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NWS YORKTOWN
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EMAIL AND ATTACHED RESPONSE TO REGULATORS COMMENTS ON THE SITE 22 RECORD OF DECISION NWS YORKTOWN VA
08/07/2012
CH2M HILL

## Marrow, Monica/VBO

**From:** Friedmann, William/VBO
**Sent:** Tuesday, August 07, 2012 11:41 AM
**To:** Oduwole.Moshood@epamail.epa.gov; Smith, Wade (DEQ)
**Cc:** Gravette, James CIV NAVFAC MIDLANT, IPTNE; Forshey, Adam/VBO; Sawyer, Stephanie/VBO
**Subject:** Revised Site 22 ROD for Review
**Attachments:** Site 22 ROD Redline Edits 080612.docx; Yorktown Site 22 ROD Comment Summaryl.xlsx; Revised Site 22 ROD ARARs.xlsx

**Importance:** High

Good morning Moshood and Wade,

Attached are three files that constitute the responses to both your comments to the Site 22 ROD. The first file contains the redline document that captures the changes made. Please note that I removed all figures except one that was commented on. This was necessary to reduce the file size to send to you as we are having access issues to the Yorktown Partnering website. The second attachment is a table where summarized/grouped all the EPA comments; we've assigned comment numbers which correspond to edits/inserted text within the document.

The third attachment is the revised ARAR tables. We realized upon receiving comments that we had a incorrect version of the ARARs in the document and therefore ask that you re-review the ARAR tables.

Please review the revised document as soon as is possible and let us know if you have any questions.
Thanks,
Bill

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# 1 Declaration

## 1.1 Site Name and Location

This Record of Decision (ROD) presents the selected remedy for groundwater at Environmental Restoration Program (ERP) Site 22, Burn Pad, at Naval Weapons Station (WPNSTA) Yorktown, Yorktown, Virginia. WPNSTA Yorktown was placed on the United States Environmental Protection Agency (USEPA) National Priorities List effective October 15, 1992 (USEPA Identification [ID]: VA8170024170).

## 1.2 Statement of Basis and Purpose

This remedy was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended. This decision is based on information contained in the Administrative Record (AR) file for the site. Information not specifically summarized in this ROD or its references[1], but contained in the AR, has been considered and is relevant to the selection of the remedy at Site 22. Thus, the ROD is based upon and relies upon the entire AR file for the site remedy selection decision.

The United States Department of the Navy (Navy) is the lead agency and provides funding for ERP activities at Site 22. The Navy and USEPA Region 3, the lead regulatory agency, issue this ROD jointly. The Commonwealth of Virginia, Virginia Department of Environmental Quality (VDEQ), the support regulatory agency, ~~has reviewed this ROD and the materials on which it is based, and~~ concurs with the ~~decision~~selected remedy.

## 1.3 Assessment of the Site

Groundwater is the only remaining environmental medium to be addressed at Site 22. A no further action ~~(NFA)~~ ROD was signed for soil at Site 22 in ~~September~~ 2003, and a no further action~~n NFA~~ ROD for sediment and surface water at Site 22 was signed in ~~September~~ 2011. Therefore, this ROD serves as the final ROD for Site 22.

Previous investigations concerning groundwater at Site 22 did not identify any potential ecological risks, but did identify the presence of ~~constituents~~ chemicals of concern (COCs) at concentrations that pose a potential threat to human health. Trichloroethene (TCE) in shallow groundwater (Yorktown-Eastover aquifer) was identified as posing a potential risk under the future construction worker exposure scenario. Vinyl chloride (VC) and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) in shallow groundwater (Yorktown-Eastover aquifer) were identified as posing a potential risk under the future residential use exposure scenario.

The response action selected in this ROD is necessary to protect the public health~~,~~ or welfare ~~, and/~~or the environment from actual or threatened releases of hazardous substances into the environment.

[1] Reference phrases, presented as ***Bold Italicized Text***, are followed by a corresponding number from the References Section.

**Commented [SS1]:** EPA Comment 1; consistent with ROD Guidance, Highlight 6-2

**Commented [SS2]:** EPA Comment 29; Acronyms spelled out throughout document

**Commented [SS3]:** EPA Comment 2; constituents changed to chemicals throughout document

**Commented [SS4]:** EPA Comment 3; consistent with ROD Guidance, Highlight 6-3

## 1.4 Description of Selected Remedy

The selected remedy for Site 22 groundwater is comprised of the following components:

- ~~Refining the conceptual site model (CSM) through a pre-design investigation~~
- Implementing Enhanced In Situ Bioremediation ~~(EISB)~~ of RDX using emulsified vegetable oil ~~(EVO)~~ bio-barriers perpendicular to groundwater flow in the target treatment area (with RDX above 100 micrograms per liter ~~([~~µg/L]) to reduce~~accelerate~~ the total time for achieving cleanup levels
- 
- Using monitored natural attenuation (MNA) for the dissolved TCE and VC plumes and the remaining dissolved RDX plume (less than 100 µg/L) following active treatment
- 
- Performance and long-term groundwater monitoring for COCs and monitored natural attenuation parameters

~~Conducting periodic groundwater monitoring and synoptic groundwater level measurements~~

- ~~Enforcing~~ Land Use Controls ~~(LUCs)~~ in the form of ~~land and~~ groundwater use restrictions ~~(controls on intrusive activities such as excavation, residential development, or groundwater use)~~ to prevent contact with and use of groundwater until cleanup levels are met

The selected remedy will address COCs in groundwater at Site 22. The primary source of contamination was the release of chemicals that occurred during waste handling and the burning of materials on the ground surface. The contaminants that were released to the ground surface leached into the soil as a result of infiltration of rain water, causing downward migration of contamination into subsurface soil and ultimately creating a dissolved phase groundwater plume. The contaminated soil at Site 22 was excavated and disposed of offsite in ~~the fall of~~ 2002 resulting in unlimited use and unrestricted exposure to soil at Site 22. Groundwater at Site 22 is not a principal threat waste.

## 1.5 Statutory Determinations

The selected groundwater remedy is protective of human health and the environment, complies with federal and state ~~regulations~~ requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable. This remedy also ~~, and~~ satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants as a principal element through treatment). Because the remedy will result in hazardous substances, pollutants or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the groundwater remedy is, or will be, protective of human health and the environment. ~~the Navy will conduct statutory reviews every 5 years to ensure that the remedy remains protective of human health and the environment. This review will be conducted after the remedy is in place and at the same time as other sites that already require statutory five-year reviews. The next five-year review is scheduled for 2012, therefore, the first five-year review for this site is not expected until 2017.~~

**Commented [SS5]:** EPA Comment 4; Deleted as requested

**Commented [SS6]:** EPA Comment 28; Every effort was used to use plainer English in the ROD without contradicting the PP, bio-barriers was text taken directly from the Proposed Plan; no changes made in this instance.

**Commented [SS7]:** EPA Comment 32; revised to be consistent throughout the document.

**Commented [SS8]:** EPA Comment 28 & 32; deleted synoptic and revised to be consistent with other descriptions of the remedy in the text.

**Commented [SS9]:** Navy Editorial change made as soil has been cleaned up.

**Commented [SS10]:** EPA Comment 5; As agreed to by the EPA during development of the Proposed Plan and discussed in an email (7/27) a specific contingency plan is not included in the ROD.

**Commented [SS11]:** Navy editorial change made

**Commented [SS12]:** EPA Comment 6; consistent with ROD Guidance, Highlight 6-4

## 1.6 ROD Data Certification Checklist

The following information is included in the Decision Summary section of this ROD. Additional information related to Site 22 can be found in the AR.

COCs and their respective concentrations (Section 2.5, **Table 2**)

Current and reasonably anticipated future land use assumptions and current and potential future uses of groundwater (Section 2.6)

Baseline risk represented by the COCs (Section 2.7, **Table 4**)

Cleanup levels established for COCs and the basis for these levels (Section 2.8, **Table 5**)

Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (Section 2.9, **Table 6**)

How source materials constituting principal threats will be addressed (Section 2.10)

Key factor(s) that led to selecting the remedy (such as a description of how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision) (Section 2.11.1)

Potential land and groundwater use that will be available at the site as a result of the selected remedy (Section 2.11.4, **Table 9**)

## 1.7 Authorizing Signatures

| | |
|---|---|
| Captain Lowell D. Crow<br>Commanding Officer<br>Naval Weapons Station Yorktown<br>~~Yorktown, Virginia~~ | Date |
| Ronald J. Borsellino<br>Director<br>Hazardous Site Cleanup Division~~Office of Federal Facility Remediation and Site Assessment~~<br>USEPA (Region 3) | Date |

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# 2 Decision Summary

## 2.1 Site Name, Location, and Description

Site 22 (Burn Pad)
Naval Weapons Station Yorktown
Yorktown, Virginia
USEPA ID: VA8170024170

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 is bounded on the northwest by WPNSTA Yorktown Cheatham Annex and the King's Creek Commerce Center; on the northeast by the York River and the Colonial National Historic Parkway; on the southwest by Route 143 and Interstate 64; and on the southeast by Route 238 and the town of Lackey.

Site 22, the Burn Pad, encompasses a 9-acre area, located in the northeastern portion of WPNSTA Yorktown (**Figure 1**). An access road runs north-south and provides vehicle access to the site from the north (**Figure 2**). Site 22 consists of a grassy field surrounded by woods, situated on a flat, elevated area, with its ground surface sloping steeply to the east, south, and southwest toward the Eastern Branch of Felgates Creek and its unnamed tributary.

FIGURE 1
**Regional Location Map**

FIGURE 2
**Site Map**

## 2.2 Site History and Enforcement Activities

Originally named the United States Mine Depot, WPNSTA Yorktown was established in 1918 to support the laying of mines in the North Sea during World War I. For 20 years after World War I, the depot continued to receive, reclaim, store, and issue mines, depth charges, and related materials. 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. On August 7, 1959, the depot was renamed the United States Naval Weapons Station. 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.

Site 22 was used for burning waste explosives and spent solvents generated from loading operations from the early 1940s until 1995. The ash from the burned solvents and explosives was transported to the Burning Pad Residue Landfill.

Site 22 once contained a 150-foot-diameter, circular array of 11 steel burning pans that were used for burning waste plastic explosives and spent solvents. A historical photograph taken in 1983 is included as **Figure 3**, and shows the numerous burn pads in a circular formation in the central and southern portion of Site 22.

FIGURE 3
**Site 22 Historical Aerial Photograph**

In 1996, a 153-foot by 86-foot biocell was constructed at Site 22 and used for the treatment of nitramine-contaminated soils and trinitrotoluene-contaminated soils from WPNSTA Yorktown Sites 7 and 19 (**Figure 2**). Use of the biocell ended in 1999, and it was subsequently removed.

In 2002, a removal action was completed to remove contaminated soils from Site 22 (**Figure 2**). The COCs included the following: carcinogenic polynuclear aromatic hydrocarbons, ~~Octahydro~~octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine, cadmium, copper, and lead. Contaminated soil was excavated to a depth of 2 feet, and confirmation samples were collected. Approximately 3,450 cubic yards of soil were removed. A ***ROD*** (Ref. 1) was signed in 2003 documenting that ~~NFA~~no further action for unlimited use and unrestricted exposure was necessary for soil at Site 22. In addition, a ***ROD*** (Ref. 2) documenting that ~~NFA~~no further action was necessary for sediment and surface water at Site 22 was signed in ~~September~~ 2011.

Groundwater at Site 22 has been characterized during several investigations. **Table 1** provides a chronological list and brief summary of previous groundwater investigations conducted at Site 22. The respective investigation documents are a part of the AR and can be referenced for further details for specific sampling strategies, media investigations, and when and where the sampling was performed. The documents listed are available in the AR and provide detailed information used to support remedy selection at Site 22.

TABLE 1

Summary of Previous Groundwater Studies and Investigations at Site 22

| Previous Study / Investigation* (Document and Document Date) | Sites | Investigation Activities |
|---|---|---|
| **Round Two Remedial Investigation Report, Sites 4, 21, and 22**<br>Baker, 2001 | Sites 4, 21, and 22~~Sites 4, 21, and 22~~ | 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 (**Figure 4**). Samples were analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds, TCL pesticides/polychlorinated biphenyls, explosives and Target Analyte List metals and cyanide.<br>The ***analytical results*** (Ref. 3) of six groundwater samples at Site 22 were used to complete a Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA). The HHRA indicated no unacceptable non-cancer hazards or cancer risks to current or future receptors under a beneficial use scenario for groundwater. The ERA, which was based on a screening of groundwater concentrations at Site 22 against marine surface water screening levels, indicated aquatic receptors would potentially be at risk from exposure to 1,1-dichloroethene, TCE, di-n-butylphthalate, aldrin, and several explosives and metals if groundwater contaminants from Site 22 were to discharge to a surface water body without dilution or natural attenuation.<br>The ***analytical results*** (Ref. 4) of six co-located surface water and sediment samples at Site 22 were used to complete an HHRA and an ERA. The HHRA indicated no unacceptable non-cancer hazards 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. |
| **Remedial Investigation Report for Groundwater at Sites 4, 21, and 22**<br>CH2M HILL, 2009 | Sites 4, 21, and 22 | From ~~Spring~~ March 2007 to ~~Spring~~ April 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~~ Upstream surface water and sediment samples were also collected to assess site-specific background conditions (Figure 4). Samples were analyzed for TCL VOCs, TCL semivolatile organic compounds, TCL pesticides and polychlorinated biphenyls, explosives, and Target Analyte List metals and cyanide.<br>The analytical results (Ref. 5) of 12 groundwater samples at Site 22 were used to complete an HHRA and ERA. The HHRA indicated potential cancer risks to future residents due to exposure to VC, 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. TCE, heptachlor epoxide, VC, RDX, and arsenic were identified as human health COCs within the Yorktown-Eastover aquifer at Site 22 under a future exposure scenario. However, based on the final results of the remedial investigation (RI), the COCs in groundwater at Site 22 identified for action were TCE, VC, and RDX (refer to Section 2.5.1 of this ROD). The RI concluded that development of a Feasibility Study (FS) for Site 22 groundwater was warranted.<br>The ERA indicated no COCs were identified for seep exposures at Site 22. Similarly, no COCs were identified for food web exposures. Thus, risks to ecological receptors were considered acceptable. Groundwater is generally considered only as a transport medium since there are no ecological exposures to groundwater until it discharges to a water body or surfaces as a seep.<br>The analytical results (Ref 6) of 11 co-located surface water and sediment samples, two independently located sediment samples, and six co-located background surface water and sediment samples were used to complete a HHRA and ERA. The ERA was completed to reevaluate conditions in surface water and sediment following the soil removal action. 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 Site 22; therefore, no additional action was recommended to address surface water and sediment adjacent to the site. |
| **Feasibility Study Report for Groundwater at Site 22**<br>CH2M HILL, 2011 | Site 22 | An FS was generated to evaluate alternatives (Ref. 7) for remediation of TCE, VC, and RDX present at unacceptable levels in the groundwater. The preferred alternative as presented in the FS was Alternative 2 - Hot Spot Treatment of RDX using ~~EISB~~Enhanced In Situ Bioremediation and Associated Performance Monitoring; MNA of TCE, VC and RDX; and ~~LUCs~~Land Use Controls. |

**Commented [SS13]:** EPA Comment 8; Table 1 Font size increased

FIGURE 4
Historical Sample Layout

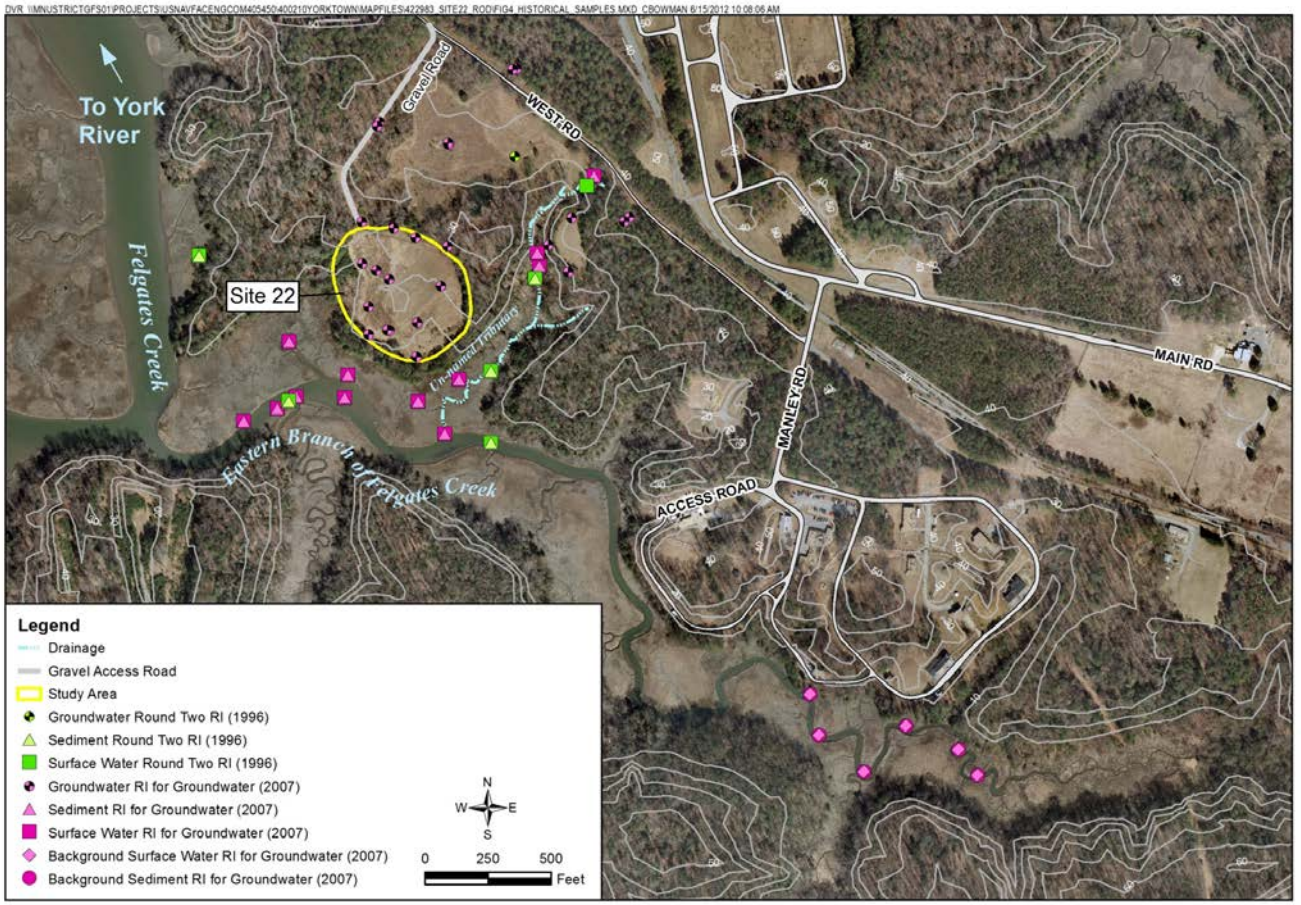


***Figure 4** illustrates the most recent activities conducted at each sampling location at Site 22 (sample locations associated with adjacent Sites 4 and 21 are included for completeness). In instances of samples collected in the same location across multiple reports, the most recent sampling event is shown.

**Commented [SS14]:** EPA Comment 7; As indicated in the note below this figure: In instances of samples collected in the same location across multiple reports, the most recent sampling event is shown. Therefore since the six monitoring wells sampled in 1996 were also sampled in 2007, they are listed as monitoring wells that were sampled in 2007. It was this reason that Figure 4 was not referenced in this summary of investigation activities.

## 2.3 Community Participation

Community participation at WPNSTA Yorktown includes a Restoration Advisory Board (RAB), public meetings, a public information repository, newsletters, fact sheets, public notices, and an ERP Website. The Community Involvement Plan for WPNSTA Yorktown, updated in 2009, provides detailed information on community participation for the ERP. The RAB was formed in 1994 and consists of community members and 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 Site 22, the findings, and the documents in the AR form the basis for this ROD. A Proposed Plan (PP) was developed and made available for public review to request public input on the selected remedy for groundwater. In accordance with 40 Code of Federal Regulations 300.430(f)(3)(i)(A), a notice of availability of the PP was published in *The Virginia Gazette* and the *Daily Press* on May 12 and 13, 2012, respectively. The PP was available for review during the public comment period in accordance with Section 117(a) of CERCLA at the York County Public Library – Yorktown (8500 George Washington Memorial Highway, Yorktown, Virginia 23692, 757-890-3376). The public comment period ran from May 14 through June 28, 2012, and included a public meeting to present the PP, which was held on May 24, 2012 at the York County Public Library – Yorktown. No comments were received during the public comment period.

This ROD, the PP, and all other information that supports the selected remedy for groundwater at Site 22 are available in the AR. The AR is accessible through the WPNSTA Yorktown ERP public website at http://go.usa.gov/yFb or by contacting the WPNSTA Yorktown Public Affairs Officer at:

Public Affairs Office
P.O. Drawer 160
Yorktown, VA 23691-0160
Phone: (757) 887-4939

## 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) to meet the requirements of CERCLA, as amended. WPNSTA Yorktown was added to the National Priorities List 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, 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. Site 22 was 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 for groundwater at Site 22. The selected remedy documented in this ROD for groundwater at Site 22 does not include or affect any other media at Site 22 or any other sites at WPNSTA Yorktown. The WPNSTA Yorktown ERP consists of 31 sites including Site 22 as detailed below:

There are 28 Installation Restoration Program sites at various phased of investigation or cleanup. Although RODs are in place for select media at some sites, below is a summary based on the last media being addressed at each site:

- ~~Fourteen~~ Fifteen (~~14~~15) sites under investigation (Sites 1, 3, 6, 7, 8, 9, 19, 23, 24, 25, 26, 31, 32, 33, and 34)
- One (1) site at the remedy decision stage (Site 22)

**Commented [SS15]:** Navy Editorial change

- Two (2) sites in long-term management (Sites 12 and 16)
- Ten (10) closed sites (Sites 4, 5, 11, 17, 18, 21, 27, 28, 29, and 30)

There are 3 Munitions Response Program sites at various phases of investigation and cleanup. Below is a summary based on the last media being addressed at each site:~~.~~

- Two (2) sites under investigation (UXO 2 and 3)
- One (1) closed site (UXO 1)

## 2.5 Site Characteristics

Site 22 consists primarily of a flat, grass-covered open area surrounded by woods; elevations for the site range from 20 to 32 feet above mean sea level. The southern and eastern edges of the site slope steeply toward the east, south, and southwest, toward the Eastern Branch of Felgates Creek and its unnamed tributary (**Figure 2**). Felgates Creek is a tidally influenced tributary to the York River. A gravel road runs north-south and provides vehicle access to Site 22 from the north. The site is currently unused except for periodic recreational hunting, and is located within a restricted area of WPNSTA Yorktown.

The hydrogeology at Site 22 consists of unsaturated soils at the ground surface, which are lithologically consistent with the Yorktown confining unit (gray silt and clay). The uppermost saturated unit in the Site 22 area is the Yorktown-Eastover aquifer, which lies below the 10- to 30-foot-thick Yorktown confining unit. The Yorktown-Eastover aquifer consists of coarse, shelly, gray sand, and is approximately 25 to 50 feet thick in the vicinity of Site 22. This aquifer overlies the Eastover-Calvert confining unit. There is no current or expected future use for groundwater at Site 22; drinking water is supplied to WPNSTA Yorktown and the surrounding area by the City of Newport News Waterworks.

Groundwater at Site 22 ranges from 5 to 20 feet bgs and flows to the south toward drainage channels and the Eastern Branch of Felgates Creek (**Figure 5**).

A ***conceptual site model***~~***CSM***~~ (Ref. 8) was developed to summarize site conditions, contaminant distribution, transport pathways, potential receptors, exposure pathways, and land use for Site 22 (**Figure 6**). The sources of contamination were releases of chemicals that occurred during waste handling and burning of materials on the ground surface. No subsurface burial of materials at Site 22 is known to have occurred. Some of the contaminants that were released to the ground surface leached into the soil as a result of infiltration of stormwater, causing downward migration of contamination into subsurface soil and ultimately creating a dissolved-phase groundwater plume. Much of the contamination remained relatively close to the land surface due to adsorption to soil. The contaminated soil at Site 22 was excavated and disposed of offsite and ~~an NFA~~a no further action ROD ~~documenting~~ which allows unlimited use of and unrestricted exposure ~~for~~ to soil was signed in ~~November~~ 2003. Contaminant concentrations in the groundwater of the Yorktown-Eastover aquifer at Site 22 are likely to decrease in the future because the source is no longer present and there is no ongoing release mechanism.

**Commented [SS16]:** DEQ Commented on the format difference between this ROD and previous RODs. This format is easier to track and more concise. In addition, this format is consistent with what is presented to the RAB.

**Commented [SS17]:** EPA Comment 33; EPA Comment 5; As agreed to by the EPA during development of the Proposed Plan and discussed in an email (7/27) a specific contingency plan is not included in the ROD.

FIGURE 5
**Yorktown-Eastover Aquifer Potentiometric Surface Map**

FIGURE 6
**Conceptual Site Model**

### 2.5.1 Nature and Extent of Contamination in Groundwater

***Numerous investigations*** (Ref. 9) have been conducted to characterize potential impacts at Site 22 (**Table 1**). Based on the results of these investigations, the COCs in groundwater at Site 22 are TCE, VC, and RDX. Sampling locations from previous investigations are depicted on **Figure 4**, and the nature and extent of contamination is discussed as follows. Maximum concentrations of ~~constituents~~chemicals identified as site COCs detected in Site 22 groundwater are presented in **Table 2**.

TABLE 2
Maximum Detected Concentrations of Site 22 ~~Constituents~~ Chemicals of Concern

| VOCs | Concentration (µg/L) | MCL (µg/L) |
|---|---|---|
| TCE | 650 | 5 |
| VC | 17 | 2 |
| **Explosives** | **Concentration (µg/L)** | **RSL (µg/L)** |
| RDX | 150 | 0.61 |

The ~~***Results***~~ ***results*** (Ref. 10) of the investigations at Site 22 indicated that TCE, VC, and RDX concentrations exceeded their respective Maximum Contamination Level (MCL) or Regional Screening Level (RSL) in shallow groundwater. TCE was detected at concentrations exceeding the MCL (5 µg/L) in five shallow monitoring wells, VC was detected at concentrations exceeding the MCL (2 µg/L) in two shallow monitoring wells, and RDX was detected at concentrations exceeding the RSL (0.61 µg/L) in 10 shallow monitoring wells.

TABLE 3
TCE and Associated Degradation Products in Monitoring Well YS22-GW04 at Site 22

| VOCs (µg/L) | 11/12/1996 | 10/25/2007 |
|---|---|---|
| **TCE** | 1200 | 69 |
| **1,1-Dichloroethene** | 1700 | 37 |
| **cis-1,2-Dichloroethene** | Not Analyzed | 22 |
| **trans-1,2-Dichloroethene** | Not Analyzed | 10U |
| ***Total 1,2-Dichloroethene*** | *370* | *32* |
| **VC** | Not Detected | 10U |

U - The material was analyzed for, but not detected.

The TCE, VC, and RDX groundwater contamination is present in a "corridor" that runs through the middle of Site 22 from north to south (**Figure 7**). Analytical results indicated the VOCs and RDX detected in groundwater were within the upper portion of the Yorktown-Eastover aquifer. The highest concentrations of TCE, VC, and RDX were detected between 10 and 50 feet bgs along the central portion of the site in sand containing a number of silt and clay stringers that may be retarding the downward mobility of the contaminants. No COCs were identified in samples taken from the base of the Yorktown-Eastover aquifer, which lies above the Eastover Calvert confining unit. Contaminant discharge to surface water via groundwater was not found to exceed any risk screening values (adjusted RSLs or ecological screening values) at Site 22; groundwater is therefore not a significant continuing source of contaminants to the aquatic habitats adjacent to the site.

### 2.5.2 Fate and Transport of COCs in Groundwater

The lateral groundwater seepage velocity at Site 22 is approximately 0.128 ~~foot~~ feet per day. However, contaminants are not expected to migrate as rapidly as groundwater because of a tendency for sorption to soil particles (retardation). Contaminants may also be migrating in groundwater through dispersion, which may slowly increase the size of the contaminant plume in groundwater. Volatilization of some contaminants from the groundwater into the air is also a possible migration pathway where elevated concentrations of chlorinated solvents are present.

**TCE and VC**

The source of TCE and its degradation product, VC, are likely releases from burn activities previously conducted at Site 22. Chlorinated VOC concentrations such as TCE and VC can change over time due to dilution and dispersion, but the primary mechanism for reductions under naturally occurring conditions is ***biodegradation*** (Ref. 11). Although, the EPA has expressed uncertainty regarding the long term success of monitored natural attenuation at the site, ~~Historical~~ historical groundwater data for monitoring well YS22-GW04 demonstrate a clear and meaningful trend of decreasing contaminant mass and/or concentration over time (**Table 3**). In addition, other sites at WPNSTA Yorktown, which share similar contaminants and aquifer characteristics, have demonstrated that the MNA process is a viable component of the selected groundwater remedy.

**Commented [SS18]:** EPA Comment 39; YS22-GW04 is highlighted in the text and Table 3 because it demonstrates the decreasing TCE and VC trends. It should also be noted that decreasing trends were observed in the wells where multiple sampling events took place. In the case of YS22-GW10, only one round of groundwater samples have been collected; however the decreasing trends will be confirmed during the pre-design investigation. However, these natural attenuation is expected to be taking place because YS22-GW10 is the most downgradient monitoring well and no VOCs were detected in the downgradient surface water.

**Commented [SS19]:** EPA Comment 33; Uncertainty about whether MNA is occurring at this site was added.

FIGURE 7
**Remedial Goal Exceedances TCE and RDX**

Note: Remedial goals are detailed in Section 2.8.

Biodegradation of chlorinated ethenes (such as TCE and VC) occurs through two primary mechanisms: ~~is a well-understood process whereby these VOCs undergo transformations through two primary pathways: use as an electron acceptor by dehalorespiring organisms (~~co-metabolism and reductive dechlorination.~~) or by co-metabolism (~~ Co-metabolism occurs as a fortuitous destruction of contaminants by organisms intending to metabolize other organic compounds~~)~~. Reductive dechlorination occurs as part of a microbial respiratory process called halorespiration. ~~Biological reductive dechlorination is a microbially mediated process in which chlorinated VOCs serve as the electron acceptor for metabolism, coupled with oxidation of an available electron donor. Reductive dechlorination results in the~~ As halorespiring organisms make energy, each chlorine ion on the chlorinated VOC molecule is sequentially ~~replacement~~ replaced ~~of a chlorine atom on the chlorinated VOC molecule~~ with hydrogen. Once all chlorine ions have been replaced, ~~and can ultimately lead to complete dechlorination to~~ only innocuous end-products, such as chloride, ethene, and ethane remain. *Dehalococcoides sp.* is the primary organism known to be capable of completely degrading contaminants like TCE to innocuous end products. This organism thrives under oxygen depleted (reducing) conditions. ~~Another process whereby VC undergoes biodegradation is through direct intracellular oxidation by oxygen-dependent microbes, which can use the contaminant as an energy source.~~ The reductive dechlorination type of ~~Biodegradation~~ biodegradation is currently occurring at Site 22. This is evidenced by the presence of the *Dehalococcoides sp.* and partially degraded TCE. TCE contains three chlorine ions. Cis-1,2-DCE contains two chlorine ions and VC contains only one. The presence of these less-chlorinated compounds indicates that halorespiring organisms are removing the chlorines through their respiratory process. ~~of chlorinated ethenes is a mechanism of degradation at Site 22, as evidenced by the presence of TCE daughter products and Dehalococcoides bacterial species at the site~~.

**Commented [SS20]:** EPA Comment 9; Every effort was used to use plainer English in the ROD without contradicting the PP

Geochemical and microbial samples were collected from two wells (YS22-GW01 and YS22-GW04) at Site 22. Results from these two locations suggest the site is characterized by low concentrations of native and/or anthropogenic carbon (0.5U and 1.0 milligram per liter, respectively). Since microbial utilization of a carbon source drives reductive dechlorination, ~~EISB~~Enhanced In Situ Bioremediation at Site 22 will create enhanced bioremediation conditions. In addition to the geochemical data, the presence of the *Dehalococcoides sp.* bacterial species (0.134J and 0.493 cells per milliliter, in monitoring wells YS220GW01 and YS22-GW04, respectively), which is the only microbe identified to be capable of degrading chlorinated ethenes completely to ethane, was identified at Site 22.

**Commented [SS21]:** EPA Comment 10; two separate results because samples were collected from two monitoring wells, revisions made to clarify.

**RDX**

The source of RDX are likely releases from burn activities previously conducted at Site 22. RDX can be biodegraded under most redox conditions and by a variety of microorganisms. Three mechanisms for the biodegradation of RDX have been identified: two-electron reduction, single-electron reduction/denitration, and direct enzymatic cleavage. The denitration pathway is considered the major pathway for biodegradation in the natural environment, resulting in the formation of ~~benign~~ products such as nitrite, ammonia, formaldehyde, and formic acid. Under ideal (laboratory) conditions, the biodegradation rate for RDX is exponential, and could decay as much as 1 to 5 times in a day (that is, a half-life of 0.2 to 1 day). RDX is not volatile and not very mobile; therefore, biodegradation is believed to be the primary attenuation mechanism for this chemical.

**Commented [SS22]:** EPA Comment 11; deleted benign

## 2.6 Current and Potential Future Land and Resource Uses

Site 22 is currently unused except for periodic recreational hunting, and is predominantly characterized by vegetated fields within a locked wire gate. Site 22 is located inside an area encumbered by the Explosive Safety Quantity Distance, which limits the activities that can be performed to explosives-related functions; therefore, the site cannot be developed for real estate purposes. It is anticipated that WPNSTA Yorktown will remain a military installation for the foreseeable future, and use of Site 22 will remain the same.

Groundwater from the Yorktown-Eastover aquifer in the vicinity of Site 22 is not a current or anticipated future source of drinking water at WPNSTA Yorktown due to generally low natural water quality and yield and a more readily available potable water source. Potable water at WPNSTA Yorktown is currently supplied by the City of

Newport News Waterworks. However, the Commonwealth of Virginia considers all aquifer groundwater of potential beneficial use as potable water.

Commented [SS23]: EPA Comment 34; revised as requested.

## 2.7 Summary of Site Risks

The baseline risk assessment estimates what risks the site poses if no action was taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for this site.

Potential human health and ecological risks at Site 22 were evaluated for groundwater and documented in the 2009 RI report (**Appendix A**). The following subsections and **Table 4** briefly summarize the findings of the risk assessments.

### 2.7.1 Summary of Human Health Risk Assessment

As part of the 2009 RI report for Site 22, an HHRA was completed. Based on the human health conceptual site model~~CSM~~ (**Appendix B**), risks were quantitatively evaluated for future adult construction workers and future adult/child residents exposed to shallow groundwater using reasonable maximum exposure (RME) and central tendency exposure (CTE) scenarios. Exposure pathways that were quantified included inhalation/ingestion of and dermal contact with groundwater for hypothetical future lifetime adult and child residents and ingestion and dermal contact with groundwater for hypothetical future construction workers. Based on current site use and conditions, there are no ***complete exposure pathways*** (Ref. 12) for groundwater at Site 22. The vapor intrusion pathway was not evaluated as part of this RI (the pathway is incomplete, there are no buildings); potential future risk for the vapor intrusion pathway will be addressed in the LUC RD.

Commented [SS24]: EPA Comment 35; added information about potential risk due to vapor intrusion.

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 chemicals of potential concern. 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.

***Potential unacceptable human health risks*** (Ref. 13) were identified under a future resident and/or construction worker exposure scenario due to exposure to TCE, heptachlor epoxide, VC, RDX, and arsenic within the Yorktown-Eastover aquifer (**Table 4**).

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TABLE 4

**Summary of Potential Human Health Risks for Site 22 COCs**

| Receptor | Exposure Pathway | COC | Exposure Point Concentration | RME Cancer Risk | RME Non-Cancer Risk (HI) | CTE Cancer Risk | CTE Non-Cancer Risk (HI) | Cancer Toxicity Factor (Cancer Slope Factor) milligrams per kilogram per day$^{-1}$ | Non-Cancer Toxicity Factor (Reference Dose) milligrams per kilograms per day |
|---|---|---|---|---|---|---|---|---|---|
| Future Resident Adult | Ingestion | VC | 17 | N/A | 0.16 | Not Applicable (N/A) | 0.016 | 0.72 | 0.003 |
| | | Heptachlor epoxide | 0.142 | N/A | 0.3 | N/A | 0.089 | 9.1 | 0.000013 |
| | | RDX | 94.17 | N/A | 0.86 | N/A | 0.076 | 0.11 | 0.003 |
| | | Arsenic | 6.96 | N/A | 0.64 | N/A | 0.21 | 1.5 | 0.0003 |
| | | Total* | -- | -- | **2.9[1]** | -- | 0.62 | -- | -- |
| | Dermal Contact | VC | 17 | N/A | 0.0083 | N/A | 0.00077 | 0.72 | 0.003 |
| | | Heptachlor epoxide | 0.142 | N/A | 0.62 | N/A | 0.17 | 9.1 | 0.000013 |
| | | RDX | 94.17 | N/A | 0.0077 | N/A | 0.00064 | 0.11 | 0.003 |
| | | Arsenic | 6.96 | N/A | 0.0033 | N/A | 0.00068 | 1.5 | 0.0003 |
| | | Total* | -- | -- | 0.8 | -- | 0.21 | -- | -- |
| | Inhalation/Shower | TCE | 315 | 1.6 x 10-5 | 0.039 | 4.0 x $10^{-6}$ | 0.026 | 0.007 | 0.17 |
| | | VC | 17 | 2.7 x 10-6 | 0.018 | 6.8 x $10^{-7}$ | 0.012 | 0.015 | 0.029 |
| | | Total* | -- | 3.3 x 10-5 | 0.1 | 8.2 x $10^{-6}$ | 0.9 | -- | -- |
| | Total Across All Exposure Routes | -- | -- | 3.3 x 10-5 | **3.8[1]** | 8.2 x $10^{-6}$ | 0.07 | -- | -- |
| Future Resident Child | Ingestion | VC | 17 | N/A | 0.36 | N/A | 0.053 | 0.72 | 0.003 |
| | | Heptachlor epoxide | 0.142 | N/A | 0.70 | N/A | 0.30 | 9.1 | 0.000013 |
| | | RDX | 94.17 | N/A | **2.0** | N/A | 0.25 | 0.11 | 0.003 |
| | | Arsenic | 6.96 | N/A | **1.5** | N/A | 0.70 | 1.5 | 0.0003 |
| | | Total* | -- | -- | **6.8** | -- | **2.1** | -- | -- |
| | Dermal Contact | VC | 17 | N/A | 0.020 | N/A | 0.0015 | 0.72 | 0.003 |
| | | Heptachlor epoxide | 0.142 | N/A | **1.4** | N/A | 0.34 | 9.1 | 0.000013 |
| | | RDX | 94.17 | N/A | 0.017 | N/A | 0.0013 | 0.11 | 0.003 |
| | | Arsenic | 6.96 | N/A | 0.0098 | N/A | 0.0015 | 1.5 | 0.0003 |
| | | Total* | -- | -- | **1.8** | -- | 0.41 | -- | -- |
| | Total Across All Exposure Routes | -- | -- | N/A | **8.7** | N/A | **2.5** | -- | -- |
| Future Lifetime Resident (Adult/Child) | Ingestion | TCE | 315 | 6.1 x 10-5 | N/A | 5.3 x $10^{-6}$ | N/A | 0.013 | N/A |
| | | VC | 17 | **1.8 x 10-4** | N/A | 1.4 x $10^{-5}$ | N/A | 0.72 | 0.003 |
| | | Heptachlor epoxide | 0.142 | 1.0 x 10-5 | N/A | 4.4 x $10^{-6}$ | N/A | 9.1 | 0.000013 |
| | | RDX | 94.17 | **1.5 x 10-4** | N/A | 1.0 x $10^{-5}$ | N/A | 0.11 | 0.003 |
| | | Arsenic | 6.96 | **1.6 x 10-4** | N/A | 3.9 x $10^{-5}$ | N/A | 1.5 | 0.0003 |
| | | Total* | -- | **6.4 x 10-4** | N/A | 8.7 x $10^{-5}$ | N/A | -- | -- |
| | Dermal Contact | TCE | 315 | 1.0 x 10-5 | N/A | 6.0 x $10^{-7}$ | N/A | 0.013 | N/A |
| | | VC | 17 | 9.8 x 10-6 | N/A | 4.9 x $10^{-7}$ | N/A | 0.72 | 0.003 |
| | | Heptachlor epoxide | 0.142 | 4.0 x 10-5 | N/A | 6.1 x $10^{-6}$ | N/A | 9.1 | 0.000013 |
| | | RDX | 94.17 | 1.4 x 10-6 | N/A | 6.2 x $10^{-8}$ | N/A | 0.11 | 0.003 |
| | | Arsenic | 6.96 | 8.9 x 10-7 | N/A | 9.8 x $10^{-8}$ | N/A | 1.5 | 0.0003 |
| | | Total* | -- | 8.4 x 10-5 | N/A | 1.1 x $10^{-5}$ | N/A | -- | -- |
| | Inhalation/Shower | TCE | 315 | 1.6 x 10-5 | N/A | 4.0 x $10^{-6}$ | N/A | 0.007 | 0.17 |
| | | VC | 17 | 2.7 x 10-6 | N/A | 6.8 x $10^{-7}$ | N/A | 0.015 | 0.029 |
| | | Total* | -- | 3.3 x 10-5 | N/A | 8.2 x $10^{-6}$ | N/A | -- | -- |
| | Total Across All Exposure Routes | -- | -- | **7.6 x 10-4** | N/A | **1.1 x 10-4** | N/A | -- | -- |
| Future Construction Worker - Adult | Dermal Contact | TCE | 315 | 1.7 x 10-7 | N/A | 2.3 x $10^{-8}$ | N/A | 0.013 | N/A |
| | | VC | 17 | 2.3 x 10-7 | 0.0074 | 2.6 x $10^{-8}$ | 0.00085 | 0.72 | 0.003 |
| | | Heptachlor epoxide | 0.142 | 4.4 x 10-7 | 0.26 | 2.0 x $10^{-7}$ | 0.12 | 9.1 | 0.000013 |
| | | RDX | 94.17 | 1.7 x 10-8 | 0.0036 | 2.1 x $10^{-9}$ | 0.00044 | 0.11 | 0.003 |
| | | Arsenic | 6.96 | 4.4 x 10-8 | 0.0068 | 1.7 x $10^{-8}$ | 0.0026 | 1.5 | 0.0003 |
| | | Total* | -- | 1.2 x 10-6 | 0.47 | 4.0 x $10^{-7}$ | 0.17 | -- | -- |
| | Inhalation | TCE | 315 | 2.2 x 10-5 | **1.3** | 1.3 x $10^{-6}$ | 0.077 | 0.007 | 0.17 |
| | | VC | 17 | 3.9 x 10-6 | 0.61 | 2.0 x $10^{-7}$ | 0.032 | 0.015 | 0.029 |
| | | Total* | -- | 4.8 x 10-5 | **3.3** | 3.7 x $10^{-6}$ | 0.28 | -- | -- |
| | Total Across All Exposure Routes | -- | -- | 4.9 x 10-5 | **3.7** | 4.1 x $10^{-6}$ | 0.45 | -- | -- |

*Exposure pathway totals are additive and include all chemicals that contribute to potential risk

1 = No COCs identified with an HI >1

**Bold**/Yellow Shaded text indicates potential unacceptable human health risk

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Although arsenic and heptachlor epoxide contributed to the total RME cancer risk for the future lifetime resident (adult/child) scenario, the Navy, in partnership with USEPA and VDEQ, agree that no additional action is required for these ~~constituents~~ chemicals for the following reasons:

- Although arsenic was considered a human health COC under the RME scenario, concentrations of arsenic did not pose risk under the CTE scenario
- Dissolved arsenic concentrations did not exceed the MCL (10 µg/L)
- Arsenic concentrations are consistent with natural background concentrations rather than a site-related CERCLA source
- Heptachlor epoxide (YS22-GW03 at 0.21 µg/L) only slightly exceeded the MCL (0.2 µg/L) in 1 out of 13 samples
- The low concentrations of heptachlor epoxide suggest its presence is attributable to routine pesticide treatment activities by the base and not a CERCLA-regulated release

The HHRA concluded TCE and VC in groundwater exceed MCLs and contribute to potential risk under hypothetical future exposure scenarios in the upper portion of the Yorktown-Eastover aquifer. No MCL exists for RDX, but concentrations were found to pose potential risk under hypothetical future exposure scenarios. COCs were not detected above MCLs or RSLs in the deep portion of the Yorktown-Eastover aquifer. The Navy, in partnership with USEPA and VDEQ, agree that remedial action for groundwater is necessary to address TCE, VC, and RDX in the upper portion of the Yorktown-Eastover aquifer.

### 2.7.2 Summary of Ecological Risk Assessment

As part of the 2009 RI report for Site 22, an ERA was completed. Complete pathways for ecological receptors were limited to exposure to surface water, surface sediment, and surface soil. Surface soil was not evaluated in the ERA because risks associated with this medium were addressed during the previous remedial action. Groundwater was considered only as a transport medium since there were no ecological exposures to groundwater until it discharged to a water body or surfaced as a seep. Based on the results of the ERA, the Navy, USEPA Region 3, and VDEQ agree that groundwater at Site 22 does not pose unacceptable ecological risks to current receptors based on the following:

- No ecological COCs were identified for surface water, sediment, or seep exposures (~~NFA~~no further action - ROD signed in ~~September~~ 2011)
- Source areas were removed during previous site activities
- Groundwater is not a significant continuing source of contaminants to the aquatic habitats adjacent to the site~~.~~

The ERA concluded there ~~are~~ is ***no potentially unacceptable risk*** (Ref. 14) due to exposure to groundwater seeps, surface water, or sediment at Site 22. The Navy, in partnership with the USEPA and VDEQ agree that no further action for groundwater is necessary to prevent exposure to ecological receptors.

### 2.7.3 Basis for Response Action

~~It is the current judgment of the Navy and USEPA, with the concurrence of VDEQ, that T~~the selected groundwater remedy in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

**Commented [SS25]:** Navy editorial change

While there are no potential ecological risks from exposure to site groundwater, there are potential future human health risks from TCE, VC, and RDX. TCE in shallow groundwater (Yorktown-Eastover aquifer) was identified as posing a potential risk under the future construction worker exposure scenario, and VC and RDX in shallow groundwater (Yorktown-Eastover aquifer) were identified as posing a potential risk under the future residential use exposure scenario (**Table 4**).

## 2.8 Remedial Action Objectives

The site-specific remedial action objectives (RAOs) for Site 22 groundwater are as follows:

- Reduce TCE, VC, and RDX concentrations in groundwater to established risk-based cleanup levels.
- Prevent human (residential and construction worker) exposure to groundwater until cleanup levels are met.

Commented [SS26]: EPA Comment 12; Comment noted. The Navy (including Navy Legal) believes the proposed addition to the text is vague to be included as a RAO.

Cleanup levels for groundwater were developed for site-related COCs (TCE, VC, and RDX) with cancer risks exceeding 1 in 10,000 or with concentrations exceeding the established MCLs (**Table 5**). MCLs were used to establish the groundwater cleanup levels for TCE and VC (5 µg/L and 2 µg/L, respectively). Attainment of MCLs is considered to be protective and suitable for unlimited use and unrestricted exposure. Because no MCL has been established for RDX, a risk-based cleanup level of 6 µg/L was calculated. Cleanup level exceedances for TCE and RDX are spatially shown on **Figure 7**; VC exceeded the MCL in two wells located within the TCE plume (22GW09 and 22GW11) and fall within the footprint of the TCE plume, and therefore is not shown. The cleanup level for RDX was determined based on Remedial Goal Option calculations, which incorporate pathways for the ingestion, dermal absorption, and inhalation of volatiles and particulates for future residents using the same exposure assumptions as the HHRA.

TABLE 5
Remediation Goals (Cleanup Levels) for COCs at Site 22

| COC | Remediation Goal (µg/L) |
|---|---|
| TCE | 5 µg/L |
| VC | 2 µg/L |
| RDX | 6 µg/L |

## 2.9 Description of Remedial Alternatives

The objective of this section is to provide a brief explanation of the remedial alternatives developed for Site 22 groundwater.

### 2.9.1 Description of Remedy Components

Remedial alternatives were ***developed and evaluated*** (Ref. 15) to address COCs in groundwater at Site 22, as detailed in the 2011 FS Report. Following the initial screening of groundwater remediation technologies, the following remedial alternatives were selected for detailed evaluation and comparative analysis:

- **Alternative 1** – No Action
- **Alternative 2** – Hot Spot Treatment of RDX using ~~EISB~~Enhanced In Situ Bioremediation and Associated Performance Monitoring; MNA of TCE, VC, and RDX; and ~~LUCs~~Land Use Controls
- **Alternative 3** – Hot Spot Treatment of RDX, TCE, and VC using In situ Chemical Oxidation (ISCO) and Associated Performance Monitoring; MNA of TCE, VC and RDX; and ~~LUCs~~Land Use Controls
- **Alternative 4** – Hot Spot Treatment of TCE, VC, and RDX using ~~EISB~~Enhanced In Situ Bioremediation and Associated Performance Monitoring; MNA of TCE, RDX, and VC; and ~~LUCs~~Land Use Controls

Based on the results of the alternatives evaluation, Hot Spot Treatment of RDX using ~~EISB~~Enhanced In Situ Bioremediation and Associated Performance Monitoring; MNA of TCE, VC, and RDX; and ~~LUCs~~Land Use Controls (Alternative 2) was selected as the Preferred Alternative. With the exception of the No Action alternative (Alternative 1), each of the alternatives includes monitoring and implementation of ~~LUCs~~Land Use Controls to prevent exposure and control changes in site use. A No Action ~~Alternative~~ alternative is required by the National Oil and Hazardous Substances Pollution Contingency Plan and serves as the baseline against which the other alternatives are compared. For Alternatives 2, 3, and 4, monitoring and ~~LUCs~~Land Use Controls would be

Commented [SS27]: EPA Comment 32; revised for consistency throughout the document

maintained until the RAOs are met, with 5-year statutory reviews to ensure protection of human health and the environment. A description of each remedial alternative is provided in **Table 6**.

TABLE 6
Description of Remedial Alternatives for Site 22

| Alternative | Components | Details | Cost |
|---|---|---|---|
| 1-No Action | None | Allow the COCs to breakdown naturally over time. | Capital Cost: $0<br>O&M Present Value: $0<br>Total Present Value: $0<br>Cost Estimate Timeframe:<br>0 years |
| 2-Hot Spot Treatment of RDX using ~~EISB~~Enhanced In Situ Bioremediation and Associated Performance Monitoring, MNA of TCE, VC, and RDX; and ~~LUCs~~Land Use Controls | • Implementing ~~EISB~~Enhanced In Situ Bioremediation using emulisified vegetable oil bio-barriers in areas where RDX concentrations exceed 100 µg/L ~~using EVO bio-barriers~~<br>• MNA for dissolved TCE and ~~,~~ VC plumes~~,~~ and the remaining RDX plume~~s where concentrations are~~ (less than100 µg/L) following active treatment<br>• Performance and long-term groundwater monitoring for COCs and monitored natural attenuation parameters<br>• ~~Conducting periodic groundwater monitoring and water level measurements~~<br>• ~~LUCs~~Land Use Controls | Injecting a suitable insoluble substrate to the subsurface providing a carbon source for microorganisms to enhance~~s~~ the biodegradation of RDX.<br>Regular, long-term monitoring performed to demonstrate that:<br>• COC concentrations continue to decrease<br>• Potentially toxic transformation products are not created at levels that are a threat to human health<br>• Impacted area is not expanding<br>• There are no changes in hydrogeologic, geochemical, or microbiological parameters that might reduce the effectiveness of the Remedial Action<br>~~LUCs~~Land Use Controls to prevent contact with and use of groundwater until cleanup levels are met~~exposure and control changes in site use~~.<br>5-year reviews | Capital Cost: $708,026<br>O&M Present Value:$1,028,565<br>Total Present Value:$1,907,000<br>Cost Estimate Timeframe:<br>34 years |
| 3-Hot Spot Treatment of RDX, TCE and VC using ISCO and Associated Performance Monitoring; MNA of TCE, VC, and RDX; and ~~LUCs~~Land Use Controls | • ISCO using permanganate (MN04) in active target treatment areas where TCE, VC, and RDX concentrations exceed100 µg/L<br>• MNA for dissolved TCE, VC, and RDX plumes where concentrations are less than100 µg/L<br>• Performance and long-term groundwater monitoring for COCs and monitored natural attenuation parameters<br>• ~~Conducting periodic groundwater monitoring and water level measurements~~<br>• ~~LUCs~~Land Use Controls | Injection of oxidizing agent to promote abiotic, in situ oxidation of COCs through reaction of oxidants with COCs to produce innocuous substances such as carbon dioxide, water, and chloride.<br>Electron donor source is provided to enhance naturally occurring reductive dechlorination process.<br>Regular, long-term monitoring performed to demonstrate that:<br>• COC concentrations continue to decrease<br>• Potentially toxic transformation products are not created at levels that are a threat to human health<br>• Impacted area is not expanding<br>• There are no changes in hydrogeologic, geochemical, or microbiological parameters that might reduce the effectiveness of the Remedial Action<br>Land Use Controls to prevent contact with and use of groundwater until cleanup levels are met ~~LUCs prevent exposure and control changes in site use.~~<br>5-year reviews | Capital Cost:$1,228,931<br>O&M Present Value:$833,902<br>Total Present Value:$2,482,000<br>Cost Estimate Timeframe:<br>25 years |
| 4-Hot Spot Treatment of TCE, VC, and RDX using ~~EISB~~Enhanced In Situ Bioremediation and Associated Performance Monitoring; MNA of TCE, RDX, and VC; and ~~LUCs~~Land Use Controls | • ~~EISB~~Enhanced In Situ Bioremediation of RDX, TCE, and VC using ~~EVO~~emulsified vegetable oil bio-barriers in areas with TCE, VC, and RDX concentrations greater than 100 µg/L<br>• MNA for dissolved RDX, TCE, and VC plumes where concentrations are less than100 µg/L<br>• Performance and long-term groundwater monitoring for COCs and monitored natural attenuation parameters<br>• ~~Conducting periodic groundwater monitoring and water level measurements~~<br>• ~~LUCs~~Land Use Controls | Injection of substrates into groundwater to facilitate reductive chlorination, thereby producing an electron donor source for biodegradation.<br>Regular, long-term monitoring performed to demonstrate that:<br>• COC concentrations continue to decrease<br>• Potentially toxic transformation products are not created at levels that are a threat to human health<br>• Impacted area is not expanding<br>• There are no changes in hydrogeologic, geochemical, or microbiological parameters that might reduce the effectiveness of the Remedial Action<br>Land Use Controls to prevent contact with and use of groundwater until cleanup levels are met ~~LUCs prevent exposure and control changes in site use.~~<br>5-year reviews | Capital Costs: $1,024,061<br>O&M Present Value: $994,759<br>Total Present Value: $2,718,000<br>Cost Estimate Timeframe:<br>29 years |

**Commented [SS28]:** EPA Comment 32; revised to be consistent throughout the document.

**Commented [SS29]:** EPA Comment 32; revised to be consistent throughout the document.

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## 2.9.2 Summary of Comparative Analysis of Alternatives

~~A comparative analysis of the four alternatives and the optimization remedy component with respect to the nine evaluation criteria was completed and is summarized in **Table 7**~~This section summarizes a comparison and analysis of the four alternatives with respect to the National Contingency Plan's nine evaluation criteria. The nine criteria are summarized in **Table 7**. It is Navy policy to evaluate and optimize remedy efficiencies; therefore, each alternative includes ~~A~~an optimization effort ~~remedy component includes the~~for development of a plan for additional plume treatment if ~~an~~ the Navy, USEPA, and VDEQ determine through routine monitoring that the alternative is not performing as anticipated~~unacceptable risk is indicated during monitoring~~ and 5-year reviews. **Table 8** depicts a comparison of the alternatives to the criteria ~~to support ranking of the alternatives~~. Alternative 1 (No Action) does not achieve RAOs designed to protect human health and the environment; therefore, it fails the first threshold criterion and is not considered further in this ROD.

**Commented [SS34]:** EPA Comment 36; recommended changes made to text.

**Commented [SS35]:** EPA Comment 14; As agreed to by the EPA during development of the Proposed Plan and discussed in an email (7/27) a contingency plan is not included in the ROD.

**Commented [SS36]:** EPA Comment 13; removed reference to optimization remedy component and replaced with revised text

**Commented [SS37]:** EPA Comment 15; revised to address EPA Comment

TABLE 7
Evaluation Criteria for Remedial Alternative Analysis

| CERCLA Criteria | Definition |
|---|---|
| **Threshold Criteria** | |
| Protection Of Human Health And The Environment | Addresses whether an alternative provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through ~~mitigation~~treatment, engineering controls, or institutional controls. |
| Compliance with Applicable Or Relevant And Appropriate Requirements (ARARs) | Addresses whether an alternative will meet all of the ARARs ~~or other federal and state environmental laws and/~~or justifies a waiver of the requirements. |
| **Primary Balancing Criteria** | |
| Long-Term Effectiveness And Permanence | Addresses the expected residual risk and the ability of an alternative to maintain reliable protection of human health and the environment over time, once clean-up goals have been met. |
| Reduction In Toxicity, Mobility, Or Volume Through Treatment | Discusses the anticipated performance of the treatment technologies an alternative may employ. |
| Short-Term Effectiveness | Considers the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved. |
| Implementability | Evaluates the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement an option. |
| Present-Worth Cost | Compares the estimated initial, O&M, and present-worth costs. |
| **Modifying Criteria** | |
| State Acceptance | Considers the state agency response to the remedial alternative described in the Proposed Plan~~comments on the PP~~. |
| Community Acceptance | Provides the public's general response to the remedial alternatives described in the ~~PP~~Proposed Plan. The specific responses to the public comments are addressed in the "responsiveness summary" section of the ROD. |

TABLE 8
Relative-Ranking of Remedial Alternatives

| CERCLA Criteria | No Action (ALT 1) | ~~EISB~~Enhanced In Situ Bioremediation and Performance Monitoring of RDX with MNA of TCE, VC, and RDX and ~~LUCs~~Land Use Controls (ALT 2) | ISCO, Performance Monitoring and MNA of TCE, VC, and RDX and ~~LUCs~~Land Use Controls (ALT 3) | ~~EISB~~Enhanced In Situ Bioremediation, Performance Monitoring, and MNA of TCE, VC, and RDX and ~~LUCs~~Land Use Controls (ALT 4) |
|---|---|---|---|---|
| **Threshold Criteria** | | | | |
| Protection of human health and the environment | ❍ | ● | ● | ● |
| Compliance with ARARs | N/A | ● | ● | ● |
| **Primary Balancing Criteria** | | | | |
| Long-term effectiveness and permanence | ❍ | ● | ● | ● |
| Reduction in toxicity, mobility, or volume through treatment | ❍ | ● | ● | ● |
| Short-term effectiveness | ❍ | ⭘ | ⭘ | ⭘ |
| Implementability | ● | ⭘ | ⭘ | ⭘ |
| Cost | N/A | ● $1,907,000 | ⭘ $2,482,000 | ⭘ $2,718,000 |
| **Modifying Criteria** | | | | |
| State Acceptance | NC | ~~N~~C | NC | NC |
| Community Acceptance | NC | ~~N~~C | NC | NC |

Ranking: ● High ⭘ Moderate ❍ Low N/A=Not Applicable

Rankings are provided as qualitative descriptions of the relative compliance of each alternative with the criteria.

NC = No significant comments were received from State or Community Members on the Proposed Plan.

C = Concurrence received from the State and Community Members on the with the preferred alternative

**Commented [SS38]:** EPA Comment 16; revised to clarify that the VDEQ concurred with the preferred alternative.

## Threshold Criteria

### Overall Protection of Human Health and the Environment

With the exception of Alternative 1 (No Action), each alternative ~~is protective of~~protects human health and the environment by reducing or controlling risks posed by the site through treatment and/or ~~LUCs~~Land Use Controls. Alternative 2 employs treatment to reduce RDX concentrations in a faster timeframe than would occur naturally. Alternatives 3 and 4 employ treatment to reduce concentrations in the RDX, TCE, and VC target areas to reduce the remedial timeframe. Performance monitoring will be conducted to confirm that the remedies are functioning and protective, and that ~~LUCs~~Land Use Controls ~~will be~~have been implemented and maintained to provide adequate protection of human health and the environment by controlling exposure to contaminated ~~site media~~groundwater and potential vapor intrusion until ~~RAOs are met~~cleanup levels are met.

**Commented [SS39]:** EPA Comment 32; revised to be consistent throughout the document

## Compliance with Applicable or Relevant and Appropriate Requirements

The ARARs for the selected remedy at Site 22 are listed in **Appendix C**. Alternatives 2, 3, and 4 are expected to comply with the federal and state ARARs. Alternatives 2, 3, and 4 would all require measures to be taken to establish performance monitoring and ~~LUCs~~Land Use Controls. All of these alternatives would also require additional measures to ensure compliance with ARARs related to the injections of reagents into the subsurface.

## Primary Balancing Criteria

### Long-Term Effectiveness and Permanence

Each alternative with the exception of Alternative 1 is expected to achieve long-term effectiveness and permanence at the conclusion of remedial activities in reducing concentrations of TCE, VC, and RDX. Once RAOs are achieved, all alternatives, except Alternative 1, are expected to be effective in the long-term, as active treatment is intended to treat the contamination (treatment for RDX using ~~EISB~~Enhanced In Situ Bioremediation for Alternative 2, treatment for RDX, TCE, and VC using ISCO for Alternative 3, and treatment for RDX, TCE, and VC using ~~EISB~~Enhanced In Situ Bioremediation for Alternative 4) and allow natural attenuation to reduce groundwater contaminant concentration to below cleanup levels. ~~Some emissions (nitrogen oxide, particulate matter less than 10 micrometers in aerodynamic diameter, carbon dioxide associated with greenhouse gas, and criteria pollutants) from reagent production, transportation, and heavy machinery use may persist for an extended period after RAOs are achieved for Alternatives 2, 3, and 4.~~

**Commented [SS40]:** EPA Comment 28; removed referenced text for simplicity.

### Reduction in Toxicity, Mobility, or Volume through Treatment

~~Alternative 1 does not include active treatment. Therefore, no contaminants are treated or destroyed under this alternative except through natural attenuation processes.~~ Alternatives 2 (treatment of RDX), 3 (treatment of RDX, TCE, and VC), and 4 (treatment of RDX, TCE, and VC) are each expected to reduce toxicity, mobility, and volume by treating the groundwater, which is a statutory preference. For Alternative 2, some active treatment of TCE and VC is assumed to occur where the VOC plumes overlap with the RDX treatment area. Also, while MNA is not considered a treatment, the natural reduction of contaminant concentrations through a variety of physical, chemical, or biological activities is expected to occur over time for Alternatives 2, 3, and 4.

**Commented [SS41]:** EPA Comment 17; This was a comment to the EPA RPM, not a comment on the ROD itself.

### Short-Term Effectiveness

~~Alternative 1 allows natural attenuation to reduce the contaminant plumes, but does not provide measures to prevent exposure to site-related COCs. Therefore, Alternative 1 is not considered protective of either human health or the environment and will pose a potential risk.~~ The short-term effectiveness associated with Alternatives 2, 3, and 4 are similar with regard to how they affect the community and the local environment. Alternatives 2, 3, and 4 all rely on direct injection technology for implementation. The community would be impacted due to the transportation of injection materials and the generated investigation-derived waste.

While the relative-rankings of the remedial alternatives provided in **Table 8** show similar short term effectiveness between Alternatives 2, 3, and 4, minor distinctions for comparative analysis are discussed below. ~~provide information relative to the compliance of each alternative with the short term effectiveness criteria, the following summaries provide a ranking of each alternative relative to each other.~~

**Commented [SS42]:** EPA Comment 18; As stated in the text above, the short-term effectiveness associated with Alternatives 2, 3, and 4 are similar with regard to how they affect the community and the local environment (Table 8); however the summaries of the alternatives provide a ranking of each alternative relative to each other.

Alternative 2 would least impact the environment due to a lower amount of construction or intrusive activities and environmental impacts (fewer injection points and ~~EISB~~Enhanced In Situ Bioremediation injections and a limited extent of treatment area). RAOs are estimated to be achieved in ~~an estimated~~ 34 years.

Alternative 3 has the highest impact on workers and the community due to the high use of heavy machinery, handling of chemical oxidants, and transportation of chemical oxidant on public roads and highways. This alternative has the highest greenhouse gas emissions and energy consumption primarily due to oxidant and polyvinyl chloride manufacturing. RAOs are estimated to be achieved in ~~an estimated~~ 25 years.

Alternative 4 will have a moderate impact on workers and the community due to the highest amount of intrusive activities (greater number of injection points and ~~EISB~~Enhanced In Situ Bioremediation injections) and the high volume of heavy machinery traffic and frequency of site visits. This alternative has the highest sulfur oxide emissions, nitrogen oxide, particulate matter less than 10 micrometers in aerodynamic diameter, and emissions due to fuel consumption. RAOs are estimated to be achieved in ~~an estimated~~ 29 years.

Alternative 2 provides the greatest short-term effectiveness due to its minimization of intrusive activities compared to Alternatives 3 and 4.

### Implementability

Alternatives 2, 3, and 4 can each be implemented using standard and widely available technologies. All materials and services needed for implementation are readily and commercially available. These three alternatives (2, 3, and 4) require engineering and construction services, and each alternative requires thorough monitoring to ensure they continue to operate on a path toward achieving RAOs. Each of the three alternatives (2, 3 and 4) is reliable provided they are designed and implemented correctly.

### Cost

An order of magnitude cost for each alternative has been estimated based on a variety of key assumptions, including an assumed 35-year project life. The estimated timeframe required to achieve the cleanup levels varies by alternative (**Table 6**). The estimated capital cost for implementation of Alternative 2 ($~~708~~700,~~026~~000) is less than that of Alternative 3 ($1.2 million) or Alternative 4 ($1.0 million). The estimated present value cost for Alternative 2 is $1.9 million, less than for Alternative 3 ($2.5 million) and Alternative 4 ($2.7 million). Alternative 2 has a lower capital cost due to the type and quantity of injection materials.

**Table 6** provides details of the cost summaries, and **Table 8** provides a relative ranking of the four alternatives.

### Modifying Criteria

#### *State Acceptance*

State involvement has been solicited throughout the CERCLA and remedy selection process. VDEQ, as the designated state support agency in Virginia, has reviewed this ROD and has given concurrence on the selected remedy for groundwater at Site 22. The selected remedy, Alternative 2 (Hot Spot treatment of the RDX target area [concentrations above 100 µg/L] using ~~EISB~~Enhanced In Situ Bioremediation and associated performance monitoring; MNA of TCE, VC, and RDX; and ~~LUCs~~Land Use Controls), is consistent with the VDEQ's preference for active treatment of high-concentration target areas.

#### *Community Acceptance*

The public meeting was held on May 24, 2012, to present the ~~PP~~ Proposed Plan and answer community questions regarding the proposed remedial action at Site 22. The questions and concerns raised at the meeting were general inquiries for informational purposes only; but no comments were received requiring amendment to the ~~PP~~Proposed Plan, and no additional written comments, concerns, or questions were received from community members during the public comment period.

## 2.10 Principal Threat Wastes

Principal threat wastes are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should an exposure occur. Although no "threshold level" of risk has been established to identify principal threat waste, a general guideline is to consider a principal threat to be those source materials with toxicity and mobility characteristics that combine to pose a potential risk several orders of magnitude greater than the risk level that is acceptable for the current or reasonably anticipated future land use, given realistic exposure scenarios. Contaminated groundwater is generally not considered to be a source material, and VOC concentrations are below 1 percent of

the aqueous solubility of each COC, indicating that groundwater contamination likely consists of a dissolved phase plume with no dense non-aqueous phase liquid present. Therefore, the groundwater at Site 22 is not considered to be a principal threat waste. However, the selected remedy includes a treatment technology that will be used to permanently reduce TCE, VC, and RDX concentrations in groundwater to established risk-based cleanup levels.

## 2.11 Selected Remedy

Based on the ***comparative analysis*** (Ref. 16), the selected remedy to address risk associated with groundwater at Site 22 is Alternative 2, consisting of three components: (1) Hot Spot Treatment of RDX using ~~EISB~~Enhanced In Situ Bioremediation and Associated Performance Monitoring; (2) MNA of RDX, TCE, and VC; and (3) ~~LUCs~~Land Use Controls.

### 2.11.1 Summary of the Rationale for the Selected Remedy

Based on the evaluation of the data and information currently available, the Navy, in partnership with USEPA, has determined that the selected remedy meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The Navy expects the Preferred Alternative to satisfy the following statutory requirements of CERCLA §121(b): 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; 4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and 5) satisfy the preference for treatment as a principal element. If, however, based on performance monitoring evaluation after the second injection event, the Navy, USEPA, and VDEQ determine ~~after two years following the second injection event~~ that if the remedy is not performing as anticipated, a plan for additional plume treatment will be developed. A long-term monitoring plan will identify criteria for remedy performance, and the estimated schedule of remedy implementation.

Alternative 2 is the selected remedy for remediation of groundwater contamination at Site 22. Alternative 2 was chosen over Alternatives 3 and 4 (not including the No Action alternative) because the cost versus benefit comparison (such as length of time, sustainability, and other factors) indicated that although Alternative 2 takes longer to reach RAOs, it is protective, more cost-effective and results in less short term risk during implementation. Targeting areas using ~~EISB~~Enhanced In Situ Bioremediation where RDX concentrations exceed 100 µg/L decreases the environmental impacts of construction or intrusive activities by reducing the extent of the treatment area. Although no active treatment process would be employed specifically for VOCs, some active treatment of TCE and VC would occur where the VOC plumes overlap with the RDX target treatment area. Outside the influence of the RDX treatment area, natural biodegradation and other attenuation processes would be occurring. ~~Therefore, reduction of toxicity, mobility, or volume of the plumes is acceptable.~~

### 2.11.2 Description of the Selected Remedy

The selected remedy (Alternative 2) for groundwater at Site 22 consists of the following elements:

- Implementing ~~EISB~~Enhanced In Situ Bioremediation of RDX using ~~EVO~~emulsified vegetable oil bio-barriers perpendicular to groundwater flow in the target treatment area (with RDX above 100 µg/L) to ~~accelerate~~ reduce the total time for achieving cleanup levels
- Monitored natural attenuation~~MNA~~ for the dissolved TCE and VC plumes and the remaining dissolved RDX plume (less than 100 µg/L) following active treatment
- Performance and long-term groundwater monitoring for COCs, and monitored natural attenuation~~MNA~~ parameters

**Commented [SS43]:** EPA Comments 30 & 31; As agreed to by the EPA during development of the Proposed Plan and discussed in an email (7/27) a contingency plan is not included in the ROD.

**Commented [SS44]:** EPA Comment 19; objectives will be identified in a LTM plan

**Commented [SS45]:** Note to the Partnering Team: SMP will be revised to include the proposed schedule (i.e., pre-design 2013, implementation 2014-2016, LTM 2017)

**Commented [SS46]:** EPA Comment 17; This was a comment to the EPA RPM, not a comment on the ROD itself.

**Commented [SS47]:** EPA Comment 32; revised for consistency throughout the document.

- ~~LUCs~~Land Use Controls in the form of land and groundwater use restrictions to prevent contact with and use of groundwater until cleanup levels are met

**Figure 8** presents a conceptual illustration of the potential implementation of the selected remedy (Alternative 2).

The Navy will implement the selected remedy in phases to optimize treatment in groundwater at Site 22. Prior to completing the Remedial Design (RD) of Alternative 2, a pre-design investigation will be performed to refine the CSM. The remedy implementation approach will be finalized during RD.

FIGURE 8
Alternative 2 - Hot Spot Treatment of RDX using ~~EISB~~Enhanced In Situ Bioremediation and Associated Performance Monitoring, MNA of TCE, VC, and RDX; and ~~LUCs~~Land Use Controls

## Pre-Design Investigation

Prior to the final design of the selected remedy (Alternative 2), a pre-design investigation will be implemented for greater resolution of the lateral and vertical extent of TCE, VC, and RDX and to identify the precise areas, depths, and lithologic units requiring RDX treatment. Based on historical data, the only monitoring well with RDX concentrations above 100 µg/L in groundwater is YS22-GW04 (at 150 µg/L in 2007). This investigation is expected to include installation of at least three new monitoring wells, one round of groundwater samples from new and select existing monitoring wells for TCE, VC, and RDX (**Figure 8**), and groundwater samples from 30 direct-push technology (DPT) points to pinpoint the RDX treatment area. Additional lines (or transects) of DPT points ~~transects~~ will be added if RDX concentrations at the edge of each ~~along the~~ transect ~~perimeter~~ exceeds 100 µg/L.

## ~~EISB~~Enhanced In Situ Bioremediation of RDX Using ~~EVO~~emulsified vegetable oil Bio-barriers

~~EISB~~Enhanced In Situ Bioremediation of RDX using ~~EVO~~ bio-barriers will be implemented in the target treatment area, defined as where RDX concentrations exceed 100 µg/L, through direct injection of a suitable insoluble substrate (such as, but not limited to, emulsified oil substrate or 3D microemulsion) to the shallow groundwater. The introduced substrate will ~~serve multiple purposes, including depleting competing electron acceptors, creating strongly reducing conditions, and producing an electron donor source for biodegradation~~ create conditions favorable for degradation for both RDX and the chlorinated ethene compounds at the site. Additionally, a pH buffer (either as a pre-buffered substrate, such as sodium bicarbonate, or as an additional injection) may be required to raise the existing groundwater pH. Based on the observed effectiveness of ~~EISB~~Enhanced In Situ Bioremediation during field investigations for other Navy projects with similar subsurface conditions, it is assumed that no laboratory treatability studies or field pilot studies are warranted prior to full-scale implementation of Alternative 2.

Before this alternative is implemented, baseline groundwater samples will be collected to confirm assumptions made in the conceptual design and to modify as necessary the application locations, substrate, and the corresponding monitoring locations. Based on current site conditions, conceptual design elements for implementation of ~~EISB~~Enhanced In Situ Bioremediation are presented in **Figure 8**.

Upon completion of the pre-design investigation, an injection method will be determined (pneumatic fracturing, direct-push, or permanent injection wells). One bio-barrier is anticipated to be placed directly upgradient of the area with the highest RDX concentrations as determined during the pre-design investigation. Two additional bio-barriers are assumed, one to the north and one to the south of this primary line. The southernmost bio-barrier will help prevent further migration of the RDX plume. Within each bio-barrier, or transect line, the injection wells will be spaced approximately 20 feet apart. The radius of influence of each injection point is assumed to be 10 feet. As shown on **Figure 8**, approximately 15 permanent injection locations are estimated for the target treatment area. The vertical target interval will be determined during the design. For cost-estimating purposes, it was assumed that each location will have two co-located permanent injection wells, each with 10-foot screens to

**Commented [SS48]:** EPA Comment 32; revised for consistency throughout the document.

**Commented [SS49]:** EPA Comment 28; revised text

**Commented [SS50]:** EPA Comment 28; revised text

**Commented [SS51]:** EPA Comment 21; Every effort was used to use plainer English in the ROD without contradicting the PP

**Commented [SS52]:** DEQ Comment: Future design should include some overlap of the estimated radius of influence of each injection point.

Comment Noted.

more effectively distribute ~~EVO~~emulsified vegetable oil to units with lower permeability across a 20-foot-depth interval. It was also assumed that two injections would be completed within a 2-year interval. If necessary, as treatment progresses and the concentrations of COCs and their daughter products change, the type and quantity of substrate, frequency of injection, and the location of injection may be revised.

**Commented [SS53]:** EPA Comment 22; revised to clarify that two injections will be completed within a 2 year interval.

### Monitored Natural Attenuation of VOCs and RDX

MNA refers to the reliance on natural processes to achieve cleanup levels. Natural attenuation processes include a variety of physical, chemical, or biological processes that under favorable conditions act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in groundwater. These processes include biodegradation; dispersion; dilution; sorption; volatilization; and chemical or biological stabilization, transformation, or destruction of contaminants. Biodegradation pathways for chlorinated VOCs were discussed in Section 2.5.

MNA will be implemented in the area outside the target treatment area and will rely on natural attenuation processes to achieve the cleanup levels for TCE (5 µg/L), VC (2 µg/L), and RDX (6 µg/L). Reducing conditions predominantly present at the site are favorable for biological~~ly mediated~~ degradation of the chlorinated VOCs and RDX. In addition, the RDX target treatment area may overlap with a portion of the TCE and VC plumes, resulting in enhanced biodegradation of these ~~constituents~~ chemicals within this area. Natural attenuation will continue under this alternative until the COC concentrations decline to below cleanup levels.

### Performance Monitoring and Long-term Monitoring

Following substrate injection, initial effectiveness of the remedial technology (~~EVO~~emulsified vegetable oil bio-barriers and MNA) will be evaluated through one year of quarterly performance groundwater monitoring following each of the two rounds of substrate injections. ~~Following the completion of this performance monitoring, the data will be evaluated to determine if the long-term reduction in COC concentrations will be monitored as part of a long-term monitoring plan designed to evaluate the achievement of RAOs over time or determine if additional injections are required.~~ Following performance monitoring and optimization review of remedy efficiency, additional injections may be implemented or if it is determined that a different remedy should be considered, the Navy, USEPA, and VDEQ will evaluate other remedial alternatives.

**Commented [SS54]:** EPA Comment 23; revised to state the EPA, DEQ and the Navy will evaluate the performance monitoring data

~~If a long-term monitoring plan is developed, LTM will initially be conducted on a quarterly basis and over time will be reduced to semi-annually, annually, then every five years, until no additional LTM is needed.~~

~~If it is determined through LTM data, that the remedy is not acting as designed, optimization data will be collected to assess changes to the remedy.~~ Based on current site conditions, it was assumed for cost-estimating purposes that any new monitoring wells plus the 12 existing shallow monitoring wells and one existing deep monitoring well will be included in the performance and long-term monitoring plans. Because contaminants will remain onsite following remedy implementation, the need for additional action to achieve the cleanup levels will be evaluated and documented during CERCLA 5-year reviews.

### Land Use Controls

**Commented [SS55]:** EPA Comment 38; The details of the Land Use Controls will be included in a LUC RD.

Throughout implementation of the remedy, the Navy will implement ~~LUCs~~Land Use Controls to prevent unacceptable risks to human~~s receptors~~ from exposure to COCs in groundwater. Under Alternative 2, the site will be designated as a "restricted use" area in the base geographic information system. This designation will place controls on groundwater at Site 22.

The associated ~~LUCs~~Land Use Controls will meet the following objectives:

- Prohibit activities that would result in contact with groundwater except for environmental monitoring

- Prohibit the withdrawal of groundwater except for environmental monitoring
- Prohibit construction of new buildings at the site without evaluation of potential vapor intrusion and/or ensuring vapor intrusion mitigation measures are included in building design
- Maintain the integrity of any current or future remedial or monitoring system

The Navy will develop and submit to USEPA and VDEQ, for review, a LUC RD within 90 days following the signature of this ROD. The LUC RD will provide for implementation and maintenance actions, including periodic inspections and reporting. The Navy will implement, maintain, monitor, report on, and enforce the ~~LUCs~~Land Use Controls according to the approved LUC RD and this ROD.

**Commented [SS56]:** EPA Comment 24; revised to include text stating that the LUC RD will be submitted within 90-days following signature of this ROD.

**Commented [SS57]:** EPA Comment 25; revised as requested.

Although the Navy may transfer these responsibilities to another party by contract, property transfer agreement, or through other means, the Navy will remain ultimately responsible for remedy integrity and will: 1) perform CERCLA Section 121(c) 5-year reviews; 2) notify the appropriate regulators and/or local government representatives of any known ~~LUC~~ land use control deficiencies or violations; 3) provide access to the property to conduct any necessary response; 4) retain the ability to change, modify, or terminate ~~LUCs~~Land Use Controls; and 5) ensure that the LUC objectives are met to maintain remedy protectiveness.

### 2.11.3 Summary of the Estimated Remedy Costs

**Table 6** presents a cost estimate summary for implementation of the selected remedy. ***Detailed cost estimates*** (Ref. 17) are provided in the 2011 FS report. The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

### 2.11.4 Expected Outcomes of the Selected Remedy

Site 22 is currently only being used for periodic hunting activities. This use is expected to continue, and there are no other planned land uses in the foreseeable future. Cleanup levels for the selected remedy are based on established risk-based cleanup levels suitable for unlimited use and unrestricted exposure. Exposure will be controlled through ~~LUCs~~Land Use Controls until COCs in groundwater (TCE, VC, and RDX) are reduced to the cleanup levels. Remedial activities at Site 22 will consist of Hot Spot treatment of RDX using ~~EISB~~Enhanced In Situ Bioremediation and associated performance monitoring; MNA of RDX, TCE, and VC; and ~~LUCs~~Land Use Controls. **Table 9** identifies the potential unacceptable human health risks (there are no potential unacceptable ecological risks), the RAOs established to address these unacceptable risks, the remedy component(s) that will be implemented to achieve each RAO, what metrics will be used to confirm the RAOs are met, and the expected outcome from implementation of the remedy components.

TABLE 9
Expected Outcomes

| Risk | | RAO | Remedy Component | Metric | Expected Outcomes | |
|---|---|---|---|---|---|---|
| Human Health | Ecological | | | | | |
| Groundwater | | | | | | |
| Ingestion of, dermal contact with, and inhalation of TCE, VC, and RDX in groundwater for hypothetical future lifetime adult and child residents; ingestion of and dermal contact with groundwater for hypothetical future construction workers | No exposure pathway | To reduce TCE, VC, and RDX concentrations in groundwater to established risk-based cleanup levels | Hot Spot treatment of RDX using ~~EISB~~Enhanced In Situ Bioremediation bio-barriers in areas where concentrations exceed 100 µg/L and associated performance monitoring | Monitor shallow groundwater concentrations to confirm reduction of RDX concentrations to cleanup levels~~below 100 µg/L and plume stabilization~~ | Reduction of RDX concentrations ~~in the groundwater plume~~to cleanup levels | No further treatment or monitoring after achieving cleanup goals that allow for unlimited use and unrestricted exposure or groundwater |
| | | | MNA for TCE, VC, and RDX | Monitor groundwater COC concentrations and their degradation products, geochemical parameters, and sensitive metals to confirm the natural degradation process is occurring until concentrations are at or below cleanup levels | Reduction of RDX, TCE, and VC concentrations ~~in the groundwater plume~~to cleanup levels | |
| | | | | Monitor shallow groundwater COC concentrations and their degradation products for potential toxic transformation products to confirm concentrations are not created at levels that threaten human health | | |
| | | To maintain ~~LUCs~~Land Use Controls to prevent human (residential and construction worker) exposure to groundwater until cleanup levels are met. | ~~LUCs~~Land Use Controls | Annual LUC inspections until cleanup levels are met for groundwater COCs | Elimination of groundwater exposure pathway | Removal of groundwater ~~LUCs~~Land Use Controls |

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### 2.11.5 Statutory Determinations

In accordance with CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan, the selected remedy meets the following statutory requirements:

**Protection of Human Health and the Environment**— The selected remedy will protect human health (there are no potential ecological risks) from known site risks to future receptors through groundwater treatment and monitoring to reduce COC concentrations, and through ~~LUCs~~Land Use Controls to restrict the use of and exposure to shallow groundwater and shallow groundwater emissions until concentrations are reduced to established risk-based cleanup levels that allow for unrestricted use and unlimited exposure.

**Compliance with ARARs**—The selected remedy will meet all identified ARARs. Federal and state ARARs for Site 22, summarized by classification, are presented in **Appendix C**. The classification of ARARs identified includes chemical-specific, location-specific, and action-specific requirements.

**Cost-Effectiveness**—The selected remedy provides the most reasonable value relative to the cost through the use of active treatment in the high-concentration target area, while allowing for MNA in the low-concentration target areas.

**Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable—**The selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner at Site 22. The selected remedy provides treatment through substrate injection that enhances biologically mediated degradation of the chlorinated COCs and RDX through natural microbial degradation processes to reduce contaminant mass. Because the long-term effectiveness and permanence, as well as reduction of toxicity and volume, are achieved through the selected remedy, the Navy, USEPA, and VDEQ concur that the selected remedy provides the best balance of tradeoffs in terms of the balancing criteria, while also considering the statutory preference for treatment as a principal element and considering state and community acceptance.

**Preference for Treatment as a Principal Element**—The selected remedy uses treatment of the high-concentration target area as a principal element, and therefore satisfies the statutory preference for treatment.

**Five-Year Review Requirements**—Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

~~This remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above established risk-based cleanup levels. The Navy will maintain LUCs and conduct a statutory remedy review every 5 years after initiating remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. If the remedy is determined not to be protective of human health and the environment because, for example, LUCs have failed or treatment is unsuccessful, then additional remedial actions would be evaluated by the FFA parties and the Navy may be required to undertake additional remedial action.~~

**Commented [SS58]:** EPA Comment 26; revised to follow ROD Guidance, Highlight 6-37

## 2.12 Documentation of Significant Changes

The ~~PP~~ Proposed Plan for Site 22 was released for public comment on May 14, 2012. The public comment period ran from May 14 to June 28, 2012 with the public meeting to discuss the plan on May 24, 2012. General inquiries were received during the public meeting on May 24, 2012, but no comments were received requiring amendment to the ~~PP~~Proposed Plan, and no additional written comments, concerns, or questions were received from community members during the public comment period. It was determined that no significant changes to the remedy as originally identified in the ~~PP~~ Proposed Plan were necessary or appropriate.

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# 3 Responsiveness Summary

The participants in the public meeting held on May 24, 2012, included representatives of the Navy and VDEQ. Two community members attended the meeting. Questions received during the public meeting were general inquiries and are included in the ***meeting transcript*** (Ref. 18 and **Appendix D**). There were no comments received at the public meeting requiring amendment to the PP, and no additional written comments, concerns, or questions were received from community members during the public comment period.

**Commented [SS59]:** EPA Comment 27; copy of the transcript attached as Appendix D.

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| Reference Number | Reference Phrase in ROD | Location in ROD | Identification of Referenced Document Available in the AR |
|---|---|---|---|
| 1 | *ROD* | Section 2.2 | Baker Environmental, Inc. (Baker). 2003. Record of Decision Site 22 Burn Pad, Naval Weapons Station, Yorktown, Virginia. September. AR No. 01375. |
| 2 | *ROD* | Section 2.2 | CH2M HILL. 2011. Record of Decision, Site 4 – Burning Pad Residue Landfill, Site 21 – Battery and Drum Disposal Area & Site 22 – Burn Pad, Naval Weapons Station, Yorktown, Virginia. August. AR No. 000262. |
| 3 | *analytical results* | 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. |
| 4 | *analytical results* | 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. |
| 5 | *analytical results* | 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. |
| 6 | *analytical results* | 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. |
| 7 | *evaluate alternatives* | Table 1 | CH2M HILL. 2011. Feasibility Study Report for Groundwater at Site 22, Naval Weapons Station, Yorktown, Virginia. November. Section 6. AR No. 000181. |
| 8 | *CSM* | Section 2.5 | CH2M HILL. 2011. Feasibility Study Report for Groundwater at Site 22, Naval Weapons Station, Yorktown, Virginia. November. Section 2.2.3. AR No. 000181. |
| 9 | *Numerous investigations* | Section 2.5.1 | CH2M HILL. 2011. Feasibility Study Report for Groundwater at Site 22, Naval Weapons Station, Yorktown, Virginia. November. Sections 2.1 and 2.2. AR No. 000181. |
| 10 | *results* | Section 2.5.1 | CH2M HILL. 2011. Feasibility Study Report for Groundwater at Site 22, Naval Weapons Station, Yorktown, Virginia. November. Sections 2.2.1. AR No. 000181. |

| Reference Number | Reference Phrase in ROD | Location in ROD | Identification of Referenced Document Available in the AR |
|---|---|---|---|
| **11** | ***biodegradation*** | Section 2.5.2 | CH2M HILL. 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Section 10.5.3. AR No. 000024. |
| **12** | ***complete exposure pathways*** | Section 2.7.1 | CH2M HILL. 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Section 8.4.2. AR No. 000024. |
| **13** | ***Potential unacceptable human health risks*** | Section 2.7.1 | CH2M HILL. 2009. Remedial Investigation Report for Groundwater, Sites 4, 21, and 22, Naval Weapons Station, Yorktown, Virginia. November. Tables 8-14 and 8-15. AR No. 000024. |
| **14** | ***no potentially unacceptable risk*** | Section 2.7.2 | 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. |
| **15** | ***developed and evaluated*** | Section 2.9.1 | CH2M HILL. 2011. Feasibility Study Report for Groundwater at Site 22, Naval Weapons Station, Yorktown, Virginia. November. Section 4.2. AR No. 000181. |
| **16** | ***comparative analysis*** | Section 2.11 | CH2M HILL. 2011. Feasibility Study Report for Groundwater at Site 22, Naval Weapons Station, Yorktown, Virginia. November. Section 6. AR No. 000181. |
| **17** | ***Detailed cost estimates*** | Section 2.11.3 | CH2M HILL. 2011. Feasibility Study Report for Groundwater at Site 22, Naval Weapons Station, Yorktown, Virginia. November. Appendix C. AR No. 000181. |
| **18** | ***meeting transcript*** | Section 3 | CH2M HILL. 2009. Proposed Plan, Site 1: Landfill Near Incinerator, Naval Weapons Station Yorktown, Cheatham Annex. January. AR No. Pending. |

Detailed site information reference in this ROD in bold blue text is contained in the AR.

For access to information contained in the AR for WPNSTA Yorktown please contact:

Public Affairs Office
P.O. Drawer 160
Yorktown, VA 23691-0160
Phone: (757) 887-4939
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~~Norfolk, Virginia 23508~~
~~Phone: (757) 322-8005~~

**Commented [SS60]:** Will include AR number if available in final ROD

**Commented [SS61]:** Revised to be consistent with Section 2.3

# Appendix A

# Appendix B

# Appendix C

Summary of USEPA Comments on the Draft Site 22 ROD
WPNSTA Yorktown - July 2012

| Comment Number | Section | Page | Comment |
|---|---|---|---|
| 1 | 1.2 | 1-1 | 2nd paragraph to follow Highlight 6-2 in ROD guidance more closely |
| 2 | 1.3 | 1-1 | chemicals, not constituents of potential concern is easier to understand and follows the EPA guidance more closely |
| 3 | 1.3 | 1-1 | editorial changes to last paragraph to follow Highlight 6-3 in ROD guidance more closely |
| 4 | 1.4 | 1-2 | Is "Refining the CSM through a pre-design investigation" a component of the remedy? I'd delete it |
| 5 | 1.4 | 1-2 | Include contingency plan in the description of the selected remedy |
| 6 | 1.5 | 1-2 | Entire section should follow Highlight 6-4 in ROD guidance exactly |
| 7 | Table 1 | 2-4 | I don't' see six sample locations on map, why? |
| 8 | Table 1 | 2-4 | Make type bigger, easier to read |
| 9 | 2.5.2 | 2-12 | Use plainer English throughout the section |
| 10 | 2.5.2 | 2-12 | why two different dehalococcoides sample results |
| 11 | 2.5.2 | 2-12 | ammonia and formaldehyde are not always so benign as stated in the text |
| 12 | 2.8 | 2-18 | add "within a reasonable time frame" to the first RAO |
| 13 | 2.9.2 | 2-21 | An optimization remedy component has not been described in the description of alternatives |
| 14 | 2.9.2 | 2-21 | Steve H wants a contingency remedy not an optimization remedy |
| 15 | 2.9.2 | 2-21 | Regarding the optimization remedy, if MNA of VOCs isn't working then it will be conducted, not if unacceptable risk is indicated during monitoring |
| 16 | Table 8 | 2-22 | Hasn't the state concurred with Alt 1? |
| 17 | 2.9.2 & 2.11.1 | 2-23 & 2-25 | is some active treatment of TCE and VC as a result of Alternative 2 a valid assumption |
| 18 | 2-9-2 | 2-23 | Why does Table 8 say Alternatives 2, 3, and 4 are all moderate on short-term effectiveness? |
| 19 | 2.11.1 & 2.11.2 | 2-25 & 2-27 | Be more specific on the objectives and measurable standards for if the remedy is not performing as anticipated |
| 20 | 2.11.2 | 2-26 | give examples of insoluble substrate |
| 21 | 2.11.2 | 2-26 | use plainer English and give examples of competing electron acceptors, creating strongly reducing condition, and producing an electron donor source |
| 22 | 2.11.2 | 2-27 | two injections completed with[in] a 2-year interval means inject once, wait 2 years and inject again? |
| 23 | 2-11-2 | 2-27 | Who will evaluate the performance monitoring data and determine if LTM or an additional injection will be needed |
| 24 | 2.11.2 | 2-28 | When will LUCs be placed on the site groundwater, 90 days of signing ROD? |
| 25 | 2.11.2 | 2-28 | The Navy will implement…… and enforce LUCs according to the LUC RD "and this ROD" |
| 26 | 2.11.5 | 2-31 | Use Highlight 6-37 of the ROD guidance, last paragraph verbatim for the statutory determination for 5-year review requirements |
| 27 | 3 | 3-1 | Please get a copy of transcript |
| 28 | General Comment | General | use plain English: bio-barriers, synoptic, upgradient, criteria pollutants, transects |
| 29 | General Comment | General | spell out acronyms |
| 30 | Contingency Remedy | General | Steve Hirsh wants this ROD to include a contingency remedy, or something like it. We need to agree on a contingency remedy and on the circumstances or criteria under which the Navy must implement the contingency remedy. In general, the idea seems to be: If MNA is not working for VOCs, then the Navy shall implement Alternative 3 or 4. We need to have a concrete, objectively measurable way of determining if MNA is not working. |
| 31 | Contingency Remedy | General | ROD needs to be modified to follow the Highlight 8-8 format, from the ROD guidance, to incorporate the contingency remedy |
| 32 | General Comment | General | The components of the selected remedy -- mainly monitoring requirements and land use controls -- are described in slightly different ways in the declaration and the selected remedy section. Try to make them the same |
| 33 | 2.5 | 2-7 through 2-12 | This section gives no hint of uncertainty about whether MNA is occurring at this site, or whether it will work. You probably should ask for some discussion of uncertainty, lack of sampling in accordance with EPA MNA guidance, etc, to support the idea that a contingency remedy or something like it is necessary. |

Summary of USEPA Comments on the Draft Site 22 ROD
WPNSTA Yorktown - July 2012

| Comment Number | Section | Page | Comment |
|---|---|---|---|
| 34 | 2.6 | 2-12 | At the end of the last paragraph, please add:<br>However, the Commonwealth of Virginia considers all aquifer groundwater of potential beneficial use as potable water. |
| 35 | 2.7 | 2-12 through 2-17 | The risk assessment should include some statements about the potential for intrusion of vapors into future buildings. We need to show that there is potential risk from vapor intrusion if we are going to include LUCs to control those risks. |
| 36 | 2.9.2 | 2-21 through 2-24 | As the beginning of the first paragraph, please insert:<br><br>This section summarizes a comparison and analysis of the four alternatives with respect to the National Contingency Plan's nine evaluation criteria. The nine criteria are summarized in Table 7 |
| 37 | 2.11.2 | 2-25 through 2-28 | Steve would like this section to say that Navy will submit a report of LTM results to EPA and VDEQ.<br><br>In last sentence of 1st paragraph, Steve would like it to say that, if an LTM plan is developed, LTM will initially be conducted on a quarterly basis and the Navy shall submit reports of the results to EPA and VDEQ. In the report, the Navy may make suggestions on reducing monitoring frequency. Then say who would decide on whether to reduce frequency.<br><br>Alternatively, the ROD could say that LTM shall be conducted in accordance with a LTM monitoring plan. The Navy shall submit a draft LTM plan to EPA and VDEQ for review and approval within ___ days/months of [some event]. The Navy shall implemented the LTM plan as approved by EPA and VDEQ. |
| 38 | 2.11.2 | 2-25 through 2-28 | Please add text and a map, which show the reader the areas where land use controls will be imposed.<br><br>Please add a statement that<br>LUCs shall be maintained until the concentration of COCs are at levels that allow for unlimited use and unrestricted exposure.<br><br>For a LUC objective for vapor intrusion, I suggest something like this:<br>• Prohibit occupation of any future buildings in the area shown on Figure ___ unless (1) an investigation, concurred upon by the Navy, EPA and VDEQ, shows that risks to human health from vapor intrusion are within acceptable limits or (2) the Navy, EPA and VDEQ concur on the design of a vapor mitigation system for the building, and the vapor mitigation system is installed and operating properly and successfully. |
| 39 | 2.5.2 | 2-10 | We can make this claim [Historical groundwater data for monitoring well YS22-GW04 demonstrate a clear and meaningful trend of decreasing contaminant mass and/or concentration over time] at this particular monitoring well but does it translate to Site-Wide decreasing trend?. Can we say the same at 22GW010 with 650 ug/l TCE?. |

APPENDIX C

Applicable or Relevant and Appropriate Requirements
*Record of Decision for Groundwater at Site 22*
*Naval Weapons Station Yorktown*
*Yorktown, Virginia*

| Classification | Media/ Location/ Action | Requirement | Prerequisite | Citation | ARAR/TBC Determination | Comment |
|---|---|---|---|---|---|---|
| Federal-Chemical Specific | ***Remedial Goals*** | | | | | |
| | Groundwater | SDWA standards serve to protect public water systems. Primary drinking water standards consist of federally enforceable MCLs. MCLs are the highest level of a contaminant that is allowed in drinking water. | Groundwater contamination exceeds MCLs. Cleanup to MCLs for the contaminants presenting Human Health Risk is being considered in order to meet the state's expectations for beneficial use. | 40 CFR 141.61 (a) (1) and (5) | Relevant and Appropriate | Relevant and appropriate because the aquifer is neither currently, nor reasonably anticipated in the future to be used as a potable water supply. The RGs set using MCLs are:<br>VC: 2 µg/L<br>TCE: 5 µg/L |
| | Groundwater | Chemical concentrations corresponding to fixed levels of human health risk (i.e., a hazard quotient of 1, or lifetime cancer risk of $10^{-6}$, whichever occurs at a lower concentration). | Assessment of potential human health risks. | USEPA Region III RSL Tables only as they apply to RDX CAS #121-82-4 | To Be Considered | The following RGs at Site 22 were developed using RSLs:<br>RDX: 6 µg/L |
| Federal-Location Specific | ***Migratory Flyway*** | | | | | |
| | Migratory bird area | Protects almost all species of native birds in the United States from unregulated taking. | Presence of migratory birds. | 16 USC 703 | Applicable | Site 22 is located in the Atlantic Migratory Flyway. If migratory birds, or their nests or eggs, are identified at Site 22, operations will not destroy the birds, nests or eggs. |
| | ***Coastal zone*** | | | | | |
| | Coastal zone or area that will affect the coastal zone | Federal activities must be consistent with, to the maximum extent practicable, State coastal zone management programs.Federal agencies must comply with the consistency requirements of 15 CFR § 930. | Actions that may affect identified coastal zone resources or uses | 15 CFR 930.33(a)(1), (a)(2), (b);.36(a) | Applicable | Activities at Site 22 that will affect Virginia's coastal zone will be consistent to the maximum extent practicable with Virginia's enforceable policies. Activites performed on-site and in compliance with CERCLA are not subject to adminsitrative review; however the substantive requirements of making a consistency determination will be met. |
| Federal-Action Specific | ***Storage of Petroleum and Non-petroleum Oils*** | | | | | |
| | Storage of fuels and oils (petroleum and non-petroleum) onsite | If storage capacity limits are exceeded a Spill, Prevention, Control, and Countermeasures Plan must be prepared and implemented with procedures, methods, equipment, and other requirements to prevent the discharge of into or upon the navigable waters of the United States. | Total onsite storage capacity exceeding 1,320 gallons in containers that are 55 gallons or larger in size. | 40 CFR 112.3(a)(1); 112.5 through 7; and 112.8(b),(c), and (d)(2) through (5) | Applicable | It is anticipated that fuels or other treatment chemicals will be stored onsite. If the storage capacity in containers that are 55 gallons or greater is equal to or exceeds 1,320 gallons a Spill Prevention, Control, and Countermeasure (SPCC) Plan must be prepared and implemented. Containers include oil and fuel reservoirs in equipment. |
| | ***Subsurface Injection*** | | | | | |
| | Underground injection | Regulates the subsurface emplacement of | Any dug hole or well that is deeper than its | 40 CFR 144.12(a), | Applicable | These alternatives will include substrate injections. |

APPENDIX C

Applicable or Relevant and Appropriate Requirements
*Record of Decision for Groundwater at Site 22*
*Naval Weapons Station Yorktown*
*Yorktown, Virginia*

| Classification | Media/ Location/ Action | Requirement | Prerequisite | Citation | ARAR/TBC Determination | Comment |
|---|---|---|---|---|---|---|
| | | liquids through the Underground Injection Control program, which governs the design and operation of five classes of injection wells in order to prevent contamination of underground sources of drinking water. The Underground Injection Control program regulates well construction, well operation, and monitoring. | largest surface dimension, where the principal function of the hole is in subsurface placement of fluids. | 144.82(a)(1) and (b), 146.8(a) through (e), and 146.10(c) | | Permits and administrative reviews are not required for on-site CERCLA injection wells; however, the remedial action will comply with the substantive requirements of the regulation. |

APPENDIX C

Applicable or Relevant and Appropriate Requirements
*Record of Decision for Groundwater at Site 22*
*Naval Weapons Station Yorktown*
*Yorktown, Virginia*

| Classification | Media/ Location/ Action | Requirement | Prerequisite | Citation | ARAR/TBC Determination | Comment |
|---|---|---|---|---|---|---|
| Virginia-Action Specific | ***Waste Management*** | | | | | |
| | Accumulation of hazardous waste in containers onsite for less than 90 days | Hazardous waste may be accumulated on site in containers for up to 90 days so long as the containers are in good condition, compatible with the waste being stored, and labeled with the words "Hazardous Waste" and the date that accumulation began. The containers must also be kept closed unless adding or removing waste and inspected weekly. | Accumulation of hazardous waste in containers onsite. | 9 VAC 20-60-262 only as it incorporates 40 CFR 262.34 (a) (1)(i), (2), (3), and 40 CFR 265.171 through 174 | Applicable | It is possible that hazardous wastes may be generated during remedial activities. Containers will be managed in accordance with these requirements. |
| | Management of non-hazardous waste in containers | Establishes standards and procedures pertaining to the management of non-hazardous solid wastes in containers. Nonputrescible wastes must be stored in appropriate containers and not staged for more than 90 days. | Generation of non-hazardous solid waste that is managed onsite in containers. | 9 VAC 20-81-95(D)(10)(b) | Applicable | It is anticipated that some wastes (such as decontamination fluids) may be generated and managed onsite in containers. Based on the analytical results from previous investigations, it is expected that these wastes will be non-hazardous solid waste. Wastes will be characterized prior to offsite disposal. |
| | ***Monitoring Well Construction and Abandonment*** | | | | | |
| | Monitoring Well Installation and Abandonment | Establishes requirements for the installation and abandonment of observation and monitoring wells, governed jointly by the State Board of Health and Department of Environmental Quality. | Observation and monitoring wells must be properly installed and abandoned in accordance with Virginia regulations to prevent contamination from reaching groundwater resources via the well. | 12 VAC 5-630-420(B) and (C); and 450(C)(1),(2),(4),(5), (7), (8), and (9) | Applicable | Monitoring wells will be installed and abandoned in accordance with the Virginia regulations. |
| | ***Spill Prevention*** | | | | | |

APPENDIX C

Applicable or Relevant and Appropriate Requirements
*Record of Decision for Groundwater at Site 22*
*Naval Weapons Station Yorktown*
*Yorktown, Virginia*

| Classification | Media/ Location/ Action | Requirement | Prerequisite | Citation | ARAR/TBC Determination | Comment |
|---|---|---|---|---|---|---|
| | Activities that could result in the discharge of pollutants into surface waters, or otherwise altering the physical, chemical or biological properties of surface waters | Discharge of pollutants to state waters is prohibitied. | Activities such as dredging, filling, or discharging any pollutant into or adjacent to surface waters, or otherwise altering the physical, chemical or biological properties of surface waters, excavating in wetlands, or conducting the following activities in a wetland:<br>1. New activities to cause draining that significantly alters or degrades existing wetland acreage or functions.<br>2. Filling or dumping.<br>3. Permanent flooding or impounding.<br>4. New activities that cause significant alteration or degradation of existing wetland acreage or functions. | 9 VAC 25-210-50(A) | Applicable | It is possible that chemicals staged onsite during remedial actions could affect waters of the state if spilled or if "daylighting" should occur. Stormwater inlets and other pathways to surface water will be protected to prevent accidential discharges of treatment chemicals to surface water. Permits and administrative reviews are not required for on-site CERCLA actions; however, the remedial action will comply with the substantive requirements of the regulation. |

**Notes:**
Selected Remedy: Enhanced In situ Bioremediation (EISB), MNA, and LUCs

**Acronyms and Abbreviations**

| | | |
|---|---|---|
| ARAR | Applicable or relevant and appropriate requirement | RCRA |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act | SDWA |
| CFR | Code of Federal Regulations | USC |
| HHRA | Human Health Risk Assessment | VA |
| MCL | Maximum Contaminant Level | VAC |
| PRG | Preliminary Remediation Goal | |

**References**


Commonwealth of Virginia, 2004. Preliminary Identification, Applicable or Relevant and Appropriate Requirements.
USEPA, 1998. *CERCLA Compliance with Other Laws Manual: Interim Final* . Office of Emergency and Remedial Response. EPA/540/G-89/006.
USEPA, 1998. *CERCLA Compliance with Other Laws Manual: Part II. Clean Air Act and Other Environmental Statutes.* Office of Emergency and Remedial Response.
USEPA, 1998. RCRA, Superfund & EPCRA Hotline Training Manual. Introduction to Applicable or Relevant and Appropriate Requirements. EPA540-R-98-020.