matthew McMahon, retired research fellow.* Mr. McMahon commented primarily on whether the proposed dredging will lead to unacceptable risks or quality of life concerns due to PCB contamination of drinking water at locations in the Lower Hudson River, namely the Poughkeepsie and Rhinebeck water supplies. Mr. McMahon acknowledged that the monitoring program would likely detect potentially unhealthy PCB concentrations before they reached these water supplies, but he noted that some residents would be upset knowing their water contains PCBs, even if at concentrations lower than regulatory limits. Mr. McMahon then reviewed EPA’s responses to the comments he submitted during the public review period. (Note: ERG provided the peer reviewers with copies of EPA’s responses to all of the comments that the Agency previously received.) Finally, Mr. McMahon encouraged peer reviewers to consider the mechanisms by which PCBs will transport downstream, given that dissolved phase releases are not controlled by silt curtains or other conventional containment measures. A copy of Mr. McMahon’s presentation materials is included in the peer review record.

- *Merrilyn Pulver, Town of Fort Edward.* Ms. Pulver first commented on several aspects of peer review process. To supplement the insights provided to the peer reviewers on the site tour, Ms. Pulver indicated that the Town of Fort Edward would send each peer reviewer a videotape that documents the town’s history and concerns regarding the proposed dredging project. She then addressed two issues that were not fully addressed during the site tour: the size of the locks along the Upper Hudson River and the ongoing New York State Department of Environmental Conservation (NYSDEC) remediation project at the GE Hudson Falls facility. Based on the experiences with the NYSDEC project, Ms. Pulver wondered what safeguards, contingency measures, and guarantees EPA will offer about the performance of the environmental dredging. Regarding the peer review process, Ms. Pulver encouraged the peer reviewers to request from stakeholders as much information as is necessary to evaluate the Draft EPS thoroughly.

Mr. Pulver then provided specific comments on the Draft EPS. She first questioned whether all three proposed standards can be achieved simultaneously, considering experiences with other sites. Ms. Pulver identified some potential conflicts among the standards, as well as conflicts between the Draft EPS and the separate quality of life standards. Ms. Pulver concluded that the three performance standards are not compatible, and she encouraged the peer reviewers to acknowledge that it is unrealistic to complete the project within 6 years while meeting the performance standards. Further, she argued that the production schedule was set only to satisfy a "political calendar," and she asked the peer reviewers to critically evaluate whether the proposed production schedule is realistic. She also asked the peer reviewers to recommend that EPA not require round-the-clock dredging. Finally, Ms. Pulver requested that the peer reviewers specify a realistic production schedule, from which EPA could develop a reasonable Productivity Standard. One suggestion was that EPA place a higher priority on the Resuspension and Residuals Standards, particularly during Phase 1, should the Agency find that the production schedule is unrealistic. A copy of Ms. Pulver's comments is included in the peer review record.

- *Judy Dean, CEASE.* Ms. Dean summarized comments that CEASE submitted to EPA during the public review period for the Draft EPS. Regarding the Resuspension Standard, Ms. Dean was concerned that EPA based its standard on unrealistic resuspension rates. She wondered if the public will be allowed to access the monitoring data as soon as they become available to EPA and its contractors and if the public will be asked for input on proposed engineering evaluations and contingencies. Regarding the Residuals Standard, Ms. Dean noted that as much as 80% of the PCBs will remain in the Hudson River, even after "large-scale dredging." Ms. Dean wondered how decisions will be made about backfilling, re-dredging, and capping, and how these decisions might affect potential releases of PCBs to the river. She noted further that sufficient information is not available to evaluate these considerations, particularly for sub-aqueous capping. Regarding the Productivity Standard, Ms. Dean expressed concern about the activities that might take place (e.g., round-the-clock dredging, use of multiple dredges, increased shoreline activities) to achieve the proposed production schedule and whether these activities would conflict with the quality of life standards. She recommended that the EPS remain in draft form until the peer review and the quality of life standards are completed. She urged the peer reviewers to carefully evaluate the Draft EPS in light of the information presented in the case studies, which show that dredging projects have generally not been able to meet the types of goals outlined in the Draft EPS.

- *Lisa Rosman, National Oceanic and Atmospheric Administration (NOAA).* Ms. Rosman summarized comments she and her colleagues at NOAA have regarding two of the standards. First, regarding the Residuals Standard, she expressed concern that use of 6-inch cores in the post-dredging confirmatory sampling would not be able to distinguish dredging residuals from missed PCB inventory. She encouraged the reviewers to consider this issue, along with the implications of including the "fluff" layer of sediments in the confirmatory samples. Further, Ms. Rosman suggested that EPA develop performance standards for engineering caps to ensure that residual PCBs are sequestered from the environment. Second, regarding the Resuspension Standard, Ms. Rosman encouraged peer reviewers to consider the limitations of the 650 kg PCB load that EPA allows over the entire 6-year dredging project. This level was estimated, using EPA's models, to be acceptable in terms of long-term recovery of the Hudson River. Ms. Rosman recommended that EPA examine the recent sediment sampling data collected by GE to determine if this PCB load limit needs to be revised.

Closing Remarks. After the stakeholder presentations ended, the peer reviewers heard closing remarks from EPA contractors, EPA, and ERG. First, Mr. Hayes (University of Utah) provided additional insights on several issues that stakeholders raised during their presentations. He informed the peer reviewers, for example, that EPA and its contractors debated whether certain issues (e.g., performance standards on caps) were more appropriately addressed in the remedial design or in the Draft EPS. Next, he clarified that EPA views Phase 1 as the first year of the 6-year dredging project; this year should be viewed as a significant removal project or a "proof-of-concept" project, rather than as a demonstration project. Mr. Hayes then addressed several specific issues, such as the role of capping, the feasibility of different types of sampling, and the complexity observers noted in some standards, particularly in the Residuals Standard.

Second, Ms. Hess (EPA) explained the background for the current peer review, noting how it fulfills requirements listed in the ROD. She then quoted passages from EPA's *Peer Review Handbook* to provide perspective on what the Agency typically seeks from independent, external peer reviews. Ms. Hess then identified various other activities occurring at the same time as the peer review, including developing the remedial design, preparing the quality of life standards, and preparing the community health and safety plan. Ms. Hess listed the information that ERG is providing to the peer reviewers as background information (e.g., the public comments, EPA's responses to public comments, stakeholders' suggested charge questions, the ROD, selected white papers). Lastly, Ms. Hess reviewed the questions in the charge to the peer reviewers, noting that the final question is open-ended and invites the peer reviewers to comment on any technical issues not explicitly covered by the other questions.

Lastly, Ms. Connery (ERG) thanked the peer reviewers, stakeholders, and observers for attending the meeting. She indicated that, over the next 3 months, the peer reviewers will independently evaluate the Draft EPS and respond to the charge questions. She asked that the peer reviewers forward any questions of clarification they have during this time to ERG for response. Ms. Connery noted that the actual peer review meeting is tentatively scheduled to occur on January 27–29, 2004.

Site Tour. ERG reserved seats on the site tour for the peer reviewers, EPA and its contractors, selected stakeholders, and observers. Observers who did not wish to ride on the tour bus were invited to follow in their personal vehicles. The site tour began in Saratoga Springs and stopped at four locations along the river. At each of these locations, Ms. Hess (EPA) briefly described the surroundings and their relevance to the site reassessment and the Draft EPS, after which peer reviewers asked questions of EPA and stakeholders. The first day of the 2-day briefing ended when the bus returned to Saratoga Springs. During the site tour, the bus stopped at the following locations:

- An observation point adjacent to Bakers Falls and directly across the Hudson River from GE's Hudson Falls plant
- The northern tip of Rogers Island
- The West River Road Marina
- The Schuylerville far-field sampling location at the Route 40 bridge

Attachments:

- Meeting agenda
- List of peer reviewers
- List of EPA and contractor participants
- List of observers

United States
Environmental Protection Agency
Region 2

Hudson River PCBs Engineering Performance Standards Peer Reviewer Briefing and Site Tour

Holiday Inn - Saratoga Springs
Saratoga Springs, NY
October 15-16, 2003

Agenda

WEDNESDAY, OCTOBER 15, 2003

7:30AM **Onsite Check-in**

8:00AM **Welcome and Introductory Remarks**

8:30AM **EPA Overview**

9:15AM **EPA Presentations**
- Resuspension Standard

10:15AM BREAK

10:30AM **EPA Presentations**
- Resuspension Standard (continued)

11:30AM LUNCH

12:30PM **EPA Presentations**
- Residuals Standard

2:00PM **Stakeholder Presentation**
- Saratoga County Environmental Management Council

2:15PM BREAK and Load Bus

2:30PM **Site Tour** (3 ½ hours)

6:00PM **Return to hotel**

(over)

THURSDAY, OCTOBER 16, 2003

8:00AM	**EPA Presentations** • Productivity Standard
9:30AM	**EPA Presentations** • Interactions Among Standards
10:00AM	BREAK
10:15AM	**Q&A**
11:15AM	**Stakeholder Presentation** • General Electric
12:15PM	Lunch
1:15PM	**Stakeholder Presentations** • Scenic Hudson • Clean Ocean Action • Saratoga County Board of Supervisors • Clearwater • First Baptist Church • Seaway
2:30PM	BREAK
2:45PM	**Stakeholder Presentations** • New York Attorney General's Office • Friends of Clean Hudson • Dr. McMahon • Town of Fort Edward • CEASE • NOAA
4:00PM	**Presentation of the Charge to Reviewers**
4:30PM	**EPA Closing Remarks**
4:45PM	**ERG Wrap Up**
5:00PM	ADJOURN

United States
Environmental Protection Agency
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Hudson River PCBs Engineering Performance Standards Peer Reviewer Briefing and Site Tour

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United States
Environmental Protection Agency
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Hudson River PCBs Engineering Performance Standards
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Hudson River PCBs Engineering Performance Standards
Peer Reviewer Briefing and Site Tour

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