Hudson River Sloop Clearwater
Natural Resources Defense Council
Riverkeeper
Scenic Hudson
Arbor Hill Environmental Justice Corp.
Clean Ocean Action
Hudson River Fishermen's Association, New Jersey Chapter
W. Haywood Burns Environmental Education Center
New York Public Interest Research Group

May 17, 2010

David King, P. E.
USEPA Hudson River Field Office
421 Lower Main St
Hudson Falls, NY 12839

RE: Supplemental Comments to Peer Review Panel; Comments on Addendum to EPA's Phase 1 Evaluation Report

Dear Mr. King:

Hudson River Sloop Clearwater, Natural Resources Defense Council, Riverkeeper and Scenic Hudson, supported by Arbor Hill Environmental Justice Corp., W. Haywood Burns Environmental Education Center, Clean Ocean Action, Hudson River Fishermen's Association New Jersey Chapter, and New York Public Interest Research Group submit the following supplemental comments on the Hudson River PCBs Site EPA Phase 1 Evaluation Report Addendum (the "EPA Addendum") for consideration by the Engineering Performance Standards ("EPS") Peer Review Panel. This letter supplements our prior comment letter on EPA's and GE's Phase 1 Data Evaluation Reports, dated April 26, 2010 (cited herein as "First Comment Letter"), and follows our review of EPA's Phase 1 Evaluation Report Addendum (the "EPA Addendum") and the oral and written presentations made by EPA and GE at the peer review meetings on May 4-6, 2010. Attached to and referenced throughout this letter is a review of the EPA Addendum we commissioned by an independent expert, Dr. Frank Bohlen (cited herein as "Second Bohlen Memo"). Dr. Bohlen's previous written review (cited herein as "First Bohlen Memo") which was attached to our First Comment Letter dated April 26, 2010, also forms the basis for many of the observations set forth below.

After consideration of the materials listed above, we believe the major objectives and components of the remedy selected in the 2002 Record of Decision ("ROD") can be achieved through reasonable adjustments to the Phase 1 protocols and ongoing adaptive management. We emphasize that cost-cutting and artificial scheduling constraints must not be used as a basis to reduce dredging or increase capping. And, in regard to GE's 11th-hour requests to delay decision making about how to proceed with Phase 2, we urge both EPA and the panel to affirm that there is

> . . . no reason to delay initiation of Phase 2. The information necessary for the development of the required Engineering Performance Standards (EPSs) is sufficient and their refinement can proceed as modeling and monitoring results and analyses are completed. The majority of these can be completed within the next year. The long term benefit to the Hudson River ecosystem from the removal of a large mass of PCB justifies initiation of Phase 2.[1]

INTRODUCTION

Between 1947 and 1977, General Electric ("GE") discharged enormous amounts of highly toxic PCBs into the Hudson River from two capacitor plants. Unfortunately, by the late 1970's when the practice was banned, untallied quantities of PCB waste[2] had been discarded and made bioavailable to the Hudson's ecosystem. Since that time, highly persistent PCB toxins have continued a relentless journey downstream over the Troy dam into the Lower Hudson, at rates ranging from 8,000 pounds per year to 600 pounds per year.[3] Indeed, one of the most critical lessons of Phase 1 was that the extent of the contamination was significantly worse than anticipated.[4]

Accordingly, we emphasize that "3-10-Select," the remedy chosen in the ROD, was removal of approximately 65% of the total mass of PCBs in the Upper Hudson by dredging.[5] The ROD specifically provided for two phases of operations so that data collected in Phase 1 would be used to determine appropriate changes to protocols and engineering standards for use in Phase 2.[6] Thus, EPA constructed the parameters of the remedy with **deliberate flexibility, so as to allow for the most comprehensive achievement of the remediation objectives.**

Further, we emphasize that a "major component" of the selected remedy was for removal of contaminated sediments to a specified predetermined level: "…with anticipated residual of approximately 1 mg/kg Tri+ PCBs (prior to backfilling)."[7] Consequently, and for additional practical reasons which are delineated herein, the excessive capping of significant PCB inventory, as performed in Phase 1, and proposed by GE for Phase 2 (vis-à-vis its proposed

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[1] Second Bohlen Memo, p.2.

[2] *See* ROD at 4. Also estimated at a minimum of 1.3 million pounds in EPA's scientific reassessment study of PCBs in the Hudson. Completed in 2000, this reassessment began in 1990, six years after the Hudson River site was placed on Superfund's National Priorities List and was aimed at understanding PCB contamination in the sediments of the upper Hudson River between the Federal Dam at Troy and Hudson Falls.

[3] ROD at 23, observing rates of 6,000 to 8,000 pounds per year in the 1970s and 600 pounds per year in the 1990s.

[4] It is also important to note that baseline loads are declining more slowly than forecast with the gap between actual and forecast baseline loads widening over ten years from 1998 to 2008. Forecast load over this 10-year period increased from the original pre-ROD modeled prediction of 2,200 kg by 1,800 kg to 4,000. According to EPA's PowerPoint presentation to the Peer Review Panel (slide 20), due to the slow decline, the amount observed by 2008 was 2.5 greater than the model would have predicted for this year. Furthermore, the observed baseline loads to the Lower Hudson prior to dredging were substantially greater than the model forecast and EPA now predicts that over 25 years the loads to the Lower Hudson River under MNA will be substantially greater than those forecast by the model by approximately 6,000 kg over 25 years. *See* EPA Report at I-14.

[5] ROD at ii.

[6] ROD at v.

[7] ROD at iii and 94 – 98.

changes to the residuals standard), conflicts directly with both the plain language of the ROD, and the statutory preference for permanent remedies.[8] Most importantly, the instability and impermanence of capping effectively mortgages the future of the River's health. As such, capping should only be considered as a last resort and on a site-specific basis, but must not be used as a cost-cutting measure, nor to adhere to a non-essential "time limit" on project duration or other scheduling constraints.[9]

Finally, we note that the most effective and efficient implementation of the remedy depends on high levels of collaboration between GE and EPA as they prepare for, and undertake Phase 2.

With the above considerations in mind, we offer the following additional comments and recommendations and urge that Phase 2 of the cleanup move ahead, without delay, in the spring of 2011.

1. OPERATIONAL CHANGES TO DREDGING OPERATIONS AND PROTOCOLS CAN ACHIEVE SIGNIFICANT IMPROVEMENTS IN REGARD TO RESUSPENSION, PRODUCTIVITY, AND RESIDUALS.

As described in the EPA Report, the EPA Addendum, the Bohlen Memos and our First Comment Letter,[10] multiple operational improvements should be evaluated and adopted to reduce resuspension, achieve more complete removal of PCBs, and improve productivity in Phase 2. In brief, these operational changes include, but are not limited to:

- Targeted additional coring prior to Phase 2 and during dredging to better assess DoC.
- Assessment of the entire length of each core to identify remaining inventory and assess residuals.
- Reduction of fine grading and instead by the use of overcuts.
- Elimination of decanting to the extent possible including elimination of all intentional decanting.
- Consideration of alternative dredge buckets; continue use of closure sensors.
- Addition of surface sorbent mats to the containment booms as a preventive measure.
- Extension of capacity of unloading wharf or addition of an additional wharf to improve scow availability;[11] addition of manpower or other facility improvements.
- Consideration of the use of large shallow draft barges with mechanical dredging and select use of hydraulic dredging with onboard dewatering facilities.
- Increased access dredging where needed.
- Improvement of monitoring efforts with additional sampling and analyses.
- During elevated resuspension readings, consideration of the following: relocation of the dredging to areas of less PCB contamination; temporary halts to dredging; reductions in

[8] ROD at 105; CERCLA Sections 104, 106 and 121 establish a clear preference for permanent removal.

[9] GE Report at ES-7.

[10] Several of these recommendations are also endorsed by the New York State Department of Environmental Conservation in "Hudson River PCB's Federal Superfund Site, Report on Observations from Phase 1 Dredging Oversight, Recommendations for Phase 2," February 2010 ("DEC Report").

[11] EPA Addendum at 5-8. EPA states that the Phase 2 productivity target can be met by adding an additional unloading station and increasing scow loads by 0.5 feet above the Phase 1 average during peak unloading period. *Id.*

the number of dredges working simultaneously; and, or moving operations to areas of lower velocity.[12]

- Classification of the 500 ppt standard as a "control level" that would allow EPA to require operational changes to reduce PCBs in the water column (instead of a "maximum allowable concentration," which results in a halt of dredging when exceeded).[13]

We note that the EPA Addendum states that, "scow unavailability is the most important factor that limited productivity."[14] When sediment handling and equipment delays occurred at the single unloading station, long queues of under-loaded scows created extensive down time at open CU's — EPA calculates that approximately 26% of the available dredging time was lost due to scow availability delays.[15] Addressing these inefficiencies would increase productivity and thereby minimize the time CU's spend open. These benefits will also improve project performance concerning the resuspension standard.

Also concerning improvements in productivity and resuspension, EPA emphasizes that "poorly defined DoC was the primary cause of additional dredging passes."[16] Accordingly, we strongly support operational changes to more accurately characterize DoC, both before and during dredging, as well as overcuts to minimize the number of passes needed to achieve the cleanup standard set forth in the ROD.[17]

2. DEVELOPMENT AND IMPLEMENTATION OF STANDARDS AND PROTOCOLS FOR PHASE 2 NEED NOT AWAIT THE COMPLETION OF ADDITIONAL MODELING.

At the May peer review meetings, GE announced that it is working on a new or revised model, which is not yet available for review, but which GE offers as a basis for its proposed revisions to the EPS. While further high-quality, unbiased, and (if containing substantial new changes) peer reviewed, modeling may be helpful, GE's ongoing modeling effort provides no reason for delay in the development and implementation of EPS for Phase 2.[18] The peer review panel is well-equipped with the information already before it to offer recommendations to improve project performance, such as those described in point 1 above. Similarly, EPA and GE are well-equipped to begin Phase 2, as scheduled in May 2011, even while concurrently proceeding with modeling efforts that might further inform "adaptive management" of the project throughout the

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[12] EPA Addendum at 11.

[13] EPA has stated that it will reimburse the Towns of Halfmoon and Waterford for any increased costs to obtain their drinking water from Troy until November 2012, and during the remaining dredging seasons. Consequently, EPA proposes to adjust the way the 500 part per trillion (ppt) standard is used in Phase 2, due to the fact that the drinking water risks will be alleviated. Specifically, EPA suggests that it will treat the 500 ppt standard as a "control level" that would allow EPA to require operational changes to reduce PCBs in the water column (instead of a "maximum allowable concentration," which results in a halt of dredging when exceeded). Regarding the 350 ppt control level, EPA would be allowed to require operational changes if the 7-day running average were in excess of 350 ppt. EPA Addendum at 10-11.

[14] EPA Addendum at 8.

[15] EPA Addendum at 5-1.

[16] EPA Addendum at 6-A-1.

[17] *See* First Comment Letter at 7 and 13, and First Bohlen Memo at 11.

[18] *See generally* Second Bohlen Memo.

five or more years of Phase 2 work. Indeed, as specifically anticipated and provided for in the ROD, **"[d]uring the full-scale remedial dredging [*i.e.*, Phase 2], EPA will continue to monitor, evaluate performance data and make necessary adjustments.**"[19]

Clearly, the peer review panel should not base any recommendations on a new model that has been developed solely by consultants to the party bearing the costs of the cleanup and that has not been peer reviewed by an independent group of appropriate experts convened specifically for that purpose.[20] (It is our understanding that the overall composition of the current peer review panel makes it an inappropriate body to conduct such a review of GE's model.) Nor should the panel's recommendations be based on a new version of the model GE put forward years ago, for use in connection with the remedy decision, which EPA long ago rejected.[21] The peer review panel should recommend that EPA and GE collaborate on updating the model(s) used for the ROD or on developing a "community model," using appropriate data gathered since the ROD, instead of developing dueling models that would lead only to further disputes.[22]

Most importantly, regardless of whether or how further modeling proceeds, enough has been learned from Phase 1 to know that is completely appropriate and necessary to proceed with the start of Phase 2; nothing from Phase 1 suggests otherwise. Indeed, the larger-than-expected mass of contamination discovered in the Upper Hudson River makes the performance of Phase 2 even more imperative. "The long term benefit to the Hudson River ecosystem from the removal of a large mass of PCB justifies initiation of Phase 2."[23]
Also in this regard, we note that GE's assertions concerning the fish tissue impacts of Phase 1 do not support any reduction in dredging or delays to start Phase 2. It was well known that the increased downstream flux of PCBs had the potential to increase the exposure of aquatic biota and the associated body burdens.[24] Data developed by both GE and EPA indicate that body total and lipid-normalized PCB concentrations increased to some extent above pre-project levels in target fish species during Phase 1 activities. The increases are often quite small however, and

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[19] ROD at 100.

[20] EPA recently issued formal guidance for the development, evaluation and application of environmental models, which sets forth the best practices to employ to help determine when a model, despite its uncertainties, can be appropriately used to inform a decision. Specifically, it recommends that model developers and users:

1) subject their model to credible, objective peer review;

2) assess the quality of the data they use;

3) corroborate their model by evaluating the degree to which it corresponds to the system being modeled; and

4) perform sensitivity and uncertainty analyses.

EPA, Office of the Science Advisor, *Guidance on the Development, Evaluation, and Application of Environmental Models*, EPA/100/K.

[21] *See* Responsiveness Summary, Hudson River PCBs Site Record of Decision (Jan. 2002), pp. 6-8 – 6-10 ("EPA does not believe that the GE model . . . is a better tool than the EPA model for developing a rigorous assessment of the benefits and impacts of a broad range of remedial options.") Responsiveness Summary is available at http://www.epa.gov/hudson/d_rod.htm#response.

[22] *See* Second Bohlen Memo at 8.

[23] Second Bohlen Memo at 2.

[24] ROD at 85; *see also*, ROD at 104 - 108, discussing the long-term benefits of removal.

sometimes within the annual range of variability. The notable effects display limited areal extent beginning abruptly near Fort Edward and typically extending downstream for a distance of approximately 15miles south of River Mile 195, the northern end of the Project Area. The effects in the vicinity of Albany marked as significant in the GE Report were very small in late 2009 and early 2010. Most effects were seen in the Pumpkinseed population. It seems reasonable to suppose that these effects will decay to background occurring within two to three years of the completion of dredging or times similar to those observed following the Allen Mill gate failure in 1991-93.[25] The fact that available data are yet to show this decrease is not surprising given the limited time since completion of the Phase 1 activities and low metabolic rates expected during the winter months. Some effects may be observable by the fall of 2010. For Phase 2, it is critical that GE and EPA utilize the same data set to calculate baseline fish tissue values which should include the entire Baseline Monitoring Program Scoping Document (BMPSD) data set.[26] It is also reasonable to anticipate that changes in Phase 2 dredging operations aimed at reducing resuspension will act to minimize exposure of aquatic biota, especially downstream of dredging operations.

3. COST-CUTTING AND ARTIFICIAL SCHEDULING CONSTRAINTS SHOULD NOT BE A BASIS TO REDUCE DREDGING OR INCREASE CAPPING.

Despite GE's assertions, Phase 2 should neither increase capping, nor minimize overcuts to avoid the costs of processing, transporting and disposing of clean sediment, or to keep to a non-essential "time limit" on the project. Although 75% of the "adjusted area" was completed and closed in compliance with the Residuals Standard during Phase 1, EPA reports that approximately 25% of the adjusted areas was capped out of compliance with the standard set in the ROD. [27] We acknowledge that ROD and remedial design allow for some capping, but it is only to be used in certain circumstances and as a last resort.[28] Accordingly, we have several objections to GE's proposals, and offer our own observations and recommendations.

First, the uncertainty concerning the DoC was not completely unanticipated: In 2005 EPA warned GE that underestimated DoC "would result in difficulties with the residual standard as well as redredging,"[29] but during Phase 1, EPA allowed GE the flexibility of managing uncertainty of DoC on site.[30] This flexibility should now be curtailed so as to comply with the ROD and to provide for a permanent remedy that removes, rather than caps, the actual inventory of contaminated sediment. As we have commented previously, and as observed by the Canal Corporation, there are multiple potential problems with capping including long-term instability, monitoring and responsibility for maintenance of capped areas, as well as interference with current and future navigational dredging needs. Furthermore, capping in the Hudson may not be

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[25] Comments by Jennifer Samson, Ph.D, *Clean Action Ocean,* Principal Scientist Consultant.

[26] Baseline Monitoring Program Scoping Document. *Id.*

[27] EPA Report at ES-2.

[28] The Phase 1 EPS provided that all redredging attempts were to be designed to reduce the mean Tri+ PCB concentration of the certification unit to 1 mg/kg Tri+ PCBs or less and to remediate any sampling nodes with Tri+ PCB concentration equal to or greater than 15 mg/kg. Only if, after two redredging attempts, the arithmetic average Tri+ PCB concentration in the surface sediment still was greater than 1 mg/kg, was capping to be implemented. EPS at 12.

[29] EPA Addendum at 6-B-1, citing 2005 Dredge Area Delineation memo, Appendix H.

[30] *Id.*

designed to withstand major flood events.[31] Certainly, no comparable river remediation data exists to measure the long-term adequacy of these caps to withstand the unique high flow and sediment scouring nature of the Hudson River. In addition, with the advent of global climate change, the severity of storm events in the region has increased and is expected to continue to intensify over time. As such, mortgaging future benefits to the River with the short-term "band-aid" of capping should be avoided to the greatest extent possible.

Furthermore, proactive steps to reduce uncertainty about DoC, combined with improved post-dredging core analysis to identify and remove unanticipated PCB inventory and strategic use of overcuts to account for uncertainty, would substantially reduce the impetus for capping. Because DoC was seriously underestimated for many of the original cut lines in Phase 1 CUs, multiple passes were required to address inventory (post-dredging cores with greater than 6 inches DoC), not residual (cores having less than or equal to 6 inches DoC). EPA reports that 42% of the 445 locations were shown to have inventory present after the first pass; 20 % required 3 or more inventory passes.[32] As Dr. Bohlen points out, "EPA shows that an overcut of 6 inches would have removed additional PCBs in 77% of the sampled locations."[33] To address this issue, EPA, DEC and the Hudson River Trustees[34] all recommend procedures to establish more accurate depth to contamination[35] and overcutting to reduce the occurrence of the multiple, thinner cuts utilized in Phase 1, which caused work areas to be open longer than necessary and subject to increased resuspension; and evaluation of core samples taken after the first pass to determine whether additional inventory is present and, if so, removal (rather than capping) of that inventory. Dr. Bohlen's review also supports this approach, particularly since the spatial variability of sediment deposits in the river makes it difficult to fully characterize DoC before the start of dredging.[36]

The unavoidable lessons of the Phase 1 experience -- are that overcutting is necessary to reduce the number of passes and related resuspension and that, to ensure achievement of remedial objectives, GE must be required to perform additional inventory dredging (not capping) when, despite best efforts, DoC turns out to have been underestimated prior to dredging. Any costs

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[31] *See* Letter from Carmella Mantello, Director New York State Canal Corp. to Mr. David King, USEPA (March 29, 2010) raising this and other concerns.

[32] EPA Addendum at 9.

[33] Second Bohlen Memo at 6.

[34] U.S. Department of the Interior, National Oceanic and Atmospheric Administration, and NYS DEC. *See also* Trustee Comments on Phase 1 Evaluation Reports for the Hudson River, April 26, 2010 ("Trustee Comments"); EPA Report at ES-19.

[35] During the Peer Review panel, some of the reviewers wisely suggest that a few inches of sand be placed over exposed areas to stabilize them after coring, while awaiting test results and a design based on this new DoC information. Initially it seemed as if this temporary measure would then be followed by either more dredging, as current performance standards call for, until full depth of contamination is met, then backfilling or capping would be undertaken as appropriate. Soon this discussion changed to streamlining proposal -- to dredge to design cut and then sample only to determine whether to cap or backfill. It's unlikely that DoC can be determined with enough accuracy in advance of dredging to take this approach. Very few suggestions were made in this regard at the May peer review meeting, and the variability of sediment deposits in the river makes it difficult to fully characterize DoC before the start of dredging, so all options must remain available in the field: more dredging when needed to remove inventory, backfilling if target cleanup standards have been met, and capping as an absolute last resort. If inventory remains after design cut is achieved, it should be efficiently identified and removed. See Second Bohlen Memo, pp. 6-7, 9.

[36] Second Bohlen Memo, pp. 6-7, 9.

associated with this approach are integral to an effective, permanent clean up and are not a valid reason for dredging less and capping more.[37]

Nor should artificial time limits on the project be a basis for adopting standards that permanently leave behind more PCBs in the river. Along with EPA, DEC and the Hudson River Trustees, we support extending the project duration beyond 5 years if necessary to achieve removal of contamination.[38] As is now well documented, Phase 1 revealed the presence of considerably more PCB contamination than originally predicted. No information was presented to the peer review panel that provides any reason to artificially limit the length of the project to 5 years. Moreover, the 5-year time period was only intended as an estimate of the project length – one that was based on a significant underestimation of the levels of contamination.[39] As stated by Dr. Bohlen, a five-year limitation on Phase 2 "may be considered somewhat arbitrary particularly if the extent of the remediation is considered. . . . When considered in combination with efforts to reduce the downstream flux of contaminants it seems clear that an extension in duration may be warranted. The proposal by EPA in their Phase 1 Report to allow them this option seems well advised and consistent with the provisions necessary for an effective adaptive management strategy."[40]

4. EPA, GE AND STAKEHOLDERS SHOULD CAREFULLY CONSIDER PREPARATION FOR, OR INCLUSION OF, NAVIGATIONAL DREDGING AS PART OF PHASE 2.

The ROD, the Remedial Design and the Engineering Performance Standards require that the responsible party remediate designated areas of PCB-contamination using environmental dredging, but do not specifically require that the GE perform separate navigational dredging. However, we sincerely hope that a reasonable agreement can be negotiated to take advantage of the presence of dredging and processing equipment present in the river during Phase 2, and after, to fully restore the navigational channel. As noted by the Hudson River Trustees,[41] EPA had envisioned that the selected remedy would provide some redress for the local communities impacted by the contamination. For example, the ROD clearly noted the high cost of the PCBs on commercial activity to the local community,[42] and observed that the selected remedy did include "navigational dredging as necessary for implementation… as well as to allow for use of the river by recreational and commercial vessels during remediation."[43] The Responsiveness Summary to the ROD adds: "A significant portion of the dredging is oriented to navigational

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[37] See also comments submitted on May 4, 2010 to the Peer Review Panel by the U.S. Department of the Interior, which state: "General Electric Company's proposal of the use of a hard cap [on downstream PCB loadings] as a modification of the residual standard is incompatible with the remedy EPA selected for the Hudson River Superfund Site. We don't support an increase in the amount of capping during the remedy implementation."

[38] *See* First Comment Letter at 18; First Bohlen Memo at 14; DEC Report at v; and Trustee Comments at 2.

[39] In 2002, the ROD mentions that the full-scale operation of Phase 2 was "expected" to last five years, but this is not a requirement delineated in the remedy components. ROD at 110.

[40] Second Bohlen Memo, pp. 8-9.

[41] Trustee Comments at 2.

[42] "Due to the PCB contamination, navigational dredging within the Upper Hudson has been severely limited in the past 25 years. As a result, commercial navigational uses have been reduced and recreational navigational uses impeded." ROD at 30.

[43] ROD at 67.

dredging that, when completed, will provide an expanded and safer capacity for recreational use of the River;"[44] and "[t]he selected remedy includes navigational dredging as necessary for implementation. It is anticipated that dredging will have a positive impact on Hudson River navigation."[45]

Moreover, and as observed by the Trustees, navigational dredging could greatly improve productivity as well as reduce resuspension related to the operation of barges in shallow channels.[46] At minimum, where a contaminated area is dredged, contaminated sediment should be removed to the full required depth. The selected remedy, REM 3/10/Select requires removal of all sediments with a mass per unit area (MPA) of 3 g/m^3 or 10 mg/kg in River Section 1 (RS-1); 10 g/m^3 or 30 mg/kg in RS-2 and in select sediments with high concentrations of PCBs and high erosion potential in RS-3).[47] Also: "Within the areas targeted for remediation the goal is to remove all of the PCB-contaminated sediments within these areas, leaving a residual of approximately 1mg/kg."[48] Furthermore, backfill should not be placed in a manner that rises above a 14-foot river depth in the channel – the depth needed by the Canal Corporation to maintain the channel for navigational use over time, and to prevent disruption by propellers or other navigational-related disturbances.

Unfortunately, this was not done in CU-1 at the Ft. Edward Yacht basin during Phase 1. As the season came to a close, capping was placed over large amounts of highly contaminated sediment[49] at a depth of 12 feet – thus vulnerable to scouring and other disruptions. Remedial costs not borne by GE will later be borne by the Canal Corporation, hence the river users, taxpayers and the public. Again, we urge that all options be considered to rectify the results at CU-1.

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Thank you for your consideration of these comments. If you have any questions or comments, please contact Rebecca Troutman at 914-478-4501, ext. 241 or by e-mail at rtroutman@riverkeeper.org.

Sincerely,

/s
Rebecca Troutman
Senior Counsel
Riverkeeper, Inc.

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[44] Responsiveness Summary at ES-7.

[45] *Id*. at Book 1 of 3, 9-44 – 9-45; *see also* ROD at 67.

[46] Trustee Comments at 2.

[47] US EPA Region 2, Hudson River PCBs Reassessment Superfund Site Proposed Plan, Dec. 2000, at 14 -15.

[48] *Id*.

[49] See Letter from NYS Canal Corps, Carmella Mantello, January 8, 2010, stating that "the capped sediments in CU-1 alone contained PCB concentrations in excess of 50 ppm in no less than 25 different sampling cores."

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Hudson River PCBs Site

A Review of the U.S. EPA Phase 1 Evaluation Report Addendum April, 2010

By
W. Frank Bohlen
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May 17, 2010

Introduction

Following publication of their Phase 1 Evaluation Report in March, 2010, the U.S. Environmental Protection Agency (EPA) issued an Addendum in early May, 2010. This Addendum presented information responding to requests and questions submitted by the Peer Review Panel at its introductory meeting in February, 2010 as well as several evaluations referenced in the Phase 1 Report but unfinished at the time of its release. Of particular interest was the EPA revised Resuspension Standard specifying allowable PCB loads at Waterford during the period of remediation. The Addendum also included discussion of water column PCB loads during and after dredging, the causes of resuspension and the associated PCB loads, contaminant transport, methods intended to reduce the effect of errors in the estimate of depth of contamination, and means to improve productivity. The following review places particular emphasis on the revised Resuspension Standard (Topic 4) and Water Column Loads During and After Dredging (Topic 1). It also offers recommendations for moving ahead with Phase 2 of the remediation, supplementing those provided in my April 26, 2010 review of the EPA and GE Phase 1 Data Evaluation Reports.

Summary of Conclusions and Recommendations

This addendum adds some additional information to that provided by EPA in their Phase 1 Report. Although much of it will elicit debate, the tools necessary for quick resolution of the associated questions are available. This resolution as well as an improved basis for the resolution of future issues would be facilitated by:

1. Use of a process based model for the specification of allowable PCB loads during the remediation project and the quantitative analysis of PCB fate and transport. Consideration should be given to the adoption of a community model for joint use by GE and EPA.
2. Maintenance of an array of instruments and samplers sufficient to provide high frequency time series observations of specified parameters at a network of stations distributed throughout the upper river.
3. Incorporation of the time series data within quantitative fate and transport analyses.
4. The collection of a number of additional core samples of the sediment column and associated sediment probing and re-analysis of previous core and probe data to facilitate improved definition of the depth of contamination (DoC).
5. Joint collaboration by EPA and GE in the development and implementation of an adaptive management strategy for use in Phase 2.

Despite the range of questions subject to debate there appears to be no reason to delay initiation of Phase 2. The information necessary for the development of the required Engineering Performance Standards (EPSs) is sufficient and their refinement can proceed as modeling and monitoring results and analyses are completed. The majority of these can be completed within the next year. The long term benefit to the Hudson River ecosystem from the removal of a large mass of PCB justifies initiation of Phase 2.

Review Comments

A. Evaluation and Prediction of Downstream Loads

Sediment sampling and the subsequent Phase 1 dredging activities provided clear indication that the mass of PCBs in place within the upper Hudson River was significantly greater than the original estimate of 115,000 kg. EPA now believes that between 1.5 and 1.8 times the original mass estimate will have to be removed or approximately 170,000 to 210,000 kg of PCB. Of this mass EPA expects that no more than 1% will be lost to the water column and transported past Waterford. This implies loads ranging from 1700 kg to 2100 kg total PCB or (on the assumption of a 3:1 ratio- Total/Tri+) Tri + values ranging between 567 to 700 kg. With these values in mind EPA, using an empirical method (Topic 4A) based on a combination of field measurements of PCB concentrations and selective sampling of streamflow data for the period 1995-2008 (1999-2000 data were reported as non-detects and deleted as non-representative since causes for this were unknown), concludes that loads at Waterford of 500 kg Tri+ over the life of the project will not adversely impact the lower Hudson and associated fish populations and will not result in any significant difference in the rate of ecosystem recovery relative to that expected from monitored natural attenuation (MNA). Based on these results they propose to increase the Resuspension Standard from the initial value of 650 kg total PCB to 2000 kg total PCB as measured at Waterford over the duration of the remediation (Phase 1 and Phase 2).

1. Modeling

Given the amount of computer modeling used to date in this project by both EPA and GE it is not clear why EPA chose to rely on an empirical method in the revision of the Resuspension Standard. In particular, the trend lines used in the empirical method appear to follow those estimated using the trends observed over the past ten years or so. This suggests that EPA assumes that the factors affecting PCB transport in the past will remain unchanged following remediation. This was most likely selected as a conservative approach since reduction in near surface concentrations due to removal and subsequent closure by capping or backfill will ultimately result in a more rapid decrease in downstream PCB concentrations. However, it leaves unanswered questions regarding the shorter term effects of the progressive settlement and transport of materials resuspended during the dredging operations. This latter factor is not included in the EPA analysis apparently on the assumption that 1. the effects are small and 2. the effects will be short lived and largely confined to the project period. GE reportedly disputes these assumptions. Although the effects of project related resuspension are most likely small compared to the long term benefit of the removal of a large mass of PCB they do warrant some attention. Presumably the best way to resolve these different opinions as well as questions regarding the adequacy of any assumed decay rates of contaminant loading would be a joint modeling effort making as much use as possible of the field data provided by the ongoing monitoring program. The tools required for this are available and there is no reason to believe that this modeling would slow the initiation of Phase 2.

2. <u>Downstream Transport</u>

Beyond the absence of numerical modeling in the EPA analysis, the empirical approach assumes a 1% loss of contaminant to the far-field (*i.e.,* Waterford) over the project period. Although as stated in my earlier review, this seems optimistic given the abundance of field data showing material losses at the site of the bucket during mechanical dredging between 1 and 5% (and higher in the presence of debris) it appears here to represent a desired target rather than an absolute upper limit. As such it seems a reasonable place to start with the final value to be determined as the project and supporting analytical efforts based on modeling and monitoring proceed. Primary emphasis in these efforts should be placed on the importance of sediment/contaminant resuspension relative to the dissolved phase. The processes associated with each phase and the factors affecting PCB change of phase from dissolved to particulate and/or vice versa clearly warrant some additional study and explanation as the project proceeds and should be an important factor affecting a variety of dredging protocols in any adaptive management scheme used during the next Phase of the project.

3. <u>Monitoring</u>

Continuing time series observations of contaminant loads at various points downstream of the project area since the completion of Phase 1 would have helped address a number of the issues raised during the efforts to revise the Resuspension Standard including resolution of the relative importance of resuspension within the downstream transport of PCBs and the associated PCB fluxes. Analyses of these data would include not simply loads (e.g. TSS and PCBs) but also quantitative analysis of PCB homolog patterns as well as the variety of supportive sediment and flow data. The intent to develop such a data set appears to be the primary reason for the extensive near and far field monitoring program included as a central element in the project plans. Given the potential value of the monitoring data to this and to future remediation projects it's unfortunate that at least at this point in time EPA in the Addendum must report that "PCB concentrations at the Thompson Island station post-dredging must all be considered suspect, particularly those collected during recent high flow events...". Or "Samples from Lock 5 and a limited number of samples at Waterford stations obtained during the post-dredging period are also clearly suspect..." (Topic 1 p. 1-A-8). The majority of the difficulties appear to be related to intake fouling resulting in some amount of sediment entrainment as the intake settled to the bottom. This seems to be a relatively simple matter to correct through a combination of hardware modifications (e.g. better intake screening and the use of stilling wells to minimize direct exposure to debris) and better routine maintenance throughout the year. It seems clear that it must be since adaptive management requires it.

4. PCB Fate and Transport Issues

Despite the weaknesses in the long term monitoring data, there appear to be sufficient data for EPA to discuss the potential role of particulate vs. dissolved phase transport (Topic 1-D) They use a combination of TSS data and concurrent PCB homolog patterns to argue that the observed increase in Tri + concentrations is evidence of loss of the lighter fractions though volatilization. GE had previously made the argument that this shift was more likely caused by particulate resuspension. It was their belief that this component of the transport system had the potential to serve as a relatively long term source of PCBs to the lower river.

Given the relatively large fraction of the total PCB mass reported by both GE and EPA as being in the dissolved phase (at least initially) it seems likely that both loss by volatilization and particulate mediated transport are active components of the downstream transport regime. Whether or not there were significant releases of PCB bearing oils (a point on which EPA and GE disagree) the data show a significant mass of PCB released to the water column at the dredging point. The finite adsorbtion capacity of the relatively small mass of suspended sediments initially favors dissolved phase transport. As downstream transport proceeds some amount of this dissolved fraction will volatize. However, some fraction will also move from the dissolved to the particulate as "clean" sediments are encountered favoring adsorbtion and/or aggregation of the finest particles resulting in the formation of larger “flocs” able to be trapped on the analytical filters and classed as “particulates”. Subsequent settling of some of these materials could form deposits which in time would be resuspended or eroded providing a source of contaminants to downstream areas. Resolution of the relative importance of dissolved vs. particulate transport again seems to be an issue that could be easily resolved through well directed and consistent monitoring and subsequent analysis. The goal should be to develop accurate mass balances of total and Tri + PCBs along several reaches of the River downstream of the project area. Again, the results should directly benefit implementation of adaptive management strategies.

B. Depth of Contamination and Overcut

Whatever the mechanisms governing transport, it seems clear that a number of the Engineering Performance Standards established for this project were affected by the accuracy of the definition of the depth of contamination (DoC). As discussed in my review of the Phase 1 Report this inaccuracy was caused primarily by the spatial variability of the sediment deposit in the project area. In Topic 6A EPA provides a more detailed analysis of the dredging required to achieve target concentration levels based on 445 cores taken following completion of the dredging to the specified DOC. Defining “residual” as cores having a contaminated sediment layer less than 6in in thickness and “inventory” as those cores with contaminated sediment layers greater than 6in in thickness, EPA shows that an overcut of 6 inches would have removed additional PCBs in 77% of the sampled locations. Inventory would have been removed at 169 locations and residuals at 115 sites. They argue that these results support their recommendation of the addition of an overcut in Phase 2.

Not surprisingly GE argues that the addition of a required overcut will result in the removal of substantial volumes of clean sediment increasing the number of bucket bites and the associated resuspension as well as potentially extending project duration. Again, there seems to be some truth in both the EPA and GE positions. The differences however, would be relatively minor if both agree that dredging should seek to reduce sediment concentrations to 1ppm Tri+ PCBs if at all possible (as specified in the ROD p.95). Reviews of the material provided in Topic

6A suggest that it might be possible to achieve this target by a slight modification of the approach advocated in my earlier review of the Phase 1 Reports in which an overcut was included in all passes as proposed by EPA. The data suggest that an alternative including some amount of additional sampling with an emphasis on probing as discussed in my review of the Phase 1 Report, analysis of the total length of the cores obtained following completion of the initial DoC dredging (minimum length 24"), possible use of larger dredge buckets (> 5 cu.yds) to extend the depth of cut, and a defined amount of overdredge for the second round of dredging could represent an efficient way to achieve the required target while reducing the amount of clean sediment removed and the number of dredge bites needed to complete the pass. It also must be realized that there will be areas where the target concentration cannot practicably be achieved and that capping is required to isolate contaminants. The use of capping however, must be limited to the extent possible and is not to be used to close CUs in order to satisfy project schedules. The effectiveness of this combination of techniques and analysis should be regularly reviewed jointly by both parties and modified as necessary. Again, this seems entirely consistent with the adaptive management approach favored for this project.

Conclusions and Recommendations

A. Resuspension

This Addendum adds some new information to that provided by EPA in their Phase 1 Report. Of particular interest is the discussion of the Resuspension Standard and the associated allowable load past Waterford. This undoubtedly will elicit some amount of debate. Although it’s unfortunate that EPA, in addition to the empirical approach, didn’t add the support of a process based model to justify their proposal to increase loads I don’t believe this to be a reason for delaying the initiation of Phase 2 since it appears that there is sufficient information available to permit development of the required Engineering Performance Standards (EPSs). Later refinement can follow modeling. Given the fact that there is a greater mass of contaminants to be removed than initially estimated it’s inevitable that more will be released to the water column than was originally anticipated and that as a result the allowable mass load must go up. The mass loss rate might be reduced relative to that observed in Phase 1 by implementation of the alteration in dredging and the associated operational protocols as discussed in the Addendum but the total mass will still likely be higher than the original target. Virtually all aspects of the effects of this release from the mode of transport to the magnitude of the downstream loads and associated fish body burdens are subject to debate. The tools to resolve these questions including both modeling and monitoring are available and in combination with the historical data set will provide robust support for the adaptive management of the remediation. Both EPA and GE should be encouraged to resolve the outstanding questions collaboratively and quickly-certainly within the next year. There are reports of a higher resolution model from GE that better incorporates the results provided by the Phase 1 experience. This model should be made available for review by EPA who in turn should expedite the review process. It might also be worthwhile for EPA and GE to consider joint implementation or the adoption of a “community model” in the interest of minimizing the potential for “dueling models”. The long-term benefit of these efforts and the contribution to the removal of a large mass of PCBs from a dynamic river system should be clear to all**.**

B. <u>Productivity</u>

In addition to the loading and fate and transport issues, many of the operational aspects of the upper Hudson River remediation are affected by the continuing difficulties in the definition of the depth of contamination DoC leading to concerns regarding project duration. The initial design called for completion in six years (Phase 1 - 1 year, Phase 2 - 5years). The basis for the specification of this duration appears to be in part scientific associated with target dates to return to MNA levels and in part social in the interest of minimizing impacts on the communities and businesses along the upper river. Both may be considered somewhat arbitrary particularly if the extent of the remediation is considered. There are a number of ongoing remediation efforts (e.g.in the Fox River and New Bedford Harbor) that have been going for more than 5 years. None of these however, contain nearly the mass of PCBs now believed present in the upper Hudson. This fact alone argues for some reasonable extension in project duration. When considered in combination with efforts to reduce the downstream flux of contaminants it seems clear that an extension in duration may be warranted. The proposal by EPA in their Phase 1

Report to allow them this option seems well advised and consistent with the provisions necessary for an effective adaptive management strategy.

C. Residuals

As for the specification of the DoC, the discussion in the Addendum adds a bit more quantitative data in support of the EPA proposal for the addition of overcuts to each dredging pass. There is however, relatively little data dealing with the issue of "bycatch" of clean sediment. GE argues that this will be substantial if the EPA recommendations are followed. It seems that this issue could be easily resolved by joint discussion. Given the spatial variability of the sediment deposits in the project area it's unlikely that the simple addition of more cores will significantly improve accuracy. Accuracy might benefit however, from additional cores at selected locations in combination with additional sediment probing. This situation would imply that the only way to really know the extent of contamination is to dredge and sample. After resolution of the debate dealing with the removal of "clean" sediment and recalculations of the DoC based on reviews of existing data, some new core data, and the careful analysis of all probe data (new and old), it may be that the best way to proceed is to dredge to the specified DoC with no overcut and then core and analyze. Laboratory analysis would cover the entire length of the core (minimum 24") and would provide the basis for selection of need for and extent of any overcut for a second inventory pass. Given the results of the Phase 1 effort it seems likely that this combination of aspects of the proposed EPA and GE protocols should succeed in achieving the target concentrations in most of the project area. Necessarily these protocols would be subject to continuing review as the project proceeds and would be central topics of the adaptive management strategies.