EXECUTIVE SUMMARY

ES.1 Overview

This report details the General Electric Company's (GE) experience performing the first year of dredging the Upper Hudson River, "Phase 1" of the remedy selected by the U.S. Environmental Protection Agency (EPA), and provides recommendations for changes to the Engineering Performance Standards (EPS) set by EPA for Phase 1.

At the introductory session for the Phase 1 peer review on February 17 to February 18, 2010, EPA credited GE's professional, cordial and cooperative working relationship with the Agency, as well as GE's extraordinary efforts to implement Phase 1. EPA noted that GE built a state-of-the-art processing facility in record time, and lauded GE's "super-human efforts" to overcome serious problems involving disposal of processed sediments. Indeed, EPA recognized GE's efforts throughout Phase 1. EPA's field coordinator noted GE's use of "the most state-of-the-art, advanced equipment out there" (Rosoff 2009). EPA's Community Liaison stated on her Hudson blog that she was "proud to be part of the monumental effort" to implement Phase 1 (September 25, 2009), and in particular credited GE with "bending over backwards" to ensure that the massive project did not disturb river communities. *The Poughkeepsie Journal*, Feb. 13, 2010. If Phase 1 failed to achieve its goals, that happened despite the best efforts of all involved.

Phase 1 was one of the largest, most complex, and most comprehensively monitored environmental dredging project ever undertaken. Dredging occurred around the clock over more than six months, from May 15 to October 27, 2009. GE performed Phase 1 following a design and detailed work plans that were thoroughly reviewed and approved by EPA. The work itself proceeded under the continuous supervision and direction of EPA, as well as the New York State Department of Environmental Conservation. GE, EPA and the State established a collaborative process to address issues as they arose, continually making adjustments in the field in an effort to meet the EPS. More than 18,000 water and air data points were collected during the first phase of dredging. But, despite employing the best available dredging technology and controls, applying best management practices, and following all of EPA's directions, Phase 1 could not achieve the EPS established by EPA.

Phase 1 was a full-scale test of the dredging project, designed to answer three critical questions. First, did the dredging project achieve the EPS set by EPA for Phase 1? Second, does the experience in Phase 1 show that those standards can be achieved, consistently and simultaneously, in "Phase 2," the rest of the project? And, third, if not, how should those standards be changed?

The answers to the three questions are clear. First, a vast data set demonstrates that the EPS were not and could not be met simultaneously in Phase 1. Second, evaluation of the data shows that those standards, as currently established, cannot be achieved in Phase 2. The answer to the third question flows from that conclusion: The EPS must be modified.

ES.1.1 The Engineering Performance Standards Were Not Met in Phase 1

EPA established three EPS: Resuspension, Residuals, and Productivity. Phase 1 demonstrated that the current standards cannot be met and that changes are needed.

In the 2002 Record of Decision (ROD), EPA identified four human health and environmental objectives for the dredging project. Collectively, these four objectives define the benefits that EPA sought to obtain through dredging. In sum, they are:

- Reduce polychlorinated biphenyl (PCB) concentrations in fish
- Reduce PCB concentrations in river water
- Reduce the bioavailable inventory (mass) of PCBs in sediments
- Minimize the long-term downstream transport of PCBs in the river

The EPS were developed by EPA to ensure that the dredging project would achieve these benefits. As a result, any changes to the EPS must be designed to achieve, not compromise, the benefits that EPA sought to achieve in choosing the dredging remedy.

> *"The[engineering performance] standards will promote accountability and ensure that the cleanup meets the human health and environmental protection objectives of the ROD."*
>
> EPA 2002 ROD, p. iii

The changes to the EPS must also address the inherent tension that exists among the three standards in order to ensure that the revised EPS can be met "consistently and simultaneously" during Phase 2.

Fundamentally, Phase 1 demonstrated that, as currently defined, the EPS are in conflict with each other. Attempts to achieve the residual and resuspension standards slowed the pace of dredging, impeding achievement of the productivity standard. Moreover, dredging more slowly did nothing to reduce the overall amount of PCBs sent down river; rather, extending the dredging compromises the benefits to be realized from the project relative to natural recovery. Attempts to meet the productivity standard resulted in higher PCB concentrations in the water, which caused exceedances of the resuspension and air quality standards. Delays inherent in attempting to comply with the Residuals Standard left Certification Units (CUs) open for extended time periods, increasing resuspension and driving down productivity.

Resuspension

Two of the most significant findings of Phase 1 relate to the resuspension of PCBs. First, dredging released nearly 25 times more PCBs into the Upper Hudson River water column than anticipated by EPA. Consistent with other environmental dredging projects, the overall resuspension rate was approximately 3% to 4% of the mass of PCBs dredged, despite the use of best management practices, and even though more than 55% of the PCB mass was removed from areas where engineering structures to limit or stop water flow were in place. The federal drinking water standard of 500 parts per trillion was exceeded 10 times. Moreover, the mass of PCBs transported downstream exceeded by large margins the mass load standard established by EPA at all three of the monitoring stations downstream from dredging (the "far-field" stations). At the first monitoring station downstream from dredging (the first far-field station), the mass of PCBs in the water exceeded EPA's standard by 400%.

Downstream Deposition

Second, dredging spread PCBs, previously buried, to downstream areas and deposited them on the sediment surface where they are mobile and available to be taken in by fish (i.e., bioavailable). This is demonstrated by multiple lines of evidence, including sediment trap and co-located sediment core data collected downstream of dredging operations, and elevated PCB water concentrations that persisted long after the end of dredging.

As a result of the magnitude of resuspension, Upper Hudson fish sampled after dredging in the fall of 2009 showed up to a 500% increase in PCB concentrations in the immediate area of dredging. Statistically significant increases of 40% to 60% were found as far downstream as the Albany/Troy area, 40 miles downstream of the 2009 dredging.

Productivity

Nearly 290,000 cubic yards of sediment were removed from 10 locations in the Upper Hudson River. While that volume surpassed EPA's goal to remove 265,000 cubic yards of sediment, approximately 45% of the targeted areas were not dredged because more PCB inventory was encountered and because so much time was devoted to less productive residual dredging in the 10 CUs that were opened in Phase 1. The additional dredging hampered productivity. Specifically, while 10% more sediment volume was removed than targeted, 25% less PCB mass was removed than planned. Consequently, the pace of dredging never reached the level required by EPA's productivity standard to demonstrate that the remainder of the project could be completed in five more years.

Residuals

In addition to these issues involving resuspension and productivity, the Residuals Standard for removing PCBs proved unworkable in field conditions. Efforts to achieve the standard led to repeated attempts to scrape small amounts of sediment from areas of uneven hard bottom and clay that eventually had to be capped. In fact, capping was necessary in parts of all but one of the CUs addressed during Phase 1.

ES.1.2 The existing Engineering Performance Standards cannot be Achieved, Consistently and Simultaneously, in Phase 2

Phase 1 – the test of whether the EPS could be met in Phase 2 – demonstrated that the EPS, as currently configured, cannot be met in Phase 2. First, it is clear that the Productivity Standard, the rate of removal required to complete the project in 5 years, cannot be achieved. In Phase 2, the PCB mass currently targeted for removal is significantly greater than in

Phase 1. As a result, Phase 2 would need to remove PCBs at almost double the rate of Phase 1. This cannot be done logistically or consistently with the Resuspension Standard. The resuspension rate in Phase 2 is expected to be the same or higher than in Phase 1. This is due in large part to the fact that there will be fewer opportunities to divert river flow around dredge areas.

Second, Phase 1 demonstrated that the Resuspension Standard cannot be met. A much faster PCB removal rate and fewer resuspension control opportunities would result in repeated exceedances throughout Phase 2 of the federal drinking water standard of 500 ng/L for PCBs. That standard was exceeded in Phase 1 as production increased, and precluded achievement of the Phase 2 monthly production target removal rate. Scaling up the Phase 1 experience to the rates of PCB removal required for Phase 2, it is evident that the concentration limit will be exceeded repeatedly.

In addition, Phase 2 cannot meet the PCB load limits established for the project. During Phase 1, more than 500 kg of PCB were sent downstream to the first far field station as the project removed 11% of the PCB mass targeted in the design; 45 kg for each 1% of the mass removed. In simple terms, this suggests that over the life of the project, 4,500 kg of PCBs could be sent downstream to the first far-field station, greatly surpassing the allowable load limit established by EPA of 650 kg for the project.

ES.1.3 Practical changes to the Engineering Performance Standards Must be Made for Phase 2

The analysis of the data and the Phase 1 experience demonstrates that practical adjustments to the EPS are necessary to ensure that the project achieves the human health and environmental benefits projected by EPA. GE's recommended changes to the EPS, discussed in Section 9 of this report, seek to strike a balance that resolves the fundamental conflict among the standards and achieves the benefits of the dredging project set out in EPA's 2002 ROD. Our recommendations recognize the reality of resuspension and the essential premise that dredging should release no more PCBs to the river than would occur under monitored natural attenuation (MNA), the baseline EPA used to compare the dredging remedy against other possible remedial options.

Resuspension

GE's recommendations center on the PCB load standard. GE derived its recommendations based on the fundamental principle in EPA's ROD that dredging not release more PCBs downriver than MNA, so that the standard preserves the benefit of the remedy projected by EPA. We believe that common sense adjustments can be made so that Phase 2 will ensure that the project reduces PCB levels in fish and reduces PCB transport downstream.

First, however, the allowable PCB load standard for Phase 2 must be corrected and established. As described below, an appropriate PCB load standard for Phase 2 cannot be determined from EPA's prior analyses. EPA made a fundamental error when the original load standard was established in the EPS, and that error must be corrected to ensure that the limit does not allow more PCBs to be released than from MNA. Also, recent data show that the EPA model used to establish the load standard needs to be recalibrated since the PCB loads predicted by the model are lower than the values measured over the last 5 years. While the latter issue suggests that the load standard could be increased somewhat, the load limit still must ensure that the project achieves its intended benefit of reducing downstream transport of PCBs.

The analysis of Phase 1 data shows that the net load released by dredging is a product of the mass of PCBs removed times the rate of resuspension. To ensure that dredging does not release more PCBs than would be released under MNA, the first step is to correctly calculate the load limit. That can only be done using model simulations of MNA and dredging that are conducted after correcting the problems with the PCB fate model that both GE and EPA have identified. GE is in the process of doing that. Once the correct load standard is determined, it should be set as a "not to exceed" standard (i.e., a hard cap, in order to protect the benefits of dredging projected by EPA). Then, the amount of PCB mass that can be removed can be calculated to ensure that the cap is not exceeded. At that point, Phase 2 can be designed to target the most effective dredging program to remove PCBs that are, or may become, bioavailable, within the limits of the load standard.

Residuals

In addition, the Residuals Standard must be streamlined to achieve faster certification and closing of CUs. Dredging should be limited to one or two passes at most. Any residual PCBs that may remain can be effectively and permanently sequestered under backfill or caps, as EPA permitted for many areas in Phase 1. In Phase 1, 90% of the PCBs were removed in the first two dredge passes, and repeated dredging passes yielded returns that were disproportionately low as compared to the effort involved. For similar reasons, when dredges hit rock or clay, no further dredging in that area should be attempted.

Productivity

If GE's recommendations are adopted, we believe that Phase 2 can be performed at a productivity rate that is practicably achievable, and that Phase 2 can be completed in 5 years, consistent with the existing Productivity Standard. Prolonging the project increases the length of time that dredging will impact the fish and water column, and delays the time to achieve EPA's desired benefits; thus, adhering to that time limit is important.

EPA's Approach Defeats the Purpose of the Remedy

While GE's recommended revisions to the EPS strike the right balance between the standards and address the fundamental principle of not sending more PCBs downriver than MNA, EPA's proposal to change the Resuspension Standard takes a very different approach. To address the resuspension and downstream transport of PCBs seen in Phase 1, the Agency recommends tripling the standard for PCB load. Specifically, EPA appears prepared to embrace a new maximum mass load limit of as much as 2000 kg of PCBs to be released to the lower river, which the Agency says is based on 1% of the PCB mass likely to be encountered in Phase 2.

There are several critical flaws in EPA's approach. First, the basis for the load standard is not a percentage of the mass of PCBs removed. As discussed in Section 2 of this report, the fundamental purpose of the load standard is to make sure that dredging releases no more PCBs to the river than would occur under MNA. This is appropriate as there is no justification for a remedy that would *increase* the load to the river. EPA's new revisionist approach is inconsistent with one of the remedial objectives for dredging, namely to "minimize the long-term downstream transport of PCBs in the river." (EPA 2002a, p. 51). Moreover, EPA's proposed modification is silent as to what should occur if the 1% mass standard proves to be unachievable.

Second, EPA's proposal compounds mistakes that the Agency made in setting and applying the Phase 1 load standard. As explained in Section 2 of this report, EPA's original load limit for the entire project was 650 kg total PCBs measured at the first far-field station below the dredging area. EPA, however, incorrectly equated load above zero resuspension with load above baseline. The standard was set based on a comparison of load caused by dredging to dredging with zero resuspension. However, the monitoring program tracks net load against baseline. The two are not the same. Furthermore, EPA incorrectly applied the 650 kg load limit to Waterford. Correcting the errors, GE's analysis and calculations show that the load standard at Waterford would have been 189 kg of PCBs for the entire project, not 650 kg.

Until the scenarios are modeled accurately, the correct load standard cannot be determined. It is undoubtedly less than the 2000 kg PCBs that EPA has proposed. To accept that standard would be to allow dredging to release far more PCBs to the river than would occur under MNA. That would eliminate the benefits of the remedy projected by EPA.

ES.2 Recommended Changes to The Engineering Performance Standards

The EPS were intended to ensure that the dredging remedy selected by EPA would meet the human health and environmental benefits projected by EPA in the 2002 ROD. As discussed above, it is now apparent that the three performance standards (Resuspension, Productivity, and Residuals) are in inexorable conflict and, most significantly, that without practical adjustments, they cannot be achieved consistently and simultaneously. Further, unless the standards are modified the EPA-projected benefits of any dredging project will not be achieved.

In developing its recommended changes to the EPS, GE has been guided by several core principles. The revised EPS must do the following:

- ***Protect the benefits that provided the rationale for the remedy selected in EPA's 2002 ROD.*** EPA developed the EPS to serve as a proxy for achieving the benefits of the remedy.
- ***Minimize the downstream transport of bioavailable PCBs.*** Within a reasonable time frame (e.g., 20 years), the project must reduce PCB loads to the river relative to MNA. The negative effects of resuspension should not persist for more than a generation.

- ***Address the interactions and conflicts among the EPS.*** The EPS must be able to be achieved individually and simultaneously.
- ***Provide for practicable implementation.*** The revised EPS must be practicable to implement in the field. Phase 2 is not a science experiment (it is a full-scale dredging project).
- ***Allow for efficient implementation.*** The revised EPS must allow for a project that removes the targeted mass as quickly and effectively as is reasonably possible.

The first principle – protecting the benefits identified as the basis for EPA's remedy – is essential to assuring that the EPS satisfy their purpose as described in the ROD, namely to "ensure that the cleanup meets the human health and environmental protection objectives of the ROD." (EPA 2002a, p. iii). To summarize those objectives, they are as follows:

- Reduce PCB concentrations in fish
- Reduce PCB concentrations in river water
- Reduce the bioavailable inventory (mass) of PCBs in sediments
- Minimize the long-term downstream transport of PCBs in the river

GE is proposing changes to the EPS that it believes preserve the benefits upon which EPA based its choice of remedy, balance the competing standards, and satisfy the goals of EPA's remedy.

Recommended Changes to the Resuspension Standard

The starting point must be calculation of the correct numerical load standard, based on a comparison to the load that would occur from MNA. That is fundamental to Phase 2, because to send more PCBs downriver than would happen without dredging eliminates the benefits of the remedy identified by EPA.

The load standard must be determined correctly. The errors that GE has pointed out in the way EPA determines net load must be fixed, and new projections must be made using an improved model that is not biased relative to the loads measured during the baseline monitoring program.

The load standard must be a hard cap. EPA originally set this standard as a fixed number, and it should remain fixed. The reason for a hard cap is the simple principle that the dredging project should improve upon the results that will be achieved under MNA. Without a hard cap, it is likely that the remedy will increase and prolong PCB levels in fish in the upper Hudson River and possibly also in the upper parts of the lower Hudson River.

Once the load standard has been set correctly, the next step is to allocate that load among dredge areas, specifically targeting the dredge areas where PCBs are, or may become, bioavailable. The details of that step will need to be worked out in the final Phase 2 design.

GE does not propose any change to the 500 ng/L resuspension standard for PCB concentration in the water column. That standard is based on EPA's drinking water standard for PCBs and should remain in place for Phase 2.

Recommended Changes to the Residuals Standard

GE's proposed changes to the Residuals Standard are based on the Phase 1 experience. In particular, it was possible to remove 90% of the PCB mass in the first two dredge passes and nearly that much in a single pass in areas with high-confidence cores. Later passes removed very little inventory, yet required disproportionate effort that prevented CU closeout, exacerbated resuspension and reduced productivity. Particularly frustrating in later passes were the futile efforts to remove thin layers of sediment on top of rock, cobbles or clay.

Accordingly, GE recommends the following approach:

- In high confidence areas, dredge to the design prism and sample to determine the appropriate cap or backfill.
- In low confidence areas, dredge to the design prism and then sample to define a re-dredge prism once. After the second pass, sample to determine the appropriate cap or backfill.
- When hard bottom is encountered, do not dredge further, but install the appropriate cap or backfill.
- When varved glacial clay is encountered, do not dredge further, but install the appropriate cap or backfill.

- Modify the dredge removal tolerances following the dredge pass to minimize the amount of unproductive time spent removing small quantities of sediment above the dredge cutline tolerance limit.

GE believes that this approach provides for an efficient project that simplifies the complex decision-making process in the current Residuals Standard. It addresses bioavailable PCBs and thus fosters a decrease in fish PCB levels. It also allows for faster closure of CUs, thereby limiting resuspension.

GE also recommends that capping not be required unless the residual surface sediment Tri+ PCB concentration is greater than 3 mg/kg. This would allow the simple application of backfill to residual concentrations that pose no significant threat to the recovery of the river. Finally, GE recommends modifications to dredge removal tolerances to improve the efficiency of dredging operations.

The proposed standard for capping is similar to the standard adopted elsewhere (e.g., the Fox River). As recognized by EPA (Palermo et al. 1998a; 2005) and the U.S. Army Corp of Engineers (Palermo et al. 1998), a properly designed cap is a stable, effective method to sequester PCBs.[1]

Recommended Changes to the Productivity Standard

GE does not recommend changing the requirement to complete Phase 2 in 5 years. That is the original duration as set by EPA, and prolonging the project extends the time to reach its intended benefits. GE believes that with the changes it is recommending, Phase 2 can be completed within 5 years. GE does recommend changing the metric for tracking

[1] EPA has focused on mass removal, not capping, even though the current Residuals Standard allows capping when the numerical goal is not achieved. EPA posits that the river bottom is dynamic and "losing" large amounts of sediment, based on a comparison of 2005 and 2009 bathymetric data. As detailed in Section 3 and Appendix O, however, that conclusion is flawed. In many locations, the 2009 pre-dredging bathymetric surveys were conducted after extensive debris removal, tree trimming and other pre-dredging support activities had occurred. In addition, many of the areas in the West Channel of Rogers Island were surveyed after scouring of the river bottom by large vessel movements had already occurred, early in the dredging project. In other areas with targeted debris, the 2009 survey electronically simulated removal of that debris. In short, these two years cannot be compared to show evidence of erosion of the river bottom.

productivity from sediment volume to area remediated and PCB mass removed. Area remediated is a measure of benefits achieved and therefore is an appropriate means to track production. PCB mass removed is an important metric because of its relationship to resuspension and the limitation it imposes on project benefits.

ES.3 Background

In 2009, GE implemented the first year of the dredging project selected by EPA in a ROD dated February 1, 2002 for the Upper Hudson River. GE conducted the work with oversight by EPA, as set forth in a Consent Decree between EPA and GE entered on November 2, 2006 in *United States v. General Electric Co.*, No. 05-CV-1270 (N.D.N.Y.; EPA and GE 2005).

Phase 1 involved construction of a massive sediment dewatering facility, the first year of dredging (including the deployment of more than a hundred vessels – consisting of dredges, barges, monitoring vessels, and other support vessels), the processing of large volumes of dredged materials, and the staging and off-site shipment by rail of processed sediments. Phase 1 included the first year of the dredging project that EPA stated will take a total of 6 years. Phase 2 is the balance of the dredging project.

Phase 1 was a test of whether the dredging project could achieve, individually and simultaneously, the prescriptive EPS developed by EPA. As noted above, the EPS were established to provide quantitative metrics to define implementation of the project and ensure that the project attains the remedial action objectives and benefits described by EPA (EPA 2004a). EPA established three sets of standards: a Resuspension Standard (both PCB concentration and total PCB load), a Residuals Standard (standards and processes for dealing with residual concentration of PCBs following dredging), and a Productivity Standard (rate of dredging productivity).

The purposes of the EPS were: 1) to prevent PCB concentrations in the water due to dredging from exceeding the federal drinking water standard; 2) to ensure that no more PCBs would be released downstream than would occur naturally without dredging; and 3) to complete the remedial actions fast enough to achieve the desired reduction in fish levels.

According to EPA, once the project was completed there would be a subsequent reduction in the amount of bioavailable PCBs remaining.

More than 18,000 environmental samples were collected during Phase 1 to use in determining whether Phase 1 passed the test. That information is summarized and reported in the Phase 1 Data Compilation delivered to EPA on November 13, 2009 (Anchor QEA 2009), and the Phase 1 Data Compilation Supplement dated January 15, 2010 (Anchor QEA 2010).

The results of Phase 1 demonstrate that, despite GE's best efforts and EPA's rigorous oversight, the project's EPS could not be achieved simultaneously. Moreover, the data show that Phase 1 dredging caused PCBs to be redeposited on the river bottom outside the areas being dredged. This has created a bioavailable layer of sediment that has contributed to ongoing PCB flux to the river even after Phase 1 dredging concluded.

ES.4 The Peer Review

This report (GE's Phase 1 Evaluation Report) will be reviewed by a panel of independent peer reviewers that has been selected in accordance with the Consent Decree. As described in the Consent Decree, this report is to "include an evaluation of the Phase 1 dredging operations with respect to the Phase 1 EPS; set forth proposed changes to the Phase 1 EPS if appropriate; and in general, evaluate the experience gained from the Phase 1 dredging operations insofar as such information is relevant to the issues identified in" the charge questions presented to the peer review panel. EPA has prepared its own Phase 1 Evaluation Report which will be reviewed by the panel alongside this report.

The peer review panel convened for a 2-day introductory session on February 17 to February 18, 2010. The panel heard presentations from EPA, GE, and members of the public. Additional presentations and the panel's deliberations are currently scheduled to be held on May 4 to May 6, 2010.

The panel has been presented with the charge questions that were initially set out in the Consent Decree. They are as follows:

1. Does the experience in Phase 1 show that each of the Phase 1 EPS can consistently be met individually and simultaneously?
2. If not, and if EPA and/or GE has proposed modified EPS, does the experience in Phase 1 and any other evidence before the panel show that it will be practicable to consistently and simultaneously meet the EPS that are being proposed for Phase 2?
3. If the experience in Phase 1 and other evidence before the panel does not show that it will be practicable to consistently and simultaneously meet the EPS that are being proposed for Phase 2, can the Phase 1 EPS be modified so that they could consistently be met in Phase 2, and, if so, how?
4. If EPA and/or GE has proposed modifications to the monitoring and sampling program for Phase 2, are the proposed modifications adequate and practicable for determining whether the Phase 2 EPS will be met?

In its consideration of GE's and EPA's Phase 1 Evaluation Reports, it is important to bear in mind the charge that it must be "***practicable***" to consistently and simultaneously meet the EPS proposed for Phase 2. Phase 2 is not meant to serve as a scientific or engineering experiment. Thus, any changes to the EPS proposed by GE, EPA or the peer review panel must be "practicable" in terms of today's engineering realities, as well as the imperatives of worker safety.[2] In addition, those changes must promote, not frustrate, achieving the benefits ascribed by EPA to the project.

Based on input from the peer review panel, discussions with GE and other information, EPA will, as stated in the Consent Decree, make certain determinations about Phase 2. Specifically, EPA will make a decision regarding the "changes, if any, to the Phase 1 EPS, the Phase 1 Quality of Life Performance Standards, the Statement of Work (SOW), and the scope of Phase 2." Once notified of those changes, GE will elect whether to perform Phase 2.

[2] The term "practicable" also appears in Section 121(b)(1) of CERCLA, where EPA is directed to select remedies that use permanent solutions "to the maximum extent practicable." The U.S. Court of Appeals for the District of Columbia Circuit has previously ruled that "practicable" in that context does not mean "whenever possible," because that would "ignor[e] the statutory mandate [in CERCLA] to select cost-effective remedies." *Ohio v. EPA*, 997 F.2d 1520, 1531-1532 (D.C. Cir. 1993).

ES.5 The Ability to Achieve The Engineering Performance Standards

The EPS were not met in Phase 1. Phase 1 dredging operations exceeded the Resuspension Standard, did not meet the Productivity Standard, and, in nine out of ten of the CUs dredged, could not achieve the Residual Standard's target post-dredging sediment concentration without capping.

ES.5.1 Resuspension Standard – Overview

As described by EPA, the Resuspension Standard "is designed to limit the concentration of PCBs in river water, such that water supply intakes downstream of the dredging operations are protected, and the downstream transport of PCB-contaminated dredged material is appropriately constrained." (EPA 2004a; EPS v. 2, p. 4.)

EPA assumed that the rate of resuspension would be, on average, 0.13% of the mass of PCBs dredged (EPA 2004a; EPS v. 2, p. 51). In fact, the overall rate of resuspension during Phase 1 was 3%, nearly 25 times that rate. The resuspension rates experienced in Phase 1 occurred even though dredging operations employed "best management practices" in an effort to control resuspension, and notwithstanding that more than 55% of the PCB mass removed was removed from areas where engineering structures to limit or stop water flow were in place. Throughout the dredging season, EPA and GE engaged in discussions and made additional efforts to reduce resuspension to within the standard, to no avail.

As the analysis in Section 5 shows, the release of PCBs appears to depend largely on the rate of sediment removal, the PCB concentration in the dredged sediments, and local river velocity. When the river velocity in the area being dredged approached 2.5 feet per second (ft/s), as much as 7% of the dredged PCBs were released and transported to the first far-field station.

ES.5.2 Ability to Meet the Resuspension Standard in Phase 1

The Resuspension Standard is a collection of metrics, including criteria for the amount of PCBs that can be introduced into the water column during dredging (expressed as concentration limits) and the net mass, or load, of PCBs that can be sent downstream over the course of dredging operations.

Elevated Water Column PCB Concentrations

Data collected during Phase 1 show that during project operations (debris removal and dredging), PCB concentrations in the water column averaged 250 nanograms per liter (ng/L), five times the average of 50 ng/L during the baseline period between 2005 and 2008. At Thompson Island, the first far-field sampling station (located more than a mile downstream of the nearest dredging operations) PCB concentrations generally ranged between 100 and 400 ng/L over much of the dredging period. The federal Maximum Contaminant Level (MCL) of 500 ng/L was exceeded in 10 samples at the Thompson Island station during the course of the project, and some of those sample results led to the suspension or alteration of dredging operations.[3] Also, PCB levels (both Total and Tri+ PCBs) as far south as Albany (50 miles from the dredging location) were elevated above pre-dredge or baseline conditions. The elevated rates of resuspension also caused concentrations to exceed the Control Level, a 7-day running average of 350 ng/L PCBs, for 20% of the total dredging period.

The Annual Net Load Standards for Both Total PCBs and Tri+ PCBs Were Exceeded During Phase 1

EPA set the net load standard for dredging to ensure that dredging would not cause more PCBs to be sent down the river than would be the case without dredging. Net load is a measure of the mass of PCBs released to the river during dredging operations – the difference between measured gross load and the estimated baseline load that would occur in the absence of dredging. During Phase 1, about half a metric ton (500 kg) of PCBs were released to the river and transported to the first far-field sampling station at Thompson Island (5 times more than occurs in the absence of dredging). Of that total, approximately 200 kg of

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[3] During dredging operations, measurements exceeding the 500 ng/L limit were reported on five occasions. These exceedances occurred on August 1 to 2, 5 to 6, 6 to 7 and 7 to 8, as well as on September 10 to 11, 2009. The August 5 to 6 exceedance led EPA to direct GE to shut down dredging operations until August 11, and the September 10 to 11 exceedance led EPA to direct GE to shut down dredging operations in two CUs until September 13 and 16, 2009, respectively. In addition, a duplicate sample on October 13 to 14 exceeded 500 ng/L, but was not reported as such because the average with the parent sample was 496 mg/L. Further, as explained in Appendix N, GE, as directed by EPA, updated the correction factor used to adjust the PCB concentrations of a few peaks measured by the modified Green Bay Method used for PCB analysis in Phase 1. When the updated correction factor is used, the data show that the 500 ng/L standard was exceeded four additional times, for a total of 10 exceedances. The four additional exceedances occurred on July 16 to 17, July 31 to August 1, August 4 to 5, and September 11 to 12, 2009.

PCBs moved past the last far-field station at Waterford.[4] The remainder either settled out or volatilized over the 34 miles between Thompson Island and Waterford.

The amount of PCBs sent past the far-field stations significantly exceeded EPA's net load standards. The limits applied during Phase 1 were based on taking the overall load that EPA deemed acceptable for the dredging project (650 kg Total PCBs) and allocating a portion of that load to Phase 1 based on the mass of PCBs to be dredged. Thus, EPA allocated to Phase 1 an allowable net load of 117 kg Total PCBs, and 39 kg Tri+ PCBs.

The amount of PCBs passing the far-field stations significantly exceeded the Control Level, as shown in this table.[5]

Station	Net Total PCB Mass (kg)	Net Tri+ PCB Mass (kg)
Thompson Island	505	231
Lock 5	316	126
Waterford	199	71

These levels at Thompson Island are approximately 430% and 600% of the allowable load for Total PCBs and Tri+ PCBs, respectively. During the same May 15 to November 30, 2009 period, the net loadings at the Waterford station were 170% and 180% of the standards. As the project moves downstream in Phase 2, fewer PCBs will volatilize or settle out between the dredge area and Waterford, increasing the mass released to the lower river.

As noted, EPA set a limit of 650 kg of Total PCBs that could be released to the first far-field station during the entire dredging project (Phase 1 and Phase 2 combined). The net load at Thompson Island (506 kg) attributed to Phase 1 dredging operations consumed 78% of that allowable total. Moreover, Phase 1 was designed to remove 20,000 kg of PCBs, but in fact

[4] EPA agrees that the standard was exceeded at all far-field stations, but calculated different net loads. The greatest difference between the EPA and GE calculations is at the Waterford station, where EPA has said that 123 kg of Total PCBs were released to the lower river. The reasons for the differences between the EPA and GE calculations are presented in Chapter 5.

[5] As with the concentration standard, GE revised the net loads reported previously, using the updated adjustment factor for the modified Green Bay Method (see footnote 3, above).

removed 20% less than the design target (16,000 kg of PCBs). Had Phase 1 removed the targeted mass of PCBs, the net load to the river would have been even greater.

The 7-day Running Average Net PCB Loading was Exceeded for the Majority of the Project

In the Resuspension Standard, EPA set a Control Level for net load, expressed as a 7-day running average of 600 g/day for Total PCBs and 200 g/day for Tri+ PCBs. These criteria were adjusted for Phase 1 (based on the adjusted annual net load criteria described above) to 1080 g/day Total PCBs and 361 g/day Tri+ PCBs. The 7-day running average net loadings were exceeded for 152 of the 166 days (92%) between the start of the project and the end of dredging. These levels were initially exceeded during the first week of dredging in mid-May and, except for brief periods in early June, mid-August, and late September, net PCB loadings were between two and four times the Control Level criteria. The maximum 7-day net PCB loadings were observed in early August right after the shutdown of dredging operations triggered by an exceedance of the 500 ng/L PCB standard.

The highest 7-day average net load, 9,770 g/day, was associated with the period of operation that got closest to the rate of removal necessary to implement Phase 2, when Phase 1 inventory dredging reached approximately 18,000 cy/week (week ending August 1). Note, however, that this was still 20% less than the target production rate established as necessary to complete Phase 2 in 5 years.

Errors in EPA's Load Standard

In its review of the original load standard and the data on PCB load in the river since EPA issued the remedy decision and the EPS, GE discovered two errors. The first is a "math" error and the second is a bias in the EPA model.

First, however, GE must set the record straight on the basis for the load standard. The foundation of the standard is clear: to allow no more PCBs to be released to the river than would occur from MNA. As stated by in the EPS, "the upper bound [resuspension export rate] will be the MNA scenario" (EPA 2004a; EPS v.2, p. 25). Also, "The forecast for acceptable load criteria would fall between the MNA and no resuspension scenario" (EPA 2004a; EPS v.2, p. 55). The basis for the standard in the ROD and EPS is not, and never has been, a percentage of the mass of PCBs to be removed. The original standard set by EPA, 650 kg of Total PCBs, coincidentally happens to correspond to 1% of the mass originally targeted for removal, but that was not the basis for the standard.

With respect to the math error, in the EPS, EPA calculated a total project load of 650 kg based on its PCB fate model, which showed that this much resuspension would not eliminate the benefit of the remedy to the lower Hudson River (EPA 2004a; EPS v.2, p. 25-26). EPA reported that its model showed that the cumulative PCB load passing Waterford would be higher than the load from MNA until about 2030, but dredging would accrue a benefit in later years (see Figure 2-4 of EPS v.2).

However, in Phase 1 EPA mistakenly applied the 650 kg load limit to the sampling station at Waterford. In fact, as derived by EPA that load pertains to the first far-field station downstream of dredging and not to Waterford. The equivalent load at Waterford is lower because of the natural declination of load that occurs between the first far-field station and Waterford. Moreover, EPA failed to recognize that the net load measured during Phase 1 (and to be measured during Phase 2) is not the absolute amount of resuspension, but is the net above what would exist if dredging had never occurred.

As explained in Section 2.2.1, the 650 kg resuspension limit for the entire project translates to a limit of 380 kg at Waterford. Moreover, the 380 kg limit at Waterford is a total resuspension load. That is, it is the additional load beyond what would pass downstream if dredging progressed with no resuspension. But that is not what is measured in the field, which is gross PCB load less an average baseline load. The resulting net load underestimates the true resuspension load because the baseline load overestimates the load produced by PCBs fluxing from sediments that have not been remediated. So, when 650 kg has been resuspended and exported to the first far-field station, the net load at Waterford would be lower than 380 kg – and would, in fact, be 189 kg.

The second error with the load standard, which EPA now recognizes, is that its load limit is subject to the biases of its model. The current EPA model underestimates the baseline load. Correcting that bias might raise the acceptable load somewhat, but the actual amount cannot be determined without re-running the MNA and dredging scenarios. Based on the differences between the model and data at Waterford and application of best professional judgment on how changes to the model would affect predictions, GE estimates that the allowable total project net PCB load at Waterford might increase from 189 kg to somewhere between 500 and 1,000 kg. GE intends to conduct additional analysis to provide the peer review panel a specific recommendation on the correct mass load limit at or prior to the May peer review session.

Impact of Resuspension: Increases in PCB Levels in Fish Were Significant and Widespread
As part of the remedial action monitoring program, yearling pumpkinseed sunfish and forage fish were sampled in early fall 2009 and were found to contain PCBs at concentrations that exceeded that of comparable fish sampled prior to dredging in 2007 and 2008. The largest impact was in the Thompson Island Pool where 2009 fish contained approximately five times the PCB concentrations observed prior to dredging. Although increases were lower further downstream, elevated PCB concentrations in these fish species were found as far downstream as Albany at statistically significant levels. The pattern of increase in fish is mirrored by the water column PCB concentrations. While these concentrations are most elevated at the Thompson Island station, significant increases are evident as far downstream as Albany. The increases have the potential to reverse the decline in fish levels documented since issuance of the ROD in 2002.

Impact of Resuspension: PCBs Spread to Other Areas Due to Dredging
Potentially the most important finding regarding resuspension is that PCB-containing sediments released to the river settled to the river bottom downstream of dredged areas. As part of the remedial action monitoring program, a special study was conducted to measure the amount of resuspended material resulting from dredging operations that settled downstream in the non-dredging target areas. Analysis of sediment traps downstream of dredged areas showed a range of 23 to 126 mg/kg, and an average PCB concentration of 61 mg/kg. These data show that PCBs from dredging are settling out downstream of dredged areas, resulting in elevated levels of PCBs. These unconsolidated sediments on the surface of the bed appear to enhance ongoing PCB release as evidenced by increased release of PCBs when flows increased, even on days when no dredging was occurring. Indeed, elevated PCB levels have persisted well past the end of Phase 1 dredging operations. Of particular concern are the implications this has for PCB levels in fish, because PCBs on the surface of the sediments are much more bioavailable than PCBs at depth.

This phenomenon is documented by the impact of the project on downstream PCB levels in the water column, even after completion of dredging and final backfill/capping. Levels at Thompson Island and Lock 5 continued to significantly exceed baseline levels in November and December 2009. Although levels at Waterford are closer to baseline levels, they remain 1.5 to 3 times higher and show no evidence of a benefit from removing PCBs from 48 acres of the river. Comparing averages, the post-dredging loads at Waterford were 860 g/d in November and 1060 g/d in December, whereas the equivalent values for the 2004-2008 baseline period are 620 g/d and 320 g/d. Data from a relatively high flow event in January continued to show increases above baseline levels – 3 months after the cessation of dredging.

Efforts to Control Resuspension During Phase 1 Were Largely Unsuccessful

GE, in close cooperation with EPA, implemented a series of "best management practices" in an attempt to limit the rate of resuspension throughout Phase 1. Techniques were implemented in the field in an attempt to contain PCBs released to the water column, including imposing operational control limits during periods of higher flows, limiting the decanting of water from dredge buckets, using containment and booms to address sheens, and limiting tug speeds. (A complete list of such controls is provided in Table 5.8-1).

These efforts were largely unsuccessful at limiting the rate of PCB releases to acceptable levels, with the possible exception of the shallow water best management practices implemented in the first week of the project. For the areas not subject to structural controls (CUs 05 to 17 and part of CU18), there was no decline in the average rate of PCB release over the course of Phase 1, in spite of implementation of all the mitigation measures deployed.

Structural controls were only modestly successful in reducing PCB release. The PCB release from the East Channel at Rogers Island, which was isolated by a rock dike that allowed a river flow of only about 200 cubic feet per second (cfs), was about 1.7% of the PCBs dredged. Similarly, about a 0.4% to 1.3% release occurred from the sheet piled area in CU18. As described in Section 3.2.4, PCB concentrations increased to very high levels within the sheet piled area. This rapid build-up of PCB concentrations inside the sheet piled area caused high volatilization and significant air PCB concentrations above EPA's Air Quality Performance

Standard. Additionally, the sheet piling caused sharply decreased dissolved oxygen levels, leading to fish kills in the stagnant water within the sheet pile structure.

Silt curtains were ineffective in containing particulate material suspended in the water column due to dredging activities, as evidenced in observations documented by photos (see Figure 6.4-1). Clouds of particulate matter can be seen equally on both sides of the silt curtain as if it were not even present. In addition, the majority of the PCBs were present in the dissolved phase, and silt curtains do not contain dissolved PCBs.

Significant efforts were made to reduce PCB loss by minimizing release (decanting) of water from dredge buckets and attempting to control oil sheens generated by dredging. These efforts had little benefit because decanting of water and sheens were determined not to be significant contributors to PCB release. See Section 5.4 and 5.5.

ES.5.3 Ability to Meet the Current Resuspension Standard in Phase 2

EPA has suggested that at least 100,000 kg and perhaps as much as 125,000 kg (depending on the actual sediment volume to be removed) of PCBs are to be removed in Phase 2 (6 to 8 times more than was removed in Phase 1). In a 5-year program, Phase 2 would have to dredge PCBs at an overall average rate of 26,000 kg per dredging season, compared to 16,000 kg removed during Phase 1 (an increase of nearly 65%). Given this, Phase 2 will result in greater PCB releases than experienced in Phase 1.

- Phase 2 contains a greater incidence of higher PCB concentration areas than Phase 1, particularly in River Section 2.
- The Phase 1 experience shows that employing all reasonably available best management practices will not be enough to achieve compliance with the Resuspension Standard.
- Engineering controls (e.g., sheetpiling) will not eliminate PCB releases. Further, such activities will reduce productivity and cause adverse impacts, including air exceedances, reduced dissolved oxygen levels leading to fish kills, noise exceedances, and erosion. The practicability of sheet piles is also constrained by potential engineering limitations imposed by sub-bottom conditions, and navigation considerations.

In addition, Phase 2 as designed cannot be conducted without exceeding the net load standard. If Phase 2 experiences the same resuspension as Phase 1 (average release rate of 3%), Phase 2 would export to the first far-field station an average 780 kg each year, and 3,900 kg over the full program. Combined with the 500 kg exported in Phase 1, the project would export 4,400 kg to the first far-field station. Conservatively assuming that only 40% of this load reaches the Lower Hudson River (based on the drop in load from Thompson Island to Waterford experienced during Phase 1),[6] the load at Waterford would be about 1,800 kg or about ***3 times*** the 650 kg overall project load calculated by EPA in the Resuspension Standard as necessary to preserve the benefits of the remedy in terms of load to the Lower Hudson.

Again, as discussed above, the 650 kg standard itself is incorrect and must be corrected. Based on GE's current estimate, that load standard, measured at Waterford, might fall into the range of 500 to 1000 kg PCBs for the entire project, or roughly 300 to 800 kg for Phase 2. Clearly, Phase 2 as currently envisioned cannot be performed without exceeding such a standard.

ES.5.4 Ability to Meet the Productivity Standard in Phase 1

Phase 1 Did Not Reach all Targeted CUs

Phase 1 was designed to remove 265,000 cubic yards (cy) of design inventory, with a minimum removal volume of 200,000 cy, from 18 CUs. While dredging in Phase 1 removed 286,000 cy of sediment, it was completed in only 10 CUs and a significant portion of the inventory targeted for Phase 1 (in the remaining 8 CUs) was never removed. This was due to the removal of additional buried inventory not captured in the pre-design sediment sampling or initial design, and the time spent attempting to remove small amounts of PCBs from CUs.

Monthly Targeted Productivity Was Not Achieved

In addition, and of greater impact on Phase 2, was the inability to meet the 1-month production rate necessary to complete Phase 2 of the full project within the 5 years set forth in the ROD. Based upon current design volume, Phase 2 requires productivity of

[6] In Phase 2, the dredging will progress closer to Waterford than in Phase 1 and the drop in load from the first far-field station to Waterford will be less than experienced in Phase 1.

approximately 89,000 cy each and every month of the five year Phase 2 project. The best 1-month production that was accomplished in Phase 1 was 77,300 cy. More typically, the weekly productivity rate during Phase 1 resulted in a monthly production of 64,000 to 77,000 cy. This rate is 15% to 30% lower than the production rate necessary to achieve the 89,000 cy per month target rate.

Causes of Reduced Productivity

The shortfall in productivity is largely explained by the difficulty of sustaining projected dredging rates in the face of the following field conditions:

- Exceedance of the Resuspension Standard PCB concentration of 500 ng/L caused two shutdowns of all or part of the dredging. In addition, the start-up following the first shutdown required a ramp-up period, further reducing productivity.
- Efforts to meet the Residuals Standard (described below) slowed the completion of dredging and subsequent close-out of CUs.
- Operations were shut down or curtailed on all or part of 33 days due to high river flows. High flows contribute to resuspension and present safety issues.
- Dredging resulted in 105 exceedances of the Air Quality Performance Standards. For a number of operations, exceedances occurred repeatedly (two or more consecutive days) despite corrective measures. Attempts were made to achieve the air standards through a variety of measures, including placing wind screens on barges, covering sediments in barges with water, partially filling barges to use freeboard as a wind screen, using containment booms in dredging locations, mixing sediments in the same barge from high and low concentration areas, and reducing the number of simultaneous dredging operations in CUs with high PCB concentrations. Those measures were not effective in achieving the air standards, resulting in continued exceedances. The repeated attempts to mitigate air exceedances had a negative impact on productivity.
- Productivity was reduced when attempting to dredge debris and residuals on clay and bedrock. Furthermore, clay significantly reduced productivity of the Sediment Processing Facility.
- Barges could not be filled to capacity with sediment because water was placed in them to minimize dredge bucket decanting to the river and to cover the dredged sediment in an effort to reduce volatilization of PCBs. Additionally, the excess water hampered barge unloading at the Sediment Processing Facility.

- The rate of barge unloading was slower than expected. The amount of water in the barges that arrived at the Sediment Processing Facility was greater than assumed in the design. Consequently, the average volume of sediment in each barge was much less than planned. This reduced the rate of barge unloading and increased the number of barge exchanges that were required to complete the work. Each barge exchange resulted in ineffective time, both at the dredge and at the unloading wharf, and increased the demand on vessel management resources.

ES.5.5 Ability to Meet the Current Productivity Standard in Phase 2

Based upon the sustainable productivity in Phase 1, which was consistently below the rate needed to complete Phase 2 in 5 years, it is evident that Phase 2, as currently designed, will take longer than the five years projected by EPA. The additional time needed to complete the project could be substantial if EPA increases the volume to be removed in Phase 2 above the current estimate of approximately 1,644,000 cy (design inventory developed in Phase 2 IDR, adding in CUs 9 to 16 which were not completed in Phase 1). The amount of re-dredging that would be required is unknown at this time. EPA has suggested that the volume of sediments to be removed in Phase 2 could be as high as 2,600,000 cy.

Removing anything near that volume of sediment would require a much higher rate of removal than was demonstrated in Phase 1, an increase in productivity through the entire project that simply cannot be achieved without exceeding the 500 ng/L concentration limit that is based on EPA's drinking water standard for PCBs. The highest 1-month average production limit attained in Phase 1 was 77,300 cy, at which point the project was shut down because water column levels exceeded 500 ng/L. Scaling up the Phase 1 experience to the rates of PCB removal required for Phase 2, it is evident that the concentration limit would be exceeded regularly, effectively acting as a ceiling on productivity.

ES.5.6 Ability to Meet the Residuals Standard in Phase 1

The Residuals Standard includes both numerical criteria (the allowable concentration of PCBs following dredging) and process steps to achieve those criteria (number of dredge passes for both inventory and residuals dredging, sampling and re-sampling, etc.). Overall, the criteria and unwieldy procedures for evaluating residuals caused delays that reduced productivity.

These are the key findings resulting from GE's analysis of the Residuals Standard in Phase 1:

- The Residuals Standard was ineffective at facilitating rapid CU close-out. The first CU close-out did not occur until September 23, 2009 – 130 days after dredging started on May 16, 2009. Most of the CUs remained open until October. The average time for a CU to be open for dredging was more than 3 months (113 days), over half of the dredging season. One CU, CU01, was open for dredging 154 days, about 5 months.
- Only one CU met the Residuals Standard's target of 1 mg/kg Tri+ PCB average or less through dredging. All others required some amount of capping to achieve a post-capping average surface concentration of 1 mg/kg or less.
- Although 92% of the targeted mass within the dredged CUs was removed during dredging (16,300 kg removed of the 17,660 kg existing PCB inventory), it was done so at the sacrifice of schedule. Excluding CU01,[7] 90% of the targeted inventory was removed within the first two dredging passes and only 6% was removed in all other re-dredge passes combined. As a result, little extra inventory was removed during re-dredging, resulting in reduced productivity for minimal gain.
- Dredging to the design cutlines was particularly effective in removing the targeted PCB mass in areas where the dredge depth or "cutlines" were defined by a relatively good coverage of cores where there was high confidence in the depth at which 1 mg/kg Total PCB occurred. In those areas with high-confidence cores, dredging to the design cutlines removed approximately 80% of the PCB mass.

In sum, most of the targeted PCBs was removed in the first two dredging passes, and repeated attempts to re-dredge the same areas removed a comparatively small amount of inventory, while adversely affecting productivity. The PCBs removed during the additional passes were at depth and thus were of limited bioavailability prior to dredging. Keeping CUs open for extended periods also allows previously buried PCBs to become subject to resuspension. With the exception of CU17, the Residuals Standard was ultimately met only after cap placement. As a result, the attempts to remove incremental amounts of PCBs did not appreciably improve the goal of mass removal, nor did they provide any real benefit to the river.

[7] CU01 was excluded because of unique conditions not seen elsewhere in the river.

ES.5.7 Ability to Meet the Current Residuals Standard in Phase 2

The current Residuals Standard establishes an average post-dredging surface concentration of 1 mg/kg Tri+ PCB or less as the target that will allow backfilling without further response actions. The Phase 1 experience shows that the only way to meet that standard in Phase 2 on a consistent basis is by capping dredged areas. Dredging alone (including repeated dredging passes to extract minimal extra inventory) will not achieve the required post-dredging surface concentrations, and will decrease productivity without corresponding benefits. Capping has been used effectively at other river dredging projects and should be used here as well.

ES.6 Ability to Achieve all Engineering Performance Standards Consistently and Simultaneously

As shown above, it was not possible to meet the three EPS consistently and simultaneously in Phase 1. GE does not believe that it is practical to meet the current standards consistently and simultaneously in Phase 2. While many factors inform that conclusion, one of the principal drivers is the clear conflict between the Resuspension Standard and the Productivity Standard. GE's analysis shows that at the pace required to meet the Productivity Standard (if that rate can even be sustained), there will be multiple and frequent exceedances of the 500 ng/L concentration standard. That, in turn, will necessitate shut-down of dredging in all or select areas, with the result that the Productivity Standard cannot be achieved. Moreover, protracted efforts to achieve mass removal as mandated by the Residuals Standard will impede productivity.

Dredging at a slower rate may reduce the frequency of exceedances of the PCB concentration standard, but would result in a much longer project that fails to achieve the Productivity Standard and extends the adverse impacts to the fish witnessed in Phase 1. Importantly, even in that case, it is evident that the project will still exceed the net load criteria within the Resuspension Standard, even after that standard is corrected. Slowing the pace of the project would spread out the rate of loading but would not reduce the overall mass of PCBs released during the project. Given how much of the net load standard has already been consumed by the incomplete Phase 1 project, without changes, the net load standard will be exceeded in Phase 2.

In addition (as evidenced by the five-fold increase in PCB levels in certain fish) extending the length of the project will likely exacerbate adverse impacts to fish, further delaying any benefits that might be realized by dredging.

Finally, dredging alone will not achieve the current Residuals Standard in Phase 2, since it is expected that, as in Phase 1, repeated attempts to re-dredge areas will still not achieve the target of 1 mg/kg Tri+ PCB average, at least in many dredge areas. Further use of capping must be incorporated in the Residuals Standard.

Overall, based on the data and experience of Phase 1, showing the impracticability of achieving the current EPS consistently and simultaneously, GE believes that adjustments are needed to ensure the project does not spread more PCBs to air and water and achieves the benefits EPA projected.