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ST JULIENS CREEK
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PROPOSED PLAN FOR SITE 21 INDUSTRIAL AREA ST JULIENS CREEK ANNEX

CHESAPEAKE VA

05/01/2011

NAVFAC MID ATLANTIC

Proposed Plan

Site 21 Industrial Area

St. Juliens Creek Annex
Chesapeake, Virginia

May 2011

1 Introduction

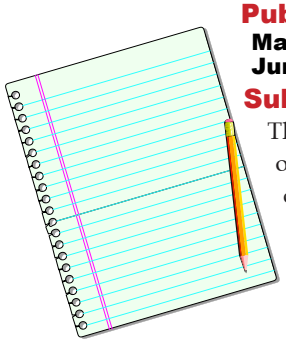
This **Proposed Plan**[1] identifies the Preferred Alternative for mitigating unacceptable human health and environmental risks at **Environmental Restoration Program (ERP)** Site 21 at St. Juliens Creek Annex (SJCA), Chesapeake, Virginia. This plan summarizes the remedial alternatives that were evaluated and provides the rationale for selection of **in situ chemical reduction (ISCR)** and **enhanced reductive dechlorination (ERD)** as the Preferred Alternative for Site 21. Monitoring will be conducted to evaluate the effectiveness of ISCR and ERD and to monitor changes in environmental conditions resulting from implementation of the Preferred Alternative. **Land use controls (LUCs)** will be maintained until site conditions allow for unlimited use and unrestricted exposure.

An Interim Proposed Plan and Interim **Record of Decision (ROD)** for Site 21 were prepared to address the unacceptable risk from **potable** use of Site 21 shallow **groundwater** while the potential risk to current and future building occupants from vapor intrusion through the inhalation of indoor air was further investigated. The Interim Proposed Plan for Site 21 was released for public comment on August 1, 2009. General inquiries were received during the public meeting on August 11, 2009, but no comments were received requiring amendment to the Interim Proposed Plan, and no additional written comments, concerns, or questions were received from community members during the **public comment period**. Based on the results of the vapor intrusion investigation, documented in the **Remedial Investigation (RI)** and **Feasibility Study (FS)** Addendum report for Site 21, no unacceptable risk from the vapor intrusion pathway was identified and, therefore, no **Remedial Action** associated with the pathway is required. However, this Proposed Plan is required in order to present the final site Preferred Alternative, which updates the Interim Preferred Alternative to reflect current site conditions.

This Proposed Plan is issued jointly by the U.S. Navy (Navy), the lead agency for site activities; and the **U.S. Environmental Protection Agency (EPA)** Region III, the lead regulatory agency; in consultation with the **Virginia Department of Environmental Quality (VDEQ)**, the support regulatory agency. This Proposed Plan fulfills the public participation responsibilities required under Section 117(a) of the **Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)**

[1] A glossary of key terms, which are identified in bold print the first time they appear in this document, can be found at the end of this document.

Mark Your Calendar for the Public Comment Period



Public Comment Period

May 1 through June 15, 2011

Submit Written Comments

The Navy will accept written comments on the Proposed Plan during the public comment period. To submit comments or obtain further information please refer to the back page.

Attend the Public Meeting

May 12, 2011 at 5:00 P.M.

Major Hillard Library

The Navy will hold a public meeting to explain the Proposed Plan. Verbal and written comments will be accepted at this meeting.

Location of Information Repository

SJCA Installation Restoration Website

https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_ww_pp/navfac_hq_pp/navfac_env_pp/env_restoration_installations/lant/midlant/sjca

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824 Old George Washington Highway N
Chesapeake, Virginia 23323
Phone: (757)-382-3600

and Section 300.430(f)(2) of the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**.

Detailed information documenting the environmental investigations and studies at Site 21 can be found in the **Site Investigation (SI)** report (June 2004), RI report (June 2008), FS report (February 2009), RI and FS Addendum report (October 2010), and other documents contained in the **Administrative Record** file and **Information Repository** for SJCA (see "Mark your calendar" box on first page). Key information from the FS report and its addendum, including all remedial options considered and detailed information for the Preferred Alternative, is summarized in this plan.

The Navy and EPA, in consultation with the VDEQ, will make the final decision on the remedial approach for Site 21 after reviewing and considering all information submitted during the 45-day public comment period. The Preferred Alternative may be modified, or another Remedial Action may be selected based on new information or public comments received. Therefore, public comment on the remedial alternatives and the rationale for selection of the Preferred Alternative is encouraged.

2 Site Background

2.1 Site Description

SJCA covers approximately 490 acres and is situated at the confluence of St. Juliens Creek and the Southern Branch of the Elizabeth River in the City of Chesapeake, Virginia (Figure 1). Most of the surrounding area is developed and includes residences, schools, recreational areas, and shipping facilities for several large industries. Potable water and water for industrial use by SJCA and the surrounding neighborhoods are provided by the Cities of Chesapeake and Portsmouth.

SJCA began operations as a naval ammunitions facility in 1849. The facility was one of the largest ammunition depots in the United States and was involved in the wartime transfer of ammunitions to other naval facilities. After **ordnance** operations ceased at SJCA in 1977, decontamination was performed in, around, and under ordnance-handling facilities by flushing the areas with chemical solutions and water. SJCA also has been involved in non-ordnance services, including degreasing; operating various shops, such as paint, machine, vehicle and locomotive maintenance, pest control, battery, printing, and electrical; operating boiler plants, wash racks, and potable-water and saltwater fire-protection systems; providing firefighter training; and storing oil and chemicals.

Site 21 is in an industrial area in the south-central portion of SJCA (Figure 1). Site 21 was initially identified as Building 187, which was a locomotive maintenance facility where **trichloroethene (TCE)** was used; however, data obtained from investigations indicated the need to expand the initial site boundary. The current boundary encompasses a number of nearby industrial buildings, which historically had been used as machine, vehicle, and locomotive maintenance shops, electrical shops, and munitions-loading facilities. The outdoor areas were used for storing equipment and chemicals. A fuel service station, including two underground storage tanks, had existed just south of Building 187, but was removed (Figure 2). Waste oils and degreasers (including TCE) were reportedly disposed of on the ground surface and around the railroad tracks in this industrial area. Many of the older buildings at the site have been demolished. Remaining buildings within the Site 21 area are used for storage and maintenance activities.

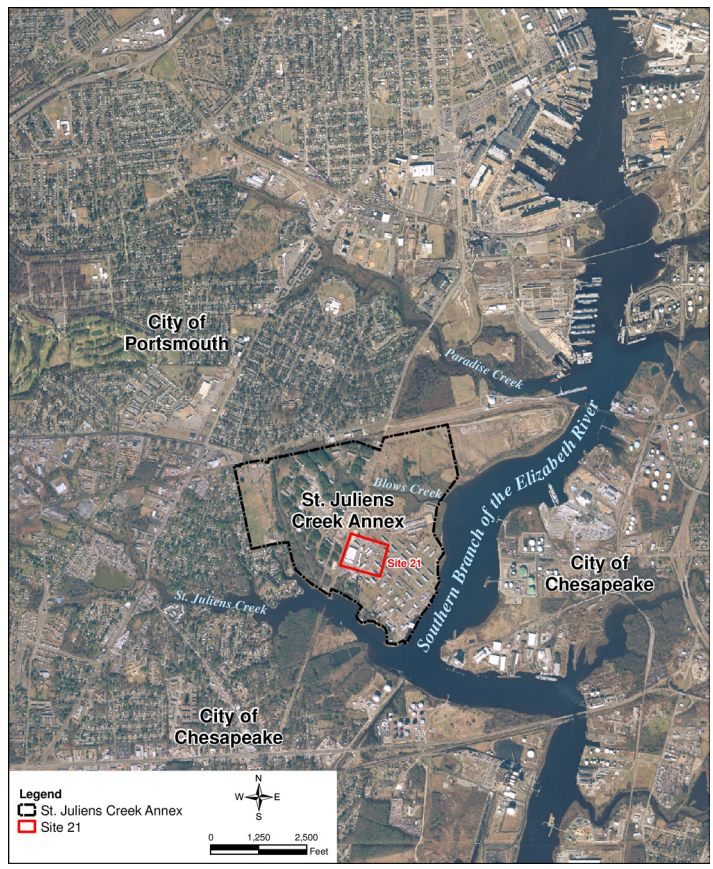


Figure 1 - Base and Site 21 Location Map

2.2 Summary of Environmental Activities

Site 21 was characterized as part of several investigations and studies since 1981. In addition, decision and planning documents associated with an Interim Remedial Action at the site were prepared. Detailed information about the environmental activities is available in the Administrative Record for SJCA. A complete list of the documents included in the Administrative Record files for SJCA can be obtained from the SJCA Installation Restoration Website, https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_ww_pp/navfac_hq_pp/navfac_

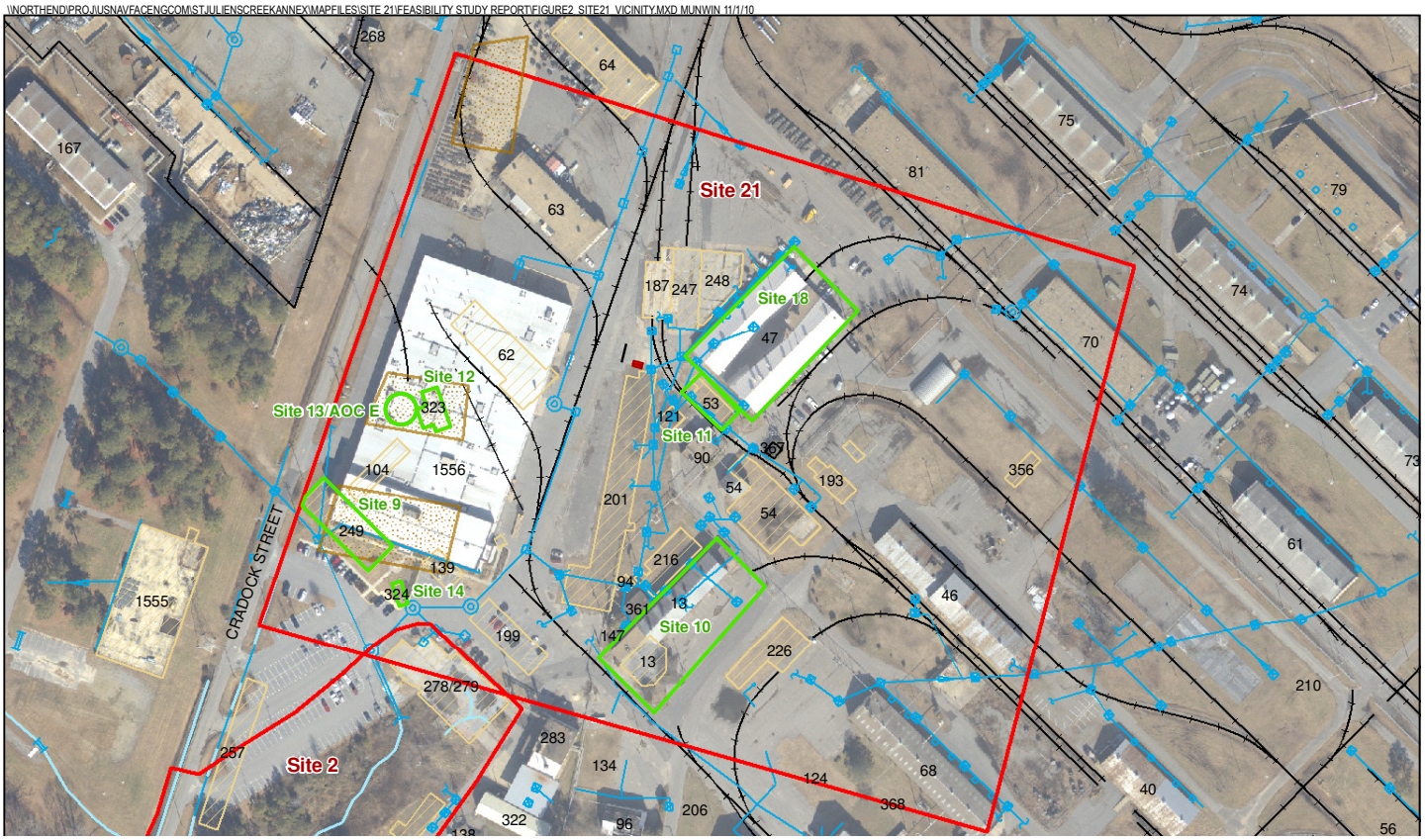


Figure 2 - Site 21 Vicinity Map

env_pp/env_restoration_installations/lant/midlant/sjca, from the Information Repository (see page 1), or by contacting the **Naval Facilities Engineering Command (NAVFAC)** Public Affairs Office at 757-341-1410.

Basewide and site-specific investigations, studies, and Interim Remedial Action documents associated with Site 21 are summarized below:

Initial Assessment Study (Naval Engineering and Environmental Support Activity, 1981)

In 1981, the Navy conducted the Initial Assessment Study (IAS) as part of the Naval Assessment and Control of Installation Pollutants (NACIP) Program. The purpose was to qualitatively identify and assess sites that posed a potential threat to human health and the environment because of contamination from past handling of and operations involving hazardous materials.

The IAS indicated that degreasers used for base operations were commonly disposed of by dumping them onto railroad tracks next to buildings. The IAS also included reports of waste hydraulic oil being disposed of along fence lines to control weeds, and waste oils and solvents being applied to roads to control dust. The area around Building 187 is detailed in the report as being saturated with oil. Details regarding pesticides, degreasers, oils, paints, solvents, etc., and the buildings associated with the use of these substances, are provided in the IAS.

Resource Conservation and Recovery Act Facility Assessment (A.T. Kearney, 1989)

The Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) was conducted to identify areas at SJCA that could be identified as solid waste management units (SWMUs) or areas of concern (AOCs). This included a preliminary review of all available relevant documents and a visual site inspection. Seven of the SWMUs and one of the AOCs identified and recommended for further action in the RFA are within the current Site 21 extended boundary (Figure 2).

Relative Risk Ranking System Data Collection Report (CH2M HILL, 1996)

A relative risk ranking (RRR) was conducted to identify and prioritize sites requiring possible further investigation. It based the ranking on the results of the RFA and focused on the areas of greatest concern (e.g., visible contamination) to serve as a conservative screen to decide whether additional investigation was necessary. The RRR included collection of groundwater and surface soil samples in the SWMUs and AOCs located within the current Site 21 extended boundary. The results indicated the presence of **volatile organic compounds (VOCs)**, **semi-volatile organic compounds (SVOCs)**, and metals in groundwater and VOCs, SVOCs, pesticides, **polychlorinated biphenyls**, and metals in soil.

Site Screening Assessment (CH2M HILL, 2002)

Based on the results of the RFA and RRR, a Site Screening Assessment (SSA) was conducted. A site visit was conducted to help determine the appropriate path forward for the sites identified in the RFA, including the necessity to collect additional samples for inclusion in the SSA report. Based on a review of the information gathered during the site visit, no additional samples were recommended within the Site 21 area. During the SSA, the analytical data from the RRR were evaluated and human health and ecological risk screenings were conducted to evaluate whether areas required additional investigation, removal action, or no further action. No further action was recommended in the SSA report for soil at all of the SWMUs and AOCs within the Site 21 area, but additional evaluation of VOCs in shallow groundwater was recommended following further investigation of groundwater at Site 21. The SSA report provided in the Administrative Record summarizes the findings for sites located within the current, expanded Site 21 boundary.

Site Investigation (CH2M HILL, 2004)

Based on the results of the SSA, an SI was conducted to further characterize potential contamination in groundwater. The investigation aimed to identify the extent and the magnitude of **chlorinated volatile organic compounds (CVOCs)** present in the Columbia **aquifer** (shallow groundwater), and determine if site activities had affected the Yorktown aquifer (deep groundwater).

The data collected during field activities confirmed the presence of a CVOC **plume** in shallow groundwater, with TCE concentrations of up to 2,500 micrograms per liter (µg/L); however, the plume was not fully delineated. SVOCs, one pesticide, explosives, and metals were also detected in shallow groundwater. One VOC, one SVOC, one explosive, and several metals were detected in deep groundwater; however, it was not clear if the detections were related to site activities.

A **human health risk screening (HHRS)** identified potential human health risks from CVOCs and **cyclotrimethylenetrinitramine**, or **RDX**, in shallow groundwater and from chloroform, arsenic, and vanadium in deep groundwater. An ecological risk screening (ERS) was also conducted. Although Site 21 provides little habitat for potential ecological **receptors**, the potential for chemicals in groundwater to be transported and discharged to St. Juliens Creek or its tributaries was identified. Therefore, chemical concentrations in groundwater were screened to determine if they are present at concentrations that could represent a potential risk to aquatic life. Only TCE was detected at concentrations exceeding its ecological screening value, indicating a potential risk. However, based on the transport distance before its discharge to surface water and the potential for mixing and dilution; it was concluded that there is minimal potential for adverse effects from TCE to ecological receptors. Therefore, no further ecological evaluation was recommended.

The SI report recommended further evaluation of shallow and deep groundwater, including further delineation of the CVOC plume in shallow groundwater and resampling select groundwater monitoring wells to confirm or rule out elevated concentrations of metals (arsenic and vanadium) in deep groundwater and RDX in shallow groundwater. No further investigation of the chloroform detected in deep groundwater was recommended because the concentration was well below the **maximum contaminant level (MCL)**.

Remedial Investigation (CH2M HILL, 2008)

The RI was conducted to determine the nature and extent of contamination present, evaluate contaminant fate and transport mechanisms, develop a **conceptual site model (CSM)**, and further evaluate whether the site posed unacceptable human health and ecological risks. Specific objectives were to define the boundary of the shallow groundwater CVOC plume, determine whether RDX was present in shallow groundwater, and further evaluate the metals detected in the deep aquifer during the SI. Storm sewer sampling was also performed to evaluate the contamination migration.

An approximately 8-acre CVOC plume [primarily of TCE, **cis-1,2-dichloroethene (DCE)**, and **vinyl chloride (VC)**] was delineated. In addition, benzene and arsenic were detected at isolated locations in shallow groundwater. RDX was not detected in shallow groundwater during the investigation. Several metals were detected in deep groundwater, including arsenic and vanadium; however, concentrations were much lower than those detected during the SI. CVOCs were detected in samples collected from the storm sewer system, indicating that groundwater discharges into the storm sewer system.

A human health risk assessment (HHRA) was conducted to quantitatively evaluate potential human health risks to current and future receptors from ingestion, dermal contact, and inhalation through showering from shallow and deep groundwater. TCE, cis-1,2-DCE, VC and 1,1-DCE were retained as the **chemicals of concern (COCs)** for potable use of the Site 21 shallow groundwater. Arsenic and benzene in shallow groundwater and arsenic and vanadium in deep groundwater were identified as posing potential risk; however, a qualitative evaluation of the data resulted in their elimination as COCs (see Section 5). The HHRA also evaluated the potential human health risks associated with current and future hypothetical industrial workers inhaling indoor air; however, an additional investigation was recommended to further assess this exposure pathway as a result

of the uncertainties identified in the HHRA. Because the stormwater data were collected to evaluate the groundwater migration pathway, they were included in the shallow groundwater HHRA evaluation. Soil was not evaluated in the HHRA based on the HHRSs conducted during the SSA and SI and the recommendation for no further action for soil.

The RI report recommended that an FS be completed to evaluate potential remedial alternatives to mitigate unacceptable human health risks from the COCs for potable use of the Site 21 shallow groundwater. No unacceptable human health or ecological risks were identified from exposure to deep groundwater, surface and subsurface soil, or stormwater.

Feasibility Study (CH2M HILL, 2008)

An FS was completed to develop and evaluate remedial alternatives to prevent unacceptable risk exposure through potable use of Site 21 shallow groundwater. Four remedial alternatives were selected for detailed comparative analysis: (1) no action, (2) monitored **natural attenuation** (MNA), (3) ISCR and ERD, and (4) **in situ chemical oxidation (ISCO)** and ERD.

Interim Proposed Plan and Record of Decision (CH2M HILL, 2009; NAVFAC, 2010)

The Interim Preferred Alternative, ISCR and ERD, for addressing the potential unacceptable risk exposure through potable use of Site 21 shallow groundwater was identified in the Interim Proposed Plan. The Proposed Plan was "Interim" because it did not address the potential risk to current and future building occupants from vapor intrusion through inhalation of indoor air, which was still being evaluated. The public notice of a public meeting and availability of the Interim Proposed Plan was issued on July 18, 2009. The Navy provided a public comment period from August 1 through September 14, 2009. The public meeting to present the Interim Proposed Plan for Site 21 was held on August 11, 2009, at the Major Hillard Library. No significant changes were made to the Interim Preferred Alternative identified in the Interim Proposed Plan as a result of the public meeting and comment period. The Interim ROD, documenting the selected remedy to address the potable use of Site 21 shallow groundwater, was signed in May 2010.

Interim Remedial Design (CH2M HILL, 2010) and Interim Remedial Action

The Interim Remedial Design for addressing the potential unacceptable risk exposure through potable use of Site 21 shallow groundwater was completed in April 2010. The Interim Remedial Action was initiated in November 2010.

Remedial Investigation and Feasibility Study Addendum (CH2M HILL, 2010)

A vapor intrusion investigation, including collection and analysis of subslab vapor, indoor air, and outdoor air samples, was conducted to evaluate the potential for the migration of the CVOCs from groundwater to indoor air in overlying occupied buildings and to assess current and future potential risk to building occupants from potential vapor intrusion, as recommended in the RI report. No unacceptable human health risks for current or future industrial workers or potential future residents from inhalation of indoor air from vapor intrusion were identified in the updated HHRA, based on the concentrations of CVOCs detected in subslab vapor and/or indoor air during this investigation. As a result, the Interim remedial alternatives developed and evaluated in the FS to address the potential unacceptable risk exposure through potable use of Site 21 shallow groundwater addressed all of the unacceptable site risks, and a separate FS for the vapor intrusion pathway was not required. However, because the concentrations of CVOCs may temporarily increase during groundwater treatment, additional vapor intrusion monitoring and LUCs to prohibit a change from current industrial building use to residential use or occupation of unoccupied buildings, construction of new buildings, and activities that would compromise the integrity of the **building envelopes** without further evaluation and/or implementation of mitigation measures were recommended as a conservative measure. If construction of additional structures or use of currently unoccupied buildings at the site is proposed, further evaluation and/or implementation of mitigation measures were recommended.

3 Site Characteristics

A CSM (Figure 3) has been developed to summarize the site conditions, contaminant distribution, potential receptors and exposure pathways, and land use data collected during the investigations. Most of Site 21's ground surface, with the exception of a few small, unconnected grassy areas, is covered with asphalt. Although many of the older buildings at the site have been demolished, several still remain, including Buildings 47 and 1556. The general topography of the area is flat, with elevations ranging from 7 to 9 feet above mean sea level. A storm sewer system runs through Site 21 and drains to a downstream inlet to St. Juliens Creek (Site 2) (Figure 2). Shallow groundwater at Site 21 is encountered from 2 to 7 feet below ground surface and flows southwest in the eastern portions of the site and southeast in the western portion of the site, toward the storm sewer system east of Building 1556 (Figure 2).

The subsurface geology at Site 21 consists of the fine to coarse silty and clayey sands of the Columbia aquifer,

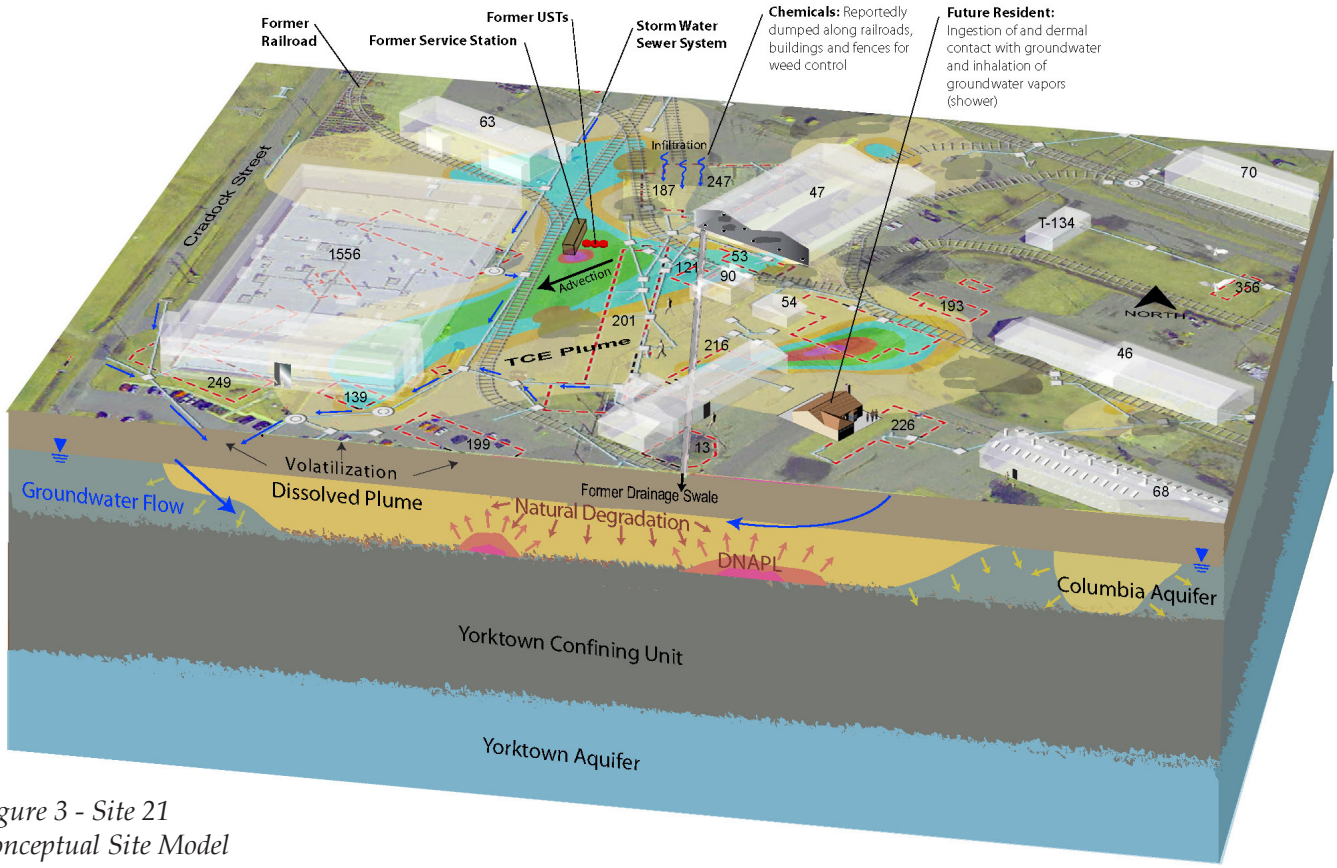


Figure 3 - Site 21
Conceptual Site Model

underlain by the high-plasticity clay of the Yorktown confining unit (Figure 3). The Columbia aquifer extends to a depth of between 13.5 and 20 feet below ground surface. Shallow groundwater flow has been calculated to be approximately 72 feet per year. The Columbia aquifer is not currently used, and is not expected to be used, as a potable or industrial water supply. Water for drinking and industrial use is supplied to SJCA by the City of Portsmouth. The Yorktown confining unit, consisting of relatively impermeable silt and clay layers, is approximately 17 feet thick and continuous at Site 21 and lies above the fine to coarse shelly sands of the Yorktown aquifer.

3.1 Nature and Extent of Contamination

The source of CVOCs in shallow groundwater is likely associated with the disposal of waste fluids (oils and degreasers, including TCE) on the ground surface within the site boundaries. TCE and its degradation products (cis-1,2-DCE and VC) were the most frequently detected contaminants in the shallow aquifer. Contaminant concentrations appear to follow groundwater flow, with the dissolved plume (low-concentration zones) moving from apparent source release points (high-concentration zones) to the southeast and southwest toward the storm sewer system. Depth-specific data indicate that contaminant concentrations are highest at the bottom of the Columbia aquifer and that contaminants may be sorbed (stuck) to the top of the Yorktown confining unit. The Site 21 CVOC plume underlies a number of the nearby industrial buildings and extends over approximately 8 acres (Figure 4). Maximum detected concentrations of the COCs are provided in Table 1.

Chemical of Concern	Maximum Concentration (µg/L)
Trichloroethene	16,000
cis-1,2-Dichloroethene	2,600
Vinyl chloride	390
1,1-Dichloroethane	11

Table 1 - Maximum Concentration for Chemicals of Concern

3.2 Fate and Transport of Contamination

The current primary migration pathways of CVOCs at Site 21 are dissolved contaminant migration downgradient with groundwater flow (advection), groundwater discharge to the leaking storm sewer system and to the south toward St. Juliens Creek, and presumed **dense non-aqueous phase liquids (DNAPLs)** (highly concentrated liquid contaminants which may act as a continuous source of contamination to groundwater) desorbing from the top of the Yorktown confining unit into shallow groundwater. The mechanisms responsible for the fate of the contaminants include sorption of contaminants to soil surfaces (e.g., sticking to them, which affects the rate at which contaminants are carried by groundwater and how far they are spread), natural degradation through various pathways (which plays a significant role in the length of time the contaminants will exist in the subsurface), and

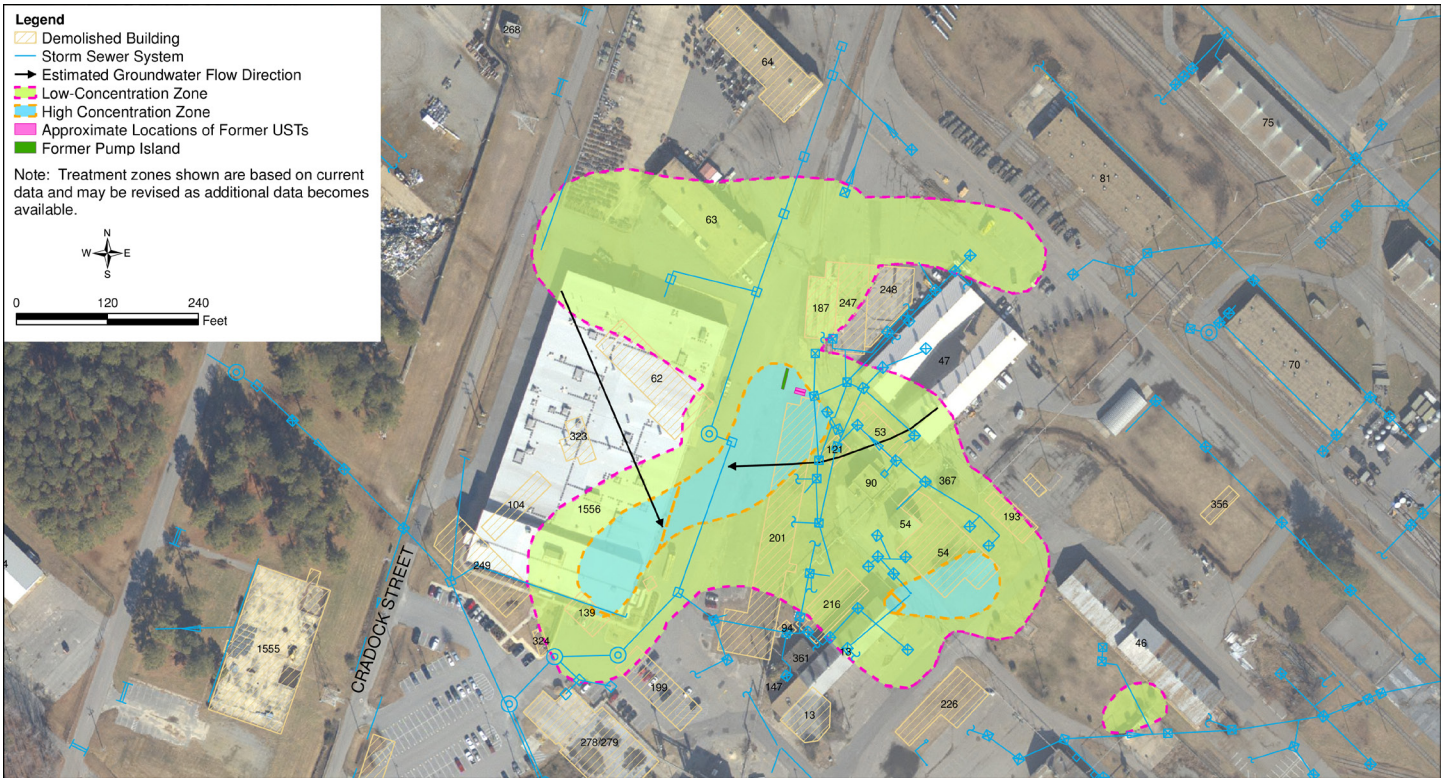


Figure 4 - Site 21 Chlorinated Volatile Organic Compound Plume

volatilization of contaminants from groundwater into the gas phase (which results in a decrease of contaminant mass from the saturated zone).

3.3 Principal Threats

"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 they be exposed. Contaminated groundwater generally is not considered to be a source material; however, **non-aqueous phase liquids (NAPLs)** in groundwater may be. Therefore, DNAPL could represent a principal threat waste if present in small, localized pockets at the top of the Yorktown confining unit. Investigations have not confirmed that DNAPL exists at the site, though the CVOC concentrations indicate it is likely to be present in select areas of the site, based on the rule of thumb that concentrations in excess of 1 percent of a compound's solubility suggest that DNAPL may be present. Therefore, although the groundwater at Site 21 is not considered to be principal threat waste, as a conservative measure, the potential DNAPL will be considered as a principal threat waste.

4 Scope and Role of Response Action

SJCA was placed on EPA's **National Priorities List (NPL)** on July 27, 2000. Fifty-nine potentially contaminated ERP sites, comprising 26 Installation Restoration Program (IRP) sites, one Munitions Response Program (MRP) site, 13 SWMUs, and 20 AOCs, have been identified. Fifty-two were closed following desk-top audits or inspections and required no action. Currently, four sites have a Final ROD:

- Site 2: Action ROD for excavation, soil cover, ERD, MNA, and LUCs
- Site 3: No further action ROD (post-removal action)
- Site 4: Action ROD for soil cover and LUCs
- Site 6: No further action ROD (post-removal action)

In addition to Site 21, three sites are currently active in the IRP—Site 2 is currently undergoing a Remedial Design, Site 4 is currently in the Response Complete phase with LUCs in place, and Site 5 is undergoing a Removal Action in accordance with an Engineering Evaluation/Cost Analysis. One site, Area UXO 1, is currently active in the MRP and is undergoing an SI. Further details are included in the Site Management Plan for SJCA, which is available in the Administrative Record and Information Repository.

The Preferred Alternative presented in this Proposed Plan is intended to address all unacceptable risks to human health and the environment at Site 21, is intended to be the final remedy for the site, and does not include or affect any other ERP site or operable unit at SJCA. The Preferred Alternative is essentially the Interim Preferred Alternative selected in the Interim Proposed Plan. The differences are that this Preferred Alternative extends the Remedial Action until cleanup levels are met, whereas the Interim Preferred Alternative limited the number of

rounds of treatment, and incorporates vapor intrusion monitoring and modified LUCs that reflect the current understanding of site conditions.

5 Summary of Site Risks

It is the current judgment of the Navy and EPA, in consultation with VDEQ, that the Preferred Alternative, or one of the other active remedial alternatives, identified in this Proposed Plan is necessary to protect human health and the environment from actual or threatened exposure to CVOCs in shallow groundwater at Site 21. Detailed results of the HHRA conducted at Site 21 are presented in the HHRA sections of the RI report and the RI and FS Addendum report, which are available in the Administrative Record.

5.1 Human Health Risk Summary

An HHRA was conducted to evaluate the potential human health risks (see sidebar, "What is Human Health Risk and How is it Calculated?") associated with current receptors (industrial workers) and hypothetical future receptors (construction workers, adult residents, child residents, and lifetime residents) and exposure scenarios (ingestion; dermal, or skin, contact; and inhalation, through showering or breathing indoor air) if no Remedial Action were implemented for the shallow and deep groundwater. This information was used to determine if any further actions needed to be taken at Site 21 to sufficiently protect human health. Health risks are based on a conservative estimate of the potential **cancer risk** or the potential to cause other health effects not related to cancer (**non-cancer hazard**, or **hazard index (HI)**). EPA identifies an acceptable cancer risk range of 1 in 1 million (10^{-6}) to 1 in 10,000 (10^{-4}), which represents the increased chance of contracting cancer as a result of exposure to site-related contaminants, and a non-cancer hazard as an HI of less than 1, which represents the ratio of the anticipated exposure to an acceptable exposure level at which no adverse health effects are expected to occur.

Soil

Because the nature and extent of contamination in soil was defined and evaluated during previous investigations in the Site 21 vicinity and no human health or ecological risks were identified, no further investigation or action for soil was necessary. Therefore, soil was not considered as a potential exposure point in the HHRA.

Groundwater

Deep Groundwater

The HHRA identified potential human health risks from exposure to arsenic and vanadium in deep groundwater (Yorktown aquifer). However, the risk assessment was performed using the results of all rounds of data collected from the deep aquifer, and the concentrations were not consistent. The arsenic and vanadium concentrations in deep groundwater collected in the first round of sampling indicated potential risk; however, arsenic and vanadium were either not detected or detected below their MCLs in the two subsequent rounds of sampling. Arsenic and vanadium were not detected in the shallow aquifer (Columbia aquifer) in the same area of the site, and a laterally extensive hydraulic aquitard (Yorktown confining unit) prevents the downward migration of contaminants. Therefore, it is likely that the arsenic and vanadium concentrations detected in the first round of sampling are indicative of natural conditions and not a site release. Data collected and presented in the RI report support the fact that deep groundwater does not appear to have been impacted by Site 21 activities, so no further investigation or action for deep groundwater is necessary.

Shallow Groundwater

Based on the **reasonable maximum exposure (RME)** reported in the HHRA, there are no non-cancer hazards or cancer risks that exceed EPA acceptable levels for a construction worker exposed to shallow groundwater during excavation activities. However, based on the RME, the following exposure pathways may pose an unacceptable risk or hazard for future child, adult, and/or lifetime hypothetical residents: ingestion of TCE, cis-1,2-DCE, VC, benzene, and arsenic through potable use; inhalation of TCE while showering; and/or dermal contact with TCE. Although potential risks were identified from exposure to benzene and arsenic, these compounds were identified only in the vicinity of a closed underground storage tank, which is the likely source of the benzene. Because benzene is fuel-related, it is not treated under CERCLA based on the petroleum exclusion and was not carried through as a COC. Arsenic commonly occurs as a natural mineral coating of the sand and gravel in the aquifer and becomes more mobile under reducing conditions, which are present near the former underground storage tank, and was, therefore, also not carried through as a COC. However, the remedy evaluation did take into consideration the potential for the mobilization of naturally occurring arsenic. Based on this evaluation, if naturally occurring arsenic mobilizes as a result of the selected remedial alternative, monitoring will be performed to confirm that the concentrations return to a level that does not pose unacceptable risk to potential receptors. RME risks and hazards for the COCs are summarized in Table 2.

Indoor Air

Following collection of additional data, the HHRA completed for the RI report was updated for the RI and FS Addendum report. The updated HHRA concluded that there are no unacceptable risks to current or future industrial workers at the existing occupied buildings or

Receptor	Media	Pathway	Chemical of Concern	Exposure Point Concentration (µg/L)	Cancer Risk	Non-cancer Hazard Index
Future Child Resident	Shallow Groundwater	Ingestion	TCE	3,100	NA	33
			Vinyl Chloride	170	NA	3.6
			cis-1,2-DCE	1,500	NA	9.7
		Dermal	TCE	3,100	NA	5.5
Future Adult Resident	Shallow Groundwater	Ingestion	TCE	3,100	NA	14
			Vinyl Chloride	170	NA	1.6
			cis-1,2-DCE	1,500	NA	4.2
		Dermal	TCE	3,100	NA	2.4
		Inhalation (while showering)	TCE	3,100	1.6×10^{-4}	0.38
Future Lifetime Resident	Shallow Groundwater	Ingestion	TCE	3,100	6.0×10^{-4}	Not calculated, risks were calculated for future child and adult residents
			Vinyl Chloride	170	3.6×10^{-3}	

Potential unacceptable risks are shaded blue.

Table 2 - Summary of Unacceptable Human Health Risks

future hypothetical buildings. Potential risks to future residential receptors from inhalation of TCE in indoor air if future residential structures are constructed at the site are equal to the maximum allowable risk. Because the calculated risk was at the allowable threshold based on conservative assumptions, human health risks for future residents from inhalation of indoor air from vapor intrusion are acceptable.

During the Remedial Action for shallow groundwater, the concentrations of TCE daughter products (cis-1,2-DCE and VC) may temporarily increase, resulting in potential short-term risks. Therefore, as a conservative measure, vapor intrusion monitoring is planned and LUCs will be implemented to prohibit a change from current industrial building use to residential use or occupation of unoccupied buildings, construction of new buildings, and activities that would compromise the integrity of the building envelopes without further evaluation and/or implementation of mitigation measures.

5.2 Ecological Risk Summary

Based on recommendations of the ERS conducted in the SSA and SI, an ecological risk assessment is not required

WHAT IS HUMAN HEALTH RISK AND HOW IS IT CALCULATED?

A human health risk assessment estimates "baseline risk." This is an estimate of the likelihood of health problems occurring if no cleanup action were taken at a site. The Navy undertakes a four-step process to estimate baseline risk at a site:

Step 1: Analyze Contamination
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In Step 1, the Navy looks at the concentrations of contaminants found at a site as well as past scientific studies on the effects these contaminants have had on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies help the Navy to determine which contaminants are most likely to pose the greatest threat to human health.

In Step 2, the Navy considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, EPA calculates a "reasonable maximum exposure" (RME) scenario that portrays the highest level of human exposure that reasonably could be expected to occur.

In Step 3, the Navy uses the information from Step 2, combined with information on the toxicity of each chemical, to assess potential health risks. The Navy considers two types of risk: cancer risk and non-cancer risk. The likelihood of any kind of cancer resulting from a site is generally expressed as an upper-bound probability, for example, a "1 in 10,000 chance." In other words, for every 10,000 people that could be exposed, one extra cancer may occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than would normally be expected to from all other causes. For non-cancer health effects, the Navy calculates a "hazard index (HI)." The key concept here is that a "threshold level" (measured usually as a hazard index of less than 1) exists below which adverse, non-cancer health effects are no longer predicted.

In Step 4, the Navy determines whether site risks are great enough to cause health problems for people at or near the site. The results of the three previous steps are combined, evaluated, and summarized. The Navy adds together the potential risks from the individual contaminants to determine the total risk resulting from the site.

for Site 21. The SI ERS concluded that Site 21 provides little terrestrial habitat (e.g., it is mostly a paved industrial area) and no viable aquatic habitats (e.g., there are no surface water features) for potential ecological receptors. Therefore, further evaluation was not recommended.

6 Remedial Action Objectives

It is the current judgment of the Navy and EPA, in consultation with VDEQ, that remedial action is necessary to protect public health, welfare, and the environment from actual or threatened releases of COCs at Site 21. Therefore, the following **remedial action objectives (RAOs)** were established for Site 21:

- Reduce contaminant concentrations in shallow groundwater to the maximum extent practicable
- Prevent exposure to shallow groundwater until contaminant concentrations allow for unlimited use and unrestricted exposure

Preliminary remediation goals (PRGs) were developed for chemicals with concentrations contributing to unacceptable risks and hazards from exposure to shallow groundwater within Site 21. Based on the RI report, COCs were identified as those site-related chemicals with cancer risks exceeding 1 in 10,000, with an HI exceeding 1 (Table 2), or with concentrations exceeding the established MCLs. The COCs are TCE, cis-1,2-DCE, VC, and 1,1-DCE. To achieve RAOs and comply with the Commonwealth of Virginia's and EPA's expectation to return usable groundwaters to their beneficial uses wherever practicable, PRGs were set at the MCLs after consideration of whether the use of MCLs would provide sufficient protection, when factoring in cumulative risks and hazards. PRGs are identified in Table 3.

Chemical of Concern	Preliminary Remediation Goal (µg/L)*
Trichloroethene	5
cis-1,2-Dichloroethene	70
Vinyl chloride	2
1,1-Dichloroethane	7

* Based on Maximum Contaminant Level

Table 3 - Preliminary Remediation Goals for Chemicals of Concern

7 Summary of Remedial Alternatives

The remedial alternatives developed and evaluated to address COCs in groundwater at Site 21 are detailed in the FS report. Following the screening of groundwater remediation technologies, the following remedial alternatives were selected for detailed evaluation and comparative analysis:

- Alternative 1: No action
- Alternative 2: MNA
- Alternative 3: ISCR and ERD
- Alternative 4: ISCO and ERD

Based on the results of the evaluation, ISCR and ERD (Alternative 3) 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 to prevent exposures that would present an unacceptable risk. Alternative 1 is required by the NCP and serves as the baseline against which the other alternatives are compared. For Alternatives 2, 3, and 4, monitoring and LUCs would be maintained until the RAOs are met, with 5-year statutory reviews to ensure protection of human health and the environment. In Alternatives 3 and 4, separate treatments are considered for the high- and low-concentration zones that could be implemented concurrently or in a phased approach, treating the high-concentration zones first, followed by the low-concentration zones.

A description of each remedial alternative is provided in Table 4.

8 Evaluation of Remedial Alternatives

The NCP identifies nine evaluation criteria for use in a comparative analysis of remedial alternatives (Table 5). Each remedial alternative for Site 21 was evaluated against these criteria and in comparison to one another (Table 6). Alternative 1 (no action) does not protect human health and the environment, which is one of the threshold criteria which must be met in order for an alternative to be selected. Therefore, Alternative 1 serves only as a baseline and is not discussed in the following sections.

8.1 Threshold Criteria

Protection of human health and the environment

Alternatives 2, 3, and 4 are all protective of human health and the environment. Alternative 2 is considered to be less protective than Alternatives 3 and 4 because it relies on natural degradation, which adds a higher degree of uncertainty for the rate of contaminant reduction and length of time to achieve RAOs. Alternatives 3 and 4 are similar in protectiveness because they each employ an active treatment to reduce chemical concentrations. Monitoring will be conducted and LUCs will provide adequate protection of human health and the environment by controlling exposure to shallow groundwater and changes in the site use until the RAOs are achieved.

Alternative	Components	Details	Cost
1 - No Action	None	Allow the COCs to breakdown naturally over time.	Capital cost $0 O&M present value $0 Total present value $0
2 - Monitored Natural Attenuation	Monitoring LUCs	Regular, long-term monitoring performed to verify that: • COC concentrations continue to decrease • Potentially toxic transformation products are not created at levels that are a threat to human health • Impacted area is not expanding • There are no changes in hydrogeological, geochemical, or microbiological parameters that might reduce the effectiveness of the Remedial Action. • Temporary conditions do not result in COC concentrations in indoor air at levels that are a threat to building occupant Implementation of LUCs to prevent exposure and control changes in site use: • Prohibit the withdrawal of groundwater except for environmental monitoring • Prohibit a change from current industrial building use to residential use or occupation of unoccupied buildings, construction of new buildings, and activities that would compromise the integrity of the building envelopes without further evaluation and/or implementation of mitigation measures	Capital Cost $50K O&M Present Value $434K Total Present Value $484K
3 - ISCR & ERD	Injection of reducing agent (e.g., zero valent iron) Injection of electron source (e.g, emulsified vegetable oil) Monitoring LUCs	Injection of reducing agents to promote abiotic in-situ reduction of COCs to ethene and chloride. Injection of an electron donor source, which is generally the limiting factor, to enhance naturally occurring reductive dechlorination process. Performance of regular, long-term monitoring to verify that: • COC concentrations continue to decrease • Potentially toxic transformation products are not created at levels that are a threat to human health • Impacted area is not expanding • There are no changes in hydrogeological, geochemical, or microbiological parameters that might reduce the effectiveness of the Remedial Action. • Temporary conditions do not result in COC concentrations in indoor air at levels that are a threat to building occupants Implementation of LUCs to prevent exposure and control changes in site use: • Prohibit the withdrawal of groundwater except for environmental monitoring • Prohibit a change from current industrial building use to residential use or occupation of unoccupied buildings, construction of new buildings, and activities that would compromise the integrity of the building envelopes without further evaluation and/or implementation of mitigation measures	Capital cost $3.1M O&M present value $0.8M Total present value $3.9M
4 - ISCO & ERD	Injection of oxidizing agent (permanganate) Injection of electron source (e.g, emulsified vegetable oil) Monitoring LUCs	Injection of oxidizing agent to promote abiotic in-situ oxidation of COCs through reaction of oxidants with the COCs to produce innocuous substances such as carbon dioxide, water, and chloride. Injection of an electron donor source, which is generally the limiting factor, to enhance naturally occurring reductive dechlorination process. Performance of regular, long-term monitoring to verify that: • COC concentrations continue to decrease • Potentially toxic transformation products are not created at levels that are a threat to human health • Impacted area is not expanding • There are no changes in hydrogeological, geochemical, or microbiological parameters that might reduce the effectiveness of the Remedial Action. • Temporary conditions do not result in COC concentrations in indoor air at levels that are a threat to building occupants Implementation of LUCs to prevent exposure and control changes in site use: • Prohibit the withdrawal of groundwater except for environmental monitoring • Prohibit a change from current industrial building use to residential use or occupation of unoccupied buildings, construction of new buildings, and activities that would compromise the integrity of the building envelopes without further evaluation and/or implementation of mitigation measures	Capital cost $4.6M O&M present value $0.7M Total present value $5.3M

O&M = operations and maintenance.

Table 4 - Descriptions of Remedial Alternatives for Site 21

CERCLA Criteria	Definition
Threshold Criteria	
Protection of human health and the environment	Addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through mitigation, engineering controls, or institutional controls.
Compliance with Applicable Relevant and Appropriate Requirements (ARARs)	Addresses whether a remedy will meet all of the ARARs of 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 a remedy 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 a remedy 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 clean-up goals are achieved.
Implementability	Evaluates the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement an option.
Present-worth cost	Compares the estimated initial, operation and maintenance, and present-worth costs.
Modifying Criteria	
State acceptance	Considers the state support agency comments on the Proposed Plan.
Community acceptance	Provides the public's general response to the remedial alternatives described in the Proposed Plan, RI report, and FS report. The specific responses to the public comments are addressed in the "Responsiveness Summary" section of the ROD.

Table 5 - Evaluation Criteria for Remedial Alternative Analysis

Compliance with Applicable or Relevant and Appropriate Requirements

Alternatives 2, 3, and 4 are expected to comply with applicable or relevant and appropriate requirements (ARARs). Alternative 2 will have a longer timeframe associated with compliance with the MCLs under the Safe Drinking Water Act, which are the primary ARARs, because it relies on natural degradation, whereas Alternatives 3 and 4, which are similar, employ active treatment and will, therefore, meet the ARARs in a shorter timeframe than Alternative 2.

8.2 Primary Balancing Criteria

Long-term effectiveness and permanence

Once RAOs have been achieved, Alternatives 2, 3, and 4 are expected to effectively reduce concentrations of VOCs in shallow groundwater to allow for unlimited use and unrestricted exposure. Alternatives 3 and 4 are

CERCLA Criteria	No Action (1)	MNA (2)	ISCR & ERD (3)	ISCO & ERD (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	●	●	◉	○

Ranking: ● High ◉ Moderate ○ Low N/A=Not Applicable

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

Table 6 - Relative Ranking of Remedial Alternatives

considered equally effective and will achieve a more rapid reduction in VOC concentrations because they employ active treatment, while Alternative 2 relies on natural degradation. For each alternative, with proper planning and implementation, controls can be put in place to monitor all the alternatives effectively to verify continued compliance with RAOs.

Reduction in toxicity, mobility, or volume through treatment

Alternatives 2, 3, and 4 are each expected to reduce toxicity, mobility, and volume. Only Alternatives 3 and 4 have treatment components, which is the statutory preference. Although MNA is not considered a treatment, the natural reduction of contaminant concentrations through a variety of physical, chemical, or biological activities is expected over time.

Short-term effectiveness

Alternatives 3 and 4 are similar with regard to how they would affect the community, in the short term, because both treatments rely on direct injection technology for implementation. The community impact associated with Alternatives 3 and 4 is slightly higher than with Alternative 2 because of the vehicle traffic through the community associated with transportation of injection materials and investigation-derived waste. Alternative 2 has a lower impact on the community because it does not rely on active treatment. Alternative 4 has a slightly higher risk to construction workers during implementation than Alternatives 2 and 3 because it involves the handling of and potential exposure to oxidizing chemicals, which present a fire and explosion hazard. Alternatives 3 and 4 have similar potential impacts to the environment because each may result in a temporary mobilization of naturally occurring metals, whereas Alternative 2 would not. Additionally, MNA associated with Alternative 2 and implementation of ERD associated with Alternatives 3 and 4 have the potential to temporarily increase the concentrations of TCE daughter products during the Remedial Action, resulting in a potential temporarily increased human health risk from vapor intrusion during the Remedial Action. Because Alternative 2 relies on natural degradation rather than active treatment, it results in the lowest rate of reduction in COCs and the longest timeframe for achieving the RAOs. Alternative 3 is the most effective in the short term.

Implementability

Alternatives 2, 3, and 4 can each be implemented using standard and widely available technologies. Alternatives 3 and 4 are more difficult to implement than Alternative 2 due to the logistical challenges of working in an industrial area (e.g., the presence of buildings and utilities). Alternative 3 would be slightly easier to implement than Alternative 4 because Alternative 3 relies on naturally occurring reducing conditions, whereas Alternative 4 would require the reversal of the existing reducing conditions to oxidizing for the initial phase of treatment (ISCO) then return to reducing for the second phase (ERD).

Cost

The estimated capital cost for implementation of Alternative 2 ($50,000) is less than that of Alternative 3 ($3.1 million) or Alternative 4 ($4.6 million). The estimated present value cost, factoring in a 30-year operation and maintenance period for each alternative, is $500,000 for Alternative 2, $3.9 million for Alternative 3, and $5.3 million for Alternative 4. Alternative 3 has a lower capital cost and present-value cost than Alternative 4 due to the type and quantity of injection materials.

Modifying Criteria

State Acceptance

State involvement has been solicited throughout the CERCLA and remedy selection process. The State supports the Preferred Alternative, Alternative 3. Final concurrence by the State will be solicited following the review of all comments received during the public comment period.

Community Acceptance

The Navy provided a public comment period between August 1, 2009 and September 14, 2009, for the Site 21 Interim Proposed Plan. A public meeting to present the Interim Proposed Plan was held on August 11, 2009 at the Major Hillard Public Library. Public notice of the meeting and availability of documents was placed in The Virginian-Pilot newspaper on July 18, 2009. General inquiries were received during the public meeting on August 11, 2009, but no comments were received requiring amendment to the Interim Proposed Plan and no additional written comments, concerns, or questions were received from community members during the public comment period. Therefore, the community concurred with the selection of Alternative 3 as the Preferred Alternative for the Interim Remedial Action. This modifying criterion will be further evaluated after the public comment period for this Proposed Plan.

A comparative analysis of the alternatives is presented in Table 6, and is detailed in the FS report.

9 Preferred Alternative

Based on the comparative analysis, the Preferred Alternative is Alternative 3, consisting of ISCR and ERD.

As a comparison, Alternative 2 does not actively treat the source area and takes significantly longer to achieve the RAOs; Alternative 4 adequately meets the RAOs but requires the reversing of oxidizing effects caused by the ISCO before the ERD is implemented. Additionally,

Alternative 4 is more expensive than Alternative 3 and has a slightly higher risk to construction workers during implementation due to their handling of and potential exposure to oxidizing chemicals.

Long-term monitoring will be conducted to evaluate the effectiveness of ISCR and ERD, and changes in the concentration and location of the plume and to monitor changes in environmental conditions resulting from implementation of the selected remedy. The monitoring will include evaluation of site information to confirm that implementation of the remedy does not produce unacceptable risk to the current receptors from vapor intrusion. Although the effectiveness of mitigation of CVOCs in groundwater will be measured by comparison to PRGs, the remedial technology is not guaranteed to reduce CVOC concentrations to levels at or below PRGs across Site 21. However, natural attenuation processes will continue to reduce VOC concentrations over time. The LUCs will be implemented to prohibit the withdrawal of groundwater except for environmental monitoring and prohibit a change from current industrial building use to residential use or occupation of unoccupied buildings, construction of new buildings, and activities that would compromise the integrity of the building envelopes without further evaluation and/or implementation of mitigation measures. The LUC boundary, depicted as a component of the Preferred Alternative, is the current CVOC groundwater plume boundary with a 100-foot buffer to account for the potential lateral migration of CVOC vapors; this boundary will be modified as the plume boundary is updated (Figure 5). LUCs will be maintained until the concentrations of hazardous substances in the groundwater have been reduced to levels that allow for unlimited use and unrestricted exposure. As required by CERCLA, 5-year reviews will be conducted to assess the effectiveness of the remedy. The need for LUCs to prevent exposure and ensure protection will be reassessed as necessary.

Based on information currently available, the Navy believes the Preferred Alternative (Alternative 3) meets the threshold criteria and provides the best balance of tradeoffs with respect to the balancing and modifying criteria. The Navy expects the Preferred Alternative to satisfy the statutory requirements of CERCLA Section 121 (b), which include: (1) protection of human health and the environment, (2) compliance with ARARs, (3) cost-effectiveness, (4) use of permanent solutions and alternative treatment technologies to the maximum extent practicable, and (5) the preference for treatment as a principal element. The Preferred Alternative will be reevaluated as appropriate in response to public comment or new information.

10 Community Participation

The Navy and EPA provide information regarding environmental cleanups at SJCA to the public through the Restoration Advisory Board, public meetings, the Administrative Record for the site, the Information Repository, and announcements published in The Virginian-Pilot newspaper. The public is encouraged to gain a more comprehensive understanding of Site 21 and the ERP (see page 1 of this plan for more details). The public comment period for this Proposed Plan runs from May 1, 2011, through June 15, 2011. A public meeting will be held on May 12, 2011, at 5:00 p.m. Minutes of the public meeting will be included in the Administrative Record file. The Navy will summarize and respond to comments in a responsiveness summary, which will become part of the official ROD and will also be included in the Administrative Record file.

During the comment period, interested parties may submit written comments to the following individuals:

Mr. Walter Bell
NAVFAC MIDLANT OPHE3
9742 Maryland Avenue
Building N-26, Room 3300
Norfolk, Virginia 23511-3095
Phone: (757) 341-0484
Fax: (757) 341-0399
Email – walt.j.bell@navy.mil

For further information, please contact:

Mr. Robert W. Stroud
EPA/ESC
701 Mapes Road
Fort Meade, Maryland 20755
Phone: (410) 305-2748
Fax: (410) 305-3096
Email – stroud.robert@epa.gov

Ms. Karen Doran
Virginia Department of Environmental Quality
629 East Main Street
Richmond, VA 23219
Phone: (804) 698-4594
Email – karen.doran@deq.virginia.gov

11 Glossary

This glossary defines in non-technical language the more commonly used environmental terms appearing in this Proposed Plan. The definitions do not constitute the Navy's, EPA's, or VDEQ's official use of terms and phrases for regulatory purposes, and nothing in this glossary should be construed to alter or supplant any other federal or Commonwealth document.

Official terminology may be found in the laws and related regulations as published in such sources as the Congressional Record, Federal Register, and elsewhere.

Administrative Record: A compilation of site-related information reviewed or relied upon by the Navy and regulatory agencies to make decisions about the site and its cleanup, which is available for public review.

Applicable or Relevant and Appropriate Requirements (ARARs): The federal or state environmental rules and regulations that are applicable or relevant and appropriate to activities conducted, specific environments, or contaminants found at a CERCLA site.

Aquifer: Underground bed of soil or rock from which groundwater can be usefully extracted.

Building envelope: The building construction elements (e.g., foundation, walls, ceiling, windows) that provide a separation between the interior and the exterior environments of a building.

Cancer risk: Cancer risk is expressed as a number reflecting the increased chance that a person will develop cancer if exposed to chemicals or substances. For example, EPA's acceptable risk range for Superfund sites is 1×10^{-6} to 1×10^{-4} , meaning there is 1 additional chance in 1 million (1×10^{-6}) to 1 additional chance in 10,000 (1×10^{-4}) that a person will develop cancer if exposed to contaminants at a site that is not remediated.

Chemical of concern (COC): A contaminant that is deemed to pose unacceptable risks or hazards to receptors at the site.

Chlorinated volatile organic compound (CVOC): Any of a number of manufactured chemicals that evaporate easily and are typically used in manufacturing as industrial chlorinated solvents, such as degreasers. See also "volatile organic compound."

Cis-1,2-Dichloroethene (cis-1,2-DCE): VOC that results from the breakdown of TCE and tetrachloroethene in groundwater.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA): A federal law, commonly referred to as the Superfund Program, that provides for cleanup and emergency response in connection with numerous existing inactive hazardous waste disposal sites that endanger public health and safety or the environment.

Conceptual site model (CSM): A description of a site and its environment that is based on existing knowledge and that assists in planning, interpreting data, and communicating. It describes sources of contamination (e.g., spills) and receptors (e.g., humans) and the interactions that link the two.

Cyclotrimethylenetrinitramine (RDX): A white crystalline explosive used in high explosives.

Dense non–aqueous phase liquid (DNAPL): See "Non–aqueous phase liquid."

Enhanced reductive dechlorination (ERD): An anaerobic (i.e., without oxygen) process in which an electron donor source is injected into the subsurface to allow chlorine atoms on a parent CVOC molecule to be sequentially replaced with hydrogen and break down COCs.

Environmental Restoration Program (ERP): The Navy, as lead agency, acts in partnership with EPA and VDEQ to conduct environmental investigations and remediation at naval facilities in Virginia through the ERP. The current ERP is consistent with CERCLA and applicable state environmental laws.

Feasibility study (FS): An analysis of the practicability of a range of remedial proposals, supported by data and risk assessment, to allow decision makers to select the most appropriate site remedy.

Groundwater: Subsurface water that occurs in soils and in geologic formations that are fully saturated.

Hazard index (HI): A summation of the hazard quotients (defined below) for all chemicals to which an individual is exposed. The HI is indicative of non-cancer health effects and is a ratio of the existing level of exposure to an acceptable level of exposure at which no adverse health effects are expected to occur. A value equal to or less than 1 indicates that the human population is not likely to experience adverse effects.

Hazard quotient (HQ): Hazard quotients are used to evaluate non-carcinogenic health effects and ecological risks. The HQ is the ratio of the existing level of exposure for a single chemical to an acceptable level of exposure for that chemical at which no adverse health effects are expected to occur. A value equal to or less than 1 indicates that the human or ecological population is not likely to experience adverse effects from exposure to that chemical.

Human health risk assessment (HHRA): An evaluation of the risk posed to human health should remedial activities not be implemented.

Human health risk screening (HHRS): A conservative evaluation of site data for risk posed to human health, conducted to determine if a comprehensive evaluation (i.e., HHRA) should be performed.

Information Repository: A file containing information, technical reports, and reference documents regarding an NPL (defined below) site. This file is usually maintained at a location with easy public access, such as a public library.

In situ chemical oxidation (ISCO): Use of oxidizing chemicals, which accept electrons during chemical reactions, to break down groundwater contaminants into carbon dioxide and water.

In situ chemical reduction (ISCR): Use of reducing chemicals, which provide electrons during chemical reactions, (e.g., zero-valent iron) to break down groundwater contaminants into harmless by-products.

Land use controls (LUCs): Physical, legal, or administrative methods that restrict the use of or limit access to property to reduce risks to human health and the environment.

Maximum Contaminant Level (MCL): The maximum permissible level of a contaminant in water delivered to any user of a public system. MCLs are enforceable standards under the Safe Drinking Water Act.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): A plan codified at 40 CFR Part 300 that provides the organizational structure and procedures for

preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants.

National Priorities List (NPL): A list, developed by EPA, of uncontrolled hazardous substance release sites in the United States that are considered priorities for long-term remedial evaluation and response.

Natural attenuation (NA): Reduction in mass or concentration of a constituent over time or distance from the source due to naturally occurring physical, chemical, and biological processes.

Naval Facilities Engineering Command (NAVFAC): Global organization that provides planning, design and construction of shore facilities for U.S. Navy activities around the world.

Non–aqueous phase liquid (NAPL): A liquid that does not dissolve or mix easily in water. A DNAPL is a NAPL that is denser than water.

Non-cancer hazard: A measure of the adverse human health effects other than cancer that are caused by contaminants present at a site. Non-cancer hazards are expressed as a quotient that compares the existing level of exposure to the acceptable level of exposure. There is a level of exposure (the reference dose) below which it is unlikely for even a sensitive population to experience adverse health effects. EPA's threshold level for non-cancer hazard at Superfund sites is 1, meaning that if the exposure exceeds the threshold, there may be a concern for potential noncancer effects.

Ordnance: Military supplies including weapons, ammunition, combat vehicles, and maintenance tools and equipment.

Plume: A space in air, water, or soil containing pollutants released from a point source.

Polychlorinated biphenyl (PCB): A type of industrial compound, such as a lubricant, heat-transfer fluid, or plasticizer that accumulates in animal tissue and results in adverse health conditions. PCBs are especially deadly to fish and invertebrates, and stay in the food chain for many years. The manufacture and use of PCBs has been regulated since the 1970s because they are very harmful to the environment.

Potable: Safe for drinking.

Preliminary remediation goals (PRGs): Chemical-specific concentration goals for specific media (e.g. soil, sediment, water and air) and land use combinations that serve as a target to use during the initial development, analysis, and selection of cleanup alternatives. These goals should both be protective of human health and the environment and comply with all ARARs for all exposure pathways being addressed.

Proposed Plan: A document that presents the rationale for proposing a cleanup alternative and requests public input regarding the proposed cleanup alternative.

Public comment period: The time allowed for the members of an affected community to express views and concerns regarding an action proposed to be taken by the Navy and EPA, such as a rulemaking, permit, or Superfund-remedy selection.

Reasonable maximum exposure (RME): The highest level of site chemical concentrations a human can reasonably be expected to be exposed to under a given exposure scenario.

Receptor: A human, animal, or plant that may be exposed to contaminants related to a given site.

Record of Decision (ROD): A legal document that describes the cleanup action or remedy selected for a site, the basis for choosing that remedy, and public comment on all of the remedial alternatives considered.

Remedial action objectives (RAOs): Cleanup objectives for a site that are developed based on contaminated media, COCs, potential receptors and exposure scenarios, human health and ecological risk assessments, and attainment of regulatory cleanup levels, if any exist.

Remedial action: A cleanup method proposed or selected to address contaminants at a site.

Remedial investigation (RI): A study of a facility where hazardous substances have been disposed or released that identifies the nature and extent of contamination at the facility. The RI supports the selection of a remedy.

Restoration Advisory Board: An advisory board made up of community members and government officials representing the Navy, EPA, and VDEQ. The Restoration Advisory Board is designed to function as a focal point for a continual exchange of information, concerns, values, and needs between the local community and the SJCA ERP representatives.

Semi-volatile organic compound (SVOC): Manufactured chemical that does not evaporate as easily as a VOC and is typically used in manufacturing materials such as adhesives and preservatives.

Site: The area where a hazardous substance, hazardous waste, hazardous constituent, pollutant, or contaminant from the facility has been deposited, stored, disposed of, or placed; has migrated; or otherwise come to be located.

Site investigation (SI): An investigation conducted to make a general assessment as to whether activities at the site have impacted environmental media and whether the site should be included in the CERCLA RI and FS processes.

Trichloroethene (TCE): VOC typically used as a solvent in industrial applications.

U.S. Environmental Protection Agency (EPA): The federal agency responsible for administration and enforcement of CERCLA (and other environmental statutes and regulations), and with final approval authority for the Selected Remedy.

Virginia Department of Environmental Quality (VDEQ): The Commonwealth agency responsible for administration and enforcement of environmental regulations.

Vinyl chloride (VC): VOC that results from the breakdown of TCE and tetrachloroethene in groundwater.

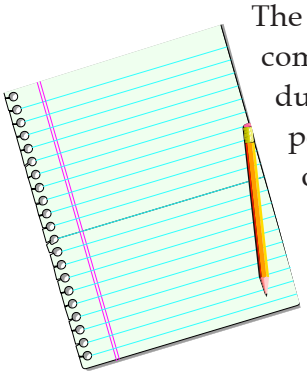
Volatile organic compound (VOC): A compound that easily vaporizes and has low water solubility. Many VOCs are manufactured chemicals, such as those associated with paint, solvents, and petroleum. VOCs are common groundwater contaminants.

Please print or type your comments for Site 21 here

Mark Your Calendar for the Public Comment Period

Public Comment Period
May 1 through
June 15, 2011

Submit Written Comments

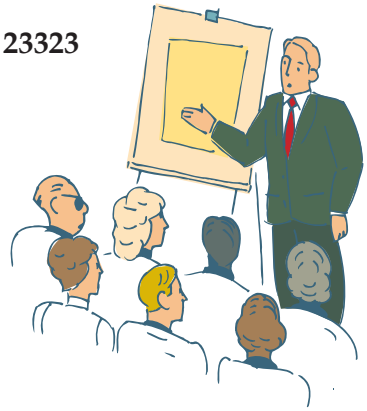


The Navy will accept written comments on the Proposed Plan during the public comment period. To submit comments or obtain further information please refer to the back page.

Attend the Public Meeting
May 12, 2011 at 5:00 P.M.

The Navy will hold a public meeting to explain the Proposed Plan. Verbal and written comments will be accepted at this meeting.

Major Hillard Library
824 Old George Washington Highway N
Chesapeake, Virginia 23323
Phone: (757) 382-3600



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Place stamp here

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