UNITED STATES

ENVIRONMENTAL PROTECTION AGENCY

REGION III

STATEMENT OF BASIS

AMOCO OIL COMPANY, A MEMBER OF THE BP GROUP

YORKTOWN

YORK COUNTY, VIRGINIA

U.S. EPA REGION III
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ACRONYMS

AOC	Area of Concern
API	American Petroleum Institute
AST	Aboveground Storage Tank
BP	British Petroleum
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CAMU	Corrective Action Management Unit
CFR	Code of Federal Regulations
CMS	Corrective Measures Study
EPA	Environmental Protection Agency
ETBE	Ethyl-Tertiary-Butyl-Ether
GPRA	Government Performance and Results Act
IC	Institutional Control
IM	Interim Measure
LNAPL	Light Non-Aqueous Phase Liquid
MCL	Maximum Contaminant Level
MTBE	Methyl-Tertiary-Butyl-Ether
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SB	Statement of Basis
SVOC	Semi-Volatile Organic Compound
SWMU	Solid Waste Management Unit
U.S.C.	United States Code
VDEQ	Virginia Department of Environmental Quality
VOC	Volatile Organic Compound
VPDES	Virginia Pollution Discharge Elimination System

STATEMENT OF BASIS FOR PROPOSED CORRECTIVE MEASURES
UNDER RCRA SECTION 3008(h)
AMOCO OIL COMPANY
YORKTOWN, YORK COUNTY, VIRGINIA

I. Introduction

This Statement of Basis ("SB") explains EPA's proposed corrective measures for remediating soil, groundwater, sediment and surface water contaminated with volatile and semivolatile organic compounds and metals at the Amoco Oil Company ("BP")[1], Yorktown Refinery ("Facility"), located near Yorktown, York County, Virginia. This document summarizes the corrective measures that the United States Environmental Protection Agency ("EPA") and BP have developed and evaluated under an Administrative Consent Order ("Order" or "Consent Order"), entered into between EPA and BP on November 4, 1991, Docket Number RCRA-III-046-CA, pursuant to Section 3008(h) of the Resource Conservation and Recovery Act ("**RCRA**")[2], as amended, 42 U.S.C. Section 6928(h).

In accordance with the Order, BP completed the tasks described in EPA-approved **RCRA Facility Investigation** ("RFI") Work Plans and it completed a **Corrective Measures Study** ("CMS"). The purpose of the RFI was to determine the nature and extent of any releases of hazardous wastes or hazardous constituents from **Solid Waste Management Units** ("SWMUs") and **Areas of Concern** ("AOCs") at the Facility. The CMS presents corrective measures to address contamination identified during the RFI, and during the course of other investigations completed by BP under the direction of the Virginia Department of Environmental Quality ("VDEQ") Aboveground Storage Tank ("AST") program, that presents a risk to human health and the environment. The evaluation of risk to human health and the environment was performed through a risk assessment, which is contained within the CMS. BP also has applied to EPA to designate a **Corrective Action Management Unit** ("CAMU") for managing remediation wastes during corrective action, and the CAMU is a focal point of the proposed corrective measures described here and in the CMS.

This document describes the corrective measures EPA considered to address contamination of groundwater, soil, surface water and sediments at the Facility, and explains EPA's rationale for the proposed corrective measures. This document also summarizes information that can be found in greater detail in the work plans and reports submitted by the

[1] As of October 1, 2001, Amoco Oil Company changed its name to "BP Products North America, Inc." For simplicity, Amoco Oil Company, a subsidiary of BP Company North America Inc., shall be referred to herein as "BP". On May 14, 2002 Giant Industries Incorporated ("Giant") assumed ownership of the Yorktown Refinery. The new name for Giant's business at the Refinery is Giant Yorktown, Incorporated.

[2] Words and abbreviations set forth in **bold** type are further defined in the Glossary attached hereto.

Facility to EPA and VDEQ during the RFI and CAMU application processes. To gain a more comprehensive understanding of the RCRA activities that have been conducted at the Facility, EPA encourages the public to review these documents, which are found in the Administrative Record. The Administrative Record is located at the EPA Region III Office. The SB and Index for the Administrative Record are available for review at the **York County Public Library**.

EPA will address all significant comments submitted in response to the proposed remedy described in this SB. EPA will make a final remedy decision and issue a Final Decision and Response to Comments after information submitted during the public comment period has been considered. If EPA determines that new information or public comments warrant a modification to the proposed remedy, EPA may modify the proposed corrective measures or select other alternatives based on such new information and/or public comments. Therefore, the public is encouraged to review and comment on the corrective measures described in this document and/or any additional options not previously identified and/or studied. The public may participate in the remedy selection process by reviewing the Statement of Basis and documents contained in the Administrative Record and submitting written comments to EPA during the public comment period. Public participation is discussed in detail in Section XI.

II. Proposed Corrective Measures

EPA's proposed corrective measures at the Facility are summarized in Table I. The remedies proposed are based on the continued operation of the Facility as a refinery (i.e., future industrial use) and are consistent with the results of the risk assessment performed as part of the CMS.

Remediation of contaminated soils and sediment will primarily rely on the CAMU to manage and provide long-term control of remediation wastes generated during cleanup activities. The CAMU will be comprised of SWMUs 1 and 3, which were previously operated as landfarms. SWMUs 5, 7, and 10 will be excavated to their unit boundaries and the contents excavated will be placed in the CAMU. Portions of SWMUs 2, 8, and 9 will be excavated and the material will be placed in the CAMU. SWMU 6 and AOC 1 will be excavated and the material will be placed in the CAMU to facilitate further use of these areas by the refinery. Verification samples will be collected from each excavation to ensure that no further risk is posed based on current conditions at the refinery. Further action to address the subsurface AST releases at SWMU 8 is required and will be carried out in a manner consistent with both EPA's corrective action and the VDEQ AST programs. SWMUs 11 and 12 were previously addressed via EPA-approved **interim measures** (i.e., low-permeability capping) that will now serve as final

remedies for those units. SWMU 4 (A & B) is permitted for operation as an industrial waste landfill under a VDEQ permit and will be operated and closed in accordance with the conditions of that permit.

There are three phases to completing groundwater remediation. Phase One will consist of source removal via the excavation of contaminated soils and the removal of free-product in a manner consistent with the VDEQ administered AST program (9 VAC 25-91-10) and EPA's Corrective Action program, additional delineation of source areas, and plume monitoring. Phase Two activities include the continued delineation of areas of known free product and associated dissolved-phase groundwater plumes or other contaminant plumes, and migration control measures. Additional corrective measures for dissolved phase groundwater plumes or other contaminant plumes will be implemented in Phase Three (e.g., in-situ remedies, phytoremediation, and long-term monitored natural attenuation) to control migration and restore groundwater, as needed. The long-term goal of groundwater remediation is to achieve **Maximum Contaminant Levels** ("MCLs") or other **risk-based concentrations** ("RBCs") based on drinking water exposure for those compounds lacking an MCL.

In addition to the remedies discussed above, appropriate **institutional controls** ("ICs") will be implemented to ensure long-term control of the site and protection of site remedies. ICs are non-engineered instruments such as administrative and/or legal controls that minimize potential for human exposure to contamination by limiting land or resource use. A more detailed discussion of the proposed ICs and the proposed remedies is set forth in Section IX.

Table I

Summary of Proposed Corrective Measures

SWMU/AOC	Proposed Corrective Measures
SWMU 1 – Landfarm 10	Designate as CAMU. Manage and contain residual wastes and hazardous constituents as part of CAMU operation and regulated unit closure. (9 VAC-20-60-265-18 and 40 CFR 265)
SWMU 2 – Landfarm 11	Excavate contaminated surface soils from eastern portion of unit and place in CAMU. Perform verification sampling and compare to risk-based levels.
SWMU 3 – Landfarm 12	Designate as CAMU. Manage and contain residual wastes and hazardous constituents as part of CAMU operation and regulated unit closure.
SWMU 4A – Industrial Waste Landfill (Inactive)	SWMU is permitted in accordance with VDEQ regulations. Operate and maintain unit in accordance with State permit, and close in accordance with VDEQ-approved closure plan at a

Table I

Summary of Proposed Corrective Measures

SWMU/AOC	Proposed Corrective Measures
	future date.
SWMU 4B – Industrial Waste Landfill (Active)	SWMU is permitted in accordance with VDEQ regulations. Operate and maintain unit in accordance with State permit, and close in accordance with VDEQ-approved closure plan at a future date.
SWMU 5 – API Separator Sludge Pits SWMU 7 – API Separator	Excavate hazardous waste to the unit boundary and place in CAMU. Remove concrete for recycling/reuse or disposal as appropriate. Collect verification samples; excavate or evaluate in-place remedial options (e.g., capping) for remaining contamination (e.g., contamination that is inaccessible due to surrounding units and equipment) if results exceed risk-based levels.
SWMU 6 – Inactive Industrial Waste Landfill	No further action is required based on the results of the risk assessment. However, BP will excavate unit and place materials in CAMU as appropriate to allow reuse of the SWMU area. Collect verification samples and compare to risk-based levels; evaluate options for reuse - consider liner prior to reuse.
SWMU 7 – Equalization Basin/Stormwater Retention Pond/Filter Backwash Pond/API Separator	Excavate hazardous waste to the unit boundary and place in CAMU. Remove concrete for recycling/reuse or disposal as appropriate. Perform verification sampling. If results exceed risk-based levels, continue excavation or line excavated area with clay or other low-permeability material to facilitate reuse.
SWMU 8 – Leaded Tank Bottom Disposal Area	Excavate contaminated soils from three hot spots and place in CAMU. Perform verfication sampling. If results exceed risk-based levels, continue excavation and place in CAMU. Implement an in-place remedy (e.g., soil vapor extraction, bioventing, or air sparging) in accordance with the Virginia AST program to address the AST release. Coordinate work with EPA.
SWMU 9 – Unleaded Tank Bottom Disposal Area	Excavate contaminated surface soils and place in CAMU. Perform verification sampling and compare to risk-based levels. If results exceed risk-based levels, continue excavation or line with clay/other low-permeability material to allow continued use.
SWMU 10 – Heat Exchanger Bundle Cleaning Pad	Remove pad and dispose of demolition debris in accordance with applicable regulations. Excavate surficial soils (i.e., 0-2 feet) surrounding and underlying pad as required by the results of the risk assessment. Perform verification sampling. Backfill the excavation with clean fill when results below risk-based levels.

Table I

Summary of Proposed Corrective Measures

SWMU/AOC	Proposed Corrective Measures
SWMU 11 – Container Storage Area	Remediation activities for this SWMU are complete as a result of interim measures (installation of an asphalt cap). Implement operations and maintenance requirements in the Interim Measures Construction Report.
SWMU 12 – Hazardous Waste Storage Building and Drum Storage Area	Remediation activities for this SWMU are complete as a result of interim measures (installation of an asphalt cap). Implement operations and maintenance requirements in the Interim Measures Construction Report.
AOC 1 – North Coker Ditch	Excavate surface soil contamination from the ditch as practicable given physical constraints of the location and place in the CAMU. Perform verification sampling. Line the ditch with a low permeability liner (e.g., clay, asphalt, or concrete) after cleaning when results below risk-based levels.
Groundwater - Phase One Source Control and Monitoring	Complete the delineation and removal of soils and free product. Remove free product to the extent practicable in a manner consistent with the VDEQ AST Program and EPA's Corrective Action program. Implement groundwater monitoring and delineation.
Groundwater- Phase Two Plume Delineation and Migration Control	Complete the delineation of the dissolved phase plume(s) and any other contaminant plumes. In the interim, achieve Environmental Indicator of no further contaminant migration in groundwater through the use of hydraulic containment or other plume controls, if necessary.
Groundwater- Phase Three Groundwater Restoration	Achieve MCLs or other risk-based levels (i.e., for constituents without MCLs) based on drinking water exposure throughout the plume(s) over the long term using remedial options such as **phytoremediation**, in situ remediation (e.g., **biosparging**), and/or monitored natural attenuation.
Contaminated Surface Water and Sediment	Remove contaminated sediments as required by the results of the risk assessment and place in CAMU. Revegetate excavated areas. Habitat restoration will include phragmites elimination with appropriate revegetation.
Sewer Line	Continue to inspect and evaluate oily waste sewer line for leaks or breaches and any associated soil or groundwater impacts; implement interim measures or corrective measures as required.

III. Facility Background

The BP Yorktown Refinery is located near the town of Yorktown, Virginia, on approximately 600 acres on the north side of Goodwin Neck Peninsula. The refinery is bordered by the York River to the north, a Virginia Power Company power station to the west, Back Creek to the south, and Bull Creek Pond and a forested area to the east. Surrounding land use is a mix of residential, industrial, waterfront, and undeveloped property. Prior to the construction of the refinery, the Facility and surrounding area was primarily forested and had not been used for industrial purposes.

The Yorktown Refinery has been in operation since its construction in 1956 by Amoco Oil Company. In 1998, BP, p.l.c. merged with Amoco Corporation, then the parent of Amoco Oil Company. The refinery can refine up to approximately 60,000 barrels (one barrel equals 42 U.S. gallons) of crude oil per day and is considered a small-capacity refinery. Crude oil is delivered to the marine docking terminal located at the refinery on the York River. Most of the refined product is also shipped from this marine terminal with a smaller portion shipped by rail and tanker truck. The refinery produces petroleum fuels (gasoline, diesel, kerosene, and home heating oil), liquid petroleum gas, butane, the gasoline oxygenate and octane enhancer methyl/ethyl-tertiary-butyl-ether ("MTBE/ETBE"), petroleum coke, sulfur, and fuel gas.

The main process area of the refinery is located near the center of the refinery property. Most of the SWMUs are located to the east of the refinery process area. ASTs, located south and east of the process area, are used to store crude oil, catalyst, and refined product. No underground storage tanks are known to have been used at the Facility. Figure I presents the layout of the Facility.

IV. Previous Investigations

Environmental investigations at the Facility have been completed in accordance with RCRA corrective action requirements specified in the Order and the Virginia AST Program. The RFI for releases from SWMUs and AOCs at the refinery has been implemented in a phased approach and administered by EPA in coordination with VDEQ. Releases from aboveground storage tanks have been investigated by BP as part of the Virginia AST program administered by the VDEQ.

V. Summary of the RCRA Facility Investigation

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Pursuant to the Order, RFI activities were conducted at the BP Yorktown Refinery. The objective of the RFI at the Yorktown Refinery was to determine the nature and extent of releases of hazardous wastes and/or hazardous constituents at or from the Facility. Based on the results of the RFI, contamination present in soils, sediments, surface water and groundwater at the Facility has been characterized and delineated sufficient to understand the nature and extent of SWMU releases, evaluate the risks to human health and the environment attributed to the releases, and to evaluate and select remedies appropriate for the mitigation of risks at the Facility.

Figure I shows the location of all SWMUs and the AOC at the Facility. Several of the SWMUs are also regulated by VDEQ. These SWMUs include SWMU 1 – Landfarm 10; SWMU 3 – Landfarm 12; and SWMU 4 – Industrial Waste Landfill Sites A and B. These SWMUs, along with nine additional SWMUs and one AOC identified below are subject to investigation under the RFI program.

- SWMU 2 – Landfarm 11
- SWMU 5 – Former API Separator Sludge Pits
- SWMU 6 – Industrial Waste Landfill (inactive)
- SWMU 7 – Equalization Pond, Stormwater Retention Pond, Filter Backwash Pond, and API Separator
- SWMU 8 – Leaded Tank Bottom Disposal Areas
- SWMU 9 – Unleaded Tank Bottom Disposal Area – Tank 110
- SWMU 10 – Former Heat Exchanger Bundle Cleaning Pad
- SWMU 11 – Container Storage Area
- SWMU 12 – Drum Storage Area and Hazardous Waste Storage Shed
- AOC 1 – North Coker Ditch

Three of these units (SWMU 5, SWMU 6, and SWMU 7) are located in the eastern portion of the refinery along with the units currently subject to other state monitoring and assessment requirements (SWMU 1, SWMU 3, and SWMU 4). These six SWMUs are located in an area where groundwater impacts were confirmed by previous investigations. The relative contribution of constituents to groundwater by the different units in the eastern portion of the refinery is difficult to establish

due to the similarity of wastes disposed at each of the units, the close proximity of the units, and the shallow groundwater gradients. Therefore, groundwater associated with SWMUs 1, 3, 4, 5, 6, and 7 was grouped as a single unit designated as the East End for purposes of completing the RFI.

The RFI for the Yorktown Refinery has been implemented in a phased approach. The Phase I RFI Work Plan was approved by EPA in January 1994, and fieldwork was implemented in February 1994. The Phase I RFI Report was submitted to EPA in 1995 and approved in December 1997. The Phase II RFI Work Plan was submitted in 1998, and was revised and approved by EPA in 1999. Fieldwork was conducted from late 1999 through mid-2000. The Phase II RFI Report was submitted in November 2000. The third phase of the RFI is the RFI Addendum. RFI Addendum work plans for soil and groundwater assessment were submitted to EPA in June 2001, and fieldwork was performed from June to August 2001. Additional data collection activities in support of the proposed CAMU were completed in the winter of 2000 and the summer of 2001. The RFI Addendum Report with the revised Phase II RFI Report was submitted to EPA in October 2001 for approval.

The RFI activities have encompassed sampling and analysis of environmental media including surface water, sediment, sludge, soil, and groundwater during various phases of investigation. A preliminary ecological assessment was also conducted in the Phase I RFI to identify sensitive ecological areas that could potentially be affected by the refinery, and a preliminary risk assessment was prepared concurrently with the Phase I RFI Report. The preliminary risk assessment was prepared prior to completion of the RFI in order to evaluate the Phase I data and establish action levels for SWMUs to determine the necessity and direction of further investigation in Phase II of the RFI. Most of the data gaps identified during the Phase II RFI were addressed in the RFI Addendum. Data collected during RFI activities were used to 1) determine the presence or absence of hazardous constituent impacts in soil, groundwater, surface water, and sediment, 2) determine the source and extent of identified impacts, 3) define areas where potential human health or ecological risk may be present, 4) estimate volumes of environmental media (contaminated soils, sediment, etc.) that may be subject to corrective action, and 5) evaluate the suitability of specific remedies for soils, sludges, sediments, surface water and groundwater.

A. Soil Investigation

A total of approximately 370 surface and subsurface soil samples and 13 sludge samples were collected by BP during the various phases of the RFI. Soil samples were collected at discrete depth intervals to the water table. These samples

were collected for delineation and/or characterization of the releases from SWMUs and AOC 1. Volatile organic compounds ("VOCs"), semi-volatile organic compounds ("SVOCs"), and inorganic constituents (e.g., metals) were detected at and delineated for each SWMU. Results were used in the risk assessment to evaluate the need for further corrective action.

B. Groundwater Investigation

The refinery is located on the York-James Peninsula, which is an embayed portion of the Atlantic Coastal Plain. The Atlantic Coastal Plain includes layered sedimentary deposits that slope gently and thicken to the east toward the Virginia coastline. The sedimentary deposits form a layered sequence of aquifers and confining units, including (from shallow to deep): 1) the Columbia aquifer; 2) the Cornwallis Cave confining unit; 3) the Cornwallis Cave aquifer; 4) the Yorktown confining unit; 5) the Yorktown-Eastover aquifer; 6) the Eastover-Calvert confining unit. In some locations, the Yorktown confining unit is not present and the combined Cornwallis Cave and Yorktown Eastover aquifers are referred to as the undivided YCS aquifer system.

The three phases of the RFI involved the installation of approximately nine permanent two-well clusters, two permanent three-well clusters, eleven permanent single wells, 18 temporary two-well clusters, and 21 temporary single well points. A total of approximately 240 groundwater samples were collected from existing and newly installed wells/well points to assess groundwater quality in both the Columbia and YCS aquifers beneath the Facility, and to verify that no offsite releases had occurred. Analytical data do not indicate impacts from waste management operations at SWMUs 9, 11, 12 and AOC 1. Based on review of soil analytical data and past waste management practices, groundwater impacts at the following SWMUs are potentially related to the waste management activities that occurred at the units: SWMU 1, SWMU 2, SWMU 3, SWMU 4, SWMUs 5 and 7, and SWMU 6. Soils and groundwater in the vicinity of SWMU 8 appear to have been impacted by a release from a storage tank, the sewer line, and other refinery operations.

C. Surface Water and Sediment Investigation

Surface water and sediment samples were collected to evaluate whether current and/or past refinery operations have impacted areas in the East End. Sixteen surface water and 33 sediment samples were collected from the salt marsh, Bull Creek Pond (a freshwater area), and a transitional area, which included a tidal pond between Bull Creek Pond and the salt marsh. RFI results indicate concentrations of SVOCs in Bull Creek Pond and the transition area tidal pond sediments.

Analysis of the petroleum hydrocarbons present in the sediments suggests that the refinery-related impacts consist of highly weathered mid-range hydrocarbons (fuel oil, diesel fuel, or residual product).

D. Drinking Water Wells in the Vicinity of the Facility

Three surveys have been conducted to determine the number, location, and actual use of domestic wells in the vicinity of the Facility. These surveys indicate a total of 72 private groundwater wells in the Waterview Area, 59 of which are located on the Goodwin Neck Peninsula in the vicinity of the refinery (See Figure I). The extent of groundwater contamination has been mapped and available data indicate that contamination does not extend beyond the Facility boundary.

E. Ecological Investigation

An Ecological Assessment was conducted to determine whether chemical constituents detected at the Facility pose a potential current or future risk to ecological receptors. Three major habitats were included in the ecological evaluation based on their proximity to the refinery and their potential to be impacted by refinery activities. These areas were the salt marsh, Bull Creek Pond (including the transitional area and tidal pond), and specific portions of the Facility.

The transition area tidal pond and Bull Creek Pond have low biological diversity and abundance, primarily as a result of physical stress. These aquatic habitats do not, at present, provide habitat suitable for a diverse fish community or for a significant community of invertebrate prey species that can serve as a prey source for birds and mammals. The salt marsh macrobenthic community reflects somewhat impaired diversity and abundance, as compared to reference marsh indices. Wildlife, including carnivorous birds (e.g., herons), use the marsh as a foraging area, and numerous birds nest in the woods surrounding the marsh. Overall, the marsh supports a typical community of species representing multiple feeding guilds.

Common wildlife species adapted to living in proximity to human activities (i.e., woodchucks) are present throughout the non-industrial portions of the refinery, including SWMU and non-SWMU areas. The SWMUs overall have minor value as wildlife habitat due to lack of high quality forage and shelter. The Yorktown Refinery Wildlife Management Program, established in 1991, enhances wildlife use of the refinery property (e.g., wood ducks in Bull Creek Pond and osprey throughout the refinery in particular).

VI. Interim Measures

Pursuant to the Consent Order, BP has conducted **Interim Measures** ("IMs") to control and mitigate releases to protect human health and the environment. SWMUs 11 (Former Container Storage Area) and 12 (Former Drum Storage Area) were investigated during the Phase I RFI conducted under the Order. Concentrations of certain hazardous constituents in surface soils at these areas were found to have the potential to leach to groundwater or come into contact with workers or other terrestrial receptors. Therefore, as IMs, these two SWMUs were capped with asphalt pavement to minimize infiltration of precipitation that could leach contaminants and migrate to groundwater, and to isolate soils from direct contact with potential receptors.

Other measures taken by BP included the recovery of **Light Non-Aqueous Phase Liquid** ("LNAPL") from wells at various locations at the Facility (e.g., LD-608, I-19, and I-28). LNAPL is recovered by bailing/skimming the liquid from the well or conducting enhanced fluid recovery where the liquid is mechanically vacuumed from the well. To date, a total of approximately 200 gallons of LNAPL have been recovered at the site. BP will continue LNAPL recovery in accordance with VDEQ AST program requirements, and as specified in this SB.

VII. Summary of Facility Risks

Potential human and ecological receptors and exposure pathways were evaluated as part of the Phase II RFI. A risk assessment was prepared in conjunction with the CMS. Potential human receptors and exposure pathways identified in the conceptual site model and evaluated in the risk assessment using data from the Phase I and Phase II RFI (including supplemental investigations in support of the RFI) include:

A. Potential Receptors in Contact with Soil

- Current and future industrial and construction workers contacting SWMU/AOC surface soils through incidental ingestion, dermal contact, and inhalation of volatiles and particulates in ambient air during the course of a normal workday.
- Current and future construction workers contacting SWMU/AOC subsurface soils through incidental ingestion,

dermal contact, and inhalation of volatiles and particulates in ambient air while performing excavation work.

- Off-site residents contacting surface soil particulates blowing from the Facility.
- Future on-site residents contacting surface soil through incidental ingestion, dermal contact and inhalation of volatiles and particulates.
- Current and future off-site recreational users and or trespassers contacting surface soil through incidental ingestions, dermal contact and inhalation of volatiles and particulates in the Bull Creek Pond area.
- Incidental exposure of terrestrial species that visit the Facility and forage on plants, bathe in and drink surface water, or consume prey associated with SWMUs.

B. Potential Receptors in Contact with Groundwater

- Current and future industrial and construction workers incidentally ingesting, inhaling and having dermal contact with groundwater while performing daily work or excavation work (if any) below the water table.
- Future on-site residents potentially drilling wells to use Facility groundwater.
- Current and future off-site residents being exposed to contaminated groundwater if the contamination were to migrate off the Facility to a point of exposure.

C. Potential Receptors for Surface Water and Sediment

- Ecological receptors that directly contact contaminated surface water and sediments, including benthic invertebrates and fish, and the avian and mammalian consumers of these species.
- Current and future off-site recreational users or trespassers (including off-site resident exposure) contacting surface water and sediment through incidental ingestion, dermal contact and inhalation of volatiles and particulates in the Bull Creek Pond area.

The corrective measures presented in Sections II and IX have been proposed to mitigate these exposure scenarios. In the risk assessment, unacceptable risks were identified for current and future industrial and construction workers contacting surface soils, subsurface soils, and groundwater at specific portions of the site (SWMUs 2, 8, 9, and AOC 1). This risk summary does not take into account groundwater use for drinking water by on-site workers, because this is not a current use

and will not be a future use under refinery operations. Ecological risk results for terrestrial receptors in potential contact with SWMU material indicated that unacceptable risk is not present for Facility related chemicals. The ecological sediment risk evaluation indicated that there is a potential risk to wildlife and aquatic biota from sediment exposure in specific areas of Bull Creek Pond. The only other scenario that would present an unacceptable risk was the hypothetical, future land-use scenario in which groundwater from the interior of the Facility was used as a potable water supply prior to final remediation to MCLs or other risk-based levels. This pathway is unlikely due to the anticipated future land use as a refinery and the use of ICs to prevent use or exposure to the groundwater (within Facility boundaries) in the future.

VIII. Scope of Corrective Action

EPA's proposed corrective measures at BP's Yorktown Refinery Facility are presented in Sections II and IX of this SB. Based on the findings set forth in the RFI, EPA has determined that soil, groundwater, and sediment contamination exists at the Facility. SWMUs and AOCs and other areas of the Facility that are addressed by the scope of corrective action discussed in this SB include:

- Landfarms 10, 11 and 12 (SWMUs 1, 2 and 3);
- Industrial Waste Landfill (SWMU 4A and 4B);
- API Separator Sludge Pits (SWMU 5);
- Inactive Industrial Waste Landfill (SWMU 6);
- API Separator/Equalization Basin/Stormwater Retention Pond/Filter Backwash Pond (SWMU 7);
- Leaded Tank Bottom Disposal Area (SWMU 8);
- Unleaded Tank Bottom Disposal Area (SWMU 9);
- Heat Exchanger Bundle Cleaning Pad (SWMU 10);
- Container Storage Area (SWMU 11);
- Hazardous Waste Storage Building and Drum Storage Area (SWMU 12);
- North Coker Ditch (AOC 1);
- Free product and Contaminated Groundwater; and
- Contaminated Sediments

The sewer line will also be addressed as part of the corrective action outlined in this document (see Table 1).

IX. Summary of Proposed Corrective Measures

Pursuant to the Consent Order and consistent with EPA policy discussion provided in the May 1, 1996 Advanced Notice of Proposed Rulemaking (pps. 19446-19449) ("ANPR"), BP prepared a streamlined CMS detailing the preferred corrective measures and risk-based cleanup goals for remediation of contamination at the Facility. EPA acknowledges that an evaluation of multiple alternatives is not always necessary, particularly if a desirable remedy can be developed directly from site characterization, application of available engineering technologies, and resolution of regulated unit issues. The BP remedy proposed by EPA is one such case. Since the proposed remedy was identified on the basis of its ability to protect human health and the environment, and because of the likelihood that it can be implemented efficiently, EPA did not find it necessary to develop alternatives. EPA considered the alternatives in the streamlined CMS as the basis for the proposed remedy for the Facility.

The proposed remedy for the Facility emphasizes source removal and source control through excavation, consolidation and capping with groundwater monitoring. For waste residuals and contaminated soil in the unsaturated zone at SWMUs and AOC 1, materials exceeding risk-based levels will be excavated (source removal) to the extent practicable and placed in the CAMU, where they will be consolidated and compacted, capped under an engineered barrier, and monitored for the long-term (source control). The CAMU design includes a hybrid cap with hydraulic performance equivalent to a RCRA Subtitle C hazardous waste landfill cap. The CAMU will be monitored using a detection monitoring well network that surrounds the unit. If significant groundwater impacts are detected via this network, additional corrective measures may be implemented. Residual contamination not removed from SWMUs/AOC for placement in the CAMU will either be at very low concentrations that do not pose a significant risk to human health or the environment or will be capped or managed in-situ to contain the material.

The proposed remedy for NAPL (free product) and contaminated groundwater in the subsurface emphasizes source removal and source control. Free product will be recovered to the extent practicable for recycling in the refinery or disposed of in accordance with state and federal regulations. In the short-term, BP will implement corrective measures (i.e., hydraulic control, collection trench, chemical oxidation, etc.) as needed to control the migration of contaminated groundwater. Over the long-term, corrective measures will be implemented, as described below, to achieve MCLs or other risk-based

levels (for constituents that lack an MCL) based on drinking water exposure throughout the groundwater plume(s).

The strategy for groundwater corrective action involves a phased implementation. Phase One will involve source removal via the excavation of contaminated soils and removal of free product. Along with implementing the proposed remedies for SWMU soils, LNAPL removal will continue under the VDEQ AST program in coordination with EPA, and the stability of delineated dissolved-phase plumes will be evaluated through a comprehensive monitoring program. Phase Two will involve further delineation of LNAPL areas and dissolved-phase plumes or other contaminant plumes that presently lack complete definition, and migration control measures, as needed. These control measures may include a groundwater pump and treat system, a grout curtain, a collection trench, and/or chemical oxidation. Compliance monitoring for the CAMU, SWMU 4, and the AST leak detection program will continue pursuant to VDEQ and EPA's requirements. Additionally, compliance with EPA's **GPRA** goals will be demonstrated and will continue to be verified. Phase Three will involve reassessment of plume characteristics after source removal and capping measures are completed, and the application of additional corrective measures to meet the final cleanup goals. Corrective measures may include hydraulic containment, phytoremediation, interceptor trench, in situ remediation (e.g., biosparging, chemical oxidation), and monitored natural attenuation.

For surface water and sediments, measures will be taken to prevent contamination from reaching surface water. Contaminated sediments will be excavated from Bull Pond to be protective and will subsequently be managed in the CAMU. Habitat restoration will be completed by eliminating phragmites in this area with appropriate revegetation. The full scope of habitat restoration for the Bull Creek Pond area will be defined in the Corrective Measures Implementation Order or the CMI workplan.

In addition to the remedies discussed above, ICs will be implemented to minimize the potential for human exposure to contamination left in place after completion of the engineering measures. Specifically, ICs will be necessary to prohibit the following activities:

- All residential use of the property in perpetuity;

- Use of groundwater as a potable source until Media Cleanup Requirements for unrestricted use of groundwater are met;

- Disturbance of the caps on SWMUs and the CAMU; and

- Any use of the site that would interfere with the implementation, integrity or protectiveness of the engineering portion of the remedy.

In addition, additional restrictions may be necessary if EPA determines that it is technically impracticable to meet Media Cleanup Requirements.

IC mechanisms to achieve these restrictions may include, but not be limited to, easements and real covenants, title notices and land use restrictions through unilateral orders from or consent orders with EPA. Factors to be considered in choosing the appropriate IC mechanisms include whether a suitable grantee can be found for an easement or covenant, and which type of enforceable mechanism EPA determines is appropriate for purposes of remedy implementation. EPA believes that multiple ICs are appropriate in order to provide overlapping assurances of protection from contamination left in place.

EPA will review the progress of the remedy activities to confirm that media cleanup requirements (Tables 2a and 2b) are being met. If EPA determines that BP is not achieving the cleanup requirements, EPA may require BP to perform additional studies and/or to modify the existing corrective measures. If new contamination is discovered (e.g., identification of a new SWMU, a new contaminant release, or additional free product/dissolved-phase groundwater contamination), or if the proposed remedial options cannot adequately mitigate risk to human health or the environment (e.g., source removal is determined to be impracticable), contingent measures will be developed and implemented. In the event that EPA requires BP to perform additional studies and/or to modify the existing corrective measures, EPA will provide an opportunity for public comment prior to the initiation of changes to the existing corrective measures, as necessary or appropriate.

X. Evaluation of EPA's Proposed Remedy Selection

The site-wide soil and groundwater remedy proposed in this SB best meets the four threshold criteria (overall protection, attainment of media cleanup objectives, source control, and compliance with waste management standards) for corrective measures and the five remedy selection decision factors or balancing criteria (long-term reliability and effectiveness;

reduction in toxicity, mobility or volume; short term effectiveness; implementability; and cost).[3] The CAMU, which serves as a cornerstone of the remedy, meets the seven CAMU designation criteria. EPA has reviewed the elements of the preferred corrective measures using these standards, decision factors, and criteria. The following discussion outlines EPA's determination for the remedy proposed at the Facility.

A. Overall Protection

This overarching standard requires remedies to include those measures that are needed to be protective, but are not directly related to other factors. The proposed corrective measures meet this standard. The risk assessment was used to define the extent of contamination posing a risk to human health and the environment, and that extent was used to derive the corrective measures. Waste residuals and contaminated soils/sediments in SWMUs and AOCs exceeding risk-based levels will be removed and placed in the CAMU as appropriate where direct contact and contaminant migration to other exposure points will be prevented by the engineered cap and compaction associated with the CAMU. The CAMU will be constructed and monitored in such a manner that will minimize further contaminant releases to surface water and groundwater. Free product will be removed to the extent practicable to prevent continued migration and continuing source loading to groundwater. The migration of contaminated groundwater will be controlled over the short-term, prevented from migrating to exposure points, and will be remediated to drinking water standards throughout the plume(s) over the long-term.

B. Attainment of Media Cleanup Standards

The preferred corrective measures will achieve the media cleanup requirements for the Facility (see Tables 2a and 2b). Waste residuals and contaminated soils that exceed media cleanup requirements determined for the Facility will be removed and managed in the CAMU. Verification sampling will be performed to confirm that media cleanup requirements have been achieved. Free product will be removed to the extent practicable, and contaminated groundwater will be cleaned up to MCLs or other risk-based levels based on drinking water exposure over the long-term.

[3]The criteria used to analyze the proposed remedy are set forth in OSWER guidance document, "Guidance on RCRA Corrective Action Decision Documents" Directive Number 9902.6, February 1991, and the May 1, 1996 ANPR.

C. Controlling Source of Releases

A critical objective of remedies must be the cessation of further environmental degradation by controlling or eliminating further releases from SWMUs or AOCs that may pose a threat to human health or the environment. Unless source control measures are taken, efforts to clean up releases may be ineffective or will involve a perpetual cleanup situation. Therefore, source control is an important factor in the long-term reliability and effectiveness of a remedy. The proposed corrective measures for the Facility involve source control activities and therefore meet this standard. Waste residuals and contaminated soils/sediments will be excavated and consolidated in the CAMU. A cap will be placed and groundwater monitoring will be completed at the CAMU to ensure that this contaminated material is adequately contained. Free product will be removed to the extent practical, and the migration of contaminated groundwater will be contained and monitored in the short term.

D. Complying with Standards for Management of Waste

The proposed corrective measures for the Facility will comply with regulatory waste management standards set forth in 9 VAC 20-60-264 and 40 CFR 264.101 (Corrective action for solid waste management units). Compliance with standards for management of wastes is met by compliance with all applicable federal, state and local regulations during corrective measures implementation to ensure that the waste is managed in a protective manner. In addition, EPA's proposed remedy is consistent with the policy and guidance provided in the May 1, 1996 ANPR for the corrective action program. This notice contains the applicable standards and approaches that EPA expects each corrective action project to follow. EPA's review of the corrective measure work plans, and auditing of their implementation, will ensure continued compliance with these standards.

E. Long-Term Reliability and Effectiveness

The long-term reliability and effectiveness standard is intended to address protection of human health and the environment over the long term. Source removal and control approaches that remove and/or consolidate remediation wastes in engineered structures or systems that protect against future releases are more reliable, and therefore preferred over those that offer more temporary, or less reliable controls. The proposed corrective measures meet this criterion because they employ source removal and capping, with groundwater monitoring, to control and contain the contamination. Waste residuals

and contaminated soils/sediments will be excavated and consolidated in the CAMU, which will be fitted with a composite cap for long-term control of the material, preventing contact with waste materials, reducing infiltration and migration to groundwater or surface water. Free product will be removed to the extent practicable, and groundwater will be cleaned up to MCLs, or other risk-based levels based on drinking water exposure, over the long-term.

F. Reduction of Toxicity, Mobility or Volume of Waste

Reduction of toxicity, mobility, or volume is directly related to the concept of long-term remedies. For this criterion, remedies that employ treatment and/or source removal and containment that are capable of permanently reducing the overall risk posed by the remediation wastes are preferred. The source removal and source controls integral to the proposed corrective measures allow the remedy to meet this criterion because they reduce the mobility and areal extent of contaminated media. Waste residuals and contaminated soils/sediments are consolidated in the CAMU under an engineered cap to reduce further contaminant mobility. Free product is removed to the extent practicable for recycling or disposal, reducing the toxicity, mobility, and volume of product in the environment. Contaminated groundwater is contained over the short-term to reduce its mobility, and cleaned up over the long term (reduction in toxicity) to MCLs or other risk-based levels based on drinking water exposure.

G. Short-Term Effectiveness

The short-term effectiveness standard is intended to address hazards posed during the implementation of corrective measures. Short-term effectiveness is designed to take into consideration the impact to site workers and nearby residents during construction. Examples of hazards addressed by this standard include the potential for volatilization of organic contaminants, the spread of contamination through dust generation, and hazardous materials spills resulting from waste loading and transport operations. Facility operating plans such as the health and safety plan, contingency plan, emergency preparedness and prevention plan, and spill prevention, control and countermeasures plan will ensure that all short-term hazards are addressed such that any corrective measure is protective of human health and the environment during short-term remedy implementation.

H. Implementability

The Implementability decision factor addresses the regulatory constraints in employing the cleanup approach. Source removal and control are well proven remedial approaches; therefore, no regulatory hurdles are anticipated that would impede implementation of the preferred corrective measures. See the additional discussion provided below under CAMU Criteria for information on the implementability of the proposed CAMU.

I. Cost

EPA's overriding mandate under RCRA is protection of human health and the environment. However, EPA believes that relative cost is a relevant and appropriate consideration when selecting among alternatives that achieve the cleanup requirements. EPA's experience in the Superfund program has shown that in many cases several different approaches will offer equivalent protection of human health and the environment, but may vary widely in cost. EPA has stated its belief that it is appropriate in these situations to allow cost to be one of the factors influencing the decision for selecting among the alternatives. The proposed corrective measures provide a cost-effective approach for the conditions that exist at the Facility.

The total estimated cost for the proposed remedial activities for soils, groundwater and sediment (i.e., excavation, confirmation sampling, NAPL removal, groundwater remediation) is approximately $ 10.20 million. The total estimated cost for the proposed CAMU construction (i.e., placement and compaction of SWMU soils, capping, groundwater monitoring) is approximately $4.5 million.

J. CAMU Criteria

In order to use the Corrective Action Management Unit approach, EPA required BP to demonstrate compliance with the CAMU requirements set forth in Title 40 of the Code of Federal Regulations ("40 CFR"), Section 264.552(c). BP submitted specific CAMU information such as areal configuration, identification of wastes that would be managed, cap design, specification of treatment requirements and goals for hazardous constituents, and groundwater monitoring approach in the Draft, revised and Final CAMU Application submittals (June 2000, October 2001, November 2002). For more detailed information, please see the Final CAMU Application dated November 21, 2002. A short summary of the CAMU requirements and BP's demonstration of compliance is provided below:

- *The CAMU shall facilitate the implementation of reliable, effective, protective, and cost-effective remedies.* The CAMU design (see the May 15, 2002 Design Report) will be reliable by incorporating dependable, proven methods for containment of impacted media using consolidation and capping with groundwater monitoring. The CAMU design will be effective, employing appropriate performance objectives to ensure that it will prevent direct contact with SWMU material and that constituents found in the residual material will not contribute significantly to existing groundwater impacts. The CAMU design will be protective since consolidation and capping will isolate both the petroleum hydrocarbons and metal constituents in the impacted media from the environment. Furthermore, using physical controls such as fences, and the institutional controls discussed in Section IX above will limit future access to the CAMU. Finally, implementation of a CAMU will allow cost-effective onsite management of remediation wastes.
- *Waste management activities associated with the CAMU shall not create unacceptable risks to humans or the environment resulting from exposure to hazardous wastes or hazardous constituents.* Risk reduction will be achieved through the following: 1) utilizing appropriate personnel protective equipment (dermal and respiratory protection) and controlling potentially hazardous areas of the construction site (temporary fencing, placarding, dust control, etc.); 2) using the appropriate technology to achieve remediation waste stabilization or treatment; 3) managing stormwater run-off through the refinery WWTP; 4) minimizing leaching through construction of a low-permeability cap; and 5) controlling long-term access to the CAMU through physical barriers (fences, etc.) and institutional controls.
- *The CAMU shall include uncontaminated areas of the facility, only if including such areas for the purpose of managing remediation waste is more protective than management of such wastes at contaminated areas of the facility.* The CAMU has been sited at SWMUs 1 and 3 (Landfarms 10 and 12), where waste management has historically occurred (by the operation of the former landfarms) and where there are other adjacent waste management areas. No part of the CAMU will be constructed in uncontaminated areas of the Facility.
- *Areas within the CAMU, where wastes remain in place after closure of the CAMU, shall be managed and contained as to minimize future releases, to the extent practicable.* Placement and capping of remediation wastes at SWMUs 1 and 3 (Landfarms 10 and 12) and ensuring that the waste meets specific performance standards for moisture content, as set forth in the May 15, 2002 Design Report, will minimize future leaching to groundwater. In addition, a groundwater monitoring system will be in place to detect a release in the event that one was to occur.

- *The CAMU shall expedite the timing of remedial activity implementation, when appropriate and practicable.* The availability of the CAMU will simplify and expedite the CMS and remedy implementation process in that one unit is available for managing all remediation wastes generated at SWMUs and AOCs.
- *The CAMU shall enable the use, when appropriate, of treatment technologies (including innovative technologies) to enhance long-term effectiveness of remedial actions by reducing toxicity, mobility, or volume of wastes that will remain in place after closure of the CAMU.* Placement and capping of waste residuals and contaminated soils/sediments in the CAMU will reduce the mobility of contaminants present in remediation wastes. Slight increases in remediation waste volume may occur if wastes are stabilized with admixtures to improve material handling and decrease leachability.
- *The CAMU shall, to the extent practicable, minimize the land area of the facility upon which wastes will remain in place after closure of the CAMU.* The designation of a CAMU at the Facility substantially minimizes the land area where remediation waste will remain in place. On a facility that controls approximately 1,500 acres of land, remediation wastes from multiple SWMUs will be consolidated into less than 20 acres of land. This area of land is subject to closure and post-closure requirements (9 VAC 20-60-265-18 and 40 CFR Section 265.115), regardless of whether a CAMU is designated there.

XI. Public Participation

On November 5, 2003, EPA placed an announcement in the Daily Press to notify the public of EPA's proposed corrective measures and administrative approvals, and of the location of the Administrative Record. Copies of this SB will be mailed to anyone who requests a copy. The Administrative Record, including this SB, is available for review during business hours at the following location:

U.S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, Pennsylvania 19103
Telephone Number: (215) 814-3427
Attn: Ms. Donna McCartney (3WC23)

STATEMENT OF BASIS FOR PROPOSED CORRECTIVE MEASURES
UNDER RCRA SECTION 3008(h)
AMOCO OIL COMPANY
YORKTOWN, YORK COUNTY, VIRGINIA

EPA is requesting comments from the public on the corrective measures proposed in this SB. The public comment period will last thirty (30) calendar days beginning November 5, 2003 and ending December 5, 2003. Comments on, or questions regarding, EPA's preliminary identification of a proposed corrective measures alternative may be submitted to:

Ms. Donna McCartney (3WC23)
U.S. EPA, Region III
1650 Arch Street
Philadelphia, PA 19103
(215) 814-3427
FAX (215) 814-3113
Email: mccartney.donna@epa.gov

Following the thirty (30) day public comment period, EPA will hold a public meeting on EPA's proposed corrective measures alternative if sufficient public interest indicates that a meeting would be valuable for distributing information and communicating ideas. After evaluation of the public's comments, EPA will prepare a Final Decision Document and Response to Comments that identifies final selected remedy. The Response to Comments will address all significant written comments and any significant oral comments generated at the public meeting. This Final Decision Document and Response to Comments will be made available to the public. If, on the basis of such comments or other relevant information, significant changes are proposed to be made to the corrective measures identified by EPA in this SB, EPA may seek additional public comments.

The final remedy will be implemented using available legal authorities possibly including, but not necessarily limited to, RCRA Section 3008(h), 42 U.S.C. 6928(h).

_____ _____

Date

Donald S. Welsh, Regional Administrator
EPA Region III

STATEMENT OF BASIS FOR PROPOSED CORRECTIVE MEASURES
UNDER RCRA SECTION 3008(h)
AMOCO OIL COMPANY
YORKTOWN, YORK COUNTY, VIRGINIA

GLOSSARY

Air Sparging - a remedial technology that reduces concentrations of volatile constituents in petroleum products that are adsorbed to soils and dissolved in groundwater. This technology involves the injection of air into the subsurface saturated zone, enabling a phase transfer of hydrocarbons from a dissolved state to a vapor phase. The air is then vented through the unsaturated zone.

Area of Concern ("AOC") – An area potentially impacted by a release of hazardous waste or hazardous constituents but not a known solid waste management unit.

Bioventing – a remediation technology where oxygen is delivered to contaminated soils in the unsaturated zone by forced air movement (either extraction or injection of air) to increase oxygen concentrations in the subsurface and stimulate biodegradation of contaminants.

Biosparging - an in-situ remediation technology that uses indigenous microorganisms to biodegrade organic constituents in the saturated zone. In biosparging, air (or oxygen) and nutrients (if needed) are injected into the saturated zone to increase the biological activity of the indigenous microorganisms.

Corrective Measures Study ("CMS") – An assessment required under RCRA to evaluate the applicability and effectiveness of remediation technologies for cleaning up or otherwise mitigating contamination determined to pose an unacceptable risk to human health and the environment.

Corrective Action Management Unit ("CAMU") - A CAMU is an area within a facility that is designated for the management of remediation wastes generated during implementation of specific corrective action activities.

Government Performance and Results Act ("GPRA") - EPA has established two near-term goals, termed "Environmental Indicators,"for the RCRA Corrective Action program under the GPRA. These goals are that by 2005, the states and EPA will verify and document that 95 percent percent of the 1,714 RCRA cleanup facilities will have "current human exposures under control," and 70 percent of these facilities will have "migration of contaminated groundwater under control.

Institutional Control ("IC") – action taken to help prevent contact with hazardous constituents, such as security fencing, restrictive convenants, zoning requirements, access restrictions, etc.

Interceptor Trench – a trench excavated in the ground perpendicular to groundwater flow used to intercept and collect

contaminated groundwater for treatment.

Interim Measure ("IM") - action taken prior to a final remedy decision to help control the spread of a release of hazardous waste or hazardous constituents.

Light Non-Aqueous Phase Liquid ("LNAPL") - a floating layer of hydrocarbon.

Maximum Contaminant Level ("MCL") - the maximum permissible level of a contaminant in water which is delivered to any user of a public water system. (See Safe Drinking Water Act, 42 U.S.C. Section 300g-l.)

Phytoremediation - the use of trees and plants to help clean up contamination.

RCRA - Resource Conservation and Recovery Act, which was enacted by the United States Congress in 1976 and amended in 1984, directed EPA to develop and implement a program to protect human health and the environment from improper hazardous waste management practices. The statute is designed to control the management of hazardous waste from its generation to its disposal.

RCRA Facility Investigation ("RFI") – an investigation required under RCRA to sample and analyze potentially impacted media (e.g., air, water, soil, sediment) to determine the nature and extent of any potential releases of hazardous wastes or hazardous constituents at or from a Facility into the environment.

Risk-Based Concentration ("RBC") – a concentration in air, water, or soil established by EPA Region III as being protective of human health and the environment. These levels are not site-specific, but instead are conservative default values to be used for risk screening purposes.

Soil Vapor Extraction ("SVE") – a process by which air is drawn through the subsurface to remove organic contaminants for collection and treatment. Using a vacuum, the air is drawn through the subsurface, enhancing natural biodegradation of contaminants and volatilizing remaining contaminants into the air stream that can then be collected and treated using a variety of air pollution control technologies.

Solid Waste Management Unit ("SWMU") - includes any unit used for the collection, source separation, storage, transportation, transfer, processing, treatment or disposal of solid waste, including hazardous wastes, whether such unit is associated with facilities generating such wastes or otherwise.

GLOSSARY

VPDES – Virginia Pollution Discharge Elimination System. The regulations governing wastewater and stormwater management and discharge.

York County Public Library - Library where the Statement of Basis and Index for the Administrative Record is located; 8500 George Washington Highway, Yorktown, Virginia, 23692. Telephone Number: (757) 890-3377.

TABLE 2a - Media Cleanup Requirements

Soil and Sediment Risk-Based Remediation Goals and Soil Screening Levels			
SWMU	**Contaminants of Concern**	**Risk-Based Remediation Goals[a] (mg/kg)**	**Soil Screening Levels[b] (mg/kg)**
SWMU 2 (Eastern Half)	Arsenic	3.87	
	Benzo(a)anthracene	8.62	
	Benzo(a)pyrene	0.86	
	Benzo(b)fluorantheneD	8.62	
	ibenzo(a,h)anthra-	0.86	
	cene		
	Indeno(1,2,3-	8.62	
	c,d)pyrene		
SWMU 5/7	Acetone		0.112
	Benzene		0.008
	Benzo(a)anthracene		0.858
	Benzo(a)pyrene		4.8
	Benzo(b)fluorantheneD		2.6
	ibenzo(a,h)anthra-		0.82
	cene		
	Ethylbenzene		6.12
	Indeno(1,2,3-		7.49
	c,d)pyrene		
	1-Methylnaphthalene		0.020
	2-Methylnaphthalene		24
	Methyl Tert-Butyl		0.012
	Ether (MTBE)		
	Naphthalene		0.306
	Toluene		4.48
	Xylene (total)		92.7
	* COCs are not fully identified; pre-construction		

Soil and Sediment Risk-Based Remediation Goals and Soil Screening Levels			
	sampling for Phase II RFI list will be conducted		
SWMU 7	Acetone Benzene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluorantheneDibenzo(a,h)anthra-cene Ethylbenzene Indeno(1,2,3-c,d)pyrene 1-Methylnaphthalene 2-Methylnaphthalene Methyl Tert-Butyl Ether (MTBE) Naphthalene Toluene Xylene (total) * COCs are not yet identified; pre-construction sampling for Phase II RFI list will be conducted		0.112 0.008 0.858 4.8 2.6 0.82 6.12 7.49 0.020 24 0.012 0.306 4.48 92.7
	Acetone Arsenic Benzene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Cadmium Copper Dibenzo(a,h)anthra-cene		0.112 1.7 0.008 0.858 4.8 2.6 0.039 54 0.82

Soil and Sediment Risk-Based Remediation Goals and Soil Screening Levels			
SWMU 6	Iron		6,471
	Lead		0.083
	Mercury		0.024
	1-Methylnaphthalene		0.020
	2-Methylnaphthalene		24
	Molybdenum		42
	Naphthalene		0.306
	Nickel		8.8
	N-nitrosodiphenyl-amine		0.426
	Selenium		0.302
	Thallium		0.225
	Tin		3.74
	Vanadium		305
SWMU 8	Acetone		0.112
	Benzene		0.0079
	Ethylbenzene		6.12
	Iron		6,471
	Lead		0.083
	2-Methylnaphthalene		24.0
	Methyl Tert-Butyl Ether (MTBE)		0.012
	Naphthalene		0.306
	Thallium		0.226
	Toluene		4.48
	Xylene (total)		92.7
SWMU 9	Arsenic	3.87	
	Benzo(a)anthracene	8.62	
	Benzo(a)pyrene	0.86	
	Benzo(b)fluorantheneD	8.62	
	ibenzo(a,h)anthra-cene	0.86	
	Indeno(1,2,3-c,d)pyrene	8.62	

Soil and Sediment Risk-Based Remediation Goals and Soil Screening Levels			
SWMU 10	Arsenic		1.7
	Antimony		0.318
	Cadmium		0.039
	Chromium		99.7
	Copper		53.6
	Iron		6,471
	Lead		0.083
	Mercury		0.024
	Nickel		
	Selenium		8.8
	Thallium		0.302
	Tin		0.226
			3.74
AOC 1	Arsenic	3.87	
	Benzo(a)anthracene	8.62	
	Benzo(a)pyrene	0.86	
	Benzo(b)fluorantheneD	8.62	
	ibenzo(a,h)anthra-	0.86	
	cene		
	Indeno(1,2,3-	8.62	
	c,d)pyrene		
Sediments (Bull Creek Pond)	Total PAHs[c]	290 ug/g organic carbon	
	Acetone	Site-specific equation[d]	

a. The risk-based remediation goals (RBRGs) for site soils were developed using a conservative and standard exposure scenario for industrial workers, assuming extensive outdoor activity. The RBRGs were calculated as a cumulative value that included the incidental soil ingestion, dermal contact (when possible), and soil inhalation pathways. The target cancer risk level was set at 1E-6 for each chemical. Toxicity values were obtained from the USEPA Region III Risk-Based Concentration Table of 10/9/2002, using the hierarchy established in that table (IRIS toxicity values have primacy, followed by HEAST and other alternatives). The total PAHs RBRG for site sediment was obtained from Consensus Sediment Quality Guidelines for Polycyclic Aromatic Hydrocarbon Mixtures (R.C. Swartz, 1999, *Environ. Tox. Chem.*,18(4):780-787). The acetone RBRG for site sediment was obtained from the equilibrium partitioning equation presented in *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision* (Jones, D.S., G.W. Suter II, and R.N.

Hull, Oak Ridge National Laboratory, 1997), using site-specific total organic carbon values.

b. Soil Screening Levels (SSLs) were derived via the methodology described in the *Soil Screening Guidance*, USEPA 1996 (EPA/540/R-96/018). BP included site-specific variables (site and soil parameters) in the calculations, as described in Appendix O (Soil Screening Levels), Phase II RFI Work Plan (revised September 1999). The only exception to this was the SSL for methyl tert-butyl ether, which was obtained from the EPA Region III Risk-Based Concentration Table, dated 10/9/2002.

c. Total PAHs equal the summation of acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene.

d. The site-specific equation for the acetone RBRG is as follows:

Acetone sediment RBRG = WQC (1.5 mg/L) x Koc (1.98 L/kg) x foc (site-specific, unitless)

WQC = Water quality criterion, or value, if WQC is not available
Koc = Organic carbon partitioning coefficient
foc = Site-specific fraction of organic carbon in sediment

TABLE 2b

Groundwater Clean-up Levels (ug/L)	
Contaminants of Concern	**Clean-up Levels**
Acetone	1920 RBRG[a]
Benzene	5 MCL[b]
Ethylbenzene	700 MCL
MTBE	28.6 RBRG
Pentachlorophenol	1 MCL
Toluene	1,000 MCL
Xylene, total	10,000 MCL
Antimony	6 MCL
Arsenic	10 MCL
Beryllium	4 MCL
Chromium	100 MCL
Lead	15 AL[c]
Nickel	384 RBRG
Molybdenum	96 RBRG
Thallium	2 MCL

a. Risk-Based Remediation Goals (RBRGs) for groundwater were developed assuming onsite lifetime residential exposure (combined child and adult), and using exposure factors from the *Exposure Factors Handbook* (USEPA, 1997). The exposure pathways included ingestion, inhalation of indoor air vapors intruding from groundwater, and dermal and inhalation exposures

during daily showering. A cumulative RBRG was then obtained from the individual pathway RBRGs.

b. Maximum Contaminant Levels (MCLs) are the maximum permissible level of a contaminant in water which is delivered to any user of a public water supply system. MCLs are established by the USEPA Office of Water.

c. Action Levels (ALs) are established by the USEPA Office of Water for contaminants which are regulated under Treatment Technique. Under this regulation, public water systems which have lead piping or solder must take tap water samples. If 10% of the samples exceed the AL, treatment steps must be taken.