PROPOSED REMEDIAL ACTION PLAN
HARBOR AT HASTINGS
Operable Unit No. 1

Village of Hastings-on-Hudson,
Westchester County, New York
Site No. 3-60-022

October 2003

Prepared by:

Division of Environmental Remediation
New York State Department of Environmental Conservation

PROPOSED REMEDIAL ACTION PLAN

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Operable Unit #1
Village of Hastings, Town of Greenburgh
Westchester County, New York
Site No. 360022
October 2003

SECTION 1: SUMMARY AND PURPOSE OF THE PROPOSED PLAN

The New York State Department of Environmental Conservation (NYSDEC), in consultation with the New York State Department of Health (NYSDOH), is proposing a remedy for Operable Unit #1 (OU 1) of the Harbor at Hastings site. This remedy is proposed to address the threat to human health and the environment created by the presence of polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), lead, copper and other inorganic contaminants at the site.

The presence of hazardous waste has created significant threats to human health and/or the environment that are addressed by this proposed remedy. As more fully described in Sections 3 and 5 of this document, past wire manufacturing operations have resulted in the disposal of hazardous wastes, including polychlorinated biphenyls (PCBs) and metals. These wastes have contaminated the soil and groundwater beneath the site, and the sediments and ecosystem of the adjacent Hudson River. These disposal activities have resulted in:

- a significant threat to human health associated with potential exposure to contaminated soils and groundwater;
- a significant environmental threat associated with the impacts of contaminants to groundwater and the surface water, sediment and ecosystem of the Hudson River.

To eliminate or mitigate these threats, the NYSDEC proposes the following remedy:

- Excavation and off-site disposal of PCB-contaminated soil to a maximum depth of 9 feet in the Northwest Corner and along the Northern Shoreline of the site,
- Containment of remaining deep contamination in the Northwest Corner and Northern Shoreline areas using a slurry wall, sealed sheet pile bulkhead, and an impermeable cap,
- Outside of the Northwest Corner and Northern Shoreline containment areas, excavation, to a maximum depth of 12 feet, of all PCB-contaminated soil. For the few areas where PCB contamination exceeds 12 feet, soil would either be excavated by alternative methods, or contained within a watertight sheet pile structure and capped.

- Excavation of lead "hot spots" in shallow soils, corresponding to lead levels between 2160 ppm and 43,200 ppm.

- Installation of a watertight steel sheet pile bulkhead along the site shoreline,

- Installation of a 2-foot thick barrier system, consisting of a demarcation layer and soil cover over areas not covered by an impermeable cap,

- Institutional controls to prevent exposure to contaminated soils and groundwater beneath the site, and to preserve the integrity of the cover system and containment cells,

- Annual certification that the institutional controls are in place and effective, and

- Long term monitoring.

The proposed remedy, discussed in detail in Section 8, is intended to attain the remediation goals identified for this site in Section 6. The remedy must conform with officially promulgated standards and criteria that are directly applicable, or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, criteria and guidance are hereafter called SCGs.

This Proposed Remedial Action Plan (PRAP) identifies the preferred remedy, summarizes the other alternatives considered, and discusses the reasons for this preference. The NYSDEC will select a final remedy for the site only after careful consideration of all comments received during the public comment period.

The NYSDEC has issued this PRAP as a component of the Citizen Participation Plan developed pursuant to the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375. This document is a summary of the information that can be found in greater detail in the December 2000 remedial investigation (RI) report entitled "Remedial Investigation Report", the November 2002 feasibility study (FS) entitled "Feasibility Study", and other relevant documents. The public is encouraged to review the project documents, which are available at the following repositories:

Hastings Public Library
7 Maple Avenue
Hastings-on-Hudson, NY 10706
Mon - Wed: 9:30 - 8:30, Thur: 9:30 - 6:00,
Sat: 9:30 - 5:00, Sun 1:00 - 5:00
Phone: (914) 478-3307

Village Clerk
Municipal Offices
7 Maple Avenue
Hastings on Hudson, NY 10706
Mon - Fri: 8:30 - 4:00
Phone (914) 478-3400

NYSDEC Region 3 Office
21 South Putt Corners Road
New Paltz, NY 12561-1696
Attention: Michael Knipfing
Monday - Friday: 8:30 - 4:30
Phone: (845) 256-3154

NYSDEC Central Office
625 Broadway, 11th Floor
Albany, NY 12233-7016
Attention: George Heitzman
Monday - Friday: 8:00 - 4:00
Phone: (518) 402-9620

The NYSDEC seeks input from the community on all PRAPs. A public comment period has been set from October 27, 2003 through December 29, 2003 to provide an opportunity for public participation in the remedy selection process. A public meeting is scheduled for November 13, 2003 in the Hastings High School Auditorium beginning at 7:00 p.m.

At the meeting, the results of the RI/FS will be presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period will be held, during which verbal or written comments may be submitted on the PRAP. Written comments may also be sent to Mr. Heitzman at the above address through December 29, 2003.

The NYSDEC may modify the preferred alternative or select another of the alternatives presented in this PRAP, based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified here.

Comments will be summarized and addressed in the responsiveness summary section of the Record of Decision (ROD). The ROD is the NYSDEC's final selection of the remedy for this site.

SECTION 2: SITE LOCATION AND DESCRIPTION

The Harbor at Hastings site is located on approximately 26 acres on the eastern shore of the Hudson River in the Village of Hastings-on-Hudson, Westchester County. As shown on Figure 1, the site is bounded to the east by the Metro North Commuter Railroad, and to the north

and west by the Hudson River. To the south, the site is bordered by the former Mobil Oil Terminal and the active Uhlich Color Company, which together comprise the Tappan Terminal Inactive Hazardous Waste Disposal Site #3-60-015.

The landmass of the site was created by filling into the Hudson River between the mid-1800's and the early 1900's. Specific sources of fill material are unknown, but common practice was to use demolition debris, ash and furnace slag as riverfront fill. The shoreline of the site is comprised of variable timber bulkheads, sheet piling, stone revetment, dock platforms, and timber piles that once supported docks.

Presently, the property is owned by ARCO Environmental Remediation Limited (AERL), an indirect subsidiary of the Atlantic Richfield Corporation (ARCO), who leases certain buildings on the site to two tenants. Other buildings are abandoned and in disrepair. Several of these buildings were demolished between 1999 and 2002. An estimated 90% of the property is covered by asphalt paving, concrete slabs or buildings.

Operable Unit Number 1 (OU#1), which is the subject of this PRAP, consists of the 28-acre on-site property and the soils and groundwater beneath it. An operable unit represents a portion of the site remedy that for technical or administrative reasons can be addressed separately to eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination.

The remaining operable unit for this site (OU#2) consists of off-site contamination in the sediments and ecosystem of the Hudson River. A separate PRAP has been developed for OU#2.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

c.1850 to 1919 - The land beneath the site was created by filling. Industries at the site included the National Conduit and Cable Company, the Hastings Pavement Company and the American Brass Company.

1919 to 1977 - The site was owned and operated by the Anaconda Wire and Cable Company for the manufacture of copper wire, lead covered cable, high voltage cable and insulated wire. Beginning in the late-1930's, PCB (Aroclor) mixtures were used to impregnate paper- and asbestos-wrapped cable before the outer sheathing was applied. These PCB mixtures were prepared in the northwest corner of the site, and the wrappings were impregnated and dried in the western water tower area (see Figure 2). Unmixed Aroclors were also stored in Building 54 prior to use. In 1977, Anaconda was acquired by the Atlantic Richfield Corporation (ARCO).

1978 to 1998 - Several owners and tenants occupied the property, the most notable owner being Harbor at Hastings Associates. From 1988 through 1992, Building 15 was leased to Age Carting for operation as a construction and demolition (C&D) transfer station. During this period, an estimated 150,000 cubic yards of C&D waste was disposed in Building 15 and elsewhere on the property. Under a Court Order, this material was removed from the property by 1998.

1998 to present - In September 1998, ARCO re-acquired the property. During this period, several buildings in the southern part of the site were demolished, site security was improved, and all sub-leases were terminated. Presently, the site has two tenants, Riverside Auto Body and Guski Trucking Company. The property is fenced and gated, and on-site security personnel control access to the site.

A more complete description of the site history and industrial facilities is provided in the October 1995 "Summary and Evaluation of Existing Data" Report.

3.2: Remedial History

Between 1976 and 1989, several geotechnical and environmental investigations were conducted at the site which involved soil sampling and analysis. In particular, the December 1987 "Site Investigation Report" summarized the results of surface and subsurface soil samples, groundwater monitoring, and building sump samples. Based on this report, the U.S. Environmental Protection Agency (EPA) issued a Preliminary Assessment for the site in January 1989. Additional investigations were conducted during 1989, resulting in the October 1989 "Environmental Investigation Report." These investigations revealed the presence of PCBs, petroleum hydrocarbons and metal contaminants in surface and subsurface soils. These contaminants were also found in groundwater beneath the site at levels exceeding water quality standards. The maximum concentration of PCBs found during these investigations prior to 1990 was 4,100 parts per million (ppm) in subsurface soils in the northwest corner of the site.

In July 1989, the NYSDEC listed the site as a Class 2 site in the Registry of Inactive Hazardous Waste Disposal Sites in New York. A Class 2 site is a site where hazardous waste presents a significant threat to the public health or the environment and action is required.

SECTION 4: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers. The PRP for the site, documented to date, is the Atlantic Richfield Company (ARCO), a subsidiary of BP America, Inc..

The NYSDEC and ARCO entered into a Consent Order on November 16, 1995. The Order obligates ARCO to implement an RI/FS only. Upon issuance of the ROD the NYSDEC will approach ARCO to implement the selected remedy under an Order on Consent.

SECTION 5: SITE CONTAMINATION

A remedial investigation/feasibility study (RI/FS) has been conducted to evaluate the alternatives for addressing the significant threats to human health and the environment.

5.1: Summary of the Remedial Investigation

The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site.

The RI was conducted between November 1995 and May 2000. The field activities and findings of the investigation are described in the October 2000 "Remedial Investigation Report".

The following activities were conducted during the RI:

- Site surveying and off-shore bathymetry (water depth) measurements;
- Site inspections to determine potential source areas;
- A subsurface investigation consisting of 237 soil borings to determine the contaminant levels and physical properties of the subsurface fill and underlying soils;

- Installation of 17 permanent monitoring wells, 25 temporary piezometers and 18 floatin product recovery wells to evaluate water quality and to estimate flow conditions beneath the site; and

- Collection of 895 surface and subsurface soil samples and 46 groundwater samples for analysis.

To determine whether the soil and groundwater beneath the site contain contamination at levels of concern, data from the investigation were compared to the following SCGs:

- Groundwater SCGs are based on NYSDEC "Ambient Water Quality Standards and Guidance Values".

- Soil SCGs are based on the NYSDEC "Technical and Administrative Guidance Memorandum (TAGM) 4046; Determination of Soil Cleanup Objectives and Cleanup Levels".

- The SCG for dioxin in soil is based on the Agency for Toxic Substances and Disease Registry (ATSDR) Interim Policy Guideline for Dioxin and Dioxin-Like Compounds in Soil.

Based on the RI results, in comparison to the SCGs and potential public health and environmental exposure routes, certain media and areas of the site require remediation. These are summarized below. More complete information can be found in the RI report.

5.1.1: <u>Site Geology and Hydrogeology</u>

The site was constructed from man-made fill that was placed into the Hudson River. The upper Fill Unit ranges in thickness from 10 to 20 feet along the eastern boundary of the site, to 20 to 40 feet along the river shoreline. The fill is comprised of sand, silt, gravel, brick, concrete, ash, cinder, slag and other debris. The Fill Unit is moderately permeable, with conductivities estimated to be 10^{-3} to 10^{-5} cm/s.

The Fill Unit is underlain by the Marine Grey Silt Unit, which represents the original Hudson River sediments. This material occurs as a soft, plastic, low permeability clayey silt, with an estimated conductivity of 10^{-5} to 10^{-7} cm/s. The Marine Silt ranges in thickness from 10 feet on the eastern side of the site, to 40 feet along the Hudson River. Because of its low permeability ($1 x 10^{-7}$ cm/s), the Marine Silt Unit serves as a confining unit between contaminants in the layers above and groundwater discharging from the Basal Sands Unit below. Structurally, the Marine Silt Unit is highly compressible and has low shear strength, so it is not a suitable bearing surface for structures.

The Basal Sands are a unit of medium to dense coarse sands and gravels that vary in thickness from 10 feet on the eastern side of the site to 70 feet along the river. Because this unit provides structural support for pile-supported structures at the site, it is also referred to as the "bearing sands" unit.

Bedrock beneath the site occurs from approximately 50 feet below grade in the eastern portion of the site, to 100 feet or more below grade along the river.

Groundwater beneath the site is present in two productive units, the man-made Fill Unit, and the Basal Sand Unit. These units are separated by the Marine Silt layer that was the original Hudson River bottom.

Shallow groundwater in the Fill Unit originates from precipitation and infiltration through the land surface east of the site, flows westward through the fill, and discharges into the Hudson River. Except along the southern shoreline, groundwater in the Fill Unit flows unrestricted into the river. The new shoreline bulkhead described in Section 5.2 below provides a watertight barrier to groundwater flow along the southern part of the site. Along this portion of the shoreline, groundwater is diverted around the bulkhead before discharging to the river. The groundwater table in the Fill Unit ranges from 2 to 8 feet below grade, and varies in the western part of the site with the tidal fluctuations of the Hudson River.

Groundwater in the Basal Sands Unit originates to the east of the site, as part of the regional flow of groundwater from the upland areas of the Hudson River Valley towards the river. Because this groundwater originates at higher elevations along the river and is confined by the Marine Silt, it occurs under artesian conditions beneath parts of the site. That is, the water level in certain deep wells is higher than the ground surface. Groundwater in the Basal Sand Aquifer flows westward beneath the site and discharges to the Hudson River.

5.1.2: <u>Nature of Contamination</u>

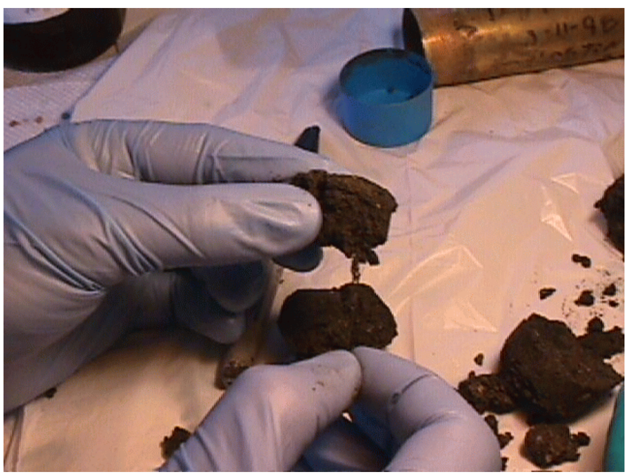
As described in the RI report, many soil and groundwater samples were collected to characterize the nature and extent of contamination. As summarized in Table 1, the main categories of contaminants that exceed their SCGs are PCBs, semivolatile organic compounds (SVOCs) and inorganics (metals).

PCBs are a group of 209 different synthetic organic chemicals that were used in industry due to their resistance to heat and electrical insulating properties. PCBs have low solubility in water, low volatility in air, and tend to adsorb to oils, fats and carbon-rich materials, if available. In the environment, PCBs are relatively persistent, and are degraded only under certain highly favorable conditions. PCBs bioaccumulate in animals, and concentrations in portions of the food chain can be 100,000 times higher than the levels found elsewhere in the environment.

PCBs were typically formulated into "Aroclor" mixtures, in which the degree of chlorination varied depending on the use of the product. The primary PCB mixture found at the Harbor at Hastings site was Aroclor 1260, with lesser amounts of Aroclor 1254. In pure form, Aroclor 1260 is 60% chlorine by weight, and is one of the heaviest, most viscous, and most persistent PCB mixtures. Aroclor 1260 is described in the technical literature as a "sticky resin." When it was used to impregnate the paper wrapping for high voltage cables, it was reportedly dissolved in a petroleum-based solvent.

The highest levels of Aroclor 1260 found at the site were associated with an elastic material that resembles rubber cement. This elastic material ranged from small hair-like filaments to a 2-inch separate layer within the soil column. A liquid form of this elastic material, highly viscous in consistency, was also found in one monitoring well along the site shoreline. This elastic material is believed to be the Aroclor wire insulating mixture that was formulated in the northwest corner of the site. The liquid elastic material was found to contain traces of the solvent in which it was originally dissolved. This material had apparently leaked or was dumped into the ground and has migrated beneath the site and into the Hudson River. As the solvent carrier dissolved from the mixture into the groundwater, the PCB component became more viscous and, ultimately, resinous. Figure 3 shows a conceptual model of PCB migration from its source locations in the northwest corner and shoreline/water tower areas of the site.

Elastic Material Containing High Levels of PCBs



Hair-like Filament of Elastic Material

SVOCs are another group of organic chemicals which generally have a moderate to low solubility in water, and which do not readily evaporate into air. The SVOCs found in site soils and fill are all polycyclic aromatic hydrocarbons (PAHs), such as pyrene, chrysene, and substituted anthracenes, pyrenes and fluoranthenes. PAHs are commonly associated with coal, ash, heavy petroleum oils and products of incomplete combustion.

The inorganic contaminants of concern are the metals arsenic, chromium, copper, lead, mercury and zinc. These metals may be associated with the ash and furnace slag that comprises much of the fill beneath the site. Copper and lead are also known to have been used by Anaconda in the manufacture of wire and cable.

Volatile organic compounds (VOCs) were not found consistently or at high levels in site media. One groundwater sample contained 1,1-dichloroethane and 1,1,1-trichloroethene at levels exceeding ambient water quality standards.

5.1.3: <u>Extent of Contamination</u>

This section describes the findings of the investigation for the environmental media that were investigated.

Chemical concentrations are reported in parts per billion (ppb) for groundwater and parts per million (ppm) for soil. For comparison purposes, where applicable, SCGs are provided for each medium.

Table 1 summarizes the degree of contamination for the contaminants of concern in soil and groundwater, and compares the data with the SCGs for the site.

<u>Soil</u>

<u>PCBs</u>

PCBs were detected in soils in five distinct areas of the site. These areas are the northwest corner, the shoreline/water tower area, the central area, the southwestern corner, and the southeastern corner of the site. These areas demonstrated different contamination characteristics, and so are discussed separately below. The total mass of PCBs present at the site is estimated to be 88,250 pounds.

Figures 4A, 4B, and 4C show the concentrations of PCBs in these areas at five depths: 1 foot, 6 feet, 10 feet, 20 feet, and 30 feet. These figures demonstrate the shallow nature of PCB contamination in the southwestern, southeastern and central areas, and the limit of contamination in the northwest corner at depths greater than 20 feet. The cleanup objectives used in these figures and in the discussion below are 1 ppm total PCBs in surface soil (0-1 foot), and 10 ppm total PCBs in subsurface soil (> 1 foot).

Northwest Corner

The highest PCB detections and greatest depth of migration were found in the northwest corner, where PCBs were historically mixed and used. The elastic matrix of highly concentrated Aroclor 1260 was found in several investigatory borings performed in the northwest corner of the site. The maximum detection in this area was 381,000 ppm (38%) PCB in a sample taken between 12 and 14 feet. In one location adjacent to the Hudson River, the liquid form of the elastic matrix was found, pooled in a depression in the surface of the Marine Silt Unit at a depth of approximately 35 feet. As shown in Figures 4A, 4B and 4C, PCB contamination extends to at least 30 feet beneath the northwest corner. In some locations, the depth of contamination approaches 40 feet.

Northern Shoreline & Water Tower Area

PCB contamination along the northern shoreline and in the water tower area is believed to be related to the storage of wire reels and other materials in open areas of this part of the site. This open area included portions of two present buildings, Buildings 52A and 52B, which were constructed after 1954. Contamination in this area is not as deep or as concentrated as in the northwest corner. As shown in Figures 4A, 4B, and 4C, contamination along the shoreline does not exceed 20 feet below ground surface. The maximum PCB concentration found in this area was 90,000 ppm at a depth of 9 feet below ground surface. The elastic matrix was found in three soil borings taken from this area, including the sample containing the highest PCB level.

Northwest Corner Investigation

Central Area

PCBs were found at shallow depths near Building 72A, which was Anaconda's former laboratory building. The maximum detection in this area was 280 ppm of PCB (Aroclor 1260) at a depth of 0-2 feet below the building slab. The deepest exceedance of state cleanup objectives was a sample collected between 4 and 8 feet, with a concentration of 16 ppm.

Southeastern Area

Six soil samples were collected from the southeastern corner of the site. Unlike the rest of the site, Aroclor 1254, which is associated with electrical transformers, was also found in this area. The maximum detections of PCBs were 430 ppm of Aroclor 1260 at the surface (0-1 feet), and 140 ppm of Aroclor 1254 at 4 feet.

Southwestern Area

A small area of PCB contamination was identified by three samples taken in 1989, which found Aroclor 1260 with a maximum concentration of 930 ppm in a sample 3 to 5 feet deep. Recent samples taken from the area, including immediately adjacent to the 1989 locations, found a maximum detection of 33 ppm. Because the 1989 samples were not analyzed in accordance with current quality control procedures, the specific numerical results are not reliable. Nevertheless, all the sample locations where PCB detections exceed their cleanup goals are included in the Southwestern Area.

Lead

Several occurrences of high lead levels, exceeding the NYSDEC soil cleanup objective of 400 ppm, were found in surface soils in the southern part of the site, where lead scrap was collected and recovered. Elevated lead levels were found in 6 samples collected from 0-2 feet in the southern area. These "hot spots", which are shown on Figure 5, ranged in concentration from 2160 ppm to 43,200 ppm. Elsewhere in this area, lead levels in surface soil were much lower, ranging from 6.8 ppm to 670 ppm. The locations with high detections were scattered throughout the southern area among locations with much lower levels, indicating a sporadic pattern of distribution.

Elsewhere, elevated lead levels, between 400 ppm and 1000 ppm, were found at intermediate depths (4' to 18') at several locations in the southern, central, and northwestern parts of the site. There is no apparent correlation of these detections to the historic use of the buildings and open spaces above them. The only discernable pattern is that they occur in the western half of the site. Based on the widespread, sporadic distribution of elevated lead at intermediate depths, with lower levels above and below, this appears to be related to the type of fill used to create the land mass. The use of more lead-bearing wastes, such as ash and slag, at certain times during the filling process would have caused this pattern of distribution.

Copper

Copper was found throughout the site at levels exceeding the NYSDEC soil cleanup objective of 25 ppm. Sporadic detections of very high copper levels (>10,000 ppm) were found at intermediate depths (6' to 18') in the southern, central, and water tower areas of the site. Three of the shallow samples identified as lead "hot spots" were also highly contaminated with copper, indicating that scrap wire operations at the south end of the site also released copper to surface soils.

Other Metals

Zinc was found throughout the site at levels exceeding the NYSDEC soil cleanup objective of 20 ppm. The highest levels of zinc (>1000 ppm) were found at intermediate depth, suggesting a fill-related source, such as furnace slag. Other metals found at lower frequencies were arsenic, barium, beryllium, cadmium, chromium, cobalt, cyanide mercury, nickel, and silver.

Chlorinated Dibenzofurans and Dioxins

A special investigation for dioxins in surface soil was conducted in areas where scrap was incinerated and refuse was burned in the open. As shown in Figure 5, these areas include:

- a former incinerator south of the south boat slip,
- an area north of Building 57 used for open burning, and
- an area further north of Building 57 where an incinerator was located.

Dioxin results are compared to the action levels established by the federal Agency for Toxic

Substances and Disease Registry (ATSDR) by determining the toxicity equivalent (TEQ) for each sample. The relative toxicity of individual dioxin-like compounds are normalized to the equivalent toxicity of 2,3,7,8-TCDD by multiplying their concentration by a Toxicity Equivalency Factor (TEF). The total TEQ is the sum of these normalized toxicity equivalents for all dioxin compounds detected. The ATSDR action level for dioxin TEQ is 1 ppb.

Samples from the southern incinerator area had dioxin TEQs of 0.19 to 0.33 ppb, below the ATSDR action level. In the northern burning areas, dioxin TEQ ranged from 5.1 to 8.3 ppb. These areas coincide with samples where PCBs exceeded 1 ppm in surface soil.

Semivolatile Organic Compounds

Semivolatile Organic Compounds (SVOCs) were detected in surface and subsurface soil samples throughout the site. The predominant group of SVOCs that were detected are polycyclic aromatic hydrocarbons (PAHs) such as pyrene, chrysene, and substituted anthracenes, pyrenes and fluoranthenes. These PAHs are commonly associated with ash, asphalt, heavy petroleum oils and products of incomplete combustion. Elevated levels of PAHs were found at intermediate depths (4' - 18') at scattered locations in the southern part of the site. Their sporadic distribution at intermediate depths suggests that they are related to the fill that was historically used to construct the site.

Groundwater

Groundwater samples taken from the Fill Unit were analyzed in both filtered and unfiltered forms to determine the influence of suspended fine particles on contaminant levels. The majority of unfiltered samples contained PCBs at levels that exceed the ambient groundwater standard of 0.09 ppb. One unfiltered groundwater sample contained PCBs at 390 ppm, which is more than 100 times greater than the reported solubility of Aroclor 1260 (2.1 ppb). This sample was taken from the well containing "liquid elastic matrix", and it is likely that particles of this matrix were collected with the water sample. Filtered samples contained much lower levels of PCBs, with a maximum detection of 1.0 ppb.

High levels of metals, primarily lead and copper, and several PAHs were also found in unfiltered groundwater samples. As shown below, filtered samples contained a lower frequency of exceedance and lower maximum levels of these metals, indicating a component of particulate-phase transport of these contaminants.

Unfiltered Samples		
	Copper	Lead
% of Samples Exceeding Standard	46%	77%
Maximum Exceedance of Standard[a]	57	106
Filtered Samples		
	Copper	Lead
% of Samples Exceeding Standard	4%	19%
Maximum Exceedance of Standard[a]	1.4	33

[a] Ratio of the maximum detected value to the standard

One groundwater sample taken in 1989 contained the volatile organic contaminant 1,1,1-trichloroethene at a concentration of 89 ppb, but this was not found in later samples.

Groundwater samples taken from the Basal Sand Unit did not contain detectable levels of PCBs or PAHs. Metals of concern were either not detectable, or well below ambient water quality standards. The highest levels of copper and lead were 7.3 ppb and 6.5 ppb, compared to their standards of 200 ppb and 25 ppb, respectively. The presence of the marine silt unit and the strong upward groundwater flow gradient have effectively prevented site contaminants from entering the Basal Sand Unit.

Floating Petroleum Product

A thin layer of petroleum product, or light non-aqueous phase liquid (LNAPL), was found floating on groundwater in the immediate vicinity of the water tower. This is the location of former 100,000 gallon above-ground storage tanks that served the boiler system in Building 57 north of the water tower. The thickness of this layer ranged from a sheen to 1 ½". This LNAPL was tested and found to contain PCBs in excess of 50 ppm. Removal of this LNAPL from the subsurface is being performed as an interim remedial measure, as discussed below.

5.2: Interim Remedial Measures

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS.

Building 14 Sump and Trench Cleanout - Building 14, located in the southern portion of the site, had been used as a boiler house and for electrolytic processing. Certain samples of standing water and sediment from three sumps and a trench were found to be contaminated with PCBs. An IRM was performed in December 1997 to pump out water and sediments, steam clean the surfaces of these structures, and backfill them with clean sand.

Floating Oil Recovery - In the water tower area, a layer of petroleum contamination was found, floating on the groundwater surface. The thickness of this layer ranged from a thin sheen to 1½ inches, and the oil was found to be contaminated with PCBs. In June 1998, oil recovery devices were installed in four monitoring wells, and oil is being removed from them on a weekly basis. To date approximately 400 gallons of oil have been recovered, and this system will continue to operate until the floating product is removed. All recovered oil is temporarily stored on-site and disposed at a permitted off-site facility.

Northwest Corner Interim Cover

In June 1998, the top 2 inches of surface soils from the Northwest Corner of the site were found to contain up to 4,400 ppm of PCBs. Because Buildings 53 and 54 are located adjacent to this area, and were occupied by a manufacturing operation, concerns were raised for potential exposure of workers to contaminated dusts. In July 1998, an interim cover of four inches of gravel was placed over exposed soils, and a fence was erected around areas of contamination.

Shoreline Bulkhead

Most of the existing bulkhead along the Hudson River is comprised of a combination of wooden bulkheads, stone revetment (rip-rap), and a short section of steel sheeting. Portions of the wooden bulkhead are badly deteriorated, and there is evidence of fill releases to the river and settlement of pavement and building slabs. Also, sediment samples taken offshore of the northwest corner were found to contain the “rubber cement” material and to be contaminated with high levels of PCBs, indicating subsurface releases along the shoreline.

To prevent the further release of contaminated fill and PCBs to the river, ARCO installed a sheet pile bulkhead as an IRM along the southern portion of the shoreline, where the deterioration was most severe. This work was completed in December 2000. The steel sheeting was driven into the marine silt layer to prevent further releases of contaminants at the site shoreline. Because the sheeting is water tight, groundwater that previously discharged continuously along the shoreline is now re-directed around the ends of the wall.

5.3: <u>Summary of Human Exposure Pathways</u>:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the human exposure pathways can be found in the Risk Assessment, which can be found at the document repositories listed in Section 1.

An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: [1] a contaminant source, [2] contaminant release and transport mechanisms, [3] a point of exposure, [4] a route of exposure, and [5] a receptor population.

The source of contamination is the location where contaminants were released to the environment (any waste disposal area or point of discharge). Contaminant release and transport mechanisms carry contaminants from the source to a point where people may be exposed. The exposure point is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (e.g., ingestion, inhalation, or direct contact). The receptor population is the people who are, or may be, exposed to contaminants at a point of exposure.

An exposure pathway is complete when all five elements of an exposure pathway exist. An exposure pathway is considered a potential pathway when one or more of the elements currently does not exist, but could in the future.

There are currently no completed human exposure pathways on OU1 of the site due to the following:

- buildings, pavement and gravel cover contaminated soil across the site;
- a fence, gate, and on-site security personnel control access to the site; and
- a public water supply provides potable water to the site.

However, in the absence of remediation, the following potential exposure pathways exist:

- humans could come into direct contact with, or incidentally ingest, contaminated soils if existing cover materials are removed and existing security measures that restrict access to the site do not continue;
- humans may inhale contaminated air-borne particulates if existing cover materials are removed and dust is generated; and
- humans may be exposed to contaminated groundwater if a private well is installed for non-potable use (e.g., as a production well) or for a supplemental source of potable water.

In addition, on-site contamination is migrating off-site and impacting the water, sediments and biota of the Hudson River. Although recreational users of the river may be exposed to site-related contaminants through the incidental ingestion of contaminated surface water, the primary human exposure pathway is through the consumption of contaminated fish. This exposure pathway is addressed in the PRAP for OU2.

5.4: Summary of Environmental Impacts

This section summarizes the existing and potential future environmental impacts presented by the site. Environmental impacts include existing and potential future exposure pathways to fish and wildlife receptors, as well as damage to natural resources such as aquifers and wetlands.

The Fish and Wildlife Impact Analysis, which is included in the RI Report, presents a detailed discussion of the existing and potential impacts from the site to fish and wildlife receptors. The following environmental exposure pathways and ecological risks have been identified:

The Hudson River environment is exposed to site contaminants due to the hydraulic connection between site groundwater and the river water. River sediments are also subject to contamination from the release of subsurface fill and elastic matrix along the shoreline, and the runoff of contaminated surface soils. Sediment samples taken from the Hudson River indicate the presence of both metals and site-related PCBs at high concentrations. As a result, the ecological exposure pathway is considered to be complete.

The primary ecological exposure pathway is through the migration of PCBs from the site to river water and sediments and their uptake and bioconcentration by aquatic organisms in addition to bioaccumulation in wildlife consuming those organisms. The potential also exists for direct contact with and/or ingestion of soils and water by wildlife living near the site.

These environmental exposure pathways have been further investigated as part of the off-site investigation of Operable Unit #2 of this site.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375-1.10. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and/or the environment presented by the hazardous waste disposed at the site through the proper application of scientific and engineering principles.

The remediation goals for this site are to eliminate or reduce to the extent practicable:

- Reduce, control, or eliminate to the extent practicable the contamination present within the soils and fill on site, and thereby eliminate the significant threat posed by the presence of hazardous wastes at the site.
- Eliminate the potential for direct human or animal contact with the contaminated soils or groundwater on site.
- Eliminate the threat to surface waters and sediments by eliminating surface run-off and subsurface releases of fill from the site.
- Eliminate, to the extent practicable, the migration of PCBs, metals and other containants into the Hudson River by surface and subsurface erosion of contaminated soils, transport of contaminated groundwater, and migration of PCBs in both elastic material and petroleum phases.
- Prevent, to the extent possible, migration of contaminants at the site to groundwater and surface water.

Further, the remediation goals for the site include attaining to the extent practicable:

- Provide for attainment of SCGs for groundwater quality at the limits of the site.

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for Operable Unit #1 of the Harbor at Hastings Site were identified, screened and evaluated in the November 2002 "Feasibility Study", which is available at the document repositories identified in Section 1.

A summary of the remedial alternatives that were considered for this site are discussed below. The present worth represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved.

7.1: Description of Remedial Alternatives

The following potential remedies were considered to address contaminated soils and groundwater at the site. Table 2 provides a summary of the key elements and certain performance measures of these alternatives. Most of these alternatives include institutional controls to prevent future exposure to any residual contamination that would remain at the site. These institutional controls would include a declaration of restrictions on the property deed, a detailed example of which is provided in Appendix A of this document. This restriction would require:

- Notification of NYSDEC and NYSDOH for any intrusive activities that could result in exposure to subsurface soils, or any change in the use of the site that could cause subsurface soils to become exposed;

- A prohibition on the construction of pile-supported structures over the Northwest Corner and Northern Shoreline containment areas;

- Development of a soils management plan to address residual contaminated soils that may be excavated from the site during future redevelopment. The plan would require soil characterization, proper health and safety procedures for subsurface excavation and, where applicable, disposal/reuse in accordance with NYSDEC regulations;

- Annual certification that the institutional controls and engineering controls put in place pursuant to the Record of Decision are still in place, have not been altered, and are still effective;

- A prohibition on the use of groundwater as a source of potable or process water without necessary water quality treatment as determined by the NYSDEC and the Westchester County Department of Health.

Alternative 1:
No Action

The no action alternative is evaluated as a procedural requirement and as a basis for comparison. It requires continued monitoring only, allowing the site to remain in an unremediated state. Ongoing IRMs would be discontinued, and existing security measures would be abandoned. This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment.

Present Worth:	$ 0
Capital Cost:	$ 0
Annual O&M:	$ 0

Alternative 1A: No Further Remedial Action
• Administrative Controls
• Reconstruction of Shoreline Bulkhead

No Further Remedial Action is a variation of the No Action Alternative that provides for continued administrative controls limiting site access, continued operation of IRMs, and reconstruction of the bulkhead along the remaining shoreline. This was presented as the No Action Alternative in the FS, but is distinguished from the No Action Alternative in this PRAP due to its extensive scope. It is presented as a sub-alternative to maintain consistency with the FS in the numbering of the remaining alternatives.

The property is presently fenced and gated, and on-site security personnel control access to the site. These administrative controls would continue. The two ongoing IRMs described in Section 5.2, floating oil (LNAPL) recovery and Northwest Corner surface cover, would continue to be operated and maintained.

To prevent the erosion of fill material into the river, the bulkhead described in Section 5.2 would be installed along the remaining shoreline. Conceptually, this bulkhead would consist of a Waterloo Barrier® or equivalent sealed sheet-pile system. The Waterloo Barrier® is a steel sheet pile system in which the joints between sheets are sealed with grout to create an impermeable wall. While this impermeable wall would prevent contaminants from flowing into the river, it could also create a backup and mounding of groundwater beneath the site. For this reason, the bulkhead would be designed to include groundwater collection, hydraulic relief or diversion structures as necessary. The bulkhead would also include a cathodic protection system to reduce the rate of corrosion. Alternative shoreline containment methods would be considered as appropriate, based on future site re-use and hydrogeologic factors.

Present Worth:	$ 16,800,000
Capital Cost:	$ 10,500,000
Annual O&M:	$ 220,000
Time to Implement	1 year

Alternative 2:
• Excavation of all PCB-Contaminated Fill
Excavation of Lead Hot Spots
• Bulkhead Reconstruction

This alternative would remove all soil that exceeds the NYSDEC's soil cleanup objective for PCBs: 1 ppm in surface soil (0 to 1 foot below grade), and 10 ppm in subsurface soil (> 1 foot below grade).

Because the total depth of excavation would approach 40 feet below grade, both dry and flooded excavation methods would be required, as described below. The estimated volume of PCB contaminated fill (as measured in place) that would be excavated and disposed off-site is 110,000 cubic yards.

Excavation Alternatives

Most of the alternatives under consideration involve varying degrees of excavation and removal of contaminated fill from the site. Specific excavation techniques are described in the following pages. Aside from the method of excavation, the following elements are common to the alternatives involving excavation:

Buildings and other structures located in areas targeted for excavation would be demolished and their foundations would be removed. Asbestos and lead abatement would be conducted as necessary prior to demolition.

Excavation cells would be created by driving sheet piles around the perimeter of the targeted area. Additional pre-design investigation may be necessary in certain areas to delineate the targeted area. As excavation proceeds, the cells would be de-watered by pumping groundwater with submersible pumps. Pumped groundwater would be filtered to remove fine soil particles, along with suspended and dissolved contaminants, with subsequent off-site disposal of the filtered solids. The treated water would be discharged to the river in compliance with the State Pollution Discharge Elimination System (SPDES).

The excavated material would be de-watered and mixed with a solidifying agent on-site as necessary to comply with transportation requirements as a solid material. The fill would be stockpiled on-site and tested to determine whether it should be disposed as hazardous or non-hazardous waste. The material would then be transported by rail or barge for disposal in a permitted off-site landfill which meets all state and federal disposal standards. Rail transportation may require rehabilitation of the existing site railroad spur.

Excavated areas would be backfilled with clean material to existing grades, then covered or capped as described in each alternative.

This remedial alternative would also include the excavation and off-site disposal of fill containing high levels of lead from the 6 "hot spots" identified in Section 5.1.3 of this document. Lead-contaminated fill would be excavated from four, two-foot deep, 50 foot x 50 foot areas and two, two-foot deep, 25 foot x 50 foot areas along the shoreline and property line. The estimated total volume of lead-contaminated fill (as measured in place) that would be excavated and disposed of off-site is 925 cubic yards. Post-excavation sampling would be conducted to verify that no high levels of lead remain in surface soils in this area.

Because this excavation would remove those areas where IRMs are ongoing (free product recovery, northwest corner interim cover), these would be discontinued. To prevent the erosion of remaining fill material along the shoreline, the shoreline bulkhead would be reconstructed as described in Alternative 1A.

Present Worth:	$ 150,000,000
Capital Cost:	$ 149,000,000
Annual O&M:	$ 12,000
Time to Implement	4 years

Alternative 3:
• Excavation of all Contaminated Fill above the Water Table
• Excavation of PCB-Contaminated Fill below the Water Table
• Bulkhead Reconstruction

In addition to the PCB-contaminated fill specified in Alternative 2, this alternative would also excavate all fill located above the water table that contains any contaminant that exceeds its soil cleanup objective. This would include the lead "hot spots" discussed in Alternative 2. Because the total depth of

“Dry” Excavation Methods

Alternatives that remove fill material from the site include varying depths of excavation, but all involve the technique of “dry excavation” for the upper several feet of material. Alternatives 7 through 12 rely solely on dry excavation methods because deeper fill is not removed.

Generally, shallow excavations within the upper 4 feet of fill could be conducted without the need for bracing or pumping of groundwater (de-watering). Beyond 4 feet, and below the water table, excavations would require shoring and bracing to be completed safely. Shoring typically consists of steel sheets driven into the ground around the perimeter of the excavation to prevent the walls from collapsing as material is removed. These are either braced internally, or are tied back to supports outside the excavation. For sheeting along the Hudson River shoreline, tiebacks into the river sediments may be necessary.

Installation of a shoring system at the site is made more difficult by the presence of buried debris, abandoned structures and foundation piles. These would likely interfere with the driving of sheeting around the excavation, and with the removal of material from within it. Pre-trenching and removal of obstructions would be necessary before any sheeting could be driven.

Excavation “in the dry” is the technique of pumping water out of an excavation to allow the material to be removed in solid form, and to visually monitor the progress of the excavation. Because the water level outside the hole is higher than inside it, the differential water pressure adds significantly to the forces acting on the shoring system.

The feasible limit of dry excavation at this site is primarily determined by the potential for “bottom heave”. Bottom heave occurs when the soil at the bottom of the excavation can no longer withstand the pressure exerted by the surrounding soils and groundwater, and it heaves upward into the excavation. This could cause the collapse of the shoring system and surrounding structures. <u>The maximum safe depth for dry excavation at this site is estimated to be between 12 and 15 feet.</u> According to ARCO’s Feasibility Study, excavation below 9 feet must be performed by injecting grout into the bottom of the excavation. This high density grout adds additional weight to the bottom of the hole to offset the forces that cause bottom heave. This technique is effective to approximately 12 feet below grade. Below this depth, excavation must proceed by flooded methods, as described below.

excavation would be approximately 40 feet below grade, both dry and flooded excavation methods would be required. The estimated volume of fill (as measured in place) that would be excavated and disposed off-site is 287,000 cubic yards.

Because this excavation would remove those areas where IRMs are ongoing (free product recovery, northwest corner interim cover), these would be discontinued. To prevent the erosion of remaining fill material along the shoreline, the shoreline bulkhead would be reconstructed as described in Alternative 1A.

Present Worth:	$ 225,000,000
Capital Cost:	$ 224,000,000
Annual O&M:	$ 25,000
Time to Implement	3 years

Alternative 4:
• Excavation of all PCB-Contaminated Fill
• Excavation of Lead Hot Spots
• Construction of a Multi-Layered Cap
• Bulkhead Reconstruction

This alternative would consist of excavation and off-site disposal of all surface and subsurface fill where PCB concentrations equal or exceed 1 ppm and 10 ppm, respectively. This alternative would also include the removal of lead "hot spots", as described in Alternative 2.

Because this excavation would remove those areas where IRMs are ongoing (free product recovery, northwest corner interim cover), these would be discontinued. To prevent the erosion of remaining fill material along the shoreline, the shoreline bulkhead would be reconstructed as described in Alternative 1A.

Because the total depth of excavation would approach 40 feet below grade, both dry and flooded excavation methods would be required. The estimated volume of PCB contaminated fill (as measured in place) that would be excavated and disposed off-site is 110,000 cubic yards.

To address fill-related contamination that would remain after excavation is complete, a multi-layer, impermeable cap would be installed. This type of cap is described below, and is designed to minimize infiltration of rainwater and snow melt into the capped area. To protect the impermeable barrier from penetrations, future development of the site would be restricted, and new buildings would not be permitted. Future use would likely be open space or parkland, using only structures that could be supported on footings, rather than piles.

Present Worth:	$ 167,000,000
Capital Cost:	$ 158,000,000
Annual O&M:	$ 311,000
Time to Implement	9 months

Alternative 5:
• Containment of the Water Tower and Northwest Corner Areas
• Excavation of Fill Containing the "Elastic Matrix"
• Excavation of Contaminated Fill above the Water Table outside the Containment Area
• Bulkhead Reconstruction

This alternative would consist of excavation and off-site disposal of all fill containing the highly contaminated "elastic matrix" described in Section 5.1.2 above. For purposes of estimating volumes and costs of this remedial alternative, the extent of fill containing the "elastic matrix" was defined as all fill containing PCB concentrations greater than or equal to 1,000 ppm. This assumption is based on RI data that shows the presence of the "elastic matrix" generally corresponds to soil concentrations greater than 1,000 ppm. Because the total depth of this excavation would approach 40 feet below grade, both dry and flooded excavation methods would be required. The estimated total volume of fill containing the "elastic matrix" (as measured in place) that would be excavated and disposed off-site is 28,000 cubic yards.

In addition to the excavation and off-site disposal of fill containing the "elastic matrix", a containment system would be constructed around the Water Tower and Northwest Corner areas, as described in the sidebar "Containment of the Northwest Corner and Water Tower Areas". This would contain the remaining PCB contamination after the highly contaminated elastic matrix is removed. This containment system would

Deep (Flooded) Excavation Methods

Alternatives that include excavation of the full thickness of fill, to 40 feet or more, require a more difficult method of excavation. Past the depth where dry excavation becomes unstable, further excavation would proceed by flooding the hole with water and dredging the fill in slurry form. This slurry, with a low solids content, would be pumped to a treatment area for de-watering and filtration. Sufficient water would be pumped into the excavation cell to maintain the water level at or above ground level to prevent bottom heave from occurring.

This method presents several significant challenges and concerns:

- Flooding the excavation increases the driving force for contaminants to move downward into the clean Basal Sand Unit. This is a particular concern where structural piles must be removed from the excavation area. As the piles are pulled out through the Marine Silt layer, the resulting void may act as a conduit for contaminant migration into the Basal Sand.
- Inspection and control of the excavation is very difficult due to the presence of turbid water in the hole. Verifying completion of the excavation is similarly difficult.
- The extracted slurry contains a high percentage of water that must be removed and treated. The de-watered fill requires additional filtration or addition of a bulking agent for shipment off-site.
- Clean backfill material is likely to be re-contaminated by the dirty water remaining in the hole.
- Tidal fluctuations in groundwater level must be accounted for in maintaining the water level in the excavation area.
- The risk of collapse, worker injury and contaminant release to the Hudson River is increased.

comprise 1.9 acres, which would be restricted from development.

In areas outside of the containment system, all fill located above the water table that contains any contaminant that exceeds its soil cleanup objective (including PCBs and lead) would also be excavated. In addition, all fill below the water table and outside the containment area with PCBs exceeding 10 ppm would be removed. This portion of the excavation could be performed using dry excavation methods. The estimated total volume of fill (as measured in place) that would be excavated outside of the containment area would be 208,000 cubic yards, bringing the total excavation volume for Alternative 5 to 236,000 cubic yards.

Finally, the bulkhead along the waterfront would be reconstructed to prevent erosion of fill material and particulate transport into the Hudson River. Operation of the LNAPL recovery system would also continue. This alternative would remove approximately 98% of the current mass of PCB contamination from the site.

Present Worth:	$ 165,000,000
Capital Cost:	$ 162,000,000
Annual O&M:	$ 111,000
Time to Implement	12 Months

Alternative 6:
• Containment of the Water Tower and Northwest Corner Areas
• Excavation of Fill Containing the "Elastic Matrix" in the Containment Area
• Excavation of Lead Hot Spots
• Construction of a Multi-Layered Cap
• Bulkhead Reconstruction

This alternative is similar to Alternative 5, except that only lead hot spots would be excavated outside the containment area, and the remainder would be covered with a multi-layer, impermeable cap.

The elastic matrix, corresponding to approximately 1000 ppm PCBs, would be excavated using both dry and flooded excavation methods, to a depth of about 40 feet. Lead hot spots in the southern part of the site would also be excavated and removed.

A containment system would be constructed around the Northwest Corner and Water Tower areas. The entire site would then be capped with an impermeable multi-layer cap, and would be restricted from development.

This alternative would remove approximately 97% of the existing mass of PCB contamination from the site.

Present Worth:	$ 132,000,000
Capital Cost:	$ 123,000,000
Annual O&M:	$ 309,000
Time to Implement	12 Months

Alternative 7:

• Containment of the Water Tower and Northwest Corner Areas
• Excavation of Shallow PCB-Impacted Fill
• Excavation of Lead Hot Spots
• Soil Barrier System
• Bulkhead Reconstruction

This alternative is similar to Alternatives 5 and 6, except that excavation would be limited to PCB-contaminated fill located within six feet of the ground surface, both inside and outside of the containment area. This alternative would also include the excavation and off-site disposal of the lead "hot spots" described in Alternative 2.

Containment of the Northwest Corner and Water Tower Areas

Alternatives 5 through 9, 11 and 12 include containment of the northwest corner and water tower areas, either alone or in conjunction with excavation. This containment area would consist of a vertical barrier surrounding the areas containing 10 ppm or greater of PCBs, and a multi-layer cap. The vertical barrier would prevent groundwater from flowing into and out of the containment area, minimizing the potential for contaminants to further migrate into the Hudson River.

The vertical barrier system would be constructed using a Waterloo Barrier® or equivalent sealed sheet-pile system along the shoreline. The Waterloo Barrier® is a steel sheet pile system in which the joints between sheets are sealed with grout to create an impermeable wall. This would also serve as the bulkhead along the shoreline.

The upland sides of the containment area would be enclosed by a slurry wall keyed into the underlying Marine Grey Silt Unit. A slurry wall is a vertical trench filled with a low permeability material such as bentonite clay or a clay-cement mixture. The trench would be excavated into the surface of the Marine Silt unit, so that the low permeability wall is sealed into a low permeability base.

The contained area would be capped by a low permeability cap to minimize infiltration into the containment cell, as described in "Multi-Layer Impermeable Cap". Water levels inside the cell would be monitored and water would be extracted and treated as necessary to prevent a buildup that could mobilize contamination.

The acreage of the PCB containment area would vary, depending on the excavation component of each alternative. The contained area would be restricted from development to maintain the integrity of the impermeable cap and prevent exposure to the high levels of PCBs beneath it.

The containment system would be constructed around areas of the site where PCBs in fill exceed 10 ppm after shallow excavaton is complete. This would include areas containing the "elastic matrix" of highly contaminated material that would not be removed under this alternative. The acreage of this containment area would be 3.8 acres, which would be restricted from development.

A soil barrier system would also be constructed over the entire site, and the bulkhead along the entire waterfront would be reconstructed. The floating product collection IRM would be continued until all LNAPL is recovered.

The estimated volume of fill that would be excavated and disposed off-site (as measured in-place) is approximately 42,000 cubic yards. Excavation of PCB-containing fill would be limited to the depth of the groundwater table. Dewatering is expected to be minimal. Post excavation sampling and analysis would be used to determine the ultimate disposition of the material. This alternative would remove approximately 29% of the existing mass of PCB contamination from the site.

Present Worth:	$ 45,800,000
Capital Cost:	$ 39,400,000
Annual O&M:	$ 221,000
Time to Implement	12 Months

Alternative 8:
• Containment of the Water Tower and Northwest Corner Areas
• Excavation of PCB-Contaminated Fill above the Water Table and outside the Containment Area
• Excavation of Lead Hot Spots
• Soil Barrier System
• Bulkhead Reconstruction

Multi-layer Impermeable Cap

Alternatives 4 and 6 include a cap with an impermeable barrier to prevent precipitation from entering the fill. For alternatives that include containment of the northwest corner and water tower areas, this type of cap is also included for the contained area.

This cap would be designed to meet the requirements for landfill capping (6NYCRR Part 360) and PCB disposal facilities (TSCA Part 761). However, because fill at the site doesn't generate methane, the gas venting requirements of a Part 360 cap would be waived. The components of the cap, from bottom to top would be:

- a bedding layer of sand or geotextile to protect the barrier from underlying debris
- an impermeable layer of geomembrane or compacted clay
- a barrier protection layer of 18" of soil
- a 6" vegetated topsoil or asphalt layer

The underlying fill and/or bedding layer would be properly sloped to promote drainage along the overlying barrier layer and away from the site. Additional drainage layers or structures may be necessary to convey water collected above the barrier to the discharge point.

Unlike the contact barrier/soil cover described elsewhere, this cap is intended to minimize the amount of precipitation entering the fill. As a result, this cap would have more stringent requirements for intrusive work beneath the cap and restrictions on structures built over it.

Soil Barrier System

Alternatives 7 through 12 include a 24-inch soil barrier system to prevent direct exposure to contaminated soil beneath the site. The system would consist of a demarcation layer of synthetic material such as Geogrid, or asphalt, concrete that is placed on top of the existing fill, except where existing foundations or pavement already provide an effective demarcation layer. Where these surfaces are in disrepair, they would be repaired or replaced. The demarcation layer would then be covered with an 18-inch layer of soil and a 6-inch layer of topsoil that would be seeded and fertilized. Alternative surfaces, such as new pavement or building slabs, would be considered as a substitute for the upper 6-inch layer, in conjunction with the final site development plan.

Although the demarcation layer is not intended to be a precipitation barrier, large areas of subsurface asphalt or concrete would collect significant rainfall and snow melt. The soil barrier system would include measures to promote runoff and/or infiltration, including grading, drainage swales infiltration zones, and/or other controls. In alternatives where containment of the northwest corner and water tower area is provided, the cover system would consist of a multi-layer cap with an impermeable layer to minimize infiltration into the containment area, as described earlier.

To ensure that future activity at the site would not compromise the integrity of the soil barrier, and to prevent future exposure to contaminated fill, an easement or restrictive covenant would be placed on the deed. This easement or covenant would specify the requirements for conducting intrusive activities beneath the soil barrier. These requirements would include NYSDEC, NYSDOH and Village notification, health and safety planning, soil management and disposal, and barrier repair procedures that must be followed in the event that intrusive activities are conducted beneath the barrier. Proposed requirements for this legal instrument are presented in Appendix A.

This alternative is very similar to Alternative 7, except that shallow PCBs inside the containment area would not be excavated. Excavation would be limited to PCB-contaminated fill located within six feet of the ground surface outside of the containment area. This alternative would also include the excavation and off-site disposal of the lead “hot spots” described in Alternative 2.

A containment system would be constructed around areas of the site where PCBs in fill exceed 10 ppm in the Northwest Corner and Water Tower area. This would include areas containing the “elastic matrix” of highly contaminated material that would not be removed under this alternative. The acreage of this containment area would be 3.8 acres, which would be restricted from development.

A soil barrier system would also be constructed over the entire site, and the bulkhead along the entire waterfront would be reconstructed. The floating product collection IRM would be continued until all LNAPL is recovered.

The estimated volume of fill that would be excavated and disposed off-site (as measured in-place) is approximately 10,000 cubic yards. Excavation of PCB-containing fill would be limited to the depth of the groundwater table. Dewatering is expected to be minimal. Post excavation sampling and analysis would be used to determine the ultimate disposition of the material. This alternative would remove less than 1% of the existing mass of PCB contamination from the site.

Present Worth:	$ 33,000,000
Capital Cost:	$ 25,900,000
Annual O&M:	$ 246,000
Time to Implement	12 Months

Alternative 9:

- **In-Situ Stabilization/Solidification of the "Liquid Elastic Matrix"**
- **Containment of the Water Tower and Northwest Corner Areas**
- **Excavation of PCB-Contaminated Fill above the Water Table and Outside the Containment Area**
- **Excavation of Lead Hot Spots**
- **Soil Barrier System**
- **Bulkhead Reconstruction**

This alternative includes all the elements of Alternative 8, with the addition of in-place stabilization of the most potentially mobile form of PCBs, the elastic matrix. Stabilization/Solidification technology was first evaluated in the June 1998 Draft Feasibility Study Report as an in-place method of treating the elastic matrix. The area where the liquid elastic matrix is present would be stabilized/solidified by injecting and mixing a binding agent such as Portland cement. Pilot testing of this technology showed a low degree of chemical immobilization of PCBs. However, solidification is expected to effectively reduce the permeability of the fill containing the elastic matrix, thereby reducing the groundwater flow and potential for contaminant migration. PCB-contaminated fill located within six feet of the ground surface outside of the containment area would be excavated and disposed off-site. This alternative would also include the excavation and off-site disposal of the lead "hot spots" described in Alternative 2.

A containment system would be constructed around areas of the site where PCBs in fill exceed 10 ppm in the Northwest Corner and Water Tower area. This would include areas containing the "elastic matrix" of highly contaminated material. The acreage of this containment area would be 3.8 acres, which would be restricted from development.

A soil barrier system would also be constructed over the entire site, and the bulkhead along the entire waterfront would be reconstructed. The floating product collection IRM would be continued until all LNAPL is recovered.

The estimated volume of fill that would be excavated and disposed off-site (as measured in place) is approximately 10,000 cubic yards. Post-excavation sampling and analysis would be used to determine the ultimate disposition of the material. This alternative would remove less than 1% of the existing mass of PCB contamination from the site.

Present Worth:	$ 37,200,000
Capital Cost:	$ 30,800,000
Annual O&M:	$ 221,000
Time to Implement	12 Months

Alternative 10:

- **Excavation of Lead Hot Spots**
- **Construction of a Soil Barrier System**
- **Bulkhead Reconstruction**

This alternative consists of excavation of fill containing lead "hot spots" and installation of a soil barrier system over the entire site. No PCB-contaminated fill would be excavated. The bulkhead along the entire waterfront would be reconstructed, and the floating product collection IRM would be continued until all LNAPL is recovered.

Present Worth:	$ 17,600,000
Capital Cost:	$ 10,500,000
Annual O&M:	$ 246,000
Time to Implement	12 Months

Monitoring and Maintenance

Alternatives that include excavation of contaminated soil or long-term management by capping or containment would require monitoring, both during the construction phase and in the long term.

Construction-Phase Monitoring

Monitoring during soil excavation would be necessary to protect the health of site workers and the surrounding community. A Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) would be developed during the remedial design phase. These plans would specify the monitoring procedures, action levels, and contingency measures that are required to protect public health. Generally, air monitoring for PCBs would include both laboratory analysis for volatile emissions and real-time measurement of dust levels. A sample CAMP is attached as Appendix B of this PRAP.

Post-Construction Monitoring and Maintenance

Long-term monitoring and maintenance would be required for alternatives that involve containment or capping of contaminated soil.

Water quality and water elevation monitoring would be performed inside the containment area to ensure that the impermeable cap, slurry wall, and sealed sheet piles are properly functioning, and that excessive groundwater does not accumulate. Groundwater monitoring would also be performed outside the containment area to demonstrate that the shoreline bulkhead is watertight and that the associated groundwater and stormwater diversion structures are functioning properly.

Alternative 11:

- **Containment of Water Tower and Northwest Corner Areas**
- **Excavation of PCB-Contaminated Fill to Multiple Depths (3, 9, and 12 feet)**
- **Excavation of Lead Hot Spots**
- **Construction of a Soil Barrier System**
- **Bulkhead Reconstruction**

This alternative consists of a mixture of on-site containment and excavation in the Northwest Corner and Water Tower areas.

Based on the FS' conclusion that the maximum feasible depth of dry excavation is 12 feet, this alternative would excavate to 12 feet in areas where this would remove all fill containing greater than 10 ppm PCBs. In certain areas of the site, the full extent of PCBs exceeding 10 ppm could be removed by excavation to a shallower depth of 9 feet. Where a 12-foot excavation would not remove all PCBs exceeding 10 ppm, excavation would be limited to 3 feet, and the location would be included in the containment system area.

A containment system would be installed around the Water Tower and Northwest Corner areas of the site where deep PCBs would remain after excavation is complete. The estimated acreage for this area would be 1.3 acres, which would be restricted from development. The area outside of the containment area would be free of PCBs exceeding NYSDEC cleanup objectives.

The estimated total volume of PCB-impacted fill (as measured in place) that would be excavated and disposed of off-site is approximately 48,000 cubic yards.

In addition to the PCB excavation, lead "hot spots", as described in Alternative 2, would also be excavated. A soil barrier system, as described above, would be installed over the entire site. Finally, the bulkhead along the entire waterfront would be reconstructed to prevent erosion of fill material and particulate transport into the Hudson River. This alternative would remove approximately 15% of the existing mass of PCB contamination from the site.

Present Worth:	$ 52,500,000
Capital Cost:	$ 46,100,000
Annual O&M:	$ 221,000
Time to Implement	12 Months

Alternative 12 Group:

• Containment of the Northwest Corner and Water Tower Areas
• Excavation of Lead Hot Spots
• Soil Barrier System
• Excavation of PCB-Contaminated Fill to a Range of Depths
• Bulkhead Reconstruction

The Alternative 12 group of alternatives was developed to evaluate a range of depths for excavation of PCBs. Each of the sub-alternatives described below specifies a maximum depth of excavation inside the containment area. Alternatives 12A, 12B, and 12C were developed as an addendum to the Feasibility Study. Alternatives 12D, 12E and 12F were developed by the Village of Hastings, Riverkeeper and ARCO as part of settlement negotiations for their RCRA citizens lawsuit. Alternatives 12D, 12E and 12F below correspond to Alternatives 1, 2, and 3 in the Settlement Term Sheet with respect to depths of excavation.

All of these depths are associated with dry excavation techniques. Even using dry methods, the difficulty of excavation and associated costs increase with depth, as does the amount of PCBs removed. By considering a range of depths, the trade off between the degree of PCB removal versus the difficulty and costs is evaluated.

Because the boundaries of the containment area are determined by the extent of deep PCBs, the acreage of the containment area is not changed by the depth of dry excavation. For all the following sub-alternatives, the containment area would comprise 1.3 acres, as in Alternative 11. Outside of the containment area, excavation would be performed to the depth which would remove all PCBs greater than 10 ppm. Based on existing sampling data, this is expected to be 12 feet or less, except in 3 locations. Because deep contamination at these locations appears to be isolated, it would be contained in individual containment cells if it cannot be removed.

For all these alternatives, lead "hot spots" identified in Alternative 2 would be excavated and disposed off-site. A soil barrier system would be installed over the entire site, and the shoreline bulkhead would be reconstructed.

Alternative 12A:

• Excavation of PCB-Contaminated Fill to the Maximum Depth Feasible by Dry Excavation

As part of the technical review of the FS, the NYSDEC contracted with an independent engineering consulting firm to perform a third-party evaluation of the feasible depth of excavation using dry methods. The purpose of this effort was to determine whether excavation could safely proceed to depths greater than 12 feet by dry methods. An excavation approach was developed that would enable fill to be removed to a depth of 15 feet. Technical discussions were conducted with ARCO and their consultants, and the differences in assumptions, soil structural properties and approach were identified. As part of these discussions, ARCO provided sufficient cost and mass removal data for the NYSDEC to develop an additional alternative for dry excavation to 15 feet.

In addition to different assumptions concerning soil structural properties, a key difference in excavation approach is the installation of the sheet pile shoring system through the marine silt and into the basal sands. The remaining sub-alternatives would have shoring installed only as deep as the top of the marine silt to avoid the potential for carrying contamination down into the basal sands.

Alternative 12A would remove PCB-contaminated fill to a depth of 15 feet. This corresponds to an excavation volume of 73,000 cubic yards, and removal of approximately 60% of the mass of PCBs from the site.

Present Worth:	$ 77,300,000
Capital Cost:	$ 70,900,000
Annual O&M:	$ 221,000
Time to Implement	12 Months

Alternative 12B:
• Excavation of PCB-Contaminated Fill to a Maximum Depth of 12 feet

This alternative is similar to Alternative 11, except that excavation would proceed to a maximum of 12 feet both inside and outside of the containment area. Where all PCBs could be removed from a location by shallower excavation (i.e., 9 feet), the maximum depth would not be necessary.

This alternative would result in the removal of 66,500 cubic yards of material, and would remove approximately 52% of the mass of PCBs from the site.

Present Worth:	$ 74,500,000
Capital Cost:	$ 68,100,000
Annual O&M:	$ 221,000
Time to Implement	12 Months

Alternative 12C:
• Excavation of PCB-Contaminated Fill to a Maximum Depth of 9 feet in the Containment Area

PCB-contaminated fill would be excavated to a maximum depth of 9 feet inside of the containment area, and to a maximum of 12 outside of the containment area.

This alternative would result in the removal of 60,100 cubic yards of material, and would remove approximately 45% of the mass of PCBs from the site.

Present Worth:	$ 62,800,000
Capital Cost:	$ 55,200,000
Annual O&M:	$ 221,000
Time to Implement	12 Months

Alternative 12D:
• Excavation of PCB-Contaminated Fill to a Maximum Depth of 7 feet in the Containment Area

Similar to Alternative 12C, this alternative would remove a maximum of 7 feet of PCB-contaminated fill inside of the containment area, and to a maximum of 12 outside of the containment area.

This alternative would result in the removal of 55,800 cubic yards of material, and would remove approximately 36% of the mass of PCBs from the site.

Present Worth:	$ 59,900,000
Capital Cost:	$ 53,500,000
Annual O&M:	$ 221,000
Time to Implement	12 Months

Alternative 12E:
• Excavation of PCB-Contaminated Fill to the Following Maximum Depths:
Northwest Corner Containment Area - 7 feet
Shoreline Containment Area - 9 feet
Other Non-Contained Areas - 12 feet

This alternative would remove fill containing PCBs greater than 10 ppm to differing depths across the site. In the Northwest Corner and Shoreline areas, where long term containment will be necessary for deep contamination, excavation would be limited to 7 feet and 9 feet respectively. Elsewhere, PCBs greater than 10 ppm can be fully removed with a maximum excavation depth of 12 feet.

This alternative would result in the removal of 58,200 cubic yards of material, and would remove approximately 40% of the mass of PCBs from the site.

Present Worth:	$ 62,000,000
Capital Cost:	$ 55,600,000
Annual O&M:	$ 221,000
Time to Implement	12 Months

Alternative 12F:
• Excavation of PCB-Contaminated Fill to the Following Maximum Depths:
Northwest Corner Containment Area - 9 feet
Shoreline Containment Area - 12 feet
Other Non-Contained Areas - 12 feet

Similar to Alternative 12E, this alternative would remove fill containing PCBs greater than 10 ppm to differing depths across the site. In the Northwest Corner and Shoreline areas, excavation would be limited to 9 feet and 12 feet respectively. Elsewhere, PCBs greater than 10 ppm would be removed to a maximum excavation depth of 12 feet.

This alternative would result in the removal of 62,300 cubic yards of material, and would remove approximately 45% of the mass of PCBs from the site.

Present Worth:	$ 65,000,000
Capital Cost:	$ 58,600,000
Annual O&M:	$ 221,000
Time to Implement	12 Months

7.2 Evaluation of Remedial Alternatives

The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375, which governs the remediation of inactive hazardous waste disposal sites in New York State. A detailed discussion of the evaluation criteria and comparative analysis is included in the FS report.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the NYSDEC has determined to be applicable on a case-specific basis.

3. Short-term Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

4. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been

implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

5. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

7. Cost-Effectivness. Capital costs and operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. The costs for each alternative are presented in Table 6.

8. Community Acceptance - Concerns of the community regarding the RI/FS reports and the PRAP are evaluated. A responsiveness summary will be prepared that describes public comments received and the manner in which the NYSDEC will address the concerns raised. If the selected remedy differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes.

SECTION 8: SUMMARY OF THE PROPOSED REMEDY

The NYSDEC is proposing Alternative 12C, as the remedy for this site. As discussed below, Alternative 12C provides the best balance of implementability, permanence, short-term effectiveness, and long-term effectiveness of the alternatives under consideration. It would achieve the remediation goals for the site by removing the most accessible PCB-contaminated fill and highest levels of lead-contaminated fill from the site and managing the remainder with a containment cell for PCBs and a contact barrier and soil cover for the remaining contaminants. The elements of this remedy are described at the end of this section.

The proposed remedy is based on the results of the RI and the evaluation of alternatives presented in the FS. This proposal is based on the findings that the remedy would be protective of human health and the environment. The key factors that the NYSDEC has considered are the implementability and short-term risks associated with deeper excavation versus the benefits of removing additional mass of PCB from the site. The NYSDEC has also considered the residual threat that would remain under this proposal, the associated controls that would be necessary to protect public health and the environment, and whether deeper excavation would alleviate these factors.

The NYSDEC believes that PCB-contaminated soil should be removed from the site to the extent possible, without creating an undue risk of spreading contamination during the removal process. PCBs that would remain at the site represent a potential ongoing source of groundwater contamination and a potential exposure threat to future users of the property. Alternatives that rely exclusively on containment and long-term management of PCBs would not provide sufficient long-term effectiveness, and would limit the opportunities for re-development of the site. Long-term effectiveness and protection of public health and the environment increase as excavation depth and PCB mass removal increase. However, at depths where flooded excavation is necessary, the short-term risks outweigh the long-term benefits, as discussed below. Because they do not call for the removal of any PCB-contaminated fill, the No Action Alternative and Alternative 10 are not recommended.

Alternatives 7 and 8, which would excavate PCB-contaminated soil to 6 feet and the water table respectively, would both leave approximately 3.8 acres of the site requiring long-term containment. This acreage would be restricted from any development involving the installation of pile-supported structures. Because the acreage of the containment area can be reduced to 1.3 acres by excavating to depths ranging from 7 to 9 feet, the NYSDEC believes it is worthwhile to do so. As a result, Alternatives 7 and 8 are not recommended.

Pilot tests conducted on in-situ stabilization did not show any significant reduction in the leachability or mobility of PCBs. For this reason, Alternative 9 is not recommended.

The short-term impacts associated with deeper excavation are potentially severe. Deep, flooded excavation would increase the risk of collapse, which could result in worker injury or even death, release of contaminants to the Hudson River, and contamination of the Basal Sands Unit. Because this deep contamination can be effectively contained, with no likely route of exposure to receptors at the surface or in the river ecosystem, the risk of encountering a severe short-term impact in order to proceed deeper is not justified.

The NYSDEC is particularly concerned where structural piles are present in the excavation area that penetrate through the Marine Silt into the Basal Sand Unit. For dry excavation to 15 feet or less, these piles would be cut at the bottom of the excavation and the upper portion would be removed. In a flooded excavation however, the depth and lack of visibility into the hole would preclude the piles from being cut, and instead they would have to be pulled out. As the piles are pulled out through the Marine Silt layer, the resulting void could act as a conduit for contaminant migration into the Basal Sand. This would be exacerbated by the additional head of water in a flooded excavation, which would serve as a downward driving force for contamination that is suspended in the excavation. Together, an open conduit and downward force would threaten to contaminate the Basal Sand Unit, a regional groundwater resource that is currently not impacted by the site.

A preliminary analysis indicates that dry excavation to 15 feet could be achieved, but this would require driving the shoring system sheeting through the Marine Silt Unit and into the underlying Basal Sands. This creates two possible pathways for contamination of the Basal Sand Unit: carrying contamination down on the piles as they are driven, and creating conduits for groundwater and contaminant migration when they are withdrawn. Although not as severe as the potential risks associated with flooded excavation, the NYSDEC believes that these risks are not offset by the benefits of excavating additional fill between 12 and 15 feet below ground surface.

For these reasons, the NYSDEC is not recommending an alternative that would require excavation below 12 feet in an area as large as the Northwest Corner or Northern Shoreline areas. As a result, alternatives whose goal is to remove all PCBs that exceed the cleanup objective (Alternatives 2, 3, and 4), or to remove the elastic matrix (Alternatives 5 and 6) are not proposed. Similarly, Alternative 12A is not recommended.

Alternatives 11 and 12 (B, C, D, E and F) would all result in contaminated fill remaining in the Northwest Corner and Water Tower areas, where contamination is present below 12 feet, and would excavate PCB-contaminated fill to a maximum depth of 12 feet outside those areas. These alternatives differ in the depth to which contaminated fill would be excavated inside the containment areas. These depths range from 3 feet (Alternative 11) to 12 feet (Alternative 12B), with various depths and combinations of depths in between. The key trade-off between these alternatives is the amount of PCB-contaminated fill that would be removed from the site versus the amount and depth that would be managed in the long term.

The acreage of deep PCB contamination in the Northern Shoreline and Water Tower areas that would remain and require long-term management are the same for all excavation depths between 7 and approximately 20 feet. These areas would be restricted from the construction of pile-supported structures, and would require installation and maintenance of an impermeable cap to prevent infiltration into the containment cells. Although increasing the maximum depth of excavation would remove additional mass of contamination, it would not reduce the acreage that would be contained and restricted from development. Removal of greater amounts of PCB-contaminated fill would reduce the reliance on long-term controls, to prevent migration and the possibility of exposure. Deeper excavation and associated clean backfill would also increase the separation distance between contamination remaining at the site and potential receptors at the surface.

The table below lists the percentage of PCB mass that would be removed from the site for each of the alternatives and excavation depths under consideration. These range from 15% for excavation to 3 feet, to 52% for excavation to 12 feet in both the Northwest Corner and Water Tower areas.

Alt. #	Excavation Depth Inside Containment Areas (feet)	%PCB removal [1]	Cost
11	3	15%	$52.5 M
12D	7	38%	$59.9 M
12E	7 NW Corner 9 Shoreline	40%	$62.0 M
12C	9	45% [2]	$62.8 M
12F	9 NW Corner 12 Shoreline	45% [2]	$65.0 M
12B	12	52%	$74.5 M

[1] Based on a total of approximately 88,250 lbs of PCB currently at the site, each 5% removed is 4,413 lbs

[2] Alternative 12F removes more PCB than Alternative 12C. However the difference is within the range of precision of the estimation method.

This data shows that significant increases in PCB removal can be achieved at moderate increases in cost up to an excavation depth of 9 feet. The difference between excavating 3 feet and 9 feet in the containment area would triple the amount of PCB removed at an increase of $10 million. However, increasing from 9 to 12 feet would only increase the PCB mass removal by 7%, while adding $11.7 million in costs. This is due to the increased costs for jet grouting to safely excavate more than 9 feet deep. A comparison of Alternatives 12C and 12F indicates that excavating an additional 3 feet in the Shoreline Area removes a minor amount of PCB mass but increases costs by $2.2 million. Because there is no apparent benefit in reducing the size of the containment area or eliminating a significant mass of contamination, the additional cost of Alternative 12F is not justified.

Excavation of fill to a depth of 12 feet outside the long-term containment areas would be sufficient to remove all PCB-contaminated fill, except in 3 known locations beneath Buildings 51 and 52B in the northern third of the site. PCB concentrations and the corresponding depths at these locations were 58 ppm (18-22 feet), 15 ppm (18-22 feet) and 180 ppm (10-14 feet). PCB concentrations from samples collected within 50 feet of these locations were less than 10 ppm at depths exceeding 12 feet. Because deep contamination at these locations appears to be isolated, it will be contained in individual containment cells if it cannot be removed. Alternatively, it may be feasible to remove small, isolated pockets of deep contamination by alternative excavation techniques, such as augering or small scale flooded excavation. The feasibility of conducting small-scale deep removal versus long-term management and the associated land use restrictions for these isolated areas will be further evaluated during the remedial design phase.

With regard to other contaminants, including lead, the proposed remedy would remove surface soils (0'-2') contaminated with high levels of lead (greater than 1,000 ppm). This would also remove several areas where copper levels in shallow soil exceed 10,000 ppm. The NYSDEC believes that the ease of excavating surface soils and the clear distinction between lead and copper concentrations in the "hot spots" compared to the surrounding soils justifies removing them. Because these hot spots are above the water table, and the proposed soil cover for this part of the site would not be an impermeable cap, removing them would reduce the potential for migration of lead and copper from soil into groundwater.

The remaining areas of high copper, lead and PAH contamination cover a broad area of the site, and at some locations exceed the depth at which dry excavation is feasible. This contamination would be managed by the soil barrier system to prevent direct human exposures, and by the reconstructed shoreline bulkhead to prevent discharges of fill and contaminated groundwater to the Hudson River.

Surface soils contaminated with dioxin above the ATSDR action level (1 ppb TEQ) would be removed under the proposed remedy because they are co-located with PCBs.

In summary, Alternative 12C provides the best balance of contaminant removal with implementability, cost effectiveness, and risk of short-term impacts. It would protect public health and the environment by removing the most accessible contamination and effectively containing the remainder. The engineering controls (containment cell, soil cover, shoreline bulkhead), in conjunction with the proposed institutional controls, would be reliable methods of preventing human exposure to contaminants and the further migration of contaminants to the Hudson River.

The NYSDEC notes that an agreement reached between the Village of Hastings, Hudson Riverkeeper and ARCO requires the installation of a 5-foot contact barrier and soil cover over the site. That system will consist of 6 inches of asphalt or concrete, 48 inches of soil or clean fill, and 6 inches of topsoil. That cover system would generally fulfill the requirements of this proposed remedy, provided that the upper 24 inches of the soil cover is composed of 18 inches of soil and 6 inches of topsoil. Clean fill, as defined in 6NYCRR Part 360, which is permitted by the agreement, and could consist of construction and demolition debris such as uncontaminated concrete, asphalt pavement, brick, and/or glass, could not be used in the upper 24 inches of the cover system. The cover system installed over the containment area must also fulfill the requirements for a multilayer impermeable cap that minimizes infiltration.

The estimated present worth cost to implement the remedy is $ 62,800,000. The cost to construct the remedy is estimated to be $ 55,200,000 and the estimated average annual operation, maintenance, and monitoring costs for 30 years is $ 221,000.

The elements of the proposed remedy are as follows:

1. A remedial design program to verify the components of the conceptual design and provide the details necessary for the construction, operation and maintenance, and monitoring of the remedial program. Any uncertainties identified during the RI/FS would be resolved.

2. Excavation of surface soil (0-12 inches) containing greater than 1 ppm PCB and subsurface soil containing greater than 10 ppm PCB to a maximum depth of 9 feet in the Northwest Corner of the site and along the Northern Shoreline,

3. Containment of the Northwest Corner and Northern Shoreline areas using a slurry wall along the upland perimeters, watertight sheet piles along the shoreline, and an impermeable cap consistent with 6NYCRR Part 360. This containment system would be monitored and maintained to ensure that groundwater does not build up within it.

4. Excavation of all soil located outside of the Northwest Corner and Northern Shoreline containment areas that contains greater than 1 ppm PCB in surface soil and 10 ppm PCB in subsurface soil. Subsurface soils containing greater than 10 ppm PCB at depths exceeding 12 feet would either be excavated by alternative methods, or contained within a watertight sheet pile structure and capped.

5. Excavation of shallow soils from the southern portion of the site that are identified as lead “hot spots”. These correspond to lead levels between 2160 ppm and 43,200 ppm.

6. Reconstruction of the shoreline bulkhead using a watertight steel sheet pile system with cathodic protection and hydraulic relief,

7. Installation of a 2-foot thick soil barrier system over the areas of the site not covered by the impermeable cap associated with containment areas,

8. Development of a soils management plan to address residual contaminated soils that may be excavated from the site during future redevelopment. The plan would require soil characterization, proper health and safety procedures for subsurface excavation and, where applicable, disposal/reuse in accordance with NYSDEC regulations.

9. An institutional control, in such form as the NYSDEC may approve, that would require prior notification of the NYSDEC and NYSDOH for any intrusive activities that could result in exposure to subsurface soils and would require compliance with the approved soils management plan.

10. An institutional control that would prohibit the construction of pile-supported structures over the Northwest Corner and Northern Shoreline containment areas.

11. An institutional control to prevent the use of groundwater as a source of potable or process water without necessary water quality treatment as determined by the NYSDEC and Westchester County Department of Health.

12. Annual certification by the property owner that the institutional controls and engineering controls put in place pursuant to the Record of Decision are still in place, have not been altered, and are still effective.

13. Since the remedy results in untreated hazardous waste remaining at the site, a long term monitoring program would be instituted. This program would include water quality and water elevation monitoring inside the containment area to ensure that the impermeable cap, slurry wall, and sealed sheet piles are properly functioning and that excessive groundwater does not accumulate. This would also include groundwater monitoring outside the containment area to demonstrate the effectiveness of the watertight shoreline bulkhead and associated groundwater diversion structures. This program would allow the effectiveness of the containment system to be monitored and would be a component of the operation, maintenance, and monitoring for the site.

TABLE 1
Nature and Extent of Contamination
December 1995 - January 2000

SURFACE SOIL (0-12")	Contaminants of Concern	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)[a]	Frequency of Exceeding SCG
PCB/Pesticides	PCBs	ND[c] - 4,000	1	32 of 36
	Dioxins (TEQ[d])	0.19 - 8.3 ppb	1 ppb	5 of 7
Semivolatile Organic Compounds (SVOCs)	Benz(a)anthracene	ND - 4.2	0.224	3 of 7
	Benzo(a)pyrene	ND - 3.5	0.061	7 of 7
	Benzo(b)fluoranthene	ND - 5.0	1.1	3 of 7
	Benzo(k)fluoranthene	ND - 4.4	1.1	2 of 7
	Chrysene	ND - 4.4	0.4	5 of 7
	Dibenzo(a,h)anthracene	ND - 0.72	0.014	3 of 7
Inorganic Compounds	Arsenic	ND - 20.4	7.5	2 of 7
	Barium	ND - 1890	300	1 of 5
	Berylium	ND - 1.2	0.16	2 of 7
	Chromium	ND - 296	50	1 of 7
	Copper	ND - 6750	25	6 of 7
	Lead	ND - 43,200	400	4 of 7
	Mercury	ND - 1.5	0.1	1 of 4
	Nickel	ND - 21.2	13	3 of 7
	Silver	ND - 3.5	2.5	1 of 6
	Zinc	ND - 1460	20	6 of 7

SUBSURFACE SOIL (>12")	Contaminants of Concern	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)[a]	Frequency of Exceeding SCG
PCB/Pesticides	PCB	ND - 380,000	10	278 of 842
Semivolatile Organic Compounds (SVOCs)	Anthracene	ND - 56	50	1 of 145
	Benz(a)anthracene	ND - 95	0.224	72 of 145
	Benzo(a)pyrene	ND - 90	0.061	81 of 145
	Benzo(b)fluoranthene	ND - 65	1.1	43 of 145
	Benzo(k)fluoranthene	ND - 62	1.1	30 of 145
	Chrysene	ND - 120	0.4	25 of 145
	Dibenzo(a,h)anthracene	ND - 29	0.014	35 of 145
	Dibenzofuran	ND - 26	6.2	4 of 145
	Indeno(1,2,3-cd)pyrene	ND - 40	3.2	19 of 145
	Phenanthrene	ND - 180	50	8 of 145
	Pyrene	ND - 160	50	5 of 145
Inorganic Compounds	Arsenic	ND - 727	7.5	61 of 123
	Barium	ND - 3010	300	19 of 145
	Berylium	ND - 2.2	0.16	107 of 154
	Cadmium	ND - 52.1	10	3 of 154
	Chromium	ND - 3940	50	14 of 154
	Cobalt	ND - 71.8	30	6 of 154
	Copper	ND - 202,000	25	135 of 164
	Lead	ND - 30,900	400	36 of 153
	Mercury	ND - 9.6	0.1	69 of 152
	Nickel	ND - 236	13	70 of 154
	Selenium	ND - 11.6	2.0	12 of 142
	Silver	ND - 70.7	2.5	9 of 151

SUBSURFACE SOIL (>12")	Contaminants of Concern	Concentration Range Detected (ppm)[a]	SCG[b] (ppm)[a]	Frequency of Exceeding SCG
	Vanadium	ND - 1980	150	2 of 152
	Zinc	ND - 5830	20	143 of 149

GROUNDWATER Filtered Groundwater	Contaminants of Concern	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)[a]	Frequency of Exceeding SCG
PCB/Pesticides	PCB	ND - 1.0	0.09	3 of 24
Semivolatile Organic Compounds (SVOCs)	2-Chloronaphthalene	ND - 21	10	1 of 16
	Benzo(a)anthracene	ND - 0.9	0.002	1 of 16
	Benzo(a)pyrene	ND - 0.6	ND	1 of 16
	Benzo(b)fluoranthene	ND - 0.7	0.002	1 of 16
	Chrysene	ND - 1	0.002	1 of 16
	Naphthalene	ND - 30	10	2 of 16
	Phenol	ND - 150	1.0	2 of 16
Inorganic Compounds	Antimony	ND - 4.1	3	5 of 20
	Barium	ND - 1030	1000	1 of 20
	Cadmium	ND - 11.4	5	1 of 20
	Copper	ND - 283	200	1 of 24
	Lead	ND - 832	25	5 of 26
	Thallium	ND - 12.3	0.5	7 of 20

GROUNDWATER Unfiltered Groundwater	Contaminants of Concern	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)[a]	Frequency of Exceeding SCG
PCB/Pesticides	PCB	ND - 390,000	0.09	24 of 35

GROUNDWATER Unfiltered Groundwater	**Contaminants of Concern**	**Concentration Range Detected (ppb)[a]**	**SCG[b] (ppb)[a]**	**Frequency of Exceeding SCG**
Semivolatile Organic Compounds (SVOCs)	2-Chloronaphthalene	ND - 38	10	2 of 24
	Benzo(a)anthracene	ND - 3	0.002	10 of 27
	Benzo(a)pyrene	ND - 4	ND	10 of 27
	Benzo(b)fluoranthene	ND - 2	0.002	10 of 27
	Bis(2-ethylhexyl) phthalate	ND - 6	5	1 of 27
	Chrysene	ND - 3	0.002	10 of 27
	Indeno (1,2,3-cd)pyrene	ND - 2	0.002	7 of 27
	Naphthalene	ND - 37	10	2 of 27
	Phenol	ND - 220	1.0	5 of 27
Inorganic Compounds	Antimony	ND - 22	3	5 of 20
	Arsenic	ND - 124	25	2 of 20
	Barium	ND - 2840	1000	2 of 20
	Beryllium	ND - 5.5	3	1 of 20
	Cadmium	ND - 19.5	5	4 of 20
	Copper	ND - 11300	200	11 of 24
	Lead	ND - 2660	25	20 of 26
	Nickel	ND - 264	100	1 of 20
	Selenium	ND - 10.2	10	1 of 20
	Thallium	ND - 16.6	0.5	10 of 20
	Zinc	ND - 5650	2000	2 of 20

[a] ppb = parts per billion, which is equivalent to micrograms per liter, ug/L, in water and ug/kg in soil;
ppm = parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil;

[b] SCG = standards, criteria, and guidance values; {list SCGs for each medium}

[c]ND = Not Detected

[d]TEQ - Toxicity Equivalents - Individual dioxins are normalized to the equivalent toxicity of 2,3,7,8 TCDD by multiplying their concentration by a Toxicity Equivalency Factor (TEF). The total TEQ is the sum of these normalized toxicity equivalents for all dioxin compounds detected. See "Dioxin and Dioxin-Like Compounds in Soil", ATSDR Interim Policy Guideline, August 21, 1997

Table 2: Summary of Remedial Alternatives

Alternative #	Excavation Elements				Containment Elements			Cost (Present Worth)
	PCB Excavation Criteria	Excavation of...		Excavation Volume (cu yds) / %PCB removal	NW Corner & Shoreline Area Containment Cell and Cap	Remaining Site-wide Cover/Cap Type	Shoreline Protection	
		Lead Hot Spots	Other Contaminants					
Alternative 1	No Action			0 cy 0%	No Action		Yes	$ 17 M
Alternative 2	All fill >10 ppm PCB	Yes	None	111,000 cy 99 %	No	None	Yes	$ 150 M
Alternative 3	All fill >10 ppm PCB	Yes	All fill above water table	287,000 cy 99 %	No	None	Yes	$ 225 M
Alternative 4	All fill >10 ppm PCB	Yes	None	111,000 cy 99 %	No	Impermeable Cap	Yes	$ 167 M
Alternative 5	Elastic Matrix (>1000 ppm) and > 10 ppm PCB outside containment area	Yes	All fill above water table	236,000 cy 98 %	Yes	None	Yes	$ 165 M

Alternative #	Excavation Elements				Containment Elements			Cost (Present Worth)
	PCB Excavation Criteria	Excavation of...		Excavation Volume (cu yds)	NW Corner & Shoreline Area Containment Cell and Cap	Remaining Site-wide Cover/Cap Type	Shoreline Protection	
		Lead Hot Spots	Other Contaminants	%PCB removal				
Alternative 6	Elastic Matrix (>1000 ppm)	Yes	None	28,000 cy	Yes	Impermeable Cap	Yes	$ 132 M
				97%				
Alternative 7	>10 ppm above the water table	Yes	None	42,000 cy	Yes	Soil Barrier System	Yes	$ 46 M
				29%				
Alternative 8	> 10 ppm above the water table outside the containment area	Yes	None	10,000 cy	Yes	Soil Barrier System	Yes	$ 33 M
				1 %				
Alternative 9	> 10 ppm above the water table outside the containment area (+ In-Situ Stabilization)	Yes	None	10,000 cy	Yes	Soil Barrier System	Yes	$ 37M
				1%				
Alternative 10	None	Yes	None	1000 cy	No	Soil Barrier System	Yes	$ 17.5 M
				0%				

Alternative #	Excavation Elements				Containment Elements			Cost (Present Worth)
	PCB Excavation Criteria	Excavation of...		Excavation Volume (cu yds)	NW Corner & Shoreline Area Containment Cell and Cap	Remaining Site-wide Cover/Cap Type	Shoreline Protection	
		Lead Hot Spots	Other Contaminants	%PCB removal				
Alternative 11	>10 ppm, depth not to exceed: 3 feet inside the containment area 12 feet elsewhere	Yes	None	49,000 cy 15%	Yes	Soil Barrier System	Yes	$ 52.5 M
Alternative 12A	>10 ppm depth not to exceed 15 feet inside and outside of the containment area	Yes	None	73,000 cy 60%	Yes	Soil Barrier System	Yes	$ 77.3 M
Alternative 12B	>10 ppm, depth not to exceed 12 feet inside and outside of the containment area	Yes	None	67,000 cy 52%	Yes	Soil Barrier System	Yes	$ 74.5 M
Alternative 12C	>10 ppm, depth not to exceed: 9 feet inside the containment area (Shoreline & NW Corner) 12 feet elsewhere	Yes	None	60,000 cy 45%[1]	Yes	Soil Barrier System	Yes	$ 62.8 M

Alternative #	Excavation Elements				Containment Elements			Cost (Present Worth)
	PCB Excavation Criteria	Excavation of...		Excavation Volume (cu yds)	NW Corner & Shoreline Area Containment Cell and Cap	Remaining Site-wide Cover/Cap Type	Shoreline Protection	
		Lead Hot Spots	Other Contaminants	%PCB removal				
Alternative 12D	>10 ppm, depth not to exceed: 7 feet inside the containment area (Shoreline & NW Corner) 12 feet elsewhere	Yes	None	56,000 cy 38%	Yes	Soil Barrier System	Yes	$ 59.9 M
Alternative 12E	>10 ppm, depth not to exceed: 7 feet in the Northwest Corner 9 feet in the Shoreline Area 12 feet elsewhere	Yes	None	58,200 40%	Yes	Soil Barrier System	Yes	$ 62.0 M
Alternative 12F	>10 ppm, depth not to exceed: 9 feet in the Northwest Corner 12 feet in the Shoreline Area 12 feet elsewhere	Yes	None	62,300 45%[1]	Yes	Soil Barrier System	Yes	$ 65.0 M

[1] Alternative 12F removes more PCB than Alternative 12C. However the difference is within the range of precision of the estimation method.

Table 3
Remedial Alternative Costs

Remedial Alternative	Capital Cost	Annual O&M	Total Present Worth
Alternative 1	$ 0	$ 0	$ 0
Alternative 1A	$ 10,500,000	$ 220,000	$ 16,800,000
Alternative 2	$ 149,000,000	$ 12,000	$ 150,000,000
Alternative 3	$ 224,000,000	$ 25,000	$ 225,000,000
Alternative 4	$ 158,000,000	$ 311,000	$ 167,000,000
Alternative 5	$ 162,000,000	$ 111,000	$ 165,000,000
Alternative 6	$ 123,000,000	$ 309,000	$ 132,000,000
Alternative 7	$ 39,400,000	$ 221,000	$ 45,800,000
Alternative 8	$ 25,900,000	$ 246,000	$ 33,000,000
Alternative 9	$ 30,800,000	$ 221,000	$ 37,200,000
Alternative 10	$ 10,500,000	$ 246,000	$ 17,600,000
Alternative 11	$ 46,100,000	$ 221,000	$ 52,500,000
Alternative 12A	$ 70,900,000	$ 221,000	$ 77,300,000
Alternative 12B	$ 68,100,000	$ 221,000	$ 74,500,000
Alternative 12C	$ 55,200,000	$ 221,000	$ 62,800,000
Alternative 12D	$ 53,500,000	$ 221,000	$ 59,900,000
Alternative 12E	$ 55,600,000	$ 221,000	$ 62,000,000
Alternative 12F	$ 58,600,000	$ 221,000	$ 65,000,000

Appendix A: Sample Requirements for Institutional Controls for the Harbor at Hastings Site.

The owner of the site will submit to the NYSDEC for review and approval a legal instrument, to run with the land, that will in perpetuity notify any potential purchasers of the property of the contamination present at the property and of the engineering and institutional controls necessary to protect public health and the environment. At a minimum, the language of the instrument will include provisions that:

1. State that soil with elevated levels of PCBs, lead, polycyclic aromatic hydrocarbons, and other contaminants is being left in place on-site and that this contamination may pose an unacceptable health risk should the soil be improperly handled, managed or disposed,

2. Require that any institutional and engineering controls specified in the Record of Decision shall continue in full force and effect and shall be maintained unless the owner first obtains permission from the NYSDEC to discontinue such controls,

3. Require annual certification that the institutional and engineering controls put in place pursuant to the Record of Decision are still in place, have not been altered, and are still effective,

4. Identify the presence and location of the PCB containment area and prohibit any activity that may breach the containment structures, including, but not limited to, excavation through the impermeable cap and installation of piles,

5. Identify the presence of the demarcation layer separating clean cover soil from contaminated fill,

6. Prohibit the extraction of water from beneath the surface of the property other than for remedial purposes without specific approval from the NYSDEC and the Westchester County Department of Health,

7. Notify future land owners, that under the authority of the New York State Department of Environmental Conservation, an existing hazardous waste remedial program is ongoing to address the on-site and off-site contamination in soils, sediments, surface water and groundwater.

8. Provide that the declaration is a covenant that shall run with the land and shall be binding upon all future owners of the Property, and shall provide that the owner and its successors and assigns consent to enforcement by the NYSDEC of these prohibitions and restrictions, and agree not to contest the authority of the NYSDEC to seek enforcement.

9. Prohibit the excavation of soils at the facility or removal of soil from the facility unless undertaken in accordance with a NYSDEC-approved Soil Management Plan submitted to the NYSDEC by the proponent that describes procedures for soil excavation and removal of soils from the facility and that are designed to protect human health and the environment. At a minimum, such a plan shall include:
   A: a provision for prior notification of NYSDEC and NYSDOH for any intrusive activities that could result in exposure to subsurface soils.

B: protocols and procedures for sampling soils to determine the concentration of contaminants.

C: a description of the health and safety requirements and general procedures to be followed during the excavation of soils. The plan shall be designed to minimize the possibility that personnel at the facility and the surrounding community will be injured or exposed to site contaminants during excavation of such soils.

D: should soil be disposed off-site, a hazardous waste determination to verify whether deposition into a secure hazardous waste landfill or a solid waste landfill is necessary.

E: a provision for submittal of a construction completion report to the NYSDEC for all activities conducted pursuant to the Soil Management Plan.

The proponent may implement the Soil Management Plan at any time after NYSDEC approval.

This instrument will be recorded and filed with the Westchester County Clerk, and proof of recording and filing will be submitted to the NYSDEC within thirty days of the Department's approval of the language of the instrument.

Appendix B: Generic Community Air-Monitoring Plan

A community air-monitoring plan (CAMP) will be developed for the Harbor at Hastings site. The CAMP will include monitoring for airborne particulates and PCBs during ground-intrusive remedial activities. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of remedial work activities.

The following are examples of typical air-monitoring plans for particulates and PCBs. Site-specific conditions may require more stringent monitoring or response levels than those shown below.

Particulates

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment will be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration will be visually assessed during all work activities.

If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work will be stopped and a re-evaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings will be recorded and available for State (DEC and DOH) personnel to review.

PCBs

The scope of sampling PCBs in air will include collection of at least five ambient air samples: one collected as a representative background sample (preferably upwind), one at the downwind perimeter of the exclusion zone, and three air samples near community occupied structures or recreational areas (preferably downwind from the work site). Samples will be taken at the following intervals:

- twice, prior to the initiation of removal activities; and
- daily, after removal activities are initiated.

The samples will be collected and analyzed for PCBs using NYS DOH Method 311-1. Each sample batch and a field blank will be sent to the NYSDEC/NYSDOH-approved laboratory for analysis with each sample shipment. The samples will be delivered to the lab on the same day of collection. PCB samples will be analyzed and results will be made available within 24-hours following delivery. Documentation of the sample results will be provided to the on-site coordinator and the State for immediate review.

A threshold value of 100 nanograms per cubic meter (ng/m^3) will be used for the site to minimize community exposures. If total PCB concentrations at the perimeter of the exclusion zone exceed 100 ng/m^3 above previous background samples taken in the area, activities will be examined and engineering controls considered to mitigate off-site emissions. If a sample collected near the community contains total PCB concentrations that equal or exceed 100 ng/m^3, activities will be temporarily terminated and modifications employed to reduce off-site emissions. If either action level is exceeded, additional sampling will be necessary to determine whether the modifications implemented successfully reduced emissions.