February 17, 2004

Dean Maraldo, Project Manager
USEPA Region 2
290 Broadway, 19th Floor
New York, NY 10007

Re: Hudson River Sloop Clearwater comment on USEPA Quality of Life Performance Standards for the Hudson River PCBs Superfund Site.

Dear Mr. Maraldo:

Hudson River Sloop Clearwater (Clearwater) commends the EPA on its thoughtful and thorough development of the Quality of Life Performance Standards for the Hudson River PCBs Superfund Site. The establishment of these standards, and subsequent public forums, are a clear indication of EPA's dedication to maintaining an open and transparent process in which the public is actively engaged. Clearwater urges EPA to use the Quality of Life performance standards as a way of demonstrating what can be done to lessen the impact of a remediation project of this size, while simultaneously achieving the ultimate goal of remediating existing PCB contamination in the Hudson River.

For the most part we are in accord with the standards that have been established pertaining to noise, odor, light and navigation. We strongly urge that the EPA use every opportunity to incorporate into these standards requirements that will exemplify the agency's dedication to making this a world class clean-up, and one that will have the best possible outcome for upriver communities. To that end, Clearwater suggests that EPA require the use of environmentally friendly materials wherever possible. For example, requiring the use of biodiesel, low sulfur diesel fuels for dredges, loaders, and other machinery to lessen the air impact of engine emissions, or using low impact lighting to reduce the amount of light trespass on nearby property will go a long way toward assuaging the concerns of up-river residents.

With regard to the performance standard for air, Clearwater is concerned that the EPA has not adequately addressed the issue of volatilization of PCBs. This is an area we believe should have been addressed in the Engineering Performance Standards, not in the Quality of Life Standards. Impacts from noise, odor and lighting, are by and large temporary and very local in their impact; potential PCB emissions may have far-ranging, long-term impacts on human health and the environment -- locally, regionally and globally. Attached please find our substantive comments on air emission standards and the need to prevent volatilization of PCBs.

Sincerely,

Andy Mele, Executive Director
Hudson River Sloop Clearwater

Hudson River Sloop Clearwater
Public Comments on
EPA's Hudson River PCB Superfund Site Remediation
December 2003 Draft Quality of Life Standards – Air Quality

Submitted February 17, 2004

Andre Mele, Executive Director
Manna Jo Greene, Environmental Director
Tim Sweeney, Environmental Associate

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Attachments

A) Additional Resources
B) Volatilization Section of Clearwater's Public Comment on EPA's Hudson River PCBs Superfund Reassessment and Proposed Remediation Plan, April 17, 2001
C) Clearwater's Comments on Hudson River Natural Resource Damage Assessment (NRDA) Plan, September 16, 2002.

Acknowledgements: Hudson River Sloop Clearwater wishes to acknowledge and extend its deep appreciation to Dr. David Carpenter of the University of Albany School of Public Health for his invaluable guidance and the use of his extensive library of source material and former Clearwater Board member, Dr. William Flank of Pace University, for his generous technical support and extensive editorial assistance in the preparation of this document. We would also like to thank David Grande of Wisconsin DNR, and Lisa Totten, Ph.D. of Rutgers and Marion Trieste of Trieste Associates for their input, and Dave Conover of Marist College and graduate student Tanessa Hartwig of the Bard College MSES program for their editorial suggestions and Vassar College intern, Carolina Lukac, for production assistance

Executive Summary for Clearwater Comments on PCB Volatilization in Response to EPA's Draft Quality of Life Performance Standards for Air released in December 2003.

Clearwater supports EPA's Draft Quality of Life Performance Standards in most respects, but questions why the volatilization of the very toxin of concern has been relegated to QOL instead of Engineering Performance Standards, where it functionally belongs. Because the technology to prevent unnecessary releases of polychlorinated biphenyls (PCBs) during remediation is readily available, EPA must ensure that all steps necessary to minimize volatilization of PCBs are taken proactively, and not in response to exceedances of the air quality standards after the remediation has begun.

By stating this, we are in no way attempting to delay or derail the remediation of the river. Clearwater recognizes that the removal of the PCB burden from the river is the ultimate solution to the problem of PCB contamination in both the water and air.

Clearwater believes that volatilization of PCBs was underreported and marginalized throughout the 12-year PCB Reassessment and the Record of Decision, and that volatilization remains marginalized to this day. Furthermore, Clearwater believes that work site safety thresholds are not adequately protective of worker health. PCBs have been shown to exhibit adverse health impacts in very small doses, in long-term cumulative doses, and in synergistic interactions with other compounds.

Volatilization has been amply documented, and the consequences are anything but trivial. Entire ecosystems have been compromised by the atmospheric transport and precipitation of PCBs, and the Hudson River's PCBs have left their trace from tree bark upwind of the Hudson River to the water column of Lake Erie and the body burdens of the few area residents whose serum PCB levels have been sampled. Clearwater cites many of these studies in this document.

Clearwater suggests that if EPA commits to a remediation system that does not adequately address volatilization, it runs a very serious risk of compromising the entire remediation process while operations are shut down and mid-course corrections are instituted. Clearwater believes that a modest level of planning and investment now will protect worker safety, keep PCBs out of host communities, keep costs down and prevent delay. Many of the proposed methods, e.g. enclosed buildings and controlled, filtered ventilation, will also help dampen noise and reduce light pollution.

The potential for PCBs to volatilize to air deserves the same rigorous attention and controls as those applied to the potential for contaminated sediment resuspension.

Clearwater sets forth a number of well-established volatilization control methods should be incorporated into remedial design at the outset.

Hudson River Sloop Clearwater's Public Comments on
EPA's Hudson River PCB Superfund Site Remediation
Draft Quality of Life Standards – Air Quality

Air Quality Standards:

Hudson River Sloop Clearwater (Clearwater) commends EPA and their consultants, Ecology and Environment, on their thorough work in preparing the Draft Quality of Life Performance Standards (DQOLPS) on odor, noise, lighting and navigation for the remediation of the hotspots north of Albany that constitute GE's Hudson River PCB Superfund Site. With regard to air quality, we have concerns regarding the Agency's emphasis on meeting existing standards for human health, rather than assuming a more universal, inclusive approach to preventing unnecessary release of polychlorinated biphenyls (PCBs) to the global environment. EPA's local and regulatory perspective minimizes the significant and credible body of evidence that PCBs volatilize from water and exposed sediment and are carried via atmospheric and oceanic transport to the far reaches of the globe, endangering both humans and marine mammals living in the Arctic and elsewhere. EPA only employs readily available protective measures for both sediment and air as the 'standards' are approached and exceeded -- after the proverbial horse is out of the barn, and requiring potentially disruptive mid-course corrections.

In its substantive public comment offered in April 2001 on EPA's Hudson River PCBs Superfund Reassessment and Proposed Remediation Plan, Hudson River Sloop Clearwater documented its concern that air could serve as an important vector for polychlorinated biphenyls (PCBs) that inevitably volatilize from both the surface of the water and from exposed wet sediments containing PCBs. We have also raised this issue at various public participation meetings during the remedial design phase, and also our disappointment that prevention of volatilization was not included in the peer-reviewable Engineering Performance Standards, which extensively addressed the prevention of sediment resuspension and remobilization but entirely omitted precautions regarding air emissions. Clearwater believes that the proposed remediation must prevent any and all avoidable volatilization of PCBs, and that EPA's draft quality of life standards may not be adequately protective in this regard for the following three receptors:

- Workers performing the remediation
- Residents and businesses in neighboring communities
- Indigenous people, marine mammals and other flora and fauna subject to the global burden of PCBs

Polychlorinated biphenyls are a group of 209 compounds that having varying numbers of chlorines (polychlorinated) attached to up to 10 sites on two (bi) linked carbon rings (phenyls). PCBs are persistent organic pollutants (POPs) that have been designated by the Stockholm POPs Convention of 2001 as one of the "dirty dozen" contaminants to be eliminated from use on a worldwide basis. Well-documented health effects of PCBs to humans and wildlife include:

- Probable human carcinogen, causing liver tumors and other cancers in rats
- Hormonal disruption, including immune suppression and reproductive disorders
- Neurological disorders, including cognitive and behavioral changes
- Other non-carcinogenic disorders, including chloracne and hypertension

Volatilization as a Pathway of Exposure: Analyses of routes of exposure to PCBs have traditionally focused on ingestion and the subsequent process of bioaccumulation by which PCBs are increasingly concentrated in higher trophic levels. Concentrations may be magnified millions of times from microscopic biota to the top predators in the food web. EPA has identified contaminated soil, sediment, and water as potential pathways in their peer-reviewed performance standards for this remediation; however, they have essentially dismissed air as a pathway for distribution of PCBs throughout the ecosystem.

While ingestion is certainly a major route of exposure for PCB contamination, inhalation is also an important route for both wildlife and humans. Respected researchers including Dr. David Carpenter, Ann Casey, Ron Scrudato PhD., and others increasingly believe that inhalation may, in fact, be a major pathway. For humans, inhalation represents an ongoing, involuntary route of exposure. People who are aware of fish advisories may intentionally avoid consuming contaminated fish, but they cannot avoid exposure from PCBs that have volatilized from contaminated sediments into the air they breathe, -- especially those living close to hotspots of PCB-containing sediments that are frequently exposed to air. Mammals, amphibians, reptiles, emergent and non-aquatic plants all respire air that contains small amounts of PCBs. It has been estimated that, for humans living near PCB contaminated sites, breathing the air for one year is equivalent to one toxic fish meal.

It is important to be clear that the major danger of volatilization of PCBs stems from their presence in the sediment (non-aqueous phase), and in the water column (aqueous phase), resulting from the discharge of up to 1.3 million pounds of PCBs from General Electric's Hudson Falls and Fort Edwards plants. While there are many other sources of PCBs in the ecosystem, these two plants are the source of PCBs for the largest Superfund Site in the United States. GE's contribution to the global PCB burden from these two sites over more than 30 years was substantial. Clearwater fully supports the proposed removal plan as the primary means of remediating the problem and preventing further local, regional and global disbursement of these toxins into the environment. However, in so doing, it is absolutely essential that all possible precautions be taken to avoid additional release of PCBs from sediments into the air, leading to local redeposition and atmospheric and oceanic transport to distant sites and biological receptors.

As early as 1966 PCBs were found in such diverse media as Arctic snow, human mothers' milk, and Icelandic plants and animals.[1] In 1974 Haque and other researchers recognized the importance of volatilization, atmospheric transport and redistribution of PCBs,[2] and in 1976 EPA estimated that 13 percent of the total PCB input to Lake Michigan was the result of atmospheric fallout.[3] A 1993 sampling by Jeff Chiarenzelli *et al.* of PCBs on Akwesasne lands near three Superfund sites along the St. Lawrence River demonstrated increased volatilization of Arochlor 1248, the principal contaminant at these sites, particularly in summer.[4] Brian Bush *et al.* report that as much as 65% of the PCBs contained in upper Hudson River water consisted of three lower chlorinated congeners: 2, 2/2, and 2/6.[5]

A March 1996 study by Garton *et al.* in New Bedford Harbor noted that the physical properties of individual non-degraded PCB congeners drive them toward sorption or volatilization. "Their preferred phases are sediment or air due to their hydrophobicity."[6] Garton, Richard Bopp and others have noted a greater sediment affinity with increased percent chlorination, and a corresponding increased tendency of lower chlorinated (partially degraded) PCBs to volatilize.[7]

In 1996, researchers at SUNY/Oswego, Jeff Chiarenzelli, Ron Scrudato *et al.* demonstrated that PCB loss from drying sediment "was positively correlated with water loss," that lower and ortho-chlorinated congeners volatilize preferentially due to their dipolar nature, and that "volatilization during drying at ambient conditions is more significant than previously recognized, particularly for sediments that have undergone extensive anaerobic microbial PCB dechlorination." [8] Sean Bushart, Brian Bush *et al.* looked at sediments from the Contaminant Cove area of the St. Lawrence River containing ~600 ppm of PCBs and found that "Microbial reductive dehalogenation of PCB congeners tends to lead to accumulation of high proportions of orthochlorinated mono- and di-chlorobiphenyls and depletion of tri- through penta-chloro-biphenyls… However, reductive dechlorination does not completely eliminate PCBs from the environment. This process will produce PCB congeners in sediments that are more soluble and more bioavailable than those in the parent mixtures" [9] In their 1999 article entitled, "Remediation of PCB-Contaminated Sediments: Volatility and Solubility Considerations," Scrudato, *et al.* have documented the process by which volatilization and long distance atmospheric transport [of] polychlorinated biphenyls (PCBs) have resulted in redistribution throughout the global environment, permeating] every known environmental niche including the remote polar regions of the globe.[10] In this article they reiterate the tendency for lower chlorinated PCBs to volatilize and become atmospherically redistributed, while more heavily chlorinated congeners remain as residuals in the originally contaminated material, and they consider the implications of this information for remedial design.

> "Remedial activities such as dredging, dewatering, or staging contaminated sediment which results in evaporative losses of water are likely to release PCBs by volatilization. Outdoor storage of exhumed soils where they can be exposed to repeated wetting and drying is also likely to result in the evaporative loss of PCBs… Populations located in proximity to remedial activities that involve drying of wet soil/sediment or those living near shallow water bodies with PCB-contaminated sediments, may be exposed to increased PCB levels via inhalation of volatilized congeners… Our findings are in agreement with studies on the Great Lakes, which suggest that PCB volatilization is the major operative loss mechanism at the present time." [11]

In their study, "PCB Volatile Loss and the Moisture Content of Sediment During Drying" of St. Lawrence sediments, Chiarenzelli, Scrudato *et al.* refer to the intermediate products of reductive dechlorination by anaerobic bacteria, noting that "biodegradation provides abundant lower chlorinated PCB congeners which have high mobility in water and air, and therefore are likely to be readily lost to the surrounding environment providing potential human exposure pathways."[12]

Ann Casey, working at the School of Public Health, University of Albany in Rensselaer noted, "PCBs have been considered to be almost nonvolatile and insoluble in water. However, recent studies have shown the importance of their slight solubility in water and capability to enter the atmosphere and disperse throughout the global environment." Casey and her colleagues tested inhalation and ingestion as routes of exposure by giving rats Arochlor 1242, the major contaminant in both the Hudson River and New Bedford Harbor, in doses of 0.9 g/m^3 [900 ng/m$^{3]}$ and 0.436 g/g (ppm) [436 ng./g (ppb)] respectively, for 30 days. They reported that "both routes caused significant serum thyroid hormone elevations. Histopathologic changes were observed in the urinary bladder, thymus and thyroid after exposure to both regimes. Rearing and ambulation were significantly decreased in both exposure regimens in an open field behavior test." [13]

Does this mean that PCBs should be left unremediated in the Hudson or other waterways? Most certainly not! The only way to stop the constant volatilization that presently occurs on an ongoing basis from the surface of the water and from PCB-containing sediments along the shores is to remove the contamination at its source. It does mean, however, that such remediation should be done with care, enclosed as much as is practicable, and monitored closely. **It means that the potential for PCBs to volatize to air deserves the same rigorous attention and restriction that has been afforded by EPA to the potential for sediment resuspension.**

We will now discuss local, regional and global implications.

Local Impacts

PCBs in Tree Bark: In a 1990 study in an area with significant PCB contamination in Bloomington, IN, Hermanson and Hite found that tree bark levels varied directly with proximity to the source, and hypothesized that bark may retain PCB from earlier periods of higher atmospheric concentrations.[14]

PCBs in Indoor Air: Currado and others have extensively documented the presence of PCBs from indoors sources such as textile dyes, printing inks, paints, carbonless copy paper, fireproofing agents, small electric capacitors in appliances, and fluorescent light ballasts that were generally up to one order of magnitude greater than surrounding outdoor.[15] Fromme *et al.* focused on air-borne PCBs from permanently elastic sealants in schools and daycare centers in Berlin, Germany averaging 114 ng/m^3. [16] Neisel *et al.* measure PCB levels in a South German school at levels of 10 – 19 ng/m^3 from flame retardant paint before the school was closed for remediation. Joint sealing compounds once contained up to 30% PCB as a plasticizer.[17] Kohler *et al.* measured total PCB concentration in indoor air up to 4200 ng/m^3 in contaminated industrial buildings.[18]

In New Bedford Harbor, MA, where scientists have recorded some of the highest outdoor air concentrations ever measured, Vorhees *et al.* tested indoor and outdoor air at 34 homes during dredging of highly contaminated sediments, noting a slight elevation in indoor air in homes near the most contaminated part of the harbor (7.9 – 61 ng/m^3) over homes at more distant locations (5.2 – 51 ng/m^3).[19] Although the elevation of PCBs in nearby homes is not large, this is precisely the effect we hope to avoid -- the preventable release of PCBs during remediation.

PCBs in Local Vegetation. Cullen *et al.* of Harvard School of Public Health measured ambient air samples in 1993 and determined that background PCB levels in the area were caused by volatilization of PCBs from highly contaminated sediments during low tide when sediments come in direct contact with air. They then found that PCBs in air and in local produce on area farms increased above background levels, during the 1994-95 dredging season, especially in tomatoes grown downwind of the hot spots. "Our results are consistent with the view that atmospheric transport and gas-phase transfer play a pivotal role in influencing the concentrations of PCBs in plant tissue. This work is an initial step toward gauging the significance of the consumption of local produce as a pathway of human exposure to PCBs in New Bedford before and during dredging." [20] Air transport was obviously the pathway from sediment to vegetation.

In the DQOLPS, EPA cites the New Bedford Harbor remediation as one of the case studies in which "established thresholds were exceeded within the operations areas on a *few occasions* [our emphasis], and mitigation measures were successfully implement to reduce the impact." [21] In fact, the White Paper prepared by TAMS for the Hudson River PCBs Responsiveness Summary, "PCB Releases to Air," lists 1,116 exceedances at New Bedford, or 28% of the 4,041 samples taken, including 10 that exceed the 1,000 ng/m^3 level..[22]

PCB Volatilization from Landfills

Hansen *et al.* looked at air, superficial dust and subsurface soil from an aged PCB-containing landfill and found the "congener composition of soil and air were surprisingly similar, being enriched in tri- and tetraCBs, while the dust retained higher proportions of congeners with 4 and 5 chlorines," postulating that the more volatile congeners produced from anaerobic dechlorination in the moist subsurface soil had already escaped into the atmosphere, while moderately chlorinated congeners were still trapped in the dust and debris.[23]

Bremle and Larsson measured the air coming from a PCB landfill constructed to contain dewatered PCB-containing sediment, during and after remediation of Lake Jarnsjon in southern Sweden.

> "The PCB concentration in the air was elevated during landfilling, and the extent was determined by the amount of sediment handled and the temperature. The air was enriched in more volatile PCB congeners compared to the deposited sediments, suggesting volatilization as the major transport process in addition to particle transport. The PCB concentration showed an exponential decline with distance from the center of the landfill, with a one order of magnitude decrease 350 m from the center. At a distance of 850 m from the center about 5% of the elevated PCB level remained, which was significantly higher when compared with the reference concentration (15 km from the landfill). The PCB congener pattern changed gradually from the landfill center to the reference. After the landfill was closed and the contaminated, dewatered sediment covered by uncontaminated soil, PCB levels and pattern were similar to that of the reference." [24]

A more recent study by Hermanson *et al.* Measured PCB air emissions two sites in Anniston AL.: Mars Hill, located between a closed PCB manufacturing plant and two PCB-containing landfills, and Carter, 1.5 km away. Total annual PCBs averaged 27 ng/m^3 from the Mars Hill site, three times the levels at Carter (9 ng/m^3). The total PCB and congener concentration at the more distant Carter site, however, showed greater seasonal variability, as more PCBs evaporated from surfaces during warmer weather.[25]

Regional Effects

Great Lakes: The amount of PCBs volatilizing from the heavily concentrated hotspots in the upper Hudson has not received the same attention as the urban centers of what Steven Eisenreich calls the Great Waters: the Greats Lakes, Chesapeake Bay, and the Hudson-Harbor Estuary, and coastal waters. Eisenreich noted that "elevated urban atmospheric concentrations lead to transport at the local and regional scale and to deposition to regional lakes, estuaries and landscapes." Wet deposition via rain and snow, dry deposition of fine/coarse particles, and gaseous air-water exchange are the major atmospheric pathways in these areas. Concentrations of atmospheric PCBs are controlled by air temperature and the mobile environmental reservoir (MER), with the footprint of elevated PCB concentrations down gradient of the source "on the order of 5-60 km, although much larger 'footprints' are expected under sustained winds blowing from urban industrial region across wide expanse of water." [26]

According to Fiedler, "PCBs in the Great Lakes…volatilise where a river discharges relatively high PCB loads into Green Bay." [27] Baker and Eisenreich [1990] calculated an average volatilization rate of PCBs from Lake Superior to be "approximately equal to atmospheric deposition." [28] Their findings support the conceptual model that these toxins permanently cycle between atmospheric and natural waters [Mackay *et al.* 1986]. "According to this model PCBs dissolved in rain drops (low chlorinated) or sorbed to particulates (higher chlorinated) are washed out of the atmosphere by rain. This input from PCBs into surface waters results in a fugacity gradient towards the atmosphere, which in turn drives volatilization." [29]

Hornbuckle and Green studied the impact of PCB volatilization from the city of Chicago on Lake Michigan for the US EPA-sponsored Lake Michigan Mass Balance Study. Their model predicted and described, "gas phase concentrations over Lake Michigan are a strong function of air temperature. When winds are from the southwest deposition of PCBs greatly increases… Current sources of gas-phase PCBs around Lake Michigan are clearly due to volatilization from [contaminated land] surfaces, and not dominated by combustions, point source release, or vehicular exhaust" [30]

In the DQOLPS, EPA cites the remediation project implemented on the Lower Fox River, WI, as a case study in which "off-site concentration averages were well below threshold [100 ng/m^3 = 0.1 g/m^3], ranging from 0.3 ng/m^3 to 1.6 ng/m^3." [31] The threshold for this project was set conservatively at 100 ng/m^3 (at which concentration a 70 year exposure could be attributed to one in 100,000 cancer risk). No samples exceeded this level. However, the most concentrated samples collected at the work site elevated the risk level by up to 120 times urban background levels, and off site by as much as 10 times background. The emission rate was estimated to be 0.01 to 0.1 pounds per day of PCBs or 0.8% of the 1,326 pounds of PCBs removed from the river bottom during this dredging project. This remedial activity occurred in cool weather (September-December 1999) and dredged sediments were treated immediately without prolonged storage. Project operator and author of the report, David Grande, noted that "there is significant temperature dependence with PCB volatilization, and that losses are likely to be greater during warmer months." Grande concluded that "dredging and processing of contaminated sediments resulted in locally elevated ambient levels; these levels did not exceed the conservative level of concern adopted for this project; [and] locations greater than 1 kilometer away from the project area were not significantly affected.” [32] In fact, one of the things this study demonstrates is the rapid dilution that occurs with distance. Although they appear to have posed little additional risk to area residents, at least some of the elevated concentrations of PCBs that escaped the work area became quickly airborne, available for atmospheric transport and recycling, and may well have ended up condensing in remote areas of higher latitude or altitude.

A recent experimental study at Indiana University using the sophisticated Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model disseminated by the National Oceanic and Atmospheric Administration supports the claim that PCBs from the Hudson River make their way to the Great Lakes region. The study's conclusions were developed from an extensive data base and carefully validated. The authors cautiously state that "Other areas of substantial PCB discharge, such as the Upper Hudson River in eastern New York . . . are also indicated . . . as potential PCB source regions to Sturgeon Point" on Lake Erie. “It is possible that some amount of the approximately 500 t of PCBs discharged into this river by General Electric is being volatilized and contributing to the atmospheric concentrations measured at Sturgeon Point.” [33]

Chesapeake Bay: Nelson *et al.* estimated PCB gas exchange fluxes Although varying seasonally, across the air-water interface of the mainstem of the bay and determined that the annual loss from PCBs by volatilization was 10 times larger than the inputs to the bay from wet and dry deposition, demonstrating the importance of air-water exchange as a possible source of PCBs to the regional atmosphere.[34] Bamford *et al.* looked at six sites from Baltimore Harbor to the northern Chesapeake Bay and also concluded that air-water exchange has the potential to be a significant source of PCBs to the rural atmosphere.[35]

Hudson River: To evaluate potential exposure of the New York City watershed from airborne PCBs from the Hudson River, Paul Bartlett, Barry Commoner *et al.* at the Center for the Biology of Natural Systems (CBNS) measured airborne PCBs near the river in Coeymans in Albany County, NY, and at a high elevation site at Frost Valley in the Neversink basin in Sullivan County, NY, 30 miles west of the Hudson River. They used the HYSPLIT model to project impacts of PCB volatilization and transport to six NYC reservoirs in the west-of-Hudson Delaware/Catskill watershed and the two east-of-Hudson reservoirs in the Croton/Kensico watersheds.[36]

GE’s Hudson River PCB sediments in the Thompson Island pool and the other upper Hudson hotspots continue to contaminate the rest of the river on an ongoing basis**.** From analysis of PCB concentrations in the middle and lower sections of the river, the average concentration in August/September 1998 was determined to be 5,280 picograms of PCB per liter of water. According to these calculations, the total emissions of PCBs to air from the Hudson River was 1,200 grams per day: 30% was due to the upper Hudson section, 42% to the middle section and 27% to the lower section. Of this, 8.26 grams per day or 0.7% was deposited on the New York City watershed, including deposition on each reservoir and associated basin.[37]

The measurement of PCBs at Coeymans was 1,760 pg/m3 (1.67 ng/m3). Comparable levels at Frost Valley of 1470 pg/m^3 (1.47 ng/m^3) exceeded the predicted value of 256 pg/m3 and were higher in the more heavily chlorinated PCB congeners than would be expected. This was attributed to the pattern of "long-term accumulation and revolatilization that has been underway since the Hudson River was first heavily contaminated with PCBs in the 1950's." [38] They note that the higher chlorinated congener profile measured at the Frost Valley site corresponds closely to the profile measured at the river, indicating that "the Catskill Mountains are a PCB sink from the river's historic emissions" that accumulate regionally by depositing on vegetation, soil and in reservoir sediments, while less chlorinated, more volatile congeners remain in the air or are easily revolatilized and transported away from the site in warm weather -- some to be redeposited back into the Hudson.[39]

Although they only account for 21% of the volume of both NYC reservoir systems, because the Croton and Kensico Reservoirs are in closer proximity to the river, exposed to large amounts of PCBs, and subject to intense eastward winds, they receive 80% of the total deposition of airborne PCBs to the reservoirs. Bartlett is currently measuring PCBs in tree bark at varying distances and orientations from the river to determine transport patterns and evaluating trees of different ages to identify historic deposition patterns.[40]

New York Harbor: At a December 12, 2003 meeting of the NY/NJ Harbor Consortium, Lisa Totten, Ph.D., presented the work of Shu Yan at Rutgers measuring volatilization of sediments in New York Harbor. For her Master's thesis, Shu Yan sampled air-water exchanges at six sites in the lower Hudson River Estuary (HRE) and coastal Atlantic Harbor, measuring atmospheric gas and aerosol phase, dissolved and suspended particulate phase and phytoplankton uptake. "The results demonstrate that air-water exchange supports and controls the phytoplankton concentrations of more hydrophobic PCBs…" concluding that "water quality management…has to be addressed by considering together aquatic and atmospheric pollution issues." [41] Shu Yan cites the work of Simcik, Zhang, Hornbuckle, Hoff *et al.* in the Great Lakes, of Offenberg, Nelson, Gustafson *et al.* in the Chesapeake and Totten, Gigliotti *et al.* in New York Harbor to demonstrate that in impacted urban estuarine systems "contaminated by anthropogenic inputs of POPs, such as Green Bay, Lake Michigan and the NY-NJ Harbor Estuary, volatilization fluxes are larger than depositional fluxes and the waters act as a source of pollutants to the regional atmosphere." Shu Yan further states that:

> "…some processes contributing to water column occurrence of PCBs such as sediment remobilization [which EPA is going to great lengths in this remediation to monitor and control] may dramatically affect water particulate concentrations, but many have limited impact on the bioavailable POP concentrations in the estuary. Therefore, air-water exchange may still be a key process in controlling PCB concentrations in the aquatic food web. If so, remediation and legislative action taken to protect aquatic systems can not be effective unless atmospheric contamination is addressed." [42]

About 50-60 PCB congeners were identified in gas, aerosol, and dissolved phases, and in suspended particulate matter and phytoplankton from sampling by Totten in July 1998 and by Shu Yan in 1999-2000. "The aerosol phase of PCBs constituted only a small fraction …of the total atmospheric PCB concentration… The gas phase dominates the total atmospheric PCB concentration and averaged 1100 pg/m^3 (500-1670 pg/m^3) for all samples collected at HRE." Seasonal effects were noted in gas phase samples collected in August and October, in which

PCB concentrations were elevated due to higher ambient air temperatures and wind velocity. Dissolved PCBs concentrations averaged 1.1 ng/L (range 0.71-1.2 ng/L) at HRE, comparable to levels in suspended particulate matter.[43]

From this study, Totten estimated the amount of PCBs that volatilize in New York Harbor to be 27 kg/y, and for the estuary from the Battery to the Newburgh-Beacon Bridge to be 504 kg/y.[44] Totten did not account for sediments exposure at shorelines in her assessment. (Several EPA representatives were present at this meeting.) [45]

While water surface is much larger in the lower Hudson and NY Harbor, concentrations of PCBs dissolved in this area are considerably lower than those found upriver at the primary source of the contamination -- in the remediation work area between Fort Edward and the Federal Dam at Troy. Since PCBs move from water to air in direct proportion to their concentration, it is clear that the exposure to workers, communities and the atmosphere in the heavily contaminated upper Hudson must be carefully monitored and precautions taken so that unnecessary releases are prevented.

Global Consequences

The global production of PCBs has been estimated at 1.3 million tons, with Monsanto being the world leader at 641,246 tons. 97% of PCB use occurred in the Northern.[46] As a result of their widespread production and use, and their semivolatile nature, PCBs are unfortunately now ubiquitous in the environment, found virtually everywhere on Earth, including pristine polar and near- polar locations, hundreds or thousands of miles from any industrial source. The degree to which a PCB congener remains airborne or attaches to particles and is redeposited depends to a great extent on its critical temperature (Tc) – the temperature above which half of the congener molecules are in vapor form, and half are attached to particles. Tc rises with the number of chlorines. For a typical mono-chlorinated PCB the Tc is -50°C; for a trichlorinated PCB it's –41°C; for tetra-CB, -24°C; for hepta, +13°C. Least chlorinated PCBs volatize throughout the year due to their low Tc., may be carried great distances before being deposited, then revolatilized. This cyclical pattern of movement, usually toward cooler climates, is called the "grasshopper effect." [47] Data by Chiarenzelli *et al.* appears to "support the general theory of global partitioning and the 'grasshopper effect' specifically, and suggests that the ultimate geographic repository and fate of POPs is tied closely to their chemical properties." [48]

According to Sweetman and Jones, while the atmosphere has provided an effective transport medium, terrestrial soils are the largest repository. During the 1950-1970's, net deposition was from the atmosphere to soils due to high primary air emissions. Following restrictions on production and use in the late 1970's, atmospheric concentrations declined, but the soil repository provided a secondary source of PCBs to be recycled back to the atmosphere [2000; p.863].[49] Emissions from lower chlorinated PCBs tend to have occurred primarily from use, and to a lesser extent from disposal (of municipal solid waste to landfills or incineration) or accidental release. For more heavily chlorinated PCBs disposal by open burning and accidental fires are more important sources of emissions, as these congeners tend to require higher temperatures to vaporize.[50]

To a minor extent these ongoing emissions are attenuated by processes which "remove" PCBs from the environmental pool available for recycling. These include destruction by reacting with OH^- radicals in the atmosphere [or photochemical reaction], microbial degradation or the formation of bound residues in soil and sediments, burial in soils, sediments, peat and ice, or incorporation into the deep oceans.[51]

Higher than expected occurrences of PCBs in remote regions of the globe are the result of volatilization in warmer climates, long-range atmospheric transport, precipitation and subsequent "cold condensation" in cooler environments in areas of high latitude and high altitude [Blais, p.585].[52] Although classified as semivolatile, vapor phase PCBs are recognized as a primary contributor to the total loading of persistent organic pollutants (POPs) that have been globally distributed to higher latitudes.**"** [53] PCBs also condense at high altitudes where they have been found in western Canadian alpine snows and meltwaters at a 10- to 100-fold increase in concentration between 770 and 3,100 m altitude. The observed increase by a factor of 10 for the less volatile compounds is simply a reflection of a 10-fold increase in snowfall over the increasing altitude. On the other hand, cold-condensation was responsible for the enhanced concentration of the lower-chlorinated, more volatile congeners [Blais *et al*., 1998] over the range.[54] Gregor *et al.* found similar elevated concentrations of homologues mono- through tetra- in Yukon snowmelt.[55]

Arctic Polar Bears: Global Burden Endangers Marine Mammals

The 1996 book on endocrine disruption, *Our Stolen Future* by Theo Colburn, Dianne Dumanoski and John Peterson Myers, has been heralded as "the *Silent Spring* of the 90's." In it they present evidence discovered by Oystein Witt that PCBs in polar bears in the pristine area of the Svalbard in northeast Greenland at 79º north latitude "carry as much as 90 parts per million of PCBs in their fat. Researchers studying declining seal populations have found that 70 ppm of PCBs is enough to cause serious problems to females, including suppressed immune systems and deformities of the uterus and the fallopian tubes." [56]

Muir, Nordstrom and Simon have measured the PCB levels in arctic ringed seal in the Barrow Strait of the Northwest Territories to provide information on the variability of congeners and homologues between age classes and sex within the seal population as a baseline to assess biological effects of individual congeners on seals in a relatively pristine environment.[57]

How did the PCBs get to these remote areas of Arctic wilderness? Colburn *et al.* postulate that the combination of atmospheric and water transport moves these persistent chemicals to the four corners of the earth. PCBs are "notorious for combining the devilish properties of extreme stability, volatility and a particular affinity for fat."[58] Tracing the transport of a hypothetical PCB molecule, they describe a cycle of volatilization and deposition that results in global transport, with the Arctic and Antarctic becoming the ultimate sinks for PCBs and other toxic contaminants. "In the heat of the Sargasso sea, the molecule suddenly vaporized, and carried on the prevailing winds, began to hopscotch north. Alternating between liquid and gas, it rode the winds farther and farther north." In cold northern climates where volatilization is less likely, PCBs molecules are transported by ocean currents and move through the food web. The Arctic food web "includes many long-lived animals that accumulate significant amounts of contamination over a lifetime. For this reason the Arctic food web concentrates and magnifies persistent chemicals to an even greater degree than that of the Great Lakes." [59]

To quote from the abstract of the Iwata *et al.* study, "Distribution of Persistent Organochlorines in Oceanic Air and Surface Seawater and the Role of Ocean on Their Global Transport and Fate":

> "Concentrations of organochlorines such as…PCBs were determined in air and surface water from various oceans in 1989-90, for understanding their recent distribution and the role of the ocean in long-term atmospheric transport and fate on global terms... Chlordane and PCBs exhibited rather uniform distribution in both hemispheres. Estimations of fluxes by gas exchange across the air-water interface gave insight into the dispersal of organochlorines through oceanic atmosphere depending on their Henry's law constant and the tendency of more transportable ones to deposit in cold waters as an ultimate sink." [60]

PCBs are deleterious in isolated exposures, however, like many other organochlorines and other endocrine-disrupting chemicals, there may be interactive and additive effects from mixed exposures. Colburn *et al.* point out that, in the real world, toxic chemicals are rarely encountered alone, but in complex mixtures. "Scientific studies make it clear that chemicals can interact or can act together to produce an effect that none could produce individually." This synergistic effect, including exposures from a variety of sources – air, water, food, soil – may lower the level at which exposure results in injury. "Although exposure from any single source may be tolerable, the total from all sources may be unsafe. For this reason, contaminant levels from any single source must be assessed within the context of cumulative exposure." [61]

A recent Washington Post article, entitled "Arctic Canada's Silent Invader," describes how PCBs and other persistent organic pollutants have impacted Inuit people in the community of Iqaluit in the Baffin Islands. The article notes, "Toxins travel here in low concentrations in ocean currents, or in the winds, falling in places where they have never been used." More than 6 tons of PCBs reach the Arctic each year this way, polluting the water and tundra. "They move up a simple food chain until they reach high concentrations in the fat of whales, walruses and seals," according to Dr. Miriam Diamond of the University of Toronto. "In more temperate climates, the chemicals dissipate in trees and soils and on the sides of buildings, but in the Arctic you don't have that…it gets into the ocean where it accumulates in mammals." Inuit hunters are reporting abnormalities in animals: polar bears with reproductive organs of both sexes and seals without hair, with cigarette-like burns in their skin." [62]

Another article in the January 13, 2004 Los Angeles Times by Marla Cone, entitled "Ancestral Diet Gone Toxic," recalls how Dr. Eric Dewailly was shocked when, in 1987, he first discovered elevated levels of PCBs in breast milk from Inuit mothers located in Nunavik in the remote Arctic that was seven times higher than the milk of mothers in Canada's largest cities. Dewailly immediately contacted the World Health Organization who advised the Inuit mothers to stop breast-feeding their babies. "Breast milk is supposed to be a gift," said Dewailly, "It isn't supposed to be a poison." Cone's article goes on to explain that, although higher levels of PCBs have been reported in the Great Lakes, the Baltic and the North Sea than in the Arctic Ocean, the main reason for this high concentration in Inuit mothers is that (much like polar bear) they eat very high on the food chain, including the flesh and blubber of whales, seals, walruses and seabirds in which the toxins are greatly biomagnified. [63]

Clearwater acknowledges that tracing the causative effects of PCBs to the Hudson River and assessing their precise contribution to these injuries could be difficult. We further understand that EPA's jurisdiction may not extend to these sensitive global resources; nevertheless, ignoring volatilization as a pathway for moving PCBs throughout the global ecosystem is indefensible.

<u>EPA's Standards for Air Quality:</u>

In the Draft Quality of Life Performance Standards, Table 4-1, EPA correctly lists air for quality of life considerations for almost all major project activities, including handling, dredging (both mechanical and hydraulic), containment, transport (by barge and by pipe), sediment transfer, processing, water treatment, solidification, loading (to rail or barge), and facility construction and decommissioning. Case studies at New Bedford Harbor, MA and the St. Lawrence River, NY, were cited as remediations in which air quality standards were exceeded, then mitigated, and the Lower Fox River, Cumberland Bay, NY, and Grand Calumet, River, IN, as examples of projects in which no exceedances occurred.[64] However, EPA's general approach to air quality is to monitor for exceedances before requiring corrective action, rather than designing protective measures to prevent the unnecessary releases of PCBs into the remediation process in the first place.

Clearwater applauds EPA for its focus on community protection, but continues to have serious concerns about the Agency's lack of attention to global receptors. On p. 6-2 of the Draft Quality of Life Standards, EPA states as the purpose of the standards for air quality "to address the potential exposure of both adults and children in the project area to emissions from the project," and consequent "impacts to human health and the environment." However, the daily standards of 0.26 g/m^3 (260 ng/m^3) for commercial/industrial areas and 0.11 g/m^3 (110 ng/m^3) for residential areas do not address the amount of volatilized PCBs that escape from the work site or storage area into the larger environment. Clearwater cannot currently challenge the assumptions in the health risk assessments that underlie the Integrated Risk Information System (IRIS) Reference Dose (RD) for non-cancer health effects specific for Arochlor 1016 as its standard, or EPA's determination that this would become the air quality standard for this project. These standards falls within the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) cancer risk for children and adults of one in 100,000 to 1,000,000. Exposure to residents and businesses outside the boundaries of proposed sediment processing/dewatering facilities were also compared to New York State Annual Guideline Concentrations (AGC) and were projected to be 10 or more times lower than the AGC value.

If these thresholds are exceeded, EPA will be notified and will require implementation of mitigation measures to reduce air emissions, potentially stalling the PCB remediation project for long periods. EPA expects occasional exceedances, but will only intervene if there are "frequent exceedances or a pattern of exceedance." As daily PCBs approach the concern level (within

20% of the standard), the first level of increased monitoring and mitigation will be implemented; when the standard is exceeded additional monitoring and mitigation will be required.

Worker safety has been deferred in the DQOLPS to be addressed in the Worker Health and Safety Plan (WHASP), although the National Institute for Occupational Safety and Health (NIOSH) workplace concentration threshold of 1 g/m^3 (1000 ng/m^3) were cited, and will be measured on-site by real-time chemical detection monitors.[65] According to the source White Paper developed by TAMS for EPA's Responsiveness Summary to comments submitted on the proposed remediation plan, entitled "PCB Releases to Air (ID 253202)," PCBs concentrations within the sediment processing/transfer facilities are projected to be within Occupational Health and Safety Administration (OSHA) standards.[66]

Criteria pollutants (PM_{10}, $PM_{2.5}$, CO_2, SO_2, NO_2, O_3 and Pb) must meet primary and secondary National Ambient Air Quality Standards (NAAQS). These have been adequately considered in the DQOLPS. Because the remediation area has been designated as only marginally non-attainment for ozone, EPA is not required to evaluate ozone precursors such as NO_X and VOCs, but will "require the RD [remedial design] team to minimize ozone precursors to the extent practical and reasonable" by recommending the use of "alternative fuels, regular maintenance, and use of new vehicles and equipment that meet the latest emissions standards." [67]

EPA's air quality criteria do not specify threshold levels for heavy metals or for dioxins and furans, which are frequently found in association with PCBs, but these and other toxins may be monitored if initial air sampling indicates potential impacts from these materials.

The proposed continuous monitoring strategy is well designed to measure 24-hour averages of total PCB emissions at local receptors (shoreline, residences), but does not track PCBs that escape into the atmosphere. The DQOLPS state, "The point of compliance for air emissions monitoring is the receptor" – referring to local receptors, not those located at a distance from the site.[68] EPA seems to be assuming that if emissions are not a problem to site workers or area residents, that the environment and the food web at distant locations will also be protected.

<u>Conclusions and Recommendations:</u>

Volatilization of PCBs necessitates taking appropriate precautions during remediation.

In view of the huge body of evidence that PCBs volatilize from water and from sediment on an ongoing basis and then disperse throughout the global ecosystem, Clearwater believes strongly that it is a serious oversight to overlook and exclude this pathway of exposure from remedial considerations, or to conclude that its contribution is insignificant.

While there are clearly many other sources of PCBs in the global ecosystem, the two plants at Hudson Falls and Fort Edward are the source of the largest Superfund Site in the U.S. GE's contribution to the global PCB burden that originated from these two sites over more than 30 years is substantial and must be considered in the remedial design.

Clearwater recommends that EPA's remedial requirements be thoughtful and comprehensive, and include quantification of PCBs in air as a major pathway to both the local remedial area and to areas that can be affected by global transport. Because this remediation represents one of the largest Superfund cleanups, including highly concentrated hotspots over 40 miles of river, we recommend that volatilization above background be calculated in pounds per year and as a percentage of what will be removed, as was done for potential sediment resuspension.

Clearwater also recommends that EPA requires air monitoring for possible volatilization directly at the sediment-air interface of exposed sediment, or the air-water interface of exposed pools. The frequency and location of air monitoring should meet criteria for best available technology.

On page 6-14 of the QOL document, EPA states: "PUF sampler analysis can provide detection limits of 0.03 g/m^3 during 24 hour sampling periods." Detection limits at the Fox River were about 100 times lower (0.0003 g/m^3, or 0.3 ng/m^3) on a 24-hour basis. From a personal correspondence from David Grande of the Wisconsin DNR: Grande notes,

> "Chances are, at the 0.03 g/m^3 detection limit, there will be no detects [found] during the background testing. There will be no detects at the upwind sampling stations. There will rarely, if ever, be detects more than a kilometer downwind. In fact, if the Fox River monitoring was based on this detection limit, there would have been 3 or 4 detects, all at the most central processing area.
>
> "Without actual quantification, there can't really be any estimates of loss to the atmosphere. There also can't really be any way of monitoring the long term recovery of the local air. For example, there does seem to be some small decrease in Green Bay's ambient PCB level since the dredging was completed in 2000. It may or may not be related to the dredging, … or it may be an artifact.
>
> "Incidentally, the increase of sensitivity can be achieved very simply and at essentially no additional cost through a very minor adjustment to the lab procedure. We were about to give up on PCB monitoring attempts in '95 because we rarely seemed to detect anything. Then I worked with the analyst at our lab and found a couple of very easy changes to the procedure that proved successful. I mention this because the contractors may try to counter that improving the detection limit will cost too much, and it just isn't so." [69]

Beyond Regulatory Criteria: Clearwater strongly agrees that an exceedance of existing regulatory criteria should trigger appropriate action. However, we also believe injury can occur without such standards being exceeded. This is primarily due to the persistence of PCBs in the ecosystem and in individual organisms, which leads to long-term cumulative effects, plus synergistic effects with other compounds. The work of Dr. Ron Scrudato and of Chiarenzelli *et al.* demonstrates the high rates of volatility of PCBs from drying sediments under laboratory conditions and underscores the necessity to take extreme caution during remediation.[70] [71] [72] [73] [74] EPA acknowledges that "engineering controls and mitigating measures are readily available," including "processing sediment within enclosed structures, using wind screens, covering material stockpiles or controlling the shape and placement of the piles, adjusting the surface area/volume ratio during material handling by using larger excavation equipment, or spraying biodegradable foam over exposed dredged sediment." [75]

We recommend going a step further by entirely enclosing the dredging, conveyor and water treatment systems, containing stored sediments under negative pressure, filtering and subjecting to sorptive or other recovery all of the trapped air before it is released into the environment, minimizing storage time, and assuring that workers use appropriate personal protective equipment when working near or with PCB-contaminated sediment. The following measures should be instituted at the outset, not after a problem has been detected:

- Utilize hydraulic dredging, rather than mechanical dredging, wherever possible.

- Minimize loss to air by pacing the remediation to move materials directly from the barge into the dewatering facility and directly from the dewatering facilities into rail cars.

- Avoid storing materials in open piles. If storage is required, insure that it be in enclosed facilities under negative air pressure and that the air is passed over a sorptive medium or other recovery system before it is exhausted into the environment. Air under covered piles should be evacuated and filtered before covers are removed.

- Assure that sediment settling occurs in covered barges, or storage tanks or in bladder-enclosed settling pools, not in open settling pools or lagoons. Air in covered barges or tanks should also be evacuated and treated, before being vented.

- In regard to dewatering equipment, belt presses and plate and frame presses can scatter sediments, require frequent cleaning, and may expose workers to more volatilization from wet sediment than if hydrocyclones are used. Air should be treated before being exhausted from dewatering facilities.

- Lime stabilization of dewatered sediment by the addition of Portland cement (or other stabilizing agent) in a pug mill can cause increased volatilization of PCBs due to heat generated by the exothermic cement hydration reaction. The rise in temperature may be as much as 18ºC or 32.4ºF.[76] Air from stabilization facilities should also be treated.

- Trucks used to transport materials temporarily, and rail cars or barges used to transport dewatered sediment to disposal sites, should be properly lined and sealed.

Even when these precautions are taken, small amounts of PCBs may escape into the environment, adding to the historic load that has resulted from years of ongoing daily and seasonal exposure of contaminated sediments to air as river water ebbs and flows. If these measures are implemented at the outset and care is taken throughout the process, any impacts will be significantly reduced.

Monitoring at Disposal Sites. Because of the documented potential for volatilization from active landfill sites, EPA should require air monitoring and contingency plans in the communities hosting the ultimate disposal sites, in addition to monitoring the communities at the project site.

Medical Monitoring: In spite of health advisories, it is well documented that many subsistence anglers continue to eat Hudson River fish. In addition, humans have been exposed through groundwater contamination, ingestion of soil, and inhalation of volatilized PCBs on an ongoing basis. Although Clearwater acknowledges that it is beyond the scope of EPA to address medical monitoring directly, we believe that it is within their purview to recommend that appropriate agencies, such as the NY State Department of Health, seek funding to sponsor much-needed epidemiological studies of Hudson River residents local to the plant sites and upland disposal sites, and other exposed individuals.

Clearwater is willing to provide further documentation and other assistance to assist EPA in closing the loopholes in the proposed remediation that may allow preventable releases of PCBs into the environment.

A list of additional resources is attached, along with the bibliography of articles and studies on PCB volatilization included with Clearwater's substantive public comment to EPA on volatilization from April 2001.

Attachments:

A) Additional Resources

B) Volatilization Section of Clearwater's Public Comment on EPA's Hudson River PCBs Superfund Reassessment and Proposed Remediation Plan, April 17, 2001

C) Clearwater's Comments on Hudson River Natural Resource Damage Assessment (NRDA) Plan, September 16, 2002.

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[76] USEPA White Paper (ID 253202), 8.

Addendum and Errata:

- Minor change in wording of paragraph # of Executive Summary

- Deleted diabetes from list of "well documented" health effects p. 3. One study of pregnant women showed a strong dose response relationship of a 5 x increase in diabetes at levels of 3.75 – 5.00 ppb as compared to a control group having <2.50 ppb serum PCBs. More studies are needed to corroborate this finding.

- Lower Fox River dredging occurred between September and December, and was monitored from August (for pre-dredging baseline) through end of November (p. 8).

- From a personal correspondence from David Grande of the Wisconsin DNR:

  "On page 6-14 of the QOL document, EPA states: 'PUF sampler analysis can provide detection limits of 0.03 ug/m3 during 24 hour sampling periods.' Detection limits at the Fox River were about 100 times lower (0.0003 ug/m3, or 0.3 ng/m3) on a 24-hour basis." Grande notes, "Chances are, at the 0.03 ug/m3 detection limit, there will be no detects during the background testing. There will be no detects at the upwind sampling stations. There will rarely, if ever, be detects more than a kilometer downwind. In fact, if the Fox River monitoring was based on this detection limit, there would have been 3 or 4 detects, all at the most central processing area.

  "Without actual quantification, there can't really be any estimates of loss to the atmosphere. There also can't really be any way of monitoring the long term recovery of the local air. For example, there does seem to be some small decrease in Green Bay's ambient PCB level since the dredging was completed in 2000. It may or may not be related to the dredging, … or it may be an artifact.

  "Incidentally, the increase of sensitivity can be achieved very simply and at essentially no additional cost through a very minor adjustment to the lab procedure. We were about to give up on PCB monitoring attempts in '95 because we rarely seemed to detect anything. Then I [Grande] worked with the analyst at our lab and found a couple of very easy changes to the procedure that proved successful. I mention this because the contractors may try to counter that improving the detection limit will cost too much, and it just isn't so."

- Miscellaneous corrections of endnotes.

Attachment A

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<u>Attachment B</u>

Hudson River Sloop Clearwater's Public Comment on EPA's Hudson River PCBs Superfund Reassessment and Proposed Remediation Plan April 17, 2001

<u>Executive Summary</u>

The following document is Hudson River Sloop Clearwater's formal submission to be entered in the public comment docket for the United States Environmental Protection Agency's (EPA's) Hudson River PCBs Superfund Reassessment and Proposed Remediation Plan. Clearwater is a non-profit environmental education and advocacy organization founded in 1966 with the mission to "...defend and restore the Hudson, its tributaries, and related waterways."

Clearwater recognizes that PCBs in the Upper Hudson sediments have long posed unacceptable risks for human health, the integrity of fish and wildlife populations, and the economies of river communities. These contaminated sediments continue to be the primary source for PCB-loading to downstream cities, towns, and river habitats. Clearwater thus supports a comprehensive river remediation plan that removes PCB-contaminated sediments from the Upper Hudson.

Further, Clearwater's analysis of documents obtained under the New York State Freedom of Information Law indicates that General Electric's PCB discharges were illegal from the very start, and at times were in violation of more than one statute.

Clearwater recommends an Upper Hudson remediation plan that maximizes PCB removal, minimizes PCB volatilization, includes sediment treatment and PCB destruction technologies, and minimizes impacts on human health, fish and wildlife, and critical habitats. Using EPA's terminology, Clearwater's recommended remedial standard is 3+/0/3+.

Clearwater is concerned about the continued threat of recontamination from the remnant deposits, and urges EPA to work collaboratively with the New York State Department of Environmental Conservation (NYS DEC) to develop a plan for removing contaminated sediments from those sites. Further, Clearwater urges EPA to clarify the status of the river segment between Fort Edward and Hudson Falls, which currently does not seem to be covered in the Proposed Plan.

The human health effects from PCB exposure have been well documented. PCBs are probable carcinogens, and have developmental effects including lowered IQ; they also cause immune system suppression, serve as endocrine disruptors, and cause acute toxic effects. PCBs bioaccumulate, concentrating in the fatty tissues of organisms, with

animals at the top of the food chain being most vulnerable. PCBs readily pass from mother to child through breast milk. Pregnant women and children are most at risk from PCB exposure, but even the children of women exposed to PCBs before pregnancy can be affected.

PCBs have been shown to volatilize from the river itself and from exposed mud flats. In this way they can enter the atmosphere and be redeposited many hundreds of miles from their source, contributing significantly to the global load of PCBs in the environment. Inhalation of PCBs likely serves as another avenue of exposure, especially to residents living near the most contaminated areas. Special care will have to be taken during the remediation to protect workers and minimize volatilization from dredged spoils.

Thousands of people in the estuarine Hudson eat the fish they catch for subsistence. Many of these people willingly risk PCB exposure, but most are unaware of the risks for a variety of reasons. Those exposed are very often from disadvantaged communities where Hudson River fish can offer a steady supply of inexpensive meals. Despite New York State Department of Health (NYS DOH) health advisories warning against the consumption of Hudson River fish, it is clear that contaminated fish are still being eaten. Awareness of the advisories is very limited, especially by lower income and linguistic minority groups in urban centers along the Lower Hudson River. Currently, the advisories warn that women of childbearing years and children under fifteen should eat no fish from the river.

Clearwater believes that the Food and Drug Administration's (FDA) consumption threshold of 2 ppm of PCBs in fish is unacceptably high, especially for subsistence anglers who may eat at least one Hudson River fish meal per week. Removal of PCBs from river sediment is the only method that has the potential to lower PCB levels in fish to the EPA goal of 0.05 ppm in our lifetimes. Without remediation, Upper Hudson fish will not be edible for an indeterminate time in excess of 67 years, which was the limit of EPA's modeling time frame. With Clearwater's recommended level of remediation, monthly or weekly fish meal consumption may become safely possible in the estuarine Hudson in a relatively few years after remediation is complete, sparing one or more human generations exposure to this persistent toxin.

The effects of PCBs on wildlife are well documented. Behavioral abnormalities, lower reproduction rates, and reduced hatchling success have been seen in a variety of bird species exposed to PCBs, including black-crowned night herons, bald eagles, and cormorants. Upper Hudson tree swallows showed a significant positive correlation between their level of PCB exposure and the loss of ability of individual swallows to build nests. PCBs have also been shown to suppress the immune system in American kestrels. Reproductive failure and immunosuppression in mammals, particularly fish-eating species (such as mink), has also been exhibited. A recent report from New York's Department of Environmental Conservation has shown greatly elevated PCB levels in predators living near the river.

Commercial fishing for striped bass, eel, and other marketable species has been shut down since the mid-seventies causing not only job losses, but the lost legacy of a traditional livelihood which is a defining feature of the Hudson's cultural heritage. Despite renewed interest in reopening commercial striped bass fishing on the Lower Hudson, PCB levels in Lower Hudson fish must be reduced significantly before the limited commercial sale of striped bass from the Hudson River resumes. The closure of the commercial fishery has led to a regulatory structure that favors recreational fishers, and it now appears that commercial fishing may never return. This condition would never have existed had commercial fishing been able to continue uninterrupted.

Despite advisories, even recreational anglers frequently consume what they catch from the Lower Hudson, so lowering PCB levels in fish to the 0.05 ppm level would greatly improve the safety of fish consumption and help remove the stigma associated with Hudson River fish, thus improving tourism and its associated economy. A post-remediated Hudson would also offer higher property values and improved navigation. The remediation itself has the potential to create thousands of jobs for the local economy, and Clearwater urges EPA to specify the maximum level of hiring local workers for the remediation process. Clearwater recommends increased public outreach about fish consumption before, during, and after remediation throughout the Hudson Valley.

Clearwater recommends using hydraulic dredging as the default value, and that dredged sediments be contained at all steps in the process, minimizing volatilization. Innovative dredge technologies should be explored. Clearwater recommends silt curtains be used to minimize resuspension, that dredging be restricted to the low river flow months of summer and fall, and that an extensive air and water monitoring program be implemented. Diesel fuel emissions from trains or trucks could be significantly reduced by using soy-based biofuels.

Clearwater strongly urges that treatment technologies be employed on some of the most-contaminated dredged sediments, and that priority be given to those technologies capable of completely destroying PCBs. Proper precautions should be taken to minimize worker exposure to sediments and volatilized PCBs.

Continued public participation after the ROD is announced is critical. A Hudson River PCB Remediation Advisory Committee of all major stakeholders should be created, and we strongly support the establishment of grants programs for outreach, education and environmental justice. Ongoing public information meetings in Ft. Edward, Albany, the Mid-Hudson, and New York City should be scheduled.

Clearwater recommends that all reasonable steps be taken to minimize the negative impacts of remediation on host communities. These steps include noise control, limited nighttime light pollution, the use of soy diesel fuel in all engines, minimization of outdoor material handling, and possible containerization of dredged materials

A comprehensive remediation is the Hudson's best hope for ecological recovery and economic revival. Clearwater believes that this is our last, best chance to remove a significant source of these toxic chemicals from not just the Hudson, but the entire global ecosystem. Without remediation, Hudson River PCBs will continue to slowly disperse and remain available to contaminate people and wildlife for many generations to come.

Clearwater Public Comment on EPA's Hudson River PCBs Superfund Reassessment and Proposed Remediation Plan

Bioaccumulation

Once PCBs enter a person's (or animal's) body, they tend to be absorbed into fatty tissue and remain there. Unlike water-soluble chemicals, they are not excreted, so the body accumulates PCBs over years. This means that PCBs also accumulate via the food chain: a small fish may absorb PCBs in water or by eating benthic organisms or plankton, and these PCBs are stored in its body fat. When a larger fish eats the small fish, it also eats and absorbs all the PCBs that have built up in the small fish. In this way, larger fish and animals can build up a highly concentrated store of PCBs; the top predators may have a concentration of toxins 25 million times that in sediment or water (Colborn *et al.* 1996). Some types of PCBs may partially degrade while stored in the body, but this process can take many years.

In the same way, PCBs accumulate in women and pass on to their infants through breast milk. This accumulation means that nursing infants ingest PCB levels as much as 50 times higher than the levels in fish and other foods consumed by their mothers (Korrick and Altshul 1998).

PCBs have been found all over the world, including significant amounts in the Arctic and Antarctic, far from any sources (Dewailly *et al.* 1993). It is thought that PCBs spread through the air, after evaporating from contaminated water and sediments, as well as through the water.

Routes of Exposure

The most common route of exposure to PCBs is from eating contaminated fish. The EPA estimates an increased cancer risk as high as 1 in 1000 for people eating fish from the Upper Hudson River—a thousand times higher than the EPA's goal for protection (EPA 2000). Calculation of a non-cancer Hazard Index shows that fish consumers take in PCBs at rates ranging from 65 (for adult) to over 100 (for children) times safe levels. The EPA has concluded that consumption of contaminated fish is the only direct pathway that presents a current health threat for humans (for a comparison of risks, see Tables 1-9 and 1-10 in EPA 2000).

Municipalities that use the Hudson River as a drinking water source carefully monitor the water for PCBs, and there are no detectable levels in the water supplies (Poughkeepsie 2001). Potential resuspension of PCBs during dredging has been a concern for these communities. However, the maximum estimated amounts of resuspension are approximately 6 kg/year, which pales in comparison to the estimated 214 kg/year currently being transferred to the water column from contaminated sediment (EPA 2000). With proper precautions, resuspension should not be an issue for towns taking drinking water from the Hudson.

Although small amounts of PCBs can enter the body from swimming in highly contaminated water, this is unlikely to be significant except in the most extreme cases (EPA 2000).

Inhalation

Inhalation has been ruled out as an important PCB pathway in the EPA documents, due to insufficient research data and its apparently minor importance compared with fish consumption. Unfortunately, due to lack of available evidence, no standards have been established for the inhalation of PCBs. Although studies were made of the toxicity of PCB vapors as early as 1956 (Treon *et al.* 1956), this pathway has been generally ignored in favor of oral and, to a lesser extent, dermal routes of exposure.

Air near a contaminated site may be polluted by PCBs. By one estimate, residents of the Hudson Valley may inhale as many PCBs as they would get by eating one contaminated fish per year (Dr. David Carpenter, personal communication). Although inhalation is generally not currently thought to be a high level route, it is important as an involuntary route of exposure to which all Hudson Valley residents are subject. PCBs that enter the body through the lungs are not metabolized as ingested PCBs are. Instead, they mix with the bloodstream and become directly available to brain tissue.

The New York State Department of Health is currently conducting a study that examines airborne and fish consumption pathways of exposure in residential Fort Edward populations. The results of this study, called the Hudson River Communities Project, will not be available until at least 2002, but correlation of PCB body burden or health effects with airborne exposure could provide useful information about the current status of volatilization as a health risk.

In addition to volatilization from the river surface (see “Volatilization as an Input of PCBs into the Ecosystem,” below), contaminated sediment on the banks could be a significant source of airborne PCBs. Remnant deposits on the banks of the Hudson in Fort Edward, containing at least 46,000 pounds of PCBs, were capped in 1991 (EPA 1984). Continuous erosion of these deposits could lead to failure of the caps and volatilization of PCBs, although little data is currently available about the viability of the capped remnants or their potential as a source of airborne PCB exposure.

It is possible to calculate the importance of inhalation as a fraction of total PCB body burden, and this method has been used by at least one paper. Currado and Harrard (1998) calculated a daily intake from a combination of indoor and outdoor background levels of 23–590 ng of ∑PCB per person. The mean exposure, 110 ng/day, amounts to about a third of the amount consumed in food (340 ng/person/day, a U.K. average), and about a tenth of the ATSDR's chronic oral Minimal Risk Level for a 50 kg person (1000 ng/person/day). The highest level, 590 ng/person/day, is more than half the ATSDR chronic oral MRL. These numbers represent an upper bound, since 100% absorption in the lungs is assumed. It is sufficient to demonstrate, however, that even at background levels inhalation may be a significant contribution to ∑PCB body burdens.

Currado and Harrad's model assumes that PCB body burden derived from inhalation relates linearly with a combination of indoor and outdoor concentrations. Since indoor air generally has much higher levels of PCBs, the vast majority of the contribution is from home or workplace exposure. Two studies have found no general correlation of indoor and outdoor PCB air concentrations, indicating that indoor levels are primarily driven by indoor sources (for example, old fluorescent light ballasts).

We will discuss the potential for volatilization to increase during remediation below (see "Volatilization"); we would like to note here that, while inhalation can be a significant source of PCB body burden for non-fish-consumers, it generally falls far below dangerous levels. In addition, we can tentatively conclude that the greatest contribution to inhalation is indoor, rather than outdoor, sources of PCBs.

Applicability of the Reasonable Maximum Exposure Scenario

One criticism of the EPA's Proposed Remedy that has been raised by opponents of the cleanup is that the RME is unreasonable. It has been suggested that the amount of fish eaten in the RME scenario (one half-pound fish meal per week) is unrealistic, and that the maximum allowable levels of PCBs in fish are too low, particularly since the EPA target levels are well below the current standards set by the Food and Drug Administration. In this section we will try to determine whether the RME scenario outlined in the Proposed Remedy is reasonable. It is important to note that these numbers apply only to fish consumption, and that other pathways, notably inhalation, may exist (see "Volatilization as an Input of PCBs into the Ecosystem," below).

The Food and Drug Administration has set a tolerance level for PCBs in commercially caught fish of 2 mg/kg (EPA 2000 FS 2-6). This is based on a "market basket" approach, in which consumers purchase a variety of fish from a variety of sources, only occasionally eating a contaminated fish (McCabe and Tomchuk, EPA, personal communication).

This approach, however, is not protective of subsistence or recreational anglers who frequently consume fish from a single source, and who are likely to consume fish targeted by health advisories (see "Fish Consumption," above). The "market basket" approach is insufficient in these cases, as we can see by an estimate of PCB intake.

The Agency for Toxic Substances and Disease Registry has recently released an update for the Toxicological Profile for Polychlorinated Biphenyls (ATSDR 2000). The new Profile sets Minimal Risk Levels (MRL) for PCB consumption, but not for PCB inhalation (due to lack of research data). The MRLs are:

intermediate-duration exposure (15 –364 days) 0.03 μg/kg-day (0.00003 mg/kg-day)
chronic exposure (duration longer than one year) 0.02 μg/kg-day (0.00002 mg/kg-day)

(ATSDR 2000)

These MRLs are based on lowest observed adverse effect levels showing non-cancerous effects (neurological and immune deficits) in tests on non-human primates.

The EPA calculates similar limits, referred to as the Reference Dose (RfD), for long-term exposure to Aroclor formulations. No RfD is obtained for total PCB. The current RfDs are:

Aroclor 1016	0.00007 mg/kg-day	(0.07 μg/kg-day)
Aroclor 1254	0.00002 mg/kg-day	(0.02 μg/kg-day)

(EPA 2000c)

These RfDs, based on developmental and immune deficits in nonhuman primates, are in close agreement with the ATSDR's MRLs. Although most of the PCBs dumped in the Hudson were Aroclor 1242, natural dechlorination over time has altered the congener profile (EPA 2000c). EPA approximates the RfD for soil and sediment by using the Aroclor 1016 RfD, and approximates the RfD for PCBs in fish by using the Aroclor 1254 RfD, based on the similarity of the congener profiles in those two settings (EPA 2000c).

The FDA's limit of 2 mg/kg in fish is well above EPA's Remedial Action Objective. For subsistence angler with a body weight of 50 kg (110 lbs), eating one meal per week of fish contaminated at the FDA limit, we can roughly calculate PCB intake:

$$\frac{2\text{ mg PCB}}{1\text{ kg fish}} \times \frac{1\text{ fish}}{\text{week}} \times \frac{0.23\text{ kg}}{\text{fish}} \times \frac{1\text{week}}{7\text{ days}} \times \frac{1}{50\text{ kg}} = \frac{0.0013\text{ mg PCB}}{\text{kg day}}$$

The Hazard Index, defined as the average dose divided by the reference dose (RfD), is intended to measure the risk of non-cancerous toxic effects due to consumption of xenobiotics. An HI above one indicates an increased risk. Although the EPA does not calculate an RfD for total PCB, we can use the ATSDR MRL and the RfD for Aroclor 1254 (which is most similar to the congener profile in fish) to calculate the HI for the RME:

based on Aroclor 1254: HI = 0.0013 mg/kg-day / 0.00002 mg/kg-day

= 65

based on ATSDR's MRL HI = 0.0013 mg/kg-day / 0.00002 mg/kg-day

for chronic exposure = 65

In this simple analysis, we are ignoring cooking loss (probably in the range of 10% to 40%, but assumed to be 0% in the RME scenario (EPA 2000c)), any in-body degradation of PCBs, and any additional sensitivity of children to PCB exposure.

We conclude that the FDA's tolerance level for PCBs is greatly insufficient to protect the health of the RME individual. EPA's Remedial Action Objective of 0.05 is an appropriate standard, and far more protective of human health than FDA's tolerance level.

Volatilization as a Pathway into Ecosystems

The volatilization of PCBs into the air, and their inhalation and inspiration by people and wildlife, is a route that has been little examined. PCBs have generally been considered insoluble and nonvolatile. However, it has been shown recently that volatilization of PCBs, and particularly of the lower-chlorinated congeners, can occur at substantial levels, and that inhalation may contribute significantly to the PCB body burdens of some people. Clearwater is concerned that these effects be examined carefully and taken into account during the design phase of EPA's remediation of the Hudson River.

Volatilization of PCBs from the water surface may be a significant input of PCBs to the ecosystem. While estimating the amount of PCBs volatilized from the Hudson River is fraught with unknowns, we may make an attempt. Achman *et al.* (1992) have calculated volatilization rates from Green Bay, Lake Michigan. The results varied widely, from 13 to 1300 ng/m^2/day, and were strongly dependent on PCB concentration in water as well as wind speed; a factor of less than 10 for each of wind speed and water concentration result in a hundred-fold increase in volatilization. Converting units, multiplying by the area of the Upper Hudson, and adding a factor of 10 for the increased PCB concentration in the Hudson (approximately 60 ng/L, equivalent to 60 parts per trillion or ppt, compared with Lake Michigan's "high" levels of approximately 6 ng/L), results in a range of approximately 6 (low wind) to 80 (high wind) kilograms of PCBs volatilized from the Upper Hudson each year. Water flow and turbulence will substantially increase this figure, which is based on the placid waters of Lake Michigan. Although this is at best a very rough estimate, it appears that volatilization of as much as hundreds of kilograms of PCBs is not unreasonable from the Upper Hudson alone. These PCBs can then be deposited into nearby areas; several studies have shown that atmospheric transport is a source of contamination of otherwise pristine bodies of water (e.g., Datta *et* *al.* 1998, Mackay 1989). In addition to contaminating the local ecosystem, PCBs have been shown to travel great distances after volatilization. Studies in the Arctic, far from any PCB sources, have found elevated levels in the breast milk of Inuit women (about 4 ppm) and in polar bear fat (3-8 ppm) (Dewailly *et al.* 1993).

Since volatilization depends at least linearly, and perhaps more strongly, on the water concentrations of PCBs, **we conclude that dredging of the Hudson, and the resulting rapid reduction of PCBs in the water column, will substantially lower this massive release of PCBs to the ecosystem.**

Current Levels of Volatilization also affect Human Health

Of the possible routes of exposure, fish consumption certainly carries the largest risk for Hudson Valley residents. In the Phase 3 Feasibility Study, EPA calculates the increased risk of cancer in the Upper Hudson due to inhalation at 2×10^{-8} (central tendency) and 1×10^{-6} (Reasonable Maximum Exposure), concluding that inhalation is not a pathway of concern for cancer in the Hudson River. Citing a lack of available research, EPA does not calculate a non-cancer Hazard Index for inhalation. Consequently, EPA has restricted itself to calculating Remedial Action Objectives for PCB levels in fish.

However, as we have seen ("Health Effects," above), inhalation may represent a significant fraction of PCB body burden for Hudson Valley residents who are not fish consumers, while still falling below dangerous levels. By lowering PCB water levels and lowering volatilization, dredging will decrease the current export of PCBs to the local and global ecosystem as well as the inhalation levels for residents who do not eat fish. **An active remediation program carries substantial ecological and public health benefits beyond lowering fish PCB levels.**

We conclude that dredging of the Hudson River will dramatically lower volatilization, which is currently a large source of PCBs into the local and global ecosystem.

In addition, although inhalation is not currently a significant health threat in most cases, lowered volatilization rates following dredging will substantially reduce PCB exposure for Hudson Valley residents who do not eat fish.

Sediment Dewatering

Sediment dredged from the river must be dewatered before it can be treated or landfilled. EPA has outlined three dewatering methods:

a. "Passive" dewatering, i.e., allowing the sediment to dry. Although requiring little energy input, this would release very large amounts of PCBs to the air. If done in an enclosed and filtered space, it may be acceptable, but it is not preferred.

b. “Mechanical” dewatering, which uses presses, hydrocyclones, belts, or other mechanical means to extract water. These methods can lower water content dramatically in a short time, lowering overall volatilization. It should be noted that the water extracted from the sediment will be contaminated with PCBs and must be treated. Depending on processing time, it is possible that air in contact with sediment must also be captured and filtered.

c. “Active” dewatering; i.e., heating. Volatilization levels from active dewatering are expected to be as high or higher than passive dewatering. Clearwater considers active dewatering unacceptable, unless a process such as post-treated heated stripping is used.

Disposal options such as landfilling which require solid waste necessitate complete dewatering (and the addition of stabilizing or solidifying elements), while other treatment trains can accept partially dewatered sediment. The exposure of workers to wet contaminated sediment must be carefully addressed. Some dewatering technologies, notably belt filters and plate-and-frame presses, are particularly messy, scattering sediments and require frequent cleaning, thereby exposing workers to a potentially large amount of wet sediment. Other methods, like hydrocyclones, are cleaner or require less cleaning. The treatment method chosen drives the choice of dewatering: solidification, the method proposed by EPA, requires complete dewatering, making this a difficult process, almost certainly requiring the use of belt filters or plate-and-frame presses, and therefore exposing workers to contaminated sediments. By contrast, an alternative treatment train (for example, one involving soil washing, solvent extraction, and chemical dechlorination) might require substantially less dewatering. In this case, a single pass through a hydrocyclone might suffice to dewater the sediment, exposing workers to significantly less volatilization during dewatering.

Clearwater recommends that the treatment methods be considered, in part, by the effect they have on requirements for dewatering, and that treatments which require less worker exposure to sediment during dewatering be preferred.

The tendency of PCBs to volatilize from wet sediment along with water indicates that dewatering must be carefully controlled to prevent escape of PCBs; for further recommendations, see “Potential for Volatilization,” below.

In addition to filtering air, EPA must carefully treat and monitor water recovered from wet sediment before returning it to the river.

EPA’s plan calls for two dewatering plants, one in the area of River Section 1 or 2, and another in the Albany area to manage the sediments from River Section 3. **Clearwater believes that only one water treatment facility is needed**. Material from River Section 3 could be barged up to one location, rather than building a second dewatering facility in the Albany area. The dewatering facility can offer a win-win solution to both the host community and to the project if it is sited in exchange for full remediation of existing upland hazardous waste sites created by NYS DOT, which dredged the original sediment to maintain navigation. An additional rail siding may be needed to accommodate up to 45 boxcar loads of dewatered sediment per day.

Volatilization

The evidence for volatilization indicates that this is currently a route by which a substantial mass of PCBs is entering the global ecosystem from the Hudson River. It is also a small but involuntary route of exposure for all residents of the Hudson Valley.

While the Proposed Remedy will lower the volatilization rate, it is important to note that an incautious remediation project may itself cause substantial volatilization during dredging. Clearwater believes that volatilization must be controlled to ensure that inhalation does not become an important pathway during the remediation process. Here we will try to estimate the amount of PCBs that could be volatilized during remediation, to calculate the potential hazards of this effect, and to make suggestions for the design of the remediation to mitigate the volatilization.

In doing so, we address several specific concerns. The first is that uncontrolled volatilization could increase airborne PCB levels enough to pose a hazard to worker safety, and even, in extreme cases, to neighboring communities. Secondly, even if PCB levels in air remain low, volatilization represents a pathway by which a large amount of PCBs reenter the ecosystem, contaminating otherwise pristine areas. It is the mandate of EPA to remove toxins from the ecosystem wherever possible, and Clearwater strongly believes that PCBs cannot be permitted to escape during the remediation process.

A number of papers by Scrudato, Chiarenzelli *et al.* have studied the effects of volatilization of small amounts of PCBs in a laboratory setting (Chiarenzelli *et al.* 1997; Chiarenzelli *et al.* 1997b; Scrudato *et al.* 1999). From 20% to 65% of the total PCB mass of a small sample was lost to volatilization over the time it took the samples to dry. Wetter sediment volatilized more PCBs, presumably due to the dipole-dipole effect of water with individual PCB molecules. While this shows the potential importance of volatilization, it does not provide us with a specific yardstick for estimating PCB release. The tiny samples (a fraction of a gram) used in the studies dry much faster than our large barge loads of contaminated sediment; in addition, the very large surface-area-to-mass ratio of the small samples means that a huge fraction of PCBs exist at or near the air-sediment boundary, where most volatilization takes place. The large volumes involved in the remediation project have a very low surface-area-to-mass ratio, exposing a small fraction of PCBs to the air, and will dry very slowly. In addition, a layer of water over the PCB-contaminated sediment will help slow this process, since the dipole-dipole interaction is strongest with a single-molecule-thick layer of water. It should be noted, however, that even one percent volatilization over the lifetime of the project would result in the release of approximately 500 kg of PCBs into the environment — an unacceptably high level.

Background levels of PCBs in outdoor air have been measured by a number of studies, usually averaging below one ng/m^3, with levels sometimes higher in industrial cities. The indoor level is almost always higher, ranging from a few ng/m^3 to a few hundred ng/m^3 in some cases. One study found a mean of 9 ng/m^3 in Birmingham (UK) (Currado and Harrad 1998); Vorhees *et al.* (1997) measured a range of 5.2 – 51 ng/m^3, with a mean of 10 ng/m^3, in their "reference" homes.

Several studies have measured increased PCB levels in air near contaminated sites. At a small lake in Sweden, which was remediated and the sediment landfilled, PCB levels were measured at a number of locations outdoors; the highest levels, with a mean of 5.9 ng/m^3, were found in the area where the sediment was dewatered and landfilled (Bremle and Larsson 1998). PCB levels were found to correlate with ambient temperature as well as recent dredging activity. Measurements of PCB levels taken near New Bedford Harbor during dredging found concentrations from 0.4–53 ng/m^3 (outdoor; mean, 4.9±4.6 ng/m^3) and 7.9–61 ng/m^3 (indoor; mean 18±1.8 ng/m^3) in areas nearest the harbor (Vorhees *et al.* 1997). An ATSDR measurement of indoor air levels in Pittsfield, Mass. found concentrations of ∑PCB of 21 ng/m^3 (in the basement) and 7.24 ng/m^3 (in the living room) (ATSDR 1999).

In most cases, indoor air levels appear to be driven largely by indoor sources (for example, old fluorescent light ballasts and electrical appliances) (Currado and Harrad 1998). Even the significant problems with volatilization experienced in New Bedford Harbor, which caused an eightfold increase in outdoor PCB concentrations, caused less than twofold increase in indoor levels.

Finally, PCB levels in produce showed some increase during dredging of the New Bedford Harbor. Tomatoes grown during dredging, at a site just 500 yards from the hot spot, showed a 6- to 8-fold increase in total PCB concentrations; tomatoes from a site five miles away showed a 2- to 3-fold increase. The increased concentrations of lower-chlorinated congeners supports the idea that these PCBs came through the air. Material dredged at this site was stored in a Confined Disposal Facility (a lined and covered holding pond), and covered with black plastic sheeting until a treatment option was agreed upon several years later. The large surface area of the CDF and heating of the black plastic covering both contributed to the volatilization of PCBs from the holding pond (David Dickerson, EPA, personal communication). Clearly, long-term storage of contaminated sediment can greatly increase risks from volatilization.

Health Effects of Volatilization During Remediation

We have seen (see "Health Effects," above) that inhalation may be a substantial contribution to PCB body burdens, although not at dangerous levels. Should we be concerned about inhalation as a route of exposure during remediation?

Clearly, workers who are exposed to high levels of PCBs in enclosed work areas for several hours per day are at the greatest risk. **Clearwater strongly recommends that all**

enclosed work areas be kept under negative pressure, drawing air away from work areas, and the air filtered.

Is there a risk to the public during remediation? The hot spot dredging project in New Bedford Harbor encountered some problems with volatilization, particularly in the area of the Confined Disposal Facility. These were apparently due to the large area of the holding pond, aggravated by the warming effect of the black plastic used to cover the sediment. Air levels in the immediate vicinity of the dredging site had concentrations elevated about eightfold (Vorhees *et al.* 1997). However, since indoor air concentrations are not strongly correlated with outdoor levels, indoor levels in this area experienced only about an 80% increase in PCB concentration, to about 18 ng/m^3. While this elevation is significant, it falls well within the range of background PCB levels measured by Currado and Harrad, and is well below mean indoor concentrations reported by other studies (mean values ranging from 100 to over 450 ng/m^3 in homes and offices, reported in Currado and Harrad 1998). Since the mean PCB intake through inhalation was found to be approximately one-tenth of the ATSDR's recommended chronic MRL, this increase does not represent a health risk even to those residents living nearest the harbor. In addition, because of the lowered PCB water concentrations after dredging, lower volatilization will occur in these areas.

Although not posing a health risk, the experience in New Bedford Harbor does emphasize the importance of containing volatilization during remediation. **Clearwater strongly recommends that volatilization be controlled with the goal of no statistically significant elevation of airborne PCB concentration during remediation and treatment.**

Stages of Remediation

Any stage during which wet contaminated sediment is exposed to air must be looked at as a potential source of volatilization. Contaminated sediment on tidal flats or washed up on shore has been shown to be a significant source of PCB input to the ecosystem, with particularly high levels in predators living near the river (DEC 2001).

However, volatilization can be decreased by simply closing any system, allowing the air and sediment to come into an equilibrium in which the vast majority of PCBs resides in the sediment. **It is the disturbance of this equilibrium by a stream of fresh air (or fresh water) that allows continuous volatilization (or dissolution) of PCBs to occur.** Therefore, a closed barge is greatly preferable to an open barge, which allows wind and diffusion to continually carry PCBs away from the sediment; similarly, any closed system will limit volatilization, although large pockets of air might contain significant amounts of PCBs when equilibrium has been reached.

During sediment treatment, care should be taken to limit contact of the wet sediment with outside air as much as possible. This will probably require that processing occur within enclosures in which a negative pressure is applied. An air pump located as far as possible from the entrance and the work areas would ensure that airborne PCBs are kept from workers. Depending on the amount of volatilization and the effectiveness of the filtration, workers may not require personal protection equipment for short exposures, although levels should be carefully monitored at all times. The air pumped in this way should be filtered before being returned to the atmosphere. Enclosure of dewatering and treatment/solidification stages will dramatically lower the levels of PCBs released to the ecosystem.

Transport and dewatering of contaminated sediment carries the highest risk of volatile PCB loss. Mechanical dredging carries increased risk because of the exposure of sediment to air in the clamshell, while hydraulic systems which pump slurry through a pipe have the advantage of keeping sediment enclosed. Open barges would allow continuous volatilization.

Dewatering of sediment can be a difficult and messy process, and probably provides more potential for volatilization than any other step of the remediation process. Volatilization must be controlled carefully during dewatering. **Enclosing the dewatering and treatment facilities, and pumping and filtering air from the enclosure, is the only way to ensure that volatilized PCBs do not escape into the local ecosystem.** Because volatilization happens most effectively with wet sediment, sediment in which water content has been greatly reduced will volatilize fewer PCBs, although it must still be contained.

As has been noted above ("Sediment Dewatering"), different treatment trains require different levels of dewatering, and consequently expose workers to different amounts of contaminated sediment and air. **Clearwater recommends that the treatment methods be chosen, in part, for the effect they have on requirements for dewatering, and that treatments which require less worker exposure to sediment during dewatering be preferred.** The filtration and monitoring of air in the work enclosures will keep worker exposure to volatilized PCBs at a minimum; however, a treatment and dewatering process which requires less worker intervention (whether for cleaning, maintenance, etc.) and less worker contact with contaminated sediment is to be greatly preferred. Treatment trains involving extraction and destruction of PCBs, allowing dewatering to be accomplished with hydrocyclones, appear to be the best choices in terms of worker exposure as well as final destruction of PCBs.

EPA has chosen solidification and landfilling as its preference for disposal of PCBs. Clearwater has elaborated ("Treatment Technologies") the reasons why we consider this to be an insufficiently protective treatment. Solidification carries some additional risks in terms of volatilization, as well. The addition of lime or other cementaceous processes has been shown to encourage massive volatilization (ATSDR 1993; Constant 1995). The need for complete dewatering, probably requiring several cycles of various processes including belt filters, adds risk of volatilization. Finally, although PCBs in solidified sediment are relatively stable, there exists the potential that they can be rewet and escape back into the ecosystem.

Recommendations for Controlling Volatilization

The available evidence indicates that volatilization is currently a major input of PCBs to the ecosystem, but will be lowered as the waterborne PCB levels are reduced by remediation. Volatilization may also be a concern during remediation, and must be carefully managed for the protection of worker safety in the immediate area of dredging and treatment, for the protection of the public from potentially increased levels of airborne PCBs, for the prevention of potentially increased levels of PCBs in local agricultural products and for the prevention of any substantial fraction of PCBs reentering the ecosystem.

Fortunately, a few steps should suffice to ensure that volatilization is kept to an absolute minimum. To this end, Clearwater makes the following recommendations.

- **The design phase of the Hudson River remediation project must consider volatilization as a potentially significant byproduct of dredging. Volatilization must be minimized wherever possible.**

- **All efforts must be made to assure worker safety; in particular, the air in any enclosed areas on site must be tested and filtered, and workers must be provided with appropriate personal protective equipment.**

- **We recommend that hydraulic dredging be used wherever possible, reducing contact of contaminated sediment with both air and water.**

- **If mechanical dredging is used, all efforts must be made to restrict contact of the wet sediment with air. Barges must be closed. In cases of long travel times, air should be pumped out and filtered before off-loading.**

- **We recommend that the dewatering and solidification facilities be built to handle the volume expected from dredging, reducing the need for storage.**

- **In general, we recommend against storing material. Any stored material should be kept in lined and covered holding ponds and all measures taken to control volatilization.** The problems with volatilization from covered holding ponds in New Bedford reinforce the difficulty of storing contaminated sediment.

- **Dewatering, solidification, and treatment processes which are liable to release additional PCBs must be employed in enclosed spaces. The application of negative pressure and filtration of the pumped air will ensure that as little PCB is returned to the atmosphere as possible, while maintaining low levels inside for the health of the workers.**

- **Should it become unfeasible to treat sediment in the port, sealed modular shipping containers, transportable by truck and rail, would lend flexibility to the project.**

- **We recommend that a series of stations be established to monitor PCB levels in air in a variety of locations in, near and remote from the dredging projects. Total releases of PCBs should be estimated throughout the project.**

- **EPA must have processes to recover and filter or treat water and air from all storage containers and facilities.**

Finally, **Clearwater recommends that EPA establish the lowest possible target level for overall volatilization during the lifetime of the project. Even a target level of 0.1% would still represent 50 kg of PCB released to the environment.**

Conclusion and Recommendations

Clearwater applauds EPA's decision to actively remove PCB-containing sediments from targeted hot spots in the Upper Hudson. It has become perfectly clear that physical removal is the only way to protect the health of at least two generations of Hudson Valley residents, and to remove the blight of continual recontamination from the non-human biological communities of the Hudson Valley. Clearwater respectfully wishes to take this opportunity to point out areas in EPA's Proposed Plan that need to be improved, as well as elements that must be addressed.

1. Clearwater's remedy recommendation:

The Preferred Remedy is neither comprehensive enough, nor cost-effective enough. It has been made clear, from the foregoing analysis, that EPA's 3/10/SELECT preferred remedy is too timorous both in terms of PCB mass removed and cost-effectiveness. **<u>Clearwater strongly urges EPA to adopt a 3+/0/3+ remedial standard</u>.**

Clearwater believes that 3+/0/3+ best meets the tests of cost-effectiveness and human health protection. In support of this statement, we offer the following:

a) **A 3/0/3 option provides the best return on investment**, measured by cost per kilogram of PCBs, and may be as much as $2,000 per kilogram less expensive than the 3/10/select option.

b**) 3+/0/3+ removes almost as much PCB mass as 0/0/3, and more than 3/0/3, more cost-effectively, while reducing the amount of material that must be dredged by almost**

500,000 cubic yards.

c) 3+/0/3+ simply involves extending the removal operations beyond a strict perimeter defined by a 3 ppm contamination level. Three-plus is a pragmatic standard that will remove more PCBs, ease the navigational burden on the dredge operators, and as a result may save money.

d) The most recent NYS DEC fish data indicate that fish at river mile 168 (Stillwater) have lipid burdens of PCBs that average eight times greater than those of fish at river mile 11 (near the George Washington Bridge). It follows that the EPA remediation hypotheses for time to safe consumption of fish at weekly or monthly intervals may be reduced significantly (if not directly by a factor of eight) for fish caught in the tidal estuary. Hence, **where monthly fish meals may be safe 26 years post-remediation at Stillwater in the 0/0/3 scenario, thousands of subsistence anglers in the estuarine Hudson may be able to safely eat their catch weekly or better within a few years after remediation at the recommended 3+/0/3+ standard.**

Clearwater believes strongly that these elements present a compelling argument in favor of more-stringent remediation, and we believe that in addition to protecting public health, 3+/0/3+ is the most cost-effective scenario.

2. EPA's final ROD should specify hydraulic suction as the default technology, and establish criteria which must be met before mechanical dredging is permitted.

There are many reasons for hydraulic dredging to be so specified:

a) Hydraulic dredging produces the lowest levels of resuspension.
b) Hydraulic dredging can be engineered to minimize volatilization.
c) Hydraulic dredging works faster than mechanical dredging.
d) The ability to pipe the spoils as far as ten miles can reduce heavy equipment traffic on the river.

The choice of dredging technologies, and the values they embody, must not be left to a contractor.

3. Clearwater believes that simultaneous removal in all three river sections is crucial to meeting any reasonable time to completion – with caveats.

Several municipalities have suggested a phased-in approach to remediation, beginning in Section 1 and proceeding downriver to Section 2, then 3. The advantage to this would be prevention of downstream recontamination and increased possibility of recapturing minor amounts of sediment that have been resuspended. The disadvantage is time-to-completion.

The advantage of EPA's plan to have environmental dredging occurring simultaneously at various locations is that the remediation project can be completed more expeditiously. Clearwater is confident that the proposed combination of protective mechanisms including the use of silt curtains and continuous monitoring minimize resuspension and remobilization so effectively that simultaneous worksites should be employed.

4. Only one water treatment facility is needed.

Material from River Section 3 can be barged or piped to one location, rather than building a second dewatering facility in the Albany area. The dewatering facility can offer a win-win solution to the host community and the project if it is sited in exchange for full remediation of existing upland hazardous waste sites created by NYS DOT, which dumped PCB-laden dredged spoils upland to maintain navigation before PCB contamination was known about.

5. The remnant deposits and reach from Hudson Falls to Fort Edward must be addressed.

Clearwater urges EPA, in the strongest possible terms, to invite and cooperate with NYSDEC to reopen and reassess the remedial orders that capped the remnant deposits left behind when the Fort Edward dam was dismantled. It is clear that PCBs are leaking from those deposits, as evidenced by the USF&WS tree swallow study. Those deposits contain massive quantities of PCBs, and constitute an accident waiting to happen. Located, as they are, upstream of all the hoped-for PCB removal sites, the remnant deposits have the potential to recontaminate the river and render even the most stringent remediation an exercise in futility. Because of that nexus, the remnant deposits must be bundled in with the remediation of record.

Similarly, the reach of river between Hudson Falls and Fort Edward seems to have been orphaned. This reach needs to be defined, assessed, and folded into the record of decision as an addendum after the fact. While this reach may not present the danger posed by the remnant deposits, it still has the capacity to recontaminate remediated areas over the long term, assuming source control has been successfully completed.

6. The Proposed Plan's preferred remedy overlooks the importance of geographic dispersion of PCBs.

Recognizing that PCBs are persistent organic pollutants that are easily being dispersed throughout the biosphere, Clearwater's perspective includes a concern about the effects of PCBs on human, wildlife, and the environment, locally and globally. First, EPA offers little acknowledgment of the global distribution of PCBs to diverse ecosystems, including the ocean and all oceanic species, and little recognition of the potential for redistribution via atmospheric transport to upland areas, including crops, all forms of habitat, and inland waters both near and far. While we acknowledge that insufficient study exists in the area of volatilization as a route of exposure to humans, EPA's apparent dismissal of volatilization as insignificant needs to be revisited.

This policy shift will be a crucial prerequisite for the design of non-volatilizing remedial facilities and infrastructure.

7. Prevent volatilization by enclosing systems, handling, and transport, and maintaining negative air pressure in material-handling facilities.

Volatilization has been described in detail herein. Clearwater strongly urges EPA to specify of its contractors that all structures in which PCBs are stored or handled be enclosed, airtight, and maintained at a pressure slightly below ambient to prevent leakage of PCBs into the environment.

Settling basins can be covered with floating membranes, and dredged spoils pumped directly beneath the membrane. All water treatment should be enclosed, and the removal of sediment from the settling basins accomplished through conveyors or other means that can be enclosed.

EPA might consider the use of modular containers to transport materials from the handling buildings directly to the point of discharge into a TSCA-approved facility. Containers offer the flexibility of being suitable for truck or rail, and are closed. They can be returned empty without extensive cleaning, for savings of time and money.

Worker safety must be assured by observance of all OSHA and NIOSH regulations, plus protection from dermal and inhalation contact with PCBs. This should take the form of protective clothing and either activated carbon or outdoor replacement respiration equipment, as well as continual (> 4x/hr.) filtration of ambient air in the buildings. Even barges should be closed after filling for transport and layover.

8. Clearwater believes that EPA should revisit treatment technologies.

Originally driven by the vast market for destruction of chemical and biological weapons, sediment treatment technologies, which can remove or destroy PCBs found in dredged spoils, offer a number of potential benefits – possibly including cost-effectiveness.

a) The quantity of gravel and backfill that must be mined will be reduced if decontaminated sediment can be put back in the river.

b) New York Harbor, with its contaminated sediment problems, has provided a test-bed for treatment technologies. The volume is so great, and the concentrations so small, that the costs of sediment treatment have been deemed unaffordable for the most part, but several technologies have been demonstrated at scales never before achieved.

c) Treatment technologies are most cost-effective when applied to the most highly-contaminated sediment. Not only is the product of the process re-usable, but the most costly shipment and disposal can be obviated.

9. PCBs are harmful to human health.

Clearwater's findings support our early contentions that PCBs are harmful to human health. The results of our colloquium at the SUNY School of Public Health were unequivocal. PCBs cause developmental problems, learning disabilities, physical deformities, hormonal disruption in many forms, immune system disruption, and cancer. Both acute and chronic effects have been repeatedly observed by researchers around the world.

Our analyses of GE's human health studies reveal a grossly unethical a priori structural bias in GE-funded studies, which renders Kimbrough's study and others almost entirely without value.

We have also learned that GE has sequestered the medical records and names of 60-100 former capacitor workers at its corporate headquarters in Fairfield, CT. GE promptly reached an expensive settlement with the Town of Moreau rather than reveal those names and records. Clearwater urges EPA to demand those unredacted records to help fill in the gaps surrounding the legendary health problems experienced by capacitor workers.

It is widely believed that GE settled preemptively with families afflicted by PCB-related illnesses. It would be very helpful for the historic record and for the sake of better understanding the effects of PCBs on human health if EPA were to develop and support a legal instrument indemnifying these GE beneficiaries from any recourse or retribution that might accrue following their complete and candid testimony before public health researchers.

10. PCBs are harmful to wildlife.

It is clear that PCBs are entering wildlife, bioaccumulating to levels that classify some animals as hazardous waste, and impairing their reproductive viability. These effects have been observed in snapping turtles, mink, river otters, muskrats, tree swallows, terns, cormorants, eagles, osprey, owls, and many other organisms. GE has made much of the return of the bald eagle, as if to say that it was in some way responsible. In fact, the eagle's comeback is due almost solely to the efforts of Peter Nye at the NYSDEC, whose hatchling relocation efforts undid the damage from decades of DDT contamination which caused local extinctions of the bird. The question should be asked: how would the eagles be doing without exposure to PCBs?

11. Clearwater believes that the PCB discharges were illegal from start to finish.

While not directly affecting remediation, the issue of legality is important to many communities. Some people object to Superfund on principle, citing a fundamental unfairness in forcing a polluter, which was ostensibly law-abiding, to pay for an expensive cleanup. It will be important, assuming that GE continues its advertising campaign to undermine popular support for the remediation itself, to fold the legality issue into any public outreach.

a) GE was in violation of the Federal Rivers and Harbors act for the entire term of manufacturing at Hudson Falls and Fort Edward.
b) GE was in violation of State water quality standards from their inception in 1965.
c) GE violated its SPDES permits 129 times, including citations which covered 30-plus individual exceedances.

12. The economic benefits of a remediation are clear and significant.

a) Navigational dredging of NY Harbor will be less expensive without continual recontamination, saving the taxpayers millions per year.
b) Over 4,500 jobs will be created during and after the term of remediation.
c) The GRP (gross regional product) of Saratoga and Washington counties will jump by $800,000,000 as a direct result of the remediation.
d) Property values post-remediation will rebound throughout the Hudson Valley. The observed range of rebound is from 2%-8%, which could increase the capital stocks of the Hudson Valley by billions of dollars.
e) As many as 8,900 new long-term jobs could be created post-remediation, resulting in an economic benefit of hundreds of millions of dollars throughout the Hudson Valley.

13. Clearwater urges the use of biodiesel fuels. Other transport issues need to be addressed.

Diesel exhaust has been brought up as a potential problem for the quality of life in the areas being remediated. Diesel exhaust can be made far more benign through the use of soy diesel biofuel, which will eliminate CO emissions, decrease particulates by 75%, and achieve significant reductions in SOx and NOx. Clearwater strongly urges that all vehicles, vessels, and stationary engines involved in the remediation be fueled with soy diesel.

Engines should be muffled to the greatest extent possible. Noise levels have been a concern shared with us by many communities.

An additional rail siding may be needed to accommodate up to 45 boxcar or container-loads of dewatered sediment per day.

EPA should specify that material shipped by rail to existing hazardous waste landfills go directly on-site without having to be transshipped onto trucks, to avoid double handling and save money.

14. Public Participation must be continued proactively throughout the entire remediation process.

Several communities and other sources have told us disturbing stories about the responsiveness of EPA after delivery of a ROD. In Cold Spring, NY, for example, phone calls were ignored, elected officials rebuffed, and community concerns unanswered. The village has an abiding distrust of EPA emanating from the Foundry Cove cleanup. This must not be allowed to happen during the upper Hudson remediation, as it will certainly engender vehement and possibly obstructional opposition from many sectors.

EPA's final ROD must specify a holistic structure for ongoing public input during remedial design phase and throughout remediation and follow-up monitoring. The system should include a Hudson River PCB Remediation Advisory Committee, an oversight group with no veto power but with the power to force reconsideration and/or appeal upon a significant majority vote. It should be comprised of representatives from local municipalities, municipalities that take drinking water from Hudson, municipalities with subsistence fishing communities, health experts, scientists, environmental experts, citizens groups, representatives of the dredging industry, treatment technologies representatives, economists, and academics.

Absent from this group is the PRP, which will undoubtedly be well-represented by certain "citizen" groups. The PRP's contact with EPA must be outside the public process, which was so effectively manipulated over the years of the PCB Reassessment, and restricted to issues of finance, legality, and logistics. The people of the Hudson Valley overwhelmingly believe that GE has been gaming the process throughout, and want the manipulation to stop.

EPA and the Department of Justice should vigorously investigate obtaining injunctive relief from GE's advertising campaign, if it continues past the end of the public comment period. If the campaign continues, it can only be for the purpose of undermining the credibility and effectiveness of a government agency, and hence must be regarded as purely destructive.

EPA has enjoyed the support of many environmental and civic associations, which have played a pivotal role in education and in balancing the public discourse. Clearwater believes that the remedial budget should include substantial funds for educational and outreach efforts, both internal and external to EPA. We call for EPA to create and staff three satellite offices, and to offer grants for educational and technical assistance.

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Attachment C

Hudson River Sloop Clearwater's Comments on Hudson River Natural Resource Damage Assessment (NRDA) Plan of September 16, 2002.

Prepared for the Trustee Council
of Hudson River PCB Natural Resource Damage (NRD):

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November 29, 2002

Prepared by

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Hudson River Sloop Clearwater's Comments on
Hudson River Natural Resource Damage Assessment (NRDA) Plan

Clearwater commends the Natural Resource Damage (NRD) Trustees on a thoughtful and comprehensive proposal, which outlines a Damage Assessment Plan that includes pathway and injury determination and quantification, and damage determination and restoration.

Ecosystem Approach to Restoration:

Clearwater joins the Friends of A Clean Hudson (FoCH) in urging the Trustees to take an ecosystem approach to restoration that acknowledges the interconnectedness of all parts of a given biological system. Although the primary impacts of the Hudson River PCB contamination are clearly to the river itself, its floodplains and the biota in the Hudsonia bioregion, the ecosystem that has been most impacted is not a closed system. The Hudson River flows into the Atlantic Ocean, which mixes with currents from around globe. Much of the wildlife that passes through the Hudson River Valley is/are migratory species. Winds blowing across the region carry airborne PCBs to distant lands. It is therefore important that the Natural Resource Damage Assessment, which focuses on Hudson River impacts and solutions, also maintains a global perspective.

Full Site Assessment:

Based on the remedial investigation work conducted by the EPA, it has been established that the General Electric Company is the primary source of PCB contamination in the Hudson River. As the primary source for PCB contamination, GE is the party responsible for the cost of remediation and restoration of the Hudson. The NRDA plan should clearly state that GE is the PRP, and should not include other potentially responsible parties.

As a result of General Electric's discharges of PCBs and pursuant to the Comprehensive Environmental Responsibility, Compensation and Liability Act (CERCLA), commonly known as Superfund, EPA has designated 200 miles of the Hudson River, from Hudson Falls to New York City, as a Superfund site. This stretch of the Hudson has long suffered as a result of GE's PCB contamination, and it is imperative that the NRD restoration address the entire 200 miles.

Additionally, while it is outside of the scope of the Superfund remediation, the impacts of the upland PCB waste sites at GE-Moreau, the Old and New Moreau sites, Special Area 13 and others should be taken into account when injury determination and restoration proposals are made in order to truly accomplish a full site assessment.

The contamination of the Hudson by GE's PCBs, beginning in the 1940's, has deprived the public of the fundamental use and enjoyment of the resources of the river, including fishing, swimming, boating and other more passive pursuits such as bird watching and relaxing by river's edge. The NRDA should be mindful of all affected communities and should provide appropriate compensation throughout the entire Superfund site.

Furthermore, the Trustees should approach the NRDA from both a retrospective and prospective point of view. That is, the Trustees should place a value on the resource damage that has been done since GE's initial discharges of PCBs, as well as looking to a point in the future where it can reasonably be assumed that the river will no longer be suffering from past GE PCB contamination. In order to achieve this goal the Trustees should use a contingent valuation approach for estimating future damage costs, and a substantial fund should be held in trust for the cost of restoration projects required in the future.

Importance of Public Participation, Outreach and Education

In our comments to the EPA on the proposed remediation of the Hudson, Clearwater stressed the importance of public involvement in achieving our goal: a world class Hudson River remediation. Similarly, we believe that public participation in the NRDA process will be critical to the successful outcome of the NRD restoration.

Clearwater joins with FoCH in commending the Trustees on their efforts to inform the public about the NRDA process by hosting availability sessions throughout the Hudson Valley. We urge the Trustees to remain steadfast, and not be discouraged by the relatively low turn-outs at the availability sessions. The fact that few people participated in the these sessions was in no way an indication of lack of interest, but was more likely due to unfamiliarity with the notion that citizens could play such an important role in a government project.

In an effort to encourage increased public involvement in the NRDA process, Clearwater will continue to assist the Trustees in their outreach efforts by communicating with our 10,000 members, 1,500 – 2,000 annual adult passengers aboard the Sloop Clearwater, and approximately 15,000 – 20,000 attendees of the Great Hudson River Revival, about the importance of getting involved in the NRDA process. We, along with FoCH, are committed to educating the public about the distinction between the remediation of the PCB "hot spots" and the restoration of the entire Superfund site.

Clearwater will work closely with the Trustees to disseminate information about possible restoration projects, and will continue to encourage the public to submit restoration project proposals for areas in which they believe compensation is due. In keeping with our willingness to work cooperatively with the Trustees, Clearwater requests that the Trustees work with the stakeholders, by keeping them apprised of the status of any ongoing negotiations between GE and the Trustees, and by making public any proposed restoration projects or negotiated settlements.

Great Hudson River Revival:

As the sponsoring organization, Clearwater would like to point out a minor omission we noted on p. 17 of the NRDA Plan in the discussion of recreation, transportation and tourism as an integral part on New York State's economic well being. The section includes detailed descriptions of historic sites, commercial cruises, recreational boating, parks and campgrounds and festivals and performances as Hudson River tourist attractions. Clearwater requests that NRD specifically include our annual festival, the Great Hudson River Revival, along with the Hudson Valley Shakespeare Festival, the Hudson Valley Film Festival and the Hudson Heritage Festival as an integral part of the Hudson Valley's cultural heritage. The Clearwater Revival, which reaches 15,000 to 20,000 participants per year, features six solar-powered stages which offer a wide variety of musical entertainment, dancing, puppetry, storytelling, crafts, and other cultural and recreational activities. In addition, the education and advocacy that occurs at Revival was in no small part responsible for the wide-spread support for remediation which resulted in EPA's historic decision of August 2001 to require General Electric to clean up the approximately 1.3 million pounds of PCBs it had discharged into the Hudson. Likewise, Clearwater is now actively educating the public about the NRDA process and encouraging participation in the design of proposed restoration projects.

Pathway Determination

Clearwater believes that the review copy of the NRDA Plan is rigorous and comprehensive in its evaluation of most of the affected natural resources, with the exception of air. When PCBs were first discharged into the Hudson, it was a common misperception that the river would wash the chemical, known toxins, away. Since then we have learned that, especially with persistent contaminants, there is no such place as "away" and that dilution is not the solution to pollution. When wind currents blow volatilized PCBs out of the Hudson Valley, the air here becomes at least temporarily cleaner at the expense of living systems elsewhere.

Volatilization as a Pathway of Exposure: The Assessment Plan specifically includes air in its definition of Hudson River resources for which PCB exposure has been confirmed, however air is not yet identified in the NRDA Pathway Determination section of Chapter 4 as a significant path for distribution of PCBs throughout the ecosystem. The pathways listed in on p. 36 of this section include "contaminated soil, sediment and water," but not air. Injury determination and quantification is underway for various species of fish, birds, mammals, reptiles and amphibians, as well as for surface water, groundwater, and geologic resources. For air, the Trustees are now "reviewing existing information to determine if they will undertake additional studies and prepare a report documenting the extent of the injury, or make a determination that provides the basis for removing this resource from the assessment." Clearwater feels strongly that, in view of the huge body of evidence that PCBs volatilize from water and from sediment on an ongoing basis and then disperse throughout the global ecosystem, it would be a serious oversight to omit this injured resource from the Assessment or to conclude that its contribution to the problem was insignificant. We are willing to provide documentation and other assistance to advocate for its inclusion in the final damage determination and to demonstrate the nexus for determining appropriate restoration projects. A bibliography of articles and studies on PCB volatilization is included with Clearwater's comments to EPA on volatilization, dated April 17, 2001, as Attachment A, and copies of select articles as Attachment B.

Most analyses of routes of exposure to PCBs have traditionally focused on ingestion and the subsequent process of bioaccumulation by which PCBs are increasingly concentrated in higher trophic levels. Concentrations may be magnified millions of times from microscopic biota to the top predators in the food web. While ingestion is certainly a major route of exposure for PCB contamination, inhalation is also an important route to both wildlife and to humans. Renowned researchers including Dr. David Carpenter, Ann Casey, Ron Scrudato and others increasingly believe that inhalation may, in fact, be a major pathway. For humans, inhalation represents an ongoing, involuntary route of exposure. People who are aware of fish advisories may intentionally avoid consuming contaminated fish, but they cannot avoid exposure from PCBs that have volatilized from contaminated sediments into the air they breathe especially those living close to hotspots of PCB containing sediments that are frequently exposed to air. Mammals, amphibians and reptiles and non-aquatic plants all participate in respiration of air that contains small amounts of PCBs. It has been estimated that for humans living near PCB contaminated sites breathing the air for one year is equivalent to one toxic fish meal.

A 1998 study by Ann Casey *et al* at the University of Albany School of Public Health noted, "PCBs have been considered to be almost nonvolatile and insoluble in water. However, recent studies have shown the importance of their slight solubility in water and capability to enter the atmosphere and disperse throughout the global environment." Casey *et al* exposed rats to Arochlor 1242 -- the major pollutant of the Hudson River and of New Bedford Harbor -- for 30 days by inhalation (0.9 ppm) and ingestion (0.436 ppm). Their findings showed that "inhalation of PCBs gave greater PCB uptake than ingestion." Both exposures led to significant serum thyroid hormone elevations, histopathologic changes in urinary bladder, thymus and thyroid and behavioral changes.[1]

A 1993 sampling by Jeff Chiarenzelli, Brian Bush *et al* of PCBs on Akwesasne lands near three Superfund sites along the St. Lawrence River demonstrated increased volatilization of Arochlor 1248, the principle contamination at these sites, particularly in summer.[2]

A March 1996 study by Garton *et al* in New Bedford Harbor noted that the physical properties of individual PCB congeners drive them toward sorption or volatilization. "Their preferred phases are sediment or air due to their hydrophobicity." [3] Garton, Richard Bopp and others have noted a greater sediment affinity with increased percent chlorination, and a corresponding increased tendency of lower chlorinated PCBs to volatilize.[4]

According to Fiedler, “PCBs in the Great Lakes…volatilize where a river discharges relatively high PCBs loads into Green Bay.” Baker and Eisenreich [1990] calculated an average volatilization rate of PCB to be “approximately equal to atmospheric deposition.” Their findings support the conceptual model that PCBs permanently cycle between atmospheric and natural waters [Mackay *et al* 1986]. “According to this model PCBs dissolved in rain drops (low chlorinated) or sorbed to particulates (higher chlorinated) are washed out of the atmosphere by rain. This input from PCBs into surface waters results in a fugacity gradient towards the atmosphere, which in turn drives volatilization.” [5]

Volatilization of PCBs necessitates taking appropriate precautions during remediation. The work of Dr. Ron Scrudato and of Chiarenzelli *et al* demonstrates the high rates of volatility of PCBs from drying sediments under laboratory conditions and underscores the necessity to take extreme caution during remediation.[6] [7] [8] [9] [10] This includes entirely enclosing the dredging, conveyor and water treatment systems, containing stored sediments under negative pressure, filtering the air before it is released into the environment, minimizing storage time, and assuring that workers use appropriate personal protective equipment when working near or with PCB-contaminated sediment. Even when these precautions are maintained, small amounts of PCBs may escape into the environment, adding to the historic load that has resulted from years of ongoing daily and seasonal exposure of contaminated sediments to air as river water ebbs and flows. Clearly the liability for all this contamination must be assigned to General Electric as the potentially responsible party in this case.

New Bedford Harbor PCBs in local vegetation. Cullen *et al* of Harvard School of Public Health measured ambient air samples in 1993 and determined that background PCB levels in the area were caused by volatilization of PCBs from highly contaminated sediments during low tide when sediments come in direct contact with air. They then found that PCBs in air and in local produce on area farms increased above background levels during the 1994-95 dredging season, especially in tomatoes grown downwind of the hot spots. “Our results are consistent with the view that atmospheric transport and gas-phase transfer play a pivotal role in influencing the concentrations of PCBs in plant tissue. This work is an initial step toward gauging the significance of the consumption of local produce as a pathway of human exposure to PCBs in New Bedford before and during dredging.” [11] Air transport was the pathway from sediment to vegetation.

Global Transport of PCBs

While there are clearly many other sources of PCBs in the ecosystem, the two plants at Hudson Falls and Fort Edward are the source of the largest Superfund Site in the U.S. GE’s contribution to the global PCB burden that originated from these two sites over more than 30 years was substantial. The global burden that accrues from these sources is definitely calculable, and must be included in a comprehensive assessment.

The 1996 book on endocrine disruption, *Our Stolen Future* by Theo Colburn, Dianne Dumanoski and John Peterson Myers, has been heralded as "the *Silent Spring* of the 90's." In it Colburn *et al* cite evidence discovered by Oystein Witt that PCBs in polar bears in the pristine area of the Svalbard on the northeast of Greenland at 79 degrees north latitude "carry as much as 90 parts per million of PCBs in their fat. Researchers studying declining seal populations have found that 70 ppm of PCBs is enough to cause serious problems to females, including suppressed immune systems and deformities of the uterus and the fallopian tubes. " [12]

Muir, Nordstrom and Simon have measured the PCBs levels in arctic ringed seal in the Barrow Strait near Resolute of the Northwest Territories to provide information on the variability of congeners and homologues between age classes and sex within the seal population as a baseline to assess biological effects of individual congeners on seals in a relatively pristine environment.[13]

How did the PCBs get to these remote areas of Arctic wilderness? Colburn *et al* postulate that the combination of atmospheric and water transport moves these persistent chemicals to the four corners of the earth. PCBs are "notorious for combining the devilish properties of extreme stability, volatility and a particular affinity for fat." [14] Tracing the transport of a hypothetical PCB molecule they describe a cycle of volatilization and deposition that results in global transport, with the Arctic and Antarctic becoming the ultimate sinks for PCBs and other toxic contaminants. "In the heat of the Sargasso sea, the molecule suddenly vaporized, and carried on the prevailing winds, began to hopscotch north. Alternating between liquid and gas, it rode the winds farther and farther north." In cold northerner climates where volatilization is less likely, PCBs molecules move by ocean currents and through the food web. The Arctic food web "includes many long-lived animals that accumulate significant amounts of contamination over a lifetime. For this reason the Arctic food web concentrates and magnifies persistent chemicals to an even greater degree than that of the Great Lakes." [15]

To quote from the abstract of the Iwata *et al* study, "Distribution of Persistent Organochlorines in Oceanic Air and Surface Seawater and the Role of Ocean on Their Global Transport and Fate":

> *"Concentrations of organochlorines such as…PCBs were determined in air and surface water from various oceans in 1989-90, for understanding their recent distribution and the role of the ocean in long-term atmospheric transport and fate on global terms... Chlordane and PCBs exhibited rather uniform distribution in both hemispheres. Estimations of fluxes by gas exchange across the air-water interface gave insight into the dispersal of organochlorines through oceanic atmosphere depending on their Henry's law constant and the tendency of more transportable ones to deposit in cold waters as an ultimate sink."* [16]

A recent Washington Post Article entitled "Arctic Canada's Silent Invader" describes how Inuit people in the community of Iqaluit in the Baffin Islands have been impacted by PCBs and other persistent organic pollutants. The article notes that "toxins travel here in low concentrations in ocean currents, or in the winds, falling in places where they have never been used…More than 6 tons of PCBs reached the Arctic each year this way polluting the water and tundra." "They move up a simple food chain until the reach high concentrations in the fat of whales, walruses and seals," according to Dr. Miriam Diamond of the University of Toronto. "In more temperate climates, the chemicals dissipate in trees and soils and on the sides of buildings, but in the Arctic you don't have that…it gets into the ocean where it accumulates in mammals." "Inuit hunters are reporting abnormalities in animals: seals without hair, polar bears with reproductive organs of both sexes, and seals with cigarette-like burns in their skin." [17] Clearwater acknowledges that tracing the causative PCBs to the Hudson River and assessing their precise contribution to these injuries will be difficult, but ignoring volatilization as a pathway for moving PCBs throughout the global ecosystem is indefensible.

Injury Determination and Quantification

Exceedance of Established Standards: Clearwater strongly agrees with Friends of a Clean Hudson and with the NRD Trustees, that an exceedance of existing regulatory criteria, the existence of state health consumption advisories, closures or restricted use of resources demonstrate an injury. However, we also believe that injury can occur without such standards being exceeded. This is primarily because the persistence of PCBs in the ecosystem and in individual organisms leads to cumulative effects over time that may be missed in individual samplings.

Recommended Studies:

- *Monitoring PCBs before, during and after dredging.* ***While this responsibility falls clearly within EPA's Hudson River PCB remediation, it is essential the NRD trustees recognize the importance this information holds for its own assessment: pathway determination, injury quantification, damage determination and restoration planning. This includes monitoring for potential sediment resuspension or remobilization, and for volatilization at the individual worksites and water treatment facilities, in the communities near the remediation, and in the communities surrounding the ultimate disposal sites.***

- In addition, NRD Trustees should obtain their own baseline and follow up air monitoring and tree bark studies to determine the impacts on air and the impacts from volatilization on other resources.

Damage Determination and Restoration

Fisheries:

Commercial:

Although a private settlement was reached regarding compensation for the loss of the commercial fishery, the NRDA process should evaluate the impact this loss has had on the people that were not party to the settlement. The public has lost a valuable food source, the state has lost the economic benefits of commercial fishing, and many people who might have chosen fishing on the Hudson as a profession were forced to look elsewhere. The public is deserving of compensation for all of these losses.

Recreational:

To many recreational anglers the Hudson River has lost its appeal as a fishing destination. The idea that they are fishing in contaminated water, and in fact a Superfund site, runs contrary to what most recreational anglers are looking for when they plan a fishing trip. The combination of fishing bans and fish consumption advisories have greatly impacted the public's perception of the Hudson. The Trustees should look for restoration projects that will compensate the public for the loss of this important recreational fishing area.

Subsistence/Cultural:

Many people fish as a means of providing food for their families, or as an important part of their cultural heritage. For these people, fish advisories and prohibitions against eating fish from the Hudson have posed more than an inconvenience – these people have been denied an important source of nutrition. Clearwater urges the Trustees to ensure that subsistence anglers are comprehensively identified and compensated for their loss of a source of nutrition.

Recreation and Tourism:

The significance of the Hudson River as a recreation and tourism attraction cannot be overstated. The Hudson Valley has been a tourism destination from the earliest days of this country, and the river lends its name to an American art movement that set the standard for landscape painting across the world. It has been called "The American Rhine," "The Landscape that defined America," and "America's First River."

However, the stigma attached to the Hudson by virtue of its reputation as a toxic river, and now as a Superfund site, has had severe impacts on the recreation and tourism interests along the river. The public should be compensated for the lost use of the river and its natural resources as a recreation and tourism destination, and the Trustees should develop restoration projects that will serve to counteract the river's negative image.

Navigation:

Clearwater applauds the work the Trustees are already doing to assess potential loss or impairment of services in the Champlain Canal and encourage a similar study of the lower Hudson, including New York Harbor. It has been the experience of many municipalities that disposal costs of PCB-containing sediments increase substantially in navigational dredging projects, even for low levels of PCBs.

For example, the Village of Haverstraw incurred increased costs for the proposed redevelopment of their downtown waterfront district when they were found to have PCBs from the upper Hudson in river sediment which exceed the allowable levels for ocean dumping. Dredge spoils from navigation and construction from this site will have to go to a landfill, which greatly increases disposal costs.

Proposed Restoration Projects:

A Bioregional/Ecological Approach: While the current plan to involve the public and solicit ideas for restoration proposals is a worthwhile endeavor--one that Clearwater heartily supports -- it represents a somewhat piecemeal approach to determining restoration projects. Some of these projects will improve river access for human use as a compensation for lost services; others have more direct effects of enhancing the quality of the river ecosystem or improving habitat for specific species. (See List of Proposed Restoration Projects, Attachment C.)

In January 2003 Clearwater will join the Friends of A Clean Hudson coalition in convening a brainstorming session that will take an ecosystem approach to restoration, with advice from scientists from the Institute for Ecosystem Studies, Hudsonia, Hudson River National Estuarine Research Reserve, Lamont Dougherty and others, and the help of a professional facilitator. Invitations will be extended to major Hudson River advocates, anglers, scientists, economists and others. The purpose of this meeting (or series of meetings) is to design major proposals that will have the maximum impact in moving us toward full restoration of the ecosystem of the Hudson River bioregion, with specific focus on the upper and lower Hudson areas and New York Harbor, as well as on the global ecosystem.

- **Establish a Foundation for Habitat Restoration, Environmental Education, Pollution Prevention, and POPs Elimination** in the Hudson Valley to provide education, to support ongoing research, and to propose and promote legislation and regulations that will contain, phase out and ultimately eliminate persistent organic pollutants from the environment.

One of the primary goals of this project would be to educate citizens about pollution prevention, remediation and restoration. This would include training of staff and volunteers to effectively implement selected restoration projects, including habitat improvement and enhancement for impacted species. It would help citizens to fully understand how fragile the river ecosystem is and to assure that such contamination is prevented from ever happening again.

PCBs are deleterious in isolated exposures, however, like many other organochlorines and other endocrine disrupting chemicals, there may be interactive and additive effects from mixed exposures. Colburn, Dumanoski and Myers point out that, in the real world, toxic chemicals are rarely encountered alone, but in complex mixtures. "Scientific studies make it clear that chemicals can interact or can act together to produce an effect that none could produce individually." This synergistic effect, including exposures from a variety of sources – air, water, food, soil – may lower the level at which exposure results in injury. "Although exposure from any single source may be tolerable, the total from all sources may be unsafe. For this reason, contaminant levels from any single source much be assessed within the context of cumulative exposure."

PCBs are persistent organic pollutants (POPs) and have been designated by the Stockholm Convention of 2001 as one of the "dirty dozen" contaminants to be eliminated from use on a worldwide basis. Others persistent compounds include a variety of pesticides, dioxins and furans. Clearwater believes that the first priority should be to remove as many sources of contamination as possible, including sources outside of EPA's current PCB remediation plan, such as the upland deposits created from earlier dredging operations. Beyond actual remediation, one of the best ways to reduce the impact of Hudson River PCBs is by ongoing pollution prevention. To this end the Foundation should partner with the International POPs Elimination Network to support a phasing out of chemicals, which can contribute to synergistic effects with PCBs in local and global ecosystems.

The International POPs Elimination Network (IPEN) is a global network of public interest non-governmental organizations, which support a common goal of POPs elimination. Its mission is "to work for the global elimination of persistent organic pollutants, on an expedited yet socially equitable basis." Founded in early 1998 by a small number of NGOs, IPEN was formally launched with a public forum at the first session of the UNEP Intergovernmental Negotiating Committee (INC1) in Montreal in June 1998 to develop a global, legal instrument to control and/or eliminate persistent organic pollutants (POPs). Throughout the course of the five negotiating sessions, the network grew to include more than 350 public health, environmental, consumer, and other non-governmental organizations in 65 countries, with extensive grassroots support for a global treaty to eliminate POPs. The final negotiating session was held in December 2000 in Johannesburg, South Africa. On May 23rd, 2001 more than 90 nations signed the Stockholm

Convention (POPs Treaty) in Sweden that legally requires the elimination of the worst known toxic chemicals. EPA chief Christine Todd Whitman signed the treaty on behalf of the United States.

- **Funding for Future Initiatives:** The Foundation should also include funding to allow for open-ended reassessments and ongoing research, and to allow for new initiatives as they occur.

- **Upper Hudson Nature Preserve:** One restoration proposal might be a the creation of a large wildlife preserve in the upper Hudson region to provide habitat support for the bald eagle and other impacted wildlife.

- **Reproductive Assistance for Marine Mammals:** Establish a program to support marine mammal populations suffering from reproductive injuries as a result of PCB exposure, such as breeding in captivity and reintroduction into the wild.

Restoration Projects to Compensate for Loss of Services from Injured Resources:

- **Nutrition Replacement Programs:** Replace the nutrition lost to subsistence anglers, and those for whom fishing is an integral part of their cultural heritage, as a result of restrictions on catching and eating fish from the Hudson over the last 25 years.

- **Medical Monitoring:** In spite of health advisories, it is well documented that many subsistence anglers continue to eat Hudson River fish. In addition humans have been exposed through groundwater contamination, ingestion of soil, and inhalation of PCBs that volatilize on an ongoing basis. Although Clearwater acknowledges that it is possibly beyond the scope of NRDA to address medical monitoring directly, we believe that it is within the purview of the NRD Trustees to recommend that appropriate agencies, such as the NY State Department of Health, seek funding to sponsor appropriate health studies of Hudson River anglers and residents local to the plant sites and upland disposal sites, and other exposed individuals.

  In fact, this monitoring should also be extended to all those at risk from exposure because their dietary practices make them especially vulnerable to PCB exposure. For example, the Inuit people in the Arctic depend on seal meat and whale blubber, which contain especially high concentrations of PCBs due to bioaccumulation. Nursing mothers then pass on this toxin through their breast milk to their infants. There is good evidence that at least a portion of these PCBs originated in the Hudson River.

Once these proposed restoration projects are refined they will be submitted on the appropriate Hudson River NRDA Restoration Proposal Forms to Larry Gumaer at the NYS DEC.

Attachments:

A) Volatilization Section of Clearwater's Public Comment to EPA on their Proposed Hudson River PCB Remediation and Volatilization Bibliography

B) Packet of Selected Articles on PCB volatilization

C) List of Restoration Projects proposed to date

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