Department of Environmental Conservation

Division of Environmental Remediation

Record of Decision
Tappan Terminal Site
Village of Hastings-on-Hudson
Westchester County, New York
3-60-015

September 2006

New York State Department of Environmental Conservation
GEORGE E. PATAKI, *Governor* DENISE M. SHEEHAN, *Commissioner*

DECLARATION STATEMENT - RECORD OF DECISION

Tappan Terminal Inactive Hazardous Waste Disposal Site
Village of Hastings-on-Hudson, Westchester County, New York
Site No. 3-60-015

Statement of Purpose and Basis

The Record of Decision (ROD) presents the selected remedy for the Tappan Terminal site, a Class 2 inactive hazardous waste disposal site. The selected remedial program was chosen in accordance with the New York State Environmental Conservation Law and is not inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan of March 8, 1990 (40CFR300), as amended.

This decision is based on the Administrative Record of the New York State Department of Environmental Conservation (NYSDEC) for the Tappan Terminal inactive hazardous waste disposal site, and the public's input to the Proposed Remedial Action Plan (PRAP) presented by the NYSDEC. A listing of the documents included as a part of the Administrative Record is included in Appendix B of the ROD.

Assessment of the Site

Actual or threatened releases of hazardous waste constituents from this site, if not addressed by implementing the response action selected in this ROD, presents a current or potential significant threat to public health and/or the environment.

Description of Selected Remedy

Based on the results of the Remedial Investigation and Feasibility Study (RI/FS) for the Tappan Terminal site and the criteria identified for evaluation of alternatives, the NYSDEC has selected limited excavation, soil and groundwater treatment and a soil cover. The components of the remedy are as follows:

- Groundwater and soil remediation using air sparging and soil vapor extraction,

- Excavation of grossly contaminated soil above the groundwater table, particularly soil that contains visible dye or petroleum contamination,

- A soil cover consisting of a demarcation layer and two feet of clean soil,

- Restoration of the site by grading and seeding of excavated and/or filled areas,

- Development of a site management plan to address residual contamination and any use restrictions,
- Execution of an environmental easement,
- Periodic certification of the institutional and engineering controls,
- Long term monitoring and maintenance.

New York State Department of Health Acceptance

The New York State Department of Health (NYSDOH) concurs that the remedy selected for this site is protective of human health.

Declaration

The selected remedy is protective of human health and the environment, complies with State and Federal requirements that are legally applicable or relevant and appropriate to the remedial action to the extent practicable, and is cost effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the preference for remedies that reduce toxicity, mobility, or volume as a principal element.

SEP - 8 2006
Date

Dale A. Desnoyers, Director
Division of Environmental Remediation

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RECORD OF DECISION

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Village of Hastings-on-Hudson, Westchester County, New York
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SECTION 1: SUMMARY OF THE RECORD OF DECISION

The New York State Department of Environmental Conservation (NYSDEC), in consultation with the New York State Department of Health (NYSDOH), has selected this remedy for the Tappan Terminal site. The presence of hazardous waste has created significant threats to human health and/or the environment that are addressed by this remedy. As more fully described in Sections 3 and 5 of this document, past industrial activities have resulted in the disposal of petroleum and hazardous wastes, including chlorobenzene, benzene, and dye-related contaminants. These wastes have contaminated the soil and groundwater at the site, and have resulted in:

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

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

- Groundwater and soil remediation using air sparging and soil vapor extraction, and/or other technologies to be considered during the remedial design phase,
- Excavation of grossly contaminated soil above the groundwater table, particularly soil that contains visible dye or petroleum contamination, and soil containing greater than 500 ppm of semivolatile organic contaminants,
- A soil cover consisting of a demarcation layer and two feet of clean soil,
- Restoration of the site by grading and seeding of excavated and/or filled areas.
- Development of a site management plan to address residual contamination and any use restrictions.
- Imposition of an environmental easement.
- Periodic certification of the institutional and engineering controls.

The selected 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 applicable (or relevant and appropriate) standards and criteria with consideration given to guidance, as appropriate. This term is hereafter called SCGs.

SECTION 2: SITE LOCATION AND DESCRIPTION

The Tappan Terminal site is located on 15 acres along the Hudson River waterfront in the Village of Hastings-on-Hudson, Westchester County, New York. The site comprises two properties, the Exxon/Mobil property, which is located adjacent to the Hudson River, and the Uhlich Color Company, which is located along the railroad tracks that define the eastern boundary of the site. The Uhlich property is a former pigment manufacturing facility, and the Exxon/Mobil property was most recently used as a petroleum distribution terminal. The Uhlich Color Company was recently acquired by the Magruder Color Company, and has discontinued operations at the site. A small portion of the southern end of the Exxon/Mobil property is leased to the Pioneer Boat Club for use as a marina. Figure 1 shows the location of the site, and Figure 2 shows the boundaries and main features of the site.

Limited access to the site is from Railroad Avenue at the southeast corner of the site and over the Zinsser Bridge that crosses the railroad tracks. Both portions of the site are surrounded by a chain link fence that is in good repair. This bridge has fallen into disrepair, and is no longer open to vehicular traffic.

The site is adjacent to the Harbor-at-Hastings site, a Class 2 inactive hazardous waste disposal site that is contaminated with polychlorinated biphenyls (PCBs), metals and polycyclic aromatic hydrocarbons (PAHs).

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

The Tappan Terminal site has a long history of manufacturing and chemical use by several owners and occupants. The landmass of the site itself was also created by disposal of manmade fill into the Hudson River between 1868 and 1970. This fill material typically consisted of sand and gravel mixed with bricks, concrete, stone, timber, ash, slag, shells, and other debris. The history of the site is summarized below:

1868: The site comprises two acres at the northern end of the current site.

1897-1955: The site was owned by Zinsser & Company for the manufacture of dyes, pigments and photographic chemicals.

1920: Filling progressed to the current Uhlich / Exxon/Mobil property line

1955-1961: Harshaw purchased the Zinsser Company and continued operations at the site.

1961-1971: Tappan Tanker Terminal purchased the property and began operating a petroleum distribution facility on the western portion of the site. During this period, waste chemicals were stored on the western portion of the site prior to open ocean disposal.

1964-2002: Paul Uhlich & Company leased, then purchased, the eastern portion of the site for the manufacture of pigments. This operation later became the Uhlich Color Company. The site layout during the recent operational period is shown on Figure 3.

1975-1985: Mobil Oil Co. purchased the western portion of the site and continued petroleum distribution operations.

Uhlich Plant Operations (2002)

In addition to the site operators identified above, several corporate mergers and acquisitions have occurred. The Harshaw Chemical Company was purchased by Kewanee Industries in 1966, which was acquired by the Gulf Oil Corporation in 1977. Gulf Oil Corporation merged with the Chevron Chemical Corporation in 1985. Mobil Oil Corporation merged with Exxon Corporation to form Exxon/Mobil in 1999.

The Uhlich Color Company ceased operations at the site in 2002, and most buildings at the site were demolished in early 2003.

3.2: Remedial History

When Mobil ceased operations on their property in 1985, a number of oil spills and bulk storage violations were discovered. Sampling various media at the site was performed between 1985 and 1989. In 1987, 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.

During a 1992 repair of a sewer pipe at the site, evidence of a petroleum release on both properties was discovered. Contaminated soil was stockpiled and later sent off site for disposal. The extent of petroleum contamination was investigated between 1992 and 1994. In 1994, an oil remediation plan was approved by the NYSDEC, and Mobil and Uhlich entered into a Stipulation Agreement to remediate this spill.

In 1996 Mobil entered into a Voluntary Agreement with the NYSDEC to investigate petroleum contamination on the western portion of the site. Because none of the potentially responsible parties agreed to perform a comprehensive investigation of the entire site, the site was referred for a State-funded investigation in 1998. However, after 1998 Mobil conducted some focused investigations and pilot studies on contamination located on their portion of the site, as described in Section 5.1.

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 PRPs for the site, documented to date, include:

- Exxon/Mobil Corporation
- Uhlich Color Corporation
- Chevron Chemical Corporation

The PRPs declined to implement the RI/FS at the site when requested by the NYSDEC. After the remedy is selected, the PRPs will again be contacted to assume responsibility for the remedial program. If an agreement cannot be reached with the PRPs, the NYSDEC will evaluate the site for further action under the State Superfund. The PRPs are subject to legal actions by the State for recovery of all response costs the State has incurred.

SECTION 5: SITE CONTAMINATION

A remedial investigation/feasibility study (RI/FS) was 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 July 1998 and September 1999. The field activities and findings of the investigation are described in the "September 1999 Remedial Investigation Report". The following activities were conducted during the RI:

- A compilation of historic site data and preparation of a comprehensive site map,
- Collection of soil samples from 25 surface and 10 subsurface locations,
- Water level measurements in 32 existing monitoring wells to determine groundwater flow characteristics. To evaluate tidal impacts, continuous water level monitoring in 6 wells through three Hudson River tide cycles.
- Sampling of groundwater in 33 existing wells and 5 temporary well points.
- Analysis of all soil and groundwater samples for a comprehensive list of contaminants.
- Collection and analysis of 10 sediment samples adjacent to the site and 2 background locations.

As part of the Feasibility Study (FS), additional soil and groundwater sampling was conducted to determine the volume of soil requiring remediation. The results of this Supplemental Investigation are reported in Section 3 of the FS Report.

In 2002, Exxon/Mobil performed a pilot test of air sparging, soil vapor extraction and enhanced bioremediation at the site. Subsequently, Exxon/Mobil performed a pilot test of biosparging technology at the site beginning in 2004. These studies were performed to further evaluate technologies under consideration in the draft Feasibility Study, and were performed under the provisions of Mobil's 1996 Voluntary Cleanup Agreement. These technologies, and the results of the pilot tests, are described in more detail in Section 7 below.

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

- Groundwater, drinking water and surface water SCGs are based on NYSDEC "Ambient Water Quality Standards and Guidance Values" and Part 5 of the New York State Sanitary Code.
- Soil SCGs are based on the NYSDEC "Technical and Administrative Guidance Memorandum (TAGM) 4046; Determination of Soil Cleanup Objectives and Cleanup Levels".

- Sediment SCGs are based on the NYSDEC "Technical Guidance for Screening Contaminated Sediments."

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 is underlain by four geologic units, the upper fill layer, the Marine Grey Silt, the Basal Sand unit, and bedrock. The upper fill layer ranges from 11 to 32 feet in thickness, and consists of sand, silt and gravel variably mixed with ash, slag, glass, metal debris, wood, crushed stone, paper, coal, sawdust and brick fragments. This material is typical of historic waterfront fill material deposited during the late 19th and early 20th centuries. The historic fill is considered to be relatively permeable, with hydraulic conductivity measurements between 9.0×10^{-2} and 3.7×10^{-1} centimeters per second (cm/s). However, intermediate bulkheads were built in stages along the shoreline as filling proceeded. These bulkheads are now buried beneath the site, and in some places act to restrict the flow of groundwater towards the river.

Groundwater flows through the fill layer from east to west and discharges to the Hudson River. However, this flow is affected by the tide stage of the river. At high tide, the groundwater flow direction reverses along the immediate shoreline, and water enters the site from the river. Generally, tidal fluctuations in the river affect groundwater levels within 100 feet of the shoreline.

Beneath the fill unit lies the Marine Grey Silt unit that represents the historic sediment of the Hudson River. This unit consists of grey to black silt with a trace of fine sand and layers of shell fragments. The Marine Grey Silt is at least 8 feet thick beneath this site, and ranges from 10 to 62 feet thick at the adjacent Harbor at Hastings site. The silt unit acts as a confining layer, with hydraulic conductivity measurements at the adjacent site between 1.0×10^{-7} and 7.7×10^{-8}. This unit is believed to be continuous beneath the site.

The Basal Sand Unit that underlies the silt layer consists of permeable, medium to coarse sands and gravels. Although this unit was not investigated at the Tappan Terminal site, measurements in the vicinity of the site indicate that the Basal Sand Unit is a confined aquifer under artesian conditions. That is, groundwater pressure in the Basal Sand is greater than in the fill unit, and flow would be upward in the absence of the confining silt unit.

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

As described in the RI report, many soil, groundwater and sediment samples were collected at the site to characterize the nature and extent of contamination. The main categories of contaminants which exceed their SCGs are inorganics (metals), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and polychlorinated biphenyls (PCBs).

The primary VOC of concern is chlorobenzene in groundwater and subsurface soils. The source of this contamination appears to be the former chlorobenzene storage tank on the Zinsser property.

Chlorobenzene was historically used as a solvent in the manufacture of dyes. Benzene and dichlorobenzenes are also present in groundwater in the same area as the chlorobenzene contamination. In the northern portion of the site, two types of ether were found in groundwater: diethyl ether and diisopropyl ether. These ethers are highly soluble in groundwater, and are associated with chemical production by the Zinsser Company.

The SVOCs found at the site can be divided into three categories: contaminants associated with chemical manufacturing at the site, contaminants related to petroleum spills, and contaminants associated with the historic fill used to create the site. Certain SVOCs may be associated with more than one category. Generally, SVOCs have a moderate to low solubility in water, and do not readily evaporate into air.

The SVOCs associated with the historic site fill are polycyclic aromatic hydrocarbons (PAHs), such as pyrene, chrysene, and substituted anthracenes, pyrenes and fluoranthenes. These PAHs are commonly associated with coal, ash, heavy petroleum oils and products of incomplete combustion. Seven of these compounds are known or suspected human carcinogens, and are designated as carcinogenic PAHs (cPAHs).

Certain of the PAHs are also ingredients and by-products of dye manufacturing, and were found in areas containing dye-related contaminants. These include chemicals related to the production of aniline and anthraquinone dyes, including, aniline, chlorinated anilines, toluidines and anthraquinones. These contaminants were found primarily in surface soils on or near the current Uhlich property. Many of these dye-related contaminants are tentatively identified compounds (TICs) in the laboratory analysis. TICs are not targeted by the standard analysis, but their presence was identified by a search of the 30 highest non-target compounds present in the sample. Standard analytical procedures provide a method to give a rough estimate of their concentration, which may be orders of magnitude higher or lower than the actual concentration. Based on the history of the site, the NYSDEC is reasonably certain of the presence of these contaminants, but considers their values to be rough estimates.

The inorganic contaminants of concern include the metals arsenic, beryllium, copper, mercury, nickel and zinc. These were found throughout the surface and subsurface fill, and are commonly associated with historic fill containing ash and furnace slag. Barium was found in some surface soil samples, and may be associated with current pigment manufacturing activities.

Polychlorinated biphenyls (PCBs) were found in low concentrations in two limited areas of site surface soil. The specific PCBs detected were Aroclors 1254 and 1260, which are the primary mixtures found at the neighboring Harbor at Hastings site. PCBs were also found in low concentrations in sediments adjacent to the site. However, the only Aroclor detected in sediment was Aroclor 1248, which is commonly associated with sources in the upper Hudson River, and was not found at the adjacent site.

The specific levels and areal extent of these contaminants are discussed below.

5.1.3: Extent of Contamination

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

Chemical concentrations are reported in parts per billion (ppb) for water and parts per million (ppm) for soil and sediment. 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. The following are the media which were investigated and a summary of the findings of the investigation.

Soil

For the following discussion, soil sample results are separated into surface, near-surface, and subsurface horizons. This distinction is made to provide a reasonable estimate of the current and potential future exposures to contaminants from various activities at the site. Surface soil samples were taken from zero to three inches (0"-3") in areas where no pavement was present, generally on the Mobil property and eastern boundary of the Uhlich property. Near-surface soil samples were taken from below asphalt surfaces on the Uhlich property, ranging in depth from three to eleven inches (3"-11"). Subsurface samples were taken from depths below twelve inches (>12"). Note that Table 1 lists soil results separately for surface, near-surface, and subsurface samples.

Surface Soil (0-3")

Semivolatile organic contaminants (SVOCs) found in surface soils include the carcinogenic PAHs discussed in section 4.1.2 above. The highest levels of SVOCs in surface soils were found in five samples collected along the eastern boundary of the Uhlich property, adjacent to the railroad tracks. Sample SS-24, located in the northeast corner of the property, contained the highest levels of most of the SVOCs listed in Table 1.

PCBs were found to slightly exceed the1 ppm cleanup guideline in 8 surface soil samples, mostly located along the Harbor at Hastings site boundary and the access road that formerly connected the two properties. The highest detected concentration was 5 ppm of combined Aroclors 1254 and 1260 at a location along the Harbor at Hastings property boundary. The location and results of all PCB samples are shown on Figure 4.

The highest levels of beryllium, copper, lead, nickel, and zinc were found in sample SS-20, located in the southeastern corner of the Uhlich property, near the Zinsser Bridge and railroad tracks. At this location beryllium was found at 8.1 ppm, compared to its cleanup guideline of 0.16 ppm, copper was found at 648 ppm compared to its cleanup guideline of 25 ppm, lead was found at 972 ppm, compared to its cleanup guideline of 400 ppm, and zinc was found at 3,200 ppm, compared to its cleanup guideline of 20 ppm. Throughout the site, beryllium, copper, mercury, nickel and zinc were found at levels exceeding their cleanup guidelines in surface soil.

Near-Surface Soil

The highest SVOC concentrations at the site were found beneath paved surfaces on the Uhlich property, and elevated CaPAHs may be partially attributable to the asphalt pavement. The highest levels were found at location SS-16, in the southern portion of the Uhlich property, where total SVOCs were 286 ppm, compared to their cleanup guideline of 500 ppm. The maximum values for individual SVOC contaminants, particularly the CaPAHs listed in Table 1, are also from this location.

Several dye-related SVOCs were found in surface soils beneath the pavement of the Uhlich property and within 50 feet of the Uhlich property line on the Mobil property. The highest levels of aniline, chloro- and dichloro-aniline, toluidines and anthraquinones were found beneath the eastern portion of the Uhlich site, where the former Zinsser dye manufacturing operation occurred. These areas generally correspond to areas of visibly discolored soil.

Subsurface Soil

The volatile organic contaminants (VOCs) of concern in soils were all found in subsurface soil samples. These include chlorobenzene, which was found throughout the central portion of the site at a maximum value of 31 ppm, compared to its cleanup guideline of 1.7 ppm. Other VOCs include tetrachloroethene (PCE) in three widely spaced samples taken beneath the Uhlich property, with a maximum concentration of 50 ppm and a cleanup guideline of 1.4 ppm. A supplemental investigation was conducted in the area around the highest detection, and no other PCE was found. Trichloroethene (TCE), 1,2-dichloroethene (DCE) and vinyl chloride (VC) were found sporadically beneath the Uhlich property. The data indicates that detections of PCE, TCE, DCE and VC in subsurface soil are isolated.

Levels of semivolatile organic contaminants (SVOCs) were generally lower in subsurface soils than in surface soils. One notable execption was at location SB-3, on the Mobil property, where a thick, oil-like material was encountered that exhibited a strong petroleum odor. Samples from that location contained many TICs that were identified generally as hydrocarbon SVOCs, which is consistent with the presence of a residual petroleum product. Dye-related TICs were also found in subsurface soil samples, at lower levels than in near-surface soil samples. Elevated PAHs were found in soil samples collected from beneath the paved area of the Uhlich property, and in sample SB-1 beneath the paved southwestern corner of the Mobil property.

PCBs were not detected in subsurface soils at levels exceeding the cleanup guideline.

The highest levels of metals were found in sample SB-4, located in the southeastern corner of the Uhlich property, near the Zinsser Bridge and railroad tracks. This is the same portion of the site where metals were highest in surface soils. At this location copper was found at 28,700 ppm, lead was found at 3,090 ppm, and cadmium was found at 122 ppm. Throughout the site, beryllium, copper, mercury and zinc were found at levels exceeding their cleanup guidelines in subsurface soil.

Sediments

Polychlorinated biphenyls (PCBs) were found in low concentrations, ranging from non-detectable to 0.14 ppm, in most sediment samples. The only PCB mixture found was Aroclor 1248, which is commonly associated with sources in the upper Hudson River, and is found at low concentrations throughout the lower river.

Groundwater

The highest levels of chlorobenzene in groundwater were found near the suspected source area in the central portion of the site, and along the abandoned sewer line that runs along the approximate Mobil/Uhlich property line. In these areas, chlorobenzene was found at concentrations up to 11,000 ppb. The groundwater standard for chlorobenzene is 5 ppb. As shown in Figure 5, the plume of groundwater contaminated with chlorobenzene above 5 ppb extends to the shoreline of the Hudson River, where it appears to discharge into the river.

Within the chlorobenzene plume, in the area of the abandoned sewer line, is an area of benzene groundwater contamination. In this area concentrations range from 5 ppb to 170 ppb, compared to the SCG of 1 ppb. Also within the chlorobenzene plume are zones of naphthalene, chlorophenol, 4-chloroaniline, and dichlorobenzene contamination. The maximum levels of these contaminants are 650 ppb of naphthalene, 61 ppb of 2-chlorophenol, 25 ppm of 4-chloroaniline, and 170 ppb of 1,4-dichlorobenzene, compared to their SCGs of 10 ppb, 3 ppb, 5 ppb and 1 ppb, respectively.

In the northern part of the site, separate from the chlorobenzene plume, is an area of ethyl ether and diisopropyl ether contamination. The highest concentration of combined ethers, which are tentatively identified compounds (TICs), is estimated to be 770 ppb in the northwest corner of the site. There is currently no ambient groundwater standard or guidance value for ethyl- or diisopropyl ether in ambient groundwater.

Metal contaminants were found at greater frequencies and higher concentrations in unfiltered samples compared to filtered samples. This indicates that, to some degree, metals are present in particulate rather than dissolved form. Iron and manganese were found to exceed their SCGs in a high percentage (68% to 79%) of filtered samples taken from the site. Barium, antimony and selenium were found to exceed their SCGs in 26% to 37% of filtered samples. Concentrations of lead and copper in only one well (OW-17) exceeded their SCGs. At this location, along the Uhlich/Mobil property line and sewer line, lead and copper were 261 ppb and 506 ppm, compared to their respective water quality standards of 25 ppb and 200 ppb.

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. There were no IRMs performed at this site during the RI/FS.

5.3: Summary of Human Exposure Pathways:

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 May 2000 “Baseline Human Health Risk Assessment”, which is available for review 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 are documented. An exposure pathway is considered a potential pathway when one or more of the elements currently does not exist, but could in the future.

The potential exposure pathways currently of concern at this site and those related to the future use or development of the site include the following:

- Inhalation of contaminated dust or vapors by on-site workers, Pioneer Boat Club members and recreational users of the site during on-site excavation activities. Inhalation of contaminated vapors in indoor air by future occupants of buildings that may be constructed on the site;

- Incidental ingestion of contaminated surface soil by on-site workers, Pioneer Boat Club members and recreational users of the site. Incidental ingestion of contaminated sub-surface soil by on-site workers involved in excavation activities; and

- Dermal contact with contaminated groundwater by on-site workers involved with site excavation, dermal contact with contaminated surface soil and river sediments by site workers, recreation users and Pioneer Boat Club members and dermal contact with contaminated sub-surface soil by on-site workers during excavation activities.

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:

- Exposure of biota in the Hudson River to contaminants discharged to the river via groundwater.

- Exposure of wildlife to contaminants in surface soils, particularly on the unpaved portion of the property owned by Mobil.

Site contamination has also impacted the groundwater resource in the upper water bearing unit. This unit, and the contamination it carries, discharges directly to the Hudson River.

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:

- Prevent ingestion of and direct contact with contaminated soil,

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards,

- Prevent inhalation of volatile organic chemicals from contaminated soil and groundwater,

- Remove the source of groundwater contamination,

- Prevent the discharge of contaminants to the Hudson River.

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

- Soil cleanup guidelines that are protective of human health and groundwater quality.

- Class GA Ambient Water Quality Standards for contaminants of concern in groundwater.

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 the Tappan Terminal site were identified, screened and evaluated in the November 2002 Feasibility Study report, which is available at the document repositories listed 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 the contaminated soils and groundwater at the site.

SOIL REMEDIATION ALTERNATIVES

S1 - No Action

The No Action alternative is evaluated as a procedural requirement and as a basis for comparison. It would allow the site to remain in an unremediated state, with no restrictions or monitoring. 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
Time to Implement	0 months

S2 - Fencing and Institutional Controls

This alternative provides for the maintenance of the existing fencing along the northern, southern and eastern boundaries of the site, installation of a fence along the western (Hudson River) boundary, and posting of signs to warn the public of the presence of contaminated soil. Institutional and land use controls, in the form of an environmental easement, would be placed on the property to ensure that future use of the property would not create unacceptable exposures to contaminated soils.

Present Worth:	$ 65,000
Capital Cost:	$ 31,000
Annual O&M:	$ 2,200
Time to Implement	6 months

S3 - Low Permeability Capping

This alternative provides for the placement of a low permeability cap over the site. This cap would be designed to meet the relevant requirements for a solid waste landfill cap under 6NYCRR Part 360. Such caps are designed to prevent precipitation from infiltrating through contaminated wastes, or the soil beneath them, and carrying contaminants into groundwater. A Part 360 cap would consist of, from bottom to top:

1. A variable thickness of grading fill to achieve desired final slopes.
2. Six inches of cushioning fill
3. A synthetic membrane liner, such as high density polyethylene (HDPE)
4. A geocomposite drainage layer
5. An 18-inch barrier protection layer (12 inches if pavement or concrete is above)
6. A 6-inch vegetated topsoil layer or asphalt pavement.

Grading fill would be necessary as the first layer to achieve a minimum slope for drainage of rainfall and snowmelt off the top surface and the membrane. Although Part 360 landfill regulations specify a 4% final grade due to expected settlement of solid waste, a 1%-2% final grade is appropriate at this site due to the known stability of the fill.

Depending on the designated future uses of the site, the final layer would be vegetated topsoil or asphalt pavement. The thickness of the barrier protection layer could be reduced beneath paved surfaces, depending on the drainage requirements of the site. The thickness of the barrier protection layer could also be increased to enable the planting of shallow-rooted trees and shrubs.

An environmental easement would be necessary to prevent excavation that would penetrate the membrane barrier or create exposure to the contaminated soil beneath it. This would limit the use of the property to greenspace and paved areas. New buildings requiring extensive foundation systems would not be permitted because they would involve excessive penetrations of the barrier layer.

Present Worth:	$ 4,700,000
Capital Cost:	$ 4,500,000
Annual O&M:	$ 13,400
Time to Implement	1 year

S4 - Demarcation Layer and Soil Cover System

This alternative provides for the installation of a 2-foot thick soil cover system over areas of contaminated soil at the site. A demarcation layer consisting of existing asphalt or concrete, where it is in good condition; or a synthetic material, such as a geogrid or geocomposite, would be placed above existing soil. The demarcation layer would identify the presence of contaminated fill beneath it, and provide a physical barrier against unintended penetration. Where existing asphalt or concrete is in disrepair, it would be repaired or replaced with a synthetic demarcation layer. The demarcation layer would then be covered with an 18-inch layer of clean soil and a 6-inch layer of soil capable of supporting vegetation. Alternative surfaces, such as new pavement or building slabs, would be considered as a substitute for the soil cover system, in conjunction with the final site development plan.

Although the demarcation layer is not intended to be a infiltration barrier, large areas of subsurface asphalt or concrete would collect significant rainfall and snow melt, which could create ponded areas or soil instability. The soil cover system would include measures to promote runoff and/or infiltration, including grading, drainage swales, infiltration zones, and/or other controls. Because it would allow rainfall to infiltrate, a geosynthetic would not cause water to collect above the barrier and create ponded or wetland conditions.

To ensure that future activity at the site would not compromise the integrity of the soil cover, and to prevent future exposure to contaminated fill, an environmental easement would be obtained by the NYSDEC. This easement would specify the requirements for conducting intrusive activities beneath the cover system. These requirements would include NYSDEC, NYSDOH and Village notification and approval, health and safety planning, soil management and disposal, and barrier repair procedures. New structures would be permitted at the site, provided that an effective barrier to subsurface contamination is maintained, and building foundations are properly ventilated to prevent exposure to contaminated soil vapors.

Present Worth:	$ 2,370,000
Capital Cost:	$ 2,170,000
Annual O&M:	$ 13,400
Time to Implement	1 year

<u>S5 - Excavation of Chlorobenzene, Petroleum and Dye-Contaminated Soil and Installation of a Soil Cover System</u>

Chlorobenzene-contaminated soil located in the source area and along the sewer line would be excavated to the water table and disposed off-site. In addition, soil that is grossly contaminated with petroleum and dye would also be excavated. Grossly contaminated soil is soil which contains free product or mobile contamination that is identifiable either visually, through strong odor, by elevated contaminant vapor levels, or is otherwise readily detectable without analytical sampling. The excavated soil, estimated to be 7,100 cubic yards, would be disposed off-site and replaced with clean backfill.

In addition to excavation of source areas, a 2-foot soil cover and demarcation layer would be placed over residually contaminated soils, and an environmental easement would be obtained, as described in Alternative S4.

Present Worth:	$ 4,125,000
Capital Cost:	$ 3,920,000
Annual O&M:	$ 13,400
Time to Implement	2 years

Remedial Technologies for Volatile Organic Contamination in Soil and Groundwater: Soil Vapor Extraction and Air Sparging

The Feasibility Study and subsequent pilot studies evaluated three distinct, but related, technologies for removing volatile organic chemicals from the subsurface. These technologies, and their applicability to the Tappan Terminal site are summarized below and on the following page:

Soil Vapor Extraction

Soil vapor extraction (SVE), also known as "soil venting" or "vacuum extraction", is a remedial technology that reduces concentrations of volatile contaminants adsorbed to soils above the groundwater table. In this technology, a vacuum is applied to wells near the source of soil contamination. Volatile contaminants evaporate, and the vapors are drawn toward the extraction wells. Extracted vapor is then treated as necessary, usually with carbon adsorption, before being released to the atmosphere. At this site, the efficiency of SVE is reduced by the shallow groundwater table, requiring an increased number of extraction wells, a horizontal extraction system, and/or an impermeable surface barrier to improve collection efficiency. The specific need for and layout of these elements would be determined during the remedial design phase. Although SVE does not fully remediate semivolatile contaminants, some reduction may occur due to the stimulation of biological activity as oxygen is delivered to the subsurface.

Air Sparging

Air sparging is a remedial technology that reduces concentrations of volatile contaminants that are adsorbed to soils below the water table and dissolved in groundwater. This technology involves the injection of clean air into groundwater, causing the contaminants to move from a dissolved state to the vapor phase. The air is then vented through the unsaturated zone. Air sparging is usually used together with SVE to treat both groundwater and soil, and to prevent the migration of vapors. This combined system, which consists of a series of air injection and vapor extraction wells, is called AS/SVE. Air sparging at this site is made more difficult by the shallow groundwater and tidal fluctuations in groundwater levels near the river. Air sparging causes groundwater to “mound” in the vicinity of injection wells, and can blow water into the vapor collection wells. Air flow rates in the injection and collection wells must be reduced and carefully controlled to avoid water entrainment in the collection system.

S6 - Soil Vapor Extraction, Excavation of Petroleum and Dye-Contaminated Soil, and Installation of a Soil Cover System

As described in the "Remedial Technologies" section above, soil vapor extraction (SVE) uses a vacuum to capture volatile contaminants from unsaturated soils. To overcome the effects of shallow groundwater at the site, horizontal collection wells and/or an impermeable surface layer in the SVE area would be evaluated during the remedial design.

Because SVE is not effective at removing semivolatile organic contaminants, an estimated 100 cubic yards of soil that is grossly contaminated with dye-related compounds and weathered petroleum would be excavated and removed from the site. Grossly contaminated soil is soil which contains free product or mobile contamination that is identifiable either visually, through strong odor, by elevated contaminant vapor levels, or is otherwise readily detectable without analytical sampling. Soil that contains lower levels of petroleum could achieve some reduction in contamination by biodegradation processes that are often associated with SVE.

The remainder of the site, which contains residual site-related contamination and historic fill, would be covered with a demarcation layer and soil cover, as described in Alternative S4 above. An environmental easement would also be obtained by the NYSDEC.

Present Worth:	$ 3,746,000
Capital Cost:	$ 2,748,000
Annual O&M:	
Years 1-5	$ 209,000
Years 6-30	$ 8,600
Time to Implement	18 months

S7 - Excavation of all Contaminated Soil above the Water Table

Soil across the entire site would be excavated to the depth of the water table to remove petroleum, chlorobenzene, dye and fill-related contamination from above the water table. Approximately 121,000 cubic yards of soil would be excavated, transported and disposed off-site. Any buildings or abandoned structures, such as tank pads or platforms, would be removed as part of this excavation. All excavations would be backfilled with clean soil to existing grade. Because soil beneath the groundwater table is contaminated, a demarcation layer would be placed beneath the clean soil backfill.

Present Worth:	$ 17,250,000
Capital Cost:	$ 17,100,000
Annual O&M:	$ 8,600
Time to Implement	3 years

Remedial Technologies for Volatile Organic Contamination in Soil and Groundwater: Bio-Sparging

Bio-Sparging

Biosparging is a remedial technology that uses indigenous microorganisms to biodegrade organic constituents in the saturated zone (below the groundwater table). In biosparging, air (or oxygen) and nutrients (if needed) are injected into the saturated zone to increase the biological activity of naturally-occurring microorganisms. In many cases, biological activity is limited by the amount of oxygen that is dissolved in groundwater. Biosparging provides a steady supply of oxygen to sustain biodegradation, at a relatively low rate as compared to air sparging. Biosparging can be used to reduce concentrations of organic contaminants that are dissolved in groundwater and/or adsorbed to soil below the water table.

Biodegradation processes typically take longer to achieve remedial goals, and may create degradation products that are equally problematic. During the 18-month pilot study at the Tappan Terminal site, biosparging decreased chlorobenzene moderately in only 4 out of 11 monitoring wells, from an average level of 1727 ppb before the test to 1354 ppb afterward. However, in the 7 other wells in the study area, average chlorobenzene levels increased from 2923 ppb to 3529 ppb. In the study area as a whole, chlorobenzene increased from 2488 ppb to 2738 ppb.

Although chlorobenzene levels increased on average, biodegradation was considered to have occurred due to the presence of its byproduct, 2-chlorophenol, at low levels. However, the rate of degradation appears to be very slow. In addition, 2-chlorophenol is equally problematic as a contaminant as chlorobenzene. The groundwater standard for 2-chlorophenol is 1.0 ppb, compared to the 5.0 ppb standard for chlorobenzene. Because biosparging does not appear to be capable of achieving groundwater quality standards for chlorobenzene and its degradation products in a reasonable time frame, it was not retained as a feasible remedial technology.

GROUNDWATER REMEDIATION ALTERNATIVES

G1 - No Action with Long Term Monitoring

Under this alternative, no active remediation of groundwater would be performed, and contamination would remain in place. If the source of groundwater contamination were to be remediated by a soil remediation alternative, some natural attenuation of groundwater contamination may occur, but not to a sufficient degree to achieve SCGs. Groundwater monitoring would be performed in the long term to evaluate the degree of attenuation.

Present Worth:	$ 98,000
Capital Cost:	$ 0
Annual O&M:	$ 6,400
Time to Implement	3 months

G2 - Air Sparging with Soil Vapor Extraction

As described in the "Remediation Technologies" section above, air sparging (AS) is the injection of air below the water table to transfer volatile contaminants from water to the vapor phase. Soil vapor extraction (SVE) uses a vacuum to capture volatile contaminants from the unsaturated zone as they are stripped from the groundwater.

The AS/SVE system would be installed in two locations, in the chlorobenzene source area, and along the sewer line where the contamination has spread laterally. Conceptually, the AS/SVE system would consist of several zones (see Figure 6), each containing a series of vertical air sparging wells and a horizontal vapor extraction well. Due to the shallow groundwater table, an impermeable layer at the ground surface, such as plastic sheeting, may be necessary to prevent short circuiting of the collection system to air at the surface.

It is estimated that the AS/SVE system would be operated for 5 years until soil and groundwater achieve cleanup goals. This would be followed by a period of long term monitoring to ensure the cleanup was effective.

Present Worth:	$ 2,060,000
Capital Cost:	$ 991,000
Annual O&M:	
Years 1-5	$ 231,000
Years 6-30	$ 6,400
Time to Implement	18 months

G3 - Hydraulic Barrier, Groundwater Extraction and Treatment

Under this alternative, contaminated groundwater would be pumped from the ground and treated prior to discharge into the Hudson River. A series of extraction wells located along both the sewer line and the Hudson River would be installed, as shown in Figure 7. To isolate the shoreline wells from the tidal fluctuations of the river and to prevent them collecting river water, a hydraulic barrier would be installed. This slurry wall would be about 20 feet deep, and would be keyed into the Marine Silt unit.

Extracted groundwater would be treated to remove the VOCs, SVOCs and metals that currently exceed surface water discharge standards. In addition, pretreatment for iron and manganese would likely be required to prevent fouling of the air stripping system used to treat VOCs.

It is estimated that the groundwater extraction and treatment system would require 15 years to achieve groundwater standards, and that this would be followed by a period of long term monitoring.

Present Worth:	$ 3,660,000
Capital Cost:	$ 1,840,000
Annual O&M:	
Years 1-15	$ 156,000
Years 16-30	$ 6,400
Time to Implement	2 years

G4 - In-situ Chemical Oxidation

In-situ chemical oxidation is an in-place treatment technology that uses an oxidant such as peroxide or permanganate to destroy contaminants in both soil and groundwater. The oxidant would be injected through a series of wells into the subsurface, where it would migrate through the aquifer and break down contaminants that are amenable to oxidation. In-situ oxidation is effective for the VOCs of concern at this site, and would fully break down these contaminants without creating by-products of concern. This technology is not effective for treating many SVOCs or any metals. To determine the best oxidant and optimal injection rate for the specific contaminants and site conditions, a pilot study would be necessary.

One limitation to this technology is the presence of organic matter in the soil matrix that would consume the oxidant and require frequent re-injection to destroy the targeted contamination. The organic content of the soils at the site is significantly high, averaging 10%, due to the ash and other man-made materials used to construct the landmass. Interference by fill-related organic matter on the oxidation technology would require investigation during the pilot study. The effect of this interference would be to significantly increase the amount and duration of oxidant required to achieving the remedial goals for the site.

For comparison purposes, oxidation is estimated to require 2 years to design and implement, followed by a long term monitoring period. However, due to the unknown effect of fill-related interference, the cost estimate and time frame have significant uncertainty.

Present Worth:	$ 1,840,000
Capital Cost:	$ 1,660,000
Annual O&M:	$ 6,400
Time to Implement	2 years

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. The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

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.

Alternatives S1 and G1 (No Further Action for soil and groundwater, respectively) would not protect human health and the environment because contamination would remain at the site in an uncontrolled condition. Alternative S2 (Fencing and Institutional Controls) would not fully protect public health because trespassers could continue to access the site and contact contaminated soil. Alternative S2 would also not protect the environment because soil would continue to be a source of groundwater contamination. Alternatives S3 (Low Permeability Capping) and S4 (Soil Cover System) would protect public health by eliminating the potential for direct contact with contaminated soil. The environmental easement and associated requirement for soil vapor mitigation systems on any new structures would prevent unacceptable exposures to contaminated vapors. However, Alternatives S3 and S4 alone would not fully protect the environment because contaminated soil below the water table would continue to affect groundwater.

Alternatives S5 and S6 would provide a high degree of health and environmental protection with respect to contaminated soils. Both alternatives would remove petroleum and dye-contaminated soils from the site, and thereby eliminate the potential for exposure to these contaminants. Alternative S5 would remove chlorobenzene-contaminated soil by excavation, while Alternative S6 would remove it using a soil vapor extraction system. Both alternatives would prevent exposure to residual contamination through the use of a soil cover system. Alternative S7 would provide the highest degree of protection from contaminated soils by excavating all contaminated soils above the water table and removing them from the site.

To be fully protective of the environment, all soil alternatives must be combined with a groundwater alternative. Alternatives G2 and G3 provide a high degree of environmental protection through proven technologies. It is uncertain whether Alternative G4 can effectively treat groundwater at this site and achieve a high degree of environmental protection.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether or not a remedy will meet applicable environmental laws, regulations, standards, and guidance.

The No Action alternatives S1 and G1 would not achieve applicable standards and guidance values for groundwater and soil at this site; nor would Alternative S2. Alternative S3 would meet the standards for a landfill cap. Alternative S4 would not meet the requirements for a cap for the levels of contamination that would remain at the site. Alternatives S5 and S6 would meet the guidance values for contaminated soil by excavation and/or soil vapor extraction. Residual contamination, particularly tentatively identified compounds for which there are no specific guidance values and historic fill, would be covered with a soil cover that would not be fully compliant with landfill capping regulations. Alternative S7 would achieve soil cleanup guidance values for soils located above the water table. For the excavation portions of alternatives S5, S6 and S7, off-site transportation and disposal of excavated material would comply with applicable solid and hazardous waste management regulations and land disposal restrictions.

Groundwater alternatives G2, G3 and G4 would comply with the requirements for air and surface water discharges from their respective treatment systems. They are also expected to meet the ambient groundwater quality standards for volatile organic contaminants. However, only alternative

G3 would meet the ambient water quality standards for semivolatile organic chemicals and inorganics assiciated with the historic fill at the site.

The next five "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

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.

Alternatives S1, S2 and G1 would not have any short-term construction-related impacts, and could be readily implemented in a short time frame. Alternatives S3 and S4 would require a longer time frame, approximately 1 year each, but would not require excavation of any contaminated soil that could cause short-term exposures to workers and residents. Alternative S5 would have a higher potential for short-term impact because a large volume of soil, containing volatile organic contaminants, would be excavated over a 2-year time frame. Alternative S6 would have less short-term impact than S5, because a much smaller volume of soil, containing less volatile contaminants, would be excavated over a shorter time period. Alternative S7 would have the greatest potential short-term impact because a very large volume of contaminated soil would be excavated over an estimated 3-year construction period.

The groundwater treatment alternatives G2, G3 and G4 would have similar, minimal short-term impacts. Alternative G2 would require careful balancing of the air sparging and vapor extraction processes to ensure that contaminant vapors are fully collected. Alternatives G3 and G4 would require worker protections to prevent exposure to chemicals associated with their respective treatment processes. Alternatives G2 and G4 would require a similar amount of time to achieve the remedial goals for the site. Alternative G2 would require a shorter design period because some pilot testing has already been done, and because AS/SVE is a well-established technology. Alternative G4 would require a longer design period due to the need for extensive pilot testing, but a shorter implementation time frame.

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.

Alternatives S1, S2 and G1 would not provide long-term effectiveness or permanence because contaminants would remain in soil and groundwater at the site and would continue to be accessible to human and environmental receptors. Alternative S3 would provide long-term effectiveness by isolating contaminants and controlling the exposure to, and release of, contaminants in soil. The components of the Part 360 landfill cap would require inspection and maintenance to be effective. Alternative S4 alone would provide less long-term effectiveness than S3 because the soil cover would provide less protection of groundwater than the landfill cap.

Alternative S5 would provide more long-term effectiveness and permanence by removing the highly contaminated soil above the water table that is impacting groundwater. The potential contact with residual contamination would be minimized with a soil cover system. Alternative S6 would provide a high degree of long-term effectiveness and permanence by stripping volatile organic contaminants from soil and excavating the highest levels of non-volatile contaminants. Alternative S7 would provide the highest degree of long-term effectiveness and permanence by removing all highly contaminated and residually contaminated soil from above the water table.

For groundwater, Alternatives G2 and G3 would provide a high degree of long-term effectiveness and permanence by removing contaminants from the subsurface. The effectiveness of alternative G4 is uncertain due to the potential interference of the fill matrix on the chemical oxidation technology.

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.

Alternatives S1, S2, and G1 would not reduce the toxicity, mobility or volume of contaminants in soil or groundwater. Alternative S3 would reduce the mobility of contaminants in soil and groundwater by isolating contaminated soil under an impermeable cap. Alternative S4 would somewhat reduce the mobility of contaminants by eliminating dust and surface runoff migration with a soil cover. However, neither Alternative S3 or S4 would reduce the volume or toxicity through treatment. Alternative S5 would reduce the mobility and volume of contaminated soil at the site by excavation and off-site disposal, and the mobility of residual contamination would be reduced by a soil cover system. Alternative S6 would provide a similarly high degree of mobility and volume reduction by a combination of excavation and soil vapor extraction. Alternative S7 would provide the highest degree of mobility and volume reduction by excavating all soil above the water table and removing it from the site. None of the soil alternatives under consideration would reduce contaminant toxicity through treatment. Alternatives G2 and G3 would reduce the mobility and volume of contamination in the groundwater phase by removing it from the subsurface. If Alternative G4 could be successfully implemented, it would reduce toxicity by breaking down organic contaminants into non-toxic or less toxic chemicals.

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.

Alternatives S1, G1 and S2 could both be readily constructed, and Alternative S1 would not require an institutional control, so it would be the easiest alternative to implement. In addition to their varying technical implementability, Alternatives S2 through S7 would require an environmental easement, which would require legal negotiations concerning the two properties that comprise the site. Alternative S4 would be relatively easy to implement because a soil cover requires less specialized equipment and installation methods than a landfill cap. Alternative S3 would be somewhat more difficult to implement due to the need to re-grade the fill and properly seam the impermeable barrier material. Alternatives S5 and S6 would be more difficult to implement due to the need to excavate areas of contamination, particularly where building foundations and/or utilities are present. Alternative S7 would be the most difficult alternative to implement because a large volume of contaminated soil would have to be excavated and removed from the site. Because this soil would contain volatile organic contaminants, strict air emission controls would be required to prevent exposures to workers and the community.

Alternatives G2 and G3 would be moderately difficult to implement due to the presence of abandoned structures, utility lines and subsurface bulkheads that could interfere with the installation of horizontal wells or collection trenches. However, the technologies associated with these alternatives are well established and readily available. Alternative G4 would be somewhat more difficult to implement because it is a recently developed technology, and would require extensive pilot testing before it could be applied to this site.

7. Cost-Effectivness. Capital costs and operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision. The costs for each alternative are presented in Table 2.

Alternatives S1 and S2 would be the least costly alternatives to implement, with S2 requiring a low annual cost to verify that fencing and institutional controls are effective. Alternative G1 would also require only low periodic groundwater monitoring costs. Alternative S4 is the least costly of the two containment options, with the full landfill cap (S3) requiring an additional $2.33 million, or nearly double, the soil cover system. Excavating VOC, petroleum and visible dye contamination (Alternative S5) would add $1.76 million (74%) to the cost of the soil cover alone. Removing the VOC contamination with an SVE system rather than excavation would add another $1.38 million (58%) to the soil cover remedy. Removing all soil above the water table is more than $12.5 million more costly than any of the other alternatives under consideration.

Alternative G4 is the least costly of the active groundwater alternatives, with a large component of capital cost for the chemical oxidant injections. Alternative G2 is slightly (12%) more expensive than G4, but would achieve cost savings if used in combination with soil vapor extraction Alternative S6. Alternative G3 is the most costly groundwater alternative, an additional $1.6 million (78%) more than Alternative G2.

This final criterion is considered a “modifying criterion” and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

8. Community Acceptance - Concerns of the community regarding the RI/FS reports and the PRAP have been evaluated. The Responsiveness Summary (Appendix A) presents the public comments received and the manner in which the NYSDEC addressed the concerns raised.

Several changes and clarifications have been made to this ROD based on public comments received.

- Additional technologies will be considered in the remedial design phase for the treatment of soil and groundwater contaminated with chlorobenzene and other VOC and SVOC contaminants. These technologies include chemical oxidation, in-situ anaerobic biodegradation, and phytoremediation. These technologies will be considered for use in different portions of the contaminated area to address highly contaminated areas (chemical oxidation) and to treat lesser contaminated areas of the groundwater contaminant plume (phytoremediation and anaerobic biodegradation). These technologies may also be applied in conjunction with air sparging and soil vapor extraction. The semivolatile organic compounds listed in Table 1 have been added to the contaminants to be targeted by these technologies.

- The estimated volume for the excavation of grossly contaminated soils has increased, and the ROD specifically provides for a pre-design investigation to delineate the extent of such contamination. A quantitative guideline of 500 ppm for total semivolatile organic compounds, including TICs, has been added to account for instances where high levels of dye-related compounds may be present with no visual indication of contamination. Excavation also includes subsurface piping and other structures associated with site contaminants.

- The ROD provides for construction of utility corridors of clean soil. If a site development plan is available when the soil cover system is designed, this will be installed as part of the soil cover system. Otherwise, the installation of clean utility corridors will be a required item of the Site Management Plan.

SECTION 8: SUMMARY OF THE SELECTED REMEDY

Based on the Administrative Record and the discussion presented below, the NYSDEC has selected a combination of Alternatives S6 and G2, consisting of excavation of grossly contaminated soil containing petroleum and dye contaminants, a soil cover with air sparging and soil vapor extraction, as the remedy for this site. The selected remedy is based on the results of the RI and the evaluation of alternatives presented in the FS.

Air sparging and soil vapor extraction (SVE/AS) are expected to effectively remove volatile organic contamination, including chlorobenzene and benzene, from soil and groundwater beneath the site. Soil containing the highest levels of semivolatile organic contaminants (SVOCs), particularly petroleum and dyes, would be excavated and removed from the site. Although SVE/AS would not remove SVOCs from groundwater, these have not migrated significantly from their source areas. The additional cost and time necessary to extract and treat contaminated groundwater is not justified by the removal of SVOCs, which are primarily the result of historic fill. For some SVOCs in soil, the soil vapor extraction component of the remedy would promote biodegradation by introducing oxygen into the subsurface. The soil cover would prevent exposure to the remaining, low levels of SVOCs and metals in soil, including those associated with the historic fill used to create the site. An environmental easement would be placed on the site to ensure that the soil cover is maintained, and that any excavations conducted beneath the demarcation layer are conducted safely.

The estimated present worth cost to implement the remedy is $ 4,226,000. The cost to construct the remedy is estimated to be $ 3,021,000 and the estimated average annual operation and maintenance cost is $240,000 for the first five years and $15,000 thereafter.

The elements of the selected remedy are as follows:

1. A remedial design program will be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program. A pre-design investigation will be conducted to determine the extent of soil contamination that must be excavated and disposed off-site.

2. Treatment of soil contaminated with chlorobenzene, benzene and groundwater contaminated with chlorobenzene, benzene, 2-chlorophenol, 1,4-dichlorobenzene, 4-chloroaniline, and naphthalene. The representative technology for this treatment is air sparging and soil vapor extraction. However, other treatment technologies such as chemical oxidation and/or phytoremediation may be evaluated during the design phase for use in place of, or in combination with, the representative technology.

3. Excavation and off-site disposal of soil that is visibly contaminated with dye or petroleum, is otherwise grossly contaminated, or contains greater than 500 ppm total semivolatile organic compounds, including tentatively identified compounds. This includes soil both above and below the water table. Subsurface piping and other structures associated with site contaminants will also be excavated from the site.

4. Construction of a soil cover over all vegetated areas to prevent exposure to contaminated soils. The two-foot thick cover will consist of clean soil underlain by an indicator such as orange plastic snow fence or existing asphalt or concrete surfaces to demarcate the cover soil from the subsurface soil. The top six inches of soil would be of sufficient quality to support vegetation. Clean soil would constitute soil that meets the Division of Environmental Remediation's criteria for backfill or local site background. Non-vegetated areas (buildings, roadways, parking lots, etc.) would be covered by a paving system or concrete at least 6 inches thick. If a site development plan is available when the cover system design is prepared, clean utility corridor(s) will be constructed. Soil excavated from the corridor(s) will either be re-graded on the site and covered, or disposed off-site, in accordance with the remaining provisions of the ROD.

5. Imposition of an institutional control in the form of an environmental easement that will require (a) limiting the use and development of the property to restricted residential use, which would also permit recreational, commercial or industrial uses;(b) compliance with the approved site management plan; (c) restricting the use of groundwater as a source of potable water, without necessary water quality treatment as determined by NYSDOH; and (d) the property owner to complete and submit a certification to the NYSDEC a periodic certification of the institutional and engineering controls.

6. Development of a site management plan which includes the following institutional and engineering controls: (a) management of the final cover system to restrict excavation below

the soil cover's demarcation layer, pavement, or buildings. Excavated soil will be tested, properly handled to protect the health and safety of workers and the nearby community, and will be properly managed in a manner acceptable to the Department; (b) continued evaluation of the potential for vapor intrusion for any buildings developed on the site, including provision for mitigation of any impacts identified; (c) monitoring of groundwater; (d) identification of any use restrictions on the site; (e) provide for the construction of a clean utility corridor if and when site development occurs; and (f) provisions for the continued proper operation and maintenance of the components of the remedy.

7. The property owner(s) will provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to the Department, until the Department notifies the property owners in writing that this certification is no longer needed. This submittal will: (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous certification or are compliant with Department-approved modifications; (b) allow the Department access to the site; and (c) state that nothing has occurred that would impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the Department.

8. The operation of the components of the remedy will continue until the remedial objectives have been achieved, or until the NYSDEC determines that continued operation is technically impracticable or not feasible.

9. Since the remedy results in residually contaminated soils remaining at the site, a monitoring program will be instituted as part of the site management plan. This will include monitoring the soil cover to ensure that it continues to effectively prevent exposures to subsurface contamination. Groundwater at the site will also be monitored to verify the effectiveness of the groundwater treatment process, and to ensure that residual contamination does not pose an unacceptable threat to public health or the environment. This program will allow the effectiveness of the soil cover to be monitored, and will be a component of the operation, maintenance, and monitoring for the site.

SECTION 9: HIGHLIGHTS OF COMMUNITY PARTICIPATION

As part of the remedial investigation process, a number of Citizen Participation activities were undertaken to inform and educate the public about conditions at the site and the potential remedial alternatives. The following public participation activities were conducted for the site:

- Repositories for documents pertaining to the site were established.

- A public contact list, which included nearby property owners, elected officials, local media and other interested parties, was established.

- In August 1998, a fact sheet was mailed to the public contact list announcing the beginning of the Remedial Investigation and associated public meeting.

- On September 24, 1998, a public meeting was held to present the Remedial Investigation Work Plan to the community.

- In October 1999, a fact sheet was mailed to the public contact list that summarized the Remedial Investigation results and announced a public meeting to discuss the site.

- On October 20, 1999, a public meeting was held to present the investigation results.

- In December 2005, a fact sheet was prepared and mailed to the public contact list that summarized the results of the RI/FS, discussed the remedy proposed in the Proposed Remedial Action Plan, and announced the public meeting and comment period.

- In January 2006, an announcement of the extension of the public comment period was mailed to the public contact list.

- A public meeting was held on January 17, 2006 to present and receive comment on the PRAP.

- A responsiveness summary (Appendix A) was prepared to address the comments received during the public comment period for the PRAP.

Table 1
Nature and Extent of Contamination

MEDIUM	CATEGORY	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppm)	FREQUENCY of EXCEEDING SCGs/Background	SCG/ Bkgd. (ppm)
Surface Soils (0-3")	Semivolatile Organic Compounds (SVOCs)	Benzo(a)anthracene	ND (0.027) to 5.4	13 of 18	0.224
		Chrysene	ND (0.030) to 6.2	12 of 18	0.400
		Benzo(b)fluoranthene	ND (0.021) to 7.1	7 of 18	1.1
		Benzo(k)fluoranthene	ND (0.019) to 5.2	6 of 18	1.1
		Benzo(a) pyrene	ND (0.027) to 6.5	16 of 18	0.061
		Dibenzo(a,h) anthracene	ND (0.014) to 1.3	13 of 18	0.014
	Polychlorinated Biphenyls	Total PCBs	ND (0.001) to 5.0	7 of 33	1.0
	Metals	Arsenic	ND (3.0) to 90	11 of 18	7.5
		Barium	ND (1.0) to 8,120	7 of 18	300
		Beryllium	ND (1.0) to 8.1	17 of 18	0.160
		Chromium	ND (1.0) to 97	3 of 18	50
		Copper	ND (1.0) to 1,110	17 of 18	25
		Lead	ND (2.0) to 1,320	8 of 18	400
		Mercury	ND (0.2) to 2.8	16 of 18	0.100
		Nickel	ND (2.0) to 119	15 of 18	13
		Selenium	ND (4.0) to 2.5	2 of 18	2.0
		Vanadium	ND (1.0) to 2,190	3 of 18	150
		Zinc	ND (1.0) to 3,200	24 of 24	20

MEDIUM	CATEGORY	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppm)	FREQUENCY of EXCEEDING SCGs/Background	SCG/ Bkgd. (ppm)
Near Surface Soils (3"-11")	Semivolatile Organic Compounds (SVOCs)	Benzo(a)anthracene	ND (0.027) to 23	5 of 6	0.224
		Chrysene	ND (0.030) to 25	4 of 6	0.400
		Benzo(b)fluoranthene	ND (0.021) to 23	2 of 6	1.1
		Benzo(k)fluoranthene	ND (0.019) to 25	2 of 6	1.1
		Benzo(a) pyrene	ND (0.027) to 25	5 of 6	0.061
		Indeno (1,2,3-cd) pyrene	ND (0.020) to 12	1 of 6	3.2
		Dibenzo(a,h) anthracene	ND (0.014) to 7.9	5 of 6	0.014
	Polychlorinated Biphenyls	Total PCBs	ND (0.001) to 4.4	1 of 6	1.0
	Metals	Arsenic	ND (3.0) to 19.8	2 of 6	7.5
		Barium	ND (1.0) to 954	3 of 6	300
		Beryllium	ND (1.0) to 0.39	6 of 6	0.160
		Copper	ND (1.0) to 428	6 of 6	25
		Lead	ND (2.0) to 403	1 of 6	400
		Mercury	ND (0.2) to 2.0	5 of 6	0.100
		Nickel	ND (2.0) to 35.9	5 of 6	13
		Zinc	ND (1.0) to 1,620	6 of 6	20

MEDIUM	CATEGORY	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppm)	FREQUENCY of EXCEEDING SCGs/Background	SCG/ Bkgd. (ppm)
Subsurface Soils	Volatile Organic Compounds (VOCs)	Chlorobenzene	ND (0.10) to 31	6 of 33	1.7
		Trichloroethylene	ND (0.01) to 15	2 of 33	0.700
		Tetrachloroethylene	ND (0.01) to 50	3 of 33	1.4
		1,2-Dichloroethene	ND (0.01) to 23	1 of 33	0.300
		Vinyl Chloride	ND (0.01) to 1.8	1 of 33	0.200
	Semivolatile Organic Compounds (SVOCs)	Benzo(a)anthracene	ND (0.064) to 2.4	5 of 10	0.224
		Chrysene	ND (0.11) to 2.4	3 of 10	0.400
		Benzo(b)fluoranthene	ND (0.12) to 2.8	3 of 10	1.1
		Benzo(k)fluoranthene	ND (0.11) to 1.9	3 of 10	1.1
		Benzo(a) pyrene	ND (0.060) to 1.7	7 of 10	0.061
		Dibenzo(a,h) anthracene	ND (0.069) to 0.330	4 of 10	0.014
	Metals	Arsenic	ND (3.0) to 14.6	5 of 10	7.5
		Barium	ND (1.0) to 3,650	4 of 10	300
		Beryllium	ND (1.0) to 0.290	8 of 10	0.160
		Cadmium	ND (1.0) to 122	1 of 10	10
		Chromium	ND (1.0) to 120	1 of 10	50
		Copper	ND (1.0) to 28,700	9 of 10	25
		Lead	ND (2.0) to 3,090	2 of 10	400
		Mercury	ND (0.2) to 1.1	9 of 10	0.10
		Nickel	ND (2.0) to 1,120	5 of 10	13
		Selenium	ND (2.0) to 2.7	3 of 10	2
		Zinc	ND (1.0) to 43,500	10 of 10	20

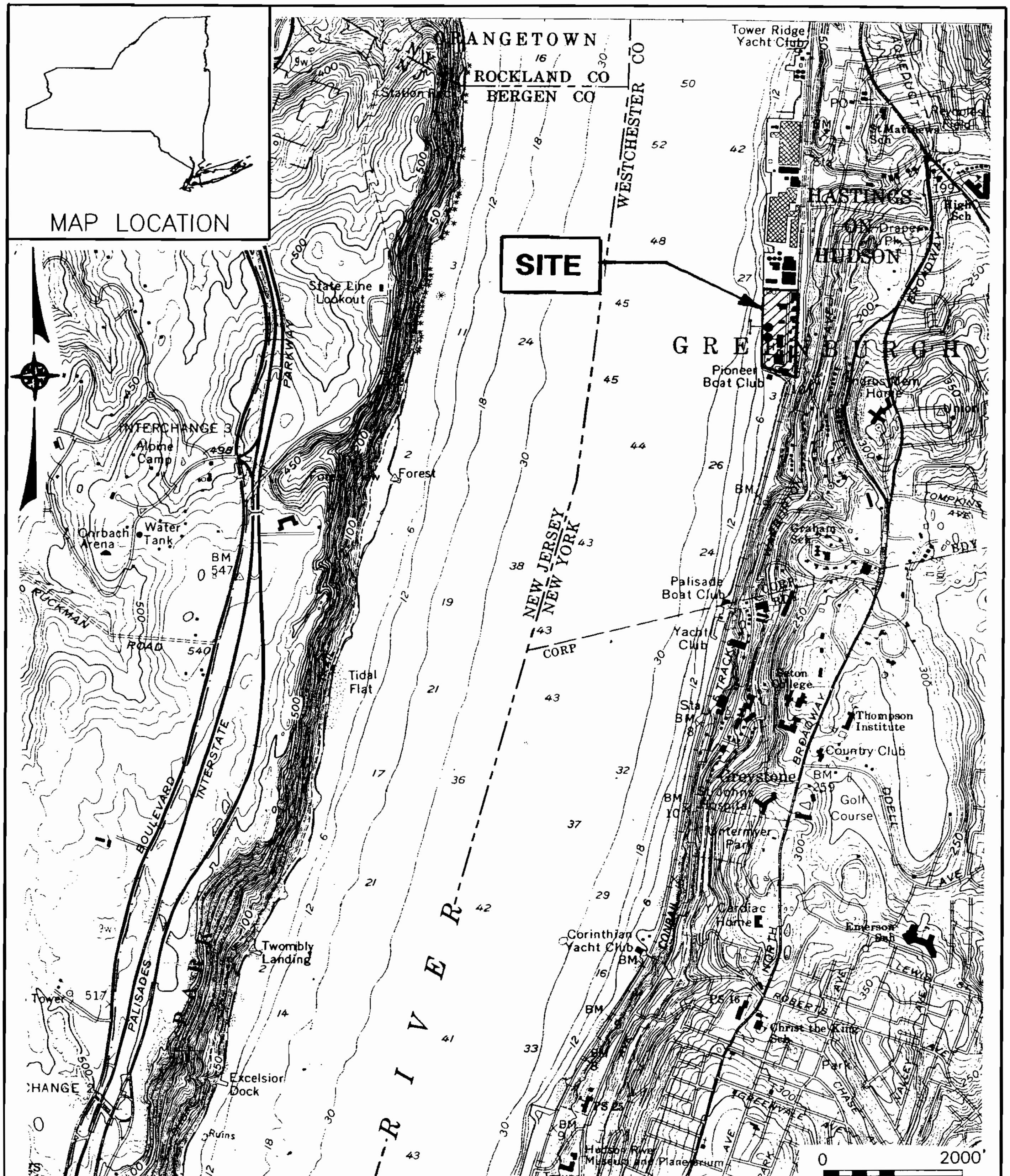
MEDIUM	CATEGORY	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppm)	FREQUENCY of EXCEEDING SCGs/Background	SCG/ Bkgd. (ppm)
Sediments	Volatile Organic Compounds (VOCs)	1,1,2,2-Tetrachloroethane	ND (1.0) to 5	1 of 12	0.45
	Polychlorinated Biphenyls	Total PCBs	ND (1.0) to 0.140	0 of 12	1.0
Groundwater	Volatile Organic Compounds (VOCs)	Chlorobenzene	ND (0.1) to 11,000	40 of 72	5.0
		Benzene	ND (0.1) to 170	18 of 72	1.0
		Ethyl Ether	ND (0.1) to 360	[1]	[1]
		Diisopropyl Ether	ND (0.1) to 410	[1]	[1]
	Semivolatile Organic Compounds (SVOCs)	2-Chlorophenol	ND (0.1) to 61	6 of 38	1.0
		1,4-Dichlorobenzene	ND (0.1) to 170	5 of 38	3.0
		4-Chloroaniline	ND (0.1) to 25	4 of 38	5.0
		Naphthalene	ND (0.1) to 650	8 of 72	10
	Metals (in filtered samples)	Antimony	ND (4.0) to 47	10 of 38	3.0
		Arsenic	ND (3.0) to 40	1 of 38	25
		Barium	ND (1.0) to 2,180	10 of 38	1,000
		Iron	ND (20) to 261,000	26 of 38	300
		Manganese	ND (4.0) to 8140	30 of 38	300
		Selenium	ND (4.0) to 17	14 of 38	10
		Thallium	ND (5.0) to 8.0	2 of 38	0.5

ND - Not detected at the detection limit listed in parenthesis

[1] - There are no ambient groundwater standards or guidance values for ethyl and diisopropyl ether

Table 2
Remedial Alternative Costs

Remedial Alternative	Capital Cost	Annual O&M	Total Present Worth
Soil Alternatives			
S1 - No Action	$0	$0	$0
S2 - Fencing and Institutional Controls	$31,000	$2,200	$65,000
S3 - Low Permeability Capping	$4,500,000	$13,400	$4,700,000
S4 - Soil Cover System	$2,170,000	$13,400	$2,370,000
S5 - Contaminant Excavation and Soil Cover System	$3,920,000	$13,400	$4,125,000
S6 - Soil Vapor Extraction, Partial Excavation and Soil Cover System	$2,748,000	Years: 1-5 $ 209,000 6-30 $ 8,600	$3,746,000
S7 - Excavation above the Water Table	$17,100,000	$8,600	$17,250,000
Groundwater Alternatives			
G1 - No Action with Long Term Monitoring	$0	$6,400	$98,000
G2 - Air Sparging and Soil Vapor Extraction	$991,000	Years: 1-5 $ 231,000 6-30 $ 6,400	$2,060,000
G3 - Groundwater Extraction and Treatment	$1,840,000	Years: 1-15 $ 156,000 16-30 $ 6,400	$3,660,000
G4 - In-Situ Chemical Oxidation	$1,660,000	$6,400	$1,835,000
Selected Remedy - Alternatives S6 and G3 Combined			
Air Sparging / Soil Vapor Extraction, Partial Excavation, Soil Cover	$3,021,000	Years: 1-5 $ 240,000 6-30 $ 15,000	$4,226,000



SOURCE: USGS YONKERS QUADRANGLE, NEW YORK–NEW JERSEY

DIR: 1570 FILE: USGSMAP.DWG

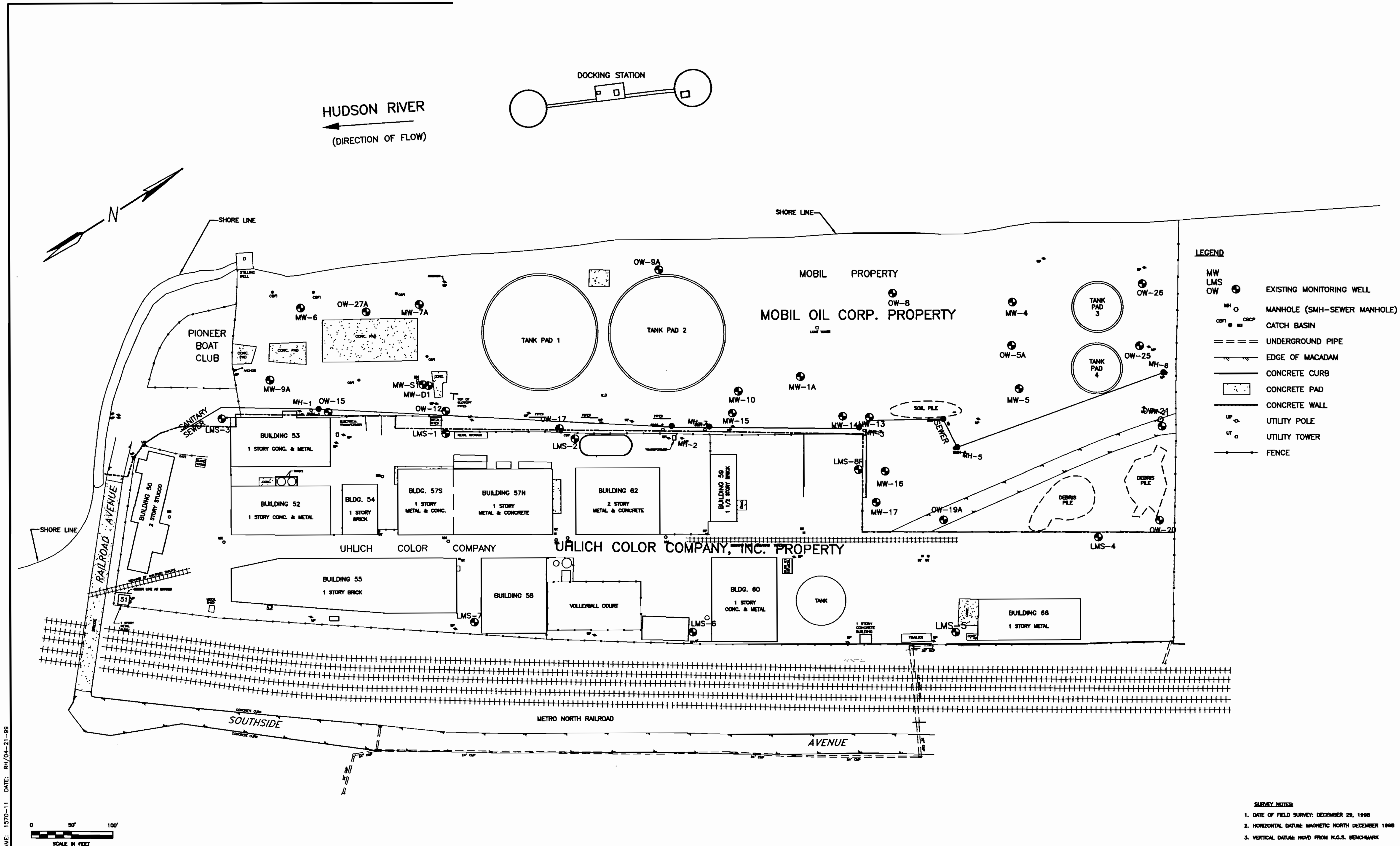
TAPPAN TERMINAL SITE
HASTINGS–ON–HUDSON, NEW YORK

SITE LOCATION MAP

FIGURE 1

Dvirka and Bartilucci
Consulting Engineers
A Division of William F. Cosulich Associates, P.C.

Figure 2:
Tappan Terminal - Aerial View

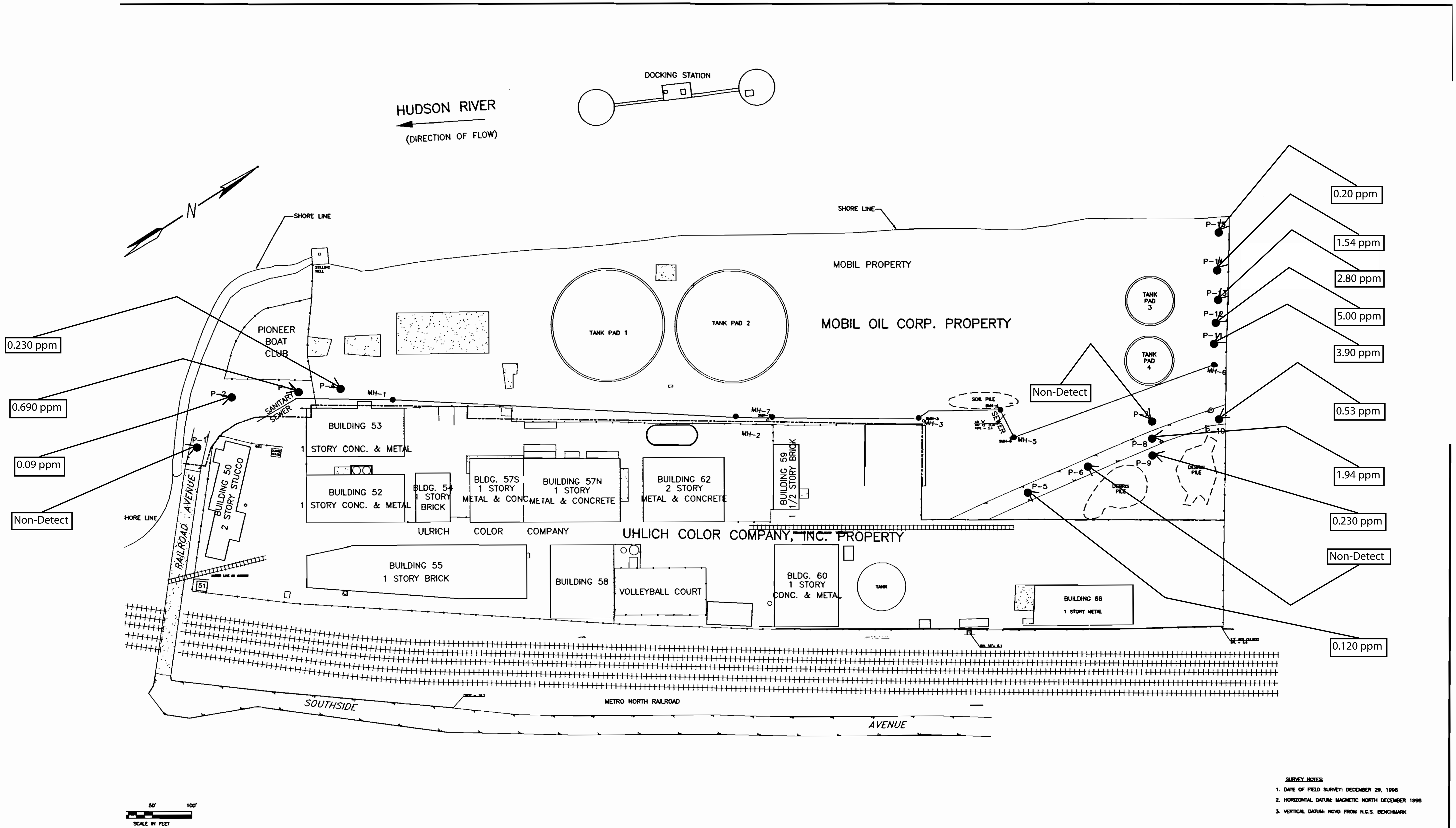


TAPPAN TERMINAL SITE
HASTINGS-ON-HUDSON, NEW YORK

Dvirka and Bartilucci
Consulting Engineers
A Division of William F. Cosulich Associates, P.C.

SITE MAP

FIGURE 3



TAPPAN TERMINAL SITE
HASTINGS-ON-HUDSON, NEW YORK

Dvirka and Bartilucci
Consulting Engineers
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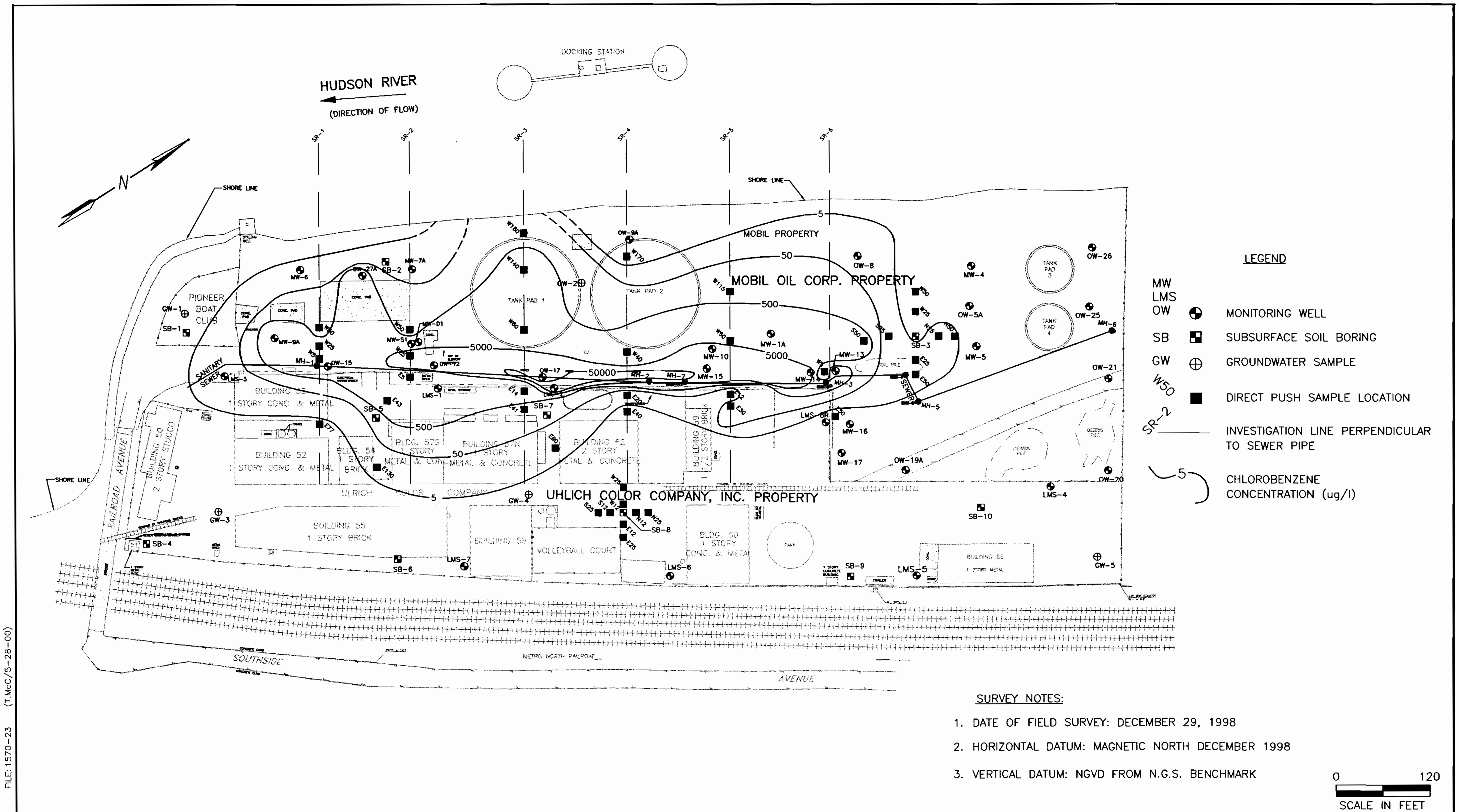
PCB SAMPLE LOCATIONS-SUPPLEMENTAL SOIL INVESTIGATION

FIGURE 4



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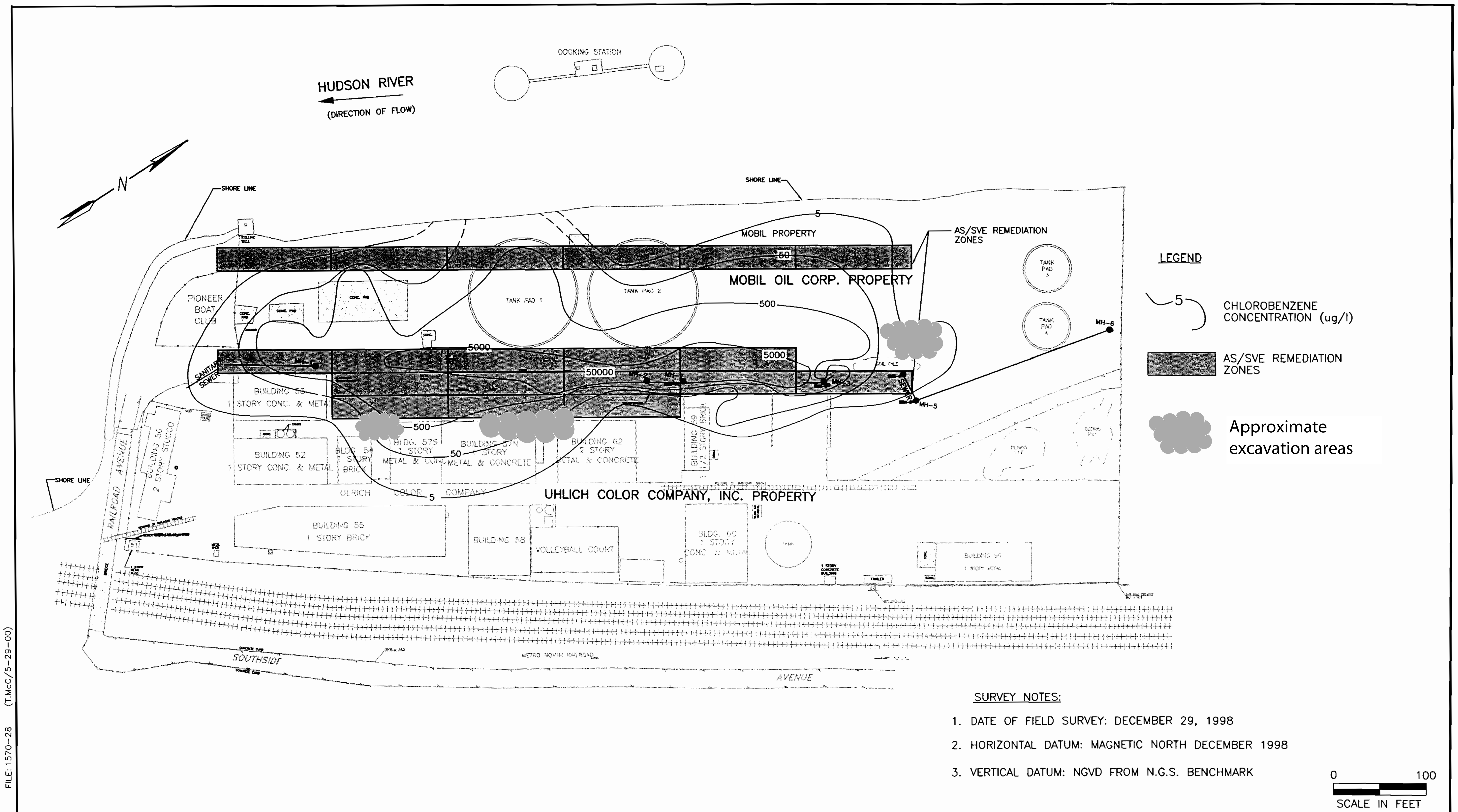
TAPPAN TERMINAL SITE
HASTINGS-ON-HUDSON, NEW YORK

CHLOROBENZENE CONCENTRATIONS IN GROUNDWATER

FIGURE 5



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TAPPAN TERMINAL SITE
HASTINGS-ON-HUDSON, NEW YORK

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Consulting Engineers
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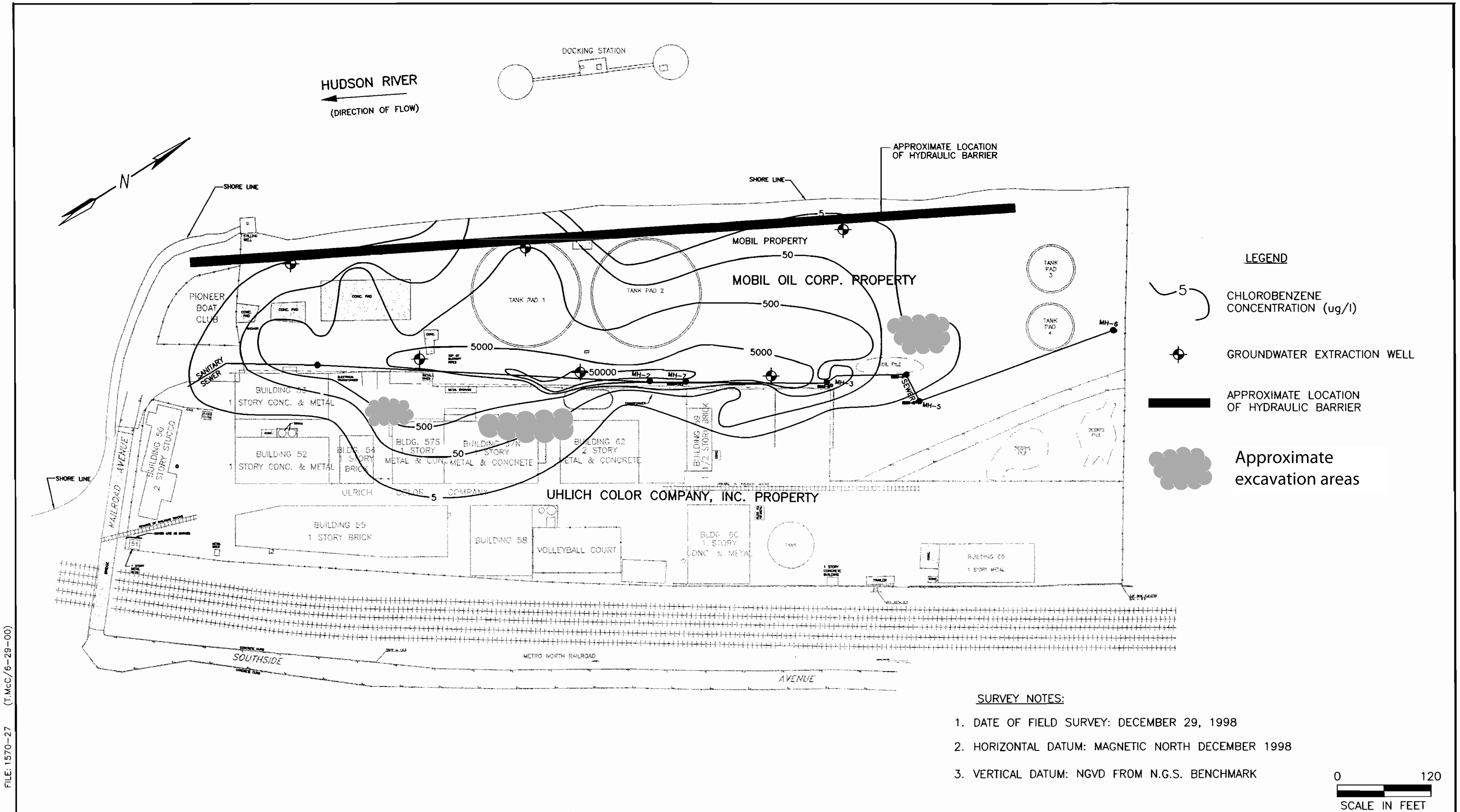
APPROXIMATE LOCATION OF AS/SVE REMEDIATION ZONES

FIGURE 6



DIR: 1570 FILE: 1570-27 (T.McC/6-29-00)

TAPPAN TERMINAL SITE
HASTINGS-ON-HUDSON, NEW YORK

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A Division of William F. Cosulich Associates, P.C.

APPROXIMATE LOCATION OF GROUNDWATER EXTRACTION WELLS AND HYDRAULIC BARRIER

FIGURE 7

APPENDIX A

Responsiveness Summary

RESPONSIVENESS SUMMARY

Tappan Terminal Site
Village of Hastings-on-Hudson, Westchester County, New York
Site No. 3-60-015
September 2006

The Proposed Remedial Action Plan (PRAP) for the Tappan Terminal site was prepared by the New York State Department of Environmental Conservation (NYSDEC) in consultation with the New York State Department of Health (NYSDOH), and was issued to the document repositories on December 19, 2005. The PRAP outlined the remedial measure proposed for the contaminated soil and groundwater at the Tappan Terminal site.

The release of the PRAP was announced by sending a notice to the public contact list, informing the public of the opportunity to comment on the proposed remedy.

A public meeting was held on January 17, 2006, which included a presentation of the Remedial Investigation (RI) and the Feasibility Study (FS) as well as a discussion of the proposed remedy. The meeting provided an opportunity for citizens to discuss their concerns, ask questions and comment on the proposed remedy. These comments have become part of the Administrative Record for this site. The public comment period was to have ended on February 2, 2006, however it was extended to March 4, 2006, at the request of the public.

This responsiveness summary responds to all questions and comments raised during the public comment period. The following are the comments received, with the NYSDEC's responses:

Mr. William Gay submitted a letter dated December 30, 2005 which included the following comments:

Comment 1: I believe the NYSDEC has done an excellent job identifying the potential threats to the surrounding neighborhood. The contaminants pose a long-term threat to all those in the neighborhood. My concern is that the proposed Soil Remediation Alternative chosen (S-6) leaves almost all of the contaminated soils on-site. Option S-6 involves the use of soil vapor extraction to clean-up all but an estimated 100 cubic yards of the material. Yet there is approximately 121,000 cubic yards of contaminated material on the site. As your report even acknowledges, soil vapor extraction is "not effective at removing semi-volatile organic contaminants." Soil vapor extraction is also not 100% effective is (sic) capturing volatile contaminants. Option S-6 has a so-called "Present Worth" cost of $4.1 million, or about $33.88/yard of contaminated material. But this assumes the DEC does not have to come back in the future and do supplemental cleanups if the extraction is not completely successful. By leaving any soils on-site exposes the community to potential long-term exposure.

Soil Remediation Alternative S-7 would remove all 121,000 cubic yards. That would completely and effectively eliminate any long-term risk to the community. The Present Worth cost of $17.2 million equates to $142/cubic yard, which is high based on current market costs. I suspect the generator could transport and dispose the entire 121,000 cubic yards for $12 million or less.

Remember that this site has rail on-site and the material could be shipped off-site with very little if any impact on the surrounding community.

I understand that the DEC needs to consider cost as a criteria in choosing its recommended remediation action plan. However, in light of the huge volume of contaminants on-site, and the not that large difference in costs between S-5 and S-7, I would suggest that the DEC consider off-hauling all or a large portion of the contaminants off-site for disposal in a secure landfill.

Response 1: Soil Alternative S-7 would remove only soils situated above the water table at the site. Contaminated soils located below the water table would remain in place and would be managed by covering them with clean soil, in similar manner as the selected remedy. It is therefore incorrect to state that S-7 would eliminate all long-term risks to the community.

The cost estimate for Alternative S-7 is based on reasonable assumptions and actual construction costs for similar projects in the region. The costs assume that a small percentage of soils (6%) are hazardous, and the remainder could be disposed as non-hazardous waste. The corresponding disposal costs, $150/ton and $70/ton respectively, are consistent with other projects. These costs may actually be underestimated because they do not include any pre-treatment costs necessary to comply with the Land Disposal Restrictions of the Resource Conservation and Recovery Act (RCRA), and do not include extensive health and safety controls during excavation. Removal of chlorobenzene-contaminated soils may require significant vapor controls during excavation, or may require treatment to reduce levels of VOCs prior to transport and disposal. These factors could significantly increase the cost of Alternative S-7. The NYSDEC does not believe that the benefit gained from the excavation of all soils located above the water table would be justified by the additional costs and significant increase in potential short-term impacts. The soils that remain at the site under the selected remedy can be effectively managed to minimized long-term risks to the community through the site management plan.

Hastings Waterfront Watch submitted a letter dated January 24, 2006 which included the following comments:

Comment 2: The initial remedy for the Anaconda Site was founded on incomplete testing of the site, and proposed to leave all of the contamination (other than PCBs) in place, without remediation, to be covered by two feet of soil as the only barrier to protect the public from exposure to the contamination. DEC withdrew its proposed remedy for the Anaconda Site, required additional testing (which found a great deal of contamination that the initial round of testing had missed) and, in connection with a federal consent decree, proposed and adopted a different remedy for the site, requiring excavation of lead "hot spots" (in addition to the excavation of the PCBs) and a contact barrier covering the entire site consisting of: (i) a 6" layer of low permeability asphalt, cement, or geosynthetics placed on top of an adequately prepared subgrade; (ii) an inserted demarcation layer (e.g., snow fence or equivalent) to indicate "no excavation" areas; (iii) a four-foot layer of Clean Fill; and (iv) a 6" layer of topsoil to be seeded and fertilized.

Response 2: The initial remedy proposed for the Harbor at Hastings site would have required excavation of PCB-contaminated soil to depths that could have resulted in potential geotechnical instability and contaminant release to the underlying aquifer and Hudson River. The final remedy selected for the site requires excavation to depths that avoid this possibility. The Record of Decision does not require the contact barrier described in the comment, but rather a 2-foot thick soil cover, except where PCBs remain at levels exceeding cleanup guidelines. Where PCBs remain, a 2-foot thick impermeable cap is required.

Comment 3: DEC's proposed remedial action plan for the Tappan Terminal Site (the "PRAP") bears a remarkable resemblance to the initial remedy that DEC proposed for the Anaconda Site in 1998, rather than final remedy that DEC, the Village, Riverkeeper and BP/ARCO approved for that site in 2004. Like the initial remedy DEC proposed for the Anaconda Site, the PRAP is founded on inadequate testing of the site. The Tappan Terminal Site is 14 acres. According to Table 1 of the PRAP, the DEC's assumptions about the soil contamination at the site are based on samples at between 18 and 33 locations, depending on the chemical substance sampled (PCBs and VOCs were sampled at more locations than metals and SVOCs). In light of the complex history of the site, which involves chemical manufacturing spanning many decades and many types of chemical products, in addition to petroleum storage, we believe that this ratio of samples to acres is, on its face, insufficient. The PRAP proposes to leave virtually all of the soil contamination in place to be covered only by a permeable snow fence and 2 feet of soil as a "barrier" to protect future users of the property from the contamination.

Response 3: The soil cover specified for the Tappan Terminal site is similar to that specified in the March 2004 Record of Decision for the Harbor at Hastings site. The differences between the cover systems relate to the demarcation layers and not the cover thicknesses. In addition to the number of subsurface soil samples referenced in the comment, at least 24 additional surface and near-surface samples were taken. Prior to 2000, 112 subsurface soil samples were obtained from 68 locations and analyzed for various parameters (see RI Report Figure 1-3). These results were not included in Table 1 of the PRAP due to the lack of complete quality assurance/quality control reporting for those samples and the variable analyses. The NYSDEC believes that the number of samples taken during and prior to the RI are sufficient to characterize the site and select a remedy. The NYSDEC also notes that the remedy for this site includes treatment of VOC contamination in soil and groundwater, and it is incorrect to state that virtually all of the soil contamination will be left in place.

Comment 4: At the public meeting on January 17, 2006, DEC's representative agreed that additional sampling would be required to implement the PRAP, in order to determine (i) the full extent of the chlorobenzene plume so as to ensure proper siting of the air sparging and soil vapor extraction ("AS/SVE") system and (ii) the location of the soil contamination "hot spots" that will require physical excavation and removal. This is a critical element of the cleanup to pick up the chemicals that DEC's representative at the public meeting referred to as "exotics". DEC should require an intensive program of additional sampling, using a closely spaced grid and a wide range of analytes. In addition to grid sampling, samples should be taken at each of the chemical storage locations identified in historic maps or photographs of the site.

Response 4: The Record of Decision specifies that design-phase sampling is necessary to fully delineate the extent of chlorobenzene and associated VOC contamination that requires treatment. The results of such testing will be integrated into the remedial plan within the framework of the selected remedy.

The term "exotic" was used during the January 17, 2006 public meeting as a layman's term for tentatively identified compounds (TICs) that are not part of the standard list of analytes. As explained at the public meeting, "exotics" at this site include both aniline-based dyes and anthraquinone dyes, the latter which are used as food colorings and in food packaging dyes. This term therefore does not connote a health or environmental threat, nor a lack thereof.

Comment 5: In addition to the dye-related SVOCs DEC's representative mentioned at the public meeting (which are not identified by chemical name in the PRAP), the sampling should test for chloronitrobenzenes, which are produced by nitration of chlorobenzene. Chloronitrobenzenes are known to have been used for the production of dyes and thus may have been used at the site. From the data presented in the PRAP, it would appear that DEC has not tested for chloronitrobenzenes at the site.

Response 5: The PRAP and ROD identify the dye-related SVOCs by family name: aniline, chlorinated anilines, toluidines, and anthraquinones. Individual chemicals in these groups are listed in Section 4.3.1 and Appendix H of the RI Report. Chloronitrobenzenes, if present at the site, would have been detected as a tentatively identified compound, in the same manner as the other dye-related compounds that were detected. Chloronitrobenzenes were not detected in the TIC analysis.

Comment 6: The PRAP (at p. 25) states that an element of the remedy is the "excavation and off-site disposal of soil that is visibly contaminated with dye or petroleum or is otherwise grossly contaminated." The soil excavation program is an important element of the proposed remedy, but it is too vaguely specified in the PRAP for the Record of Decision to simply carry this language over without further elaboration. DEC makes clear in the PRAP that it will not excavate the entire 14 acre site, but there is no discussion of an intermediate approach under which, for example, the most contaminated soils (e.g., those in the 90th percentile or above for a toxic chemical) are removed. Clearly, any soils that significantly exceed health-based standards for residential or recreational uses must be removed, particularly if DEC intends to use a two foot soil cover as its only "barrier" to exposure.

Response 6: Because many of the contaminants of concern are tentatively identified compounds whose concentrations can only be estimated, setting a statistically-based cleanup level, as suggested, would be meaningless. Most soils at the site contain PAHs that exceed health-based guidelines, as a result of the fill materials used to construct the landmass of the site. The suggestion to remove all such soil/fill would result in Alternative S7 of the PRAP and ROD, which the NYSDEC believes would result in severe short term impacts and would not be cost effective. See also Response #1.

Comment 7: It may be prudent to excavate the soils in some areas *after* the removal of VOCs using the AS/SVE system to prevent unnecessary disturbance of soils contaminated with volatile chemicals.

Response 7: The DEC will consider whether to perform the excavation specified in the ROD after VOCs have been removed by the treatment system. This may be necessary to comply with the Land Disposal

Restrictions of the Resource Conservation and Recovery Act (RCRA). This will be determined during the remedial design phase of the project.

Comment 8: DEC's representative at the public meeting appeared to suggest that DEC lacks legal authority to require removal of chemicals for which no standards, criteria, and guidance ("SCGs") have been established. The DEC regulations clearly state that the remedy must provide for "overall protection of public health and the environment." 6 N.Y.C.R.R. 375-1.10(c)(2). There would have been no need for this provision had DEC intended to limit cleanups to achievement of the SCGs identified in 375-1.10(c)(1). Thus, in considering the scope of the "hot spot" excavation program, DEC must investigate the health risks associated with the "exotic" chemicals mentioned at the public meeting. These chemicals were not analyzed in the Baseline Human Health Risk Assessment that DEC prepared for the site. If there are no SCGs for these chemicals, DEC (possibly through the New York State Department of Health) should arrange for a professional toxicologist to search the primary toxicological/epidemiological literature (and EPA's IRIS database) for information as to the toxicity of these chemicals or the chemical "family" to which they below (sic). This information should be shared with the community and would provide a basis for a better informed delineation of those soils that are so contaminated that they must be excavated.

Response 8: The NYSDEC's legal authority to remediate inactive hazardous waste disposal sites includes the goal of restoring such sites to pre-disposal conditions to the extent feasible. Neither the PRAP nor ROD state that the NYSDEC has limited authority to require the removal of tentatively identified compounds (TICs), only that their values are considered to be estimates. Health-based guidelines for the TICs present at the site are not available. The NYSDEC searched EPA's Integrated Risk Information System (IRIS), the International Agency for Research on Cancer (IARC) and the National Toxicity Program for data pertaining to site-related TICs. None of these sources listed a reference dose or cancer slope factor that could be used in a quantitative risk assessment. The following TICs had no relevant information in any of the sources:

1,4-dihydroxy, 9,10-anthracenedione (CAS 81-64-1)
m-chloroaniline (CAS 108-42-9)
o-chloroaniline (CAS 95-51-2)
4-chloro, 1,3-benzenediamine (5131-60-2)
2,5-dichloro benzenamine (CAS 95-82-9)

The following TICs were considered by IARC to be "not classifiable as to (their) carcinogenicity to humans (Group 3)":

2-methyl, 5-nitro benzenamine (CAS 99-55-8)
hydroquinone (CAS 123-31-9)

The above TICs also appear in the IRIS database with the entry:

> "This substance/agent has not undergone a complete evaluation and determination under US EPA's IRIS program for evidence of human carcinogenic potential."

One TIC is listed by IARC as a possible human carcinogen - 1-hydroxy, 9,10-anthracenedione (CAS 129-43-1).

Only 2-methyl benzenamine (CAS 95-53-4), or ortho-toluidine, is listed by IARC as a probable human carcinogen, but with a significant disclaimer. IARC states that

> "there is sufficient evidence for the carcinogenicity of ortho-toluidine hydrochloride in experimental animals. An increased incidence of bladder cancer has been observed in workers exposed to ortho-toluidine, but as all were exposed to other possibly carcinogenic chemicals, ortho-toluidine cannot be identified specifically as the responsible agent. Ortho-toluidine should be regarded, for practical purposes, as if it presented a carcinogenic risk to humans."

However, a slope factor is not provided in any of the literature.

Because there is insufficient data to include these chemicals in a quantitative risk assessment, and because their results are considered to be rough estimates, the PRAP and ROD address their risks through a qualitative exposure assessment (section 5.3)

Comment 9: The notion that hot spot excavation be limited to *visually* contaminated soils must be rejected, as high concentrations of many toxic chemicals are not visible to the naked eye. This reinforces the need for extensive additional sampling to implement the "hot spot" excavation element of the proposed remedy.

Response 9: The definition of grossly contaminated soil is not limited to just visually contaminated soil, but also includes soil which contains a strong odor or is readily detectable without analytical sampling. The ROD also provides for the excavation of soil containing greater than 500 ppm of total SVOCs.

Comment 10: The PRAP is seriously flawed in suggesting that "[t]here are no known completed exposure pathways at the site." [PRAP at 10]. This statement is not true, because there is a "known completed exposure pathway." DEC's Baseline Risk Assessment for the site (at Table 5.1) presents calculations that the current user of the Pioneer Boat Club is exposed to a cancer risk that is more than three times higher than the target "1 in a million" cancer risk established by the National Contingency Plan. (This figure is for soil contamination only, and does not include exposure to the "exotic" chemicals.) This is a completed exposure pathway. There are, of course, reasonably anticipated future pathways as well, as the site makes its transition from its present under-utilized condition to more active uses.

Response 10: An exposure pathway has five elements namely: a contaminant source, contaminant release and transport mechanisms, a point of exposure, a route of exposure, and a receptor population. An exposure pathway is complete when all five elements of an exposure pathway are present or documented. An exposure pathway is considered a potential exposure pathway when one or more of the elements currently do not exist but hypothetically could exist in the future if the site was not remediated. Exposure to on-site contamination in soil by Pioneer Boat club members is highly unlikely because the site is largely paved. Access to the site is restricted and not part of the

Pioneer Boat Club. Therefore, there is no direct site soil contact (route of exposure) by club members. Since one of the five elements comprising a completed exposure pathway is not present, the soil exposure pathway for Pioneer Boat Club members was evaluated as a "potential" exposure pathway. Remediation of this site as per the PRAP will mitigate the potential for exposure to site-related contaminants.

Comment 11: Fortunately, the PCB levels at the Tappan Terminal Site are much lower than at the adjacent Anaconda Site. Nevertheless, if there are PCBs present at the Tappan Terminal Site that are at concentrations that would trigger removal at the Anaconda Site, they should be treated the same way at both sites and be removed. Additional sampling is required to determine the full breadth of the required PCB removal. The PRAP errs in failing to discuss whether any of the PCBs at the Tappan Terminal Site should be excavated.

Response 11: The ROD addresses the low levels of PCBs found at the site by covering them with the 2-foot soil cover. The result will be that PCBs will not exceed 1 ppm in surface soils and 10 ppm in subsurface soils. These values will comply with the NYSDEC's soil cleanup guidelines for PCBs.

Comment 12: The proposed remedy for the chlorobenzene plume – air sparging and soil vapor extraction – is reasonable (at least in light of the alternatives discussed in the PRAP), but the Record of Decision needs to provide additional specification that is missing from the PRAP. First, it is important for the Record of Decision to provide numerical performance standards (cleanup levels) that make clear when the system can be turned off. The cleanup levels should be low enough to protect human health even if a residential building were to be built directly above the plume without any special precautions in the construction of the building or the operation of its HVAC system. The PRAP is deficient in not stating expressly what DEC's cleanup goals are for chlorobenzene. Presumably, they are the SCGs for chlorobenzene listed in Table 1 of the PRAP (i.e., 1.7 ppm for soils and 5.0 ppm for groundwater). These goals may be inadequate, however, because they were never designed to be protective with respect to vapor intrusion. A vapor intrusion model must be employed to calculate the "safe" level of residual chlorobenzene contamination, which may result in ROD-specified performance standards that are more stringent than the SCGs referenced in Table 1 of the PRAP. (The presence of such performance standards is in addition to, rather than in lieu of, the imposition of institutional controls requiring that special precautions be taken with respect to the design of any future buildings at the site.)

Response 12: One of the remediation goals for the project, as stated in Section 6 of the PRAP and ROD, is to attain, to the extent practicable, soil cleanup guidelines that are protective of human health and groundwater quality. Numerical values of these goals appear in Table 1 of the ROD.

Although mathematical models have been developed to estimate concentrations of contaminants in indoor air resulting from concentrations in soil and groundwater, these models are imprecise and limited in the scope of their applications. They are therefore typically used only for screening purposes under suitable conditions. These models are limited because they neglect the presence of fractures, macropores, wells, tree roots, heterogeneous fill, bedded utilities and other preferential pathways that may be present in the subsurface. In addition, the US EPA models assume that groundwater table fluctuations are small, with no contamination in the capillary fringe, which is an unrealistic assumption for this project, where tide-related groundwater fluctuations are known to occur. When considering contaminant migration into future structures, additional uncertainty is associated with site-specific parameters that vary from current conditions. For example, subsurface vapor intrusion models require an estimate of the moisture content of soil under a structure. This is difficult to predict before a building is constructed. Soil under buildings is generally drier than soil around buildings, or soil samples collected before construction. As soil moisture is a highly influential model parameter, a high level of uncertainty concerning soil moisture content will increase uncertainty associated with model output. In summary, the NYSDEC would not be confident that a soil cleanup value calculated by such a model would protect human health through the vapor intrusion pathway into a future building. The NYSDEC will rely on the Site Management Plan requirement to evaluate the potential for vapor intrusion into new buildings and mitigate them as necessary. It should be noted that developers on brownfield sites often construct new building foundations with subslab ventilation systems and vapor barriers as a default, rather than perform extensive sampling and modelling, which is often more expensive.

Comment 13: It is not in the public interest for re-use of this site to be put on hold for another decade during the Remedial Design and predicted 5-8 years of operation of the AS/SVE system operation. The Remedial Design needs to ensure that the system work as quickly as possible. This may require the use of more pipes and more vigorous suction-action (or other engineering measures) than are used at other sites where the system's installation and operation would not delay re-use of a site with significant public use value.

Response 13: Re-use of the site may proceed during the operating period of the AS/SVE system, which the NYSDEC estimates is 5 years. During this time, buildings or other structures may be constructed at the site, provided that they do not interfere with the system, and provided that the potential for vapor intrusion is evaluated and mitigated as necessary. Nevertheless, the NYSDEC recognizes the community's desire for an expedited operation period, and will prepare or review the remedial design with this goal in mind.

Comment 14: The Record of Decision should establish a fallback remedy to remove the chlorobenzene and other VOCs in the event that the AS/SVE system is unable to achieve the required performance standards in a reasonable time period.

Response 14: Based on the proven performance of AS/SVE systems, the NYSDEC does not believe that a contingent remedy is necessary. However, as discussed in Response #55 below, additional soil and groundwater treatment technologies will be considered as enhancements to the AS/SVE system.

Comment 15: Hastings Waterfront Watch has consistently rejected reliance upon two feet of soil as a long-term remedy to prevent exposure to contaminated soils. It is unreasonable to assume that two feet of soil is a "permanent" remedy for the site when it is common knowledge that it takes only a few minutes to dig through two feet of soil with a simple shovel. Common sense tells us that a cleanup plan for the Tappan Terminal Site – which has been designated for future recreational use, such as ball fields for our children, and possible residential use – should be remediated to ensure that it does not present a long-term threat to future users or residents. It is precisely for this reason that, in the case of the Anaconda Site, the Village and Riverkeeper insisted on a much more permanent barrier (such as 6” of asphalt), beneath a 4½’ cover. We see no reason why Exxon-Mobil and Chevron (the principal liable parties at the Tappan Terminal Site) should be held to a less protective remedy than the one that British Petroleum agreed to at the adjacent Anaconda Site.

Response 15: The NYSDEC views the settlement that was reached between the Village, Riverkeeper and Atlantic Richfield as one which addresses both remediation and re-development factors. The soil cover specified in that agreement provides more thickness than is necessary to protect public health and the environment. Accordingly, the NYSDEC specified a two-foot thick soil cover in the Record of Decision for that site, and the two sites are held to the same standard of health and environmental protection.

Comment 16: The key flaw in relying on two feet of soil as the principal remedy for the site is that such an approach does not provide long-term protection from the toxic substances left in place at the site. Over the coming decades, it is clearly foreseeable that as a result of natural phenomena (wind, erosion, floods, burrowing animals, worms) or human intervention (construction work, tree planting, utility maintenance) the top two feet of surficial soils at the sites will be disturbed so as to expose future residents, or recreational users, to the underlying toxins if they are not otherwise remediated or covered over. This is especially true at this site because: (i) it has been designated for future residential and/or active recreational use; (ii) it is on the Hudson River, which floods portions of the site during storms at high tides; (iii) the water table at the site rises almost to the surface during high tides; (iv) much of the land that comprises the site will be submerged beneath the River’s waters in the event of a 100-year flood; and (v) brisk winds bear down on the site throughout the year as a result of its location at the water’s edge. DEC’s regulations require that remedies selected under this program be effective over the “long-term.” (6NYCRR 375-1.10(c)(4)). We believe that the use of only two feet of soil to cover the toxic waste at these sites does not meet that standard, particularly for the site in question for the reasons stated above. Although the state legislature recently amended the Environmental Conservation Law to allow the use of two feet of soil cover at certain brownfields sites, it did not add an analogous provision with respect to the sites, such as the Tappan Terminal Site, remediated under the inactive hazardous waste site program.

Response 16: All of the natural and human disturbances listed in the comment are required to be addressed by the site management plan. The long term effectiveness of the remedy is ensured by proper maintenance of the soil cover and periodic certification by a professional engineer or qualified professional that the remedy remains in place and is protective.

At high tide, groundwater depth ranges from approximately 5 feet beneath the central portion of the site, to 2.5 feet along the shoreline. With the 2-foot cover added, these depths will increase to 7 feet and 4.5 feet, respectively. It is unlikely that a flood event would cause contaminants to migrate upwards into the clean soil cover at levels that would cause the soil cover to exceed cleanup guidelines. During a flood event, low-lying lands are inundated by the flooding stream. The corresponding response in groundwater level will vary with the duration of the flood event. A rapid rise and fall of the flooding stream will have little effect on groundwater levels, with a predominantly downward flow direction as the floodwaters recede and standing water seeps into groundwater. A sustained flooding event could cause groundwater levels to rise, but the resulting groundwater flow velocity is unlikely to mobilize contaminant particles in sufficient mass to cause the overlying soil cover to exceed cleanup guidelines.

Comment 17: We have researched whether there is support for using two feet of soil as an adequate remedy for contaminated soil at sites located in other States, and therefore subject to other State superfund programs. Our research leads us to conclude that many jurisdictions, particularly Washington, Pennsylvania, and Maryland, would not consider two feet of soil cover to be an adequate solution to property as contaminated as the Tappan Terminal Site. Instead of assuming that two feet of soil would constitute an adequate barrier, DEC should remediate "hot spots" of contamination at which concentration levels are particularly high (as discussed above), and then require a thick, reinforced, permanent barrier across the entire surface of the sites; such a permanent barrier could then be covered with a hydraulically impermeable layer (such as a geotextile liner) and then with sufficient clean fill and top soil to allow for ordinary vegetation, such as grasses, shrubs and small trees. If a hydrogeologically impenetrable barrier is rejected as infeasible, a five foot cover could nevertheless be added to match that aspect of the remedy at the adjacent Anaconda Site.

Response 17: The NYSDEC has also researched the soil cleanup standards and guidelines of several other states and notes that all contain provisions for considering the feasibility of achieving standards at the point of compliance. These states all provide conditions for containment remedies where the points of compliance cannot feasibly be met. Remedies have been selected by both State agencies and the USEPA in Washington, Pennsylvania and Maryland that are similar to the remedy selected for this site.

The USEPA has issued many Records of Decision which specify soil covers of two feet or less for residential properties, including sites in the State of Washington. In the ROD for the Jackson Park Housing Complex in Kitsap County, Washington, the USEPA selected an 18-inch soil cover for recreational areas and a 24-inch soil cover for residential areas. The State of Washington concurred with this remedy.

The soil cleanup standards for the other state and federal environmental programs cited in the comment recognize the limited feasibility of achieving such standards in all cases. Where it is not feasible to achieve standards at the targeted point of compliance, the applicable laws and/or regulations allow for the use of engineering and institutional controls to protect public health and the environment. In practice, these state and federal agencies have written Records of Decision that are consistent with the remedy chosen for the Tappan Terminal site.

The New York State Legislature recognized the protectiveness of two feet of clean soil as a remedial cover in the passage of the 2003 Superfund/Brownfields Cleanup Law. For residential land use, ECL 27-1415 (6)(d) defines "exposed surface soils" as the top two feet of soil, where the risk-based soil cleanup objectives must be achieved.

Comment 18: Even if DEC were to reject our request for a more permanent barrier, the Record of Decision should nevertheless require the installation of appropriate utility corridors and tree wells so that the future development of the site as a park can be done with minimal disturbance of contaminated soils. The location of the utility corridors and tree wells can be worked out with the Village in the Remedial Design phase of the project.

Response 18: The NYSDEC agrees with the concept of creating utility corridors in clean soil so that any maintenance work can be performed in a way that minimizes the potential for worker exposure and damage to the cover system. Based on this comment, the ROD includes a provision that if a final site development plan is available when the cover system design is prepared, clean utility corridor(s) will be constructed. Soil excavated from the corridor(s) will either be re-graded on the site and covered, or disposed off-site, in accordance with the provisions of the ROD. However, there is uncertainty as to the future use of the site as a park or otherwise. Because a site development plan may not be available when the remedial design is prepared, the ROD cannot require the installation of specific utility corridors or planting zones when the soil cover is constructed. The future construction of utility corridors is properly addressed as an element of the Site Management Plan. A provision has also been added to the ROD requirements for the Site Management Plan to include the construction of clean utility corridors during site development.

Comment 19: At the public meeting, the DEC representative stated that the stone revetment (rip rap) and associated filter fabric at the Tappan Terminal Site is an important environmental feature of the site because it physically contains the contaminated soils and prevents them from entering the Hudson River. We agree. Accordingly, it is essential that the Record of Decision state explicitly that maintenance of the rip rap and filter fabric is required in perpetuity. In addition to protecting the environment, this will ensure that the liable parties, rather than the taxpayers, bear this maintenance cost.

Response 19: The NYSDEC agrees that the shoreline protection system is an important component of the remedial cover, and that this element must be maintained in the long term. This will be added to the technical requirements of the Site Management Plan.

Comment 20: Similarly, if DEC insists on going forward with two feet of soil as the “barrier” layer for the contaminated soils, the integrity of the remedy over the long-term will depend on constant maintenance of the soil cover, including removal of saplings, shrubs or other flora (or fauna) whose presence could affect the integrity of the soil cover. (Appropriate plantings in DEC-approved tree wells may, of course, remain at the site.) In short, DEC’s remedy will require the grass at the site to be mowed in perpetuity and that any wear and tear on the top soil be quickly repaired to prevent risk of contact with the underlying contamination. If this is the manner in which DEC intends to proceed, the Record of Decision must expressly impose this maintenance obligation as an element of the DEC-approved remedial action to make it clear that this maintenance work is required as an element of the DEC-required remediation.

Response 20: Inspection, maintenance and certification of the integrity of the remedy is an element of the site management plan referenced in the PRAP and ROD. Note that frequent grass mowing is not necessarily required to protect the soil cover, and that certain shallow-rooted shrubs are acceptable. The NYSDEC has constructed landfill covers that include vegetation which provides food and habitat to various fauna. These covers are managed by cutting at intervals as long as 3 years. As stated in Section 4 of the PRAP and ROD, the NYSDEC will contact the potentially responsible parties to assume responsibility for the remedial program, including site management.

If agreement cannot be reached with them, the State will evaluate the site for action under the State Superfund and seek to recover costs.

Mr David Kalet of the Atlantic Richfield Company submitted a letter dated January 30, 2006 which included the following comments:

Comment 21: The Tappan Terminal PRAP states that the type of polychlorinated biphenyls ("PCBs") found in the surface soil on the Tappan Terminal site are "the primary mixtures found at the neighboring Harbor at Hastings site." *See* PRAP at 8. Further, even as to PCBs that were *not* found in the sediment in the Hudson River in front of the Tappan Terminal site, the PRAP states that these types of Aroclors are "associated with the adjacent Harbor at Hastings site." *Id*. at 10. AR disagrees with any statement or suggestion that PCBs found (or not found) at the Tappan Terminal site are attributable to the Harbor-at-Hastings site. AR has never found evidence, and NYSDEC presents no evidence, to suggest that PCBs in the surface soil at the Tappan Terminal site are from the Harbor-at-Hastings site. AR agrees with NYSDEC comments made at the January 17, 2006 Tappan Terminal PRAP public meeting that the PCB problem had "not crossed over" to the Tappan Terminal site from the Harbor at Hastings site.

Response 21: The NYSDEC makes no assertion as to the source of the PCBs found in surface soils at the site, only that the chemical mixtures are the same. Since Aroclor 1260 is also associated with other sources, the statement concerning contamination not found in sediments will be removed.

Comment 22: The Tappan Terminal PRAP indicates that high levels of lead exist in various locations on the Tappan Terminal site, particularly in the southern portion of the site. Although there are certain "hot spot" areas containing lead at the Harbor-at-Hastings site, AR maintains that any lead found on the Tappan Terminal site did not originate from the Harbor-at-Hastings site. No evidence was presented to link the levels of lead at the two sites, and further, there are a number of potential historical sources of lead on the Tappan Terminal site, including past paint manufacturing and/or chemical manufacturing.

Additionally, AR notes that the Tappan Terminal PRAP documents the pervasive presence of copper, lead, and zinc in the Tappan Terminal site surface and subsurface soils. For example, surface copper levels range from an average of 335 ppm to as high as 1110 ppm, and subsurface copper levels range from an average of 3,024 ppm to as high as 28,700 ppm. The PRAP states that such metals are "commonly associated with historic fill containing ash and furniture slag." *See* PRAP at 7; *see also* Remedial Investigation Report for the Tappan Terminal Site, 5-3 (1999) (attributing "the widespread occurrence of metals" to the "industrial nature of the fill material on the site"). AR further notes that these historic fill materials extend out into the Hudson River in front of the Tappan Terminal site, and are an undefined source of metals in that portion of the river.

Response 22: The comment is noted. The NYSDEC has no evidence that historic fill materials extend from the Tappan Terminal site into the Hudson River. All ten sediment sample logs indicate that a soft grey and black silt was obtained (RI, Appendix B). The Remedial Investigation Report attributes background levels of metals in Hudson River sediments to regional urban land use (pg 4-17).

Comment 23: Finally, AR believes that coordination of the remediation projects between the Tappan Terminal site and the Harbor-at-Hastings site would be beneficial to all parties. Pursuant to the Record of Decision for the Harbor-at-Hastings site dated March 2004 (“ROD”) and the Consent Decree between AR, the Hudson Riverkeeper Fund, Inc. and the Village of Hastings-on-Hudson, AR is required to place five (5) feet of clean fill on the Harbor-at-Hastings site as part of the containment remedy. As the Tappan Terminal PRAP requires only two (2) feet of clean fill as part of its containment remedy, coordination between the two sites will be necessary for engineering, technical and aesthetic reasons.

Response 23: The NYSDEC agrees. Logistical coordination between the two projects will also be necessary due to the access and transportation limitations present at the Tappan Terminal site. See also Response 2.

Mr. Eric Annes of Riverkeeper submitted a letter dated February 6, 2006 which included the following comments:

Comment 24: The technology selected in the PRAP, "a combination of Alternatives S6 and G2" is essentially G2 while adding the removal off 100 cubic yards of "grossly contaminated soil". PRAP at 24. According to the November 2002 "Feasibility Study" ("FS") "Alternative G2 would not completely meet the remedial action alternatives that pertain to groundwater for the site. This alternative would not reduce elevated levels of metals and may not be effective in reducing elevated levels of SVOC contaminants to below standards/guidelines." FS at 4-20-2 1. The PRAP justifies its selection of an alternative that will not meet standards by stating, "The additional cost and time necessary to extract and treat contaminated groundwater is not justified by the removal of SVOCs."

Riverkeeper strongly objects to this conclusion. First, "a site's program must be designed so as to conform to standards and criteria that are generally applicable." 6 NYCRR Part 375- 1 .lO(c)(l)(i). Only implementation of a hydraulic barrier and groundwater extraction and treatment "would meet the ambient water quality standards for semivolatile organic chemicals and inorganics.” PRAP at 21. Second, the Environmental Conservation Law states:

> The goal of any such remedial program shall be a *complete* cleanup through the elimination of the significant threat to the environment posed by the disposal of hazardous wastes at the site of the imminent danger of irreversible or irreparable damage to the environment caused by such disposal.

NY Environmental Conservation Law § 27-1 3 13(d) (2003) (emphasis added).

The alternative selected in the PRAP falls short of providing a complete cleanup. In contrast, implementation of a hydraulic barrier and groundwater extraction and treatment, would remove and destroy all contaminants in the groundwater and be "considered irreversible." FS at 5-19. The PRAP's writing off of groundwater standards and completing the clean up is unacceptable. The PRAP recognizes that the remediation must meet New York State standards and criteria sating, "The first two evaluation criteria (including meeting all New York standards for ground water) are termed 'threshold criteria' and must be satisfied in order for an alternative to be considered for selection." PRAP at 20. Despite recognizing that only Alternative G3 is capable of meeting groundwater criteria, the PRAP inexplicably selects Alternative G2 and dismisses the goal of meeting groundwater criteria. If meeting groundwater standards is truly a threshold criteria, there is no reasonable explanation for selecting Alternative G2 rather than Alternative G3.

Response 24: The NYSDEC has carefully reviewed the locations of SVOC detections in groundwater, and the nature of contaminants that were found. The SVOC contaminants listed in Table 1 (2-chlorophenol, 1,4-dichlorobenzene, 4-chloroaniline and naphthalene), along with 1,3-dichlorobenzene and 1,2-dichlorobenzene, were found only in wells located within the chlorobenzene plume depicted in Figure 5. As a result, these contaminants are within the area designated for treatment by AS/SVE, and/or the other technologies to be evaluated in the remedial design (see Response #55). Therefore, the SVOCs listed in Table 1 as groundwater contaminants of concern have been added to the list of contaminants targeted for groundwater treatment. The NYSDEC does not believe that groundwater extraction and treatment, as described in Alternative G3, is necessary to remediate these contaminants. The additional groundwater treatment technologies under consideration will be evaluated for their ability to treat these SVOCs.

By targeting dye-related SVOCs in groundwater, a more complete groundwater remedy will be achieved. However, because metals and other SVOC are associated with the fill used to create the site landmass, the NYSDEC believes that it is not feasible to achieve groundwater quality standards for those contaminants.

Comment 25: According to the PRAP problems with Alternative G2 "may occur if subsurface obstructions, such as buried bulkheads and debris, are encountered. However, due to the shallow depth of wells, these subsurface obstructions should not inhibit implementation of this alternative." FS at 5-20. Though the Feasibility Study states that the shallow wells are an advantage for Alternative G2, the EPA states that a shallow groundwater table inhibits the effectiveness of the vacuum system. See www.epa.gov/swerust1/cat//sve1.htm. The shallow well may allow the system to avoid problems from subsurface obstructions, but this needs to be balanced against the shallow groundwater table. The shallow wells at the site indicate that the selected system will not be operating in optimal conditions. This is particularly troubling because according to the EPA, the vacuum system has difficulty removing concentrations over 90% even in optimal conditions. See www.epa.gov/swerust1/cat//sve1.htm. A system that in only able to remove 90% and will be operating in sub-optimal conditions is not the best alternative for the site. DEC should select a system that will ensure a complete and irreversible cleanup.

Response 25: The EPA guidance document referenced in the comment applies to soil vapor extraction (SVE) systems to remediate contaminated soil from underground petroleum storage tanks. The 90% effectiveness rate refers to concentrations in soil, not groundwater. The NYSDEC notes that if the maximum detection of chlorobenzene in soil listed in Table 1, 31 ppm, is reduced by 90% to 3.1 ppm, it approaches the soil cleanup guideline of 1.7 ppm. The corresponding guidance document for air sparging (http://www.epa.gov/swerust1/cat//airsparg.htm), which is the groundwater treatment portion of the selected remedy, does not list a similar treatment limit. Instead it lists advantages that include the fact that air sparging “can enhance removal by SVE”.

The SVE guidance cited in the comment states that:

> "SVE is generally not appropriate for sites with a groundwater table located less than 3 feet below the land surface. Special considerations must be taken for sites with a groundwater table located less than 10 feet below the land surface because groundwater upwelling can occur within SVE wells under vacuum pressures, potentially occluding well screens and reducing or eliminating vacuum-induced soil vapor flow."

The groundwater table in the source area ranges from 5 to 5.5 feet below ground surface during the tidal cycle. The NYSDEC acknowledges in the PRAP and ROD that special considerations, including horizontal extraction wells and a temporary impermeable barrier, may be necessary. Nevertheless, the guidance indicates that SVE can be effective at this site. The consideration of additional groundwater treatment technologies is also expected to improve the effectiveness of AS/SVE.

Comment 26: The PRAP states, "Because SVE is not effective at removing semivolatile organic contaminants, an estimated 100 cubic yards of soil that is grossly contaminated would be excavated and removed from the site. Riverkeeper objects to this part of the remedy for two reasons: First, the definition of "grossly contaminated soil" is highly subjective, arbitrary and devoid of any scientific basis. It is the opinion of Riverkeeper soil should not need a "strong smell" to be considered grossly contaminated. If the PRAP is not going to select an alternative that removes all contaminated soil DEC should establish a parameter with some scientific reliability which can be reviewed. Second, "because SVE is not effective at removing semivolatile organic contaminants," the removal of only the poorly defined "grossly contaminated soil" is insufficient protection. If DEC implements a system that is not going to remove contaminants, some of which are carcinogenic, the soil removal needs to be more thorough. As noted above, Riverkeeper objects to the PRAPs dismissal of the need to cleanup of SVOCs, our objection is even more emphatic when contaminated soils are being defined so arbitrarily.

Response 26: Grossly contaminated soil includes visual as well as olfactory evidence of contamination. The ROD also specifies SVOCs greater then 500 ppm as a criterion for soil excavation at the site. Removal and/or treatment of grossly contaminated soil is first in the hierarchy of source removal and control measures. As discussed during the January 17, 2006 public meeting, the industrial contaminants of concern at the site, dyes and petroleum, have readily-identifiable visual properties that support using this definition as a relevant and appropriate criterion for soil removal. Because fill-related SVOC contaminants are present throughout subsurface soil due to the historic fill used to construct the property, the NYSDEC considers removal of all SVOCs from the site to be infeasible. Public health and the environment will be protected from these fill-related contaminants by the soil cover and institutional controls.

Comment 27: The PRAP justifies selecting air sparging with soil vapor extraction ("AS/SVE") over a hydraulic barrier and groundwater extraction and treatment in-part because of additional time for implementation. However, according to the FS "if Alternative G3 is combined with a soil alternative that addresses source removal or containment (i.e. S3, S5 or S6) in the vadose zone, the duration of remediation can be reduced to perhaps *5* years." FS at 5-21. The selected alternative, of S6 and G2 is expected to take five years. Therefore, the expected time of cleanup if G3 were selected in combination with S6, the cleanup time would be the same. Further, even if selection of Alternative G3 did require additional time, the PRAP fails to consider that the grounds would be available for use sooner with Alternative G3 than with Alternative G2. The economic benefit the earlier use of the land confers should be considered in offsetting the added costs for the project. The PRAP suggests that the Time to Implement alternative G2 is one year while the Time to Implement G3 is two years. In presenting these numbers, however, the PRAP selected the low end of the estimate from the FS for Alternative G2 (1 2- 18 months) while selecting the upper end of the estimate for G3 (18-24 months). See FS at 5-1 7. When data is misrepresented and skewed to favor certain outcomes, the credibility of the conclusions comes into question. The presentation of data in the instant situation portrays a PRAP interested in advocating certain options rather than presenting honest and fair analysis. If the PRAP selects the low end of estimates for one option while selecting the high end for another option in the context of time, one can only conclude that the same choice was made for cost estimates. DEC skews the presentation of its data at the price of its integrity.

Response 27: The PRAP's justification for AS/SVE is not based on the time to implement, as that term is used in the commenter's FS citations, but rather on the time to achieve groundwater standards and soil cleanup guidelines. "Time to implement", as used in the Short-term Impacts and Effectiveness section of the FS, refers to the time required to install and start up the treatment system. However, the NYSDEC is concerned with the estimated time to complete the treatment process and achieve remedial goals, as presented in the Implementability section of the FS. For Alternative G2 this is 5 years, and for Alternative G3 this is 15 years. The FS identifies actions that could reduce the time frames for both alternatives to "approximately 2-3 years" and "perhaps 5 years", respectively. However, for consistency, the NYSDEC has used the "likely" time frames identified in the FS, 5 years and 15 years. Combined with the higher cost for G3, the NYSDEC considers the shorter total duration of G2 to be preferable.

The comment is correct that the PRAP listed the shorter the implementation time for Alternative G2, while the longer estimate was used for G3. The ROD was revised to list the higher values for both alternatives, 18 months for G2 and 24 months for G3. The cost information in the PRAP and ROD are correct, and the NYSDEC rejects the assertion that the presentation is skewed.

Comment 28: The PRAP's failure to address the discharge of contaminants into the Hudson River violates the fundamental goal of the remedial program to "eliminate or mitigate all significant public health and/or the environment presented by the hazardous waste disposed at the site." Fish consumption advisories do nothing to mitigate the risk to the wildlife and the environment. More fundamentally, these advisories are generally ineffective at protecting public health, as fish advisories are routinely ignored, especially by subsistence fishers. As the site is likely to be developed and open to the public access, fishing and fish consumption is likely to increase. Fish advisories will not address the substantial public health risk under these circumstances. The risk assessment's reliance on fish advisories as result of past PCB pollution is not be an acceptable reason to fail to remediate the discharges into the Hudson River, and squarely contradicts DEC policy. To do such, is essentially writing off the River. Accordingly, Riverkeeper urges DEC to adopt a remedy for Tappan Terminal that is complete and meets all New York State criteria and standards.

Response 28: One explicit goal of the PRAP and ROD is to prevent the discharge of contaminants from the site to the Hudson River, and the remedy selected for the site will achieve this goal. Neither the Baseline Risk Assessment nor the ROD rely on fish consumption advisories to mitigate the impacts of contaminant releases from the site.

Mr. Steve Trifelletti of ExxonMobil submitted a letter dated March 2, 2006 which included the following comments:

Comment 29: The proposed remedy outlined in the PRAP includes groundwater remediation because concentrations exceed applicable drinking water standards for a select few compounds of concern at the site. Groundwater at the site is saline and is not practical for use as potable water. We therefore propose the development of more applicable site specific clean up standards using EPA approved risk assessment methodologies.

The PRAP identified two potential future exposures to contaminants for which groundwater could be a source. These include:

- Potential dermal groundwater exposure to a worker during excavation
- Inhalation of volatile groundwater constituents in indoor air in hypothetical future buildings.

The first potential exposure: dermal exposure to groundwater to an excavation worker, was quantitatively evaluated in the May 2000 risk assessment performed for NYSDEC. Since 2000, EPA has issued final guidance which has detailed exposure values for use in determining this pathway. The May 2000 risk assessment used an approach that is still used today, with somewhat different exposure assumptions. The result of the May 2000 risk assessment determined that an excavation worker could have a cumulative cancer risk of 3.6×10^{-8} and a non-cancer risk of 3 related to dermal contact with groundwater. The non-cancer risk driver was chlorobenzene.

The second exposure was not evaluated in the May 2000 risk assessment. Currently, the NYSDOH is assessing potential indoor air impacts using the draft Guidance for Evaluating Soil Vapor Intrusion in the State of New York (February 2005). As there are currently no buildings on the property, a complete indoor air evaluation cannot currently be conducted. The guidance identifies that, for undeveloped parcels, institutional controls may be used to assure that no development will occur without addressing the potential exposures. Often, an environmental easement is used to ensure that use restrictions or engineering controls are used. The guidance provides further information that potential future indoor air impacts may be mitigated by constructing a building with a sub-slab depressurization system (SSD system) with sealing, and/or a sub-membrane depressurization (SMD) system with a soil vapor retarder. Per Section 8 of the PRAP, a site management plan will be developed that will include evaluation of "the potential for vapor intrusion for any buildings developed on the site, including provision for mitigation of any impacts identified". As applicable, an environmental easement could be used that would then render the potential exposure to indoor air pathway incomplete, and the pathway would then be removed from risk-based cleanup calculations. (Also refer to Comment 7.)

By removing the indoor air pathway, the only pathway retained for evaluation is dermal contact with groundwater. A target cleanup level could be derived for this pathway based on noncarcinogenic risk as follows:

Target GW Concentration = <u>target risk of 1 RfD * body weight * averaging period * conversion factor</u>
exposure parameters

The target concentrations would be calculated by either using standard default exposure variables for an excavation scenario, or the exposure variables provided in the May 2000 risk assessment prepared for the NYSDEC. The May 2000 risk assessment identified only chlorobenzene as exceeding a risk limit, therefore the only cleanup value that is needed, based on human health exposure, is for chlorobenzene.

Response 29: The remedy selected for the site includes soil and groundwater treatment for VOCs because such treatment is feasible, and results in a more permanent remedy than relying on an institutional control to limit exposure. As discussed in Response #54 below, the goal of inactive hazardous waste disposal site remedial programs is to restore sites to pre-release conditions to the extent feasible. The NYSDEC cannot accept a risk-based cleanup approach when there is a feasible approach to achieve pre-disposal conditions. The ROD requirement for evaluation of the vapor intrusion pathway for future buildings is based on the potential that soil and groundwater treatment may not be complete when such buildings are planned, or that residual contamination may remain at the site.

Comment 30: The selected soil remedy outlined in the PRAP includes hot spot excavation and the installation of a 2 foot cap across the entire 15 acre property. The need for this cap is based on the potential for exposure to chemicals present in the fill material at the site and is not related to any site activities. 'The compounds detected in the soils are also present in background samples collected by NYSDEC and therefore these conditions should be considered background conditions. We propose the use of a site specific risk evaluation to develop clean up goals based on the compounds of concern present at the site and any future development plans for the site.

Arsenic, benzo(a)pyrene and PCBs drive the soil risks, which are below risk limits for the hypothetical excavation worker. Estimated risks due to dermal exposure to soil for the current use of the boat launch and hypothetical recreational users and site workers exceed the chemical-specific risk limit of 1×10^{-6} for at least arsenic for each receptor. VOCs in soil contribute negligible risk compared to risks related to PAHs and inorganics; no VOC in soil drives risk.

As part of the RI, soil samples SS-11 and SB-1 were collected from an area that was considered to be unimpacted from site operations to understand local background conditions. Results of the analyses at SB-1 indicated carcinogenic PAH and some metal concentrations greater than any other surface soil sample collected on site. Similarly, carcinogenic PAH and metals concentrations at SS-11 are similar to, or higher than, those found at sample locations near potential contaminant sources. As a result of carcinogenic PAH and metals concentrations at the background locations occurring at higher levels than locations possibly affected by on-site contaminant sources, it is assumed that the source of carcinogenic PAHs and metals is the historic fill material.

The results of the investigation completed by NYSDEC indicate that conditions in background areas are similar or greater than those found in areas of concern. We propose the use of a site specific risk assessment to evaluate which portions of the site require capping. The risk assessment would take into consideration concentrations of the compounds of concern and the uses of the various portions of the site based on the future development plans once they are fully understood.

Response 30: The NYSDEC did not conduct an investigation of background soil conditions for this project. Neither the PRAP nor the ROD consider the samples taken from the Pioneer Boat Club (SB-1 and SB-2) to be background samples. The RI refers to these as locations “likely to be unaffected by the petroleum bulk storage operations”, but makes no claim that they are representative of background conditions. In fact, the RI states that SB-2 was located at the edge of the reported chlorobenzene groundwater plume and near a truck loading area. The surface soil sample taken from the Pioneer Boat Club (SS-11) is described as being from an area of stained soil and stressed vegetation. The PRAP and ROD do not utilize a background-based approach for setting soil cleanup goals.

The PRAP and ROD acknowledge that historic fill used to construct the site is contaminated with metals and PAHs, the latter at levels that exceed health-based guidelines. Table 1 demonstrates that these fill-related PAHs are ubiquitous throughout the site. Therefore a soil cover combined with the appropriate institutional controls is the only feasible method to prevent future exposures.

Comment 31: The selected remedy for groundwater remediation at the site includes the installation of an AS/SVE system, despite the fact that pilot studies completed at the site have indicated that it would be difficult to effectively operate an SVE system due to the shallow depth to groundwater. The difficulty associated with operating an SVE system at this site was discussed during the public meeting held on January 17, 2006. We believe that the PRAP should be modified to include the information developed during the AS/SVE pilot study.

The inset in the PRAP: "Remedial Technologies for Volatile Organic Compounds in Soil and Groundwater" makes reference to the Soil Vapor Extraction and Air Sparging (SVEIAS) pilot test conducted in September 2002; however, particular details associated with operating the AS/SVE pilot test system should be highlighted as they are for the Biosparging pilot test system. During the AS/SVE pilot test, even lowering the SVE flow rate to just exceed and capture the sparge rate was only able to achieve an estimated 50% run time under the most diligent operational circumstances with daily site visits during testing.

The site is flat and depth to groundwater is nominally 3-5'. A horizontal SVE well would presumably be installed at a depth of 2'. In addition to short-circuiting air from the surface, an SVE system installed within a few feet of the water table will tend to draw water. This will be exacerbated by seasonal and tidal water table fluctuations, ambient precipitation, and mounding of the water table from air sparging. For a full-scale system, to prevent airlvapor discharge to atmosphere at the rates for conventional sparging, the system will need to automatically shutdown pending manual drain and re-start each time the SVE system draws water. While horizontal SVE wells are the best option to minimize drawing water, our experience has been that these systems only operate during the dryer summer and fall months and chronically flood each spring with the trenches having a lower permeability than the undisturbed soil and causing a "bath tub" effect.

We understand your concern that Biosparging may take a long time to remediate the site. However, a Biosparging system can operate year round, independent of the water table elevation.

We would like to propose Biosparging as an option during periods of high water table that preclude operation of the SVE system. Considering the potential for seasonal operation of the SVE system, the duration for remediation by AS/SVE may not be significantly more expedient than that projected for Biosparging.

Response 31: The SVE pilot study was performed using a vertical extraction well, despite the NYSDEC's recommendation to evaluate the horizontal well system under consideration in the FS. Therefore the difficulties encountered in the pilot study may not apply to the final remedy. The NYSDEC acknowledges that the AS/SVE system will require special design considerations to optimize operation. Such considerations include a temporary impermeable layer to prevent short circuiting and the bathtub effect described in the comment, as well as condensate traps and drains. These were also not included in the pilot study. As discussed in Response #25, federal guidance indicates that SVE can be effective with groundwater depths greater than 3 feet, as is the case here. The AS/SVE pilot study recommended that a limited use of AS/SVE and enhanced bioremediation should be considered to reduce contaminant mass in the source area. The ROD includes the flexibility to consider other technologies both in the source area and in the downgradient plume.

While the NYSDEC will consider alternative technologies for soil and groundwater treatment (see Response #55), the 18-month biosparging pilot study has not demonstrated that this technology would be effective. Because the average concentration of chlorobenzene in groundwater increased from 2,488 ppb to 2,738 ppb during the study, the NYSDEC cannot reasonably predict when groundwater quality standards would be achieved, if at all. As a result, biosparging is not included as a potential technology for evaluation during the design.

Comment 32: The definition of "grossly contaminated soil" presented in the PRAP is inconsistent with 6 NYCRR PART 375-1.2 (w). We ask that text in PRAP Section 7.1, S5 - Excavation of Chlorobenzene, Petroleum and Dye-contaminated Soils and Installation of a Soil Cover System, be modified to include the word "vapor", such that the text will read:

"Grossly contaminated soil is soil which contains free product or mobile contamination that is identifiable either visually, through strong odor, by elevated contaminant **vapor** levels, or is otherwise readily detectable without analytical sampling."

Response 32: The NYSDEC agrees with this comment and has revised the ROD accordingly.

Comment 33: As outlined in the PRAP, the selected soil remedy includes the excavation and off-site disposal of "grossly contaminated soils" related to residual petroleum identified on the former Mobil Tappan Terminal. Figure 6 of the PRAP depicts the proposed location for the completion of this soil excavation. The PRAP does not provide information on the deciding factor in determining grossly contaminated soils or the extent of the area to be evaluated for the presence of grossly contaminated soils.

During the public meeting held on January 17, 2006, representatives from NYSDEC indicated that a preliminary investigation would be necessary during the remedial design stage to further evaluate the extent of grossly contaminated soil. Specific information was not provided concerning the extent of the investigation and the criteria to be used to determine which soil requires excavation. We use this opportunity to present our proposed method for evaluating the extent of the area targeted for soil excavation, as follows below.

Based on a review of site data, it appears that the excavation area was selected due to the results observed for soil boring SB-3 and the 8 nearby sampling locations. Therefore, the investigation will be completed in the area of SB-3. Soil borings will be advanced via direct push techniques until the water table is encountered and soil samples will be collected continuously and evaluated for the presence of grossly contaminated soil. The soil borings will be installed in a grid centered on the SB-3 location. The grid will extend until soils which do not appear to be grossly contaminated have been encountered in all directions.

Response 33: Because the soil excavation criterion has changed to include total SVOCs, including TICs, greater than 500 ppm (see Response #44), specific approaches for the pre-design investigation will be discussed during the remedial design planning stage.

Comment 34: As indicated in our correspondence of January 19, we believe that site access issues will be a key limiting factor in the schedule for remediation and completion of the selected remedy at the site. As you are aware, the Zinsser Bridge is currently closed and not likely to be replaced for at least 2 to 4 years. Current access to the site is only through the ARCO property, which based on discussions with NYSDEC, will no longer be an option due to upcoming remedial activities at the ARCO site. In addition, construction activities are currently planned for the railroad property adjacent to the Site which would eliminate that as a route for access to the property. Based on this, it is likely to take a minimum of 2 years before any full-scale remediation can commence.

The soil cover over all vegetated areas, as part of the proposed remedy, will best be constructed as site development takes place to ensure integrity and quality of the cover. We propose to defer installation of the soil cover until development plans are put into effect and the soil cover can be installed without being disturbed, integral to the development project. Deferment of the cap installation will not result in undue exposure to site conditions. The site is thickly vegetated deterring trespassing, stabilizing soil, and continuing conditions for natural attenuation processes, such as phytoremediation. The Site is currently inaccessible due to the presence of an 8 foot fence surrounding the entire property. In addition, the Zinsser Bridge, the only public road access to the property, is currently condemned and barricaded further limiting unauthorized access.

Response 34: The NYSDEC disagrees with the assumption that access through the ARCO site will no longer be available due to remediation activities to be conducted there. As discussed in Response #23, coordination between the two sites is essential for engineering and logistical reasons. The NYSDEC acknowledges that site access for construction is a challenge that must be addressed in the remedial design and in construction scheduling.

The NYSDEC cannot accept an indefinite deferment of the soil cover until the site is developed.

Comment 35: As indicated in the PRAP, institutional controls will be part of the selected remedy for the Site. The institutional controls include the development of a site management plan, the imposition of an environmental easement which among other things would limit future use of the site, prevent groundwater at the site from being used as potable water, and require the property owner to complete periodic review of the remedy ensuring compliance with institutional controls, site development restriction and cap maintenance.

Part of the site management plan will require the evaluation of "the potential for vapor intrusion for any buildings developed on the site, including provision for mitigation of any impacts identified". We would like this wording to be changed to require that, instead of an indoor air evaluation, a sub-slab depressurization system will be included as part of the construction for any occupied building at the site.

The PRAP indicates that the environmental easement would require approval by NYSDOH, NYSDEC and the Village of Hastings on Hudson prior to the completion of any intrusive work on the property. Whereas it is appropriate to notify the Village regarding the environmental easement and any intrusive work, approvals for the remediation work to be completed under the forthcoming ROD and Remedial Design Work Plan should only be required from NYSDEC and NYSDOH.

Response 35: Because buildings may be constructed after the soil and groundwater has been fully remediated, or in areas of the site where groundwater is not contaminated, it is not necessary to require a sub-slab depressurization system for all occupied structures. The NYSDEC acknowledges that installing a sub-slab depressurization system as a default may be more cost-effective than conducting a vapor intrusion investigation and evaluation. This approach would be acceptable under the ROD.

The NYSDEC agrees that approvals under the Site Management Plan (SMP) are the responsibility of the NYSDEC and NYSDOH. The ROD has been changed to reflect that the Village will only receive notification of actions undertaken at the site pursuant to the SMP.

Mr. Michael DeMaio of Uhlich Color Company, Inc. submitted a letter dated March 2, 2006 which included the following comments:

Comment 36: We strongly support the proposed residential deed restriction that would be placed on the future use of the Site after cleanup and capping measures are complete. Any change in the proposed strategy that would further restrict the proposed restricted residential designation would not be acceptable to Uhlich. It is our understanding that the restricted residential status would allow for the construction of multi-family housing on the Site, while prohibiting the construction of single family homes.

Response 36: The comment is noted.

Comment 37: Uhlich is opposed to any proposal to divide the Site into two separate cleanup units. The Site has, for decades, been treated as one Site for purposes of assessment and cleanup. The source of the contamination on the Site is clearly associated with prior owners and operators in the oil business and dye business. The contaminants found on the Site as the result of the activities of prior owners and operators have impacted the Site. Therefore, any attempt at dividing the Site into two separate cleanup units would unnecessarily duplicate efforts and be an inefficient use of resources.

Uhlich believes that there should be allowance for separate capping schedules and temporary capping activities on the Uhlich and Mobil properties. Such an allowance would allow the owners more flexibility in pursuing their own future development plans, provided that one owner's development plans are not interfered with because of delays in cap installation by the other owner. The recommended air SVE technology can be readily incorporated into future site plans and logically should be installed before the two foot cap. However, the technology could be installed after the cap at an additional cost.

Response 37: The NYSDEC has no plans at this time to address the site as two (or more) operable units. The detailed schedule for implementing the site remedy will be developed during the remedial design phase, including property-specific considerations. While the capping element of the site remedy may be coordinated with timely site development, the NYSDEC will not delay implementation of the remedy if site development lags.

Comment 38: After review, we agree with and support DEC's assessment of the Site, with respect to the contamination found on the Site and the sources of that contamination. We would like to emphasize that Uhlich never used chlorobenzene in any of its production processes, nor did Uhlich ever engage in the dye or fine chemicals manufacturing business or operate oil storage and processing facilities on the Site. Therefore, Uhlich is not the primary responsible party for the chlorobenzene, oil or dyes associated with Zinnser and the oil facilities which were operated by Zinnser and its successors on the Site.

Response 38: The comment is noted.

Comment 39: With the multiple efforts by the consultants to Mobil, Uhlich, and the NYSDEC over a period of twenty years, there is a substantial body of knowledge regarding the distributions of contaminants at the site, and there is no need for further sampling to support the PRAP's recommendation for the cap. The DEC has extensive reports and sample records for the Site and has incorporated this information in its analysis. A thorough risk assessment of the contaminants found on the Site was also prepared. It is extremely unlikely that there is any hidden and undiscovered source of contamination on the Site.

Response 39: Additional sampling will be necessary during the remedial design phase to delineate and properly design the AS/SVE system, and to properly characterize and delineate soil for removal. However, the NYSDEC agrees that the site is sufficiently characterized to select a site remedy.

Comment 40: Uhlich agrees with the proposal in the PRAP for a 2-foot soil cover (or new roadways, building foundations, etc.) for the site. The 2-foot depth is an appropriate remediation and is specified in the New York Brownfield Law for restricted residential, where Soil Cleanup Objectives (SCOs) are not met. Such cover systems have been accepted for other similar projects in New York State.

Uhlich is aware that a thicker cover is being required for the ARCO site to the north. However, that neighboring site has substantial PCB contamination that may not all be removed during the remedial excavation. For the purposes of a soil cover on the Uhlich property, there is ample sampling data to demonstrate that the PRAP's recommended 2-foot cover will protect human health and the environment. For example, NYSDEC has proposed new SCOs to replace the old TAGM guidance. With the SCOs, both properties would be compliant for zinc, selenium and nickel. (There are no proposed SCOs for total mercury and vanadium.) With the exception of benzo(b)fluoranthene and PCBs, the proposed SCOs would allow significantly higher residual concentrations in restricted residential environments than the TAGM levels upon which the PRAP is based. A re-tabulation of the Remedial Investigation ("RI") data would show relatively fewer excursions on the Uhlich property with the proposed SCOs. Even for chlorobenzene, the chemical which is the focus for the air sparging and SVE, all of the soils on the Uhlich portion of the Site except for just one sample with only a 20% exceedance would be compliant with the restricted residential SCO . Granted, the SCOs are only proposed at this stage and do not have the force of promulgated regulation. However, they were derived from significant health risk assessment data and consideration of other factors. The TAGM values have always been guidance, only.

The contaminants and risks posed by the ARCO site are different from, and far more extensive than, those found on the Site. Given that the chlorobenzene will be removed from the Site by the proposed air sparging and soil vapor extraction, the only reason that the entire Site must be capped consists of the various contaminants including polyaromatic hydrocarbons, associated with the original fill material put in place under the supervision of the Army Corps of Engineers. The PRAP proposes a two foot soil cap for the entire Site with a clear demarcation layer to reasonably address these concerns. It must be noted that the Uhlich property is almost completely covered by paving or concrete foundation slabs at this time. There is no potential for human interaction with the fill material on the Site at present, since the Site is unused, vacant, all structures on the Site have been removed.

Response 40: The comment is noted. The NYSDEC agrees that the contaminants and risks posed by this site are different than those present on the ARCO site.

Comment 41: The existing pavement and foundation slabs should be acceptable as temporary capping for the Uhlich property. Since the Uhlich portion of the Site is not now being used for any commercial or residential use, until such time as development plans are in place for the Site, or for any portion of the Site, the existing pavement and foundations will adequately prevent exposure to the underlying fill soils. Permanent capping should be completed by such time as development begins on the Site.

Response 41: The ROD does not require, nor recognize, a temporary cap for purposes of preventing exposure to contaminants. As discussed in Response #37, the specific time frame for implementing the various components of the remedy will be developed during the remedial design. A temporary, impermeable cap may be necessary to optimize the operation of the AS/SVE system.

Comment 42: Uhlich agrees with the PRAP that an appropriate remedy for groundwater is air sparging, coupled with SVE. Uhlich believes that this remedy can be effective, does not require significant piloting, and would also address volatile contaminants in both the saturated and vadose zones. While we have some concerns with the alternative technologies cited in the PRAP, Uhlich would also support other effective technologies which are found capable of removing the chlorobenzene in the soil above and below the water table and groundwater in a timely manner. Assuming new buildings constructed as part of a site redevelopment would be located outside the sparge and SVE lines, this remedy can be easily incorporated into future site development plans.

Though not mentioned in the PRAP, phytoremediation has also been suggested by others, but this technology is unproven in this area and would require an extended period to pilot. The soil cap recommended in the PRAP could not be installed until after the completion of the phytoremediation (or worse case, after installation of an alternate technology should phytoremediation fail). Therefore, this technology would result in unacceptable delay to redevelopment of the Uhlich property.

While we agree that measures should be taken to remedy the ground water and any soils containing chlorobenzene at unacceptable levels, we do not believe that it should be necessary to cleanup the groundwater to levels at or approaching the standard applicable to drinking water. The water under the Site is brackish. The groundwater is not now, nor would it ever be, used for potable purposes. Groundwater should therefore be remedied to a level consistent with the future use of the Site.

Response 42: As discussed in Response #55 below, phytoremediation will be retained as a possible remedial technology for low levels of groundwater contamination where the plume discharges to the Hudson River. The source area, which is generally beneath the Uhlich property, would not be considered for this technology.

The applicable standards for groundwater beneath the site are the 6NYCRR Part 703.5 ambient groundwater quality standards. Drinking water standards (10NYCRR Part 5) are not being applied to groundwater beneath the site. Groundwater beneath the site will be remediated to pre-disposal conditions, the State Superfund goal for the site, to the extent feasible.

Comment 43: In general, Uhlich supports the position set forth in the PRAP regarding the soil and groundwater cleanup of the Site. We remain concerned with the term “grossly contaminated soil” which would identify soils requiring excavation from the Site. We support the potential necessity to excavate some soils to a maximum of 100 cubic yards from the Site. The PRAP defines “grossly contaminated soil” as follows:

> Grossly contaminated soil is soil which contains free product or mobile contamination that is identifiable either visually, through strong odor, by elevated contaminant levels, or is otherwise readily detectable without analytical sampling.

This definition does not appear to be consistent with NYSDEC’s latest draft of DER-10 which defines grossly contaminated soil as “soil which contains visibly identifiable free or otherwise readily detectable free or residual product”.

The definition in the PRAP is also inconsistent with the definition in the 2003 Brownfield Law, which defines grossly contaminated soil as follows: “Grossly contaminated soiltt shall means soil which contains free product or residual contamination which is identifiable visually, through the perception of odor, by elevated contaminant “vapor” levels, by field instrumentation, or is otherwise readily detectable. (emphasis added)

Uhlich believes that the PRAP definition should reflect the established Brownfield Law definition by adding the word “vapor” before the word “levels”. The relevance of this edit is addressed below.

Response 43: See Response #32.

Comment 44: The following analysis reviews each element of the definition of "grossly contaminated" and demonstrates that the soils targeted for excavation by the PRAP on the Uhlich portion of the Site do not likely meet the requirements for grossly contaminated soil.

a. ". . .contains free product or mobile contamination", The RI sampling logs indicate that free product is not present;

b. ". . .that is identifiable either visually", The RI sampling logs demonstrate that visual discoloration by dye is not present in the soils targeted for excavation;

c. ". . .or through strong odor", The RI sampling logs demonstrate that the targeted soils do not have an odor;

d. ". . . elevated contaminant (vapor) levels", PID measurements completed during the RI demonstrate low vapor levels typical of the site soils in general;

e. "...or is otherwise readily detectable without analytical sampling", Short of costly contract laboratory analysis for SVOC - TICS, the contaminants in the soil on the Uhlich property targeted by the PRAP for hot spot excavation can not be detected.

The commonly accepted concept regarding grossly contaminated soil is that such soil can be readily identified in the field during excavation so that the excavation manager has a rational basis for determining what soils have to be remediated and what soils can be left alone. Although there will always be some question as to where to draw the line between grossly contaminated and "contaminated", there is typically no doubt between grossly contaminated and uncontaminated. This determination is not possible for an excavation of dye-impacted soil on the Uhlich property, since such soil can not be distinguished from soil that has not been impacted with dye.

Response 44: Review of the sampling logs confirms that the samples from the Uhlich property containing high levels of dye-related TICs did not show clear visual evidence of contamination, as noted in the comment. As a result, the ROD has been revised to include 500 ppm total semivolatile organic compounds (TSVOCs), including TICs, as a criterion for soil excavation. This value, which is listed in NYSDEC Technical Administrative Guidance Memorandum (TAGM) 4046, would include the two sampling locations (SS-16 and SS-17) where TICs are very high, but would exclude samples containing lower levels of fill-related SVOC contamination, which is not feasible to fully excavate. The pre-design investigation will require soils to be delineated with respect to this criterion, along with the grossly contaminated criteria.

Comment 45: The PRAP identifies three hot-spot areas that would be excavated to remove what the PRAP describes as soil grossly contaminated with dye-related compounds (two on the Uhlich property) and weathered petroleum (one on the Mobil property). With an estimate of 100 cubic yards for all three excavations, the PRAP appears to indicate that these excavations will be limited to surface and near surface soils. While Uhlich would accept the excavation of no more than 100 cubic yards of soil, if necessary, we believe that the description of these soils, and the resulting perceived need to remove these soils, is inappropriate.

The PRAP's stated need to conduct the Uhlich excavation is the magnitude of the concentrations of dye-related compounds, measured as tentatively identified compounds ("TICs") through the analysis of semivolatile compounds. The excavation area depicted in the PRAP encompasses the RI sample locations SS-16 and SB-5 to the south and SS-17 and SB-7 to the north. The proposed excavation areas identified in the PRAP are beneath pavement and isolated from the sewer line on the Mobil property where the PRAP speaks of soils impacted with colored dye.

There is no established or proposed regulation or guidance in New York concerning numerical soil cleanup objectives specific to the TICs reported in the four soil samples. Accordingly, there is no basis for the PRAP to propose a remediation for those impacted soils. Impact to groundwater from the identified TICs is insignificant. The PRAP suggests that the rationale for proposing the excavation is based only on the perception that the concentrations appear high. The concentrations are not in themselves high. At SS-17, the location where the highest concentrations were reported, aven assuming that all of the unknown TICs are dye-related, the total TIC concentration amounts to less than 1% of the soil weight. This is an insignificant amount in light of the sampling logs showing the soil contains layers of ash, slag and other materials that the PRAP would allow to remain on-site beneath the proposed soil/asphalt/concrete cap.

The above conclusions are consistent with the RI and Feasibility Study ("FS") completed by the NYSDEC's engineering consultants. In their reports, the consultants discussed the TICs on the Uhlich property, but never suggested that targeted excavation would be an appropriate remediation for those soils. When the supplemental sampling was conducted for the Feasibility Study to investigate, among other areas, the hot-spot on the Mobil property, the Uhlich TIC-contaminated areas were not the subject of further remedial consideration. Uhlich assumes that the draft RI and FS reports were provided to the NYSDEC prior to the finalization of the PRAP. Uhlich is concerned that there is no apparent basis for the appearance of the additional targeted remediation area during the interim period between the FS and the PRAP, since no new data was generated during that time frame to support this change in scope.

Response 45: Technical Administrative Guidance Memo (TAGM) 4046 lists a soil cleanup objective of 500 ppm for total SVOCs, which has been incorporated into this ROD. The presence of dye-related contaminants, including TICs, in the subsurface is an indication of disposal. Because the goal of the site remedial program is to achieve pre-disposal conditions to the extent feasible, and because the selected treatment technologies are not considered to be effective on these TICs, these soils have been targeted for excavation.

The RI and FS provide a technical basis for the PRAP and ROD, but the two documents are not necessarily identical. USEPA's "Guidance for Conducting Remedial Investigation and Feasibility Studies under CERCLA" indicates that the RI/FS Report can be modified by risk management decisions and policy judgements as the proposed plan (PRAP) is developed.

Comment 46: The targeted area on the Uhlich property should be covered with the soil/asphalt /concrete cap that the PRAP adopts for the remainder of the soil on that property. The ash and other fill material used to create the entire waterfront contains hundreds of contaminants associated with coal ash and incomplete combustion, as well as other waste and discarded materials used simply to take up space. This problem is common to all of the sites created in the shallow areas along the Hudson River. The tentatively identified compounds which may have originated from dye production on the Site prior to 1955 are not significantly different from, nor are these compounds at all likely to pose a risk greater than, the contaminants which are already in the ash and debris used to fill the Site. The proposal for two feet of soil cap and a demarcated fill barrier is more than sufficient to eliminate future exposure to the fill materials on the Site.

Response 46: The dye-related contaminants and TICs are sufficiently different from fill-related contaminants to warrant limited excavation and removal from the site. As discussed in Response #8, there is no data, or only inconclusive data, concerning the potential health effects from the dye-related TICs found at the site. Because the extent of TIC contamination is much more limited than fill-related contamination, it is also feasible to remove it to achieve pre-disposal conditions of the site with respect to these compounds.

Comment 47: The PCBs found on the Site have the same chemical fingerprint as the PCBs found on the Anaconda-Harbor-at Hastings Site ("Anaconda site") and are likely the result of natural movement from the Anaconda site.

With regard to PCBs on the southern portion of the property, the contamination appears to be surficial and localized, though its precise limits are unknown. The PCB concentration, though over restricted residential guidance, is still relatively moderate (4.4 mg/kg in just one sample). Therefore, the proposed cap is an appropriate remedy in this area. The source of the PCBs in the southern portion is unknown. However, to the north, the distribution and chemical fingerprint of the reported PCBs strongly implicates operations or migration from the adjoining Anaconda property as the source. Nevertheless, the cap recommended in the PRAP will address that contamination also.

Response 47: The NYSDEC cannot say with certainty whether the source of PCBs at this site is the adjacent former Anaconda Wire Facility. The NYSDEC agrees that the soil cover specified in the ROD is sufficient to address the low levels of PCBs present at the site. See also Responses #11 and #21.

Comment 48: DEC has indicated clearly that sampling has not shown any significant migration of contaminants to the Hudson River from the Site.

Response 48: The PRAP and ROD state that sediments adjacent to the site have not been impacted by site contaminants. Surface water samples have not been taken, but the conceptual model is that the groundwater plume discharges into the waters of the Hudson River.

Comment 49: As worded, the PRAP would require prior NYSDEC, NYSDOH, and Village notification and approval for any intrusive work through the cap.

A soil management plan will be prepared, approved by the NYSDEC, and incorporated into a deed restriction. The PRAP should have recognized that intrusive work through the cap requires agency notification, but if conducted in accordance with the soil management plan, does not require agency approval unless an agency disapproves the disturbance.

There is no time limit imposed for such agency approval. Unless the local municipality has a permitting requirement for excavations, there is no formal agency approval process for such work. Neither the NYSDEC nor the NYSDOH have forms or procedures for approving such notices. Uhlich reasonably anticipates excessive delays in obtaining approvals in such situations. If the NYSDEC persists in retaining the approval language as opposed to a notice provision, there should be a time limit imposed on the receiving Agency for generating a response to the request.

Some recognition must also be made for emergency work.

Response 49: Specific notification procedures, forms and time frames for agency review will be contained in the Site Management Plan that is reviewed and approved by the NYSDEC. The NYSDEC agrees that the Site Management Plan should make provisions for emergency maintenance work.

Comment 50: Uhlich agrees with the PRAP that sub-slab vapor venting be provided for all structures that will not be open to the air (such as gazebos). Such venting is readily installed, operated and monitored and is proven effective in preventing vapor intrusion into buildings.

Response 50: The ROD requires that vapor intrusion into buildings must be evaluated and mitigated as necessary prior to construction. Developers often install sub-slab ventilation systems and vapor barriers as a default on re-developed sites, rather than perform extensive sampling and modeling, which may be more expensive and time-consuming. This approach would be acceptable under the ROD.

Mr. William McCune of Blasland, Bouck and Lee, Inc., on behalf of Kewanee Industries, submitted a letter dated March 2, 2006 which included the following comments:

Comment 51: To facilitate the ability of the responsible parties to implement the remediation of this site, we request that the agency allow for the division of the site into several operable units (OUs), as has been allowed by the agency at other sites with similar issues. Dividing the site into three OUs (i.e., groundwater OU, Mobil Soil OU and Uhlich Soil OU) would facilitate the ability of the responsible parties to effectively implement the remedial activities in connection with each portion of the site in a timely manner.

It is Kewanee's view that the division of the site into three OUs will also facilitate the consent order negotiation process. As discussed in detail below, it is also Kewanee's view that settlement will be encouraged if the remediation goals for the site are protective of human health and the environment, but also are attainable.

Response 51: The NYSDEC believes that site conditions do not favor dividing the site into three operable units. The source of chlorobenzene contamination is beneath the Uhlich property, but has impacted soil and groundwater beneath both Uhlich and ExxonMobil properties. The sewer line, which has acted as a conduit for preferential transport of the chlorobenzene plume, lies on the border between the two properties. The selected AS/SVE remedy is inherently an integrated soil and groundwater technology. Design, construction and operation of this system must carefully balance injection and extraction rates between soil and groundwater phases, and within portions of the overall treatment area. For these reasons, the NYSDEC will continue to approach the Tappan Terminal site as a single operable unit.

Comment 52: We agree with the basic premise that the selected remedy at this site 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. We also agree that the remediation goals for this site should prevent ingestion of and direct contact with contaminated soil, prevent ingestion of groundwater with contaminant levels exceeding drinking water standards, and prevent inhalation of volatile organic chemicals from contaminated soil and groundwater. However, we would contend that the remedy can adequately protect human health and the environment without complete removal of the source of groundwater contamination or preventing any discharge of contaminants to the Hudson River. Therefore, we suggest the following modification of these components of the remedial goals:

- Remediate the source of groundwater contamination as required to achieve relevant groundwater standards, to the extent practicable; and
- Prevent the discharge of contaminants to the Hudson River above relevant standards, to the extent practicable.

The PRAP further proposes that remediation goals for the site soil include attaining, to the extent practicable, soil cleanup guidelines that are protective of human health and groundwater quality. While we agree with the establishment of remedial goals that are protective of human health and groundwater quality, we believe this can be accomplished best through the development of site-specific risk-based remedial objectives for soil. This approach would be more appropriate than the application of generic soil cleanup guidelines (e.g., Technical and Administrative Memorandum 4046: Determination of Soil Cleanup Objectives and Cleanup Levels) that do not consider actual site conditions, the likely future site use and other relevant considerations such as the application of institutional controls which would mitigate potential risk.

Response 52: The goal of site remedial programs is to achieve pre-disposal conditions to the extent feasible. The NYSDEC cannot accept a risk-based cleanup approach when there is a feasible approach to achieve pre-disposal conditions.

Comment 53: We are also concerned regarding the proposed application of the term "grossly contaminated soil" as referenced in the selected soil remediation alternative. According to the definition in the PRAP, "grossly contaminated soil is soil which contains free product or mobile contamination that is identifiable either visually, through strong odor, by elevated contaminant levels, or is otherwise readily detectable without analytical sampling." We contend that this definition is unclear and overly broad and would likely result in the removal of soils which, although exhibiting staining, do not contain constituents at concentrations which would not represent a threat to either human health or groundwater quality. We contend that the establishment of site-specific risk-based remedial objectives, as described above, would provide a more appropriate basis on which to determine the extent of soil requiring removal from the site.

Response 53: The removal of grossly contaminated soil is consistent with the goal of achieving pre-disposal conditions to the extent feasible. See also Responses 453 and 46.

Comment 54: PRAP also proposes to establish Class GA Ambient Water Quality Standards as a remedial goal for contaminants of concern in groundwater, to the extent practicable. While we understand this is the typical groundwater standard applied for most site remedial programs, we believe this remedial objective would be overly conservative and inappropriate for application at this site. The background condition of the groundwater in the site vicinity does not meet the Class GA Ambient Water Quality Standard for salinity, therefore, this aquifer should not be considered as a potable water source. Furthermore, all of the remedial alternatives considered for this site will include adequate institutional controls to ensure the groundwater at this site is never used as a potable water source.

The human health risk assessment (HHRA) conducted in May 2000 on behalf of NYSDEC concluded that the only potential exposure route of concern with respect to groundwater, is the potential exposure of a hypothetical excavation worker via dermal contact with groundwater. Therefore, we would propose that risk-based site-specific cleanup objectives be established for the groundwater, which would mitigate this identified potential risk. The application of the Class GA Ambient Water Quality Standards would not be any more protective of human health than the application of these proposed site-specific risk-based cleanup objectives.

Response 54: The goal of remedial programs is to achieve pre-disposal conditions to the extent feasible. Class GA ambient water quality standards for site-related contaminants represent levels that approximate pre-release conditions, and levels which would result in an acceptable level of risk for consumers of groundwater. The NYSDEC believes that the remedial technologies specified in this ROD are capable of reducing groundwater VOC concentrations to levels that approach ambient water quality standards in a reasonable time frame and at a reasonable cost. However the feasibility of achieving water quality standards cannot be known until the combination of remedial technologies is selected and the systems are operational. The NYSDEC cannot accept a risk-based cleanup approach when there is a feasible approach to achieve pre-disposal conditions.

The NYSDEC also notes that the HHRA did not evaluate the vapor intrusion pathway of exposure. As discussed in Response # 12, the current state of the science does not permit a reliable correlation between levels of contaminants in soil and groundwater and those in indoor air. A risk-based approach for dermal exposures to groundwater would therefore not protect against exposures to indoor air.

Comment 55: The selection of remedial alternatives S6 - Soil Vapor Extraction, Excavation of Petroleum and Dye-contaminated Soil and Installation of a Soil Cover System and G2 - Air Sparging with Soil Vapor Extraction may not be the most appropriate technical approach for meeting the remediation goals at this site. There are many obstacles to the efficacy of the proposed alternatives, site conditions and compounds affected by the alternatives, which can be more efficiently addressed by other alternatives possibly at reduced cost. The S6 alternative assumes shallow groundwater constraints will be "evaluated during the remedial design." However, other physical and hydrological conditions will affect system operation. Shallow and fluctuating water table conditions, buried bulkheads, and subsurface heterogeneity from debris, all pose major obstacles in the effective operation (e.g. creating a uniform vacuum gradient) of a SVE and AS/SVE systems. Given the significant concerns we have regarding the implementability of the selected remedy, we request the NYSDEC include adequate flexibility in the Record of Decision (ROD) to allow the responsible parties an opportunity to assess alternative remedial technologies (in-situ biosparging, chemical oxidation, in-situ anaerobic biodegradation, and phytoremediation), which may provide potentially more appropriate and effective means of achieving the remediation goals at this site. Specifically, we request the ROD allow for development of a remedial design work plan which provides for a performance of additional remedial technology evaluation and would allow for the implementation of an alternative remedy should it be adequately demonstrated that this alternative approach has the potential to meet the established remediation goals. The ROD could also include appropriate language providing for the implementation of the agencies selected remedy as a contingency in the event an alternative can not be successfully implemented.

Response 55: Based on this comment, the ROD has been revised to allow an opportunity to evaluate alternative remedial technologies to achieve the goal of remediating soil and groundwater contamination. As suggested by the comment, AS/SVE is retained as the representative technology in the event that alternative technologies are not demonstrated to be effective. However, as discussed in Response #31, the NYSDEC believes that biosparging has been given a sufficient opportunity to be demonstrated, and the results indicate that it is not capable of reaching the remedial goal in a reasonable time frame. As discussed in Response #24, the alternative technologies must also be capable of remediatiing the SVOCs listed in Table 1 that are found within the chlorobenzene plume.

Comment 56: We wish to clarify the timing of the requirement for an environmental easement, as referred to within the PRAP. The environmental easement is a post-remediation requirement that would not take effect until the remediation of the site was complete. The assumption presented in the PRAP with regard to the possible future uses of the site would be further narrowed, should the property owners decide to apply deed restrictions to ensure the elimination of additional potential future uses (e.g., restrictions against any residential future use).

Response 56: The timing of the environmental easement will be determined based on the remedial design process. Environmental Conservation Law [ECL 27-1318(b)] requires the site owner or responsible party to place an environmental easement on an inactive hazardous waste disposal site within 60 days of starting the remedial design.

Comment 57: We wish to raise several issues that need to be considered which, impact the overall schedule for the remedial implementation at this site.

As you are aware, the Zinnser Bridge, which had provided vehicular access to the site, was closed by the NYSDOT. While there has reportedly been some planning by the NYSDOT to repair this bridge, it is not clear when, or if, this route of access will be available. In the intervening period, the only potential route for vehicle access to the site is through the adjacent Harbor at Hastings site. We understand that the NYSDEC would be willing to assist in coordinating access by this route, to the extent possible. While we will work with the agency to mitigate any potential delays to the project relate to these access limitations, we request that these limitations be considered as we establish the overall remedial schedule for this site.

To some degree the impacts of the current access constraints may be mitigated through the sequencing of the remedial program. Once the remedial design has been completed, we would anticipate the first component of the remedial program would involve the activities to address groundwater. The sequencing of the soil remediation after completion of the groundwater remediation would make logistical sense to avoid having the intrusive activities associated to the groundwater remedial program penetrate the surface cover anticipated in conjunction with the soil remedy.

We also think it would also make sense to delay installation of the surface cover until the future uses of the various portions of the site have been established. This would allow the final design of the surface cover to be adjusted, as appropriate, to accommodate the identified future use to the extent practicable. Given the previous risk assessment conclusions regarding the current lack of complete exposure pathways at this site, the suggestion to delay implementation of the soil cover installation would not present any further risk to the community. A contingency requirement for an interim cover of unpaved surfaces could be considered in the event the delay exceeds a reasonable time period.

Response 57: The specific remedial sequencing will be determined during the remedial design. See also Responses #37 and #41.

Mr. William Lee Kinnally, Mayor of the Village of Hastings-on-Hudson, submitted a letter dated March 3, 2006 which included the following comments:

Comment 58: Although the Board supports the use of air sparging/soil vapor extraction ("AS/SVE") as a general approach with respect to the chlorobenzene contamination on the Tappan Terminal Site, we reluctantly conclude that the overall proposed remediation does not adequately take into account the anticipated uses of the Site, the need for a reasonably expeditious remediation, the applicable hierarchy of remedies articulated in governing regulations (6 NYCRR 375-1.10(c) (5)), and the current conditions of the Site. In particular, the remedy articulated in the PRAP does not assure that the Site would be delisted and placed back into productive use by the public as soon as practicable and within a reasonable time. We believe that there are alternatives that have not been fully considered that would achieve the appropriate remedial goals and meaningfully accelerate the completion of remediation while also being cost-effective.

Response 58: The ROD provides for treatment technologies that will remove and/or destroy chlorobenzene and other contaminants in a reasonable time frame. Institutional and engineering controls, particularly the soil cover and requirements for soil vapor investigation and mitigation, will enable the site to be brought back into productive use in a manner that protects public health and the environment. Because both the Harbor at Hastings and Tappan Terminal sites will contain residual contamination, the NYSDEC expects that they will be reclassified to sites which require continued monitoring (Class 4), rather than delisted.

Comment 59: As did the ROD for the Anaconda site, the ROD for this Site should make clear that all excavated soils and others materials would be transported from the Site for disposal by rail or barge.

Response 59: Transportation access to the site will be a significant challenge, and the NYSDEC is reluctant to restrict particular means of access in the ROD. While the NYSDEC has a preference for rail and barge transportation to and from the site, the Tappan Terminal site does not have the same rail infrastructure as the adjacent former Anaconda Wire site. However, the site also has severely limited road access due to the closure of the Zinsser Bridge. It is not clear whether the former petroleum offloading facilities would be serviceable for barge access of soils. The specific methods of transportation access will be determined during the remedial design phase of the project.

Comment 60: The PRAP does not consider the need for the overall remedy to be reasonably expeditious, and does not weigh the benefits of an expedited remediation versus any detriments thereof. In particular, the PRAP does not consider expediting the operation of the AS/SVE system through additional well points, which would significantly reduce the anticipated five-year time frame for this element of the proposed remediation. Nor does it consider the benefits of the removal of chlorobenzene-contaminated soil to minimize the need for SVE and expedite the overall remediation.

Response 60: The PRAP and ROD considered the duration and short-term effectiveness of the remedial alternatives in selecting the remedy. Because the rate of contaminant extraction is determined to a large degree by subsurface conditions and desorption characteristics, it is uncertain how the duration of the AS/SVE component would be reduced by increasing the number of extraction points. Nevertheless, the remedial design will establish an array of AS/SVE extraction points the maximizes removal efficiency and minimizes the duration of treatment. As discussed in Response #55, the NYSDEC will consider the benefits of other treatment technologies to expedite the soil and groundwater treatment component of the remedy.

Comment 61: The cover system of two feet of clean fill should be modified to be consistent with the remedy to be implemented at the adjacent Anaconda site, particularly in light of the failure to consider the exposure risks of the TICs, and the need for the cover to accommodate appropriate plantings.

Response 61: See Responses 3, 15, 16, and 17.

Comment 62: The FS assumes that the Uhlich portion of the Site would continue as industrial use. (FS at 1-1 1.) Although it also indicates that future residential use is a hypothetical pathway of exposure (id.), it is unclear whether that assumption was carried forward in the PRAP because that document is vague about future uses. The PRAP only states, in identifying as one potential exposure pathway: "Inhalation of contaminated vapors in indoor air by future occupants of buildings.. .." (PRAP at 11 .) The PRAP does appear to assume that part of the Site would be used for recreational purposes, and it identifies dermal contact with contaminated soil and/ River sediments by Pioneer Club members and recreation users.

The ROD must assume that the Site would be used in the foreseeable future for residential and open space-recreational uses. The Waterfront Zoning, the State's coastal zone management policies and the Village's draft LWRP all contemplate residential and open space recreational use of the Site.

Response 62: The PRAP and ROD clearly state that permissible land uses at the site are restricted residential, recreational, commercial and industrial uses. In limiting residential use of the site to "restricted residential", which excludes single family detached housing, the NYSDEC is consistent with the highest use permitted in the Village's Waterfront Zoning District.

Comment 63: The PRAP proposes to implement an AS/SVE system to address the extensive chlorobenzene plume on the Site, which appears to be centered on the Mobil/Uhlich Paint property boundary line. Initially, there is a need to more precisely delineate the plume, which requires additional groundwater and soil sampling. The PRAP relies on sampling that was conducted prior to the demolition of the Uhlich Color Company portion of the site, and did not include borings in the locations of buildings. There should also be a concomitant geotechnical evaluation to more precisely identify important site features that can significantly impact the effectiveness of the proposed AS/SVE remedial system. Of major concern are buried bulkheads, rip-rap and other geological features noted in the RI and FS that do not appear to be considered in the AS/SVE treatment zones of influence. In addition, there should be sampling for chlorobenzene at depth to ensure the efficacy of AS/SVE in addressing the contamination. This further investigation should be required as part of the ROD, so as not to further delay issuance of that document, the completion of remediation and the return of the Site to productive use.

If this sampling discerns the presence of obstacles that could prevent or seriously hinder the effectiveness of this remedy and/or extend the time for its implementation and completion, andlor chlorobenzene contamination at levels suggestive that AS/SVE may not effectively remediate the contamination, the ROD should provide for a second remedy. That backup remedy should probably consist of excavation of contaminated soil, dewatering and the treatment of dewatered groundwater. As in the Anaconda site ROD (at 19), the ROD for the Site should make clear that all excavated soils and other materials would be transported from the Site for disposal by rail or barge.

In addition, the PRAP does not mention how AS/SVE will address underground transport/delivery systems associated with chlorobenzene in which chlorobenzene product likely remains. As AS/SVE would not reach such contamination, some removal action addressing these structures will likely be necessary to augment the proposed remedy.

The PRAP does not articulate the remedial objectives for the AS/SVE remediation, other than in the most general terms. The Board assumes that the objective is the achievement of the applicable standards, criteria and guidance ("SCGs") for chlorobenzene in soil and groundwater. These objectives should be sufficient to eliminate, to the maximum extent possible, the need for the imposition of engineering andlor institutional controls to address vapor intrusion into buildings that may be constructed on the Site -particularly residential dwellings. An appropriate vapor intrusion model (such as the Johnson-Ettlinger model) should be considered to assure achievement of this objective.

Response 63: The NYSDEC agrees that additional sampling is necessary to design the conceptual remedy selected in the ROD, and that this sampling must address both contaminant distribution and subsurface geologic conditions. The NYSDEC also agrees that contamination beneath the former Uhlich Color Company buildings must be delineated. However, the NYSDEC disagrees that excavation and off-site disposal of contaminated soil is the preferred backup remedy. As discussed in Response #55, other *in situ* treatment technologies are potentially viable to address soil and groundwater contamination at the site. The NYSDEC believes that the short-term impacts of excavating and transporting soil contaminated with volatile organic contaminants are potentially severe, and that the cost and delays to mitigate these impacts would be unacceptable.

Based on this comment, the ROD includes a provision to remove the subsurface piping and other potential structures associated with site contaminants.

As discussed in Response #12, the NYSDEC does not believe that current vapor intrusion modeling or field experience is sufficient to establish definitive soil cleanup objectives to address the vapor intrusion pathway at this site.

Comment 64: The Department should consider the use of chemical oxidation to provide an immediate reduction in contaminants, followed by AS/SVE to expedite treatment. Although chemical oxidation was somewhat experimental when the FS was issued in July 2000, it is over five and a half years later, and this technology is now an accepted remedial technology. A pilot test could be implemented for chemical oxidation during the time other Site remediation commenced. If demonstrated to be successful, chemical oxidation could be implemented after targeted removal of the most highly chlorobenzene-contaminated soils, as discussed below, with SVE then utilized to remediate any remaining contamination. This combination would produce the most comprehensive and expedited soil remediation.

Response 64: As discussed in Response #55, the ROD provides flexibility in the selection of technologies to treat soil and groundwater at the site. While the NYSDEC remains concerned that the high organic content of the site fill may interfere with the effectiveness of chemical oxidants, its use will be evaluated in the remedial design phase.

Comment 65: The AS/SVE remedy would take approximately five years to complete. Alternative S5, which was not recommended, would provide for the removal of approximately 7,000 cubic yards of chlorobenzene-contaminated soil to the groundwater table. The justifications advanced for not selecting this remedy are that the chlorobenzene would be remediated by the AS/SVE system and that the excavation and removal of approximately 7,000 cubic yards of such material (together with the additional 100 cubic yards of grossly contaminated soil) would have "a high degree of short-term impact because a large volume of soil, containing volatile organic contaminates (sic), would be excavated over a 2-year time frame." Neither of these rationales withstands scrutiny.

The first proffered justification is that SVE would remediate the chlorobenzene-contaminated soil. However, as explained earlier, there is significant concern that the numerous subsurface obstructions present on Site would materially reduce the effectiveness of this approach and/or would extend the time the remedy would take to effectuate. Thus, the success of the SVE to remediate soil is not a foregone conclusion. Excavation and removal of chlorobenzene-contaminated soil, however, would indisputably accelerate the time period in which the AS/SVE remediation would be complete. The removal of the 7,000 cubic yards of chlorobenzene-contaminated soil would significantly reduce the need for SVE, and allow it to be focused on areas beneath the remaining slabs, near underground utilities and other areas in which excavation is difficult to achieve. At a minimum, the aereal extent of SVE coverage would be substantially reduced.

Should removal of soil to the groundwater table present a question as to the efficacy of the AS/SVE system related to the necessary pressure for its successful implementation, that could be addressed through a combination of predesign testing and placement of a liner over the area being remediated to ensure the requisite vacuum effect and vapor capture zone. Indeed, both of these measures are identified as being necessary for the AS/SVE approach in the FS in any event. (See FS at 4-1 1, 4-20.) In the event it was determined that complete excavation of chlorobenzene-contaminated soil would render the AS/SVE system less effectual, some quantity of soil short of complete excavation to the groundwater table could be removed.

Moreover, removal of the contaminated soil would achieve assurance of a permanent long-term remedy, as compared to the AS/SVE approach. As acknowledged in the PRAP, Altemative S5 would remove "the highly contaminated soil above the water table that is impacting groundwater." (PRAP at 22.) In contrast, Alterative S6, the proposed remedy, would "provide a high degree of long-term effectiveness by stripping volatile organic contaminants from soils and excavating the highest levels of non-volatile contaminants." (Id.) Removal would guarantee a permanent solution, and thus be somewhat more consistent with the Department's hierarchy of remedies. 6 NYCRR 375- 1.10(c)(5).

The second justification advanced to justify rejection of removing chlorobenzene-contaminated soil is the supposed "high degree" of short-term impact. There is no explanation for this asserted impact. Moreover, this reason is not advanced in the FS. (See FS at 5-6 to 5-7.) The fact that excavation might cause odors can be addressed by appropriate odor control measures; the Department has recent extensive experience with the success of proper odor controls in the Queens West Development project in Region 2 and Manufactured Gas Plant sites in New York City and other locations. A properly implemented odor control program should avoid significant odor problems. The volume of incremental soil that would require removal - 7,000 cubic yards - is not that large an amount. Excavation and removal actions at sites throughout the State frequently exceed this volume. And it is quite puzzling why the removal of 7,100 cubic yards of soil under Alternative 6 would require two years while the removal of 121,000 cubic yards of soil under Alternative 7 could be completed in three years. (PRAP at 18, 21 .)[1]

The estimated net present value cost of Alternative S6, including removal of petroleum and dye-contaminated soil and SVE, is $3,746,000. The cost of removing the chlorobenzene, petroleum and dye-contaminated soil is $4,125,000. Thus, the incremental cost of removing of chlorobenzene-contaminated soil is approximately $379,000, together with the cost of replacement fill. At a conservative cost of $20 per cubic yard for (as opposed to the $13 per cubic yard used in the FS), that additional cost is approximately $513,000. That incremental cost would be further reduced by the savings from the reduction in the time of operations and O&M for the contemplated AS/SVE operations resulting from removal of the chlorobenzene contaminated soil. In any event, the Board believes that these incremental costs certainly should not preclude consideration of this alternative approach, particularly given the benefits of an accelerated remediation and greater consistency with the Department's hierarchy of remediation.

[1] The FS indicates that this Alternative (S5 in the FS) could be achieved within 12-18 months. (FS at 5-7.) It is unclear why the PRAP increased the time for this remedy by up to 100%.

Neither the FS nor the PRAP considers an intermediate approach consisting of the excavation and removal of some quantity of chlorobenzene contaminated soil, which would accelerate the completion of remediation and enhance the likelihood of the success of the AS/SVE approach. For example, the excavation could be focused on areas that are easier to access, leaving areas near harder-to-reach areas such as subsurface utilities, etc., for the SVE system. The excavation could instead focus on the soil areas with the highest concentrations of chlorobenzene. Or, alternatively, the top several feet of chlorobenzene-contaminated soil could be excavated and removed, which would accelerate the AS/SVE remediation without the need to excavate the entire 7,000 cubic yards as assumed in Alternative S5. At a minimum, the Department should consider middle-ground approaches that would yield at least an equally effective but more expeditious cleanup, and which would remain cost-effective.

Response 65: As discussed in Responses 25 and 55 above, the NYSDEC believes that AS/SVE can be effectively implemented at this site, and has also provided flexibility for additional technologies to be evaluated to expedite the cleanup and reduce the resulting cost. The commenter's assumption that the extent of SVE would be reduced if the excavation remedy is performed is invalid. SVE would still be a required element of the air sparging treatment of subsurface soil and groundwater beneath the excavated area.

With regard to the time to implement each alternative, the ROD has been revised to consistently reflect the longest estimate of the range provided in the FS. For Alternative S5, this is 2 years, and for Alternative S6 this is 18 months.

In comparing costs for remedial alternatives, the commenter has not included the full costs of addressing both soil and groundwater contamination. The selected remedy, costing $4.226 million, includes air sparging and soil vapor extraction to address both soil and groundwater contamination. To compare equivalent costs, the cost of a groundwater remedy must be added to the excavation cost (Alternative S5). Adding the air sparge alternative (G2) results in a remedy costing $6.125 million, which is $1.96 million more than the selected remedy. Soil vapor extraction is significantly more cost effective because it is also an essential component of the air sparge remedy that is necessary for groundwater treatment.

Note that the NYSDEC did include the cost of backfill in the soil excavation cost estimate, at a cost of $15 per cubic yard. However, the cost estimate assumes that excavation can be performed in the open, without the need for a tent or temporary structure to control air emissions. Many of the New York City manufactured gas plant sites referenced by the commenter required the use of temporary structures with air circulation and treatment systems to prevent vapor emissions to neighboring properties. These systems can add $500,000 to the cost of an excavation project.

The NYSDEC will evaluate an "intermediate approach" suggested in the comment, but primarily with respect to treatment technologies, rather than excavation. As discussed in Response #55, the NYSDEC believes that a combination of soil and groundwater treatment technologies may be more effective and cost effective than AS/SVE alone in certain segments of the contaminated area.

Comment 66: Alternative S6, part of the proposed remedy, entails the removal of about 100 cubic yards of soil that is grossly contaminated with dye-related compounds and weathered petroleum. It is unclear whether such soil is present only above the groundwater table and, if not, whether the removal will also extend below the groundwater table. Excavation should not be limited to above the water table for such grossly contaminated soil; rather, if there is grossly contaminated soil below the water table it should be excavated and removed absent a compelling showing as to why this cannot or should not be done.

The ROD should also include excavation and removal of underground transport/delivery systems associated with Site contaminants (in addition to those relating to chlorobenzene). Although the RI (at 3-1) discusses buried chemical piping, it does not specify what chemicals were transported in this piping. Absent a showing that the piping in fact did not carry chemicals or was not otherwise involved with chemical use, it should be excavated and removed from the Site.

Response 66: The NYSDEC agrees with this comment, and the ROD clarifies that grossly contaminated soil includes soil located below the groundwater table.

Comment 67: The only mention in the PRAP of vapor intrusion is in the context of the Environmental Easement that would accompany a number of the alternatives. Alternative S4, in addressing this issue, speaks of requiring a proper barrier and a ventilation system to address vapor intrusion. However, the PRAP's discussion of the proposed remedy is more ambiguous on this subject, and appears to provide for the adoption at some point in the future of criteria to determine the need for such protection.

As noted above, the AS/SVE system should be designed and implemented under criteria that avoid the need for engineering or institutional controls in or under buildings in order to address vapor intrusion. If that is not possible, the ROD should articulate the criteria to determine the need for a vapor barrier and/or ventilation system (such as a subslab depressurization system). This should be spelled out in some detail, and not left to future documents.

These requirements should also be made part of the SMP and be specified, pursuant to the Environmental Easement, as a cost to be borne by the responsible parties. If these requirements are not made an explicit component of the SMP and Environmental Easement, the costs would need to be born by prospective developers of the Site, which would serve as a deterrent to Site redevelopment.

Response 67: As noted, the PRAP and ROD include a specific requirement for the evaluation and mitigation, as necessary, of potential vapor intrusion in buildings to be developed on the site. This will be performed using applicable NYSDEC and NYSDOH guidance documents in effect when the buildings are proposed. In the absence of existing buildings or specific plans to construct new buildings, the ROD cannot specify that a subslab depressurization system, or other mitigation method, is required. Such a determination must consider the location of the building with respect to volatile organic contamination, and the construction time frame with respect to operation of the soil and groundwater treatment system. Similarly, costs to provide these measures would be highly speculative.

The NYSDEC expects that the soil and groundwater remediation system, which includes AS/SVE, will reduce contamination to levels that should obviate the need for a vapor intrusion mitigation system. However, the relationship between subsurface conditions and vapor migration into structures is an evolving science, and specific soil and groundwater criteria are not presently available to accurately model this pathway. The requirement to address the vapor intrusion pathway as part of the Site Management Plan is included in the PRAP and ROD.

Comment 68: The PRAP and FS appear to rely on the good condition of the existing rip-rap and associated filter fabric to retain contaminated soil. The requirement should be imposed on the responsible parties to maintain such a system in perpetuity, and to provide financial assurance for repairs thereto, as part of the ROD, the SMP and the subsequent Environmental Easement.

Response 68: See Response #19. Responsibility for implementation of the Site Management Plan will be determined along with responsibility for the remedy as a whole.

Comment 69: The Site contains historic fill with elevated levels of metals and polycyclic aromatic hydrocarbons ("PAHs") (although some of such contaminants may result from historical industrial uses). The remedial standards that were applied to the neighboring Anaconda site should also apply at the Tappan Terminal Site.

The PRAP, however, does not apply comparable standards. The only remedy relating to metal and PAH "hot spots" is covering with two feet of soil. There is no alternative that discusses removal of hot spots. The assumption that these contaminants were derived from historic fill does not vitiate the potential need for remediation beyond soil cover. It is commonplace in the State's remedial programs to require excavation and removal of hot spots regardless of the source (i.e., whether the contamination resulted from historic industrial operations or represents anomalies in the context of historic fill at the Site).

The ROD for the Anaconda site required the excavation and removal of hot spots. For example, that ROD required that lead hot spots >1,000 ppm be excavated and removed from surface soil (defined as the top two feet). At the Site, lead was found in surface soils (top 3 inches) at concentrations up to 1,320 ppm, and 8 of the 18 samples exceeded the cleanup objective of 400 ppm. Lead was found in subsurface soils (>11 inches depth) at levels up to 3,090 ppm. The removal of lead at the Site is of particular consequence, as lead significantly exceeds the water quality standard (261 ppb versus 25 ppb) in a filtered sample.

In addition, arsenic is found at levels up to 90 ppm in surface soil (the TAGM RSCO is 7.5) and chromium is found at concentrations up to 97 ppm in surface soil (with a TAGM RSCO of 10 ppm). Similarly, there are exceedances of the RSCOs for cPAHs in the surface soils. Six cPAHS exceed the applicable RSCO of background levels in surface and near surface soils.

Response 69: Lead "hot spots" at the former Anaconda Wire Plant are defined as locations where lead exceeds 2160 ppm (See ROD at 10 and 37). That area became contaminated as the result of lead wire recycling and reclamation operations, and is not associated with historical fill. Lead in that area reaches a maximum concentration of 43,200 ppm in surface soils, an order of magnitude higher than the maximum value found at the Tappan Terminal site.

The cited result of 261 ppb for lead in a filtered sample is an incorrect value. As discussed in the summary of the Data Usability Summary Reports (RI page 4-21), the container labels for filtered and unfiltered samples from monitoring well OW-21 appear to have been switched. The presence of sediment in the bottom of the sample labeled "filtered" indicates that it was not filtered. The site-wide maximum filtered detections of lead and copper, originally listed in Table 1 of the PRAP, were found in this sample. The next highest values for lead and copper in filtered samples, 22.0 and 15.3 ppb respectively, are both below the respective groundwater quality standards. As a result, Table 1 of the ROD has been revised to exclude lead and copper as groundwater contaminants of concern. They remain as contaminants of concern in soil, to be addressed by the soil cover.

Comment 70: The Tappan Terminal PRAP is deficient in not assessing the risk associated with the TICs and assessing the need for soil and/or groundwater remediation. The HRA does not assess the risk associated with the different TICs found on the Site, when some of these chemicals, such as ethyl ether, is noted in the RI as a key contaminant but is not addressed in either the HRA or remedial program in the PRAP (other than in the context of the two-foot soil cover).

According to the PRAP, there are several locations on the Mobil property that contain TICs that were generally identified at hydrocarbon semi-volatile organic compounds and dye-related TICs. (PRAP at 9.) It does not appear that the limited soil removal proposed as part of Alternative S6 would include this area. And the PRAP acknowledges that the AS/SVE system would not be effective in remediating these contaminants. Thus, the PRAP recommendation has been met without any assessment of the risk of leaving these constituents in situ.

Similarly, the PRAP notes that in the northern part of the Site, separate and distinct from the chlorobenzene plume (at least as delineated to date), there is an area of ethyl ether and diisopropyl ether contamination. The PRAP also notes that there is no ambient groundwater standard or guidance for these chemicals. (PRAP at 10.) Although the proposed AS/SVE system would include this area, it is unclear whether that remedy would address the TICs, or the ethyl ether and diisoproply (sic).

Response 70: As discussed in Response #8, health risk information for dye-related TICs found at the site is not available. The site remedy addresses high levels of SVOC TICs (>500 ppm) through excavation, and lower levels by the soil cover.

Comment 71: The PRAP offers no remediation other than two feet of soil cover for the residual contamination at the Site that would remain after implementation of AS/SVE and the limited removal of grossly contaminated soil. This remedy is insufficient, particularly in the absence of any hot spot removal, the limited sampling and lack of a health risk assessment for TICs and/or, as discussed below, if asphalt is retained as a demarcation barrier. Two feet of fill would not allow for planting necessary for appropriate vegetation. It would also guarantee that any utilities installed in the future would disturb highly contaminated fill, causing unnecessary risk to construction workers. Accordingly, particularly (i) if hot spots are not proposed to be excavated, (ii) in the absence of any further delineation or assessment of the health risks associated with leaving TICs in place, or (iii) if asphalt is to be utilized as a demarcation layer, significantly more soil cover, consistent with that required at the Anaconda site, should be required at the Site.

Response 71: The PRAP and ROD provide for a combination of excavation, in-place treatment and containment, along with an environmental easement and site management plan, that protects public health and the environment. The removal of grossly contaminated soil called for by the

ROD is a removal of "hot spots" for the particular contaminants of concern at this site. The depth of cover required for this site is the same as that required by the Department in the Harbor at Hastings (Anaconda) site ROD. The ROD has been modified to state that if site development can be coordinated with the soil cover, clean utility corridors will be constructed (see response #18).

Comment 72: Alternative S4, which is incorporated into the proposed remedy (Alternative S6), provides for the existing asphalt on the Site to be used as a demarcation barrier, to be covered with eighteen inches of clean soil and then a 6-inch layer of topsoil. Using asphalt in this manner would cause increased levels of cPAHs in the soil as the asphalt breaks down over time, as is acknowledged in the FS. Thus, the result of this portion of the remedy would be to increase, rather than decrease, the levels and extent of cPAHs in the underlying soil. The proposal would also present serious stormwater management issues, as the PRAP acknowledges. It would further prevent the planting of appropriate vegetation. Thus, if the ROD allows the asphalt to remain, it should require sufficient additional soil cover to serve as a protective layer against future exposure and to support appropriate plantings for open space use.

On a related issue, the potential use of remaining slabs from former buildings on the Site as an impervious surface barrier would be problematic. The RI (at 3-3) notes the existing differential settling of Building 55, which suggests that any use of an impermeable subsurface banier for this Site would not be successful.

Response 72: The FS at 1-6 does not state that leaving the asphalt in place could cause increased levels of cPAHs in the soil cover above it, as the comment suggests. The FS attributes higher levels of cPAHs in soil samples collected immediately below asphalt surfaces to the asphalt itself. Because asphalt particles are not expected to be transported upward into the clean cover, a thicker soil cover is not necessary. The NYSDEC agrees that the presence of asphalt and concrete building slabs present stormwater management issues that need to be addressed during the remedial design.

Comment 73: The PRAP notes a problem with securing an appropriate Environmental Easement, as the responsible parties have not cooperated with the Department to date. To prevent this problem from delaying effectuation of the remedial program, the ROD should contain a condition that if the responsible parties refuse to record an Environmental Easement consistent with the ROD within a specified time frame, the remedy would shift to a greater deployment of excavation and removal (and other permanent remedies) to lessen the need for reliance on the Easement and the accompanying provisions of the SMP.

Response 73: The PRAP and ROD do not indicate a "problem" in obtaining easements for the site, only that legal negotiations would be required because two properties are involved. Preliminary discussions with both site owners indicate that easements are implementable, and therefore a contingency remedy is not necessary.

Comment 74: There does not appear to be one sampling event that represents a snapshot in time of the entire Site.

Response 74: A comprehensive groundwater sampling event was conducted during the Remedial Investigation between September 28, 1998 and October 1, 1998. Surface soil samples were collected in late

September 1998, and most subsurface soil boring samples were collected in early October 1998. Together these samples represent a synoptic characterization of the nature and extent of contamination. Historical (pre-1998) sampling results were included in the RI report because the results were valid, and they contributed to the understanding of environmental conditions at the site.

Comment 75: There is no information regarding sampling of soil and debris piles on-site as shown in figures from the RI and the FS. There is no information about whether the soil and debris piles were removed and, if so, whether they were sampled and characterized before removal, and the result of such work.

Response 75: The NYSDEC has no information concerning these soil and debris piles, or whether they remain at the site. These will have to be addressed when the site is prepared for the soil cover.

Comment 76: The investigation was conducted at a time when Uhlich Color Company was still operating and, as a result, does not appear to have conducted sampling under former buildings. Samples taken from the Boat Club were chosen to represent background conditions on the basis that it is unlikely that Mobil petroleum products could influence that area. However, boats use many lubricants, oil, gas, and cleaning fluids like TCE. Accordingly, this does not seem like a likely source for a background sample.

Response 76: The NYSDEC does not consider these to be background samples. See Response #30. Sampling was not conducted under the then-operating buildings of the Uhlich Color Company. This is a data gap that must be addressed during the design phase, as discussed in Response #44.

Comment 77: The RI indicates that there are no surface water bodies on the Site. However, the RI goes on to state that there is standing water consistently within one foot of the surface. The FS mentions the growth of cattails. Thus, the document raises the potential for the presence of wetlands on the Site, an environmental issue not addressed by the FS or PRAP. (The fact that such wetlands may be manmade as a result of site industrial activities is irrelevant to the presence and value of such an area.)

Response 77: The RI at 3-23 contains Table 3-1 with no reference to surface water bodies. The RI at 3-2 states that there are no flowing surface water bodies on the site, but describes a drainage swale that accumulates runoff after storm events. The FS at 3-4 describes a low-lying area along the sewer pipe alignment where cattails grow, and which appears in aerial photographs as frequently being wet. Because this area represents much less than 1% of the site acreage, it was not identified as habitat of significance in the Site Ecology section of the RI.

Comment 78: There is no figure that shows the location of the chlorobenzene storage tank or its supply and delivery structures. The only reference to the location of this tank is in the FS (at 1- 8), which refers to boring SS-2. Yet there does not appear to be a boring SS-2.

Response 78: The location of the chlorobenzene tank is shown on Sheet 1-1 of the RI Report “Historical Site Features Map”. The FS correctly refers to sampling location SS-2, which is a surface soil sample. Location SS-2 is shown on Sheet 4-1 of the RI Report, in close proximity to a circular structure labeled as “Former Location of Chlorobenzene Tanks”

Comment 79: The FS notes high salinity in sampling due to tidal fluctuations. The RI references the use of meters to measure tidal flow at the Site, but does not discuss how the high salinity may have influenced chemical testing or analysis.

Response 79: The RI contains data for salinity, specific conductance, and individual inorganics (i.e. sodium) for all monitoring wells tested. Salinity and specific conductance data are presented in Appendix B, Monitoring Well Groundwater Sampling, Sample Information Records. The RI summary of the Data Usability Summary Reports for the project states that, aside from certain specific problems unrelated to salinity, no other problems were found with the data packages.

Comment 80: The RI mentions sampling for a suspect dense non-aqueous phase liquid ("DNAPL") plume. There are, however, no results or any further discussion of DNAPL at the Site.

Response 80: DNAPL was not found at the site and so was not discussed further.

Comment 81: There is no discussion of historic Site use of underground chemical transport or disposal facilities. The RI mentions soil and drilling fluids stored for disposal in the Uhlich Color Company wastewater treatment system, but does not indicate whether this was on- or off- Site. If on-Site, there should be a discussion of the chemical testing of that material, and transport and disposal records.

Response 81: The RI (page 5-7) contains a description of the sewer line that served as a conduit for site contamination. The NYSDEC has no further information concerning underground chemical transport facilities.

Purge water (not soil) from wells located on the Uhlich property was temporarily stored there until analytical results became available from the monitoring well sample. This information was provided to Uhlich personnel, who subsequently determined that the purge water could be treated in the on-site wastewater pre-treatment system, which discharges to the sanitary sewer. The groundwater monitoring results for wells on the Uhlich property are found in the RI Report.

Comment 82: The 95% upper confidence limit ("UCL") concentrations used as the exposure point concentrations ("EPCs") in the HRA exposure assessment do not appear to have been calculated appropriately. It was assumed that all data were normally distributed and the t-statistic (for normally distributed data) was used to calculate the 95% UCL concentrations. However, the correct procedure is to determine the underlying statistical distribution of the data, if possible, and to use an appropriate parametric equation to calculate the 95% UCL concentration. If the distribution cannot be determined, it is more widely accepted practice, particularly with soil data, to assume the data are log-normally distributed and use an appropriate nonparametric equation to calculate the 95% UCL concentration. Consequently, the EPCs that were used may incorrectly estimate exposure.

Response 82: The Health Risk Assessment (HRA) is just one tool of many tools used to help decide whether further actions need to be taken to mitigate exposures. In addition, the risks developed in such assessments are based on conservative assumptions, and tend to overestimate rather than underestimate the actual risks. HRA uses assumptions such as exposure to contaminate frequency of up to 30 years, 24 hours a day and a life span of 70 years, most people are not exposured for such a long time. Based on all the exposure analysis done at the site and including the conservative HRA, the statistics would not change the exposure scenario at the site. It is possible that the statistics are not perfect based on the set of assumptions used, hence the need to use other tools in the exposure assessment.

Comment 83: 95% UCL concentrations were also calculated in the HRA and used as the EPCs even for environmental media with very small data sets (e.g., subsurface soil with 2-3 or 8 samples). These statistics would not generally be run with sample sizes less than 10. Since average or 95% UCL concentrations are questionable with such small sample sizes, the maximum detected concentrations should have been used as the EPCs. Therefore, the risks for these media may be understated.

Response 83: The number of subsurface soil samples collected for the site was at least 10. (See Table 1) The HRA document may have used a limited number of samples based on the assumptions (highest concentration detected etc) used.

Comment 84: There may be some discrepancies in the data summaries in the HRA. For example, the text indicates that exposure to groundwater on the Uhlich property is based on data from that property only and that exposure to groundwater on the Mobil property is based on data from both properties. However, the data summary tables for both properties indicate a sample size of 37. It is also not clear why "NA" is listed in the tables for the summary statistics for some chemicals.

Response 84: There may be some discrepancies in the data summaries in the HRA; however, it is not the only tool that was used to analyze exposures. Other tools used in the investigation to evaluate exposures were the Feasibility Study, Supplemental Investigation, and the Remedial Investigation Report for the site. See also Response #82. Site groundwater is not used for potable purposes at the site currently, nor is expected to be in the future. An existing municipal water supply system already services the site and is readily available for potential future site development. Exposure to contaminated groundwater at the site is unlikely. NA means not analyzed or not available.

Comment 85: Although recreational exposure to sediment is identified as a potential exposure pathway in the HRA, it is not discussed in the exposure profiles.

Response 85: Sediments adjacent to the site were not found to contain site-related contaminants of concern. The ROD does not discuss exposures or risks associated with background or other sources.

Comment 86: A few future receptors/scenarios in the HRA showed risk estimates above acceptable levels: i.e., consumption of home-grown produce by residents, ingestion of surface soil by resident children, and dermal contact with groundwater by construction workers. The cPAHs, arsenic, iron, cadmium, mercury, and vanadium were the constituents of interest largely responsible for these risk estimates. This should be further explained.

Response 86: The imposition of institutional controls will limit the use and development of the property to restricted residential, commercial or industrial uses only. Under restricted residential (apartment complexes, townhouse development) vegetable gardens are prohibited, although community gardens may be allowed by NYSDEC in consultation with NYSDOH. Therefore homegrown exposure pathway is unlikely. Excavation of contaminated soil and a soil cover/demarcation layer will reduce any potential exposure to surface soil by future resident children. Any land development such as a childrens recreation park would need NYSDEC/NYSDOH review and approval. Although a potential dermal exposure pathway to contaminated groundwater exist for workers involved in the site development plan, the site management plan will require that workers involved in intrusive activities (excavations etc) at the site follow an approved Health And Safety Plan (HASP). An approved HASP would require that acceptable measures be implemented to prevent exposures.

The following verbal comments were received during the January 17, 2006 public meeting. These have been grouped by topic for clarity. Several verbal comments were reiterated in the written comments presented above, and are not repeated below. Comments and questions concerning the adjacent Harbor at Hastings site are also not addressed below.

Comment 87: Additional testing is need after the remediation to ensure that all contaminants are removed. Westchester County would like to work with the Village to maximize the opportunity for public access to the site and the waterfront.

Response 87: Post-excavation sampling will be required to ensure that the excavation is completed within the framework of the ROD. The remainder of the comment is noted.

Comment 88: It is premature to estimate a volume of grossly contaminated soil without additional testing.

Response 88: The NYSDEC recognizes that the volume of grossly contaminated soil is a rough estimate. However an estimate is necessary for understanding the scope and estimating costs so that alternatives can be compared. The estimate will be refined during the remedial design.

Comment 89: PCBs should be excavated from the site in a manner similar to the Harbor at Hastings site next door.

Response 89: The levels of PCBs at the site exceed the relevant guideline for surface soil, but are within the guideline for subsurface soil. Placement of the 2-foot soil cover over surface soils at the site will make the PCB-contaminated soils compliant with these cleanup guidelines. See also Response #11.

Comment 90: What is the location of the proposed air sparging system with respect to the dye-related contaminants?

Response 90: The eastern edge soil and groundwater treatment system overlaps the two locations with high levels of dye-related TICs (SS-16 and SS-17).

Comment 91: What percentage of chlorobenzene will be removed from the site? Will chlorobenzene levels be low enough after 5 years? Is there a contingency remedy if groundwater standards are not met.

Response 91: The NYSDEC has not estimated the mass of chlorobenzene in soil and groundwater at the site, and so cannot estimated the percent that will be removed. The 5-year estimated time frame is the NYSDEC's estimate for the system to achieve groundwater standards and soil cleanup guidelines.

With the consideration of additional or alternative technologies, the NYSDEC believes that these remedial goals can be met.

Before determining that the air sparging operation can be shut down if the remedial goals are not met, the NYSDEC would first require the system to be optimized. This is done by pulsing the operation, changing flow rates, and reconfiguring the extraction and collection wells. If the remedial action objectives are not met and optimization does not improve system success, an evaluation of alternatives to address the residual contaminatiion would be performed. The alternatives analysis would evaluate other possible remedial technologies to achieve the remedial action objectives, and would include a no further action alternative.

Comment 92: Why was groundwater pumping and treatment ruled out? A slurry wall should be considered for the site. Was a pilot study conducted for either the air sparging system or a groundwater pumping system?

Response 92: Groundwater pumping and treating was not selected because the contaminants it would remove, metals and SVOCs, are primarily related to the fill used to construct the site. The NYSDEC believes that it is not feasible at this site to remediate the impacts of historic fill on groundwater by extracting and treating it. A groundwater treatment system, such as air sparging supplemented by other *in situ* technologies, that targets VOCs and dye-related SVOCs is expected to successfully remediate these contaminants in a reasonable time frame and at a reasonable cost. However, a groundwater extraction system that is designed to address all metals and SVOCs would require a longer time frame and higher cost due to the large volume of historic fill that produces these contaminants. The purpose of the slurry wall described in Alternative G3 is to reduce the volume of river water that enters the groundwater treatment system, and not to fully contain groundwater beneath the site.

A pilot study was conducted for air sparging, but not for groundwater pumping. See also Response #31.

Comment 93: What costs were included in the operation, monitoring and maintenance costs for the site? The State should consider establishing a perpetual care fund for the costs of future Site Management.

Response 93: Apart from the operation costs of the groundwater treatment system, the following costs were included in the monitoring and maintenance (M&M) costs for the site:

Site Inspection and Annual Certification
Vegetation Maintenance
Miscellaneous Site Work and Cover Repair
Groundwater Sampling and Analysis
Equipment, materials & supplies

Responsibility for the annual M&M costs will be included in legal negotiations concerning the responsibility for the overall site remedy.

Comment 94: Was any drilling conducted in the Hudson River, and what was found?

Response 94: Surficial sediments from the Hudson River adjacent to the site were collected using a dredge sampler. Drilling to collect subsurface sediments was not conducted. The sampling results are presented in Table 1 of the ROD and discussed in Section 4.2.4 of the RI Report.

Comment 95: What is the difference between the bulkheads at this site and at the adjacent Harbor at Hastings site?

Response 95: The entire shoreline of the Tappan Terminal site is protected by stone rip rap underlain by filter fabric. The shoreline of the Harbor at Hastings site is a mixture of stone rip rap, wooden piles, dock structures and modern steel sheeting.

Comment 96: Will the presence of rip rap along the shoreline of the site require the waterfront promenade to set back?

Response 96: The location of a potential waterfront promenade with respect to the shoreline rip rap is an element that will be addressed during the design of the promenade.

Comment 97: Will the air coming out of the air sparging system be safe?

Response 97: The air discharge of the AS/SVE system will be treated and discharged in compliance with NYSDEC air emissions standards.

Comment 98: How effective is the air sparging technology?

Response 98: Air sparging is an effective technology for removing contaminants with high Henry's Law constants (most volatile organic compounds). See also Response #25.

Comment 99: What are the health effects from exposure to chlorobenzene in air from site groundwater?

Response 99: Elevated levels of chlorobenzene were detected in site groundwater and subsurface soil. However, chlorobenzene was not detected in site surface soil. Since chlorobenzene is present only in the sub-surface, the potential for this volatile organic compound (VOC) to volatilize directly to ambient air is reduced. In addition, should any chlorobenzene in sub-surface media volatilize and migrate to the surface, air (ambient air) dilution would significantly reduce the concentration of this VOC. In consideration of this information and given current site conditions (vacant site) it is unlikely for health effects to occur from exposure to chlorobenzene in air. To prevent potential soil vapor intrusion into future on-site buildings, the remedy for this site includes a soil vapor intrusion investigation for any new structures planned for this site and the implementation of an air sparge/soil vapor extraction system to treat contaminated soil vapor. In addition, a community air monitoring plan will be in place during any ground intrusive remedial activities to prevent the off-site migration of site-related contamination in concentrations that would represent a health concern.

Comment 100: Does the NYSDEC have an estimate of the amount of chlorobenzene present in the groundwater?

Response 100: The mass of chlorobenzene in groundwater has not been estimated.

Comment 101: What would happen if standards for chlorobenzene are not met after the air sparging operation is complete?

Response 101: See Response #91.

Comment 102: What would happen if chlorobenzene is detected in a building that is constructed on the site in the future?

Response 102: The selected remedy will address this possibility by removing the source of contamination, requiring an evaluation of vapor intrusion potential before buildings are constructed, and mitigating any potential impacts that are identified. If, despite these measures, indoor air contamination is attributed to vapor intrusion from contaminated soil or groundwater, the NYSDEC would require the installation of a mitigation system. Mitigation systems usually consist of vapor collection wells or pipes that are vented to the atmosphere to provide a preferential pathway for vapors to avoid passing into buildings.

Comment 103: Is there a concern for people using the site at the surface, outside of the buildings?

Response 103: There is a concern for potential exposure of people to contaminants in the fill and soil beneath the site. This exposure pathway is addressed by the clean soil cover specified in the ROD.

Comment 104: Are there contaminants present that are not readily identified, and how is the remedy protective for them?

Response 104: There are contaminants that are not readily identified and do not exhibit the characteristics of grossly contaminated soil. Some of these will be removed by the soil and groundwater treatment elements of the remedy, and some of these are addressed by the clean soil cover.

Comment 105: Two feet of cover may not support the kinds of vegetation that people want at the site. What kinds of vegetation could be planted on two feet of cover?

Response 105: Two feet of clean soil cover is sufficient to support many varieties of grasses, flowers and shrubs. Trees could be planted, provided that this is done in compliance with the Site Management Plan.

Comment 106: If all volatile contaminants will be gone, why are institutional controls necessary at the site?

Response 106: Institutional controls are necessary for the SVOC, metal and low-level PCB contamination that will remain at the site, and for VOC contamination that may be present if the site is developed before soil and groundwater treatment is complete.

Comment 107: Worms can move a lot of soil around and go deeper than two feet down.

Response 107: Worms are generally drawn to areas of high organic material, such as the topsoil component of the soil cover. Worms may go deeper than two feet below ground surface during colder weather, but it is unlikely that they would re-distribute sufficient contaminated fill to create an exposure risk in the clean soil cover.

Comment 108: What does air sparging do to organic material in the soil?

Response 108: Because organic material such as humic acids in soil are not volatile, air sparging will have no effect on it.

Comment 109: Could frost heaves move contaminated material up through the soil cover to the surface?

Response 109: Frost heaves require three conditions in order to form. These are:

- Sufficiently cold climate to allow freezing temperatures to penetrate below the ground surface;
- A supply of water into the freezing zone; and
- A soil material that is frost susceptible and is lying within the freezing zone. Silts or silty clay soils are considered amongst the most frost susceptible. Other soils considered frost susceptible include fine sands, clayey gravel and rock flour.

The remedial design will provide for a soil cover that has sufficient surface and subsurface drainage, and is composed of a soil that is not frost subsceptible. This will address frost heaves at the site.

Comment 110: If some toxic elements remain at the site, will it be difficult to grow things?

Response 110: As discussed in Response #105, shallow-rooted species that don't penetrate the clean soil cover will not be affected by the presence of contaminants in the subsurface. Plant species have varying tolerances for contaminants (and salinity), so plants for the site should be chosen by an experienced landscape professional.

Comment 111: Will it be necessary to remove unwanted vegetation from the site?

Response 111: Yes, in order to place the soil cover, the NYSDEC expects that existing vegetation will be removed and the site regraded.

Comment 112: Who will bear the cost of the cleanup?

Response 112: The State will contact the potentially responsible parties to assume responsibility for implementing the ROD. If an agreement cannot be reached with any of them, the State will implement the remedy.

Comment 113: Why is this the best remedy the NYSDEC can recommend when the companies involved are making record profits?

Response 113: The remedy is based on the feasibility of achieving pre-disposal conditions, the nature of contamination found at the site, and the criteria for remedy selection found in State laws and regulations.

Comment 114: Any disturbance of soil must be controlled to be sure that airborne contaminants don't enter the neighborhood during future construction.

Response 114: The NYSDEC agrees. Future construction at the site, both remedial and development, will be conducted under a site management plan, which will include a community air monitoring plan. This plan will require monitoring of dusts, vapors, and other contaminant phases as necessary to protect public health in the surrounding community. The site management plan will also include procedures for the proper handling and disposal of excavated soil.

Comment 115: Floods could cause a problem at this site, just like in New Orleans which is now a Superfund site.

Response 115: The site remedy does not address re-contamination of the site by floods or other off-site sources.

Comment 116: Has the NYSDEC conducted a review of the industrial history of the site over the past 150 years?

Response 116: The industrial history of the site since 1868 is summarized in Table 1-1 and on Sheet 1-1 of the Remedial Investigation Report.

Comment 117: Is there any data concerning the concentration of chlorobenzene in the unsaturated zone?

Response 117: The data for subsurface soil that appears in Table 1 of the ROD and Table G-2a of the Remedial Investigation Report are from the unsaturated zone (above the water table). This will be addressed by the SVE/AS system.

Comment 118: Has the fill been tested for dioxin?

Response 118: Unlike the adjacent Harbor at Hastings site, where PCB-containing wire insulation may have been incinerated, the Tappan Terminal site did not conduct any industrial processes that are expected to have generated dioxins. Before conducting special testing for chlorinated dioxins and chlorinated dibenzofurans, the NYSDEC evaluates the results for their chemical precursors, dibenzofurans, which are part of the standard SVOC analysis. Because the precursors were not found at levels exceeding cleanup guidelines, neither the fill nor surface soil was tested for dioxin.

Comment 119: What is the estimated time frame for operation of the SVE system?

Response 119: The estimated time frame for operating the SVE/AS system is 5 years. Because the ROD provides for other treatment technologies to be combined with SVE/AS, this time frame may be reduced.

Comment 120: What is the estimated volume of chlorobenzene-contaminated soil to be shipped off-site?

Response 120: Under the selected remedy, chlorobenzene-contaminated soil will be treated in place, and no such soil will be shipped off-site. The soils targeted for off-site disposal, grossly contaminated soil and containing greater than 500 ppm total SVOCs, may also contain chlorobenzene. However, it is uncertain whether this soil would be treated to remove chlorobenzene before it is excavated based on these other criteria. See Response #7.

APPENDIX B

Administrative Record

Administrative Record

Tappan Terminal Site
Village of Hastings-on-Hudson, Westchester County, New York
Site No. 3-60-015
September 2006

1. Proposed Remedial Action Plan for the Tappan Terminal site, dated December 19, 2005, prepared by the NYSDEC.

2. "Final Draft Screening Site Inspection - Mobil Oil Tappan Terminal", Volume 1, May 1989, NUS Corporation

3. "Final Draft Screening Site Inspection - Mobil Oil Tappan Terminal", Volume 2, May 1989, NUS Corporation

4. "Pre-Score Analysis - Mobil Oil Tappan Terminal", May 1989, NUS Corporation

5. "Final Site Screening Inspection - Paul Uhlich Company Site", Volume I, April 1996, Foster Wheeler Environmental Corporation

6. "Final Site Screening Inspection - Paul Uhlich Company Site", Volume II, April 1996, Foster Wheeler Environmental Corporation

7. "Final Site Screening Inspection - Paul Uhlich Company Site", Volume III, April 1996, Foster Wheeler Environmental Corporation

8. Referral Memorandum dated January 27, 1998 for the Tappan Terminal Site.

9. "Project Management Work Plan", July 1998, Dvirka & Bartilucci

10. "Remedial Investigation and Feasibility Study Work Plan", August 1998, Dvirka & Bartilucci

11. August 1998 Fact Sheet, Remedial Investigation Start

12. "Remedial Investigation Report", September 1999, Dvirka & Bartilucci

13. Letter dated October 5, 1999, Dvirka & Bartilucci, "Pre-Design Investigation"

14. October 1999 Fact Sheet, Remedial Investigation Results

15. Letter dated February 29, 2000, Dvirka & Bartilucci, "Supplemental Soil Investigation Results"

16. "Baseline Human Health Risk Assessment", May 2000, Dvirka & Bartilucci

17. "Feasibility Study", July 2000, Dvirka & Bartilucci

18. Letter dated June 28, 2002, Woodward & Curran, “Response to Pilot Study Comments”

19. Letter dated September 20, 2002, Woodward & Curran, “Review of Site Capping Options”

20. “Review of SVE/AS and Enhanced Bioremediation Feasibility Test”, December 23, 2002, Woodward & Curran

21. Letter dated March 31, 2004, Woodward & Curran, “Biosparge Pilot Testing Work Plan”

22. “Supplemental Work Plan to Perform Biosparge Pilot Testing Activities”, March 26, 2004, Woodward & Curran

23. Letter dated May 27, 2004, Woodward & Curran, “TIC Investigation”

24. “Updated Technical Memorandum - Biosparge Pilot Test”, October 31, 2005, Woodward & Curran

25. “Feasibility Study - Supplemental Cost Estimates”, December 2005, NYSDEC

26. December 2005 Fact Sheet, Proposed Remedial Action Plan

27. Letter dated December 30, 2005 from Mr. William Gay, commenting on the PRAP

28. Letter dated January 16, 2006 from Mr. Michael DeMaio of Uhlich Color Company, commenting on the PRAP

29. Letter dated January 19, 2006 from Mr. Steve Trifiletti of Exxon Mobil, commenting on the PRAP

30. Letter dated January 23, 2006 from Mr. Mark Stella, commenting on the PRAP

31. Letter dated January 24, 2006 from Hastings Waterfront Watch, commenting on the PRAP

32. Letter dated January 26, 2006 from Mark Stella, commenting on the PRAP

33. Letter dated January 30, 2006 from Mr. David Kalet of Atlantic Richfield Company, commenting on the PRAP

34. January 2006 announcement of extension of public comment period

35. Letter dated February 6, 2006 from Mr. Eric Annes of Riverkeeper, commenting on the PRAP

36. Letter dated March 2, 2006 from Mr. William McCune of Blasland, Bouck and Lee, Inc., on behalf of Kewanee Industries, commenting on the PRAP

37. Letter dated March 3, 2006 from Mayor W. Lee Kinnally of the Village of Hastings-on-Hudson, commenting on the PRAP