An Evaluation of the Feasibility of Environmental Dredging in the Upper Hudson River

Including

An Evaluation and Critique of
Scenic Hudson's Dredging Report

402812

GE Corporate Environmental Programs

May 1997

Executive Summary and Introduction

Environmental Dredging Ineffective and Impractical for the Upper Hudson River

For 20 years, interested parties in government, environmental activists, citizens and GE have been involved in decisions regarding what to do — or not to do — about PCBs buried in the Hudson River. Recently, an environmental group issued a report advocating dredging in the Hudson River. After evaluating and analyzing dredging technologies and environmental dredging efforts attempted in the United States, GE has prepared this document to address the issue. In addition, a critique of Scenic Hudson's report is included.

The environmental dredging debate has focused on whether dredging sediments, including buried PCBs, from the bottom of the Hudson is the most appropriate environmental remedy. The question now confronts the U.S. Environmental Protection Agency for the second time. Three major issues are presented:

- First, what is the predominant source of PCBs affecting the environment, particularly fish — the primary indicator of the river's health and the primary route of human exposure;

- Second, would dredging reduce PCB levels in fish, which is the goal of EPA's reassessment; and

- Third, would dredging, even if effective, be the most appropriate remedy considering the inherent risks of the technology, the residual level of contamination that would be left, the damage it would inflict on the river, the time it would take to implement and the need it would create for a massive hazardous waste landfill to hold all of the material removed from the river.

Dredging presumes fish derive their PCBs mainly from buried sediment. But an analysis of the voluminous Hudson River data collected by GE and government agencies since the mid-1980s demonstrates that aged PCBs buried deep in sediments in the Upper Hudson River are not the principal source of elevated PCB levels in fish. Instead, the data show that fish levels are affected by PCBs that have entered the Hudson River in the recent past from the vicinity of GE's Hudson Falls plant site. Therefore, dredging the buried PCBs from the river bottom would not be an effective way to reduce PCB levels in fish, which is the main goal of EPA's reassessment. Instead, control of the sources in the vicinity of GE's Hudson Falls plant site will accelerate the natural recovery of the river.

In the last 20 years, two New York State proposals for massive dredging projects in the Hudson and the associated landfills have been rejected, the first by New York State's highest court, the second by the state's Hazardous Waste Siting Board. Washington County citizens, farmers and elected officials organized to fight both projects. They pursued successful lawsuits against the first project, and intervened in the regulatory process that resulted in rejection of the second project.

In 1983, the Hudson River was named a federal Superfund site. In 1984, the U.S. Environmental Protection Agency rendered the standing decision for the site. In the decision, EPA evaluated two dredging approaches — "bank-to-bank" dredging for the entire 40 miles of the Upper Hudson and "hot spot" dredging, in which areas of relatively higher PCB concentrations would be removed but other parts of the river would be left mainly intact.

EPA concluded that "bank-to-bank dredging could be environmentally devastating to the river ecosystem and cannot be considered to adequately protect the environment" (USEPA, Record of Decision, at Page 6) and that "hot spot" dredging would be largely ineffective in reducing PCBs in the river system. EPA, therefore, issued a "no action" decision on dredging, which it is now reassessing.

Scenic Hudson, an environmental group that participated in legal proceedings involving the state's unsuccessful efforts to site a landfill and has waged a long political campaign in support of dredging, recently released a report citing dredge tests and projects in other waterways which were purported to support a Hudson dredging project. But the Hudson is not any other waterway. Its character and conditions are unique, and the PCB situation in the Hudson is unique. These factors create practical considerations that are critical to any valid analysis of the feasibility and advisability of a Hudson dredging project.

Scenic Hudson failed to consider the most fundamental issue: Whether a dredging project of any kind is warranted in the Hudson in view of the evidence that sediment PCB deposits are not the principal source to the fish. The group also failed to acknowledge the problems associated with dredging, such as the likelihood that it would result in a residual layer of PCBs coating the surface of the sediments, resulting in higher PCB concentrations in fish and wildlife, at least in the short term. Scenic Hudson failed to evaluate the long- and short-term ecological impacts of excavating the river bottom, removing tons of mud and plant life in the most sensitive and productive parts of the river. The report did not assess the length of time required to complete a dredging project (ten years or longer, by our estimate), nor did it present any alternative to the massive hazardous waste landfill that would be required. The landfill would be a permanent intrusion on otherwise productive agricultural land in Washington County. It is vigorously opposed by local residents and officials and considered a threat to the local agricultural economy, and a deterrent to recreational, tourism and economic development opportunities in the Upper Hudson area.

Scenic Hudson said its report had been prepared to illustrate the feasibility of remedial dredging, but its feasibility can only be determined after a thorough examination of all of the site-specific ramifications of dredging in the Upper Hudson, which Scenic Hudson failed to perform. The U.S. Army Corps of Engineers, which conducts dredging projects, has concluded in another context that a comparison of various dredge types without consideration to site-specific conditions and characteristics is of little value. (Zappi and Hayes, 1991)

GE has conducted a site-specific analysis of the feasibility of dredging in the Upper Hudson. The research was conducted by Bradford S. Cushing, P.E., a dredging authority with Applied Environmental Management, Inc., with assistance from Blasland, Bouck and Lee, Inc., professional engineers and scientists. GE's report presents the following conclusions:

- Dredging should be ruled out as a remedial option for the Hudson River because it would not reduce PCB levels in fish faster than is happening naturally as a result of ongoing remediation projects, augmented by resedimentation and the river's other natural processes.

- "Bank-to-bank" or "hot spot" dredging in the Upper Hudson would be a project of unprecedented size, scope and environmental impact. None of the environmental dredging projects undertaken in the United States involved such a long stretch of open river and the amount of material to be removed and disposed of. The Hudson "hot spots" comprise roughly 270 acres; 1.3 million cubic yards of sediment could be generated by dredging them. By contrast, the largest environmental dredging project at a Superfund site to date generated 159,000 cubic yards of material and took 15 months. Consequently, comparisons of an Upper Hudson project to smaller dredge sites or dredge tests are of questionable relevance.

- "Dredging efficiency" — or the overall rate at which sediment was removed at the major environmental dredging projects in the U.S. to date — has typically been 5 to 100 cubic yards removed per hour. Applying these rates to a proposed Hudson River "hot spot" dredging project suggests that it would take a decade or longer, without counting the time it would take for mobilization/demobilization of equipment and personnel, downtime caused by equipment problems or adverse weather and legal issues involved in gaining access to private property and in siting dewatering and landfill facilities. The state's unsuccessful prior efforts to site landfill and dewatering facilities took more than a decade.

- The environmental dredging projects performed to date in the U.S. have either failed to achieve or failed to verify achievement of target clean-up goals in sediment. Most have typically focused on "mass removal" rather than risk reduction. Most have had no clearly defined environmental target or goal, and did not attempt to measure environmental benefits.

- All of the environmental dredging projects were in relatively small, focused areas and many had the availability of an adjacent industrial site for a "beach head" or staging area and, in some cases, a containment facility, benefits not available in the Upper Hudson, which is surrounded by private properties and undeveloped, forested shoreline.

402816

Remediation of Contaminated Sediments by Dredging: A Feasibility Report

Even though state and federal regulatory agencies are confronting contaminated sediment problems from coast to coast, no technical consensus has emerged about the extent and severity of the problem or whether environmental dredging is an appropriate or effective remedy in accomplishing clean-up goals and reducing environmental and human health risk. This is in part due to the complexity and site-specific nature of the sediment-contamination problem and to the fragmented and inconsistent regulatory approach that has evolved.

It is clear, however, that environmental dredging is an infrequent and undeveloped procedure. A 1989 report by the National Research Council's Committee on Contaminated Marine Sediments said: "Despite the widespread extent of the contaminated sediment problem, remedial actions directed at excavating, treating, or otherwise manipulating contaminated marine sediments have been extremely rare." (<u>Contaminated Marine Sediments — Assessment and Remediation</u>, National Academy Press, 1989.)

The alternatives:

Current technology allows for a limited number of ways to remediate contaminated sediments in waterways. These options are:

- Allowing contaminated sediments to remain in place (in-situ), allowing natural recovery processes of burial/sedimentation and biological degradation to proceed;

- Allowing contaminated sediments to remain in place (in-situ) and applying an artificial cap of clean material to contain contaminated sediments;

- Removing and disposing of contaminated sediments by dredging or wet excavation (where water flow is diverted, sediment is dewatered and then removed by conventional earth moving equipment); then transporting the material to a confined disposal facility located along the shore or on land (landfill) for dewatering and permanent containment; or,

- Removing and transporting the contaminated sediments by dredging or wet excavation; transporting the removed material to a temporary holding area on land for containment and dewatering; treating the dewatered material to remove or destroy contaminants; and disposing or reusing the decontaminated material. This option is practically applicable to small sediment volumes only.

Wet excavation by its nature is limited to small volumes of material in shallow streams or nearshore areas, or shallow lakes, ponds or marsh areas of manageable size. Remediation of all other types of contaminated sediment settings — such as rivers and streams — requires full-scale dredging.

A river poses the most complex obstacles for environmental dredging. Miles of access would be required along each side of the shoreline, most of which is privately owned. Contaminated materials resuspended during dredging are more susceptible (than in lakes, ponds or harbors) to being transported downstream. Rivers often contain "hot spot" areas with higher concentrations of contaminants than the rest of the river bottom. These "hot spots" are often located in depositional areas along the shoreline where overhanging vegetation makes access difficult. Because these areas have never been dredged, rocks, boulders and debris would greatly interfere with and delay the dredging process. Finally, the onshore area designated to receive removed sediments and water may be miles away, necessitating a lengthy pipeline for the risky transport of material. This is the situation in the Hudson River.

Maintenance Dredging vs. Environmental Dredging

Maintenance dredging and environmental dredging are very different processes, often with dramatically different ramifications and results. Maintenance dredging — mainly for navigational purposes — is a century-old process used for creating and maintaining satisfactory depths of water in harbors, rivers and canals and for preparing foundations for marine and river construction. Maintenance dredging quickly removes a large amount of dredged material (or spoils) with little concern for its handling and disposal. On the other hand, environmental dredging attempts to remove a precise amount of contaminated material with strict handling procedures applied to both the movement and disposition of sediments and water (see Table 1).

With maintenance dredging, suspended sediments are allowed to escape into the river or be dispersed into the water column by river currents. Numerous dredge spoil disposal sites, including cleared diked areas near the water, upland disposal sites and deep ocean containment areas, may be used because removed materials pose no hazard to the surrounding environment. No post-dredging monitoring is needed.

Experiences with maintenance dredging cannot be used to justify environmental dredging as practical and appropriate for the Hudson River. An environmental dredging project — as suggested for the Hudson River — is significantly more complicated. Because sediments are contaminated, resuspension and transport of buried sediments must be minimized. Frequent monitoring must be undertaken to evaluate resuspension of contamination downstream and upstream and sufficient concern must be given to the redisposition of contaminated sediments on surface sediment layers. An engineered and permitted containment facility — such as a landfill — must be approved for disposal of the contaminated dredged spoils, and provisions made for long-term maintenance and monitoring of the disposal site.

In maintenance dredging, water is often allowed to overflow from the barge, which in turn allows the barge to transport a larger amount of denser sediment. Overflow of this type would not be allowed in an environmental dredging operation because the water is contaminated. Therefore, the millions of gallons of water removed in an environmental dredging project would have to be contained and immediately transported to a disposal facility or water treatment plant, with an attendant reduction in project speed and efficiency.

The only similarity between maintenance and environmental dredging is the types of equipment used. Failure to recognize the vast differences between environmental and maintenance dredging when considering a Hudson River dredging project will lead regulators and dredging proponents to reach the wrong conclusions about the feasibility of such a project — resulting in irreversible and devastating consequences for the river.

Environmental Dredging

In order to be considered effective, environmental dredging must:

- minimize the transport of contaminated sediments into the surroundings by resuspension, settlement on surface layers, "pipeline" leakage or barge overflow;
- achieve target contamination concentration levels without causing greater environmental harm to the body of water and its environs;

402819

- function effectively, no matter what the particular environment is either above or below water — such as shallow or deep water, rocks and debris, underwater vegetation, weather constraints, high water flow rates, or wetland and other environmentally sensitive areas;
- handle, treat and dispose of dredge spoils (both water and sediments) in an environmentally safe and socially acceptable manner; and,
- be completed in a reasonable time frame, maximizing removal of contaminated sediments while minimizing removal of non-contaminated water and nearby "clean" sediments.

While each of these objectives is obvious, they are not readily achieved as a group because each is in direct conflict with the others. For instance, minimizing resuspension requires slower dredging removal rates, conflicting with the objective of timely completion. Also, achieving low target concentration levels, which may require repeated passes with the dredge over sensitive areas, conflicts both with the need to prevent environmental harm to the waterway and the need to complete the project in a reasonable timeframe.

Three types of dredges are typically used, with varying results: mechanical, hydraulic and specialty dredges. Specialty dredges, developed in Japan and The Netherlands, can remove contaminated, fine-grained material from harbors and lake bottoms with minimum resuspension. However, availability of these dredges has historically been limited both by the Merchant Marine Act of 1920 (also referred to as the Jones Act) and by U.S. demand. In addition, their production rates are low as compared to conventional hydraulic dredges and they are particularly susceptible to plugging by debris and vegetation, further negating their usefulness for sizable environmental dredging projects.

Consequently, *none* of these specialty dredges has been used in any of the major environmental dredging projects implemented in the U.S. The U.S. projects instead have employed conventional hydraulic systems, such as cutterhead or horizontal auger dredges or mechanical dredges, such as backhoes and clamshells. All have had inconsistent results, which bear close examination, and render them useless as justification for a dredging project for the Hudson River.

Prior Environmental Dredging Projects

Fourteen sites in the U.S. involving substantial volumes of contaminated sediments have been identified and evaluated (several other sites in the early stages of sediment removal have not been included in this report because project information is incomplete). At 11 of these sites, environmental dredging was implemented.

At two of the other three sites — James River, VA, and Twelvemile Creek/Lake Hartwell, SC, — environmental dredging was judged infeasible. The affected length of the river and total acreage of contamination was large at both sites, although contaminant concentrations in sediments were relatively low and diffuse.

At James River, regulatory agencies determined that the natural recovery approach of gradual burial of contaminated river sediments with clean sediments was the most appropriate remedy. This was indeed successful. By 1988, 13 years after the river's contaminant source was identified and removed, all fishing advisories for the waterway were lifted.

In 1994, EPA determined that natural recovery combined with upland source control was the best approach for 24 miles of Twelvemile Creek and 56,000-acre Lake Hartwell. Sufficient time to evaluate the success of the remedy at this site has not yet passed.

At the Triana/Tennessee River site in Alabama, an EPA-led review panel concluded that dredging DDT-contaminated sediments could destroy aquatic and wetland habitats and potentially expose downstream populations to additional contamination. Instead, a diversion and in-place burial remedy was implemented.

Examination of data from the remaining 11 sites provides the best available measure of the feasibility and effectiveness of environmental dredging (see Tables 2, 3 and 4). Assembling data on these sites was a formidable task; documentation was, in varying degree, incomplete, closely held or extremely slow in being made public. This lack of formalized documentation and specific data fosters skepticism of favorable claims by regulatory agencies regarding the outcomes of these dredging projects, as well as making any application of lessons learned to future remedial projects difficult.

Volumes of sediment remediated at the 11 sites ranged from 3,100 to 159,000 cubic yards — much smaller than the 1.3 million cubic yard "hot spot" dredging project proposed in the Hudson by New York State and endorsed by Scenic Hudson. In fact, dredging the Hudson River "hot spots" would amount to eight times the sediment removed from the largest environmental dredging project attempted in the U.S. to date. In addition, the sites that were dredged tended to be in readily accessible, discrete and focused water areas, rather than sites like the Hudson that involve a long, open stretch of river.

At nine of the 11 sites, industrial property in the immediate vicinity of the dredge site was used as a "beach-head" or staging area to support dredging equipment, storage and dewatering facilities and sometimes containment facilities. Access to private properties or undeveloped, forested shoreline, as are common in the Upper Hudson, was typically not required.

Most important, none of the projects required the construction of a nearby massive hazardous waste landfill, as would be required by a Hudson River dredging project. During the last 20 years, two New York State proposals for massive dredging projects in the Hudson and the accompanying landfills have been rejected, the first by New York Courts, the second by the state's Hazardous Waste Siting Board. Washington County citizens, farmers and elected officials organized to fight both projects. They pursued a successful lawsuit against the first project, and intervened in the regulatory process which ended in rejection of the second project. Since EPA's "no action" dredging decision in 1984, various proposals to establish both traditional and hazardous waste landfills in the Hudson Valley have run squarely into vigorous citizen opposition. An Army Corps of Engineers proposal to convert an abandoned quarry in East Kingston into a landfill for dredge spoils from New York Harbor is currently being fought by citizens and elected officials in Ulster County. No landfills to contain contaminated dredge spoils have been approved to operate on private lands outside of industrial sites in New York State since 1984.

Dredging Elsewhere: Where Measured, Not Effective

Measures of success for several of the aforementioned 11 environmental dredging projects were not established. The plans tended to focus on "mass removal of contaminants," with no clearly defined expectations for improvement of the body of water. None of the projects demonstrated that sediments could be dredged to a level where contaminant levels in fish were reduced or risks to human health ameliorated.

There was wide variability in target levels, as is clear from a review of Table 3. Post-dredging sampling to verify residual levels of contamination, surprisingly, was not performed at five of the 11 sites. At four others, only haphazard post-dredging sampling was performed.

At five of the sites — Waukegan Harbor, the Black River, Bayou Bonfouca, Lipari Landfill and LTV Steel — regulatory agencies aimed to achieve a pre-determined depth of sediment removal rather than a measured contaminant clean-up level. By doing so, regulators presumed that these depths were either clean or below a target contamination level, based on pre-dredging results from sediment sampling and analysis programs. However, final results were never confirmed.

A similar approach was used at two other sites. At Ruck Pond, the target was to remove the maximum amount of sediment practical, down to bedrock if possible, using a wet excavation technique, rather than dredging. However, residual PCB levels of 10-300 ppm remained after the excavation was completed.

At Marathon Battery, the project originally targeted removal of the top foot of sediments over a 44-acre area, containing an estimated 95% of the site's cadmium contamination. Multiple passes with a horizontal auger dredge were subsequently made to depths greater than one foot in an attempt to achieve a residual contamination level of 20 ppm. Documentation is as yet unavailable to determine whether this level was or was not consistently achieved.

Where post-dredging verification sampling was performed, there were as many different sampling procedures and end results as there were sites. This makes it difficult to compare the technologies used at these sites, as well as to determine the success of the dredging projects.

At New Bedford Harbor, 15 composite samples from the top six inches of sediment were used to establish final residual PCB levels in five "hot spots" that totaled five acres. The EPA justified the collection of so few verification samples because the removal action was an interim measure aimed at mass removal, with an elevated target level of 4,000 ppm PCBs.

At the Alcoa (Massena) site — a one-acre nearshore "hot spot" in the Grasse River that was enclosed by a triple tier of silt curtains — EPA reportedly hoped that the full-scale pilot dredging program would achieve a 10 ppm or less level of PCBs. Despite repeated passes with a horizontal auger dredge, an average residual level of no lower than 75 ppm was achieved in the top six inches of the remaining sediment.

After failure of a silt curtain enclosure system, an 11-acre near-shore area in the St. Lawrence River (the GM Massena site) was enclosed by sheetpiling and then divided into six quadrants by silt curtains. Dredging was then implemented, with the target of removing more than 85% of the sediments and achieving a 1 ppm or less level of PCBs. The first goal was achieved — 85% of sediments was successfully removed. However, target PCB levels were not obtained, despite intensive efforts which included numerous passes with a horizontal auger dredge. Ultimately, the project concluded with EPA's approval, although PCB residual levels of up to 9 ppm remained in five of the six quadrants. In the sixth quadrant, levels of up to 90 ppm remained. This quadrant was capped with 18 inches of sand, gravel and stone, thus ending further remedial efforts at this nearshore location.

At the Sheboygan River, interim (pilot) dredging was performed within the confines of a containment system comprising an internal geotextile silt screen and an external geomembrane silt curtain. Dredging was performed in 15 "hot spots" that totaled about one acre, followed by sediment sampling and analysis ("hot spots" in the Hudson River total 270 acres). First, one dredge pass was made to remove as much sediment as possible down to hard subgrade material. Following this first pass, the area within the silt containment system was allowed to settle, followed by a second pass with dredging equipment. One or two additional dredge passes were made in areas where post-dredging sediment sampling results showed elevated PCB levels. In all, a limited number of 21 post-dredging verification samples was obtained. Residual PCB levels in eight of the "hot spot" areas ranged from 25 to 295 ppm, despite the two or more passes with the dredge.

These post-dredging results lead to an obvious question: Why is dredging unsuccessful in achieving targeted or otherwise low residual contaminant levels in sediment? Reasons for the failures include:

- surface sediments in between furrows are missed by the dredgehead, possibly due to dredge swing inconsistencies;
- residual sediments are left on and in the bedrock/sediment interface due to the incapability of dredging equipment to access and capture residual sediments;

402824

- sediment contamination above the target level is deeper than the total depth of the cut and is missed in attempting to minimize the volume removed by precision dredging;
- sediment contaminant concentrations are not uniform with depth along horizontal planes, i.e., the total depth of the cut achieves the clean-up level at some locations but not at others; and,
- resuspended sediments that escape removal by the dredgehead subsequently resettle on the dredged surface. This resuspended sediment would have contaminant levels equivalent to the average within the resuspended layer.

These factors are all failures of the environmental dredging process, which may be unresolvable and in any case are not eliminated by the use of more sophisticated operational controls. The interplay of these factors makes one skeptical as to how effectively the targeted contaminant levels were achieved at the five sites where no post-dredging verification data were obtained.

Another issue raised by the failure to achieve target contamination levels is the need to develop a proper and technically-defensible post-dredging verification program. Often, as already noted, there is no formal process to determine that target levels were achieved.

Proper Handling of Contaminated Water

Environmental dredging projects generate large volumes of water — water which, because of exposure to contaminated sediments, cannot be returned to the original body of water without proper treatment. Therefore, controlled collection and treatment of this water is necessary to reduce contaminant levels, allowing legal discharge back to the water body of origin.

Water volume quantities were identified for five of the 11 environmental dredging projects (see Table 5). They range from 12 million gallons to 171 million gallons, even though the amounts of material dredged are relatively small. In a much larger Hudson River dredging project — where 1.3 million cubic yards of sediment could be targeted — more than one billion gallons of water would need to be transported and treated.

Scenic Hudson's Dredging Report

Scenic Hudson, an environmental organization, recently released a report that purported to present objective information in defense of a future Hudson River dredging project. In fact, the study included only a small number of references. Nearly half of the dredging projects cited were conducted prior to or within one year of EPA's 1984 Hudson decision, and as such, were reached independent of the same technology and site-specific limitations that led EPA to reject dredging for the Hudson.

Scenic Hudson's report mischaracterized prior dredging projects, ignored critical practical considerations that would adversely affect dredging success rates and focused narrowly on the issue of resuspension rather than on equally important technical issues, as well as on logistical ones when assessing the feasibility of a Hudson River dredging project. Despite these omissions and oversights, the report concluded with this remarkable statement: "We do endorse and recommend dredging as a component of the Hudson River PCBs remedy, based on demonstrated technical feasibility and effectiveness." (Scenic Hudson, <u>Advanced in Dredging Contaminated Sediment</u>, pg. 65-66)

Scenic Hudson's report presumes — incorrectly — that fish in the Upper Hudson derive most of their PCBs from PCBs buried in river-bottom sediment. In fact, an analysis of the voluminous Hudson River data collected by GE and government agencies since the mid-1980s demonstrates that aged, buried PCBs are not the principal source of elevated PCB levels in fish. Instead, the data show that fish levels are affected by PCBs that have entered the Hudson in the recent past from the vicinity of GE's Hudson Falls plant site. Therefore, dredging the river bottom would not be an effective way to reduce PCB levels in fish, which is the main goal of EPA's reassessment. (GE Comments on EPA Data Evaluation and Interpretation Report, 1997)

Scenic Hudson also failed to evaluate in any meaningful way the benefit of other, less risky remedial alternatives, including control/elimination of ongoing PCB sources to the Hudson; sedimentation/burial in which clean sediment covers deposits of PCBs, sequestering them from the food chain; and natural bacterial processes that reduce the toxicity and bioavailability of PCBs and destroy PCBs.

The study's relevance to the Hudson is undermined by its authors' acknowledged failure to evaluate dredging in the context of site-specific issues and other ramifications of large sediment removal projects. The U.S. Army Corps of Engineers, which conducts dredging projects, has concluded that a comprehensive comparison of dredge types, without consideration of site-specific factors, is of little value. (Zappi and Hayes, 1991)

The Scenic Hudson report focuses on only one problem associated with dredging technology — sediment resuspension. In so doing, the study ignores equally or more important problems, such as:

- The residual layer of contaminated sediment left behind after dredging due to resuspension and subsequent resettling of particulate matter.

- The difficulty in predicting with precision the level of contamination that will still exist after dredging in the sediment and in fish and other living things that eat plants growing in the sediment.

- The impossibility of dredging a precise sediment layer, and the contamination it contains, as a result of river-bottom topography; rocks, logs, debris and other site-specific characteristics; and limitations in the dredging process.

- The logistical difficulties involving environmental dredging in an extended river, including access from a heavily vegetated shoreline, movement of dredged materials over extended distances, and a final disposal area for the dredged materials.

The report also fails to realistically consider "dredging efficiency" — the time necessary to actually mobilize and complete an environmental dredging project.

Dredging projects have many other significant ramifications — also ignored in the Scenic Hudson report — including the need to:

- Establish facilities to contain and dewater large volumes of sediment;
- Construct facilities to treat water for the removal of contaminants so that it can be legally returned to the water body of origin; and
- Establish a hazardous waste landfill to contain the remaining sludge.

Scenic Hudson's failure to consider the landfill issue is inexplicable considering that the prior proposals to dredge the Hudson all have run aground on the controversial issue of a landfill. Scenic Hudson also gave no consideration to the need for a lengthy pipeline that would have to be floated/supported on the river or constructed along private shoreline property for transport of contaminated material from the dredge to the dewatering facility. The forested and residential character of the Upper Hudson and its shoreline would be dramatically altered for decades by the pipeline and by the network of haul roads that would have to be built to carry dredging and support equipment and vehicles.

By ignoring these critical factors, Scenic Hudson gives the impression that movement of a dredge from Hudson River "hot spot" to "hot spot" would be easy and unencumbered. On the contrary, dredging of this magnitude would require a long train of dredging equipment, barges, onshore facilities and transport vehicles, moving from one site to the next — all disrupting normal river activity for a decade or more.

Scenic Hudson acknowledges that access to "hot spots" may be limited by physical obstructions, such as bridges, dams, etc. However, the report fails to identify many of the other water-depth and site-access constraints and difficulties. For example, many of the 40 "hot spots" are in fairly shallow water areas that also may contain various debris such as rocks, logs and wood that must be considered. Such restrictions may preclude the use of hydraulic dredging or result in excessive clogging of a dredge intake, i.e., equipment incompatibility/downtime. Other considerations not addressed by Scenic Hudson include the effects of site-access limitations on the ability to complete a dredging project of such magnitude. Based on the location of the "hot spots," several multiple acre processing areas could be necessary at points along the river or multiple barges and/or trucks utilized to transfer and/or transport materials to a central processing location. Transport and transfer of materials, either by barges or pipelines, to processing areas, carries its own risks of accidents, including overturned trucks, vessels and ruptured pipes, all with potentially significant risks to the environment and human health.

In the past, many experts have criticized dredging technologies because of the "resuspension" or release of buried contaminants (such as PCBs) into the water column. Scenic Hudson goes to some length to refute this claim by discussing in detail the effectiveness and availability of new dredging equipment. While resuspension can be controlled to some degree, it cannot be eliminated and controlling it requires slower dredging, further extending the disruption of normal river use by years for a project of this size.

Moreover, a major test of the feasibility of a Hudson River dredging project hinges on logistical issues (such as haul roads, access to the river and neighboring private property), the handling and disposal of removed sediment and water, and the siting of the necessary landfill, rather than the ability to control resuspension of contaminated material. Scenic Hudson's report offers no reason to believe that a new effort to overcome these obstacles would be any more successful than failed past efforts, including those in which they participated.

Unintended adverse impacts of dredging were not presented, such as the increased bioavailability of the contaminant being dredged, as occurred in the Black River in Ohio. Post-dredging fish tumor incidence increased after dredging of sediments containing PAHs (polycyclic aromatic hydrocarbons). (Baumann, 1995)

Scenic Hudson selected an odd mix of projects to evaluate in the narrative of its report: Nine are field tests, five are dated and vaguely defined removals in foreign countries, six are non-Superfund projects and only four are Superfund sites (Marathon Battery, New Bedford Harbor, GM Central Foundry and Waukegan Harbor). At least five of these 24 sites involved removal of non-contaminated sediment. Scenic Hudson apparently included many of these sites because they involved the use of dredge types discussed in its publication, but that have not been used on any major environmental dredging projects in the U.S. Many of the 24 projects cited by Scenic Hudson involved small-scale dredging of only a few hundred or a few thousand yards of sediment.

The authors suggest that environmental dredging has evolved in the last 13 years and claim that there were no large cleanups of contaminated sediment in the U.S. at the time of EPA's 1984 Hudson decision. However, at least 11 of the 24 projects in the text of Scenic Hudson's report were conducted prior to or within one year of EPA's 1984 decision.

The Scenic Hudson report summarizes 24 dredging tests, demonstrations and projects. These are not necessarily environmental dredging projects and many are field tests not involving contaminated sediment. In addition, some cited projects involve dredges not readily available in the U.S.

Despite Scenic Hudson's claim of documenting recent dredging advances, nearly one-half of the projects are more than a decade old (circa 1973-1986). In addition, Scenic Hudson mischaracterizes prior dredging efforts. For example,

- According to Scenic Hudson, a test of modified dustpan dredge was conducted in the James River, VA. However, the selected remedy for the site was natural recovery. The National Research Council's Committee on Contaminated Research Sediments said: "The James River case stands out as a clear example of the utility of natural recovery... under the right circumstance, natural recovery can represent the most cost-effective, environmentally beneficial and politically acceptable management scheme." (National Research Council, 1997)

- At the Collingwood Harbor site in Ontario, Canada, there was no full-scale dredging, as Scenic Hudson implied, but rather a small dredging demonstration of a modified pneuma system within two boating slips next to the harbor and at a .75-acre area just outside one of the slips. (HSP, Inc., 1993a and 1993b)

Scenic Hudson also uses a 1995 government report on Manistique River as its Appendix B list of 29 PCB-contaminated sites. Accordingly, the list is at least two years old. It is this list that Scenic Hudson has used to support its claim that "dredging is now the preferred remedy at PCB-contaminated sediment sites... included in 23 of 25 cleanup decisions at Superfund sites with PCB-contaminated sediments since 1984." This is not accurate as is demonstrated in Tables 6 and 7.

Only ten of the sites that Scenic listed can be characterized as true dredging projects (five implemented and five in the planning stage). The rest were wet or dry removals of relatively small volumes of sediment (5 to 20,000 cubic yards in volume) using conventional earth-moving equipment or vacuum truck removal.

Only three of the projects Scenic Hudson cites involve removal of more than 100,000 cubic yards of sediment. For perspective, dredging only the 40 "hot spots" in the Upper Hudson could generate 1.3 million cubic yards of sediment.

Scenic Hudson mentions various in-river problems, such as low percent solids, debris interferences and varying sediment characteristics, which can affect production rates of environmental dredging, but the report never ties these problems into actual experience. Some of the information presented by Scenic Hudson is contradicted by site-specific reports. At Collingwood Harbor, Scenic Hudson claimed the pneuma pump removed 183 cubic yards of *sediment* per hour. However, demonstration reports for the site show that the average pumping rate of *dredged mixture* (including sediments and water) was 183 cubic yards per hour. The sediment rate was only 39 cubic yards per hour in the first phase and 33 cubic yards per hour in the second phase of the project. (HSP, Inc., 1993a and 1993b)

Scenic Hudson's reliance on manufacturers' specified removal rates, or theoretical removal rates under ideal conditions, such as are presented in Exhibits 19 and 20 of the report, lead to wildly optimistic projections for future environmental dredging projects. This is best illustrated by estimating overall average removal rates achieved at the four Superfund dredging projects cited in Scenic Hudson's report:

- At Marathon Battery, 77,000 cubic yards were removed over an eight-month period, resulting in an overall average production rate of 40 to 60 cubic yards/hour;
- At New Bedford Harbor, 14,500 cubic yards were removed over 16.5 months, resulting in an overall average production rate of 5 to 10 cubic yards/hour;
- At GM Central Foundry, 24,000 cubic yards (including 10,000 cubic yards of rocks) were removed over a 6-month period, resulting in an overall average production rate of 15 to 25 cubic yards/hour; and,
- At Waukegan Harbor, 32,000 cubic yards were removed over a two-month period, resulting in an overall average production rate of 80 to 100 cubic yards/hour. Follow the dredging, the material took three years to settle in an abandoned boat slip prior to final capping.

Similarly, Scenic Hudson cites an EPA-proposed program (OU-2) for New Bedford Harbor which proposes removal of 450,000 cubic yards over an eight-year period, or an average of 56,000 cubic yards removed each year. This annual total is only about 5 percent of the Hudson River "hot spots" volume. Based on this production rate, dredging Hudson River "hot spots" would take several decades or more. Scenic Hudson fails to acknowledge that the low removal rates that were achieved at some Superfund sites and considered acceptable because of the small amounts of material involved render a Hudson River project totally impractical.

Conclusion

Environmental dredging should be ruled out as a potential remedial option for PCBs in buried sediment in the Upper Hudson River because, fundamentally, dredging would not address the principal source of PCBs to fish in the Upper Hudson and there are other less risky and likely more effective options at hand — notably, the ongoing plant site remediation projects that GE is conducting, which are accelerating the PCB reductions in fish and the natural recovery of the river.

EPA ruled out dredging as a remedial option in 1984 and the experience with environmental dredging at other sites since that decision supports EPA's reasoning. In almost every case where the effects of dredging have been evaluated, dredging failed to reduce contamination in sediments to levels required to measurably reduce environmental and human health risk.

Dredging remains an unreliable technology for the specific conditions found in the Upper Hudson. While it has been tried, with varying results, at other sites, dredging has never been attempted on as long a stretch of open river as would be the case in the Hudson (40 miles) and never involving as much material to be removed and landfilled as is contemplated in the Hudson (1.3 million cubic yards.) A dredging project on the Hudson River would disrupt normal use of the river for a decade or longer and pose other practical and logistical obstacles, including the problems associated with gaining access to and disrupting private property for use by equipment, vehicles, dewatering of dredged sediment, treatment of water and ultimately permanent containment of the removed materials.

Proponents mislead the public by trying to depict environmental dredging as a risk-free, tried and true methodology when in reality it is anything but. Maintenance dredging may be; environmental dredging is not. Dredging is an enormously complicated undertaking involving many adverse environmental and social ramifications that can only be evaluated on a site-specific basis. Based on GE's analysis of Hudson River conditions, dredging is not an appropriate remedy and should not be considered further.

References

Baumann, P., Abstract, "Effect of Remedial Dredging on Bullhead Tumor Frequency in a Recovering River." Presented at Second SETAC World Conference: Global Environmental Protection: Science, Politics, and Common Sense. Vancouver, British Columbia, Canada. November 1995.

BBLES, Inc., St. Lawrence River Sediment Removal Project — Remedial Action Completion Report. June 1996.

Blasland, Bouck and Lee, Inc. (BBL) Alternative Specific Remedial Investigation Report: Sheboygan River and Harbor, for Tecumseh Products Company. October 1995.

BBL, Draft Non-Time-Critical Documentation Report. Syracuse, NY: December 1995.

BBL, Conversations with Tames, P., USEPA. February 19-25, 1997a.

BBL, Conversation with Hahnenberg, J., USEPA, Region 5. February 1997b.

BBL, Conversation with Searles, D., Dredging Specialists. February 1997c.

BBL, Conversation with Lee, D., Soli-Flo, Oceanside, CA. February 13, 1997d.

BBL, Non-Time Critical Removal Action: Documentation Report (Grasse River Study Area, Massena, NY) for Alcoa. December 1995.

Clarke and McFarland, U.S. Corps of Engineers, Assessing Bioaccumulation in Aquatic Organisms Exposed to Contaminated Sediments, Miscellaneous Paper D-91-2. July 1991.

Ebasco Services, Inc. for EPA, Draft Final: Feasibility Study of Remedial Alternatives for the Estuary and Lower Harbor/Bay, New Bedford Harbor, MA. Volume I. August 1990.

Environment Canada, Collingwood Harbour Contaminated Sediment Removal Demonstration — Report on the Water Quality Monitoring Program. January 1994a.

Environment Canada, Hamilton Harbour Contaminated Sediment Removal Project — Report on the Water Quality Monitoring Program. January 1994b.

Environment Canada, Contaminated Sediment Removal Program. June 1994c.

Federal Register, Vol. 61, No. 92. 40 CFR Part 300, National Oil and Hazardous Substances Pollution Contingency Plan; National Priorities List. May 10, 1996.

Hebrich, J., Review of New Bedford Harbor Pilot Study — Removal of Contaminated Sediments. Date Unknown.

Herbich, Brahms and Andrassy, Generation of Re-Suspended Sediment by Dredges, Proceedings Twelfth World Dredging Congress, Orlando, FL. May 2-5, 1989.

HSP, Inc., Demonstration of Pneuma Dredging Technology at Collingwood Harbour, Ontario (Phase I), Arva, Ontario: May 28, 1993a.

HSP, Inc., Demonstration of Pneuma Dredging Technology at Collingwood Harbour, Ontario (Phase II), Arva, Ontario. May 28, 1993b.

Huggett, R., Kepone and the James River — A Case Study. Technical Paper from Contaminated Marine Sediments Symposium/Workshop. June 1988.

Interagency Review Team, Assessment of Remediation Technologies: Manistique River and Harbor Area of Concern, Final Report. April 10, 1995.

Killam Associates, DLA Division (PA), Black River Sediment Removal Completion Report, for USX Corporation — USS Division (Lorain Works). January 1991.

Marano, P. and Russell, T., Advanced GeoServices Corporation (PA), Contaminated Sediment Dredging in a Tidal Estuary (re: Marathon Battery site). 1994.

Marano, P. and Russell, T., Contaminated Sediment Dredging in a Tidal Estuary, Technical Paper from Geoenvironment 2000. Date Unknown.

McLellan, Havis, Hayes, and Raymond, Corps of Engineers, Field Studies of Sediment Resuspension Characteristics of Selected Dredges, Technical Report HL-89-9. April 1989.

Miles, P. and Marr, D., The Welland River Dredging Demonstration.Technical Paper from Dredging '94, Volume 2. November 13-16, 1994.

402834

National Academy Press, Contaminated Marine Sediments — Assessment and Remediation. 1989.

National Research Council, Committee on Contaminated Marine Sediments, Contaminated Sediments in Ports and Waterways: Cleanup Strategies and Technologies, Washington, D.C. 1997.

Shaw, T. et al., Effectiveness of an Excluder Device in Preventing the Entrainment of Benthic Invertebrates and Demersal Fishes in Grays Harbor, Washington. Technical Paper from Proceedings of the Western Dredging Association 17th Technical Conference and 29th Annual Texas A&M Dredging Seminar. June 11-14, 1996.

Taylor, M. et al., Marathon Battery Superfund Project — A Review of Design, Construction, and Lessons Learned. Technical Paper from Dredging '94, Volume 2. November 13-16, 1994.

USEPA, Contaminated Sediment Management Strategy, EPA 823-R-94-001. August 1994.

USEPA, Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, EPA/540/G-89/004. October 1988.

USEPA, An Overview of Sediment Quality in the United States, EPA No. 905/9-88/002. 1988.

USEPA, Selecting Remediation Techniques for Contaminated Sediment, EPA-823-B93-001. June 1993

USEPA, Record of Decision, Hudson River PCBs Site, Glens Falls, New York. September 25, 1984.

USEPA, Assessment and Remediation of Contaminated Sediments (ARCS) Program: Remediation Guidance Document, EPA 905-R94-003. October 1994.

USEPA, Manistique River/Harbor Site — Action Memorandum. Letter from W. Muno, Director of Superfund Division to V. Adamkus, Regional Administrator. 1996a.

USEPA, National Perspective on Sediment Quality, report prepared by Battelle under EPA Contract No. 68-01-6986. July 1985.

402835

USEPA, Proposed Cleanup Plan — Upper & Lower New Bedford Harbor — New Bedford, MA. November 1996b.

USEPA, Superfund Site Close-Out Report: Marathon Battery Company Site, Approved by Jeanne M. Fox, EPA Regional Administrator. September 28, 1995.

Zappi, P. and Hayes, D., Innovative Technologies for Dredging Contaminated Sediments, for U.S. Army Corps of Engineers, Washington, D.C. September 1991.

Records of Decision (RODs) for the specific Superfund Sites cited.

Communications by Applied Environmental Management, Inc. with (1) EPA and State agency personnel, (2) consultants, (3) remedial contractors, and (4) PRPs.

Project-specific EPA and State-agency memos and correspondence accessed through Freedom of Information Act requests.

TABLE 1: MAINTENANCE DREDGING vs. REMEDIAL DREDGING

	MAINTENANCE	REMEDIAL
OBJECTIVE	Restore depth; emphasis is on low cost, high removal rate	Remove and manage only sediments contaminated above a target level
ACCESS	Via water of sufficient depth to float dredge	May require access to shallow and non-navigable bodies of water
END RESULT	Flat bottom profile of appropriate depth	Removal of only contaminated sediments without regard to final depth or profile
RESUSPENSION	Of concern only for dissolved oxygen and turbidity constraints	Of major concern due to contaminants; minimize both the amount and the downstream transport; frequent monitoring; subsequent redeposition on surface also of concern
POST-DREDGING MONITORING	None	Sediment samples to assess remaining contaminant levels; results may dictate additional dredge passes
DISPOSAL OF SPOILS	Low tech. Options include deep ocean; nearshore CDF*; upland CDF	Engineered, permitted containment; long-term maintenance/monitoring
WATER CONTROL	None. Barge overflow often allowed to increase solids	No barge overflow of pipeline leakage permitted; return water from CDF requires treatment to stringent standards
ROCKS/DEBRIS	Little or none; redredging of channels/harbors	Often extensive; dredging nearshore and previously untouched (undredged) areas

* Confined Disposal Facility

AEM, Inc.

TABLE 2: MAJOR SEDIMENT SITES IN THE U.S. WITH REMEDIES IMPLEMENTED

EPA REGION	SITE	BODY OF WATER (Operable Unit)	CONTAMINANTS[2]	RECORD OF DECISION
I	NEW BEDFORD HARBOR, MA	Acushnet River and New Bedford Harbor (980 acres, 3.8 miles) (OU-1, 2)	PCBs	1990 (OU-1) 1992, '95 (ESDs)
II	ALCOA (Massena), N.Y.	Grasse River (7 miles)	PCBs, CN, metals	None[1]
II	GM CENTRAL FOUNDRY (Massena), N.Y.	St. Lawrence River (OU-1) (2500', 11 acres)	PCBs	1990
II	LIPARI LANDFILL, N.J.	Alcyon Lake (18 acres), Chestnut Branch Marsh (5 acres), and two streams	organic solvents	1988
II	MARATHON BATTERY, N.Y.	E. Foundry Cove and Pond (43 acres); also, one-acre cove in Lwr. Hudson River	metals	1989
III	JAMES RIVER, VA	James River (81 miles)	Kepone	None[1]
IV	SANGAMO-WESTON, SC	Twelvemile Creek (24 miles) and Lake Hartwell (56,000 acres) (OU-2)	PCBs	1994 (OU-2)
IV	TRIANA/TENNESSEE RIVER, AL	11 miles of tributaries to the Tennessee River	DDT	DDs[1]
V	BLACK RIVER, OH	Black River (15 miles); Lake Erie	metals, PAHs	None[1]
V	LTV STEEL, IN	1300' intake channel from Indiana Harbor Canal	PAHs (oils)	None[1]
V	RUCK POND, WI	0.3 mile length of Cedar Creek, between two dams	PCBs	None[1]
V	SHEBOYGAN RIVER/HARBOR, WI	Sheboygan River (14 miles)/ Harbor (100 acres)	PCBs, metals	None[1]
V	WAUKEGAN HARBOR, IL	Waukegan Harbor (37 acres)/ Lake Michigan	PCBs	1989
VI	BAYOU BONFOUCA, LA	4000' length of turning basin	PAHs (creosote)	1987 1990 (ESD)

1. Alcoa (Massena), NY; James River, VA; Black River, OH; LTV Steel, IN; and Ruck Pond, WI are not Superfund Sites. The Triana/Tennessee River site was regulated by Decision Documents (DDs) in lieu of a Record of Decision, prepared by a Review Panel established by Consent Order. The Sheboygan River/ Harbor is a Superfund Site that has implemented a full-scale pilot dredging remedy, but no Record of Decision has yet been signed.
2. PCBs are polychlorinated biphenyls; PAHs are polycyclic aromatic hydrocarbons.

AEM, Inc.

402838

TABLE 3: ENVIRONMENTAL DREDGING EXPERIENCE IN THE U.S.

PROJECT	TARGET	Vol (cy) removed	Total Cost ($) (million)	Total Unit Cost ($/cy)	Disposition of Dredged Sediments
ALCOA (GRASSE RIVER) N.Y.[1]	10 ppm PCBs (informal)	3,100	4.9	1,670	Onsite TSCA[2] landfill
SHEBOYGAN RIVER, WI	10 ppm PCBs (informal)	5,900	—	>600	Temporary onsite storage in tank and bio-treatment facility
RUCK POND, WI[1] (CEDAR CREEK)	Removal of 95-99% of PCB-contaminated sediments	8,000	7	925	Commercial landfills: TSCA[2] (30%) and non-TSCA[2] (70%)
NEW BEDFORD, MA	4,000 ppm PCBs	14,000	20.1	1,430	Nearshore confined disposal facility pending treatment
GM (MASSENA), N.Y.	1 ppm PCBs	15,000[3]	10	670	On-site holding basin pending treatment
WAUKEGAN HARBOR, IL	50 ppm PCBs	32,000	15-21	300-420[4]	Into abandoned boat slip, and capped
BLACK RIVER, OH[1]	Removal down to natural till (targeting PAHs[5] and metals)	60,000	5	83	Into dedicated onsite landfill and capped
MARATHON BATTERY, N.Y.	10-20 ppm cadmium	77,000	9-11	115-140	Chemical fixation, then to out-of-state non-hazardous landfill
LTV STEEL, IN	Removal down to natural bottom (targeting PAHs[5]: oils)	114,000	12	105	Oil recovery, then to state special waste landfill
LIPARI LANDFILL, N.J.	Non-detect for bis-2-chloro-ethyl-ether	154,000	50	325	Thermal desorption or solidification, then onto site areas
BAYOU BONFOUCA, LA	1,300 ppm PAHs[5]	159,000	115	725	Onsite incineration

1. Not an NPL site. 2. Toxic Substances Control Act 3. Also, 10,000 cy of rocks. 4. Based on 50,000 cy soils/sediments total. 5. Polycyclic aromatic hydrocarbons

AEM, Inc.

TABLE 4

ENVIRONMENTAL DREDGING: TARGET vs. RESULT

DIDN'T VERIFY

Bayou Bonfouca	(1,300 ppm PAHs**)
Black River	(PAHs**) (into till layer)
Lipari Landfill	(VOCs***) (into clay layer)
LTV Steel	(PAHs**) (into till layer)
Ruck Pond	(PCBs) (95-99% removal)
Waukegan Harbor	(50 ppm PCBs) (into sand layer)

DIDN'T ACHIEVE

Alcoa: Grasse River	(10 ppm PCBs)*
GM Massena	(1 ppm PCBs)
Sheboygan River	(10 ppm PCBs)*

MET INTERIM

New Bedford Harbor	(4000 ppm PCBs)

MET DE-FACTO TARGET

Marathon Battery	(20 ppm cadmium)

* Informal target
** Polycyclic aromatic hydrocarbons
*** Volatile Organic Compounds

TABLE 5

VOLUME OF SEDIMENT vs. VOLUME OF WATER ENVIRONMENTAL DREDGING

PROJECT	SEDIMENT (CY)	WATER TREATED (GAL)	AVG. % SOLIDS	DISCHARGE LIMIT (ppb)*
Alcoa (Massena)	2,600	12 million	6.5	0.065
New Bedford Harbor	14,000	160 million	2.5	0.6**
GM (Massena)	15,000	43 million	10	0.065
Waukegan Harbor	32,000	95 million	8	5 avg. 15 max.
Bayou Bonfouca	159,000	171 million	27	20 polycyclic aromatic hydrocarbons

* PCBs, unless noted otherwise
** Monthly average

AEM, Inc.

TABLE 6: CATEGORIZATION OF SCENIC HUDSON'S LIST OF 29 SITES

Implemented Dredging Projects:	Sediment Volume:
Outboard Marine	32,000 cy
Hooker 102nd Street	28,000 cy (PCBs secondary)
GM Central Foundry	14,000 cy
New Bedford Harbor	14,000 cy (450,000 cy more planned)
Sheboygan River and Harbor	5,900 cy (potentially more planned)

Planned Dredging Projects:	
Commencement Bay	est. 250,000 cy
Harbor Island	est. 134,000 cy
Reynolds Metals	est. 130,000 cy
Fields Brook	est. 14,000 cy
Eagle Harbor (not PCBs)	est. 9,000 cy

Implemented Wet/Dry Removal with Conventional Excavation Equipment:		
Smith's Farm	20,500 cy	(soils/sediments combined)
Schmalz Dump	3,500 cy	(soils/sediments/debris)
Re-Solve	3,000 cy	
Strandley — Manning	3,000 cy	
Folkertsma Refuse	2,900 cy	
S. Municipal Water Supply Well	1,200 cy	(from freshwater marsh during dry period)
Martha C. Rose Chemicals	800 cy	(semi-dry creek bed)
Dayton Tire and Rubber	240 cy	
Middletown Airfield	5 cy	(vacuum truck removal from storm drain area)
New Waterbury, Ltd.	--	(small, $550K)

Planned Wet/Dry Removal with Conventional Excavation Equipment:

Sullivan's Ledge	20,000 cy	
Burnt Fly Bog	5,600 cy	
Ottati & Goss	<5,000 cy	
Paoli Rail Yard	800 cy	
Millcreek Dump	—	(wetland; dry creek/ditches)
Sangamo Dump	—	(drained pond; 2 ditches)
Carolina Transformer	—	(dry creek bed)

No Removal:

Hudson River (remnant deposits)	(capping)
Sangamo/Weston/Twelvemile Creek	(natural recovery)

SCORECARD

10 DREDGING PROJECTS PLANNED or IMPLEMENTED at the 29 SITES
(only 3 larger than 32,000 cy)

Applied Environmental Management, Inc.

TABLE 7: COMPARISON OF 29 SITES WITH PCBS IN SEDIMENTS

NOTE: This list included by Scenic Hudson in its April 1997 report is identical to the list in Appendix D of the Report of the Interagency Review Team for the Manistique River and Harbor, dated April 10, 1995. Accordingly, the list is at least two years old. The dated, vague, and frequently misleading data in this list of 29 sites have been replaced by Applied Environmental Management, Inc. with current, more accurate information, which is presented below. The sequence of the sites listed below is the same as in the table included by Scenic Hudson in their report.

Site Name	Status	Remarks
GM CENTRAL FOUNDRY, Massena, N.Y.	Removed about 14,000 cubic yards of sediments and 10,000 cubic yards of rocks from an 11-acre nearshore area in the St. Lawrence River. Sediments were dewatered and stored onsite pending a decision on disposal.	Failed to meet cleanup goal of 1 ppm PCBs. Settled for average of 3 to 25 ppm. Six months. $7-10 million.
REYNOLDS METALS, Massena, N.Y.	Targeting 130,000 cubic yards of sediments at >1 ppm PCBs in a nearshore area of the St. Lawrence River. Waiting for state approval of plans submitted in Dec. 1995. Target cleanup level of 1 ppm PCBs being debated along with possible Record of Decision modification.	Cable-arm clamshell selected. 1997 start now doubtful.
HUDSON RIVER, N.Y.	Four out-of-water shoreline deposits called remnants were capped in 1990-91. Roughly 300,000 cubic yards of remnant deposit materials exceeding 5 ppm (51.6 acres) were capped with 425,000 cubic yards of clean fill and cap material, minimum 2-feet thick. No dredging or sediment removal.	No action Record of Decision in 1984. EPA reassessment in progress since 1990. Record of Decision for river targeted for late 1998.

402844

Site Name	Status	Remarks
NEW WATERBURY LTD. New Waterbury, CT[1]	Sediments were reportedly excavated to a depth of seven feet below the existing river bed after which it was judged not technically feasible to continue due to the unstable cofferdam and river bank conditions. Contaminated sediments with concentrations up to 6,500 ppm PCBs were left in the river bottom. The dredged area was backfilled with clean fill to the original elevation of the river bed.	No information on date, volume, purpose, or disposition of sediments. Apparently small project based on listed cost of only $550,000. Apparently river diverted to allow wet excavation.
NEW BEDFORD HARBOR, New Bedford, MA	Dredging of 5 acres of hot spots (OU-1) completed; took 16.5 months for 14,000 cubic yards; storage for up to 5 years in nearshore confined disposal facility pending selection of treatment technology; proposed OU-2 (estuary and lower harbor) in public comment phase; proposes a $116 million, 8-year dredging remedy comprising 433,000 cubic yards at >10 ppm from the estuary and 17,000 cubic yards at >50 ppm PCBs from the Lower Harbor, with disposal in four new nearshore confined disposal facilities.	Only OU-1 removal completed.
OTTATI & GOSS, Kingston, NH	Marshy area downgradient on site; some PCBs migrated into South Brook; 4,700 cubic yards soil/sediment excavated and treated by LTT aeration in 1989 at Ottati side of site; additional 9,000 cubic yards soils and 300 cubic yards sediments to be targeted.	More a wet/dry excavation procedure than dredging.

402845

Site Name	Status	Remarks
S. MUNICIPAL WATER SUPPLY WELL, Peterborough, NH	Excavated 1,200 cubic yards of sediments from a freshwater marsh during a dry period in 1994.	Wet excavation. No dredging.
SANGAMO/WESTON/ TWELVEMILE CREEK, Pickens, SC	EPA-lead RI/FS. Institutional Controls only. Cleanup level of 1 ppm (4.7 million cubic yards of sediments) judged infeasible. Natural recovery to FDA fish levels predicted, by modeling, to occur within 12 years.	Dredging judged infeasible. Dredging not part of remedy.
HARBOR ISLAND, Seattle, WA	Record of Decision calls for combination dredging/capping in East and West Waterways adjacent to the island. Estimated 134,000 cubic yards. Disposal primarily in CAD or nearshore bermed sites (locations not yet identified.) Design/ construction negotiations with PRPs in progress. PCB target level is 65 ppm. Target levels are defined for metals and PAHs also. After dredging, areas remaining above target levels will be capped with 2 feet of sand.	Not implemented. Possible start in 1998.
STRANDLEY-MANNING, Purdy, WA[1]	Removal of 3,000 cubic yards of soils and sediments from wetlands area in 1996, including 1,500 feet of stream bed, followed by stream bed replacement.	More a wet/dry excavation procedure than dredging.

402846

Site Name	Status	Remarks
COMMENCEMENT BAY/ NEARSHORE TIDE FLATS, Tacoma, WA	Multiple dredging projects planned for implementation after source control; 425,000 cubic yards of sediments potentially contaminated with heavy metals were dredged from Sitcum Waterway as part of a larger navigational dredging project; Sitcum completed July 1994; only 30% of the 425,000 cubic yards was contaminated, and not with PCBs; dredged material deposited in abandoned waterway to settle and be paved over. For other Commencement Bay locations, EPA has proposed modifying PCB sediment cleanup level from the original Record of Decision standard of 150 ppb at 10 years after cleanup to 450 ppb immediately after cleanup. EPA intends to dredge or cap areas of Commencement Bay which exceed 450 ppb PCBs; estimated at 250,000 cubic yards.	ESD in public comment period. Dredging of "other Bay locations" years away.
SULLIVAN'S LEDGE, New Bedford, MA	Ecological-based cleanup levels; delayed for consent decree negotiations and design; capping and GW pump and treat projected to be bid in spring 1997; 20,000 cubic yards of sediments to be excavated from stream, four golf course water hazards, and a marsh, then dewatered and consolidated under a cap. Also, 7 acres of wetlands to be remediated.	Not clear what portion is wet excavation and what portion (if any) is dredging. Implementation several years away.

402847

Site Name	Status	Remarks
HOOKER 102ND ST. Niagara Falls, NY	Dredged about 28,000 cubic yards of sediments (including the temporary earthen berm) in 1996 from a shallow embayment along the 1,700-foot front of the site; no verification sampling; a portion of the sediments was incinerated, rest deposited onsite under landfill cap. Removal done by both a clamshell dredge and a conventional backhoe, each supported on a barge.	Record of Decision in 1990 predicted $9.1 million. No actual cost data available.
MIDDLETOWN AIRFIELD, Dauphin County, PA	Vacuum truck removal of about 5 cubic yards of sediments (two 55-gallon drums) from a storm drain area.	Sampling of sediments in a nearby tributary and in the Susquehanna River revealed detectable PCBs, but not levels of concern. No remediation was considered necessary.
PAOLI RAIL YARD, Paoli, PA	1992 Record of Decision designated excavation of 7,500 feet (787 cubic yards) of stream sediments along Valley Creek, Little Valley Creek, and is tributaries to <1 ppm PCBs and sediments to be returned to the rail yard for treatment. May require installation of 2.3 miles of access roads during implementation of the remedy with the potential for "destruction and loss of natural habitat along the stream corridors..."	Wet/dry excavation, not dredging. Not yet implemented.
CAROLINA TRANSFORMER, Fayetteville, NC	Five-acre site. 1991 Record of Decision calls for excavation and treatment of soil via solvent extraction along with groundwater pump and treat. Only sediments are associated with a generally dry creek bed.	Probably dry creek bed excavation. No dredging. Not yet implemented.

Site Name	Status	Remarks
SMITH'S FARM, Brooks, KY (Sheperdsville, KY)	Sediments mentioned in context of two intermittent valley streams on both sides of long ridge near previously permitted landfill and unpermitted drum disposal area. Reportedly excavated 20,500 cubic yards of soil and sediment, treated by thermal desorption, then disposed into newly-constructed onsite landfill.	Implemented in 1996. Not clear what portion is wet/dry excavation and what portion (if any) is dredging and what portion of the 20,500 is soil vs. sediments.
FOLKERTSMA REFUSE, Walker, MI	Excavation of a total of 2,900 cubic yards of sediments from an unnamed creek, ditch, and Indian Mill Creek, and solidification of the sediments onsite by mixing them with pelletized lime. The excavated areas were restored.	Combination of wet/dry excavation with a bulldozer. No dredging. Total cost (whole project) $1.3 million.
SANGAMO DUMP/CRAB ORCHARD NATIONAL WILDLIFE REFUGE, Carterville, IL	Primarily a soil remediation project. The Record of Decision indicates that "contaminated soil and sediment from geographically distinct study sites will be excavated using conventional equipment." Sediment seems to be limited to a small, drained man-made pond and two drainage ditches.	Excavation and onsite incineration near completion (April 1997). No dredging.
RE-SOLVE, N. Dartmouth, MA	Primarily a soil remediation project. About 36,000 cubic yards of soil excavated and treated by low temperature thermal desorption in 1994. Also, about 3,000 cubic yards of sediment in a one-acre wetlands area excavated and treated.	Conventional excavation. No dredging.

Site Name	Status	Remarks
SHEBOYGAN RIVER AND HARBOR, Sheboygan, WI	5,900 cubic yards of sediments removed from 15 discrete locations along 3.2 miles of river in 1990-1991. Removal done by a modified clamshell dredge or a conventional back-hoe, supported on a barge. Removed sediments are stored in a tank at the PRP site pending disposal decision; some sediments were used at the PRP site in a bioremediation test facility.	Feasibility study in progress; completion targeted for spring 1997 and proposed cleanup plan by fall 1997. Record of Decision may dictate different technologies in different river sections.
BURNT FLY BOG, Monmouth County, NJ	The Record of Decision calls for "excavation of approximately 5,600 cubic yards of contaminated materials from the Downstream Area which have migrated past the Westerly Wetlands." A sedimentation basin will be installed in the excavated area to prevent downstream migration of contamination. Remainder of the Record of Decision addresses an estimated 76,000 cubic yards of soil.	No mention of dredging. Appears to be conventional excavation of a wet drainage area. Sediment remediation underway. Estimated cost $6.1 million.
MILLCREEK DUMP, Millcreek, PA	Ten-year-old Record of Decision calls for excavating or dredging soils and sediments and consolidating the excavated material under an onsite RCRA cap. Sediment areas include a wetland on the southern portion of the site, ditches within and on the perimeter of the site, and in Marshall's Run bordering the eastern portion of the site. No volume estimates provided.	Marshall's Run and all drainage ditches were dry during the RI. Presumably remediation would be by wet/dry excavation during such periods. Remediation scheduled to start in 1997.

402850

Site Name	Status	Remarks
FIELDS BROOK, Ashtabula, OH	ESD to be issued in April 1997; will reduce volume of sediments to be remediated to 14,000 cubic yards compared to the 50,000 cubic yards in the original Record of Decision. Target cleanup levels are 1.3 ppm PCBs in residential stretches and 3.1 ppm in industrial stretches. Reasons for the volume reduction include (1) deleting stream areas lying upstream of the sources, (2) targeting average cleanup levels, and (3) allowing contaminated sediments below the depth of hydraulic scour to be left in place. Plan is to temporarily relocate steam, dewater, and perform wet/dry excavation.	90% design to be complete by mid-summer 1997. Separate Record of Decision (OU-4) for floodplains due in April 1997.
OUTBOARD MARINE, Waukegan Harbor, IL	Completed late 1994. 50,000 cubic yards of soils and sediments remediated, including 32,000 cubic yards of sediments dredged from 10-acre harbor area in 1991. Dredged material disposed in an adjacent abandoned boat slip and capped after a three-year settling period. Fish consumption ban lifted in January 1997.	Total cost $15-21 million.
SCHMALZ DUMP, Harrison, WI	A seven-acre dump site near Lake Winnebago. In 1988, 3,500 cubic yards of PCB-contaminated and debris-laden soil and sediments were excavated and removed from the site grounds, a filled wetlands area and from an onsite pond. Final remedy, which included debris removal and installation of an earthen cap and slurry wall, completed in 1995. Groundwater monitoring is continuing.	Apparently conventional excavation. Less than 3,500 cubic yards of sediments removed.

Site Name	Status	Remarks
MARTHA C. ROSE CHEMICALS, Holden, MO[1]	Sediments reportedly excavated from creek bed in semi-dry condition, after diversion of creek flow. Incinerated onsite. Site remediation completed in 1996.	Apparently wet/dry excavation, not dredging.
DAYTON TIRE & RUBBER, Dayton, OH[1]	Three-phase removal action by EPA in 1987-1989. About 240 cubic yards of sediments removed fom Wolf Creek (a tributary of the Great Miami River) during Phases I and II — primarily bank soils.	Conventional excavation equipment.
EAGLE HARBOR, Tacoma, WA	East Harbor capping remedy partially complete on 54 acres; 2 hot spots of 54 acres were capped (nominal 3 feet) with 280,000 cubic yards of clean sediments from a navigational dredging project; monitoring of effectiveness in progress; after additional source control, some additional capping planned. Design for West Harbor remediation, to include dredging 2 hot spots of 9,000 cubic yards and capping an adjacent area, completed in June 1996. Negotiations in progress with PRPs for implementation. 1992 Record of Decision amended in Dec. 1995 to include construction of a one-acre nearshore confined disposal facility at West Harbor. Contaminants of concern are mercury and polycyclic aromatic hydrocarbons, not PCBs.	

1. Not a Superfund Site.