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FINAL RECORD OF DECISION FOR SITES 4 BURNING PAD RESIDUE LANDFILL, 21  
BATTERY AND DRUM DISPOSAL AREA AND 22 BURN PAD NWS YORKTOWN VA  
08/01/2011  
NAVFAC MID ATLANTIC

Final

# Record of Decision

Site 4: Burning Pad Residue Landfill

Site 21: Battery and Drum Disposal Area

Site 22: Burn Pad

Naval Weapons Station Yorktown

Yorktown, Virginia

EPA ID: VA8170024170



August 2011



Final

## Record of Decision

Site 4 - Burning Pad Residue Landfill,  
Site 21 - Battery and Drum Disposal Area, &  
Site 22 - Burn Pad

Naval Weapons Station Yorktown, Yorktown, Virginia  
August 2011

## 1 Declaration

This Record of Decision (ROD) presents the selected remedy of No Further Action for Environmental Restoration Program (ERP) Site 4, Burning Pad Residue Landfill, Site 21, Battery and Drum Disposal Area, and Site 22, Burn Pad, at Naval Weapons Station (WPNSTA) Yorktown, Yorktown, Virginia. These Sites were investigated and are addressed together based on their proximity. The No Further Action determination has been made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan. This decision is based on information contained in the Administrative Record (AR) file for the Sites. The entire AR file for the Sites served as the basis for making the No Further Action determination. Information not specifically summarized in this ROD or its references, but contained in the AR file, has been considered and is relevant to Sites 4, 21, and 22.

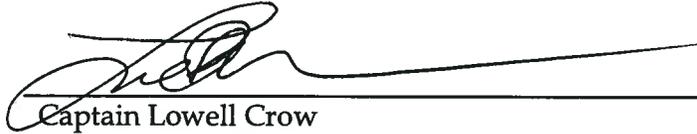
The United States Department of the Navy (Navy) is the lead agency and provides funding for ERP activities at Sites 4, 21, and 22. The Navy and United States Environmental Protection Agency (USEPA) Region 3, the lead regulatory agency, issue this ROD jointly. The Commonwealth of Virginia Department of Environmental Quality (VDEQ), the support regulatory agency, actively participated throughout the investigation process, has reviewed this ROD and the materials on which it is based, and concurs with this No Further Action decision.

Comprehensive environmental restoration activities at WPNSTA Yorktown began in 1984 under the Navy Assessment and Control of Installation Pollutants program prior to state and federal regulatory oversight of environmental activities at the installation. The Navy Assessment and Control of Installation Pollutants program was modified to become the ERP in 1986 (then known as the "Installation Restoration Program") to meet the requirements of CERCLA. WPNSTA Yorktown was added to the National Priorities List on October 15, 1992 (EPA ID: VA8170024170). A Federal Facilities Agreement (FFA) between the Navy and USEPA Region 3 was signed in August 1994. This agreement identified CERCLA sites, Site Screening Areas, and Areas of Concern for investigation and possible cleanup, and provided the framework and a schedule to accomplish this work. Subsequent to the FFA, additional sites, Site Screening Areas, and Areas of Concern were added to the ERP. Sites 4, 21, and 22 were evaluated in accordance with CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan under the Navy's ERP, the status of which can be found in the AR file for WPNSTA Yorktown.

## 1.1 Selected Remedy

Based on previous environmental investigations and actions, there is no unacceptable risk to human health or the environment due to exposure to soil, surface water, and sediment at Sites 4, 21, and 22. There is also no unacceptable risk from exposure to groundwater at Sites 4 and 21. The selected remedy at Sites 4 and 21 is No Further Action for soil, groundwater, surface water, and sediment. This is the final ROD for Sites 4 and 21; soil associated with Site 4 was previously addressed in a ROD signed in 2000, while soil associated with Sites 21 and 22 were previously addressed in RODs signed in 2003. The selected remedy for Site 22 is No Further Action for soil, surface water and sediment. Potential human health risks were identified from exposure to groundwater at Site 22. Groundwater at Site 22 currently remains in the Remedial Investigation/Feasibility Study (RI/FS) stage of the CERCLA process and is not addressed in this ROD. Because the selected remedy will not result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a 5-year review will not be required for Sites 4 and 21.

**1.2 Navy Authorizing Signature for the No Further Action Record of Decision for Groundwater, Surface Water, and Sediment at Site 4, Burning Pad Residue Landfill, and Site 21, Battery and Drum Disposal Area; Surface Water and Sediment at Site 22, Burn Pad, WPNSTA Yorktown, Yorktown, Virginia**

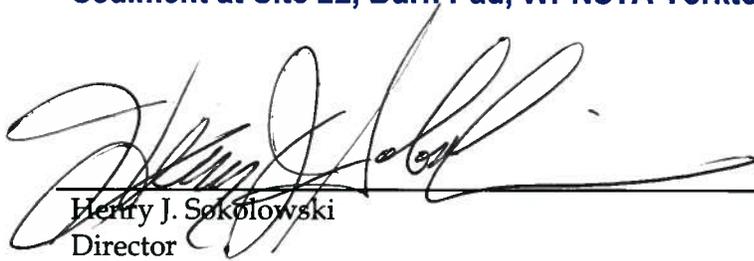


Captain Lowell Crow  
Commanding Officer  
Naval Weapons Station Yorktown

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Date

**1.3 USEPA Region 3 Authorizing Signature for the No Further Action Record of Decision for Groundwater, Surface Water, and Sediment at Site 4, Burning Pad Residue Landfill, and Site 21, Battery and Drum Disposal Area; Surface Water and Sediment at Site 22, Burn Pad, WPNSTA Yorktown, Yorktown, Virginia**



Henry J. Sokolowski  
Director  
Office of Federal Facility Remediation and Site Assessment

Sept 12, 2011

Date

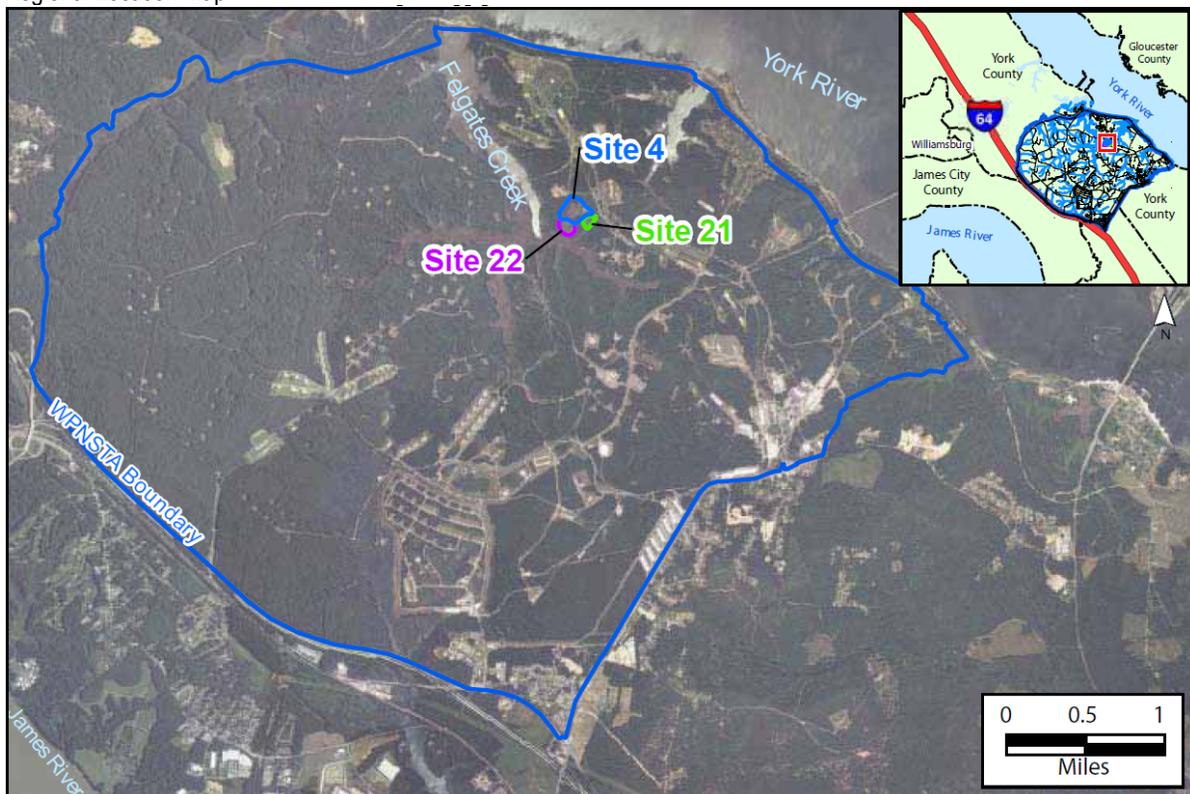
## 2 Decision Summary

### 2.1 Site Description and History

#### 2.1.1 Naval Weapons Station Yorktown

WPNSTA Yorktown is a 10,624-acre installation located on the Virginia Peninsula between the York River and the James River in Virginia (Figure 1). WPNSTA Yorktown was established in 1918 to support the laying of mines in the North Sea during World War I. During World War II, the facility was expanded to include three trinitrotoluene loading plants and new torpedo overhaul facilities. A research and development laboratory for experimentation with high explosives was established in 1944. In 1947, a quality evaluation laboratory was developed to monitor special tasks assigned to the facility, which included the design and development of depth charges and advanced underwater weapons. Today, the primary mission of WPNSTA Yorktown is to provide ordnance, technical support, and related services to sustain the war-fighting capability of the armed forces in support of national military strategy.

**FIGURE 1**  
Regional Location Map



### 2.1.2 Site 4, Burning Pad Residue Landfill

The Site 4 study area is a 13-acre open area surrounded by woods located in the north-central portion of WPNSTA Yorktown. Site 4 is bordered to the south by Sites 21 and 22 and to the west by Felgates Creek (Figure 1). The Site 4 landfill was operated from 1940 until 1975 and received an estimated 17 tons of waste per year (estimated total of 595 tons of waste). Carbon-zinc batteries from underwater weapons, burning pad residues, tree stumps, fly ash from coal fired boilers, mine casings, electrical equipment (e.g., telephone poles and line hardware), and transformers were reportedly buried at Site 4. Backfilling operations reportedly took place three to four times per week. An ash pile, measuring approximately 100 feet by 150 feet, was located in the northeast corner of Site 4. The ash pile consisted of ash from the burning of waste plastic explosives and spent solvents at Site 22.

### 2.1.3 Site 21, Battery and Drum Disposal Area

The Site 21 study area is an approximately 2.5-acre open area surrounded by woods. Site 21 is bordered to the north by Site 4 and to the west by Site 22 (Figure 1). Site 21 was reportedly used as a land disposal area in the 1950s during which it received an estimated 7,000 tons of waste. Filling operations reportedly occurred three to four times a week.

### 2.1.4 Site 22, Burn Pad

The Site 22 study area is an approximately 5-acre open area surrounded by woods. Site 22 is bordered to the north by Site 4, to the east by Site 21, and to the west by Felgates Creek (Figure 1). Site 22 was reportedly used for burning waste explosives and spent solvents from loading operations. The ash from the burned solvents and explosives was then transported to the landfill at Site 4. Burning was conducted at Site 22 from the early 1940s until 1995.

## 2.2 Previous Investigations

A summary of the site-specific investigations conducted for Sites 4, 21, and 22 are presented below in Table 1. Due to the close proximity of the Sites, investigations of groundwater, surface water, and sediment were conducted concurrently from 2001 through 2009.

**TABLE 1**  
Summary of Previous Studies and Investigations

| Previous Study / Investigation*  | Sites  | Investigation Activities  |
|--|--------|---|
| <b>Initial Assessment Study of Naval Weapons Station Yorktown</b><br><br>Naval Energy and Environmental Support Activity (NEESA), 1984 | Site 4 | In 1984, The <b>Initial Assessment Study</b> <sup>1</sup> (Reference [Ref.] 1) was commissioned by the Naval Energy and Environmental Support Activity to evaluate evidence of contamination that may pose a potential threat to human health or the environment. A review of archival and activity records, interviews with personnel, and on-site surveys identified Site 4 as a potentially contaminated site due to documentation and verbal reports of the disposal of unknown types of batteries from weapons and burning pad residues. The study recommended further investigation to evaluate possible impacts on site media from wastes disposed of at the site. |

<sup>1</sup> Reference phrases, presented as **Bold Italicized Text**, are followed by a corresponding reference number from the References section.

TABLE 1 (CONT.)  
Summary of Previous Studies and Investigations

| Previous Study / Investigation*  | Sites          | Investigation Activities   |
|--|----------------|--|
| <p><b>Remedial Investigation Interim Report</b></p> <p>Versar, 1991</p>  | Site 4         | <p>In 1986, five shallow groundwater and two co-located surface water and surface sediment samples were collected for the <b>Step 1 A Confirmation Study Round One</b> (Ref. 2) and analyzed for target compound list (TCL) VOCs, TCL semivolatile organic compounds (SVOCs) (referred to as base/neutral/acid extractable organics and phenols in the report), pesticides, polychlorinated biphenyls (PCBs), explosives, and target analyte list (TAL) metals and cyanide. In 1988, an additional five shallow groundwater and two co-located surface water and surface sediment samples, each from the same approximate locations as in 1986, were collected as part of the <b>Step 1 A Confirmation Study Round Two</b> (Ref. 3) and analyzed for TCL VOCs, TCL SVOCs, explosives, and TAL metals and cyanide (<b>Figure 2</b>). The results of the Step 1A Confirmation Studies were summarized in the RI Interim Report. Concentrations of VOCs, SVOCs, explosives, and metals in downgradient groundwater and explosives and metals in surface water and sediment exceeded human health and ecological screening criteria. The RI Interim Report concluded that additional investigation was required to further characterize the nature and extent of contamination at Site 4.</p>  |
| <p><b>Site Inspection Report for Site 21</b></p> <p>Baker and Weston, 1992</p>   | Site 21        | <p>In October 1991, three groundwater samples were collected to identify the nature and extent of contamination at Site 21 (<b>Figure 2</b>). Groundwater samples were analyzed for TCL VOCs, TCL SVOCs, TAL metals and cyanide, and total petroleum hydrocarbons. <b>The analytical results from the Inspection Report</b> (Ref. 4) indicated concentrations of cadmium and zinc exceeding human health screening values, as well as the presence of total petroleum hydrocarbons. The Site Inspection Report (which was never finalized) concluded that additional investigation was required to further characterize the nature and extent of groundwater contamination at Site 21.</p>   |
| <p><b>Round One Remedial Investigation Report for Sites 1-9, 11, 12, 16-19, and 21</b></p> <p>Baker and Weston, 1993</p> | Sites 4 and 21 | <p>In July 1992, groundwater, surface water, and surface/subsurface sediment samples, were collected to further define the nature and extent of contamination at the Sites 4 and 21 (<b>Figure 2</b>). All samples were analyzed for TCL VOCs, TCL SVOCs, explosives and TAL metals and cyanide. Sediment samples were also analyzed for TCL pesticides, and groundwater was also analyzed for TCL pesticides and PCBs.</p> <p><b>At Site 4, the analytical results of five groundwater samples</b> (Ref. 5) indicated concentrations of several metals exceeding human health screening criteria on-site, while concentrations of TCE exceeding the maximum contaminant limit (MCL) were detected in downgradient samples.</p> <p><b>At Site 21, the analytical results of the four groundwater samples</b> (Ref. 6) indicated concentrations of several metals exceeding human health screening criteria.</p> <p><b>At Sites 4 and 21, the analytical results of the five co-located surface water and sediment samples</b> (Ref. 7) indicated concentrations of several metals and pesticides in sediment exceeding ecological screening values.</p> <p>Based on the analytical results, the Round One RI recommended further investigation and the completion of a Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA).</p> |

TABLE 1 (CONT.)

Summary of Previous Studies and Investigations

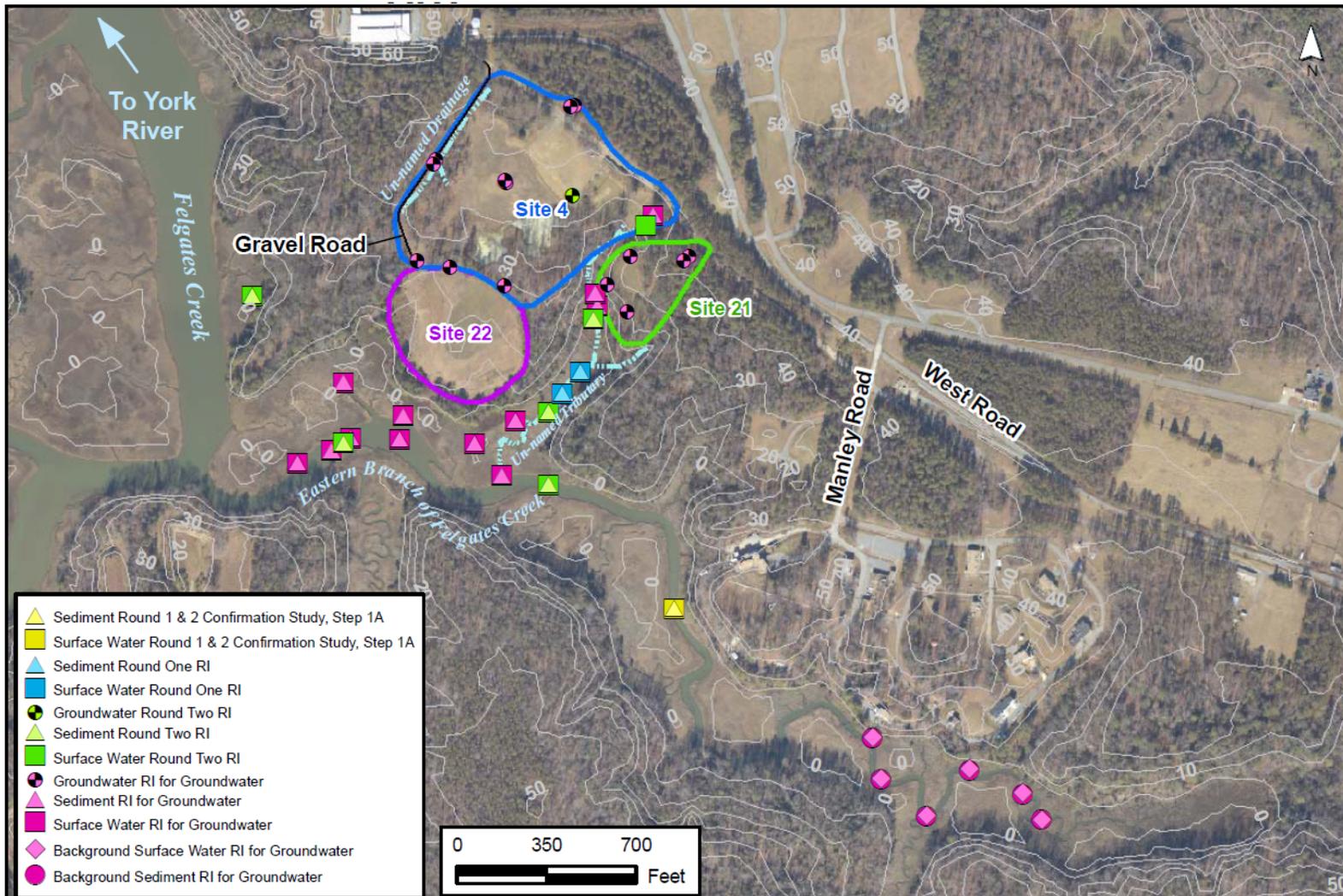
| Previous Study / Investigation*   | Sites                      | Investigation Activities   |
|---|----------------------------|--|
| <p><b>Round Two Remedial Investigation Report, Sites 4, 21, and 22</b></p> <p>Baker, 2001</p> | <p>Sites 4, 21, and 22</p> | <p>From August to November 1996, groundwater, surface water, and surface/subsurface sediment samples were collected to evaluate potential risks to human health and the environment (<b>Figure 2</b>). Samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, explosives and TAL metals and cyanide.</p> <p><b>At Site 4, the analytical results of nine groundwater samples</b> (Ref. 8) were used to complete an HHRA and ERA. The HHRA indicated no unacceptable non-cancer hazard or cancer risks to current or future receptors under a beneficial use scenario for groundwater. The ERA indicated potential risk to ecological receptors from exposure to several pesticides, explosives, and metals resulting from unattenuated groundwater migration to surface water.</p> <p><b>At Site 21, the analytical results of the four groundwater samples</b> (Ref. 9) were used to complete an HHRA and ERA. The HHRA indicated no unacceptable non-cancer hazard or cancer risks to current or future receptors under a beneficial use scenario for groundwater. The ERA indicated potential risk to ecological receptors from exposure to heptachlor and several metals resulting from unattenuated groundwater migration to surface water.</p> <p><b>At Site 22, the analytical results of the six groundwater samples</b> (Ref. 10) were used to complete an HHRA and ERA. The HHRA indicated no unacceptable non-cancer hazard or cancer risks to current or future receptors under a beneficial use scenario for groundwater. The ERA indicated potential risk to ecological receptors from exposure to 1,1-dichloroethene, trichloroethene, di-n-butylphthalate, aldrin, and several explosives and metals resulting from unattenuated groundwater migration to surface water.</p> <p><b>At Sites 4, 21, and 22, analytical results of the six co-located surface water and sediment samples</b> (Ref. 11) were used to complete an HHRA and an ERA. The HHRA indicated no unacceptable non-cancer hazard or cancer risks to current or future receptors from exposure to surface water and sediment. The ERA indicated potential risk to ecological receptors from exposure to several pesticides, explosives, and metals in sediment.</p> |
| <p><b>Record of Decision, Site 21</b></p> <p>Baker, 2003</p>                                  | <p>Site 21</p>             | <p>An NFA ROD for soil and waste at Site 21 was <b>signed in September 2003</b> (Ref.12) following the completion of two non-time-critical removal actions (NTCRAs) conducted in 1994 and 2002. Removal actions were conducted based on the results of previous investigations, which indicated potential unacceptable risk to ecological receptors from exposure to several metals in surface soil. Approximately 6,070 tons of batteries mixed with soil, 650 tons of debris, 4 drums, and 90 tons of soil were removed as part of the first NTCRA. An additional 145 cubic yards of contaminated soil was removed as part of the second NTCRA. Following the completion of the removal actions, the Navy and the USEPA, in partnership with the VDEQ, agreed that the source of contamination had been removed and no unacceptable risk from exposure to soil and waste remained at Site 21.</p>  |
| <p><b>Record of Decision, Site 22</b></p> <p>Baker, 2003</p>                                  | <p>Site 22</p>             | <p>An NFA ROD for soil at Site 22 was <b>signed in September 2003</b> (Ref.13) following the completion of a NTCRA conducted in 2002. Removal actions were conducted based on the results of previous investigations, which indicated potential unacceptable risk to ecological receptors from exposure to octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) and several metals in surface soil. Approximately 3,540 yd<sup>3</sup> of contaminated soil were removed as part of the NTCRA. Following the completion of the removal action, the Navy and the USEPA, in partnership with the VDEQ, agreed that the source of contamination had been removed and no unacceptable risk from exposure to soil remained at Site 22.</p>  |

**TABLE 1 (CONT.)**  
Summary of Previous Studies and Investigations

| Previous Study / Investigation*   | Sites                      | Investigation Activities   |
|---|----------------------------|--|
| <p><b>Record of Decision, Site 4</b><br/><br/>Baker, 2005</p>   | <p>Site 4</p>              | <p>An NFA ROD for soil and waste at Site 4 was <b>signed in September 2005</b> (Ref.14) following the completion of two NTCRAs conducted in 1994 and 2001. Removal actions were conducted based on the results of previous investigations which indicated potential unacceptable risk to both human and ecological receptors from several PAHs and metals, as well as risk to human receptors from 2,4,6 trinitrotoluene in surface soil. Surface debris, the ash pile, and buried batteries were removed as part of the first NTCRA. Approximately 59,400 tons of waste (construction debris, transformers, drums, and ordnance items) and contaminated soil were removed during the second NTCRA. Following the completion of the removal activities, the Navy and the USEPA, in partnership with the VDEQ, agreed that the source of contamination had been removed and no unacceptable risk from exposure to soil and waste remained at Site 4.</p>  |
| <p><b>Remedial Investigation Report for Groundwater at Sites 4, 21, and 22</b><br/><br/>CH2M HILL, 2009</p> | <p>Sites 4, 21, and 22</p> | <p>From Spring 2007 to Spring 2008, groundwater, groundwater seep, surface water, and surface and subsurface sediment samples were collected to evaluate potential risks to human health and the environment. Upgradient surface water and sediment samples were also collected to assess site-specific background conditions (<b>Figure 2</b>). Samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, explosives, and TAL metals and cyanide.</p> <p><b>At Site 4, the analytical results of the thirteen groundwater and two groundwater seep samples</b> (Ref. 15) were used to complete an HHRA. The RI concluded that no unacceptable risk from groundwater is present at Site 4 and the original source (surface debris, buried batteries, and an ash pile) had been removed; therefore, no additional action was recommended for groundwater at Site 4.</p> <p><b>At Site 21, the analytical results of the eight groundwater and two groundwater seep samples</b> (Ref. 16) were used to complete an HHRA. The RI concluded that no unacceptable risk from groundwater is present at Site 21 and the original source (batteries and drums) had been removed; therefore, no additional action was recommended for groundwater at Site 21.</p> <p><b>At Site 22, the analytical results of the seven groundwater samples</b> (Ref. 17) were used to complete an HHRA. The HHRA indicated potential cancer risks to future residents due to exposure to vinyl chloride, RDX, and arsenic, as well as non-cancer hazards to future residents from exposure to RDX, arsenic, and heptachlor epoxide and to construction workers due to exposure to TCE. The RI concluded that development of an FS for Site 22 groundwater independent from upgradient groundwater at Sites 4 and 21 was warranted.</p> <p><b>At Sites 4, 21, and 22, the analytical results of eleven co-located surface water and sediment, two independently located sediment samples, and six co-located background surface water and sediment samples</b> (Ref. 18) were used to complete a HHRA and ERA. The HHRA and ERA identified no unacceptable risk to human health or the environment. Based on the results of the HHRA and ERA, the RI concluded that no unacceptable risk to human health or the environment from exposure to surface water or sediment is present at Sites 4, 21, or 22; therefore, no additional action was recommended to address surface water and sediment adjacent to the three sites.</p> |

\* The documentation listed is available in the Administrative Record and provides detailed information used to support the No Further Action determination for Sites 4, 21, and 22.

**FIGURE 2**  
Sites 4, 21, and 22 Historical Sample Layout



\*Figure 2 illustrates the most recent activities conducted at each sampling location at Sites 4, 21, and 22. In instances of samples collected in the same location across multiple reports, the most recent sampling event is shown.

## 2.3 Site Characteristics

### 2.3.1 Topography and Site Features

Site 4 is predominately flat, with elevations ranging between 33 to 47 feet above mean sea level (amsl). Site 4's topography slopes steeply in the wooded areas along the southeastern portion of Site 4, with elevations changing from 39 to less than 10 feet amsl. A gravel road borders Site 4 to the east with an ephemeral drainage channel located east of the gravel road running parallel to the road.

Site 21 is predominately flat in the central portion, with elevations ranging between 30 to 45 feet amsl. Site topography slopes steeply toward the unnamed tributary along the northern, western, and southern boundaries with elevations changing from 45 to 5 feet amsl.

Site 22 is predominantly flat, with elevations changing from 32 to 20 feet amsl. Site 22's topography slopes steeply to the east, south, and southwest toward the Eastern Branch of Felgates Creek. A gravel road runs north-south along the west side of Site 4 and provides vehicle access to Site 22 from the north.

### 2.3.2 Hydrogeology

Given the proximity of Sites 4, 21, and 22, the geology at all Sites is similar and interconnected. The uppermost hydrogeologic unit is the Columbia aquifer. This unit extends from the ground surface to a maximum depth of approximately 20 feet below ground surface (bgs) and is characterized by brown and orange silts and sands. This unit overlies the Yorktown confining unit, a gray silt and clay unit encountered between 10 to 30 feet bgs. The Yorktown confining unit overlies the Yorktown-Eastover aquifer, a sandy unit with shell hash that extends to about 90 to 110 feet bgs. Groundwater at all Sites is first encountered within the Columbia aquifer between approximately 5 and 17 feet bgs and flows to the south toward drainage channels and the Eastern Branch of Felgates Creek and west toward Felgates Creek.

## 2.4 Scope and Role of Operable Unit

Comprehensive environmental restoration activities at WPNSTA Yorktown began in 1984 under the Navy Assessment and Control of Installation Pollutants program prior to state and federal regulatory oversight of environmental activities at the installation. The Navy Assessment and Control of Installation Pollutants program was modified to become the ERP in 1986 (then known as the Installation Restoration Program [IRP]) to meet the requirements of CERCLA as amended. WPNSTA Yorktown was added to the National Priorities List (NPL) on October 15, 1992 (USEPA ID: VA8170024170). A Federal Facilities Agreement (FFA) between the Navy and USEPA Region 3 was signed in August 1994. This FFA identified CERCLA sites, SSAs, and areas of concern (AOCs) for investigation and possible cleanup, and provided the framework and a schedule to accomplish this work. Subsequent to the FFA, additional sites, SSAs, and AOCs were added to the ERP. Sites 4, 21, and 22 were evaluated in accordance with CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan under the Navy's ERP, the status of which can be found in the current version of the Site Management Plan in the AR file for WPNSTA Yorktown.

This ROD presents the selected remedy of No Further Action for groundwater, surface water, and sediment at Sites 4 and 21 and surface water and sediment at Site 22.

The following Sites are currently in the RI/FS stage of the CERCLA process:

- Groundwater – Sites 9 and 19
- Groundwater, surface water, and sediment – Sites 1, 3, and 6
- All associated media – Sites 8, 23, 24, 25, 26, 31, 32, 33, and 34

The following Sites have a final ROD in place:

- Soil and waste – Sites 1, 3, 4, 6, 21, and 22
- Soil, surface water and sediment – Site 9
- Soil – Site 19
- All associated media – Sites 5, 7, 11, 12, 16, 17, 18, 27, 29, and 30

A final No Action ROD is pending for all media at Site 28. The No Further Action determination documented in this ROD for groundwater at Sites 4 and 21 and surface water and sediment at Sites 4, 21, and 22 does not include or affect any other media at Sites 4, 21 and 22 or any other sites at WPNSTA Yorktown.

## 2.5 Current and Potential Future Land and Resource Uses

Presently, Sites 4, 21, and 22 are predominantly vegetated fields with no designated land use. The sites are currently unused. It is anticipated that WPNSTA Yorktown will remain a military installation for the foreseeable future, and Sites 4, 21, and 22 will remain the same; however, Site conditions allow for unrestricted future land use at Sites 4 and 21.

Groundwater for potable use at WPNSTA Yorktown is currently supplied by the City of Newport News Waterworks. Shallow groundwater from the Columbia aquifer in the vicinity of Sites 4, 21, and 22 is not a current or anticipated future source of drinking water at WPNSTA Yorktown due to general low quality and yield and more readily available potable water.

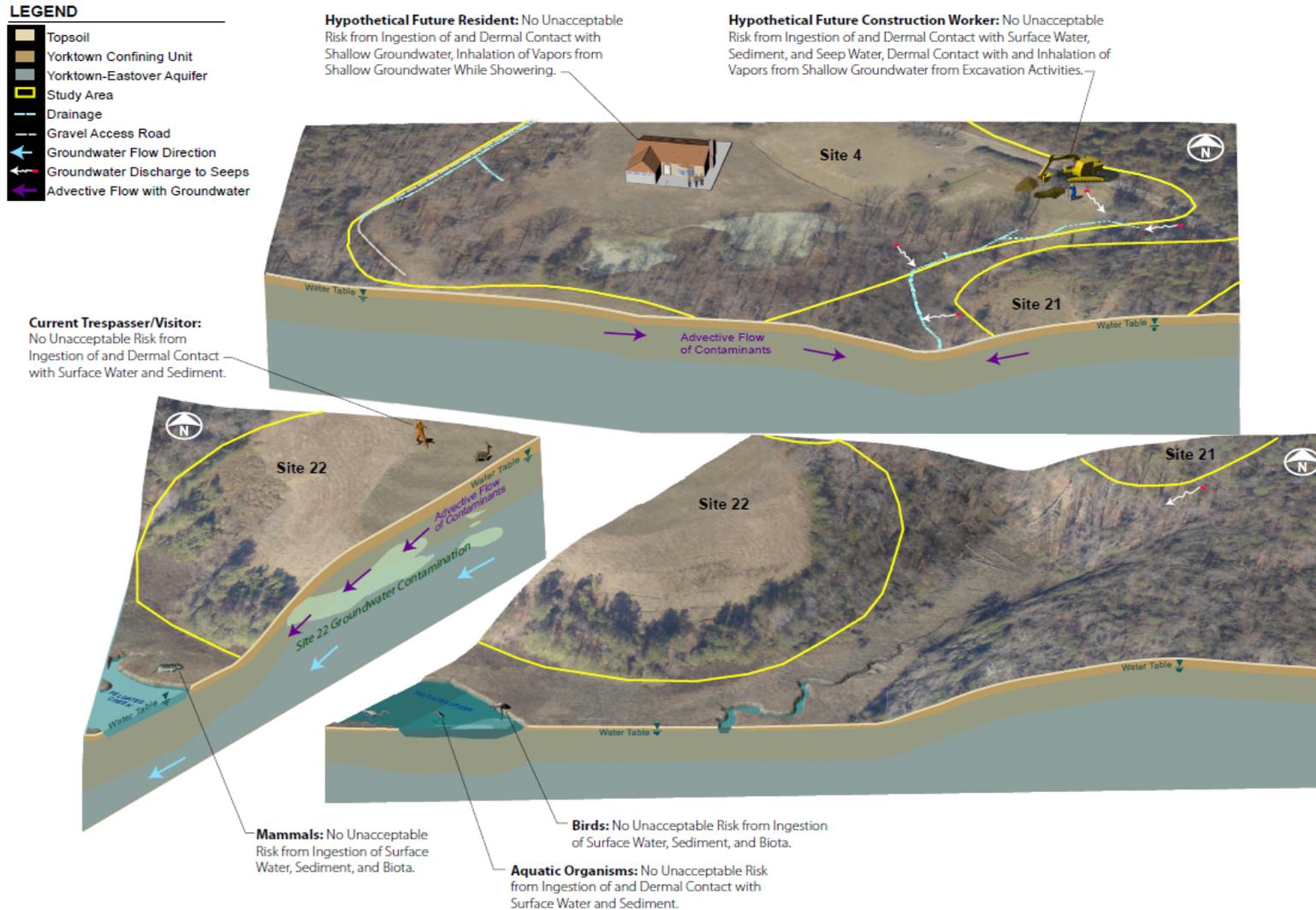
## 2.6 Summary of Site Risks

Potential human health (Attachments A-1 through A-4) and ecological risks at Sites 4, 21, and 22 are documented in the 2009 RI Report for Groundwater at Sites 4, 21, and 22. The results and conclusions of the HHRA and ERA documented are summarized below.

### 2.6.1 Summary of Human Health Risk Assessment

Based on the human health conceptual site model (**Figure 3**), risks were quantitatively evaluated for current adult and adolescent trespassers, future adult construction workers, and future adult/child/lifetime residents exposed to groundwater, groundwater seeps, surface water, and sediment using reasonable maximum exposure (RME) and central tendency exposure (CTE) concentrations. Exposure pathways quantified included ingestion and dermal contact for groundwater, groundwater seeps, surface water and sediment. Inhalation was initially considered as a potential pathway during the risk assessment, but was not quantified, as no VOCs were identified as constituents of potential concern (COPCs).

**FIGURE 3**  
 Sites 4, 21, and 22 Conceptual Site Model



The RME calculation determines risk based on the highest level of human exposure that could reasonably be expected to occur, whereas the CTE level reflects human exposure to average concentrations across the site. The potential non-cancer hazards, expressed as the hazard index (HI), and cancer risk estimates were calculated using RME concentrations. For non-cancer effects, an HI represents the ratio between the reference dose and the dose for a person in contact with site COPCs. An HI exceeding 1.0 indicates that potential health effects may occur. For known or suspected carcinogens, acceptable exposure levels generally are concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between  $10^{-4}$  (a 1 in 10,000 chance of developing cancer) and  $10^{-6}$  (a 1 in 1,000,000 chance of developing cancer) using information on the relationship between dose and response.

#### **Sites 4, 21, and 22 Surface Water and Sediment**

Based on RME calculations, *no unacceptable human health risks* (Ref. 19) were identified to any receptor from exposure to sediment or surface water elevated above background and reference samples. In addition, because any potential sources of contamination related to the waste and soil have been removed, additional chemical contributions to the creek are expected to be minimal and decrease over time.

#### **Site 4 Groundwater and Groundwater Seeps**

Based on RME calculations, *potentially unacceptable cancer risks and non-cancer hazards* (Ref. 20) from the ingestion of groundwater were identified for future adult residents due to exposure to 1,3-dinitrobenzene, future child residents due to exposure to 1,3-dinitrobenzene and arsenic, and future lifetime residents due to exposure to arsenic (**Table 2**). However, based on CTE calculations, no target-organ-specific HI exceeded 1.0 and no cancer risk exceeds the acceptable risk range of  $10^{-4}$  to  $10^{-6}$ . No unacceptable cancer risks or non-cancer hazards were identified to any current or future receptors from direct exposure to groundwater seeps.

Although 1,3-dinitrobenzene was identified as posing risk in groundwater, it was only detected in exceedance of the Adjusted Tap Water Regional Screening Level of  $0.37 \mu\text{g/L}$  in 1 of 13 groundwater samples collected in late 2007. There were no unacceptable risks associated with 1,3-dinitrobenzene under the CTE scenario. In addition, the Navy and USEPA Region 3, with concurrence of the VDEQ, *signed a ROD* (Ref. 21) affirming that no source of contaminants remained at Site 4. As the detection of 1,3-dinitrobenzene was isolated and there is no remaining source, the USEPA and Navy agree with the *conclusion of the 2009 RI for Groundwater* (Ref. 22) that the detected concentration will likely be reduced to below established risk screening values over time by natural advective and dispersive processes.

Arsenic was identified as posing a potential risk in groundwater, with dissolved concentrations detected in exceedance of the Adjusted Tap Water Regional Screening Level of  $0.045 \mu\text{g/L}$  in 4 of the 13 groundwater samples collected in late 2007. However, only one sample exceeded the maximum basewide background concentration of  $5.4 \mu\text{g/L}$ . Concentrations of arsenic in all samples were below the Federal MCL of  $10 \mu\text{g/L}$ . In addition, arsenic did not pose risk under the CTE exposure scenario. The USEPA and Navy

agree that arsenic detected at Site 4 was likely the result of geochemical conditions driven by the degradation of organic matter, rather than a direct source from Site 4.

**TABLE 2**  
Summary of Potential Human Health Risks from Exposure to Groundwater at Site 4

| Receptor                 | Pathway                | COC                | RME EPC (µg/L) | RME Cancer Risk              | RME Non-Cancer (HI) | CTE EPC (µg/L) | CTE Cancer Risk        | CTE Non-Cancer (HI) | CSF (mg/kg-day) <sup>-1</sup> | RfD (mg/kg-day) |
|--------------------------|------------------------|--------------------|----------------|------------------------------|---------------------|----------------|------------------------|---------------------|-------------------------------|-----------------|
| Future Adult Resident    | Ingestion              | 1,3-Dinitrobenzene | 5              | N/A                          | <b>1.4</b>          | 0.59           | N/A                    | 0.076               | N/A                           | 0.0001          |
|                          | Dermal                 | 1,3-Dinitrobenzene | 5              | N/A                          | 0.051               | 0.59           | N/A                    | 0.0027              | N/A                           | 0.0001          |
|                          | Total <sup>(1)</sup>   | --                 | --             | N/A                          | <b>2.5</b>          | --             | N/A                    | 0.41                | --                            | --              |
| Future Child Resident    | Ingestion              | 1,3-Dinitrobenzene | 5              | N/A                          | <b>3.2</b>          | 0.59           | N/A                    | 0.25                | N/A                           | 0.0001          |
|                          |                        | Arsenic            | 8.7            | N/A                          | <b>1.9</b>          | 6.4            | N/A                    | 0.9                 | N/A                           | 0.0003          |
|                          | Dermal                 | 1,3-Dinitrobenzene | 5              | N/A                          | 0.11                | 0.59           | N/A                    | 0.0052              | N/A                           | 0.0001          |
|                          |                        | Arsenic            | 8.7            | N/A                          | 0.012               | 6.4            | N/A                    | 0.002               | N/A                           | 0.0003          |
|                          | Total <sup>(1,2)</sup> | --                 | --             | N/A                          | <b>6</b>            | --             | N/A                    | <b>1.4</b>          | --                            | --              |
| Future Lifetime Resident | Ingestion              | Arsenic            | 8.7            | <b>2.0 x 10<sup>-4</sup></b> | N/A                 | 6.4            | 5.1 x 10 <sup>-5</sup> | N/A                 | 1.5                           | N/A             |
|                          | Dermal                 | Arsenic            | 8.7            | 1.1 x 10 <sup>-6</sup>       | N/A                 | 6.4            | 1.3 x 10 <sup>-7</sup> | N/A                 | 1.5                           | N/A             |
|                          | Total*                 | --                 | --             | <b>2.0 x 10<sup>-4</sup></b> | N/A                 | --             | 5.1 x 10 <sup>-5</sup> | N/A                 | --                            | --              |

<sup>(1)</sup>Totals are additive and include all chemicals listed in **Attachments A-1 and A-2**

<sup>(2)</sup> Although the Total CTE Non-Cancer Hazard exceeds 1.0, no target-organ-specific HI was greater than 1.0.

**Bold** indicates risk above the USEPA acceptable risk range

CSF = cancer toxicity factor

COC = contaminant of concern

CTE = central tendency exposure

EPC = exposure point concentration

HI = hazard index

mg/kg-day= milligrams per kilogram per day

N/A = not applicable

RfD = reference dose

RME = reasonable maximum exposure

### Site 21 Groundwater and Groundwater Seeps

Based on RME calculations, *potentially unacceptable cancer risks and non-cancer hazards* (Ref. 23) from the ingestion of and direct contact with groundwater were identified for future adult residents due to exposure to manganese, future child residents due to exposure to arsenic, iron, and manganese, and future lifetime residents due to exposure to arsenic (**Table 3**). However, based on CTE calculations, no target-organ-specific HI exceeded 1.0. In addition, no potentially unacceptable cancer risks were identified for any current or future receptors. No unacceptable cancer risks or non-cancer hazards were identified to any current or future receptors from direct exposure to groundwater seeps.

Iron and manganese are essential human nutrients, toxic only at very high doses. The estimated RME iron intake rate of 0.92 milligrams per kilogram per day (mg/kg-day) from incidental ingestion of groundwater corresponds to an intake of 13.8 milligrams per day (mg/day) for children (ages 7 months to 8 years). This is slightly above the recommended daily allowance range of 7 - 11 mg/day; however, it is below the Upper Intake Level of 40 mg/day, the maximum intake below which no adverse effects are anticipated (Institute of Medicine, 2005). Therefore, exposure to iron in groundwater is not likely to pose a health concern for the future child residents. The estimated RME manganese intake rate of 0.2 mg/kg-day for children and 0.085 mg/kg-day for adults from incidental ingestion of

groundwater corresponds to an intake of 3 mg/day and 5.9 mg/day, respectively. This intake is higher than the adequate intake of 0.6 to 1.5 mg/day for children and 1.6 to 2.3 mg/day for adults; however, *it is below the Upper Intake Level of 2 to 3 mg/day for children and 6 to 11 mg/day for adults* (Ref. 24). Therefore, ingestion of manganese in the groundwater is not likely to pose a health concern for the future child or adult residents.

TABLE 3

Summary of Potential Human Health Risks from Exposure to Groundwater at Site 21

| Receptor                 | Pathway                | COC       | RME EPC (µg/L) | RME Cancer Risk              | RME Non-Cancer (HI) | CTE EPC (µg/L) | CTE Cancer Risk        | CTE Non-Cancer (HI) | CSF (mg/kg-day) <sup>-1</sup> | RfD (mg/kg-day) |
|--------------------------|------------------------|-----------|----------------|------------------------------|---------------------|----------------|------------------------|---------------------|-------------------------------|-----------------|
| Future Adult Resident    | Ingestion              | Manganese | 3,100          | N/A                          | <b>3.6</b>          | 290            | N/A                    | 0.15                | N/A                           | 0.024           |
|                          | Dermal                 | Manganese | 3,100          | N/A                          | 0.46                | 290            | N/A                    | 0.012               | N/A                           | 0.00096         |
|                          | Total <sup>(1)</sup>   | --        | --             | N/A                          | <b>5.7</b>          | --             | N/A                    | 0.55                | --                            | --              |
| Future Child Resident    | Ingestion              | Arsenic   | 6.7            | N/A                          | <b>1.4</b>          | 5.3            | N/A                    | 0.75                | N/A                           | 0.0003          |
|                          |                        | Iron      | 14,000         | N/A                          | <b>1.3</b>          | 4,000          | N/A                    | 0.25                | N/A                           | 0.7             |
|                          |                        | Manganese | 3,100          | N/A                          | <b>8.3</b>          | 290            | N/A                    | 0.51                | N/A                           | 0.024           |
|                          | Dermal                 | Arsenic   | 6.7            | N/A                          | 0.0094              | 5.3            | N/A                    | 0.0016              | N/A                           | 0.0003          |
|                          |                        | Iron      | 14,000         | N/A                          | 0.0087              | 4,000          | N/A                    | 0.00053             | N/A                           | 0.7             |
|                          |                        | Manganese | 3,100          | N/A                          | <b>1.4</b>          | 290            | N/A                    | 0.028               | N/A                           | 0.00096         |
|                          | Total <sup>(1,2)</sup> | --        | --             | N/A                          | <b>14</b>           | --             | N/A                    | <b>1.8</b>          | --                            | --              |
| Future Lifetime Resident | Ingestion              | Arsenic   | 6.7            | <b>1.5 x 10<sup>-4</sup></b> | N/A                 | 5.3            | 4.2 x 10 <sup>-5</sup> | N/A                 | 1.5                           | N/A             |
|                          | Dermal                 | Arsenic   | 6.7            | 8.8 x 10 <sup>-7</sup>       | N/A                 | 5.3            | 1.0 x 10 <sup>-7</sup> | N/A                 | 1.5                           | N/A             |
|                          | Total*                 | --        | --             | <b>1.5 x 10<sup>-4</sup></b> | N/A                 | --             | 4.2 x 10 <sup>-5</sup> | N/A                 | --                            | --              |

<sup>(1)</sup>Totals are additive and include all chemicals listed in **Attachments A-1 and A-2**

<sup>(2)</sup> Although the Total CTE Non-Cancer Hazard exceeds 1.0, no target-organ-specific HI was greater than 1.0.

**Bold** indicates risk above the USEPA acceptable risk range

CSF = cancer toxicity factor

COC = contaminant of concern

CTE = central tendency exposure

EPC = exposure point concentration

HI = hazard index

mg/kg-day= milligrams per kilogram per day

N/A = not applicable

RfD = reference dose

RME = reasonable maximum exposure

Arsenic was identified as a posing potential risk in groundwater, with dissolved concentrations detected in exceedance of the Adjusted Tap Water Regional Screening Level of 0.045 µg/L in 2 of the 7 groundwater samples collected in late 2007. However, only one sample exceeded the maximum basewide background concentration of 5.4 µg/L. Detections of arsenic in all samples were below the Federal MCL of 10 µg/L. In addition, concentrations of arsenic did not pose a risk under the CTE exposure scenario. The USEPA and Navy agree that arsenic detected at Site 21 was likely the result of geochemical conditions driven by the degradation of organic matter, rather than a direct source from Site 21. The Navy and USEPA Region 3, with concurrence from the VDEQ, *signed a ROD* (Ref. 25) affirming that no source of contaminants remained. The USEPA and Navy agree that since waste and soil have been removed, organic matter will no longer create reducing conditions that may result in arsenic mobilization.

### 2.6.2 Summary of Ecological Risk Assessment

The Ecological Risk Assessment (ERA) conducted for Sites 4, 21, and 22 consisted of Steps 1 through 3A, in accordance with Navy and USEPA policy and guidance. Exposure routes evaluated included direct contact with groundwater seeps, surface water, and sediment (aquatic lower-trophic receptors), root uptake from sediment (aquatic plants), ingestion of surface water (aquatic and terrestrial upper-trophic level receptors), incidental ingestion of sediment (aquatic upper-trophic level receptors), and ingestion of plant and animal tissues (aquatic upper-trophic level receptors). Groundwater was not evaluated because it is not a direct exposure point for wildlife at the site and adequate groundwater seep, surface water, and sediment data were available for evaluation.

In order to assess risk to ecological receptors, the environmental setting, chemical fate and transport, ecotoxicity and potential receptors and complete exposure pathways were first identified. This information was used to develop a conceptual site model (**Figure 3**). Aquatic pathways were assessed to be complete at Site 4, 21, and 22. These receptor pathways were based on contaminants in groundwater seeps, surface water, and sediment. Terrestrial pathways were not evaluated as part of this ERA based upon the remedial actions that have occurred at these sites, which have eliminated complete and significant terrestrial ecological exposure pathways.

*Medium-specific screening values* (Ref. 26) for ecologically relevant media (i.e., groundwater seeps, surface water, and sediment) were established for direct exposure to all Site media based on the USEPA Region 3 Biological Technical Assistance Group screening values, where applicable. Alternate screening values from relevant, peer-reviewed literature were used when Biological Technical Assistance Group values were unavailable or more conservative values were available. *Ingestion screening values* (Ref. 27) for dietary exposures were derived only for contaminants with the potential to bioaccumulate. Ingestion screening values were derived for both chronic No Observed Adverse Effect Level and chronic Lowest Observed Effect Level endpoints. Toxicological information from the literature for wildlife species most closely related to the receptor species was used, where available, but was supplemented by laboratory studies of non-wildlife species (e.g., laboratory mice) where necessary.

Next, based on detected chemical concentrations and established screening values, hazard quotients (HQs) were calculated to characterize the potential for contaminants to pose unacceptable ecological risk using both conservative and more realistic exposure assumptions. HQs represent a ratio of the exposure level to an ecological effect level and are an estimate of potential risk. Maximum and mean (arithmetic and geometric) concentrations of groundwater seep, surface water, and sediment contaminant concentrations were used in this step to estimate potential exposures for the ecological receptors selected to represent the assessment endpoints for these media. Contaminants with HQs greater than or equal to one, the level at which receptors are expected to demonstrate adverse reactions to a chemical, were *identified as COPCs* (Ref. 28). These COPCs were then *compared to background samples* (Ref. 29) to determine if concentrations of these contaminants were statistically significant relative to naturally occurring concentrations

The ERA performed as part of the 2009 RI for Groundwater identified *no potentially unacceptable risk* (Ref. 30) to aquatic upper and lower trophic receptors due to exposure to groundwater seeps, surface water, or sediment at Sites 4, 21 and 22. Although COPCs were identified in each media, no constituents were retained as contaminants of concern after screening against background and reference concentrations. The ERA was conducted following the NTCRAs at Sites 4, 21, and 22 and, because any potential sources of contamination related to the waste and soil have been removed, additional chemical contributions to the creek are expected be minimal and decrease over time.

## 2.7 No Further Action Determination

Exposure to groundwater, surface water, and sediment at Sites 4 and 21 and surface water and sediment at Site 22 poses no unacceptable risks to human health or the environment. The Navy in partnership with the USEPA Region 3 and VDEQ agree no further action is required under CERCLA for groundwater at Sites 4 and 21 and surface water and sediment at Sites 4, 21, and 22. Therefore, no remedial response action and no restrictions on these media are necessary at Sites 4, 21, and 22.

## 2.8 Community Participation

Community participation at WPNSTA Yorktown includes a Restoration Advisory Board (RAB), public meetings, public information repositories, newsletters, fact sheets, public notices, and an ERP Website. The Community Involvement Plan for WPNSTA Yorktown provides detailed information on community participation for the ERP. The RAB was formed in 1994 and consists of community members, representatives from USEPA Region 3, VDEQ, and the Navy. RAB meetings are held twice a year and are open to the public to provide opportunity for public comment and input.

The investigations conducted at Sites 4, 21, and 22, the findings, and the documents in the Administrative Record form the basis for this ROD. A Proposed Plan (PP) was developed and made available for public review to request public input on the No Further Action decision. In addition, in accordance with Section 117(a) of CERCLA, the Navy provided a public comment period between July 26 through September 9, 2010 for the Sites 4, 21, and 22 PP. In accordance with 40 CFR 300.430(f)(3)(i)(A), a notice of availability was published in *The Virginia Gazette* and the *Daily Press* on July 24 and 25, 2010, respectively. The PP was available for review during the public comment period at the York County Public Library – Yorktown (8500 George Washington Memorial Highway, Yorktown, VA 23692, 757-890-3376). The public comment period included a public meeting to present the PP which was held on August 18, 2010 at the York County Public Library – Yorktown. No comments were received during the public comment period for the Sites 4, 21, and 22 PP.

This ROD, the PP, and all other information that supports this No Further Action determination are available in the AR. The AR is accessible to the public at:

Public Affairs Office  
NAVFAC Atlantic  
6506 Hampton Blvd  
Norfolk, VA 23508-1278  
757-322-8005

### 3 Responsiveness Summary

The participants in the public meeting included RAB members representing the Navy and VDEQ. Since no one from the public or RAB members outside the Navy and VDEQ attended the meeting, no presentation was made and no questions or concerns were received during the meeting. No meeting transcript was generated. No additional written comments, concerns, or questions were received by the Navy, USEPA, or VDEQ during the public comment period.



# References

| Reference Number | Reference Phrase in ROD  | Location in ROD | Identification of Referenced Document Available in the Administrative Record  |
|------------------|--|-----------------|---|
| 1                | <i>Initial Assessment Study</i>  | Table 1         | NEESA, 1984. Initial Assessment Study of Naval Weapons Station Yorktown. July. AR No. 00247.  |
| 2                | <i>Step 1 A Confirmation Study Round One</i>   | Table 1         | Dames & Moore. 1986. Confirmation Study Step 1A (Verification), Round One, Naval Weapons Station Yorktown, Yorktown, Virginia. June. AR No. 00256.  |
| 3                | <i>Step 1 A Confirmation Study Round Two</i>   | Table 1         | Dames & Moore. 1986. Confirmation Study Step 1A (Verification), Round Two, Naval Weapons Station Yorktown, Yorktown, Virginia. June. AR No. 00259.  |
| 4                | <i>The analytical results from the Inspection Report</i>   | Table 1         | Baker and Weston, 1992. Draft Final Site Inspection Report, Site 21, Naval Weapons Station, Yorktown, Virginia. February. Tables 4-1 and 4-2. AR No. 00213.   |
| 5                | <i>At Site 4, the analytical results of five groundwater samples</i>                                       | Table 1         | Baker and Weston, 1993. Round One Remedial Investigation Report, Sites 1-9, 11, 12, 16-19, and 21, Naval Weapons Station, Yorktown, Virginia. July. Table 5-21. AR No. 00313.   |
| 6                | <i>At Site 21, the analytical results of the four groundwater samples</i>                                  | Table 1         | Baker and Weston, 1993. Round One Remedial Investigation Report, Sites 1-9, 11, 12, 16-19, and 21, Naval Weapons Station, Yorktown, Virginia. July. Table 5-21. AR No. 00313.   |
| 7                | <i>At Sites 4 and 21, the analytical results of the five co-located surface water and sediment samples</i> | Table 1         | Baker and Weston, 1993. Round One Remedial Investigation Report, Sites 1-9, 11, 12, 16-19, and 21, Naval Weapons Station, Yorktown, Virginia. July. Table 5-20. AR No. 00313.   |
| 8                | <i>At Site 4, the analytical results of nine groundwater samples</i>                                       | Table 1         | Baker, 2001. Round Two Remedial Investigation Report, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. January. Tables 4-12 through 4-14. AR No. 01296, 01297, and 01298.                              |
| 9                | <i>At Site 21, the analytical results of the four groundwater samples</i>                                  | Table 1         | Baker, 2001. Round Two Remedial Investigation Report, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. January. Tables 4-27 through 4-29. AR No. 01296, 01297, and 01298.                              |
| 10               | <i>At Site 22, the analytical results of the six groundwater samples</i>                                   | Table 1         | Baker, 2001. Round Two Remedial Investigation Report, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. January. Tables 4-36 through 4-38. AR No. 01296, 01297, and 01298.                              |
| 11               | <i>At Sites 4, 21, and 22, analytical results of the six co-located surface water and sediment samples</i> | Table 1         | Baker, 2001. Round Two Remedial Investigation Report, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. January. Tables 4-15 through 4-20 and Tables 4-39 through 4-41. AR No. 01296, 01297, and 01298. |

REFERENCES

| Reference Number | Reference Phrase in ROD   | Location in ROD | Identification of Referenced Document Available in the Administrative Record  |
|------------------|---|-----------------|---|
| 12               | <i>signed in September 2003</i>   | Table 1         | Baker, 2003. Record of Decision Site 21 Battery and Drum Disposal Area, Naval Weapons Station, Yorktown, Virginia. September. AR No. 01374.   |
| 13               | <i>signed in September 2003</i>   | Table 1         | Baker, 2003. Record of Decision Site 22 Burn Pad, Naval Weapons Station, Yorktown, Virginia. September. AR No. 01375.   |
| 14               | <i>signed in September 2005</i>   | Table 1         | Baker, 2005. Record of Decision Site 4 Burning Pad Residue Landfill, Naval Weapons Station, Yorktown, Virginia. September. AR No. 02026.  |
| 15               | <i>At Site 4, the analytical results of the thirteen groundwater and two groundwater seep samples</i>   | Table 1         | CH2M HILL, 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Tables 4-3 and 4-4. AR No. 000024.                  |
| 16               | <i>At Site 21, the analytical results of the eight groundwater and two groundwater seep samples</i>   | Table 1         | CH2M HILL, 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Tables 5-3 and 5-4. AR No. 000024.                  |
| 17               | <i>At Site 22, the analytical results of the seven groundwater samples</i>  | Table 1         | CH2M HILL, 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Table 6-3. AR No. 000024.                           |
| 18               | <i>At Sites 4, 21, and 22, the analytical results of eleven co-located surface water and sediment, two independently located sediment samples, and six co-located background surface water and sediment samples</i> | Table 1         | CH2M HILL, 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Tables 7-1 and 7-7. AR No. 000024.                  |
| 19               | <i>no unacceptable human health risks</i>   | Section 2.6.1   | CH2M HILL, 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Tables 8-18 and 8-19. AR No. 000024.                |
| 20               | <i>potentially unacceptable cancer risks and non-cancer hazards</i>   | Section 2.6.1   | CH2M HILL, 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Tables 8-4. AR No. 000024.                          |
| 21               | <i>signed a ROD</i>   | Section 2.6.1   | Baker, 2005. Record of Decision Site 4 Burning Pad Residue Landfill, Naval Weapons Station, Yorktown, Virginia. September. AR No. 002026.   |
| 22               | <i>conclusion of the 2009 RI for Groundwater</i>  | Section 2.6.1   | CH2M HILL, 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Page 11-1. AR No. 000024.                           |
| 23               | <i>potentially unacceptable cancer risks and non-cancer hazards</i>   | Section 2.6.1   | CH2M HILL, 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Tables 8-9. AR No. 000024.                          |
| 24               | <i>It is below the Upper Intake Level of 2 to 3 mg/day for children and 6 to 11 mg/day for adults</i>   | Section 2.6.1   | Institute of Medicine, 2005. <i>Dietary Reference Intakes: Elements</i> . <a href="http://www.iom.edu/Object.File/Master/7/294/0.pdf">http://www.iom.edu/Object.File/Master/7/294/0.pdf</a> . |
| 25               | <i>signed a ROD</i>   | Section 2.6.1   | Baker, 2003. Record of Decision Site 21 Battery and Drum Disposal Area. Naval Weapons Station, Yorktown, Virginia. September. Page 1-1. AR No. 001374.  |

| Reference Number | Reference Phrase in ROD                 | Location in ROD | Identification of Referenced Document Available in the Administrative Record   |
|------------------|---|-----------------|--|
| 26               | <i>Medium-specific screening values</i> | Section 2.6.2   | CH2M HILL, 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Table 9-10. AR No. 000024.               |
| 27               | <i>Ingestion screening values</i>       | Section 2.6.2   | CH2M HILL, 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Tables 9-12 and 9-13. AR No. 000024.     |
| 28               | <i>identified as COPCs</i>              | Section 2.6.2   | CH2M HILL, 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Tables 9-14 through 9-16. AR No. 000024. |
| 29               | <i>compared to background samples</i>   | Section 2.6.2   | CH2M HILL, 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Tables 9-20 through 9-22. AR No. 000024. |
| 30               | <i>no potentially unacceptable risk</i> | Section 2.6.2   | CH2M HILL, 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Section 9.5.4. AR No. 000024.            |

Detailed site information reference in this ROD in bold blue text is contained in the Administrative Record. For access to information contained in the Administrative Record for WPNSTA Yorktown please contact:

Public Affairs Office, NAVFAC Atlantic  
 6506 Hampton Blvd  
 Norfolk, Virginia 23508  
 Phone: (757) 322-8005

**Attachment A**

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## ATTACHMENT A-1

Summary of Reasonable Maximum Exposure Cancer Risks and Hazard Indices  
based on 2009 Human Health Risk Assessment  
Site 4, Burning Pad Residue Landfill, Yorktown, Virginia

| Receptor                                      | Media                        | Exposure Route | Cancer Risk                | COPCs with Cancer Risk >10 <sup>-4</sup> | Hazard Index | COPCs with HI >1                                    |
|---|------------------------------|----------------|----------------------------|--|--------------|---|
| Current/Future Adult Trespasser/ Visitor      | Groundwater Seeps            | Ingestion      | 5.0 x 10 <sup>-7</sup>     | --                                       | 0.01         | --  |
|   |                              | Dermal Contact | 6.0 x 10 <sup>-8</sup>     | --                                       | 0.0033       | --  |
|   |                              | Total          | 5.7 x 10 <sup>-7</sup>     | --                                       | 0.014        | --  |
| Current/Future Adolescent Trespasser/ Visitor | Groundwater Seeps            | Ingestion      | 2.6 x 10 <sup>-7</sup>     | --                                       | 0.014        | --  |
|   |                              | Dermal Contact | 2.2 x 10 <sup>-8</sup>     | --                                       | 0.0032       | --  |
|   |                              | Total          | 2.8 x 10 <sup>-7</sup>     | --                                       | 0.018        | --  |
| Current/Future Child Trespasser/ Visitor      | Groundwater Seeps            | Ingestion      | 5.9 x 10 <sup>-7</sup>     | --                                       | 0.049        | --  |
|   |                              | Dermal Contact | 2.4 x 10 <sup>-8</sup>     | --                                       | 0.0053       | --  |
|   |                              | Total          | 6.1 x 10 <sup>-7</sup>     | --                                       | 0.054        | --  |
| Future Construction Worker                    | Groundwater (Excavation Pit) | Dermal Contact | 8.8 x 10 <sup>-8</sup>     | --                                       | 0.39         | --  |
|   |                              | Total          | 8.8 x 10 <sup>-8</sup>     | --                                       | 0.39         | --  |
|   | Groundwater Seeps            | Ingestion      | 7.0 x 10 <sup>-9</sup>     | --                                       | 0.0023       | --  |
|   |                              | Dermal Contact | 5.9 x 10 <sup>-9</sup>     | --                                       | 0.0023       | --  |
|   |                              | Total          | 1.3 x 10 <sup>-8</sup>     | --                                       | 0.0044       | --  |
| Future Adult Residents                        | Groundwater (Tap Water)      | Ingestion      | N/A                        | --                                       | <b>2.5</b>   | 1,3-Dinitrobenzene (HQ = 1.4)                       |
|   |                              | Dermal Contact | N/A                        | --                                       | 0.094        | --  |
|   |                              | Total          | N/A                        | --                                       | <b>2.6</b>   | 1,3-Dinitrobenzene (HQ = 1.4)                       |
| Future Child Residents                        | Groundwater (Tap Water)      | Ingestion      | N/A                        | --                                       | <b>5.7</b>   | 1,3-Dinitrobenzene (HQ = 3.2)<br>Arsenic (HQ = 1.9) |
|   |                              | Dermal Contact | N/A                        | --                                       | 0.24         | --  |
|   |                              | Total          | N/A                        | --                                       | <b>6.0</b>   | 1,3-Dinitrobenzene (HQ = 3.2)<br>Arsenic (HQ = 1.9) |
| Future Lifetime Residents                     | Groundwater (Tap Water)      | Ingestion      | <b>2 x 10<sup>-4</sup></b> | Arsenic (CR = 1.9 x 10 <sup>-4</sup> )   | N/A          | --  |
|   |                              | Dermal Contact | 1.1 x 10 <sup>-6</sup>     |  | N/A          | --  |
|   |                              | Total          | <b>2 x 10<sup>-4</sup></b> | Arsenic (CR = 1.9 x 10 <sup>-4</sup> )   | N/A          | --  |

N/A - Not Applicable; receptor was not analyzed for this risk/hazard.

**ATTACHMENT A-2**

Summary of CTE Cancer Risks and Hazard Indices based on 2009 HHRA  
 Site 4, Burning Pad Residue Landfill, Yorktown, Virginia

| Receptor                  | Media                   | Exposure Route | Cancer Risk            | COPCs with Cancer Risk >10 <sup>-4</sup> | Hazard Index | COPCs with HI >1 |
|---------------------------|-------------------------|----------------|------------------------|--|--------------|------------------|
| Future Adult Residents    | Groundwater (Tap Water) | Ingestion      | N/A                    | --                                       | 0.4          | --               |
|                           |                         | Dermal Contact | N/A                    | --                                       | 0.0078       | --               |
|                           |                         | Total          | N/A                    | --                                       | 0.41         | --               |
| Future Child Residents    | Groundwater (Tap Water) | Ingestion      | N/A                    | --                                       | <b>1.3</b>   | --               |
|                           |                         | Dermal Contact | N/A                    | --                                       | 0.017        | --               |
|                           |                         | Total          | N/A                    | --                                       | <b>1.4</b>   | --               |
| Future Lifetime Residents | Groundwater (Tap Water) | Ingestion      | 5.1 x 10 <sup>-5</sup> | --                                       | N/A          | --               |
|                           |                         | Dermal Contact | 1.3 x 10 <sup>-7</sup> | --                                       | N/A          | --               |
|                           |                         | Total          | 5.1 x 10 <sup>-5</sup> | --                                       | N/A          | --               |

N/A - Not Applicable; receptor was not evaluated for this risk/hazard.

**ATTACHMENT A-3**

Summary of Reasonable Maximum Exposure Cancer Risks and Hazard Indices  
 based on 2009 Human Health Risk Assessment  
 Site 21, Battery and Drum Disposal Area, Yorktown, Virginia

| Receptor                   | Media                        | Exposure Route | Cancer Risk                  | COPCs with Cancer Risk >10 <sup>-4</sup> | Hazard Index | COPCs with HI >1  |
|----------------------------|------------------------------|----------------|------------------------------|--|--------------|---|
| Future Construction Worker | Groundwater (Excavation Pit) | Dermal Contact | 4.5 x 10 <sup>-8</sup>       | --                                       | 0.96         | --  |
|                            |                              | Total          | 4.5 x 10 <sup>-8</sup>       | --                                       | 0.96         | --  |
| Future Adult Residents     | Groundwater (Tap Water)      | Ingestion      | N/A                          | --                                       | <b>5.2</b>   | Manganese (HQ = 3.6)  |
|                            |                              | Dermal Contact | N/A                          | --                                       | 0.53         | --  |
|                            |                              | Total          | N/A                          | --                                       | <b>5.7</b>   | Manganese (HQ = 3.6)  |
| Future Child Residents     | Groundwater (Tap Water)      | Ingestion      | N/A                          | --                                       | <b>12</b>    | Arsenic (HQ = 1.4)<br>Iron (HQ = 1.3)<br>Manganese (HQ = 8.3) |
|                            |                              | Dermal Contact | N/A                          | --                                       | <b>1.6</b>   | Manganese (HQ = 1.4)  |
|                            |                              | Total          | N/A                          | --                                       | <b>14</b>    | Arsenic (HQ = 1.4)<br>Iron (HQ = 1.3)<br>Manganese (HQ = 8.3) |
| Future Lifetime Residents  | Groundwater (Tap Water)      | Ingestion      | <b>1.5 x 10<sup>-4</sup></b> | Arsenic (CR = 1.5 x 10 <sup>-4</sup> )   | N/A          | --  |
|                            |                              | Dermal Contact | 8.8 x 10 <sup>-7</sup>       |  | N/A          | --  |
|                            |                              | Total          | <b>1.5 x 10<sup>-4</sup></b> | Arsenic (CR = 1.5 x 10 <sup>-4</sup> )   | N/A          | --  |

N/A - Not Applicable; receptor was not evaluated for this risk/hazard.

**ATTACHMENT A-4**

Summary of CTE Cancer Risks and Hazard Indices based on 2009 HHRA  
 Site 21, Battery and Drum Disposal Area, Yorktown, Virginia

| Receptor                  | Media                   | Exposure Route | Cancer Risk                  | COPCs with Cancer Risk >10 <sup>4</sup> | Hazard Index | COPCs with HI >1 |
|---------------------------|-------------------------|----------------|------------------------------|---|--------------|------------------|
| Future Adult Residents    | Groundwater (Tap Water) | Ingestion      | N/A                          | --                                      | 0.53         | --               |
|                           |                         | Dermal Contact | N/A                          | --                                      | 0.024        | --               |
|                           |                         | Total          | N/A                          | --                                      | 0.55         | --               |
| Future Child Residents    | Groundwater (Tap Water) | Ingestion      | N/A                          | --                                      | <b>1.8</b>   | --               |
|                           |                         | Dermal Contact | N/A                          | --                                      | 0.055        | --               |
|                           |                         | Total          | N/A                          | --                                      | <b>1.8</b>   | --               |
| Future Lifetime Residents | Groundwater (Tap Water) | Ingestion      | <b>4.2 x 10<sup>-5</sup></b> | --                                      | N/A          | --               |
|                           |                         | Dermal Contact | 1.1 x 10 <sup>-7</sup>       | --                                      | N/A          | --               |
|                           |                         | Total          | <b>4.2 x 10<sup>-5</sup></b> | --                                      | N/A          | --               |

N/A - Not Applicable; receptor was not evaluated for this risk/hazard.

 CH2MHILL

January 18, 2011

377124.PP.DR

Mr. Wade Smith  
Remedial Project Manager  
Office of Remediation Programs  
Virginia Department of Environmental Quality (VDEQ)  
629 East Main Street  
Richmond, Virginia 23219

Subject: Response to Comments on *Draft Record of Decision, Site 4 – Burning Pad Residue Landfill, Site 21 – Battery and Drum Disposal Area, & Site 22 – Burn Pad, Naval Weapons Station Yorktown, Yorktown, Virginia, August 2010*

Dear Mr. Smith,

On behalf of the U.S. Department of the Navy's Naval Facilities Engineering Command (NAVFAC), CH2M HILL has prepared this letter in response to your September 9, 2010 e-mail, providing comments for the subject document via track changes in the Word file. Comments received are shown below, followed by the Navy's response in italics.

- **Comment #1—Section 1, Declaration:** The July 2010 Proposed Plan states that the preferred alternative is the no action alternative. Please explain the reasoning for changing the language from no action in the Proposed Plan to No Further Action throughout the ROD.

*Response: The document has been revised to indicate No Action (which is consistent with the Proposed Plan). No Action is necessary for sediment and surface water at Sites 4, 21, and 22 and No Action is necessary for groundwater at Sites 4 and 21.*

- **Comment #2—Section 1, Declaration:** The July 2010 Proposed Plan refers to this site as The Burning Pad.

*Response: The site name is documented as "Burning Pad" in the SMP and previous historical documents. This ROD has not been revised based on the comment and Site 22 remains as "Burning Pad."*

- **Comment #3—Sections 2.1.2, 2.1.3, and 2.1.4, Site Histories:** Multiple comments received on site area presented in the ROD vs. larger areas in the Proposed Plan.

*Response: The areas presented in the ROD have been revised to be consistent with those presented in the Proposed Plan. The Proposed Plan identifies the study areas of each site, which are consistent with the figures shown and the well locations but are slightly different than the site areas presented in other site related documents. The text of this document now reflects the study area of each site.*

Mr. Wade Smith  
January 18, 2011  
Page 2

- **Comment #4—Section 2.2, Previous Investigations:** Table 1 contains several discrepancies in Author, Document Title, and AR Document Number when referenced against the Proposed Plan and the References section of the ROD. Please review both Table 1 and the References section for correctness and consistency.

*Response: Table 1 has been revised to reflect the correct references to Authors, Document Titles, and AR Document Numbers. Additionally, the References Section has been revised to reflect the proper references.*

- **Comment #5—Section 2.4, Scope and Role of Operable Unit:** 28 Sites are listed below. Please verify.

*Response: This section has been revised to be consistent with other RODs for WPNSTA Yorktown.*

- **Comment #6—Section 2.4, Scope and Role of Operable Unit:** No final ROD in place (regarding Site 28).

*Response: Agreed, Site 28 has been removed from the list and a sentence has been added to the end of the section to note that a No Action ROD for all media is pending for Site 28.*

- **Comment #7—Section 2.6.1, Summary of Human Health Risk Assessment:** Please reword.

*Response: The referenced sentence has been revised to read, "As the detection of 1,3-dinitrobenzene was isolated and there is no remaining source, the Partnering Team agrees with the conclusion of the 2009 RI for Groundwater (Ref. 22) that the detected concentration will likely to be reduced to below established risk screening values over time by natural advective and dispersive processes."*

- **Comment #8—Section 2.8: Community Participation "vs. Fiscal Year 1995"**

*Response: This section has been revised to indicate the RAB was formed in 1994, which is consistent with other RODs at WPNSTA Yorktown*

In addition, all editorial changes have been accepted and retained and are not discussed on a case by case basis within this letter. If you have any questions or comments regarding the above response to comments, please feel free to contact me at 757-671-6223 or Adam Forshey at 757-671-6267.

Sincerely,

CH2M HILL



William J. Friedmann, Jr.,  
Project Manager

cc: Mr. Tom Kowalski/NAVFAC Mid-LANT  
Mr. Rob Thomson /USEPA Region 3  
Mr. Adam Forshey/CH2M HILL



CH2M HILL  
5700 Cleveland Street, Suite 101  
Virginia Beach, VA 23462  
Tel 757.518.9666

June 16, 2011

377124.PP.PM

Mr. Robert Thomson, P.E., R.E.M.  
Office of Federal Facility Remediation  
United States Environmental Protection Agency, Region III  
1650 Arch Street  
Philadelphia, PA 19103-2029

**Subject:** Response to USEPA Comments on *Draft Record of Decision, Site 4 – Burning Pad Residue Landfill, Site 21 – Battery and Drum Disposal Area, & Site 22 – Burn Pad; Naval Weapons Station Yorktown; Yorktown, Virginia*

Dear Mr. Thompson:

On behalf of the U.S. Department of the Navy's Naval Facilities Engineering Command (NAVFAC), CH2M HILL has prepared this letter in response to your April 28, 2011 email, providing comments for the subject document. Comments are presented, shown in italics, followed by Navy's responses.

**1. Comment:** *[Table 1, Page 2-4] How did this (referencing the groundwater risk discussion) change from 1992 to no unacceptable non-cancer hazard?*

**Response:** Sites 4, 21, & 22 were included as part of a Round One Remedial Investigation Report for Sites 1-9, 11, 12, 16-19, and 21 in 1993. The three sites were evaluated to determine whether they could be closed out with available data or would require additional data to perform a quantitative risk assessment. The screening level risk assessments for each site determined that media required additional data and the performance of quantitative human health and ecological risk assessment. A Round II RI completed in 2001 collected additional information and determined that surface water and sediment did not pose unacceptable risk; groundwater for Sites 4, 21, and 22 required further evaluation. Based on the conclusions and recommendations of the Round II RI, a groundwater RI for Sites 4, 21, and 22 was completed in 2009. Table 1 provides only a summary of the results of the Round I and Round II investigations and, based upon previous comments received from EPA on December 8, 2010, does not include a detailed risk evaluation discussion. A more detailed risk discussion is included in Section 2.6 of the ROD. No revision has been made to the table based on this comment.

**2. Comment:** *[Table 1, Page 2-5] Being what? Identify. (referencing the original source at Site 4 and Site 21)*

**Response:** Additional text has been added to identify the source materials at Site 4 (surface debris, buried batteries, and an ash pile) and Site 21 (batteries and drums).

**3. Comment:** *[Section 2.6.1, Site 4 Groundwater and Groundwater Seeps, Page 2-10] Are we going to follow up on this?*

**Response:** This comment is referencing the sentence which indicates that detected concentrations of 1,3-dinitrobenzene will likely be reduced to below established risk screening values over time by natural advective and dispersive processes. No Action is proposed for the groundwater at Site 4. Therefore, no additional follow up is proposed for 1,3-dinitrobenzene at the site. No change was made to the text based on this comment.

**4. Comment:** *[Section 2.6.1, Site 4 Groundwater and Groundwater Seeps, Page 2-10] Not clear what this is trying to say?*

**Response:** This comment is in reference to the sentence that states, "The Partnering Team agrees that concentrations of arsenic at Site 4 are not site-related." This sentence (and subsequent similar sentences) has been revised to state, "The USEPA and Navy agree that arsenic detected at Site 4 was likely the result of geochemical conditions driven by the degradation of organic matter, rather than a direct source from Site 4." This is consistent with the conclusions made in the Round Two RI.

All other editorial and formatting comments were made as suggested in the comments provided. If you have any questions or comments regarding the above response to comments, please feel free to contact me at 757-671-6223.

Sincerely,



William J. Friedmann, Jr.  
CH2M HILL  
Activity Manager

cc: Mr. Tom Kowalski /NAVFAC Mid-Atlantic  
Mr. Moshood Oduwole/USEPA Region III  
Mr. Wade Smith/VDEQ  
Ms. Mary Anderson/CH2M HILL  
Mr. Adam Forshey/CH2M HILL



# COMMONWEALTH of VIRGINIA

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Douglas W. Domenech  
Secretary of Natural Resources

David K. Paylor  
Director

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September 2, 2011

Mr. Henry J. Sokolowski, Director  
Office of Federal Facility Remediation and Site Assessment (3HS10)  
U.S. Environmental Protection Agency, Region 3  
1650 Arch Street  
Philadelphia, PA 19103-2029

**RE: Final Record of Decision**  
**Site 4 – Burning Pad Residue Landfill**  
**Site 21 – Battery and Drum Disposal Area and**  
**Site 22 – Burn Pad**  
**Naval Weapons Station Yorktown**  
**Yorktown, Virginia**

Dear Mr. Sokolowski:

The Virginia Department of Environmental Quality (DEQ) staff has reviewed the Final Record of Decision (Final ROD) for Site 4 – Burning Pad Residue Landfill, Site 21 – Battery and Drum Disposal Area, and Site 22 – Burn Pad located at Naval Weapons Station Yorktown (NWSY), Yorktown, Virginia. The DEQ concurs with the No Further Action determination, as described in the August 2011 Final ROD, which was signed by Lowell Crow (Captain, U.S. Navy, Commanding Officer) on August 31, 2011.

Please contact Wade Smith at (804) 698-4125 or [wade.smith@deq.virginia.gov](mailto:wade.smith@deq.virginia.gov) with any questions.

Sincerely,

A handwritten signature in cursive script that reads "Durwood H. Willis".

Durwood H. Willis  
Director, Office of Remediation Programs

cc: Jim Gravette, NWSY  
Milt Johnston, DEQ, TRO  
Wade Smith, DEQ, CO  
Moshood Oduwole, EPA



**CH2MHILL**

**For access to the Administrative Record or  
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