THE FRIENDS OF A CLEAN HUDSON:

AN INDEPENDENT REVIEW OF EPA'S UPPER HUDSON RIVER PCB DREDGING REMEDY

Hudson River PCBs Superfund Site
Operable Unit 2 (Upper Hudson)

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EXECUTIVE SUMMARY

Beginning in 1947 and continuing for decades, General Electric ("GE") dumped its toxic PCB waste into the Hudson River. PCBs are known carcinogens that have also been linked to neurological damage, asthma, and diabetes. **One of the original "forever chemicals" (persistent organic pollutants), PCBs do not readily break down once in the environment and are able to easily cycle between air, water, and soil.**

GE's waste turned the Hudson – home to diverse fish and other wildlife species, world-class views, treasured parks, and fertile farmland – into the largest Superfund site in the nation. Today, eight years after GE completed a targeted cleanup of hotspots in a 40-mile stretch of the Upper Hudson, and 40 years after the Hudson River was identified as a Superfund site, the risk-reduction dredging remedy chosen by the U.S. Environmental Protection Agency ("EPA") to protect human health and the environment is not achieving the goals set by the agency in its 2002 Record of Decision ("ROD"), the legal agreement between the EPA and GE governing the cleanup action. **This will, in effect, continue an environmental injustice legacy on the most vulnerable populations living along the shores of the river – subsistence fishermen from communities of color and impoverished families who rely on the river for food**.

As part of its upcoming third Five-Year Review ("FYR") of the cleanup action, EPA must determine whether the dredging remedy is proving to be protective of human health and the environment. In anticipation of this decision, the Friends of a Clean Hudson ("FOCH") worked with technical experts to conduct an independent analysis of the remedy's protectiveness. The conclusion: The dredging remedy has missed key targets deemed necessary to protect human and ecological health, as such **EPA must acknowledge the cleanup is "Not Protective of Human Health and the Environment."**

This analysis of publicly available project data shows that PCB concentrations in Upper Hudson sediment and fish **are much higher than EPA predicted in the selection of remedial alternatives in the 2002 ROD. Neither fish nor sediment are recovering at the rates needed to achieve key goals laid out in the 2002 ROD.**

Specifically:

- Human health and ecological risk are still well above EPA's "acceptable risk range" and will remain so for the foreseeable future;
- Fish consumption advisories are not effective at protecting human health and place the burden on the public to avoid contaminated fish. In addition, such advisories do nothing for the ecological receptors that depend on the Hudson's ecosystem;
- Fish data show minimal reduction of PCB contamination in most species at most locations;
- The first preliminary remediation target, to achieve average concentrations of 0.4 mg/kg of PCB in fish within five years after the completion of dredging (i.e., by 2020), was not met;

- Sediment data show little recovery in the uppermost layer of sediment; and
- Post-dredging sediment recovery rates to date are likely not sufficient to allow the ongoing slow natural recovery in fish to reach the second preliminary remediation target of 0.2 mg/kg of PCB in fish within 16 years after the completion of dredging (i.e., by 2031).

Under the Superfund law, EPA is charged with protecting people and the natural environment from toxic pollution at our country's most contaminated sites. At Superfund sites like the Hudson River, where EPA identifies pollution that "may present an imminent and substantial danger to the public health and welfare," **the agency must select an appropriate remedy that will "attain a degree of cleanup [that] . . . at a minimum assures protection of human health and the environment." 42 U.S.C. § 9621(d)(1**).

To date, EPA has performed two FYRs to determine whether the remedy is "protective of human health and the environment." In both reviews, EPA essentially ignored the warning signs the data trends were showing. Even as GE was completing its six-year dredging project in 2015, analysis of project data warned that a significant amount of contaminated sediment would remain in the Hudson River at levels that likely would not allow for "unlimited use and unrestricted exposure after cleanup." **At this point, the data are clear: The remedy is "not protective of human health and the environment."**

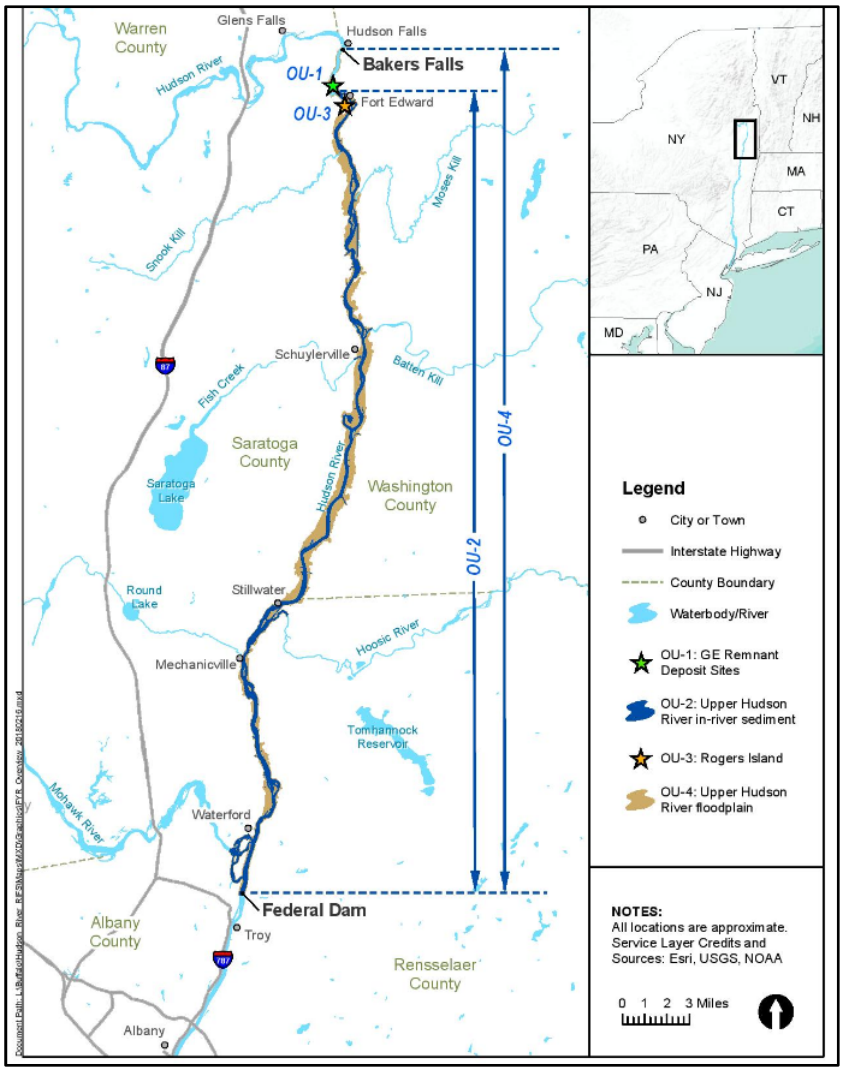
The FiveYear Review process allows and encourages EPA to address potential problems with remedies as they become apparent, but unless and until EPA acknowledges the failure of the remedy to meet the goals and objectives in the expected timeframes, the opportunities to "fix" the remedy and take additional steps to address PCB contamination in the Hudson River will be lost. For low-income families and disadvantaged communities who subsist on the river's tainted fish, **the continued delay by EPA has essentially placed the burden of "protection of human health" squarely on the people themselves – essentially turning the Hudson Superfund Site into a "risk-avoidance" remedy that is neither acceptable nor just.**

The complex nature of PCBs ensures GE's toxic waste will continue to travel throughout the Hudson River ecosystem, resisting degradation, biomagnifying in food chains, and bioaccumulating in human and animal tissue. Stalled waterfront economic development planning, warnings against fish consumption, and ongoing damage to the unique ecosystem of the Hudson River are just a few of the limitations PCB pollution has forced on people living along the river for decades. Without additional actions, **the health risks and generational impacts of living, working, and playing within a heavily polluted Superfund site along a nearly 200-mile stretch of the Hudson River will exist for the foreseeable future.**

Hudson River PCBs Superfund Site Maps

Map 1

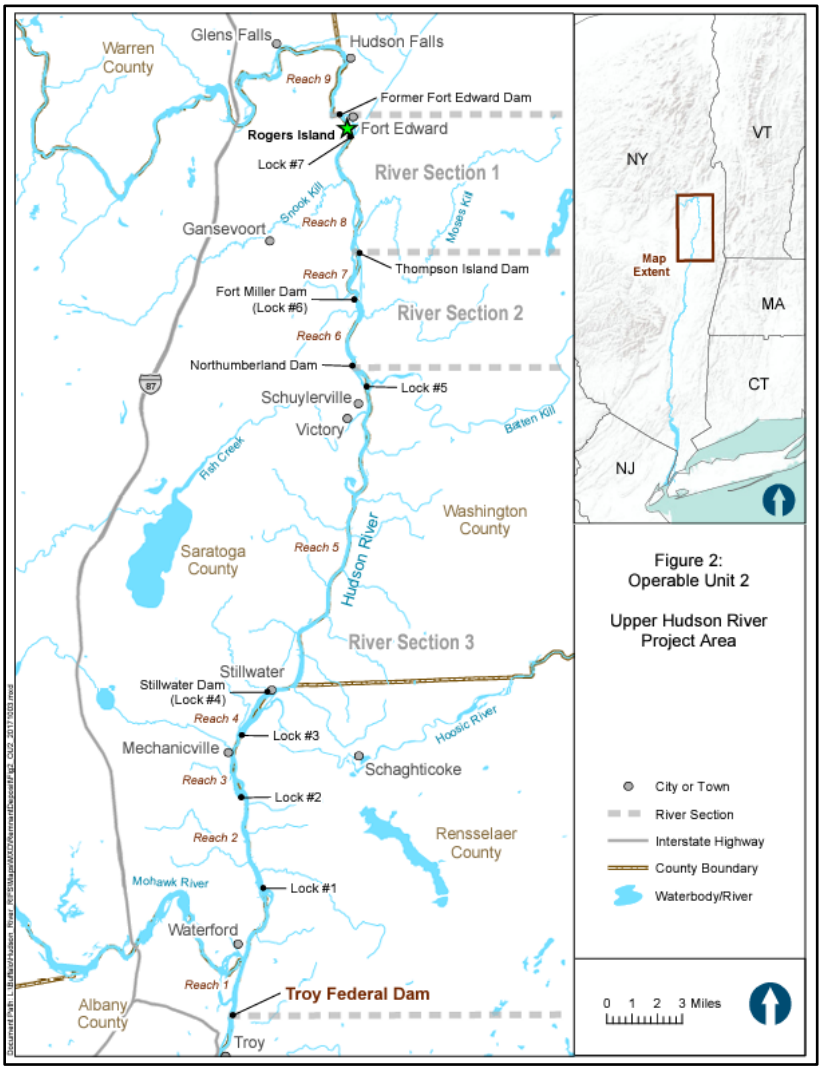
Operable Units of the Hudson River PCBs Superfund Site



Note: The U.S. Environmental Protection Agency is addressing the Site in discrete phases or components known as operable units (OUs). The 1984 Record of Decision for the first OU (OU1) addresses areas, known as the Remnant Deposits, and in addition called for a treatability study of the Waterford Water Works to determine whether upgrades or alterations of that facility were needed. The 2002 ROD for the second OU (OU2) selected dredging to address PCB-contaminated sediments of the Upper Hudson River, as well as monitored natural attenuation (MNA) of PCB contamination that remains in the river after dredging. OU3 is a removal action taken on Rogers Island by EPA in 1999 to address soil contamination with PCBs and metals. OU4 pertains to the Upper Hudson River floodplain areas, currently the subject of an ongoing remedial investigation. In 2022, the Lower Hudson River, including the portion of the Hudson River from the Federal Dam at Troy to the Battery in New York City, was designated as OU5. **This report focuses only on OU2.**

Map 2

River Sections of the Upper Hudson River PCBs Superfund Site



Note: EPA divided the Upper Hudson River area into three main sections known as River Section 1, River Section 2, and River Section 3. River Section 1 consists of the Thompson Island (TI) Pool. This river section extends about 6.3 miles from the former Fort Edward Dam to the TI Dam. The area between the former Fort Edward Dam and the northern end of Rogers Island, a distance of about 0.2 miles, contains minimal PCB contamination and was not considered for remediation under this decision document. River Section 2 extends from the TI Dam to the Northumberland Dam near Schuylerville, an extent of 5.1 river miles. River Section 3 extends from below the Northumberland Dam to the Federal Dam at Troy, an extent of 29.5 river miles.

The Friends of a Clean Hudson:

An Independent Review of EPA's Upper Hudson River PCB Dredging Remedy

November 2023

SECTION 1

Abstract

The Hudson River PCBs Superfund Site (the "Site") includes a nearly 200-mile stretch of the Hudson River from the Village of Hudson Falls, NY, to the Battery in New York City. In 2002, the U.S. Environmental Protection Agency ("EPA") issued a Record of Decision ("ROD") to address the ongoing environmental and human health risks posed by the discharge of millions of pounds of polychlorinated biphenyls ("PCBs") by General Electric ("GE") from its capacitor production facilities in Hudson Falls and Fort Edward, NY (referred to herein as the "2002 ROD"). The remedy selected in the 2002 ROD called for dredging to remove PCB-contaminated in-place sediments of the Upper Hudson River[1] and Monitored Natural Attenuation ("MNA")[2] of PCB contamination remaining in the river after dredging. The selected remedy was designed to reduce the dangerous health risks to humans and ecological receptors[3] living in and near the Upper and Lower Hudson River.[4] Dredging was conducted in two phases[5] and completed in 2015. GE was given a certificate of completion for the active portion of the remedial action in 2019. However, significantly more PCBs remain in the river sediment post-dredging than were originally estimated and EPA is now relying solely on monitored natural recovery to achieve the remedial goals set forth in the ROD and institutional controls, i.e., fish consumption advisories to protect human health.

[1] The Upper Hudson River is an approximately 40-mile stretch of the Hudson River between Fort Edward and the Federal Dam at Troy.
[2] Monitored Natural Attenuation is a risk-reduction strategy that relies solely on naturally occurring processes to contain, destroy, or reduce the availability or toxicity of contaminants in the environment to living organisms. EPA now describes Monitored Natural Attenuation as "Monitored Natural Recovery."
[3] The term "ecological receptors" refers to river-dependent wildlife (including endangered and threatened species).
[4] The Lower Hudson River is an approximately 150-mile stretch of the Hudson River between the Federal Dam at Troy and the Battery in New York City.
[5] Phase 1 dredging occurred in 2009 and Phase 2 dredging took place from 2011-2015.

SECTION 2

Introduction

In April 2022, EPA announced it would begin its third Five-Year Review ("FYR")[6] of the Hudson River PCB Superfund Site. As required by the federal Superfund law, EPA must conduct these periodic studies at hazardous waste sites where cleanups do not remove all contaminants from the site. The purpose of the study is to ***determine whether the remedy selected in the 2002 Record of Decision ("ROD") is achieving the agency's goals for the cleanup,*** specifically whether the remedial action ***is protective*** of human health and the environment. This decision made by the EPA will deeply impact the health – as well as the economic and environmental future – of hundreds of communities and millions of people who live, work, and play along the banks of this long-contaminated river for generations to come.

As members of the Hudson River PCBs Superfund Site Community Advisory Group[7] and the Friends of a Clean Hudson ("FOCH") coalition, we appreciate that EPA has long-recognized the value offered by stakeholder groups understanding and participating in Superfund processes, and how significant public involvement contributes to the overall success of the Superfund program. Utilizing the most recent, publicly available project data and best available scientific methods, we offer the following critical observations and recommendations to EPA Region 2 Project Staff in advance of EPA's release of the third FYR.

SECTION 3

Five-Year Review Summary Statement

Federal Superfund law requires EPA to conduct a study every five years for hazardous waste cleanups that do not completely remove all contaminants from the site. The purpose of the study is to ***determine whether the remedy is achieving the agency's goals for the cleanup,*** specifically whether the cleanup is protective of human health and the environment. The EPA must answer three fundamental questions in a FYR:

Question A: Is the remedy functioning as intended by the decision document?

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

In this document, the FOCH coalition set out to answer these three questions in advance of EPA's draft third FYR. FOCH utilized the expertise of independent scientists to analyze publicly available data from ongoing EPA and GE monitoring programs and, wherever possible, the

[6] The first FYR was completed in 2012. The second FYR was released for public comment in 2017 and finalized in 2019.
[7] https://hudsoncag.wspis.com/

format and logic of the established EPA FYR process for consistency. Based on a review of the data we have determined the following:

Question A: The data available since 2015 (last year of dredging) for Upper Hudson sediment and fish illustrate that PCB concentrations do not appear to be recovering at the rates needed to achieve the remedial goals set in the 2002 ROD. The first goal was to achieve average concentrations of 0.4 mg/kg of PCB in fish fillet within five years after the completion of dredging. That goal was not and has not yet been met. In addition, the surface sediment PCB concentrations, as measured by sediment sampling in 2016/17 and again in 2022, appears to be little changed since dredging was completed.

Question B: The exposure assumptions in the 2002 ROD are inaccurate. The site risks may be understated, and the reliance upon fish consumption advisories is not an effective control on human health risks. EPA should update its understanding of the relationship between sediment and fish PCB concentrations to determine how much further active remediation is required to meet the risk reduction targets in the time frames needed to achieve the objectives of the ROD.

Question C: The data available since the 2002 ROD was issued, and since the dredging remedy was implemented, indicate that a significant mass of bioavailable PCBs has been left behind in the surface sediments of the Upper Hudson River. The data also indicate that the sediment and fish concentrations post-dredging are much higher than anticipated and rapid decline in sediment PCB concentrations is not occurring, as a result a corresponding rapid decline in fish PCB concentrations is also not occurring. In addition, the annual average and cumulative PCB load post-dredging is higher than was expected in the 2002 ROD.

In conclusion, the data available support the finding that the selected remedy is not protective of human health and the environment. The human health and ecological risks are well in excess of EPA's acceptable risk ranges, and (based on current trends in fish and sediment PCB levels) will not be in the acceptable range for the foreseeable future.

SECTION 4

Technical Assessment

An FYR is conducted pursuant to Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1990, as amended ("CERCLA"), 42 U.S.C. 9621(c), and 40 C.F.R. 300.430(f)(4)(ii) and undertaken in accordance with EPA's Comprehensive Five-Year Review Guidance, OSWER Directive 9355.7-03B-P (June 2001). The triggering action for this third FYR is EPA's April 11, 2019 signature of the second FYR. The purpose of the third FYR is to evaluate the implementation and performance of a remedy to determine if the remedy is or will be protective of human health and the environment. When determining the protectiveness of the remedy, EPA must consider the following questions:

Question A: Is the remedy functioning as intended by the decision document?

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

EPA issued the 2002 ROD to address the ongoing environmental and human health risks posed by the discharge of millions of pounds of PCBs from GE's capacitor production facilities in Hudson Falls and Fort Edward, NY. The remedy selected in the 2002 ROD called for dredging to remove PCB contamination in-place sediments of the Upper Hudson River, and Monitored Natural Attenuation ("MNA") of PCB contamination remaining in the river after dredging. The selected remedy also assumes separate source control action near the GE Hudson Falls plant and Fort Edward facilities, which are under NYSDEC jurisdiction.

In connection with the 2002 ROD, EPA developed five remedial action objectives ("RAOs") for protection of human health and the environment:

1. Reduce the cancer risks and non-cancer health hazards for people eating fish from the Hudson River by reducing the concentration of PCBs in fish. The risk-based preliminary remediation goal for the protection of human health is 0.05 mg/kg PCBs in fish fillet based on non-cancer hazard indices for the RME adult fish consumption rate of one half-pound meal per week (this level is protective of cancer risks as well). Other target concentrations are 0.2 mg/kg PCBs in fish fillet to be attained within 16 years of completion of dredging, which is protective at a fish consumption rate of one half-pound meal per month, and 0.4 mg/kg PCBs in fish fillet within five years after dredging, which is protective at a rate of one half-pound meal every two months.

2. Reduce the risks to ecological receptors by reducing the concentration of PCBs in fish. EPA identified two preliminary remediation goals for fish PCB concentrations to protect fish-eating wildlife, ranging from 0.07 to 0.3 mg/kg. It should be noted that these numbers are based on whole body PCB concentrations, which are much higher than fillet concentrations.

3. Reduce PCB levels in sediments in order to reduce PCB concentrations in river (surface) water.

4. Reduce the inventory (mass) of PCBs in sediments that are or may be bioavailable.

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

The length of time needed to achieve the preliminary remediation goals and RAOs set forth in the 2002 ROD was an important factor considered by EPA in comparing remedial alternatives. EPA's models estimated that it would take decades longer to reach the 0.2 mg/kg and 0.4 mg/kg PCB target levels under either the No Action alternative or the MNA-only alternative (involving no dredging). As a result, EPA concluded that active remediation was necessary to protect human health and the environment. EPA believed that implementation of the selected active remedy would greatly reduce the mass of PCBs in river sediments and lower the average PCB concentration in surface sediments to in turn reduce PCB levels in the water column, fish, and other biota, and thereby rapidly reducing the level of risk to human and ecological receptors.

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Question A: Is the remedy functioning as intended by the decision documents?

At this time, the human health and ecological remedial goals set forth in the 2002 ROD have not been achieved. The post-dredging data indicate that the remedy is inconsistent with modeling analysis and expectations presented in the ROD. The following summarizes the status of the remedy:

- MNA is not occurring as modeled. (*See* Figures 1-6.)

- NYSDEC and NYSDOH maintain fishing restrictions and advisories against consumption of Hudson River fish for the entire 200 mile stretch of the river from Hudson Falls to the Battery in New York City. Altogether, the "don't eat" advisory applicable to all species in the Upper Hudson River has been in place for nearly 40 years.[8] Although there are fish consumption advisories in place and warning signs posted along the river, fishing has been observed and fish are being consumed. In addition, these advisories do not work on ecological receptors, which are still exposed to unacceptable risks posed by PCB contamination in fish, sediments, and surface water.

- EPA chose an active remedy under which significant amounts of PCBs would be removed from the sediments of the Upper Hudson by sediment dredging. EPA selected this remedy primarily based upon the time it would take to achieve targeted fish PCB concentrations after dredging. This was necessary, according to EPA, to protect the human and ecological receptors exposed to PCBs by eating fish. EPA understood advisories for people to stop eating fish were not completely effective, and could never apply to ecological receptors, and thus the remedy selection needed to be based primarily upon the time to meet the targeted reductions in fish PCB concentrations. Specifically,

[8] The NYSDOH advises women of childbearing age and children under 15 to not eat fish from the Hudson River south of the Corinth Dam. The NYSDOH also recommends that no individual eat any fish caught between the Corinth Dam and the Federal Dam in Troy. Further advisories exist for specific locations and species.

EPA stated in the 2002 ROD that a delay of ten years in reaching target fish concentrations, of 0.4 mg/kg and 0.2 mg/kg, was unacceptable. Based on the data, we can predict that it will take significantly more than ten additional years to achieve the preliminary remediation goals set forth in the 2002 ROD.

- EPA reported and is counting on an 8% per year decline in fish tissue, but actual data show higher than expected post-dredging PCB sediment concentrations and consistently lower recovery rates. The risks to human health and the environment remain well above EPA's acceptable risk range. In fact, the risks remain well above EPA's acceptable risk ranges as they were before dredging started in 2009. (*See* Figures 3-4.)

- The EPA "acceptable risk range" for human health used in the Federal Superfund program has two criteria: excess cancer risk, and the non-cancer health effect metric of "hazard index." In the 2002 ROD, EPA states that the acceptable cancer risk range is between 1 in 10,000 and one in 1,000,000. At the time the 2002 ROD was issued, the cancer risk from PCB exposure in the Upper Hudson was stated as 1 in 1,000 for the "reasonable maximum" exposed people. Also stated in the 2002 ROD was EPA's estimate of Hazard Index. The 2002 ROD stated that the Hazard Index for non-cancer health effects was between 7 and 12 for an average exposure, while the reasonable maximum exposure resulted in a hazard index between 65 and 104. These two metrics describing the health risk associated with PCB exposure in the Upper Hudson are well above the EPA acceptable risk range. Even taking into account reductions in fish PCB concentrations since the 2002 ROD was issued (approximately a threefold decrease), the risks posed by PCB exposure in the Upper Hudson are still well above the acceptable range, for both cancer and non-cancer health effects.

- Current and future concentrations of PCBs in the sediment in the Upper Hudson River are expected to limit the ability to achieve the targets for PCBs in fish. (*See* Figure 6.)

- The magnitude and extent of PCB contamination in the surface top two inches post-dredging is much greater than assumed in the 2002 ROD. While GE removed more sediment than was initially targeted in the ROD, less than 76% of total PCB mass was actually removed.[9]

- The average surface sediment (top two inches) PCB concentrations after dredging are two to three times higher than anticipated in the 2002 ROD. Such concentrations are more consistent with the model predictions for the MNA (no dredging) alternative for River Sections 2 and 3. (*See* Figures 3-4).

- Sampling design de-emphasized cohesive (fine-grained) sediment areas in River Sections 2 and 3, which were identified as the most important primary source of PCBs to the food web and were shown to have the highest surface concentrations in areas surrounding the dredged areas.

[9] Final Second Five-Year Review Report for the Hudson River PCBs Superfund Site, April 11, 2019, p. 5 ("EPA estimates that approximately 76 percent of the overall PCB mass from the Upper Hudson River was removed by the dredging.")

- The rapid reduction in sediment concentrations did not occur, and the expected rate of natural recovery is not occurring either. (*See* Figures 1-2.)

- The selected remedy for the Hudson River PCBs Superfund Site requires the comparison of Tri+ PCB concentrations in the top 12 inches of sediment[10] (surface concentration). However, EPA is only sampling the top two inches of sediment. Such sampling substantially underestimates the amount of bioavailable PCBs, which affects EPA's ability to understand how PCB concentrations in sediment are continuing to impact PCB concentrations in fish, re-contaminating dredged areas, and contributing to loading in the Lower Hudson River.

- EPA established sediment cleanup levels to guide the sediment removal process. These cleanup levels were based upon: (a) EPA's understanding of sediment-based sources of PCBs to fish and water, (b) EPA's understanding of how PCBs moved from sediment to water and to fish, (c) computer modeling efforts that quantified how PCBs moved through the system, and (d) how various remedial alternatives (i.e., different sediment cleanup levels) would impact the trends in fish and water PCB concentrations. The data show that PCB levels in sediment and fish are higher than EPA models expected and are not decreasing at the expected rate. This is an area where further study is needed to determine if further sediment remediation is required to meet the ROD goals.

- In the 2002 ROD, EPA set different cleanup levels in sediment, depending on where the dredging was to be done. In the first six miles from Fort Edward to the Thompson Island Dam, the cleanup levels established were a concentration of ten milligrams per kilogram (mg/kg, or part per million) of Tri-Plus PCBs[11] in the surface top 12 inches and a mass per unit area of three grams of PCB per square meter (g/m^2) of river bottom. For the remaining portion of the Upper Hudson from the Thompson Island Dam downstream to the Federal Dam at Troy, the cleanup levels were 30 mg/kg and 10 g/m^2. The different cleanup levels were primarily driven by the modeling work and based upon the conclusion derived in EPA's "Data Evaluation and Interpretation Report" that the area upstream of the Thompson Island Dam was the primary source of PCBs to the freshwater Hudson. The data available show that pre-dredging concentrations in sediment and fish were higher than expected and post-dredging levels demonstrate that the 2002 ROD goals are not being achieved. EPA must reevaluate the cleanup levels used in the 2002 ROD using post-dredging data to determine what changes to the cleanup levels need to be made to meet EPA's goals set forth in the 2002 ROD.

- Surface sediment (top two inches) concentrations were found to be three to five times greater than assumed at the time of the 2002 ROD. As a result, sediment PCB concentrations post-dredging were far higher than anticipated. The model EPA used to inform the cleanup did not accurately capture the extent of contamination or accurately predict the length of time required to reduce unacceptable risk.

[10] According to EPA, PCBs in the top 12 inches of sediment are bioavailable to ecological receptors.
[11] Total PCB concentrations are approximately twice the Tri-Plus PCB concentration.

- The surface sediment PCB concentrations in the top two inches, as measured by sediment sampling in 2016/17 and again in 2022, have changed very little since dredging was completed. (*See* Figures 1-2.)

- The remedial work at the GE plant sites was designed to achieve an average surface water PCB concentration of two nanograms per liter at Rogers Island. This location is downstream of both GE plants, and upstream of the areas dredged. Surface water monitoring has thus far shown that this goal has been met, but monitoring is ongoing. As such, there are no data to support an argument that upstream loads are a cause for elevated PCB concentrations in sediment and fish.

- Analysis of the data available show that the remedy is not functioning as intended. Full achievement of human health and ecological remedial goals will take decades, and very little progress is being made toward the interim targets.

- For at least 15 years,[12] EPA has known that the models used in the 2002 ROD substantially underestimated PCB concentrations in surface sediment. PCBs remaining after dredging in the surface sediment continue to be bioavailable, contribute to recontamination of dredged areas, and prolong loading to the Lower Hudson River.

In summary, the monitoring data available to date confirm that the remedy is not functioning as intended. The targeted sediment removal has not been successful in allowing for the post-removal natural recovery processes to achieve the anticipated rapid reductions in fish PCB concentrations and in human health and ecological risk.

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Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

The cleanup levels set forth in the 2002 ROD for the sediment-dredging element of the remedy were risk based. EPA established a cleanup level based on the anticipated risk reduction associated with the selected remedy. For the Site, the reductions in risk to be achieved in the specified time frames through application of the sediment cleanup levels were a function of the anticipated reductions in fish PCB concentrations to be achieved as a direct result of the sediment removal, followed by natural recovery. The understanding of site risks may be understated, as the risks of PCB exposure to humans and wildlife are based on outdated assumptions that EPA is still in the process of evaluating on a national basis.

[12] 2012 Five-Year Review, Appendix A, Technical Memorandum Comparison of ROD and SSAP-based Estimates of the Reduction in Surface Sediment, May 30, 2012, "Over the past few years, there have been several discussions and analyses regarding the differences between the concentrations used in the ROD and the ones developed from the SSAP program. Concerns have been raised that the remedial design as currently planned will not yield the level of improvement in surface sediment concentrations of Tri+ PCBs anticipated by the ROD in all river sections."

The assumptions in the 2002 ROD about site uses may understate the actual risks associated with PCB exposure to humans, as the reliance by EPA on the State Department of Health fish consumption advisories continues to allow for uncontrolled human exposures to PCBs in fish.

EPA also continues to rely on the assumption, stated in the investigation documents leading up to the 2002 ROD and stated in the 2002 ROD itself, that the area upstream of the Thompson Island Dam (the first six miles of river to be remediated) was the primary source of PCBs to the rest of the river. This assumption, which was the primary basis for the less stringent cleanup levels set forth in the 2002 ROD for the portion of the river downstream of the Thompson Island Dam, resulted in significant masses of bioavailable PCBs remaining in the 34 miles of Upper River downstream to Troy.

In summary, it appears that the site risks may be understated, that the reliance upon fish consumption advisories is not an effective control on human health risks, and that the fundamental understanding of what cleanup level in sediment would be necessary to achieve the remedial goals in the ROD needs to be revisited and updated. This requires extensive sampling of surface sediment in the top 12 inches with an emphasis on the areas identified in the remedial design sampling with elevated PCBs. Comprehensive understanding of the currently remaining surface PCBs is essential to any revisiting of cleanup levels.

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Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

In answering this third question in a FYR, all new information, including monitoring data gathered during remedy implementation and during post-remedial monitoring, should be evaluated to determine if this new information would lead the reviewer to conclude that the remedy is not protective. As discussed above, the data available since the 2002 ROD was issued, and since the dredging remedy was implemented, indicate that a significant mass of bioavailable PCBs was left behind in the surface sediments of the Hudson River. These data also indicate that the anticipated rapid decline in surface sediment PCB concentrations – and as a result, a corresponding rapid decline in fish PCB concentrations – is not occurring.

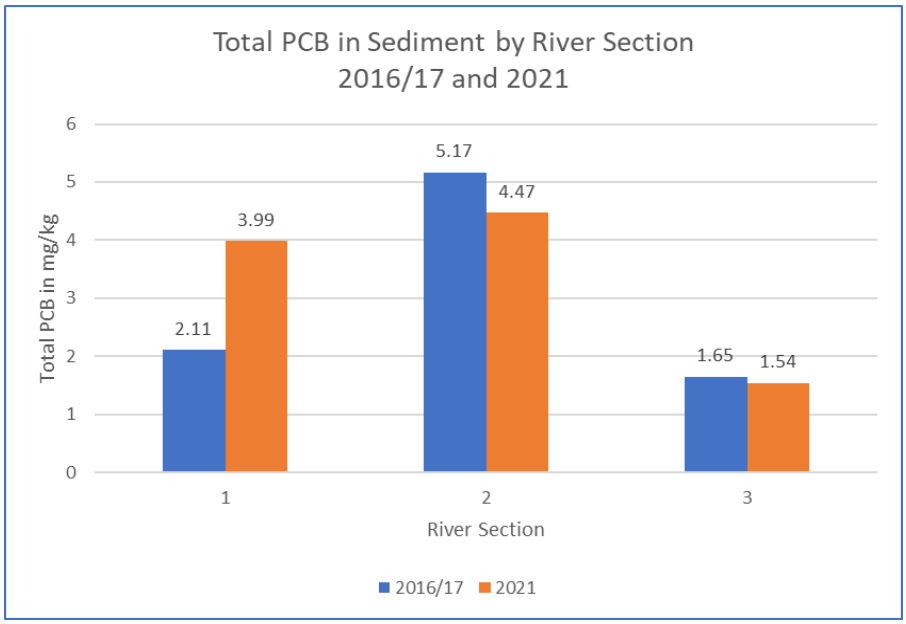
SECTION 5

Figures

PCBs in Sediment by River Section

Figure 1

Total PCB in Sediment by River Section



Note: The rate of change in the PCB concentrations of post-dredged sediment between 2016 and 2021 is much less than what is necessary to achieve the targeted reductions in fish concentrations.

Figure 2

Total Tri+ PCB in Sediment by River Section

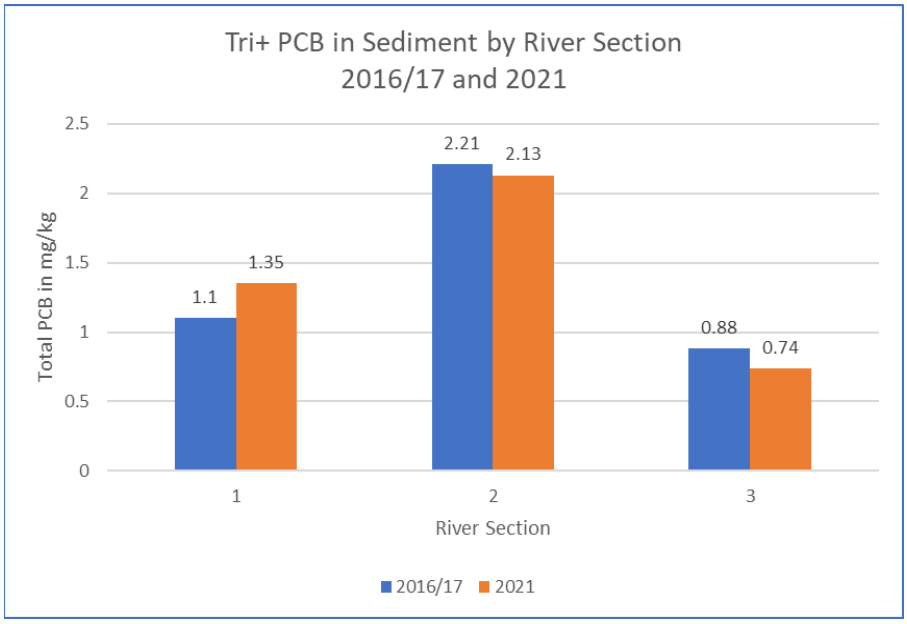
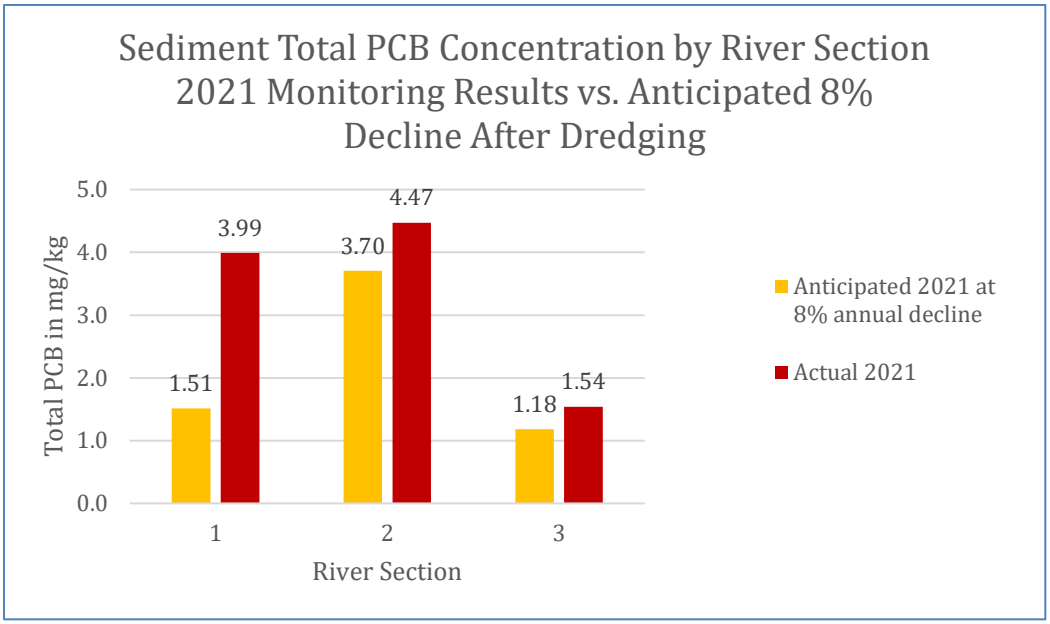


Figure 3

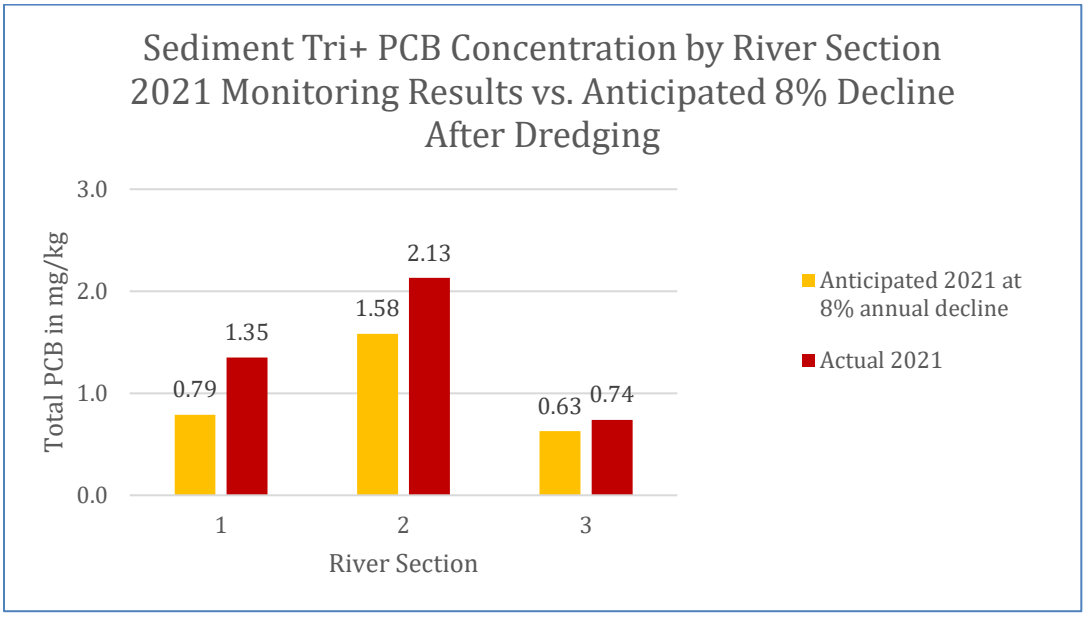
Total PCB Concentrations in Sediment by River Section: Sediment Sampling Results EPA Anticipated for 2021 Compared to the Actual Sediment Sampling Results Collected in 2021



Note: The 8% rate of decay is the rate[13] EPA anticipated in the 2002 ROD. The projected 8% rate of decay is based on data collected in 2016/2017 (the first year after dredging) as the baseline year.

Figure 4

Sediment Tri+ PCB Concentrations in Sediment by River Section: Sediment Sampling Results EPA Anticipated for 2021 Compared to the Actual Sediment Sampling Results Collected in 2021

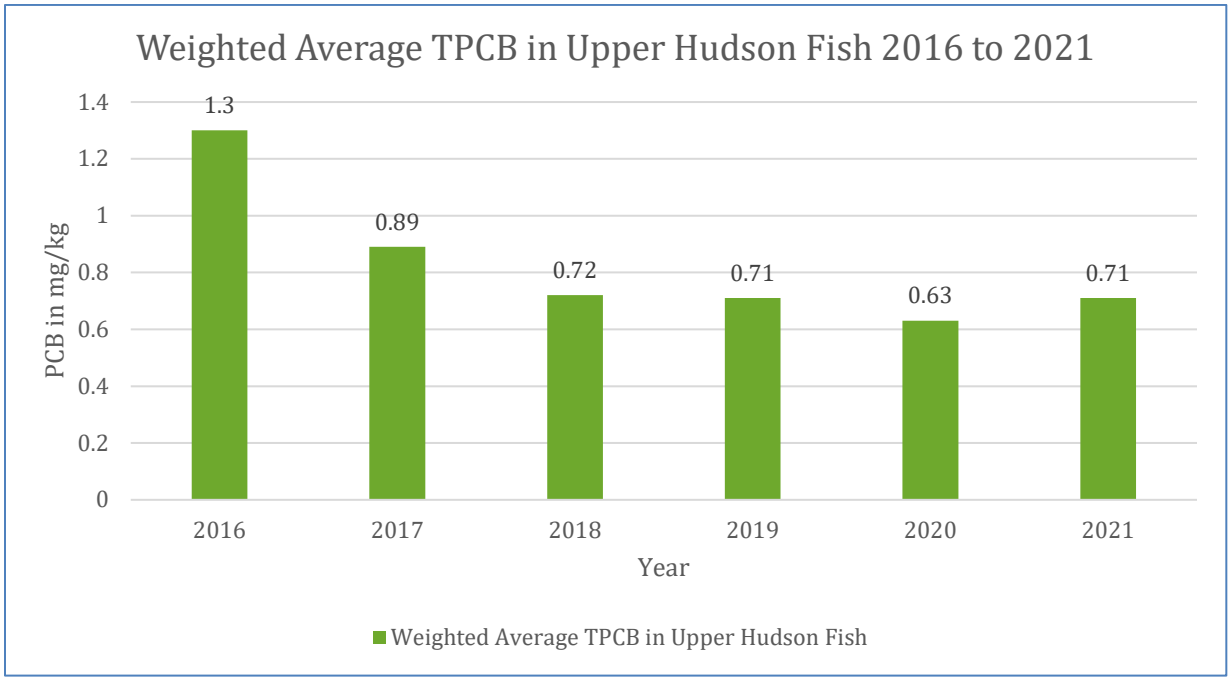


[13] The rate of decay is how quickly concentrations decline or the rate PCB concentrations decrease in sediment.

PCBs in Fish

Figure 5

Total PCB (Weighted Average) in Upper Hudson River Fish

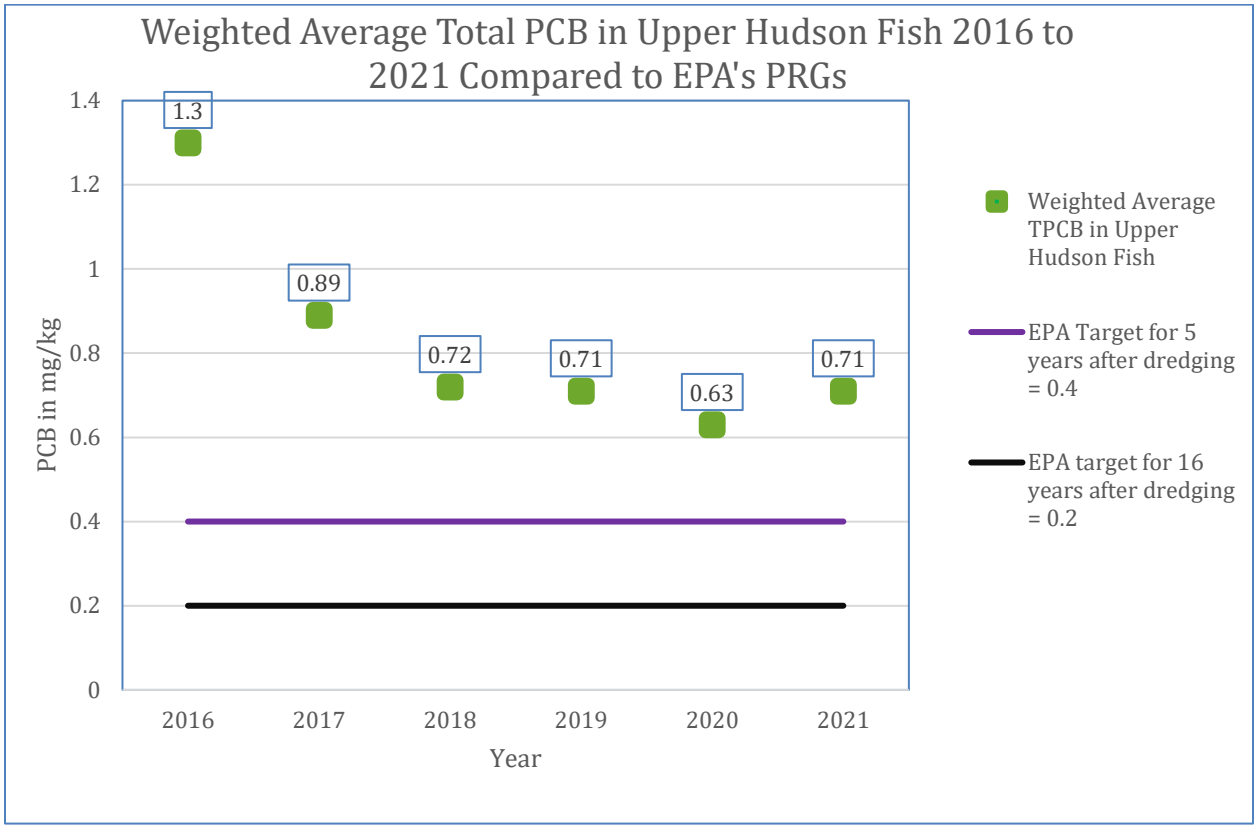


Note: In the 2002 ROD, EPA adopted target concentrations of 0.4 mg/kg and 0.2 mg/kg PCBs in species-weighted fish fillet to be attained by 2020 and 2031, respectively.[14] Meeting these target concentrations was expected to facilitate the relaxation of fish consumption advisories from the current "eat none" recommendation in the Upper Hudson River to one of limited fish ingestion.

[14] EPA's modeling projected that the target concentration of 0.4 mg/kg PCB in fish fillet would be attained within five years of completion of dredging. The target of 0.2 mg/kg PCB would be attained within 16 years of completion of dredging for the three active remediation alternatives.

Figure 6

Total PCB (Weighted Average) in Upper Hudson River Fish Compared to EPA's Preliminary Remediation Goals in the 2002 ROD



SECTION 6

Environmental Justice

Risk Avoidance v. Risk Reduction

For nearly 76 years,[15] human and environmental health threats posed by GE's PCBs in the river have been borne by generations of people living along its shores. The health effects – cancers, birth defects, neurological impacts – are long-term and cumulative but that does not minimize the urgency nor the responsibility to more effectively prevent or reduce these risks. Consumption of contaminated fish is the single greatest source of human exposure to PCBs[16] and for many decades, the only protection from the negative health impacts due to "exposure" to PCB-laden fish has been fish consumption advisories. Such advisories are part of EPA's "risk-avoidance" strategy. This strategy forces the public to alter their behaviors so as to avoid the harms from exposure to contamination. The burden is on the risk-bearers to protect themselves – in this case, the fish consumers – rather than those who caused the risk (polluters) or those who are tasked with protecting the public from the dangers of toxic pollution in systems like the Hudson River (EPA).

In addition to fish advisories, EPA concluded in the 2002 ROD that active remediation, i.e., dredging, followed by MNA,[17] was "necessary to protect the public health or welfare and the environment"[18] from the significant health and ecological risks associated with the ingestion of PCB-laden fish. EPA's active remedy was a risk-reduction[19] strategy designed to clean up environmental contamination by requiring GE to reduce or eliminate the contamination.

In the 2002 ROD, EPA adopted PRGs as the final remediation goals for the Site.[20] The risk-based PRG for the protection of human health is 0.05 mg/kg PCBs in fish fillet based on non-cancer hazard indices for the reasonable maximum exposure adult fish consumption rate of one half-pound meal per week.[21] EPA also adopted interim target concentrations of 0.2 mg/kg PCBs in fish fillet, which is protective at a fish consumption rate of one half-pound meal per month, and 0.4 mg/kg PCBs in fish fillet, which is protective of the average angler, who consumes one half-pound meal every two months.[22] EPA's models projected that these interim targets would be attained within 16 and 5 years of the completion of dredging, respectively.[23] EPA had hoped that attaining such levels would facilitate the relaxation of the fish consumption advisories and fishing restrictions.[24]

Today, eight years after the completion of active dredging, the first goal for fish has not been met

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[15] *Hudson River PCBs Superfund Site*. New York, NY: US Environmental Protection Agency (EPA). 2020-08-25.
[16] Office of Water, EPA, Fact Sheet, Polychlorinated Biphenyls (PCBs) Update: Impact on Fish Advisories (1999), https://www.epa.gov/sites/default/files/2018-11/documents/polychlorinated-pcbs-impact-fish-advisories-factsheet.pdf
[17] Natural attenuation relies on natural processes to decrease or "attenuate" concentrations of contaminants in soil and groundwater. Community Guide to Monitored Natural Attenuation EPA-542-F-21-018, 2021
[18] Hudson River PCBs Site, Record of Decision (2002), at 49.
[19] Environmental Protection Agency, Risk Assessment, https://www.epa.gov/risk/about-risk-assessment ("EPA considers risk to be the chance of harmful effects to human health or to ecological systems resulting from exposure to an environmental stressor.")
[20] Hudson River PCBs Site, Record of Decision (2002), at 51.
[21] Hudson River PCBs Site, Record of Decision (2002), at 50.
[22] Hudson River PCBs Site, Record of Decision (2002), at 50.
[23] Hudson River PCBs Site, Record of Decision (2002), at 103.
[24] Hudson River PCBs Site, Record of Decision (2002), at 50.

and the expected rates of MNA recovery are not being achieved. (*See* Figures 3 and 4.) Without a robust natural recovery, the current elevated human health and ecological risks posed by fish consumption will likely persist for the foreseeable future. Because sediment and fish PCB concentrations have not declined as EPA anticipated for the Hudson River, EPA is forced to rely on risk avoidance efforts. The reliance on fish consumption advisories is not an effective nor a just solution for mitigation of human health risks, particularly for environmental justice communities who rely on subsistence fishing. In addition, risk avoidance does not address the risks threatening the ecological receptors.

For far too long, communities along the Hudson River have faced persistent environmental injustice through toxic PCB pollution. These communities have experienced disproportionate and adverse human health and environmental burdens. Recently, EPA has made commitments to prioritize environmental justice in general operations and has specifically provided tools and guidance for cleanup actions such as the Hudson River Superfund Cleanup. In a July 1, 2021 memo,[25] regional Superfund directors were instructed to consider additional enforcement actions at sites, like the Hudson River PCBs Superfund Site, that have been designated as "human exposure not under control."[26] Furthermore, on April 21, 2023, President Biden signed Executive Order 14096 to revitalize our nation's commitment to environmental justice for all.[27] Building on prior directives to incorporate environmental justice into their operations, the Executive Order directs agencies to consider measures to address and prevent disproportionate and adverse environmental and health impacts on communities. In light of these commitments to environmental justice, EPA must address the needs and concerns of environmental justice communities in the Hudson River Valley by taking additional actions to meet the RAOs set forth in the 2002 ROD. Instead, EPA has essentially done the opposite; EPA is backing away from the modest goals and time frames laid out in the 2002 Record of Decision, which already included decades of delay before providing real relief to environmental justice communities along the Hudson.

[25] Memorandum from Acting Assistant Administrator for Enforcement and Compliance Assurance Larry Starfield, "Strengthening Environmental Justice Through Cleanup Enforcement Actions," July 1, 2021, available at: https://www.fedcenter.gov/Documents/index.cfm?id=37173&pge_prg_id=45198&pge_id=4339

[26] *See* Memorandum from Acting Assistant Administrator for Enforcement and Compliance Assurance Larry Starfield, "Strengthening Environmental Justice Through Cleanup Enforcement Actions," July 1, 2021, available at: https://www.epa.gov/enforcement/environmental-justice-enforcement-and-compliance-assurance. In addition, CERCLA RI/FS ASAOC and SOW Model Documents, issued just days after the ASAOC was entered into, include provisions in accordance with this commitment. *See* 2022 CERCLA RI/FS ASAOC and SOW Model Documents, available at: https://www.epa.gov/enforcement/2022-cercla-rifs-asaoc-and-sow-model-documents.

[27] https://www.federalregister.gov/documents/2023/04/26/2023-08955/revitalizing-our-nations-commitment-to-environmental-justice-for-all

SECTION 7

Protectiveness

EPA's continued statement that additional data is needed to render a protectiveness determination is not supported by any specific decision criteria. EPA's continued demand for more data essentially abandons the time frames laid out in the 2002 ROD. Given the current fish and sediment data and observed trends, waiting for more data will only prolong the inevitable determination that the remedy is not protective of human health and the environment.

EPA's own data supports the conclusion that the interim targets identified in the 2002 ROD will not be reached within the time frames estimated at the time the ROD was issued. A critical factor needed for the protectiveness determination is a reliable calculation of the rate of decline in post-dredging fish tissue PCB levels. Natural attenuation processes have not helped the river reach the interim remediation goals for the protection of human health with regard to fish consumption.[28] In the interim, the State of New York is relying on fishing restrictions and fish consumption advisories to control human exposure pathways that lead to unacceptable risks. However, these consumption advisories are not fully effective in that they rely on voluntary compliance in order to prevent or limit fish consumption. For the reasons stated herein, the selected remedy is currently not protective of human health and the environment as there are known exposures to both human and ecological receptors, which have not been controlled and which remain in excess of EPA's acceptable risk range.

SECTION 8

Conclusions

Conclusion 1 - The Upper Hudson sediment remedy is not protective of human health and the environment. The human health and ecological risk are well in excess of EPA's acceptable risk ranges, and (based on current trends in fish and sediment PCB levels) will not be in the acceptable range for the foreseeable future.

Conclusion 2 - The observed rates of natural recovery in fish and sediment PCB concentrations are significantly less than anticipated in the 2002 ROD, and significantly less than those needed to achieve the RAOs set forth in the 2002 ROD and remedial goals.

Conclusion 3 - The understanding of the relationship between how much PCB was left behind in Upper Hudson sediments and the rates of recovery in sediment and fish needs to be updated to determine if further remedial work is necessary to achieve remedy protectiveness.

Conclusion 4 - EPA should determine what further active remediation is needed to allow the remedy to function as intended (allow for natural recovery after dredging to achieve the rapid reductions in human health and ecological risk) to allow the RAOs to be achieved.

[28] 0.2 mg/kg PCBs in fish fillet to be attained within 16 years of completion of dredging, and 0.4 mg/kg PCBs in fish fillet within 5 years after dredging.

SECTION 9

Recommendations for Next Steps

To illustrate the next steps needed, the EPA's five-year review guidance provides a specific course of action. The guidance states that:

> *If your evaluation of data indicates that the remedy is not meeting and will not be able to meet the RAO stated in the ROD, then you may need to determine if the remedy is protective and, if not protective, what additional actions are needed. For example, if the risk associated with the cleanup levels currently being achieved by the remedy are within EPA's acceptable risk range, the remedy generally should be considered protective. However, if the remedy will not be able to meet the RAOs, further actions may be needed, depending on the specificity of the original RAOs in the ROD. Your Five-Year Review report should identify such further actions as recommendations and/or follow-up actions.*[29]

EPA has many tools available to it to reevaluate the remedy and take additional steps to clean up PCBs in the Hudson River. In order for EPA to compel additional action in the Upper Hudson River, the EPA must first issue a "not protective determination." This section highlights paths forward, but none can be pursued without a finding from EPA that the remedy is not protective of human health and the environment.

Remedy Optimization

In recent years, EPA has increasingly turned to remedy optimization to resolve complex issues at particularly challenging Superfund sites. Through the remedy optimization process, EPA brings in a team of independent technical experts to recommend ways to improve the effectiveness of a cleanup action. Those recommendations can include improvements to the conceptual site model, changes to the remedial approach, and best practices for data management. While remedy optimization can take place at any stage in the Superfund process and at any type of Superfund site, EPA prioritizes large and complex sites where there is a "desire to accelerate or improve effectiveness of the remedial process."

The Hudson River Superfund Site is exactly the type of site that EPA should be targeting for remedy optimization. First, the site has many of the features that EPA looks for: It is a large and complex site that has concerns about the effectiveness of the remedy and uncertainty regarding the conceptual site model. Second, the Hudson River Superfund Site urgently needs outside review from independent experts. The same team has been working at the site for years (in some cases, for decades); fresh eyes and a new perspective would be extremely helpful. Third, remedy optimization is intended for sites in all phases of the Superfund process. Since the Upper Hudson and Lower Hudson are at very different stages, it is important to have a flexible approach that can address both portions of the Site.

[29] Environmental Protection Agency, Comprehensive Five-Year Review Guidance, OSWER Directive 9355.7-03B-P (June 2001), at p. 4-9.

Remedial Investigation and Feasibility Study for the Lower Hudson River

EPA should expand the investigation of the Site to include performance of a formal Remedial Investigation and Feasibility Study ("RI/FS") for the Lower Hudson River. Such RI/FS is necessary to determine the nature and extent of PCB contamination in the sediments, water, and biota of the Lower Hudson River, and to evaluate remedial alternatives to address the currently uncontrolled, unacceptable risks to human health and the environment.

The sampling and investigation to be carried out by GE is not a substitute for an RI/FS; it will merely delay the beginning of an RI/FS, which must occur before any meaningful response action can take place. The 160-mile Lower Hudson portion of the Hudson River PCBs Superfund Site has waited nearly 40 years for resolution of the legacy PCB pollution that has poisoned the river's wildlife, destroyed a vibrant fishing industry, impaired new commercial activity, and compromised the health of those living along its shores. The proposed sampling and investigation of the water column, sediment, and fish in the Lower Hudson described in the sampling plan is unlikely to yield significant useful information to resolve the spatial distribution of PCBs and other contaminants in the Lower Hudson. The Lower Hudson is a much larger and more complex ecosystem than the Upper Hudson. A plan should be developed now to expand the initial sampling work to provide a meaningful understanding of the distribution of PCB contamination in Lower Hudson fish and of the relationships between water, sediment, and biota. This sampling effort should include the various fish species that are commonly consumed by humans, and ecological receptors from various locations in the estuary. This effort should also include using PCB congener analysis as the primary analytical approach rather than relying on the outdated Aroclor method that provides minimal information necessary to understand processes and source identification.

In addition, the proposed supplemental exploratory sediment sampling program will provide extremely limited insight into the spatial variation in sediment PCB concentrations throughout the Hudson estuary. The planned water column monitoring, sampling, and analysis will only demonstrate small incremental improvement in understanding the distribution of PCBs in the river. In addition, sampling locations 50 miles apart, in the complex environment of the Hudson River estuary, simply will not provide the spatial resolution necessary to meaningfully advance the understanding of the nature and extent of PCB contamination in the Lower Hudson.

Adaptive Management of the Remedy[30]

EPA may consider using adaptive site management to make progress toward the RAOs and remediation goals, inform uncertainties, and make decisions about whether and when additional remediation is necessary to achieve the RAOs for the Site.

Adaptive site management relies on monitoring to continually improve site understanding and track progress toward goals. This allows decision-makers to:

- better establish the contaminant relationship between soils/sediments, water, and biota;
- identify unknown contaminant sources or exposure drivers;
- assess the effectiveness of remedial approaches; and

[30] https://semspub.epa.gov/work/HQ/100003040.pdf

- determine the degree of remediation necessary to achieve a final, protective remedy.

At a practical level, the value of adaptive site management at sediment sites is the potential for expediting significant progress toward final remediation goals while monitoring the system response and gauging what, if any, additional steps are needed to achieve those goals. Remediation under adaptive site management acts on what is known while acknowledging what is not fully understood. It includes plans to collect the necessary information to reduce uncertainties and achieve a final, protective remedy for the site. This approach allows work to proceed in areas with high contaminant exposure and transport while additional data collection and testing of responses is conducted to determine the appropriate level of remediation in remaining areas.

Explanation of Significant Differences ("ESD")

EPA should consider incorporating significant changes into the 2002 ROD to amend the scope and performance of the alternative to protect human health and the environment. An ESD must describe to the public the nature of the significant changes, summarize the information that led to making the changes, and affirm that the revised remedy complies with the NCP and the statutory requirements of CERCLA. To describe the nature of the significant changes, it is suggested that a side-by-side comparison of the original and proposed remedy components be used to clearly display the significant differences. The ESD should provide additional information on changes that have resulted in the remedy as a result of the change (e.g., changes in the cleanup cost estimate or remediation time frame).

ROD Amendment

If "fundamental," rather than merely "significant," changes are made to the scope, performance, or cost of a remedial action, then EPA must propose an amendment to the ROD. A ROD amendment requires an evaluation of the proposed change, a revised proposed plan, and an opportunity for public comment.

Reopener

Although EPA issued a Certificate of Completion of the Remedial Action for the Upper Hudson, EPA can still compel GE to perform additional response actions in the Upper Hudson to the extent that the reopener provisions in the 2006 Consent Decree are satisfied. Specifically, the reopener provisions require that EPA discover "previously unknown conditions, or previously unknown information" indicating that the remedial action is not protective. Since EPA issued the certificate in 2019, a great deal of new information – including information about the amount of remaining contaminated sediment and the lack of recovery in fish – has revealed that the remedy in the Upper Hudson is not protective of human health and the environment. Therefore, EPA can compel GE to take additional remedial action in the Upper Hudson.