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November 2, 1998

Mr. Douglas Tomchuk
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RE: FS SOW Comments

Dear Mr. Tomchuk:

The General Electric Company ("GE") is pleased to submit the enclosed comments on the Scope of Work for the Hudson River PCBs Superfund Site Feasibility Study ("SOW").

The SOW has several shortcomings. Most important, it is not focused on the three central questions posed at the beginning of the reassessment that EPA set out to answer, namely:

- When will PCB levels in fish meet human health and ecological risk criteria under continued No Action?
- Can remedies other than No Action significantly shorten the time required to achieve acceptable risk levels?
- Would buried PCBs become "reactivated" following a major flood?

Without focusing on these issues, the Agency will be unable to evaluate whether any remedial alternative in the Upper River can achieve meaningful risk reduction materially faster than No Action. Instead of directing its analysis towards defined risk reduction, which must be the focus of the Feasibility Study, the SOW confuses mass removal with risk reduction.

The SOW raises other important issues as well:

- It is improperly biased toward large-scale and intrusive remedies – namely, dredging – even though other nature-friendly, nondisruptive remedies exist and ought to be equally considered;
- It does not call for an adequate analysis of the effectiveness of dredging to achieve remedial objectives in a river system of this size or complexity;
- It does not properly incorporate the present and future benefits from GE's continued source control and clean-up work at Hudson Falls;
- Its proposed method for analyzing remedial alternatives diverges from the requirements of the National Contingency Plan;
- It arbitrarily seeks to expand the Hudson River Superfund Site without need or justification; and,
- It proposes a Feasibility Study that will not quantitatively evaluate the short-term risk resulting from implementation of remedial alternatives, some of which could take years to complete.

Based on these and other deficiencies (discussed in attached comments), we urge the Agency to submit the Feasibility Study to an independent peer review panel. EPA has already committed to the peer review process to ensure the Hudson River remedial decision is based on sound science. The document that results from this SOW is central to the Agency's remedial decision. Accordingly, it is not enough that only the documents that preceed this upcoming report will be reviewed by independent scientists. The Feasibility Study, too, ought to be subject to a review by independent experts.

If you would like to discuss these comments in greater detail, please do not hesitate to contact me.

Sincerely,

Melvin B. Schweiger / MSE

Melvin B. Schweiger

cc: Richard Caspe
William McCabe
Melvin Hauptman
John Cahill
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COMMENTS OF GENERAL ELECTRIC COMPANY ON HUDSON RIVER PCBS REASSESSMENT RI/FS PHASE 3 FEASIBILITY STUDY SCOPE OF WORK

November 2, 1998

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I. Introduction and Executive Summary

General Electric Company ("GE") welcomes this opportunity to submit comments on the "Hudson River PCBs Reassessment RI/FS Phase 3 Feasibility Study Scope of Work" ("SOW"). These comments present a number of major issues.

1. *The Agency established an appropriate remedial goal for the Hudson River PCBs Superfund Site ("Site") through three central questions posed at the beginning of this reassessment. The remedial objectives listed in the SOW diverge from this goal.*

The questions as originally set forth were:

- When will PCB levels in fish populations recover to levels meeting human health and ecological risk criteria under continued No Action?
- Can remedies other than No Action significantly shorten the time required to achieve acceptable risk levels?
- Are there contaminated sediments now buried and effectively sequestered from the food chain that are likely to become "reactivated" following a major flood, possibly resulting in an increase in contamination of the fish population?

The Feasibility Study ("FS") must be directed at answering these questions. First, EPA must determine the PCB concentration in fish that constitutes an acceptable level of risk. Second, relying on the knowledge of the exposure pathways of PCBs to fish derived from its fate, transport and bioaccumulation models, the Agency must identify an array of possible remedial alternatives that would achieve the defined acceptable risk level. This is an important step; knowledge of the source of PCBs (buried vs. surficial sediments; upstream source vs. TIP) is essential to selection of a remedial alternative. Third, because "No Action" at this Site encompasses natural recovery, all possible remedial alternatives must be compared to "No

Action" to evaluate whether any will achieve the defined acceptable risk level at a materially earlier date than would "No Action."

Risk reduction is the proper remedial goal at this Site. Because most of the PCBs are not bioavailable, mass removal does not equate to risk reduction and violates the National Contingency Plan ("NCP") mandate of cost effectiveness here. EPA's remedy selection must not be driven by a vague affinity for mass removal, but by achieving a defined, targeted concentration of PCBs in fish that is deemed acceptable materially faster than would occur naturally. The logic of the remedial selection process directs this order of procedure.

2. *The SOW is improperly biased toward the consideration of large-scale and intrusive remedies -- namely, dredging; other nature-friendly, nondisruptive remedial alternatives get little or no discussion but deserve far more thorough evaluation.*

In considering large-scale and intrusive remedial alternatives, such as dredging, careful consideration must be given to their actual performance at other sites. First, there must be assurance that dredging in the Hudson would be focused on the actual source of PCBs to fish and the water column. Remediation of PCBs in locations that do not predominantly affect fish, such as the so-called "hot spots," will accomplish little or nothing. Second, the efficacy of dredging must be demonstrated, which is a difficult task given both the limited experience and the paucity of post-dredging analysis at other sites. Third, in light of the consistent pattern of remedial dredging at other sites taking far longer to implement and costing far more than was anticipated, realistic construction schedules and cost estimates must be developed. Fourth, the destructive ecological impacts of dredging must be accurately weighed in the remedial calculus. Finally, the practical feasibility of dredging must be addressed.

3. *EPA can not expand the Site down the river or along its shorelines without providing a reasoned explanation.*

The SOW provides neither a practical need nor a logical justification for the expansion of the Site by 160 square miles.

4. *The evaluation of the monitored natural attenuation alternative must consider the significant factors that affect recovery of the Hudson.*

These factors include burial of sediments containing PCBs by cleaner solids; PCB dechlorination in the river; and control of the upstream source, which must precede the commencement of any downstream remedy.

5. *The application of applicable or relevant and appropriate requirements ("ARARs") and "To Be Considered" benchmarks ("TBCs") at this Site should be constrained by the voluminous site-specific information.*

This information includes the quantitative PCB fate, transport and bioaccumulation models that are being prepared by EPA and GE and the baseline human health and ecological risk assessments for the Site. In addition, many of the requirements identified in the SOW are not properly considered ARARs or TBCs for this Site for legal reasons or because of insufficient data and analysis to support them.

II. <u>The Remedial Analysis Must Assess Whether Remedial Alternatives Can Achieve a Meaningful Reduction in Risk in Materially Less Time Than No-Action</u>

The fundamental remedial goal at all Superfund sites is derived from the core instruction in section 121(b)(1) of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), 42 U.S.C. § 9621(b)(1), that remedial actions be "protective of human health and the environment." <u>See also</u> 40 C.F.R. § 300.430(a)(1)(i) ("The national goal of the remedy selection process is to select remedies that are protective of human health and the environment"). To translate this broad goal to this Site, EPA posed the three questions set out above. These questions properly characterize what should be the overriding question of the Agency's remedial analysis: Will any remedial alternative achieve the targeted, defined and, measurable reduction in risk to humans or biota from PCBs in fish materially faster than would occur under No Action within the time frame for which the models can reliably forecast conditions?

The best tools for answering the three questions are the quantitative fate, transport and bioaccumulation models that the Agency is developing. When properly calibrated and validated, these models have important uses beside projecting the No Action scenario: (1) to identify the source(s) and pathways, of PCBs to fish (*e.g.*, the upstream source vs. the Thompson Island Pool ("TIP") sediments; surface sediments vs. buried sediments), and (2) to screen possible remedial alternatives. Once the analyses are complete, EPA should then be able to use the models to distinguish one source of PCBs from another, identify which is the primary source, and assess and quantitatively compare the risk-reduction benefits of various remedial alternatives, including natural recovery. Because "No Action" will achieve the acceptable risk level in time, a central criterion for remedy selection is whether the remedy will materially accelerate the date at which the desired risk level is achieved. If models show that a remedial alternative cannot materially accelerate the achievement of the risk target, it must be rejected. The goal of remediation must be acceleration of the achievement of the target risk level.[1]

For example, assume the models predict that PCB levels in fish after 20 or 30 years under the No Action scenario will be X. Under one remedial alternative, the models predict that PCB levels in fish after the same time period will be Y. If the risks from human consumption of fish with X concentrations of PCBs are not materially different from the risks of human consumption of fish with Y concentrations, then this remedial alternative has not met the basic test at this Site and should be excluded from further consideration. EPA's site-specific fate, transport and bioaccumulation models make this sort of analysis possible because they permit the risk manager to calculate PCB levels in fish directly instead of using inferior and indirect measurements of PCB levels in other media (*e.g.*, sediment and the water column) which are assumed to lead to an acceptable PCB concentration in fish. To be sure, the baseline risk assessments and ARARs will provide numerical criteria at the direct points of exposure, such as fish, water (for direct human contact or consumption), or sediment (for direct human contact). By providing a direct link to evaluate a specific action against a specific remedial goal (*e.g.*, PCB

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[1] EPA cannot utilize CERCLA to achieve goals unrelated to the protection of human health and the environment, such as increasing the depths of navigational channels. Thus, the statement in the SOW that "[r]emoval, rather than containment (capping) or *in situ* treatment will be considered the preferred action for contaminated sediments within the limits of the navigation channel, if necessary," (SOW at 18) is improper. Any action selected with the intent of increasing the depth of navigational channels, rather than attaining risk-derived objectives, would be inconsistent with the NCP.

concentrations in fish), however, the models make indirect remedial criteria, such as sediment concentrations intended to achieve a protective level in fish, unnecessary.

Unfortunately, the SOW's proposed use of the models does not consistently match this approach. On the one hand, the SOW correctly states that the "main point of the modeling is to provide a basis on which to evaluate various remedial action scenarios in view of attaining acceptable PCB body burdens in fish within an acceptable time frame" (SOW at 15). Here, EPA makes clear that the model should be used to compare the relative effectiveness over time of different remedial alternatives to achieve a pre-determined remedial action objective -- acceptable PCB body burdens in fish. A few pages earlier, however, the SOW suggests that EPA will back into this process by selecting an arbitrary list of remedial scenarios first (*i.e.*, those set out on pages 12 and 13) and then inputing these scenarios to the models to develop a list of potential remedial objectives. This approach is backwards; one must first establish remedial objectives and then develop and evaluate remedial scenarios for their ability to meet them.

Thus, the basic focus of EPA's remedial analysis must be comparative risk reduction over time. Remedial alternatives not aimed at reduction of risk to acceptable levels should be eliminated from consideration. Quantitative models provide the primary tool upon which to make this analysis.[2]

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[2] The SOW suggests that EPA may abandon its modeling effort: "due to the scale and complexity of PCB contamination in the Hudson, there remain a number of less well-understood issues or parameters which may add a degree of uncertainty to model output. As a result, the model output cannot be used as the sole basis for the selection of remedial action objectives" (SOW at 14). EPA must not abandon the best quantitative tool for making rational and informed decisions in favor of some unspecified criteria that may be subject to even greater uncertainty. Instead, EPA is obliged to assess the uncertainty associated with the model and determine what assumptions and parameters are most critical in controlling achievement of the remedial action objectives.

(continued...)

Unfortunately, the remedial objectives identified at pages 15-16 of the SOW are not focused on reduction of risk to acceptable levels. While the first two listed objectives (achieving PCB levels in fish protective of human health and achieving PCB levels in near-shore sediments that protect against direct human contact) fall squarely within the risk reduction framework, they do not contain an element of time. The remaining three (reducing "ecological risk" generally, reducing water column concentrations of PCBs to water quality standards, and reducing the inventory of PCBs) neither relate to achieving a defined level of acceptable risk nor reference the time element. Further, they are too vague to be useful. Almost any remedial action could satisfy these criteria, and almost any remedial action might be disqualified from consideration because it could not.

The SOW's focus on goals other than risk reduction is also evident from the proposed remedial scenarios set out on pages 12-13. These scenarios involve the removal or isolation of sediments based on one of four criteria:

- PCB levels (M/L^3) exceeding a threshold value,
- PCB inventory (M/L^2) exceeding a threshold value,
- location (*i.e.*, the NYSDEC hot spots; NYSDEC dredge locations; bank-to-bank within the TIP), or
- sediment type (*i.e.*, fine-grained sediments).

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[2] (...continued)
Abandoning the models in favor of subjective analyses of data would not reduce uncertainty; it would increase it. Any remedial decision made without substantial reliance on quantitative models that can project the effectiveness of remedial alternatives over an extended period of time will be arbitrary and capricious.

These criteria are all based on the false notion that remediation in the areas of greatest PCB mass -- mass reduction -- will maximize risk reduction. This presumption is false. Risk reduction will be achieved by reducing PCB flux to the water column and exposure of biota to PCBs, not by simply removing an arbitrary quantity of contaminated sediments. This is because: (1) most of the PCB mass is sequestered from the water column in deep sediments; (2) water column PCB flux is controlled by PCB concentrations in surface sediments, not local, buried deposits of PCB mass; and (3) biotic exposure to PCBs is driven by PCB concentrations in surface sediments, not local, buried deposits of PCB mass. At this Site, mass removal does not equate to risk reduction.

Most of the PCB mass is sequestered from the water column in subsurface sediments.

GE's 1991 sediment PCB data, EPA's Phase 2 high resolution coring, and GE's 1998 sediment coring all demonstrate that PCB concentrations are highest in buried sediments or those sediments greater than 10 cm below the sediment-water interface (GE 1997; 1998). The 100-year flood model described in EPA (1996a) demonstrates that contaminated sediments more than several centimeters below the sediment-water interface are not affected by extreme flood events. GE's own modeling effort confirms this.

PCB concentrations in surface sediments, not local, buried regions of PCB mass, control the PCB flux to the water column.

Flux to the water column occurs via diffusion from sediment pore water and event-driven resuspension of surface sediments. Surface sediment pore water PCB concentrations are controlled by the PCB concentrations in sediment organic matter (*i.e.*, mg PCB/kg organic carbon) because PCBs preferentially adsorb to this component of the sediment. Local areas of PCB deposits (*i.e.*, the so-called *hot spots* or regions of fine sediment) are not regions of highest

PCB concentration in sediment organic matter. In fact, surficial sediment organic carbon-normalized PCB concentrations are similar in and out of the so-called *hot spots* as well as between coarse-and fine-grained areas (QEA 1998a). The diffusive flux of PCBs is similar across the various sediments, and a remedial program that targets areas of PCB mass can only reduce the diffusive flux of PCBs to the water column in proportion to the fraction of total sediment surface remediated. Since the so-called *hot spots* comprise only a small part (on the order of 10%) of the total sediment surface area in the Upper Hudson, simply targeting the hot spots for removal will not achieve meaningful risk reduction. Furthermore, the regions of high PCB mass tend to be the depositional regions of the river and, therefore, are not the dominant components of the erosive flux to the water column.

PCB concentrations in surface sediments, not local, buried areas of PCB mass control exposure of biota to PCBs.

Biota derive their PCBs partially from the water column (and thus from both upstream sources and diffusive flux from surface sediments) and partially from the ingestion of sediments by deposit-feeding invertebrates. Deposit feeders, such as worms, consume a certain amount of sediment organic matter each day to fulfill their energy requirements. The PCB dose they receive depends on the PCB concentration in the organic matter. Because this average concentration in organic matter is similar in and out of the areas of buried PCB mass, the dose to the food web does not come preferentially from high PCB mass areas.

EPA must consider the mechanisms and routes of PCB transfer and bioaccumulation when analyzing possible remedial actions. Thus, EPA must not emphasize sediment PCB mass removal, but must focus on the risk-related goals of: (1) elimination of ongoing sources that contribute to surface sediment contamination; (2) broad-scale reduction of PCB flux from surface sediments by natural and active remediation; and (3) stabilization of areas subject to erosion, if necessary, to reduce downstream transport.

III. Remedial Technologies

A. The SOW Is Improperly Skewed Toward Large-Scale Remediation Through Dredging

The SOW is improperly biased toward large-scale remediation projects involving removal of sediments. This bias is evident from its screening out certain technologies as infeasible because of the assumed large-scale of remediation, while not acknowledging that a large-scale remedial action would call into question the feasibility of remedial dredging.

EPA has eliminated potential technologies based on a premature judgment that they are inappropriate or infeasible for a large cleanup when, in fact, the size of the cleanup has not yet been determined. For example:

- "several technologies were screened out based on the scale of the potential cleanup effort"
- "solvent extraction of PCBs in sediments was eliminated as an *in-situ* treatment option based on the large scale of the remediation required"
- "centrifuge techniques were eliminated as a potential sediment pretreatment/dewatering process based on the anticipated large volumes of sediment to be treated."

SOW at 21 (emphasis supplied). As the SOW acknowledges: "[t]he actual volume to be remediated will of course be dependent on the selected remedial action objectives and will be determined in Phase 3 after the final selection of objectives is made by EPA" (SOW at 21). Thus, EPA's elimination of technologies on the grounds that they are inappropriate for the scale of remediation is improper and suggests that the Agency has already determined that it wishes to pursue a large-scale remediation project.

While EPA has used the assumed large-scale of remediation to screen out certain treatment technologies, it failed to analyze removal technologies (dredging) in the same manner. Table 1 presents estimated removal volumes associated with 8 of the 10 remedial scenarios set out in on pages 12-13 (two cannot be estimated due to insufficient characterization data). As an initial matter, the SOW provides no explanation for how these remedial scenarios were identified and selected. For example, on what basis were the PCB target levels used to define the different scenarios (*e.g.*, 1 ppm, 10 ppm, 50 ppm) selected? On what basis were the areas for remediation (*e.g.*, hot spots in the TIP, hot spots elsewhere, bank to bank) identified? Why has EPA focused on mass reduction instead of risk reduction?

In any event, it must be acknowledged that even the smallest of these remedial scenarios is six to nine times larger than any remedial dredging project accomplished in the United States to date. Yet, their inclusion in the SOW suggests that the Agency has already concluded that removal or capping of sediment at this scale is technically feasible. This assumption is misplaced and must await the screening of technologies and remedial alternatives in the FS. GE's analysis shows that most of the ten remedial scenarios are technically infeasible for this Site for several reasons: they all would take years or decades to implement; the ability to dredge to low cleanup levels (*e.g.*, 1 ppm PCBs) in a river has never been demonstrated; isolation (capping) of such extensive areas in a river has not been demonstrated.

To inject reality into its evaluation of remedial scenarios, the SOW must evaluate what has and has not been accomplished at other sites where remedial dredging has been implemented (discussed further in the next Section). For example, consider that the average size of a single NYSDEC hot spot is 7.7 acres (309 total acres divided by 40 hot spots). A <u>single</u> 7.7

acre hot spot dredged to a 3 foot depth would generate 36,400 cy of sediment, more material than has been removed at all but a handful of remedial dredging projects to date. Applying average monthly removal rates of 3,000 to 8,000 cy, derived from ten of the 14 actual dredging projects implemented to date (those for which such data are available), illustrates that removal time for one such hot spot would be 4.5 to 12 operating months - one to two construction years. Further, one hot spot in the Hudson typically is one construction project, distinct from each successive hot spot. EPA presents these potential scenarios as routine removals, assuming they be accomplished in a single, broad sweep. This would not be the case.[3]

Recognition of these factors and assessing and incorporating them into the analysis of remedial alternatives is vital to a credible FS.

B. Specific Comments on Remedial Technologies

1. Remedial Dredging Has Not Been Demonstrated to be Effective in Reducing Risk

The SOW's apparent bias toward large-scale dredging seems to be premised on the assumption that remedial dredging has proven to be effective in reducing risk. An exhaustive

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[3] To illustrate, consider the construction requirements and factors for a single hot spot, each with unique logistical characteristics, and geographical and physical constraints. These requirements include: (1) obtaining permits and access agreements; (2) siting and constructing land-based dewatering and water-treatment facilities and a TSCA disposal site; (3) constructing access roads across private shoreline property for certain hot spots; (4) installing sheetpile or silt curtains adjacent to the hot spots, as the case may be; (5) selecting, making available, and providing access for the removal equipment; (6) identifying and implementing methods and means of removing and managing rocks, boulders, vegetation, and debris; (7) identifying and implementing the means of transport of the removed material to land-based dewatering or disposal sites (*e.g.*, pipelines, barges, or trucks); and (8) designing and putting in place pre-, during, and post-dredging monitoring programs.

examination of the 27 sediment remediation projects in progress or completed in the United States undermines this assumption:[4]

- Remedial dredging was performed at fourteen of the 27 projects; eleven used dry excavations (after temporary diversion of the water). Two were natural recovery. Combined removal volume for all of these projects was 1,350,000 cubic yards (cy), a volume about equal to the smallest of the ten removal scenarios identified by EPA.

- At least eight different types of sediment target goals have been identified for the 27 sites. While this could be attributed to the complexity and unique features at each site, it is symptomatic of the confusion surrounding the subject of sediment remediation and the absence of a clearly articulated remedial goal for sediment sites.

- Overall costs for removal projects ranged from $83 to $1,670 per cubic yard, with a median of about $350 to 400 per cubic yard. (Navigational dredging typically costs $1 to $10 per cubic yard). The high costs are typically due to a combination of low production rates (*i.e.*, extended time for implementation due to the inefficiency of remedial dredging) and high disposal costs

- Treatment was seldom a component of disposal. Two projects employed incineration; two projects, in part, used thermal desorption. The predominant method of disposal (17 of the 24 removal projects) was in commercial landfills. Disposal in near-shore confined disposal facilities was employed at two projects. At three projects, removed material is being stockpiled pending a final disposal decision.

- Specialty dredges or excavators were generally not used on the 24 removal projects. Thus, recent claims of substantial advances in dredging equipment are not borne out. This is not surprising in that specialty dredges tend to focus only on improving limited aspects of the remedial dredging process (such as minimizing

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[4] GE, with the assistance of Applied Environmental Management and Blasland, Bouck & Lee, has been collecting information about and preparing a documented analysis of lessons learned from sites where sediment remediation has been implemented. GE anticipates that this document will be completed soon, and we intend to submit it to EPA, for inclusion in the Administrative Record. The Agency must consider this information in its remedial analysis for the Site.

resuspension or allowing passage of larger-size solids) and, by their nature and due to their specialized features, tend to have low production rates.[5]

These 27 projects underscore the important problems and limitations of not only the technologies employed but also the process by which these projects were selected and implemented.

First, the objectives of remedial dredging are often not presented in terms of measurable benefits to human health or the environment, but typically focus on achieving a reduction in PCB mass or a target contaminant concentration level. As we show above, mass removal can not be equated to risk reduction. If the contamination is buried so that it is effectively not bioavailable, mass removal may remove the protective layer and leave higher concentrations of contaminants in the bioavailable surface layer. Unless the source of contaminants has been controlled, the sediments will be re-contaminated in a few years and no long-term benefit will be derived.

Second, it is rare to find post-dredging monitoring data that determines whether the objective (such as reduced contaminant concentrations in fish) has been met. At sites where post-dredging measurements are available, target concentration levels in sediments have often not been attained.

Third, the schedule and costs of implementing dredging are typically far greater than originally estimated, in part because the production rates are dramatically lower than originally estimated. The reduction in production rates results from several factors: the need for care in removal to keep resuspension to a minimum; the need to make several passes because target concentration levels have not been achieved with the first pass (or ever); and the presence

[5] Tables 2 and 3 present additional data concerning these projects.

of impediments to dredging, such as rocks, vegetation and debris. An additional factor reducing the speed with which remedial dredging projects can be implemented is the inability of the land-based dewatering and treatment facilities to process the amount of material removed. Indeed, remedial dredging projects always generate significant volumes of water that must be treated.

Fourth, the short- and long-term ecological impacts of remedial dredging are not addressed in any systematic manner. This is a particularly important issue for the Hudson because the areas that EPA has identified as potentially subject to dredging (SOW at 12-13) are predominantly shallow shoreline and backwater areas which provide important ecological functions. Dredging in these areas can result in direct mortality of valued organisms, including submerged aquatic vegetation, aquatic invertebrates, juvenile and adult fish, reptiles, and amphibians. Similarly, the need to provide a staging area for equipment to support the dredging operations has the potential to adversely impact riparian soils and vegetation and riparian habitat. Resuspension of sediment and contaminants also remains an issue that must be squarely addressed.

Fifth, the practical difficulty of implementing a remedial dredging program is often not considered. These issues, again, are very important to the Hudson. As EPA is aware, there has been fierce public opposition to remedial dredging and to the siting of a dewatering/treatment facility and landfill near the Upper Hudson River. A prior attempt by New York State to site a landfill to support a dredging project was successfully blocked by a local citizens group's lawsuit in a case that was decided by New York's highest court. The remedial alternatives set out at pages 12-13 are orders of magnitude greater than any previously attempted remedial dredging project. Any of them is likely to provoke vigorous public and political opposition and to present unprecedented logistical problems.

In short, EPA must not prematurely assume that remedial dredging is feasible, will achieve risk-based goals, can be performed in a cost-effective and timely manner and will be deemed acceptable by the State of New York and the local community. EPA must carefully examine the information from other sites where remedial dredging has been implemented and recognize that the Hudson presents fundamentally different site-specific considerations that must be practically and carefully evaluated.[6]

2. Engineered Capping

An alternative to removal by remedial dredging often considered is in-site confinement of contaminants by placement of an engineered cap. There are few sites where such caps have actually been employed, and questions remain about their effectiveness. Additionally, many of the same logistical, access and physical constraints associated with remedial dredging apply equally to the construction of engineered caps.

An engineered cap is designed to: (1) accomplish short and long-term isolation of chemical contaminants; (2) compensate for consolidation of both the underlying sediments as well as the cap materials after placement; (3) protect against bioturbation, erosion, or groundwater intrusion, and (4) be hydraulically compatible with the waterway. Multi-layer cap designs typically include: (1) rocks or cobbles to serve as a top, armor layer; (2) geotextile to act as a

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[6] As part of its remedial analysis, EPA must also consider H.R. Rep. 105-769 (Conference Report for VA-HUD FY 1999 Appropriations Bill), which directs EPA not to select dredging as a remedy at contaminated sediment sites until the National Academy of Science issues its report on sediment remediation technologies. See H.R. Rep. 105-769 at 271-72 (1998).

divider between layers, to limit mixing of cap materials between layers, and to limit intrusion of biota by bioturbation; (3) sandy upper layers, which are readily placed, relatively stable, and resistant to burrowing organisms; and (4) fine-grained lower layers, which promote binding (adsorption) with the contaminants at the sediment surface.

In-situ capping for remediation of sediment has been accomplished at a handful of freshwater sites but not in an extended stretch of river, such as the Hudson. Capping was rejected at New Bedford Harbor, the GM Massena site and the Manistique River primarily because of concerns about the permanence of an engineered cap and uncertainty about the types of materials to be used, their sequence and thickness, and the cap's potential effectiveness. Additional concerns include the potential for advection (by groundwater intrusion) and bioturbation (burrowing organisms).

3. Thin-Layer Capping

Sediment broadcasting or thin-layer capping is an alternative to engineered capping. The goal of sediment broadcasting is to accelerate the natural recovery of the system by increasing the rate of contaminant burial over a broad area, thus reducing the bioavailability of the contaminants. Sediment broadcasting, in essence, augments the natural burial processes. An important design element in sediment broadcasting is the solids mix, which must be selected based on river hydraulics. An advantage of sediment broadcasting is that it is less intrusive than either dredging or engineered capping, and thus has the potential for reduced adverse impacts to the environment. While innovative, EPA should consider thin-layer capping as a remedial alternative, since it focuses on the source of PCBs to fish (surface sediments), is ecologically-friendly, and will not present the community acceptability issues associated with the large-scale removal.

4. Stabilization

Stabilization of sediments in specific areas of the river also should be evaluated as a remedial technology. Stabilization might involve the addition of rip-rap or other stabilizing materials along transitional zones between coarse-grained and fine-grained sediment deposits.

IV. The SOW Attempts to Expand The Site By 160 Square Miles Without Providing a Practical Need or Legal Justification

The SOW, in one sentence, unilaterally attempts to expand substantially the scope of the "Site," apparently to avoid the New York State permitting process to site and approve a treatment, storage or disposal facility to manage dredge spoils removed during a dredging project. The SOW states that for purposes of dredging, "'on-site' refers to a corridor including the Upper River and extending two miles from either bank." SOW at 17.

When the Site was listed on the NPL, the Agency included only the upper river itself, not any adjacent lands. GE recognizes that, for purposes of implementing remedial actions, the NCP defines "on-site" to mean "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action." 40 C.F.R. § 300.5. Nevertheless, the SOW provides no justification for expanding the Site by <u>two miles</u> on each side of the River to encompass lands that are not impacted by PCBs and which have no relationship to the PCBs found in the river.

The expansion of the Site appears to be an attempt by EPA to avail itself of the "permit exemption" found in CERCLA § 121(e)(1) ("[n]o Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely onsite"). This provision allows the Agency to avoid the <u>procedural</u> requirements associated with implementation of a remedy, including the need to apply for and obtain necessary permits or approvals. As the Agency well knows, a person seeking to site a landfill or treatment facility to accept dredge spoils in New York State would normally need to submit a permit application to NYSDEC, proceed through public hearings and government and community scrutiny to ensure that the proposed landfill meets all applicable legal and environmental requirements and then ultimately obtain a permit. Prohibitions established by state law (against siting a landfill in certain agricultural lands or in a floodplain, for instance) would normally have to be satisfied, as would certain applicable requirements established by local governments. Before taking so drastic a step to foreclose public scrutiny, the Agency must demonstrate both the necessity and relationship of these areas to PCB-impacted areas in the River. EPA has done neither. Fierce public opposition to a landfill along the Hudson has blocked previous attempts to site such a facility. A single, unsupported sentence in the SOW should not be used to bypass the public scrutiny demanded by state law designed to balance legitimate community and environmental concerns raised by projects exactly like this. Community acceptance is an important principle at Superfund sites.

V. **<u>The SOW Does Not Describe or Apply the NCP Analytical Criteria Accurately or Appropriately</u>**

A. <u>Given Improving Conditions, the "No Action" Alternative can be Effective in the Long-Term</u>

An important consideration in the analysis of remedial alternatives is to assess the long-term effectiveness of each alternative. As the NCP explains, this analysis involves, in part, an assessment of the degree to which each alternative reduces the volume, toxicity, mobility and propensity to bioaccumulate. 40 C.F.R. § 300.430(e)(9)(iii)(c)(1). The SOW, however, seems to use the long-term effectiveness criteria inappropriately to favor sediment removal. First, the SOW states that EPA "prefers those processes which degrade contaminants" and implies that this factor outweighs natural attenuation and No Action (SOW at 17). Second, the SOW states that removal of sediment would be more effective over the long-term than capping or No Action: "long-term effectiveness will consider the degree to which the contamination is effectively isolated from the river over a long period of time" (SOW at 30).

Both these discussions of long-term effectiveness misconstrue the NCP criterion and understate the long-term effectiveness of the No Action/natural attenuation alternative. The No Action alternative, through natural attenuation, reduces the toxicity, bioavailability and mobility of sediment-bound PCBs (GE 1996; 1997; 1998). Toxicity is reduced through dechlorination. Bioaccumulation potential is reduced through dechlorination and burial. Mobility is also reduced through burial, as the results of EPA's 100-year flood model demonstrate. In fact, the 100-year flood model provides a persuasive analysis of the long-term effectiveness of the No Action alternative. Capping alternatives, moreover, have the potential to accelerate the reduction in bioaccumulation and reduction in mobility of sediment-bound PCBs. EPA must not use the long-term effectiveness criterion to favor removal of sediments over natural attenuation or capping.

B. <u>Short-Term Risks Associated with a Remediation Project Must Be Identified and Quantified and Cannot Be Qualitatively Dismissed</u>

Another important aspect in the consideration of alternatives is to assess the short-term effectiveness and risks associated with the implementation of each alternative. While EPA intends to consider the long-term effectiveness of each alternative using the quantitative fate, transport and bioaccumulation models, the SOW indicates that the Agency does not intend to analyze the short-term risks with the same degree of specificity. For example:

> [s]hort-term risks associated with the period of remediation are much more difficult to quantify due to the lack of information on the nature of PCB release during this time. Although both resuspension and air-borne releases may take place during removal and treatment, the ultimate fate of these materials will not be well-known . . . As a result, any risks . . . will be handled qualitatively only.

SOW at 27. EPA must examine the short-term risks quantitatively.

As an initial matter, the SOW incorrectly implies that short-term risks are limited to the effects of PCB releases by resuspension and air-borne releases. There are numerous other short-term risks associated with any remedial action. For example, any large construction and transportation project has the potential to create risks to the community and the workers. Actuarial data is available to estimate the predicted number of major injuries and deaths that are likely to occur during such a project. In addition, as explained previously, there is a significant potential for severe ecological harm during and following remediation, particularly for the massive projects identified in the SOW. These risks need to be considered and compared to the hypothetical reduction in risk to be obtained by any project.

Furthermore, the SOW appears to ignore or downplay the potential for short-term risks. For example, the SOW states that the models will be "run assuming various remedial actions have taken place" (SOW at 12). This approach effectively avoids consideration of short-term risks. As the SOW notes, short-term risks include resuspension and downstream transport of bottom sediments, and temporary increases in water column PCB concentrations as PCBs sequestered in the sediments are released to the water column during remediation. These processes may result in a short-term increase in PCB levels in fish, and consequently, human health and ecological risks. The short-term risks associated with the larger scenarios may negate much of the long-term risk reduction achieved by remediation, particularly when compared against other, less intrusive options, such as source control and natural attenuation. For this reason, remediation-related processes, such as sediment resuspension, increased water column PCBs, and downstream PCB transport, need to be incorporated into the model projections and the FS process.

Moreover, "short-term," in the case of some of the removal scenarios listed on pages 12 and 13, is likely to mean years and possibly decades. A quantitative assessment of risk of implementation is thus essential to judge the effectiveness of a remedial alternative when compared to No Action. The extended time frames likely required to implement the remedial scenarios set out on pages 12-13 have two critical consequences. First, the timing and scale of the impact of remediation on fish PCB body burdens relative to No Action will be increased compared to other, less extensive actions which can be implemented in less time. This obviously reduces the actual benefits of remediation, a fact that will be ignored if the actions are assumed to have taken place instantaneously, as currently proposed. Second, it is important to consider the length of time for implementation of a remedial action when comparing its outcome with No Action. For example, if the models predict that fish PCB body burdens would decline below the target remedial action objective within ten years under the No Action scenario, but it requires ten years to perform a remedial scenario, the benefits to be derived by the remediation would, in fact, be non-existent.

To account for the short-term risk and the time required to perform remediation, the EPA needs to parameterize the models with real world data and quantify:

- sediment resuspension during dredging,
- redistribution of PCBs within the system during and post dredging,
- achievable sediment cleanup levels, and
- start dates and durations for the different remedial scenarios.

Information from remedial dredging at other sites, combined with available information at this Site, should be used to develop input data for the models.

C. <u>The Feasibility of Remedial Alternatives Must be Carefully Assessed</u>

The definition of "technical feasibility" is critical to the screening of technologies. The definition on page 20 -- "[t]echnologies or process options will be determined to be technically infeasible based on study area-specific factors" -- is too narrow and vague. Greater specificity is required. Criteria that should be considered for assessing "technical feasibility" include whether the technology (1) has been successfully demonstrated at full-scale, (2) is exorbitantly costly,[7] (3) is unacceptably risky to implement, or (4) is incapable of achieving the targeted goal and, even if demonstrated at full scale, can be applied to be a project far larger and more complicated than any project completed to date. Technologies that fail to satisfy one of these criteria must be judged technically infeasible.

[7] The SOW's use of the term "relative cost" of technologies as one of the screening criteria (SOW at 21) is incorrect. The NCP directs that technologies can be eliminated if their costs are "grossly excessive" compared to their overall effectiveness. 40 C.F.R. § 300.430(e)(7)(iii).

VI. **The Monitored Natural Attenuation Alternative Must Incorporate Burial, Dechlorination and Source Control**

The SOW states that "[n]atural attenuation could occur by *in situ* processes such as biodegradation, dispersion, dilution, sorption, volatilization, and chemical and biological stabilization, transformation, or destruction of PCBs" (SOW at 17). This discussion of natural attenuation ignores three significant factors affecting natural recovery: (1) burial of PCB contaminated sediments by clean sediment, (2) PCB dechlorination, and (3) control and reduction of upstream sources of PCBs. These factors must be incorporated into the quantitative modeling framework.

A. Burial of PCB-Containing Sediments by Clean Solids

Burial of PCB-containing sediment represents an important natural recovery process because exposure of aquatic organisms to PCBs in the Upper Hudson River is through PCBs found in surface sediments, not PCBs at depth. Burial is the process by which clean solids entering the Upper Hudson River from upstream and from tributaries settle within depositional zones and effectively sequester sediment containing elevated PCB concentrations from the food chain and from the impacts of a flood event. Rigorous data and modeling analysis conducted by both EPA and GE show that widespread burial is occurring within the Upper Hudson River. These analyses include:

- tributary and river solids balance calculations (LTI 1998),
- rigorous sediment transport modeling (GE 1998),
- deposition rates estimated from ^{137}Cs dating of EPA's high resolution cores (EPA 1997),
- ^{7}Be presence in EPA low resolution cores (GE 1998), and

- PCB concentration and composition profiles obtained from EPA high resolution cores (EPA 1997) and 1998 GE cores (QEA 1998b).

Previous Phase 2 reports (EPA 1997; 1998) focus on the buried PCBs in the so-called *hot spots* and claim that these PCBs are finding their way into the water column and fish. As we have explained previously (GE 1996; 1997; 1998), these reports provide no cogent explanation of how such PCBs become available to the river. In fact, other than erosion, there is no known mechanism for making buried PCBs bioavailable, and EPA's own 100-year flood model demonstrates that even the maximum-design flood does not displace a significant amount of sediment or PCBs. The FS must recognize that burial is an important aspect of natural attenuation.

B. PCB Dechlorination

PCB dechlorination is an important natural recovery process. PCB dechlorination involves the microbially mediated removal of meta- and para-chlorines from the biphenyl molecule and results in the depletion of highly chlorinated PCB congeners with a corresponding increase in lower-chlorinated PCBs. The principal products of this process are ortho-substituted mono- and dichlorinated PCBs. Although PCB dechlorination may not represent a significant mass loss mechanism (EPA 1997), this is not its chief benefit. Dechlorination does have a dramatic effect on the physiochemical and toxicological properties of PCBs including: reduced toxicity, reduced carcinogenicity, and reduced bioaccumulation potential (GE 1997). Therefore, PCB dechlorination results in meaningful risk reduction and should be considered in the assessment of natural attenuation of Hudson River PCBs.

C. Upstream Source Control

Control of the most important PCB source in the upper Hudson is perhaps the most significant element of the river's natural recovery, and it must be carefully considered in any credible evaluation of the efficacy of remedial alternatives. The SOW's limited discussion of GE's major source-control activities at Hudson Falls and their beneficial results for the river suggests that EPA is not closely following GE's work and does not fully appreciate the benefits of controlling the source and the magnitude of the clean-up and monitoring program. Indeed, the SOW marches out the same flawed and so-vague-as-to-be-useless conclusion initially presented in the DEIR that the TIP sediments are "a major, if not the major" source of PCBs to the water column in the upper Hudson (SOW at 10). GE submitted extensive comments on the DEIR more than 18 months ago, challenging the soundness of its conclusions and demonstrating the importance of source control. EPA has not responded to these comments, and the SOW does not even acknowledge that the DEIR's conclusions have been called into question. The importance of the Hudson Falls source to PCB dynamics in the Upper Hudson River is obvious, and its impact must be evaluated against each remedial alternative .

The mathematical models being developed by EPA and GE represent the best means of assessing the impact of plant site sources and their control on surface sediment and biota PCB levels. When calibrated with the 20 years of water column, sediment, and biota PCB data, the models can assess the impact of plant site loadings on PCBs in the TIP sediments and water column and simulate the impact of plant site source control by making varied assumptions regarding the PCB concentrations at the upstream boundary of the model. These assumptions may include projection of PCB loadings in the river at the Fort Edward Station at 1980s levels, current levels and zero. In this manner, the models can simulate the effects of past and future source control efforts, and the results can be compared to other remedial action scenarios and No Action.

VII. EPA Can Not Justify Upper River Remediation Based on Presumed Benefits to the Lower River

The SOW does not explain how conditions in the lower river will be used in the evaluation of remedial alternatives. As GE has previously advised EPA, the Company believes that the Superfund Site is limited to the area above the Federal Dam at Troy and does not include the lower river. We base this view on the administrative record supporting the addition of the Site to the NPL, which limited its analysis to the upper Hudson. EPA cannot expand the Site by more than 150 miles without proceeding first through notice and comment rulemaking. See, e.g., U.S. v. Ascarco, Inc., No. CV96-0122-N-EIL (D. Idaho Sep. 30, 1998) (post-rulemaking statements cannot change scope and size of site from the description provided in the NPL record).

The SOW, however, repeats EPA's intention to consider the lower river part of the Site and implies that the Agency may seek to justify remediation in the upper river based on benefits to the lower river: "the USEPA Reassessment and Thomann/Farley models will be used to examine the impact of possible remedial actions in the Upper Hudson River on PCB levels in fish and water in both the Upper Hudson River and Mid-Hudson River" (SOW at 6). If this statement reflects the Agency's intent to consider the potentially adverse impacts on PCB levels in lower river biota from upper river remediation, then GE does not take issue with the proposed approach. If, however, EPA is seeking to justify upper river remediation based on presumed benefits to the lower river, then the Agency's approach is objectionable. In light of the significant other sources of PCBs to biota in the lower river, EPA cannot use perceived benefits there to justify remediation in the upper river unless EPA expands its analysis and considers alternatives to address all PCB sources in the lower river. The SOW indicates that EPA does not intend to conduct an analysis of such actions in the lower river.

VIII. EPA Should Not Blindly Apply ARARs and TBCs at the Site

A. EPA Should Give Preference to Site-Specific Information

CERCLA and the NCP direct EPA to give preference to site-specific information over the rote application of ARARs and TBCs. In order to assess ARARs, one must understand the remedial goals for the Site. As we explained above, the central question at this Site is to determine whether a remedial action will achieve a defined level of risk from fish consumption or direct contact with the river materially faster than No Action. If a regulatory requirement is designed to achieve the same end, then it is reasonable to identify that requirement as a potential ARAR or TBC for the Site. Where the goals of the remediation and the requirement diverge, however, that requirement can be disqualified from further consideration. For example, drinking water standards might qualify as ARARs because they are designed to protect human health through the consumption of water.

Nevertheless, many ARARs or TBCs that meet the basic "consistency" test were adopted for non-remedial purposes and apply to a variety of circumstances not necessarily relevant to the Hudson River. For instance, a general water quality standard may be designed to protect an aquatic or terrestrial species not found in or near the Hudson. Many general standards are based on outdated data that do not reflect current scientific information. For instance, EPA lowered its estimate of the carcinogenicity of PCBs a few years ago. A number of PCB standards are based on PCB carcinogenicity but have not been amended to reflect this reassessment. The quality of the data on which a benchmark is based is particularly a problem for TBCs, which, by definition, are not promulgated requirements and have not been subject to the type of rigorous review to which most ARARs are put. In such circumstances, EPA should emphasize the wealth of site-specific information in its possession and being developed when determining remedial standards for the Hudson.

Such an approach is consistent with and mandated by CERCLA. CERCLA does not require mechanical application of ARARs. Rather, as expressed by section 121(b)(1), the overriding goal of CERCLA is to ensure that remedial actions are protective of human health and the environment. The ARARs requirement, which was added as part of the 1986 amendments to CERCLA, originally derived from EPA's "Compliance With Other Laws" policy and the 1985 NCP. Congress intended, and EPA has consistently interpreted, ARARs as surrogates to help ensure that this overriding goal is met and that a consistent level of protection is achieved:

> EPA has determined that the requirements of other Federal environmental and public health laws . . . will generally guide EPA in determining the appropriate extent of cleanup at CERCLA sites as a matter of policy. These laws were enacted with the goal of protecting public health and the environment. Regulations developed under these laws have imposed requirements that EPA and other Federal agencies deemed necessary to protect public health and the environment. Because protection of public health and the environment is also the goal of CERCLA response actions, other Federal environmental and public health laws will normally provide a baseline or floor for CERCLA responses.[8]

ARARs are requirements promulgated under environmental laws that are legally applicable or otherwise relevant and appropriate to the particular circumstances of the site. 40

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[8] 50 Fed. Reg. 47917 (Nov. 20, 1985); see also "Superfund Amendments and Reauthorization Act of 1986 Conference Report," H.R. Rep. 99-962, 99th Cong. 2d Sess. ("The general standard is that remedial actions must attain a degree of cleanup . . . at a minimum that assures protection of human health and the environment"); 50 Fed. Reg. 5865 (Feb. 12, 1985) ("other environmental requirements often provide critical guidance in determining the appropriate level of cleanup at a CERCLA site"); 53 Fed. Reg. 51422 (Dec. 21, 1988) ("The overriding mandate of the Superfund program is to protect human health and the environment"); 55 Fed. Reg. 8712-8713 (Mar. 9, 1990) (explaining that remedial action "goals," typically based on ARARs, are a subset of and are intended to implement the more general remedial action "objectives").

C.F.R. §§ 300.5, 300.400(g). TBCs are unpromulgated advisories, criteria or guidance "useful" to develop a remedy. 40 C.F.R. § 300.400(g)(3). Congress recognized that there would be circumstances where it would not make sense to apply these requirements rigidly and provided EPA flexibility to account for such circumstances. 42 U.S.C. § 9621(d)(4) (identifying circumstances when application of ARARs should be avoided). Congress never intended the ARARs requirement to supplant reliance on site-specific information:

> [T]he section is not intended to trigger rigid imposition of standards. . . . For the Administrator to determine control levels at sites without reference to how standards under other environmental laws come into play could lead to absured [sic] and costly results that could drain the Fund and jeopardize the national cleanup effort without achieving any additional meaningful protection of human health and the environment. That is not how the NCP currently operates and that is not the intent of this section.

H.R. Rep. No. 253, 99th Cong., 1st Sess., pt. 1, at 98 (1985) (House Committee on Energy and Commerce).

EPA has also recognized the benefit of relying on site-specific information instead of general standards that may not best reflect the circumstances of a site:

> CERCLA requires that all Superfund remedies be protective of human health and the environment but provides no guidance on how this determination is to be made other than to require the use of ARARs as remediation goals, where these ARARs are related to protectiveness. Under CERCLA (as under other environmental statutes), EPA relies heavily on information concerning the contaminant toxicity and the potential for human exposure to support its decisions concerning "protectiveness." EPA's risk assessment methods provide a framework for considering site-specific information in these areas in a logical and organized way. . . EPA disagrees with the commenter who advocates national cleanup standards, however, because the specific concentrations developed for one site may not be appropriate for another site because of the nature of the site, the waste, and the potential exposures as noted

> above. . . . [B]ecause these standards [ARARs] are established on a national or statewide basis, they may not adequately consider the site-specific contamination . . . and, therefore, are not the sole determinant of protectiveness.

55 Fed. Reg. 8709 (Mar. 9, 1990).

This basic preference for site-specific information is expressed most clearly in the fourth ARAR "waiver," 42 U.S.C. § 9621(d)(4)(D). This provision provides that site-specific studies should be used where they provide information that will allow achievement of the same goals and level of protection as the ARAR. The Conference Report accompanying the 1986 Amendments to CERCLA explains:

> Subsection (d)(4)(D) allows the selection of a remedial action that does not comply with a particular Federal or State standard or requirement of environmental law, where an alternative provides the same level of control as that standard or requirement through an alternative means of control. . . . [A]n alternative standard may be risk-based if the original standard was risk-based.

H.R. Rep. 962, 99th Cong., 2d Sess. at 247 (1986). This "waiver" is particularly appropriate for the Hudson, where EPA has collected voluminous site-specific data, is intending to prepare detailed human health and ecological risk assessments and is developing fate, transport and bioaccumulation models that are intended to allow prediction of the outcome of various remedial alternatives. EPA should rely on data and analyses of this sort and not blindly apply generally applicable or relevant state and federal regulatory requirements to devise the appropriate remedy for the Site.

B. <u>EPA Should Reject Many of the Proposed ARARs or TBCs</u>

Not only should EPA give preference to site-specific data and analyses, the rote application of ARARs or TBCs is also inappropriate for technical, policy and legal reasons.

First, it does not make sense to apply ARARs or TBCs developed for other purposes and circumstances as a basis for establishing remediation standards. Sediment criteria intended as <u>screening</u> tools do not make appropriate cleanup standards.

Second, many of the ARARs and TBCs cannot and should not be applied here because they do not reflect the most reliable toxicologic information concerning PCBs, nor do they take into account the differences in toxicity among PCB congeners. Many criteria and standards for PCBs are based on outdated toxicological information concerning PCBs and do not reflect EPA's recent decision to lower substantially the cancer-slope factor for PCBs (EPA 1996b). Equally important, it would be inappropriate to rely on ARARs that do not take into account the substantial dechlorination of PCBs in the river, as well the differential uptake and depuration of congeners by fish and other biota. Standards and benchmarks applied to the Hudson must be relevant to the PCB congeners and biota actually present in the Hudson at the time any proposed remedy would be undertaken. Given the different toxicity and effects of a specific congener, it would be arbitrary to consider a remedy based on standards derived from analysis of a particular Aroclor, say Aroclor 1260, when congeners other than those found in that Aroclor are being addressed. The requirement must be applicable and relevant to the specific chemicals found at the site.

EPA has recognized that the Agency should not apply ARARs in such circumstances, but should rely on the most current information available to the Agency:

> CERCLA 121(d)(2) requires that, in determining whether a FWQC [Federal water quality criteria] is relevant and appropriate, the latest information available be considered. Thus, a FWQC may be relevant but not appropriate if its scientific basis is not current. EPA's recommended RfDs and cancer potency factors, which are

> based on the EPA's evaluation of the latest information, should be used when a FWQC does not reflect current information.

53 Fed. Reg. 51442 (Dec. 12, 1988). The Agency must base its remedial analysis on the most current toxicological information on PCBs and take into account the substantial modification of PCBs in the River and fish.

In this context, we review below several of the ARARs and TBCs listed in Tables 1 and 2 of the SOW.[9]

1. <u>Surface Water Criteria</u>

Table 1 of the SOW identifies New York's PCB water quality standards ("WQS") based on human health protection (fish consumption) (0.000001 ug/l) and wildlife protection (0.00012 ug/l) as potential ARARs. These standards are set forth at 6 NYCRR 703 and NYSDEC TOGS 1.1.1 (June 1998) but should not be applied as ARARs for the following reasons:

- The SOW correctly recognizes that a primary goal of the remedial action objectives ultimately selected for the Hudson is reduction of concentrations of PCBs in fish to acceptable levels. SOW at 15. Virtually all of the site-specific modeling work being performed at the site is focused on this goal. <u>See</u> SOW at 12-15. Applying the human health (fish consumption) and wildlife protection WQS as ARARs would be inconsistent with this objective because the State WQS, which were derived from acceptable fish contamination levels, are generic standards. Applying the WQS as ARARs would in effect substitute generic standards for the standards that will be developed from the site-specific work that is being undertaken.

- The human health (fish consumption) and wildlife protection WQS are wholly inappropriate for application to the Hudson. These WQS were derived using bioaccumulation factors that were developed for the pelagic food web typical of

[9] We do not present any comments on "action-specific" ARARs and TBCs listed in Tables 1 and 2 because such requirements will be only triggered when and if a particular remedial option might be implemented. Thus, any comments on such requirements would be premature.

the Great Lakes, and are irrelevant to the largely benthic food web of the Hudson River.

Table 1 of the SOW also lists "Federal Water Pollution Control Act and Ambient Water Quality Control" as a TBC. These criteria are not relevant where a state has adopted applicable water quality standards, as New York has. EPA only uses the Federal Ambient Water Quality Control criteria to promulgate standards for the states that do meet the CWA requirements. See 40 C.F.R. §§ 131.21 -.22. In this case, EPA has approved New York State's water quality standards, so the Federal Ambient Water Quality Control criteria are neither applicable nor relevant and appropriate in New York.

Table 1 also lists the Safe Drinking Water Act maximum contaminant level ("MCL") and goal ("MCLG") for PCBs as a relevant and appropriate requirement for the Site, although it fails to identify how the MCL and MCLG would be used in the context of remedial decisionmaking. MCLs and MCLGs should not be used to establish cleanup levels, because compliance with these is measured after treatment, not at the source of drinking water. 40 C.F.R. §§ 141.2 (defining a MCL as "the maximum permissible level of a contaminant in water which is delivered to any user of a public water system"), 141.24(f)(2) (directing community water systems to measure compliance with MCLs after treatment). The statutory provision directing attainment of MCLGs (42 U.S.C. § 121(d)(2)(A), does not change the fundamental fact that attainment of MCLs and MCLGs is measured at the tap, not at the source.

Finally, the Toxic Pollutant Effluent Standards for PCBs, contained in 40 C.F.R. § 129.105, listed in Table 1 as "applicable" requirements, are neither applicable nor relevant to the Site. These requirements apply to certain discharges of PCBs by manufacturers of PCBs or PCB-containing electrical capacitors or transformers. 40 C.F.R. § 129.105. To GE's knowledge, none of these activities currently takes place on the Hudson. Contrary to the statement in Table 1, these requirements do not establish a generally applicable ambient water quality criterion for PCBs. Rather, this criterion is relevant only in establishing more stringent effluent limits for PCB/electrical equipment manufacturers where the ambient water quality criterion is not being met. 40 C.F.R. § 129.7; 42 Fed. Reg. 2588, 2610-11 (ambient water quality criteria in Part 129 are used to establish effluent limits and to provide a mechanism to tighten such limits). In any event, this criterion was developed in 1976 and is clearly not based on the most current information available.

2. Sediment Criteria

The SOW identifies three potential TBCs for sediments: NYSDEC's "Technical Guidance for Screening Contamination Sediment," NOAA's "Potential for Biological Effects of Sediment Sorbed Contaminants," and the TSCA Spill Cleanup Policy. None of these is a valid TBC for the Site.

First, the sediment criteria in NYSDEC's Technical Guidance should not be considered because they are not intended to establish cleanup levels and are technically flawed. As the title of NYSDEC's guidance indicates, these target levels are to be used for screening purposes to determine whether additional investigation or remediation is required. Id. at 17-18. The 1997 supplement emphasizes that the "sediment criteria are not cleanup standards. The sediment criteria represent [NYSDEC's] best reasonable estimate of contaminant levels below which significant adverse impacts are not expected." Accordingly, the sediment criteria should not and are not intended to be used as sediment cleanup levels.

Further, the technical basis for establishing the criteria is suspect. The document lists eight limitations in the equilibrium partitioning methodology it uses for determining sediment criteria, warning that equilibrium partitioning "is not a highly accurate procedure in and of itself." Id. at 8-9. Indeed, EPA's Science Advisory Board has cautioned against the use of equilibrium partitioning to establish cleanup levels, believing that they are only valid to establish conservative screening levels to identify sites which warrant more in-depth investigation. E.g., EPA SAB "Evaluation of the Equilibrium Partitioning (EqP) Approach for Assessing Sediment Quality" (EPA-SAB-EPEC-90-006), February 1990; EPA SAB "Evaluation of Superfund Ecotox Threshold Benchmark Values for Water and Sediment" (EPA-SAB-EPEC-LTR-97-009), August 1997.

Second, the NOAA document does not provide "technical guidance for use in establishing sediment cleanup levels," as claimed in the SOW, and is not properly considered a TBC. The cited study was intended as a screening mechanism to prioritize sediment sites sampled in NOAA's "National Status and Trends" ("NS&T") program, not as general guidance for developing "cleanup" levels at other sites. This document plainly states that the values developed in this study "were not intended for use in regulatory decisions or any other similar applications." Id. at 2. Similarly, the document states that the "ER-L" and "ER-M" values "are not to be construed as NOAA standards or criteria," id. at 1, but are "intended only for use by NOAA as general guidance in evaluating the NS&T Program data." Id. at 7.

Finally, the TSCA Spill Cleanup Policy is not intended to provide guidance on sediment cleanup levels. The numerical cleanup standards set out in the Spill Policy do not apply to spills "that result in direct contamination of surface water." 40 C.F.R. § 761.122(d)(2)(i). The

Spill Policy also is not applicable because it applies only to spills that occur after May 4, 1987. 40 C.F.R. § 761.120(a).[10]

3. Air Criteria

The SOW identifies a number of federal and state "air" criteria as potential ARARs. Most of these, as the SOW notes, may only be applicable in the context of implementing certain remedies, and, consequently, we will not address them here. The SOW, however, also identifies as TBCs "applicable to emissions of PCBs from the Hudson River (e.g., volatilization)" two New York State target levels for PCB concentrations in the air: 0.01 g/m^3 as a "Short-term Guideline Concentration" ("SGC"), and 0.00045 g/m^3 as an "Annual Guideline Concentration" ("AGC"), found in a NYSDEC pamphlet entitled "Draft New York State Air Guide-1: Guidelines for the Control of Toxic Ambient Air Contaminants" ("Draft Air Guide"). As an initial matter, these guideline concentrations bear no relevance to the core remedial objectives, particularly in light of the complete lack of data showing any potential risks from "volatilization" of PCBs from the river. In any event, the Draft Air Guide contains the following caveat about the use of these TBCs:

> The word guideline is stressed because these values are developed to aid in the regulatory decision making process. . . [T]hey have not undergone the rigorous regulatory scrutiny that would be afforded a proposed Federal or State standard.
>
> New York State has not proposed adoption of these "guideline values" as standards [because, among other reasons,] a significant portion of the AGCs and SGCs are interim guidelines based on

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[10] The cleanup standards set out in the recently promulgated PCB "Megarule," 63 Fed. Reg. 35383 (June 29, 1998) also do not apply to the site. See 63 Fed. Reg. 35448 (reprinting new 40 C.F.R. § 761.61(a)(1), which states that the cleanup standards do not apply to sediments in marine or freshwater ecosystems).

> occupational values, and do not reflect the extensive toxicological review necessary to establish a standard . . .

Draft Air Guide at 13 (emphasis in original). As the Draft Air Guide emphasizes, these guideline values are meant merely to aid in decision-making and are not legally enforceable. In any event, these guidelines are not based on and do not reflect the most recent cancer slope factor for PCBs.

IX. Miscellaneous Comments

Page 2: The Landfill/Treatment Facility Siting Survey (TAMS 1997), cited at the top of page 26, is not included in the list of Phase 2 reports, but should be made part of the Responsiveness Summary to be released later this year.

Page 3: The SOW states that a "substantial portion of these sediments were stored in relatively quiescent areas of the river." No basis for this statement is presented. The use of the term "stored" is inappropriate. No specific stretch of river is identified. No data are offered to support the characterization of the term "relatively quiescent."

Page 3 / 4: The SOW claims that loading of PCBs to the Upper Hudson continued due primarily to "erosion of contaminated remnant deposits, discharges of PCBs via bedrock fractures from the GE Hudson Falls plant, and erosion from contaminated deposits above the water line near the GE Fort Edward plant outfall." There is no data that show significant PCB loading originating from the remnant deposits nor from the area "above the water line" near the Fort Edward site. In fact, the available data indicate the PCB loading from this segment of the river originates near the Hudson Falls site. This speculation should be eliminated from the SOW.

Page 4: The SOW states that in "September 1991, high PCB concentrations were again detected in Hudson River water." It is not clear here what events are being compared.

Page 4: The PCB removals from within the Allen Mill were accomplished by GE.

Page 5: The term "changing loading" should be "decreased loading."

Page 7: While EPA acknowledges the usefulness of comments received from the public and interested parties, it fails to recognize that when the Community Interaction Program (CIP) was established, GE and other participants expected that EPA would offer responses to comments in a timely way. EPA has not responded to the voluminous comments, and as a result, the CIP process is a monologue, not a dialogue among interested parties.

Page 10: In the discussion of the preliminary risk assessment prepared as part of the Phase 1 report, it is claimed that PCBs were determined to be the contaminant of primary concern. This statement is misleading in that it suggests the Phase 1 Report included an analysis of other contaminants in the river. It did not. This claim must be acknowledged as a unsubstantiated assumption.

Page 16: GE questions the basis for the statement that the Agency intends to assume that the target maximum PCB concentration in sediment is in the range of 1 to 50 mg/kg. This statement is premature.

Page 26: The term "fishing ban" is no longer appropriate for the Upper Hudson.

REFERENCES

Environmental Protection Agency, 1996a. *Phase 2 Report - Review Copy, Further Site Characterization and Analysis, Volume 2B - Preliminary Model Calibration Report.* Hudson River PCBs Reassessment RI/FS. October, 1996.

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Environmental Protection Agency, 1997. *Phase 2 Report - Review Copy, Further Site Characterization and Analysis, Volume 2C - Data Evaluation and Interpretation Report.* Hudson River PCBs Reassessment RI/FS. February, 1997.

Environmental Protection Agency, 1998. *Phase 2 Report - Review Copy, Further Site Characterization and Analysis, Volume 2C-A, Low Resolution Sediment Coring Report, Addendum to the Data Evaluation and Interpretation Report.* Hudson River PCBs Reassessment RI/FS. July, 1998.

General Electric Company, 1996. *Comments of General Electric Company on Phase 2 Report - Review Copy, Further Site Characterization and Analysis, Volume 2B - Preliminary Model Calibration Report.* Hudson River PCBs Reassessment RI/FS. October, 1996.

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General Electric Company, 1998. *Comments of General Electric Company on Phase 2 Report-Review Copy, Further Site Characterization and Analysis, Volume 2C-A. Low Resolution Sediment Coring Report, Addendum to the Data Evaluation and Interpretation Report.* Hudson River PCBs Reassessment RI/FS, July, 1998.

HydroQual, 1997. *Hudson River PCB DNAPL Transport Study.* Prepared by HydroQual, Inc. for the General Electric Company, Corporate Environmental Programs, Albany, NY. June, 1997.

LimnoTech, Inc. 1998. Memorandum from Penelope Moskus and Mike Erickson of LimnoTech to Doug Tomchuk of the USEPA dated September 1, 1998 regarding Preliminary mainstream and tributary TSS load estimates for the upper Hudson River between Ft. Edward and Federal Dam

Quantitative Environmental Analysis, LLC, 1998a. *Thompson Island Pool Sediment PCB Sources.* Prepared for General Electric Company Corporate Environmental Programs, Albany, New York. March, 1998.

Quantitative Environmental Analysis, LLC, 1998b. *Thompson Island Pool Sediment Coring Program.* Prepared for General Electric Company Corporate Environmental Programs, Albany, New York. June, 1998.

TABLES

TABLE 1

SOW REMOVAL SCENARIOS

	EPA Scenario	Target Acreage	Million Cubic yards (3')	Million Cubic Yards (2')
1.	Rogers Island to Troy Dam: >50 ppm (EPA)[1]	298	1.4	1.0
2.	Rogers Island to Troy Dam: Bank to Bank	3702	17.9	11.9
3.	Rogers Island to Troy Dam: RA Level	- -	- -	- -
4.	Rogers Island to Troy Dam: >50 ppm (NYSDEC)	309	1.5	1.0
5.	Rogers Island to Troy Dam: >10 gm PCBs per m^2	- -	- -	- -
6.	Rogers Island to Lock 5: >50 ppm (EPA) plus Lock 5 to Troy Dam: >50 ppm (NYSDEC)	385	1.9	1.2
7.	TIP: Bank to Bank	408	2.0	1.3
8.	TIP Bank to Bank, plus >50 ppm (NYSDEC) below the TIP	598	2.9	1.9
9.	Rogers Island to Troy Dam: >10 ppm within 50 feet of Shore and >50 ppm at >50 feet from Shore	712	3.4	2.3
10.	Pirnie 1992 Dredging Design[2] -TIP (189 acres) -TIP Dam to Lock 2 (293 acres)	483	- -	1.8

[1] EPA hot spot mapping ends at Lock 5 and covers only 11 river miles, whereas NYSDEC hot spots are located from Rogers Island to Lock 2 (31 miles).
[2] Average dredging depth 2.3 ft. Total also includes 220,600 cy (12%) for access dredging.

TABLE 2
SEDIMENT REMEDIATION PROJECTS

Project	Remedial Target	How Target Established	Remediation Method	Volume Removed	Total Cost (million)	Disposal
James River, VA	Levels in fish	FDA fish levels	Natural recovery	N/A	N/A	N/A
Sangamo-Weston, SC	1 ppm PCBs	Technical feasibility, after HH risk assessment	Natural recovery	N/A	N/A	N/A
Bayou Bonfouca, LA	1300 ppm PNAs	HH risk assessment	Mechanical dredging	159,000 cy	$115	Onsite incineration
LTV Steel, IN	Depth horizon	Consent Decree	Hydraulic dredging and diver assisted	114,000 cy	$12	Commercial landfill
United Heckathorn, CA	590 ppb DDT	HH risk assessment	Mechanical dredging	108,000 cy	>$12	Commercial landfill
Manistique R., MI	10 ppm PCBs	HH risk assessment	Hydraulic dredging	87,000 cy	$15.5	Commercial landfill
Marathon Battery, NY2	10 ppm Cd	Eco risk analysis	Hydraulic and mechanical dredging; also, natural recovery	77,000 cy	$9-11	Commercial landfill
Black River, OH	Depth horizon	Consent Decree	Hydraulic and mechanical dredging	60,000 cy	$5	Onsite landfill
Outboard Marine, IL (Waukegan Harbor)	50 ppm PCBs	Flux modeling	Hydraulic dredging	38,300 cy	$15	Nearshore CDF
Ford Outfall, MI	10 ppm PCBs	HH risk assessment	Mechanical dredging	29,000 cy	$5.4	Onsite landfill
New Bedford H., MA	4000 ppm PCBs	Maximize mass removal	Mechanical dredging	14,000 cy	$20.11	Nearshore CDF (temporary)
GM (Massena), NY	1 ppm PCBs	Technical feasibility, after HH risk assessment	Hydraulic dredging and wet excavation	13,800 cy	$101	Onsite storage (temporary)

Project	Remedial Target	How Target Established	Remediation Method	Volume Removed	Total Cost (million)	Disposal
Formosa Plastics, TX	500 ppb EDC	Not determined	Mechanical dredging	7,000 cy	$1.4	Commercial landfill
Sheboygan River, WI	None	Pilot hot spots removal	Hydraulic dredging, wet excavation, and capping	3,800 cy	$71	Onsite storage (temporary)
Grasse River, NY	None	Pilot hot spot removal	Hydraulic dredging, wet excavation, and divers	3,000 cy	$4.9	Onsite landfill
Eagle (West) Harbor, WA	Various for Hg and PAHs	State Sediment Standards and supplemental EPA objectives	Mechanical dredging, wet excavation, capping, enhanced natural recovery	3,000 cy	$3	Nearshore CDF, commercial landfill and in-situ capping
Willow Run Creek, MI	1 ppm, 7.5 ppm, or 21 ppm PCBs	Eco modeling and State Env. Response Act	Dry excavation	270,000 cy	Not available	Nearby project-specific landfill
Lipari Landfill, NJ	Depth horizon	HH risk assessment	Dry and wet excavation	154,000 cy	$50	Some thermal desorption and beneficial reuse; some stabilization and placement
Town Branch Creek, KY	0.1 ppm PCBs (all sediments practicable)	Circuit Court Judgment supporting KY NREPC observations	Dry excavation	17,000 cy (sediment and banks); 76,000 cy (floodplains)	Not available	Commercial landfill
Loring AFB, ME	1 ppm PCBs, 35-87 ppm total PAHs	Eco risk assessment	Dry and wet excavation	80,000 cy	Not available	Onsite landfill
Hooker (102nd St.), NY	Depth horizon and areal extent	HH risk assessment	Dry excavation	28,500 cy	Not available	Onsite landfill
Love Canal, NY	1 ppb 2,3,7,8 TCDD	CDC action level	Dry excavation	17,000 - 31,000 cy	$141	Commercial incineration
Marathon Battery, NY2	100 ppm Cd	Eco risk analysis	Dry excavation	23,000 cy	Not available	Commercial landfill

Project	Remedial Target	How Target Established	Remediation Method	Volume Removed	Total Cost (million)	Disposal
Ruck Pond, WI	All sediments practicable	N/A	Dry excavation	7,730 cy	$7.5	Commercial landfill
Gill Creek, NY	All sediments practicable	N/A	Dry excavation	8,020 cy	$10-14	Commercial landfill
Housatonic River, MA	Depth	CERCLA Order for hot spot removal; final depth dictated by EPA field decisions	Dry excavation	6,000 cy sediment and banks	$4.5	Commercial landfill
M. Baker, NJ	10 ppm DDT	NJDEP designated limit to define extent of hot spot removal	Dry excavation	3,500 - 4,000 cy	$1.2	Onsite landfill
Triana/Tennessee R., AL	DDT levels in fish	FDA fish levels	In-situ direct burial; also, natural recovery	None	$30	In-situ direct burial

1. Does not include disposal cost.
2. Listed twice, since both dredging and dry excavation were used.

TABLE 3
SEDIMENT REMEDIATION PROJECTS

Project	Remedial Target	How Target Established	Remediation Method	Outcome and Post-Monitoring
James River, VA	Levels in fish	FDA fish levels	Natural recovery	Natural recovery site. Commercial fish advisory lifted in 1988. Numerous monitoring studies past and present.
Sangamo-Weston, SC	1 ppm PCBs	Technical feasibility, after HH risk assessment	Natural recovery	Natural recovery in-progress. Annual sediment (20 locations) and fish monitoring (six stations) ongoing for 15 years minimum.
Bayou Bonfouca, LA	1300 ppm PNAs	HH risk assessment	Mechanical dredging	Dredged to a depth determined by characterization samples. No verification samples. Post-remediation fish data insufficient to compare to pre-remediation fish data or to identify trends.
LTV Steel, IN	Depth horizon	Consent Decree	Hydraulic dredging and diver assisted	Dredged to a depth horizon. No verification samples. No post-monitoring identified.
United Heckathorn, CA	590 ppb DDT	HH risk assessment	Mechanical dredging	Dredged to a depth horizon. Limited verification samples for chemical concentration, for info only. Annual post-monitoring program for mussels; five years planned.
Manistique R., MI	10 ppm PCBs	HH risk assessment	Hydraulic dredging	Verification samples being taken to verify cleanup level. Dredging still in progress.
Marathon Battery, NY2	10 ppm Cd	Eco risk analysis	Hydraulic and mechanical dredging; also, natural recovery	Natural recovery for 300-plus acres of marsh and cove; for removal areas, originally a depth target only; subsequently verification sampling to verify residual concentrations; long-term (30 years) monitoring program for sediments, surface water, biota, and vegetation.
Black River, OH	Depth horizon	Consent Decree	Hydraulic and mechanical dredging	Dredged to a depth horizon. No verification samples. Extensive annual river-wide long-term fish monitoring on-going, not targeting only the dredged area.

Project	Remedial Target	How Target Established	Remediation Method	Outcome and Post-Monitoring
Outboard Marine, IL (Waukegan Harbor)	50 ppm PCBs	Flux modeling	Hydraulic dredging	Dredged to a depth horizon. No verification samples for chemical concentration. Annual fish sampling program for harbor and Lake Michigan but not focused specifically on effects of dredging remedy.
Ford Outfall, MI	10 ppm PCBs	HH risk assessment	Mechanical dredging	Verification samples taken to verify cleanup level. Post-monitoring not identified.
New Bedford H., MA	4000 ppm PCBs	Maximize mass removal	Mechanical dredging	Fifteen composite verification samples obtained to verify cleanup level. Long-term biennial monitoring program (30 years) underway, including baseline monitoring in 1993, to assess the effectiveness of remedial activities.
GM (Massena), NY	1 ppm PCBs	Technical feasibility, after HH risk assessment	Hydraulic dredging and wet excavation	Extensive verification sampling. Cleanup level not achieved.
Formosa Plastics, TX	500 ppb EDC	Not determined	Mechanical dredging	Spill removal action. Verification samples taken to verify cleanup level. No post-monitoring identified.
Sheboygan River, WI	None	Pilot hot spots removal	Hydraulic dredging, wet excavation, and capping	Pilot removals. Verification samples taken to determine residual PCB concentrations. Pre-, during-, and post-remediation water and caged/resident fish sampling.
Grasse River, NY	None	Pilot hot spot removal	Hydraulic dredging, wet excavation, and divers	Pilot removal. Extensive verification sampling to determine residual PCB concentrations. Post-dredging monitoring of sediment, water, and biota on-going.
Eagle (West) Harbor, WA	Various for Hg and PAHs	State Sediment Standards and supplemental EPA objectives	Mechanical dredging, wet excavation, capping, enhanced natural recovery	Verification samples taken in areas of removal, to verify cleanup level. Post-monitoring not identified.
Willow Run Creek, MI	1 ppm, 7.5 ppm, or 21 ppm PCBs	Eco modeling and State Env. Response Act	Dry excavation	Verification samples taken to verify cleanup level. Remediation still in progress.

Project	Remedial Target	How Target Established	Remediation Method	Outcome and Post-Monitoring
Lipari Landfill, NJ	Depth horizon	HH risk assessment	Dry and wet excavation	Removal to a depth horizon. No verification samples. No post-monitoring identified.
Town Branch Creek, KY	0.1 ppm PCBs (all sediments practicable)	Circuit Court Judgment supporting KY NREPC observations	Dry excavation	Removed sediment to the extent practicable (to bedrock). No verification samples. Post-remediation biota data collection pending completion of subsequent downstream phases of creek sediment removal.
Loring AFB, ME	1 ppm PCBs, 35-87 ppm total PAHs	Eco risk assessment	Dry and wet excavation	Verification samples taken to verify cleanup level. Remediation still in progress.
Hooker (102nd St.), NY	Depth horizon and areal extent	HH risk assessment	Dry excavation	Removal to a defined areal extent and depth. No verification sampling performed. Post-monitoring not determined.
Love Canal, NY	1 ppb 2,3,7,8 TCDD	CDC action level	Dry excavation	Verification samples taken to verify cleanup level. Post-removal fish monitoring performed.
Marathon Battery, NY2	100 ppm Cd	Eco risk analysis	Dry excavation	Refer to listing on Page 1.
Ruck Pond, WI	All sediments practicable	N/A	Dry excavation	Removed sediment to the extent practicable (to bedrock). No verification samples. Seven samples analyzed for residual PCBs, for info only. Long-term water column and biota monitoring ongoing downstream.
Gill Creek, NY	All sediments practicable	N/A	Dry excavation	Removed sediment to the extent practicable. No verification samples. No post-monitoring identified.
Housatonic River, MA	Depth	CERCLA Order for hot spot removal; final depth dictated by EPA field decisions	Dry excavation	Removal of sediment to maximum depth practicable. Extensive verification sampling to determine residual PCB concentrations and whether to continue removal (no defined cleanup level). Pre-, during-, and post-remediation water column and fish monitoring.
M. Baker, NJ	10 ppm DDT	NJDEP designated limit to define extent of hot spot removal	Dry excavation	Removed sediment first to a cleanup level, then beyond to bedrock, where practicable. Verification samples taken to verify cleanup level. No post-monitoring identified.

Project	Remedial Target	How Target Established	Remediation Method	Outcome and Post-Monitoring
Triana/Tennessee R., AL	DDT levels in fish	FDA fish levels	In-situ direct burial; also, natural recovery	Stream diversion for isolation, then direct burial of most-contaminated sector; natural recovery for other sectors. Biennial fish and surface water sampling for ten years.

1. Does not include disposal cost.
2. Listed twice, since both dredging and dry excavation were used.