

Final

Record of Decision

Site 11: Bone Yard (EPA Operable Unit 5)

Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, Virginia

EPA ID: VA3170024605



August 201



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Williamsburg, Virginia

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1 Declaration

This Record of Decision (ROD) presents the selected remedy of No Further Action (NFA) for all media (soil, groundwater, surface water, and sediment) at Environmental Restoration Program (ERP) Site 11, Bone Yard (also known as USEPA Operable Unit 5), at Naval Weapons Station (WPNSTA) Yorktown Cheatham Annex (CAX), Williamsburg, Virginia (USEPA ID: VA3170024605). The NFA determination has been made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, 42 U.S.C. §§9601 et seq., and the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300. 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 references¹, but contained in the AR file, has been considered and is relevant to the NFA determination for Site 11. Thus, this ROD is based upon information in the AR file for the site.

The United States Department of the Navy (Navy) is the lead agency and provides funding for ERP activities at Site 11. The Navy and United States Environmental Protection Agency (USEPA) Region 3, the lead regulatory agency, issue this NFA ROD jointly. The Navy and USEPA have relied upon information in the AR file for the site to make the remedial decision in this ROD. The Commonwealth of Virginia Department of Environmental Quality (VDEQ), the support regulatory agency, participated throughout the investigation process, has reviewed this ROD and the materials on which it is based, and concurs with this decision for NFA.

1.1 Selected Remedy

Based on the findings of environmental investigations completed at Site 11, there is no unacceptable risk to human health or the environment under current or potential future site uses. Therefore, the selected remedy for Site 11 is NFA for all media (soil, groundwater, surface water, and sediment). Because there are no hazardous substances, pollutants, or contaminants remaining on-site above the levels that allow for unlimited use and unrestricted exposure, a five-year review is not required.

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

1.2 Navy Authorizing Signature for the No Further Action Record of Decision for All Media (Soil, Groundwater, Surface Water, and Sediment) at Site 11, Bone Yard, CAX, Williamsburg, Virginia

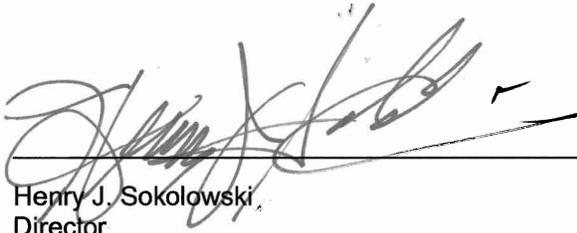


Captain Charles B. Marks, III
Commanding Officer
Naval Weapons Station Yorktown, Cheatham Annex

25 AUG 10

Date

1.3 USEPA Region 3 Authorizing Signature for the No Further Action Record of Decision for All Media (Soil, Groundwater, Surface Water, and Sediment) at Site 11, Bone Yard, CAX, Williamsburg, Virginia



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

August 31, 2010

Date

2 Decision Summary

2.1 Site Description and History

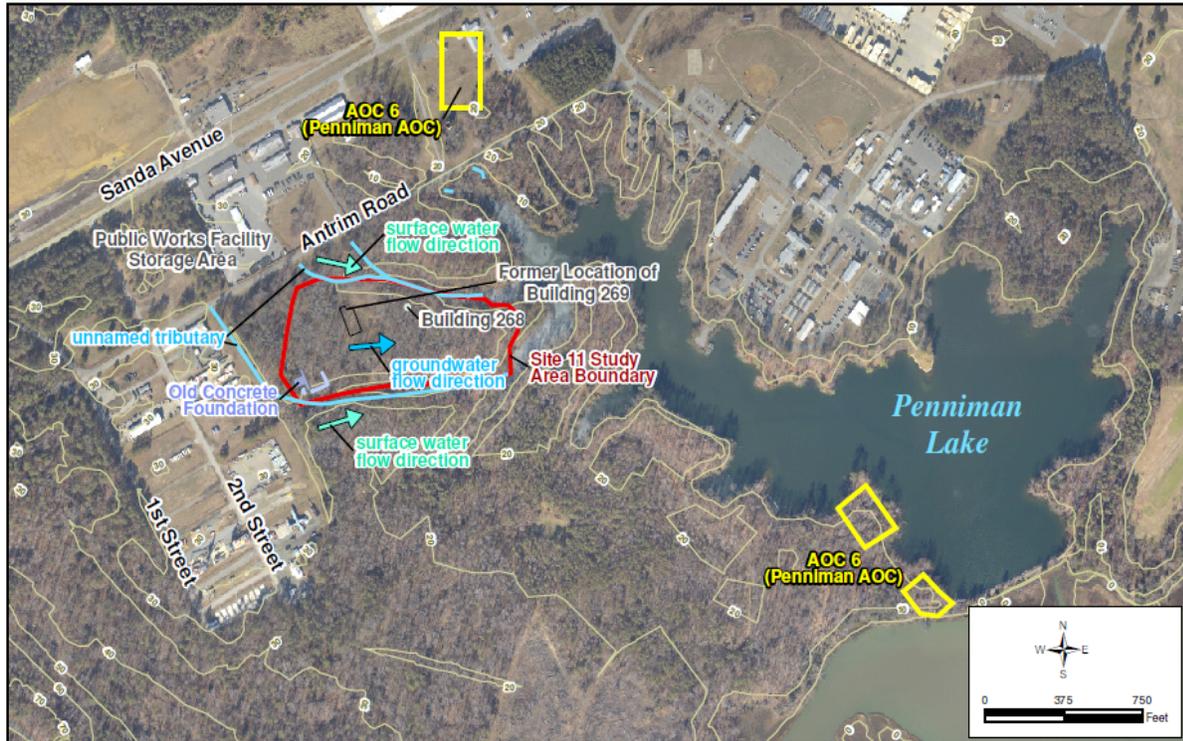
CAX is located in Williamsburg, Virginia on the site of the former Penniman Shell Loading Plant, a large powder- and shell-loading facility operated during World War I (**Figure 1**). The Penniman facility closed in 1918 and had been dismantled by 1923. Between 1923 and 1942, the property was used for farming or left idle until construction began in 1942 for a new Navy supply facility. CAX was commissioned in 1943 as a satellite unit of the Naval Supply Depot in Norfolk, VA to provide bulk storage facilities and serve as an assembly and overseas shipping point throughout World War II. CAX is currently comprised of 2,300 acres and is divided into two separate parcels, with the larger parcel situated along the banks of the York River. The mission of CAX includes supplying Atlantic Fleet ships and providing recreational opportunities to military and civilian personnel.

FIGURE 1
Regional Location Map with the Location of Site 11, Bone Yard



Site 11, commonly referred to as the “Bone Yard” because of its use as a storage area for old cars, encompasses an area of approximately 2.7 acres in the south central portion of CAX. The site is located south of Antrim Road and the CAX Department of Public Works Facility, west of Penniman Lake, and between areas comprising the Penniman Area of Concern (AOC), also known as AOC 6 (**Figure 2**). The site currently consists of a vegetated field and an abandoned building and is bound to the north and south by two unnamed tributaries of Penniman Lake. Additional structures previously located within the site included former Building 269 and an old concrete foundation. The 1984 Initial Assessment Study (IAS) reported Site 11’s period of operation as from 1940 to 1978; however, it also stated it was unknown how long Site 11 was used for waste disposal, but available information indicated the site was active from the World War II era until 1978. Site 11 was reportedly used by the CAX Department of Public Works to store scrap materials. Tanks containing petroleum products, drums, old containers, fence posts, abandoned cars, heavy construction equipment, and various other scrap materials were historically observed at the site.

FIGURE 2
Site Layout – Site 11, Bone Yard



2.2 Previous Investigations and Removal Actions

Site 11 was first identified as an area for further investigation during the 1984 IAS commissioned by the Naval Energy and Environmental Support Activity. Due to the presence of disposed fuel oil containers, mixing tanks, and construction debris, as well as verbal accounts of historical releases, the IAS concluded unacceptable risk to human health and the environment might be present at Site 11. As a result, Site 11 was further characterized through a series of investigations which are summarized below in **Table 1**.

TABLE 1
Summary of Previous Studies and Investigations

Previous Study/ Investigation	Date	Investigation Activities
Initial Assessment Study	C.C. Johnson & Associates, Inc. and CH2M HILL, 1984	<i>The IAS</i> (Reference [Ref.] 1) was commissioned by the Naval Energy and Environmental Support Activity to evaluate evidence of contamination that may pose a potential threat to human health or the environment. A review of archival and activity records, interviews with activity personnel, and an on-site survey was conducted. The IAS recommended a confirmation study at Site 11 based on the hazardous substances reportedly disposed and the potential for surface water discharge.

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

Previous Study/ Investigation	Date	Investigation Activities
Remedial Investigation Interim Report	Dames & Moore, 1991	In 1986, nine surface soil, three groundwater, and three co-located surface water and sediment samples were collected for the Step 1 A Confirmation Study Round 1 (Ref. 2). In 1988, an additional three groundwater and three co-located surface water and sediment samples, each from the same approximate locations from 1986, were collected as part of the Step 1 A Confirmation Study Round 2 (Ref 3). All samples collected were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), phenols, lead, and oil/grease. The results of the Step 1A Confirmation Studies were summarized in the Remedial Investigation (RI) Interim Report. Analytical results (Ref. 4) indicated that concentrations of SVOCs and lead in surface water and SVOCs in groundwater posed potentially unacceptable risk to human health and the environment. The RI Interim Report concluded that additional investigation was required to further characterize the nature and extent of contamination at Site 11.
Site Investigation Report for Sites 1, 10, and 11	Baker, 1994	In July and August 1992, additional sampling was conducted at Site 11 to confirm the Confirmation Study (Rounds 1 and 2) results and to further define the extent of contamination. During the Site Investigation (SI) activities, soil gas samples were collected and analyzed for VOCs to determine soil sampling locations for the SI. Subsequently, 12 surface soil, 6 subsurface soil, five groundwater, 5 surface water, and 16 sediment samples were collected (Figure 3) and analyzed for VOCs, SVOCs (referred to as base/neutral/acid extractable organics [BNAs] in the SI Report), total inorganics, and total petroleum hydrocarbons (TPH). Analytical results (Ref. 5) indicated that VOCs, SVOCs, TPH and inorganics (metals) were present in soil and sediment and that VOCs and inorganics were present in groundwater and surface water. The SI recommended removal of surface debris at the site and re-sampling of soil, groundwater, and surface water to confirm SI results.
Site Screening Process Report for Sites 1, 10, and 11	Baker, 1997	In August 1997, five groundwater samples were collected (Figure 3) and analyzed for VOCs, SVOCs, pesticides and inorganics. The collected groundwater data was included in a Site Screening Process (SSP) Report and used in conjunction with data collected during the SI to complete a qualitative human health and ecological risk screening. Based on the analytical results (Ref. 6), site-related contaminants of potential concern (COPCs) were present in all media. However, it was noted that concentrations of inorganics posing potential risk were similar to background and concentrations of SVOCs posing potential risks were detected at depths unlikely to result in receptor exposure. Additional debris in the wooded area surrounding the investigation area was identified during the SSP and was addressed as part of a removal action in 1997.

TABLE 1 (CONT.)

Summary of Previous Studies and Investigations

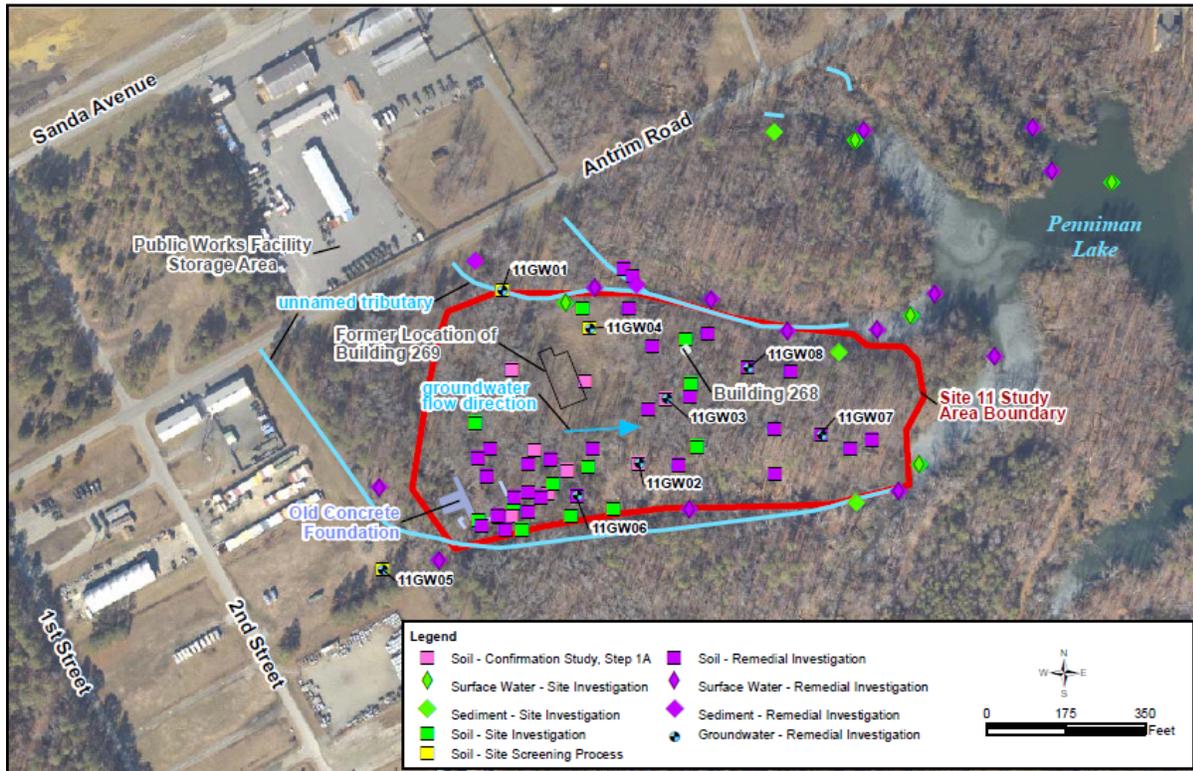
Previous Study/ Investigation	Date	Investigation Activities
Removal Closeout Report	Baker, 2000	<p>The results of drum removal actions conducted in 1987 and 1997 were summarized in the Removal Closeout Report.</p> <p>Analytical results (Ref. 7) of contents of fifteen 55-gallon drums identified during the Step 1A Confirmation Study indicated that one drum failed the RCRA characterization due to sulfide reactivity, while two additional drums failed due to lead concentrations. In 1987, the drums were removed and disposed of off-site at appropriate facilities, along with several 500-gallon tanks containing tar.</p> <p>In 1997, additional drums and tar storage boxes, along with their contents, as well the mixed surface debris, all identified during the SSP were removed and disposed off-site as non-hazardous. Confirmation soil samples were collected in the vicinity of the debris in November 1999; analytical data (Ref. 8) indicated the presence of localized areas of SVOC and lead contamination in soil. Based on the evaluation, a Remedial Investigation/ Feasibility Study (RI/FS) was recommended.</p>
Remedial Investigation Report	Baker, 2007	<p>In June 2002, 21 co-located surface/subsurface soil, 3 separate surface/subsurface soil, 8 groundwater, 13 co-located surface water/sediment, and 2 additional sediment samples were collected (Figure 3) to supplement the 1999 confirmatory sampling data set and aid in defining the nature and extent of contamination. Samples from all media were analyzed for VOCs, SVOCs, pesticides, polychlorinated biphenyls (PCBs), and inorganics. The results from the RI (Ref. 9) and the 1999 confirmatory sampling were used to complete a human health risk assessment (HHRA) and screening-level ecological risk assessment (SERA). The HHRA identified a potentially unacceptable risk to future adult and child residents from concentrations of arsenic, iron, and manganese in groundwater and to future child from iron in soil. The SERA identified potentially unacceptable risk to terrestrial receptors in four areas of the site (Figure 4) from exposure to total polyaromatic hydrocarbons (PAHs), various pesticides, and various inorganics in soil. The SERA also identified potentially unacceptable risk to aquatic receptors from exposure to arsenic, iron, and Aroclor-1260 in surface water and/or sediment. The RI recommended additional investigation of soil, surface water, and sediment to further evaluate the extent of contaminants identified. Additionally, removal of the four soil areas identified was recommended to eliminate unacceptable risk to ecological receptors and a potential source of contaminants to adjacent unnamed tributaries.</p>
Engineering Evaluation/ Cost Analysis	CH2M HILL, 2008	<p>In November 2008, an Engineering Evaluation/Cost Analysis (EE/CA) evaluated remedial action alternatives for mitigation of potential ecological risks associated with receptors exposed to soil at Site 11. Based on an evaluation of cost, effectiveness, and implementability, the EE/CA recommended complete excavation and offsite disposal of all soil contamination posing unacceptable ecological risk. During the development of the EE/CA, preliminary remediation goals (PRGs) (Ref. 10) were developed based upon their protectiveness to ecological receptors.</p>

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

Previous Study/ Investigation	Date	Investigation Activities
Removal Action and Construction Completion Report	Shaw, 2009	Between January and March 2009, a Non-Time-Critical Removal Action (NTCRA) was conducted to address the four focus areas identified in the EE/CA, and a fifth area with a lead concentration that the Navy concluded did not pose an unacceptable ecological risk but was identified as a concern by USEPA (Figure 4). In total, approximately 2,891 cubic yards (4,338 tons) of contaminated soil, debris, and concrete were removed from the five focus areas. Following excavation, confirmation samples were collected and analyzed for area-specific contaminants of concern. Results were compared to the Remediation Goals (RGs) (Ref. 11) and additional excavation was conducted until the confirmation sample results in each focus area met established RGs. Following removal, the site was backfilled and seeded.
Technical Memorandum Consensus for No Further Action in Soil and Groundwater	CH2M HILL, 2009	A technical memorandum (Ref. 12) was prepared in September 2009 to acknowledge the mitigation of potentially unacceptable ecological risks associated with Site 11 soil through the completion of the NTCRA and to document soil, groundwater, surface water, and sediment risk management consensus. The Navy and USEPA Region 3, in partnership with the VDEQ, agreed unacceptable ecological risks identified in the RI had been mitigated through removal of soil contaminants exceeding established remediation goals. Consensus was also reached that inorganics detected in the soil and the groundwater of two upgradient monitoring wells, as well as PCBs detected in surface water and sediment, were not the result of site activities and would be investigated as part of future investigations of Penniman Lake (AOC 9). Therefore, NFA is warranted at Site 11.

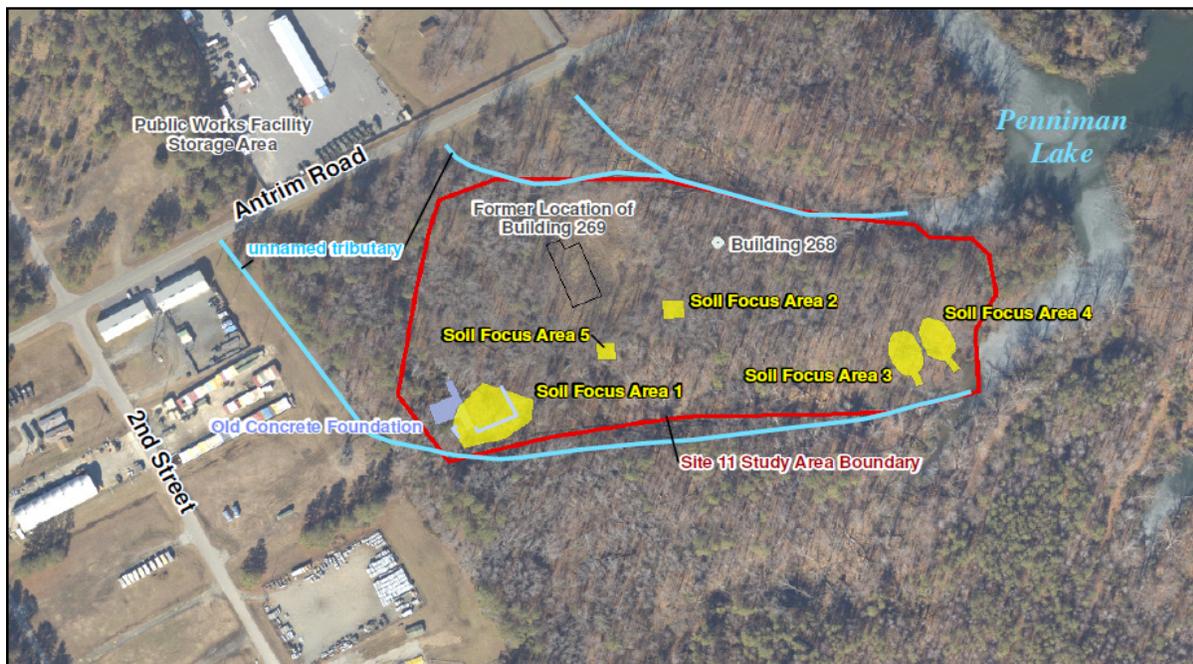
* The documentation listed is available in the AR and provides information used to support the NFA determination for Site 11.

FIGURE 3
Historical Sampling Locations – Site 11, Bone Yard*



* Figure 3 illustrates the most recent activities conducted at each sampling location at Site 11. In instances of samples collected in the same location across multiple reports, the most recent sampling event is shown.

FIGURE 4
Excavation Limits of 2009 NTCRA – Site 11, Bone Yard



2.3 Scope and Role of Operable Unit

Comprehensive environmental restoration activities at CAX began in 1984 under the Navy Assessment and Control of Installation Pollutants (NACIP) program prior to state and federal regulatory oversight of environmental activities at the installation. A Navy Initial Assessment Study (IAS) was conducted in 1984 and identified 12 potentially contaminated areas for investigation. In 1986, the NACIP program was modified to become the ERP (then known as the Installation Restoration Program) to meet the requirements of CERCLA, as amended. Subsequently, the Navy, USEPA, and VDEQ identified seven additional potential source areas and designated them as AOCs 1 through 7. CAX was added to the National Priorities List on February 4, 2000, and a Federal Facilities Agreement between the Navy and USEPA Region 3 was signed in March 2005. This agreement initially identified four sites (Sites 1, 4, 7, and 11) requiring further investigation and possible remedial efforts and provided the framework and schedule to accomplish this work. However, since the FFA was signed, two additional AOCs (AOCs 8 and 9) have been added to the ERP..

Site 11 is one of 19 ERP sites and AOCs being addressed under CERCLA at CAX. The following sites are currently in the Site Inspection stage of the CERCLA process:

- Site 4 – Outdated Medical Supply Area
- Site 7 – Old DuPont Disposal Area
- Site 9 – Transformer Storage Area
- AOC 1 – Scrap Metal Dump
- AOC 2 – Dextrose Dump
- AOC 3 – CAD 11/12 Pond Bank
- AOC 6 – Penniman AOC
- AOC 7 – Drum and Can Disposal Area
- AOC 8 – Area South of Site 7
- AOC 9 – Penniman Lake

The following sites have a final ROD in place:

- Site 1 – Signed September 2009, No Further Action for all media

Decision Documents for No Further Action have been signed for the following sites:

- Site 2 – Signed August 2003 for all media
- Site 3 – Signed August 2004 for all media
- Site 5 – Signed August 2003 for all media
- Site 6 – Signed August 2003 for all media
- Site 8 – Signed August 2003 for all media
- Site 10 – Signed August 2003 for all media
- Site 12 – Signed August 2004 for all media

Information on the status of all ERP sites at CAX can be found in the Site Management Plan for Fiscal Years 2010-2011 in the AR. The NFA determination documented in this ROD for Site 11 does not include or affect any other site or AOC at CAX.

2.4 Site Characteristics

Site 11 is primarily an open, overgrown grassy field surrounded by mixed-hardwood woodland. The site contains abandoned Building 268 and is bordered on the west by Penniman Lake, and to the north and south by two unnamed tributaries of Penniman Lake. The area in the site vicinity ranges in elevation between 0 to 30 feet (ft) above mean sea level (amsl), sloping to the east towards Penniman Lake. Surface soil at the site is characterized by orange-brown silty clay and/or clayey silt with small amounts of fine sand and brown silty sand. This soil layer extends 5 to 10 ft below ground surface (bgs), underlain by more granular and fine-grained olive-gray silty sand, trace clay deposits,

and trace marine shell fragments. These silt deposits become more granular with depth, transitioning to predominantly fine-grained sand with marine shell fragments approximately 20 ft bgs. Groundwater at the site is encountered between approximately 14 and 21 ft bgs in the unconfined Columbia Aquifer. Based on site topography and available groundwater elevations, groundwater flows primarily east towards the Penniman Lake. The site receives surface water runoff from the surrounding industrial area and surrounding wooded area, which either drain into one of the unnamed tributaries or directly to Penniman Lake.

2.5 Current and Potential Future Land and Resource Uses

Presently, Site 11 is predominantly a vegetated field with no designated land use. Potential current uses for Site 11 and the immediate surrounding areas are industrial in nature. Land use is not expected to change significantly in the future unless the mission of the base is altered; however, site conditions allow for unrestricted future land use. Groundwater at Site 11 is not a current or anticipated source of drinking water at CAX. Potable water to CAX is supplied by the City of Newport News Waterworks.

2.6 Summary of Site Risks

Potential human health risks (**Attachments A-1 and A-2**) and ecological risks were evaluated and documented in the RI Report and discussed in further detail in the **No Further Action Technical Memorandum** (Ref. 13).

2.6.1 Human Health Risk Assessment (HHRA) Summary

Based on the *human health conceptual site model (CSM)* (Ref. 14 and **Attachment B**), risks were quantitatively evaluated for current adult and adolescent trespassers, current adult on-site workers, current adult industrial/commercial workers, future adult construction workers, and future adult and child residents exposed to soil, groundwater, surface water, and sediment using reasonable maximum exposure (RME) and central tendency exposure (CTE) concentrations. Exposure pathways considered included ingestion and dermal contact for surface water and sediment and inhalation, ingestion, and dermal contact for groundwater and soil.

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 a more realistic 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 RME dose for a person in contact with site contaminants of potential concern (COPCs). An HI exceeding 1 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.

Based on RME calculations, **potentially unacceptable cancer risks and non-cancer hazards** (Ref. 15) from the ingestion of groundwater were identified for future adult residents due to exposure to arsenic and to future child residents due to exposure to arsenic, iron, and manganese (**Table 2**). Under CTE calculations, no potentially unacceptable cancer risks were identified for any current or future receptors. Potentially unacceptable non-cancer hazards from ingestion of groundwater were identified for future adult residents due to cumulative exposure to arsenic, iron, and manganese and for future child residents due to ingestion of arsenic, iron, and manganese.

TABLE 2
Summary of Potential Human Health Risks from Exposure to Groundwater

Receptor	Pathway	COC	EPC (mg/L)	RME Cancer Risk	RME Non-Cancer (HI)	CTE Cancer Risk	CTE Non-Cancer (HI)	CSF (mg/kg-day)	RfD (mg/kg-day)	
Future Adult Resident	Ingestion	Arsenic	0.013	1.8 x 10⁻⁴	1.2	2.5 x 10 ⁻⁵	0.56	1.5	0.0003	
		Iron	9.58	N/A	0.87	N/A	0.41	N/A	0.3	
		Manganese	0.693	N/A	0.95	N/A	0.44	N/A	0.02	
	Dermal	Arsenic	0.013	2.5 x 10 ⁻⁷	0.0016	1.3 x 10 ⁻⁸	0.0003	1.5	0.0003	
		Iron	9.58	N/A	0.0015	N/A	0.00028	N/A	0.3	
		Manganese	0.693	N/A	0.042	N/A	0.0077	N/A	0.0008	
	Total*	--	--	1.9 x 10⁻⁴	3.1	2.8 x 10 ⁻⁵	1.4	--	--	
	Future Child Resident	Ingestion	Arsenic	0.013	1.1 x 10⁻⁴	2.8	2.4 x 10 ⁻⁵	1.9	1.5	0.0003
			Iron	9.58	N/A	2	N/A	1.4	N/A	0.3
Manganese			0.693	N/A	2.2	N/A	1.5	N/A	0.02	
Dermal		Arsenic	0.013	1.1 x 10 ⁻⁷	0.0028	7.2 x 10 ⁻⁹	0.00056	1.5	0.0003	
		Iron	9.58	N/A	0.0026	N/A	0.00053	N/A	0.3	
		Manganese	0.693	N/A	0.071	N/A	0.014	N/A	0.0008	
Total*		--	--	1.1 x 10⁻⁴	7.3	2.5 x 10 ⁻⁵	4.8	--	--	

* Totals are additive and include all chemicals listed in **Attachments A-1 and A-2**

Bold represents an unacceptable human health risk

CSF = cancer toxicity factor

COC = contaminant of concern

CTE = central tendency exposure

EPC = exposure point concentration

HI = hazard index

mg/kg-day = milligrams per kilogram per day

N/A = not applicable

RfD = non-cancer toxicity factor

RME = reasonable maximum exposure

The concentrations of arsenic, iron, and manganese that presented potentially unacceptable risks were detected in the groundwater of two monitoring wells (11GW01 and 11GW05) that are hydraulically upgradient of site activities. In addition, these same concentrations are consistent with CAX background conditions (**Table 3**). The arsenic occurrence at monitoring wells 11GW01 and 11GW05 also correlates with elevated concentrations of iron and manganese, a strong indication that arsenic is naturally occurring and not from a site release. Arsenic is commonly adsorbed to, or co-precipitated with, iron and manganese oxides, adsorbed to clay mineral surfaces, and associated with sulfide minerals. Dissolving or desorbing of arsenic from these materials under natural conditions releases arsenic to groundwater. Overall, background arsenic, iron and manganese concentrations within the coastal plains of southeast Virginia are highly variable and elevated due to the soil composition, and naturally occurring arsenic concentrations in the coastal plains of southeast Virginia are typically detected above the maximum contaminant level.² Therefore, the detected concentrations of arsenic, iron, and manganese in groundwater from monitoring wells 11GW01 and 11GW05 are representative of background conditions rather than historic site activities and are not included in determinations of whether a site-specific remedy is warranted. Because the maximum detected concentrations were used as EPCs to quantitatively evaluate risks to human health, excluding the data from upgradient monitoring wells 11GW01 and 11GW05 reduces the EPCs (maximum detected) of iron and manganese to levels below the adjusted tap-water Regional Screening Levels. In addition, arsenic was not detected in site monitoring wells. The Navy and USEPA Region 3, in

² United States Geologic Services, 2008. "Arsenic in Ground-Water Resources of the United States." Available online at <http://pubs.usgs.gov/fs/2000/fs063-00/fs063-00.html#HDR1>. August.

partnership with the VDEQ, therefore **agreed to eliminate arsenic, iron and manganese as COCs** (Ref. 16)

TABLE 3

Comparison of Arsenic, Iron, and Manganese Detections in Wells 11GW01 and 11GW05 with Background

Constituent*	11GW01	11GW05	Maximum Background*
	(µg/L)	(µg/L)	(µg/L)
Arsenic	13	10.1	9.8 J
Iron	9,580	783	10,700
Manganese	693	17.9	730

***Dissolved fraction** (Ref. 17)

J = reported value is estimated

µg/L = micrograms per liter

Based on RME calculations, **potentially unacceptable non-cancer hazards** (Ref. 18) from ingestion of and dermal contact with total soil (combined surface and subsurface soil) were identified for future child residents due to exposure to iron (**Table 4**). However, the EPC used in the calculation of RME risk for iron (26,349 mg/kg) is below the associated soil background value (30,000 mg/kg). Therefore, the Navy and USEPA Region 3, in partnership with the VDEQ, agree that any potential non-cancer hazards associated with exposure to iron in total soil are consistent with naturally occurring conditions. In addition, there were no unacceptable future hazards associated with exposure to site soil based on CTE calculations.

TABLE 4

Summary of Potential Human Health Risks from Exposure to Combined Soil

Receptor	Pathway	COC	EPC (mg/kg)	RME Cancer Risk*	RME Non-Cancer (HI)	CTE Cancer Risk*	CTE Non-Cancer (HI)	CSF (mg/kg-day) ⁻¹	RfD (mg/kg-day)
Future Child Resident	Ingestion	Iron	26,349	N/A	1.1	N/A	0.38	N/A	0.3
	Dermal	Iron	26,349	N/A	0.031	N/A	0.015	N/A	0.3

* Cancer risk not calculated because iron is not a carcinogen

Bold represents an unacceptable human health risk

CSF = cancer toxicity factor

COC = contaminant of concern

CTE = central tendency exposure

EPC = exposure point concentration

HI = hazard index

mg/kg-day= milligrams per kilogram per day

N/A = not applicable

RfD = non-cancer toxicity factor

RME = reasonable maximum exposure

No potentially unacceptable human health risks (Ref. 19) were identified to any receptor from exposure to on-site sediment or surface water. Based upon the risk calculations and management decisions described above and the fact that the source of contamination at Site 11 was removed during the NTCRA, the Navy, USEPA Region 3, and VDEQ agree that there is no remaining unacceptable risk to human health due to exposure to soil, groundwater, surface water, or sediment and NFA is warranted for protection of potential human receptors.

2.6.2 Ecological Risk Assessment Summary

The Ecological Risk Assessment (ERA) for Site 11 was conducted in accordance with Navy and USEPA policy and guidance. Exposure routes evaluated included direct contact with soil, surface water, and sediment (aquatic lower-trophic receptors), root uptake from sediment (aquatic plants), ingestion of surface water (aquatic and terrestrial upper-trophic level receptors), incidental ingestion of sediment (aquatic upper-trophic level receptors), and ingestion of plant and animal tissues (aquatic upper-trophic level receptors). Groundwater was not evaluated because it is not a direct exposure point for wildlife at the site and adequate surface water and sediment data were available for evaluation.

In order to assess risk to ecological receptors, the environmental setting, chemical fate and transport, ecotoxicity and potential receptors and complete exposure pathways were first identified. This information was used to develop an **ecological CSM** (Ref. 20 and **Attachment C**) and **ecological assessment and measurement endpoints** (Ref. 21). Both terrestrial and aquatic pathways were assessed to be complete at Site 11. These receptor pathways were based on contaminants in soil, surface water, and sediment.

Media-specific screening values (Ref. 22) for ecologically relevant media (i.e., soil, surface water, and sediment) were established for direct exposure to site media based on the USEPA Region 3 BTAG screening values and Ecological Soil Screening Levels (Eco-SSLs), where applicable. Alternate screening values from relevant, peer-reviewed literature were used when BTAG or Eco-SSL values were unavailable or more conservative values were available. **Ingestion screening values** (Ref. 23) for dietary exposures were derived only for contaminants with the potential to bioaccumulate. Ingestion screening values were derived for both chronic No Observed Adverse Effect Level (NOAEL) and chronic Lowest Observed Effect Level (LOAEL) endpoints. Toxicological information from the literature for wildlife species most closely related to the receptor species was used, where available, but was supplemented by laboratory studies of non-wildlife species (e.g., laboratory mice) where necessary.

Next, based on detected chemical concentrations and established screening values, hazard quotients (HQs) were calculated to characterize the potential for contaminants to pose unacceptable ecological risk using both conservative and more realistic exposure assumptions. HQs represent a ratio of the exposure level to an ecological effect level and are an estimate of potential risk. Maximum and mean (arithmetic and geometric) concentrations of soil, surface water, and sediment contaminant concentrations were used in this step to estimate potential exposures for the ecological receptors selected to represent the assessment endpoints at Site 11. Contaminants with HQs greater than or equal to one, the level at which receptors are expected to demonstrate adverse reactions to a chemical, were **identified as COPCs** (Ref. 24). These COPCs were then **compared to base-wide 95 percent upper concentration limits** (Ref. 25) to determine if concentrations of these contaminants were statistically significant relative to naturally occurring concentrations.

The ERA identified **potentially unacceptable risk** (Ref. 26) to aquatic upper- and lower-trophic receptors due to exposure to arsenic, iron, and Aroclor-1260 in surface water and Aroclor-1260 in sediment. However, the Navy, USEPA, and VDEQ agree that, because the data indicate that the presence of PCBs is not related to historic Site 11 activities, PCBs in Penniman Lake and its tributaries will be addressed as part of a future Penniman Lake investigation. Arsenic and iron in surface water and sediment that pose unacceptable risk to ecological receptors may be attributed to migration from site soils; however, the potential source of contamination was addressed as part of the NTCRA. Additionally, because the elevated concentrations in surface water were detected in only one sample (the same sample with detections of Aroclor-1260) directly adjacent to Penniman Lake, that sample location has been grouped with other Penniman Lake samples and will be addressed as part of a future Penniman Lake investigation. **Potentially unacceptable risks** (Ref. 27) were identified for terrestrial plants and soil invertebrates from direct exposure to total PAHs, pesticides, and various inorganics in surface soil and/or subsurface soil. Unacceptable risks to upper-trophic-level terrestrial receptors from food web exposures were also identified for 4,4'-DDD, 4,4'-DDE, and mercury.

An NTCRA was conducted in 2009 to excavate and dispose of those soils posing risk to ecological receptors. Since there were no potentially unacceptable, site-related risks to human health identified from exposure to soil, NTCRA PRGs were identified as the higher of ecological screening criteria, background soil concentrations, or PRGs previously established at other CAX or WPNSTA Yorktown sites with similar characteristics. PRGs were established for select ecological COCs based on frequency of detections and extent of screening criteria exceedances, as discussed in **Section 3.2.3** (Ref. 28) in the EE/CA. Focusing the NTCRA on these select ecological COCs reduced the concentrations of the remaining ecological COCs to acceptable concentrations.

Following the removal action, **post-excavation confirmation sampling results** (Ref. 29) verified that concentrations of COCs in the soil remaining on-site were below the associated RGs (**Table 5**). Since soil RGs were established to be protective of ecological receptors, the Navy, USEPA Region 3, and VDEQ agree that no potentially unacceptable risk remains on-site from exposure to soil and NFA is warranted for potential ecological receptors.

TABLE 5

Maximum Concentrations of COCs Remaining in Soil following Removal Action

COC	Copper	Lead	Mercury	Selenium	Zinc	Iron	4,4-DDD	4,4-DDE	Total PAHs
Remediation Goal (mg/kg)	70	120	0.24	1.8	120	46,400	0.1	0.1	18
Maximum Remaining Concentration (mg/kg)	18	15.3	0.059	ND	36.5	34,900	0.007	0.0693	2.1

mg/kg= milligrams per kilogram

ND = not detected

2.7 No Further Action Determination

Exposure to soil, groundwater, surface water, and sediment associated with Site 11 poses no unacceptable risk to human health or the environment. The Navy and USEPA Region 3, in partnership with the VDEQ, agree NFA is required under CERCLA for Site 11. Site conditions allow for unlimited use and unrestricted exposure. No further remedial response action and no restrictions on any land use are necessary at Site 11.

2.8 Community Participation

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

The investigations conducted at Site 11, the findings, and the Proposed Plan (PP) that forms the basis for this NFA ROD have been presented and discussed with the RAB. In addition, in accordance with Section 117(a) of CERCLA, the Navy provided a 45-day public comment period from April 18, 2010 through June 1, 2010 for the Site 11 NFA PP. In accordance with 40 CFR 300.430(f)(3)(1)(A), a notice of availability was published in *The Virginia Gazette* and the *Daily Press* on April 17 and April 18, 2010, respectively. The PP was available for review during the public comment period at the York County Public Library - Yorktown (8500 George Washington Memorial Highway, Yorktown, VA 23692, 757-890-3377). The public comment period included a public meeting to present the PP which was held on May 27, 2010 at the York County Public Library - Yorktown. No comments were received during the public comment period for the Site 11 NFA PP.

This ROD, the PP, and all other information that supports this NFA determination are available in the AR. The AR is accessible to the public at:

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



References

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record
Ref. 1	The IAS	Table 1	C.C. Johnson & Associates, Inc. and CH2M HILL, 1984. Initial Assessment Study Naval Supply Center (Norfolk) Cheatham Annex and Yorktown Fuels Division. AR No. 000132.
Ref. 2	Step 1 A Confirmation Study Round One	Table 1	Dames & Moore. 1986. Confirmation Study Step 1A (Verification), Round One, Cheatham Annex, Williamsburg, Virginia. AR No. 000256.
Ref. 3	Step 1 A Confirmation Study Round Two	Table 1	Dames & Moore. 1988. Confirmation Study Step 1A (Verification), Round Two, Cheatham Annex, Williamsburg, Virginia. AR No. 000259.
Ref. 4	Analytical results	Table 1	Dames & Moore. 1991. Remedial Investigation Interim Report, Cheatham Annex, Williamsburg, Virginia. Table 4-7. AR No. 000812.
Ref. 5	Analytical results	Table 1	Baker. 1994. <i>Final Site Investigation for Sites 1, 10, and 11</i> , Naval Supply Center Cheatham Annex, Williamsburg, Virginia. Tables 4-10 through 4-16. AR No. 000140
Ref. 6	analytical results	Table 1	Baker. 1997. <i>Final Site Screening Process Report for Sites 1, 10, and 11</i> , Naval Supply Center Cheatham Annex, Williamsburg, Virginia. Tables 6-8 through 6-12. AR No. 000131
Ref. 7	Analytical results	Table 1	Baker. 2000. <i>Draft Removal Closeout Report</i> , Cheatham Annex, Williamsburg, Virginia. Appendix B. AR No. 001477
Ref. 8	analytical data	Table 1	Baker. 2000. <i>Draft Removal Closeout Report</i> , Cheatham Annex, Williamsburg, Virginia. Appendix E. AR No. 001477
Ref. 9	results from the RI	Table 1	Baker. 2007. <i>Remedial Investigation Site 11</i> , Cheatham Annex, Williamsburg, Virginia. Table 7-1 through 7-7. AR No. 002171
Ref. 10	preliminary remediation goals (PRGs)	Table 1	CH2M HILL. 2008. <i>Engineering Evaluation/Cost Analysis Site 11</i> . Naval Supply Center Cheatham Annex, Williamsburg, Virginia. Table 3-1. AR No. 002285
Ref. 11	Results were compared to the Remediation Goals (RGs)	Table 1	Shaw. 2009. <i>Final Construction Completion Report Hot Spot Removal Action at Site 11</i> . Naval Supply Center Cheatham Annex, Williamsburg, Virginia. Tables 8 through 11. AR No. 000043

REFERENCES

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record
Ref. 12	technical memorandum	Table 1	CH2M HILL. 2009. <i>Final Technical Memorandum Consensus for No Further Action in Soil and Groundwater</i> . Naval Supply Center Cheatham Annex, Williamsburg, Virginia. AR No. Pending
Ref. 13	No Further Action Technical Memorandum	Section 2.6	CH2M HILL. 2009. <i>Final Technical Memorandum Consensus for No Further Action in Soil and Groundwater</i> . Naval Supply Center Cheatham Annex, Williamsburg, Virginia. AR No. Pending
Ref. 14	human health conceptual site model (CSM)	Section 2.6.1	Baker. 2007. <i>Remedial Investigation Site 11, Cheatham Annex, Williamsburg, Virginia</i> . Figure 7-1. AR No. 002171
Ref. 15	No potentially unacceptable human health risks	Section 2.6.1	Baker. 2007. <i>Remedial Investigation Site 11, Cheatham Annex, Williamsburg, Virginia</i> . Tables 7-11 through 7-22 AR No. 002171
Ref. 16	agreed to eliminate arsenic, iron and manganese as COCs	Section 2.6.1	CH2M HILL. 2009. <i>Final Technical Memorandum Consensus for No Further Action in Soil and Groundwater</i> . Naval Supply Center Cheatham Annex, Williamsburg, Virginia. Page 9. AR No. Pending
Ref. 17	Dissolved fraction	Table 3	Baker, 2003. <i>Final Background Investigation Naval Weapons Station Yorktown, Yorktown, Virginia Cheatham Annex Site Williamsburg, Virginia</i> . Table 7-9. AR No. 001379.
Ref. 18	potentially unacceptable cancer risks and non-cancer hazards	Section 2.6.1	Baker. 2007. <i>Remedial Investigation Site 11, Cheatham Annex, Williamsburg, Virginia</i> . Tables 7-16 through 7-19. AR No. 002171
Ref. 19	potentially unacceptable non-cancer hazards	Section 2.6.1	Baker. 2007. <i>Remedial Investigation Site 11, Cheatham Annex, Williamsburg, Virginia</i> . Tables 7-18 through 7-19. AR No. 002171
Ref. 20	ecological CSM	Section 2.6.2	Baker. 2007. <i>Remedial Investigation Site 11, Cheatham Annex, Williamsburg, Virginia</i> . Figure 8-2. AR No. 002171
Ref. 21	ecological assessment and measurement endpoints concentrations	Section 2.6.2	Baker. 2007. <i>Remedial Investigation Site 11, Cheatham Annex, Williamsburg, Virginia</i> . Table 8-2. AR No. 02171
Ref. 22	Media-specific screening values	Section 2.6.2	Baker. 2007. <i>Remedial Investigation Site 11, Cheatham Annex, Williamsburg, Virginia</i> . Table 8-3. AR No. 002171
Ref. 23	Ingestion screening values	Section 2.6.2	Baker. 2007. <i>Remedial Investigation Site 11, Cheatham Annex, Williamsburg, Virginia</i> . Tables 8-5 and 8-6. AR No. 002171
Ref. 24	identified as COPCs	Section 2.6.2	Baker. 2007. <i>Remedial Investigation Site 11, Cheatham Annex, Williamsburg, Virginia</i> . Table 8-13 through 8-23. AR No. 002171
Ref. 25	compared to base-wide 95 percent upper concentration limits	Section 2.6.2	Baker. 2007. <i>Remedial Investigation Site 11, Cheatham Annex, Williamsburg, Virginia</i> . Evenly Numbered Tables 8-36 through 8-60. AR No. 002171
Ref. 26	potentially unacceptable risk	Section 2.6.2	Baker. 2007. <i>Remedial Investigation Site 11, Cheatham Annex, Williamsburg, Virginia</i> . Table 8-64. AR No. 002171

Item	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record
Ref. 27	Potentially unacceptable risks	Section 2.6.2	Baker. 2007. <i>Remedial Investigation Site 11</i> , Cheatham Annex, Williamsburg, Virginia. Table 8-64. AR No. 002171
Ref. 28	Section 3.2.3	Section 2.6.2	CH2M HILL. 2008. <i>Engineering Evaluation/Cost Analysis Site 11</i> . Naval Supply Center Cheatham Annex, Williamsburg, Virginia. Section 3.2.3. AR No. 002285
Ref. 29	post-excavation confirmation sampling results	Section 2.6.2	Shaw. 2009. <i>Final Construction Completion Report Hot Spot Removal Action at Site 11</i> . Naval Supply Center Cheatham Annex, Williamsburg, Virginia. Tables 8 through 11. AR No. 000043

Detailed site information referenced in this ROD and appearing in bold blue text in this list is contained in the Administrative Record.

For access to information contained in the Administrative Record for CAX please contact:

Public Affairs Office, NAVFAC Atlantic
6506 Hampton Blvd
Norfolk, Virginia 23508-1278
Phone: (757) 322-8005

Attachment A

ATTACHMENT A-1

Summary of RME Cancer Risks and Hazard Indices based on 2007 HHRA

Site 11, Bone Yard, Williamsburg, Virginia

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risk >10 ⁻⁴	Hazard Index	COPCs with HI >1	
Current/Future Adult Trespassers	Surface Soil	Ingestion	1.5 x 10 ⁻⁶	--	0.034	--	
		Inhalation	1.8 x 10 ⁻⁹	--	0.000081	--	
		Dermal Contact	5.2 x 10 ⁻⁷	--	0.013	--	
		Total	1.6 x 10 ⁻⁶	--	0.047	--	
	Surface Water (streams)	Ingestion	3.4 x 10 ⁻⁷	--	0.002	--	
		Dermal Contact	1 x 10 ⁻⁵	--	0.00014	--	
		Total	1 x 10 ⁻⁵	--	0.0021	--	
	Sediment (streams)	Ingestion	1.5 x 10 ⁻⁶	--	0.024	--	
		Dermal Contact	2.5 x 10 ⁻⁷	--	0.0017	--	
		Total	1.8 x 10 ⁻⁶	--	0.025	--	
	Current/Future Adolescent Trespassers	Surface Soil	Ingestion	8.7 x 10 ⁻⁷	--	0.054	--
			Inhalation	1 x 10 ⁻⁹	--	0.00013	--
Dermal Contact			8.1 x 10 ⁻⁷	--	0.052	--	
Total			1.7 x 10 ⁻⁶	--	0.106	--	
Surface Water (streams)		Ingestion	2 x 10 ⁻⁷	--	0.0031	--	
		Dermal Contact	5.7 x 10 ⁻⁶	--	0.0002	--	
		Total	5.8 x 10 ⁻⁶	--	0.0033	--	
Sediment (streams)		Ingestion	9 x 10 ⁻⁷	--	0.037	--	
		Dermal Contact	3.9 x 10 ⁻⁷	--	0.0069	--	
		Total	1.3 x 10 ⁻⁶	--	0.044	--	
Current/Future Adult Recreational User		Surface Soil	Ingestion	1.5 x 10 ⁻⁶	--	0.034	--
			Inhalation	3.6 x 10 ⁻⁹	--	0.00016	--
	Dermal Contact		5.2 x 10 ⁻⁷	--	0.013	--	
	Total		2 x 10 ⁻⁶	--	0.047	--	
	Surface Water (streams)	Ingestion	8.8 x 10 ⁻⁷	--	0.0051	--	
		Dermal Contact	8.6 x 10 ⁻⁵	--	0.0011	--	
		Total	8.6 x 10 ⁻⁵	--	0.0062	--	
	Sediment (streams)	Ingestion	1.5 x 10 ⁻⁶	--	0.024	--	
		Dermal Contact	2.5 x 10 ⁻⁷	--	0.0017	--	
		Total	1.8 x 10 ⁻⁶	--	0.025	--	
	Current/Future Adolescent Recreational User	Surface Soil	Ingestion	8.7 x 10 ⁻⁷	--	0.054	--
			Inhalation	2.1 x 10 ⁻⁹	--	0.00025	--
Dermal Contact			8.1 x 10 ⁻⁷	--	0.052	--	
Total			1.7 x 10 ⁻⁶	--	0.106	--	
Surface Water (streams)		Ingestion	5.1 x 10 ⁻⁷	--	0.008	--	
		Dermal Contact	1.8 x 10 ⁻⁵	--	0.0063	--	
		Total	1.9 x 10 ⁻⁵	--	0.0086	--	
Sediment (streams)		Ingestion	9 x 10 ⁻⁷	--	0.037	--	
		Dermal Contact	3.9 x 10 ⁻⁷	--	0.0069	--	
		Total	1.3 x 10 ⁻⁶	--	0.044	--	

ATTACHMENT A-1

Summary of RME Cancer Risks and Hazard Indices based on 2007 HHRA

Site 11, Bone Yard, Williamsburg, Virginia

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risk >10 ⁻⁴	Hazard Index	COPCs with HI >1
Current/Future On-Site Worker	Surface Soil	Ingestion	3.7 x 10 ⁻⁶	--	0.083	--
		Inhalation	3.2 x 10 ⁻⁸	--	0.0014	--
		Dermal Contact	4.3 x 10 ⁻⁶	--	0.1	--
		Total	8 x 10 ⁻⁵	--	0.18	--
	Surface Water (streams)	Ingestion	1.7 x 10 ⁻⁶	--	0.0095	--
		Dermal Contact	3 x 10 ⁻⁵	--	0.00038	--
		Total	3.2 x 10 ⁻⁵	--	0.0099	--
	Sediment (streams)	Ingestion	3.8 x 10 ⁻⁶	--	0.057	--
		Dermal Contact	2.1 x 10 ⁻⁶	--	0.013	--
Total		5.9 x 10 ⁻⁶	--	0.07	--	
Future Industrial/Commercial Worker	Total Soil	Ingestion	7.4 x 10 ⁻⁶	--	0.16	--
		Inhalation	2.4 x 10 ⁻⁸	--	0.001	--
		Dermal Contact	1.5 x 10 ⁻⁶	--	0.035	--
		Total	8.9 x 10 ⁻⁶	--	0.20	--
Future Construction Worker	Total Soil	Ingestion	1.4 x 10 ⁻⁶	--	0.79	--
		Inhalation	2.1 x 10 ⁻⁹	--	0.0023	--
		Dermal Contact	1.7 x 10 ⁻⁷	--	0.1	--
		Total	1.6 x 10 ⁻⁶	--	0.89	--
	Groundwater	Ingestion	1.4 x 10 ⁻⁷	--	0.055	--
		Dermal Contact	8.9 x 10 ⁻⁸	--	0.21	--
		Total	2.3 x 10 ⁻⁷	--	0.26	--
Future Adult Residents	Total Soil	Ingestion	9.9 x 10 ⁻⁶	--	0.23	--
		Inhalation	7.2 x 10 ⁻⁸	--	0.0033	--
		Dermal Contact	3.5 x 10 ⁻⁶	--	0.084	--
		Total	1.3 x 10 ⁻⁵	--	0.32	--
	Groundwater	Ingestion	1.9 x 10⁻⁴	Arsenic (1.8 x 10 ⁻⁴)	3.1	Arsenic (HQ = 1.2)
		Dermal Contact	5 x 10 ⁻⁷	--	0.05	--
		Total	1.9 x 10⁻⁴	Arsenic (1.8 x 10 ⁻⁴)	3.1	Arsenic (HQ = 1.2)
	Surface Water (streams)	Ingestion	2.6 x 10 ⁻⁷	--	0.0015	--
		Dermal Contact	8 x 10 ⁻⁶	--	0.0001	--
		Total	8.3 x 10 ⁻⁶	--	0.0016	--
	Sediment (streams)	Ingestion	1.2 x 10 ⁻⁶	--	0.018	--
		Dermal Contact	1.9 x 10 ⁻⁷	--	0.0013	--
		Total	1.4 x 10 ⁻⁶	--	0.019	--

ATTACHMENT A-1

Summary of RME Cancer Risks and Hazard Indices based on 2007 HHRA

Site 11, Bone Yard, Williamsburg, Virginia

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risk >10 ⁻⁴	Hazard Index	COPCs with HI >1
Future Child Residents	Total Soil	Ingestion	2.3 x 10 ⁻⁵	--	2.1	Iron (HQ = 1.1)
		Inhalation	4.8 x 10 ⁻⁸	--	0.015	--
		Dermal Contact	5.7 x 10 ⁻⁶	--	0.55	--
		Total	2.9 x 10 ⁻⁵	--	2.7	Iron (HQ = 1.1)
	Groundwater	Ingestion	1.1 x 10⁻⁴	Arsenic (1.1 x 10 ⁻⁴)	7.2	Arsenic (HQ=2.8), Iron (HQ=2.0), Manganese (HQ=2.2)
		Dermal Contact	2.1 x 10 ⁻⁷	--	0.086	--
		Total	1.1 x 10⁻⁴	Arsenic (1.1 x 10 ⁻⁴)	7.3	Arsenic (HQ=2.8), Iron (HQ=2.0), Manganese (HQ=2.2)
	Surface Water (streams)	Ingestion	3 x 10 ⁻⁷	--	0.0071	--
		Dermal Contact	4.6 x 10 ⁻⁶	--	0.00024	--
		Total	4.9 x 10 ⁻⁶	--	0.0073	--
	Sediment (streams)	Ingestion	2.8 x 10 ⁻⁶	--	0.17	--
		Dermal Contact	3.1 x 10 ⁻⁷	--	0.0084	--
		Total	3.1 x 10 ⁻⁶	--	0.18	--

ATTACHMENT A-2

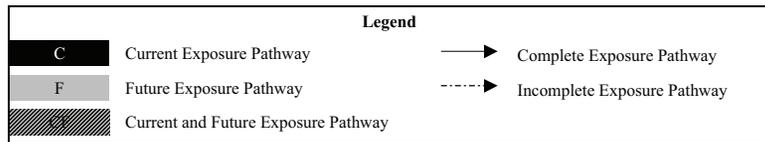
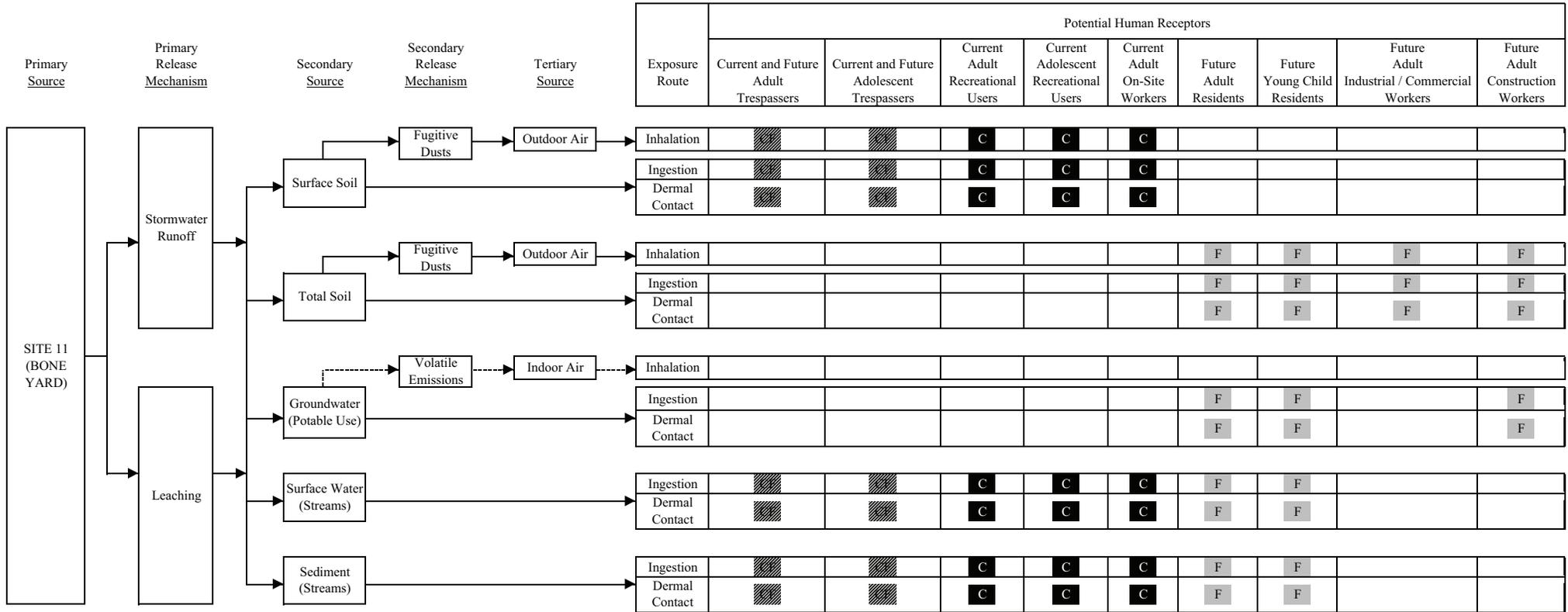
Summary of CTE Cancer Risks and Hazard Indices based on 2007 HHRA

Site 11, Bone Yard, Williamsburg, Virginia

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risk >10 ⁻⁴	Hazard Index	COPCs with HI >1
Future Construction Worker	Total Soil	Ingestion	1.2 x 10 ⁻⁸	--	0.69	--
		Inhalation	6.2 x 10 ⁻¹⁰	--	0.00068	--
		Dermal Contact	1.5 x 10 ⁻⁷	--	0.085	--
		Total	1.4 x 10 ⁻⁷	--	0.78	--
	Groundwater	Ingestion	1.3 x 10 ⁻⁷	--	0.048	--
		Dermal Contact	7.6 x 10 ⁻¹¹	--	0.00018	--
Total		1.3 x 10 ⁻⁷	--	0.048	--	
Future Adult Residents	Surface Soil	Ingestion	9.7 x 10 ⁻⁷	--	0.077	--
		Inhalation	1.4 x 10 ⁻⁸	--	0.0022	--
		Dermal Contact	6 x 10 ⁻⁷	--	0.049	--
		Total	1.6 x 10 ⁻⁶	--	0.13	--
	Groundwater	Ingestion	2.5 x 10 ⁻⁵	--	1.4	--
		Dermal Contact	2.7 x 10 ⁻⁸	--	0.0094	--
		Total	2.5 x 10 ⁻⁵	--	1.4	--
	Surface Water (streams)	Ingestion	7.6 x 10 ⁻⁸	--	0.0015	--
		Dermal Contact	2.1 x 10 ⁻⁶	--	0.000091	--
		Total	2.1 x 10 ⁻⁶	--	0.0016	--
	Sediment (streams)	Ingestion	1.7 x 10 ⁻⁷	--	0.0091	--
		Dermal Contact	4.9 x 10 ⁻⁸	--	0.0011	--
Total		2.2 x 10 ⁻⁷	--	0.01	--	
Future Child Residents	Subsurface Soil	Ingestion	2.6 x 10 ⁻⁶	--	0.72	--
		Inhalation	1.9 x 10 ⁻⁸	--	0.26	--
		Dermal Contact	9.1 x 10 ⁻⁷	--	0.01	--
		Total	3.5 x 10 ⁻⁶	--	0.99	--
	Groundwater	Ingestion	2.4 x 10 ⁻⁵	--	4.8	Arsenic (HQ=1.9), Iron (HQ=1.4), Manganese (HQ=1.5)
		Dermal Contact	1.4 x 10 ⁻⁸	--	0.017	--
		Total	2.4 x 10 ⁻⁵	--	4.8	Arsenic (HQ=1.9), Iron (HQ=1.4), Manganese (HQ=1.5)
	Surface Water (streams)	Ingestion	1 x 10 ⁻⁷	--	0.0071	--
		Dermal Contact	1.1 x 10 ⁻⁶	--	0.00017	--
		Total	1.2 x 10 ⁻⁶	--	0.0072	--
	Sediment (streams)	Ingestion	4.7 x 10 ⁻⁷	--	0.085	--
		Dermal Contact	7.5 x 10 ⁻⁸	--	0.006	--
Total		5.3 x 10 ⁻⁷	--	0.091	--	

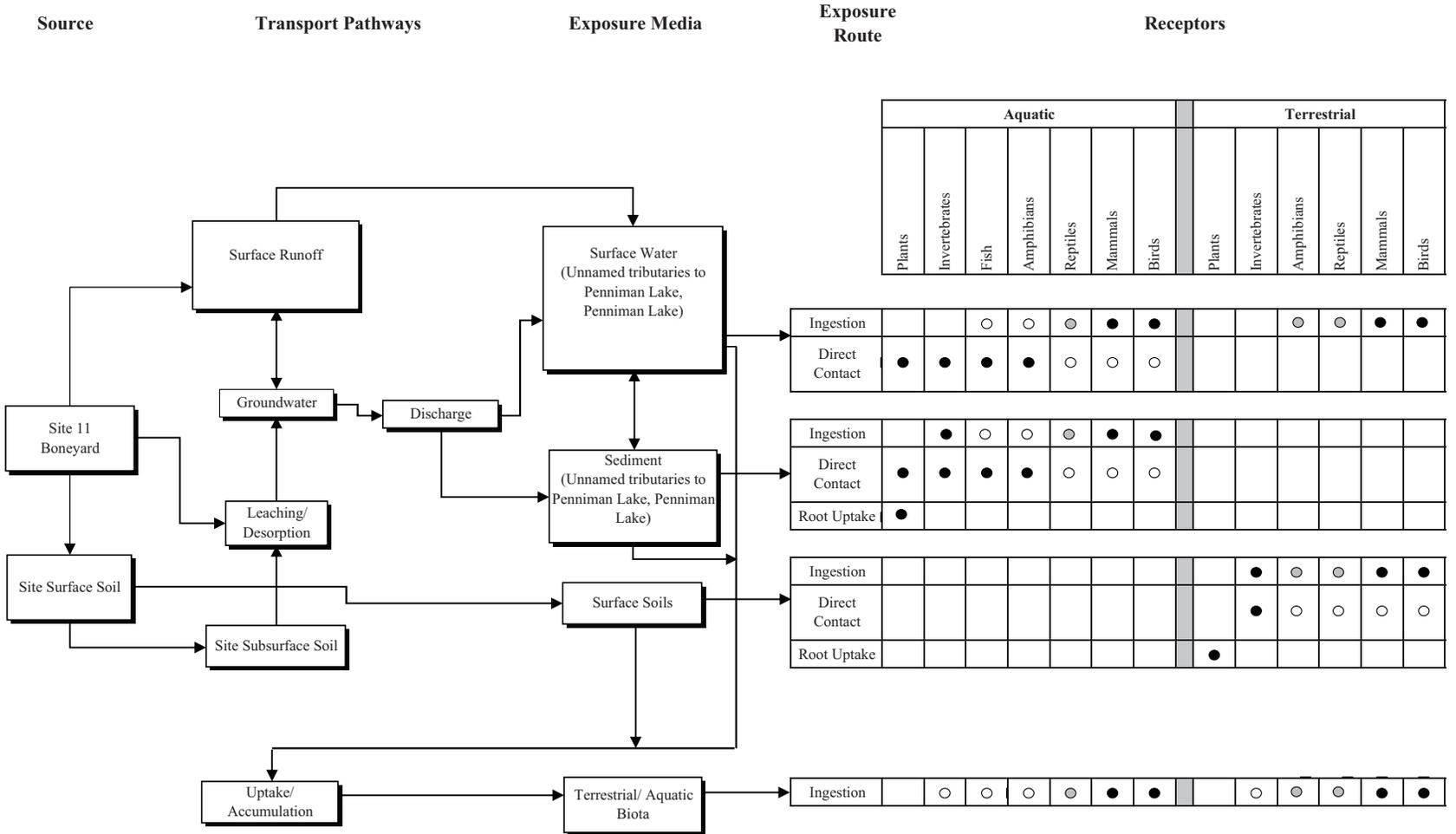
Attachment B

**FIGURE 7-1
FLOWCHART OF POTENTIAL EXPOSURE PATHWAYS AND RECEPTORS
SITE 11 (BONE YARD)
CHEATHAM ANNEX SITE, NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA**



Attachment C

**FIGURE 8-2
PRELIMINARY CONCEPTUAL MODEL
SITE 11 - BONEYARD
NAVAL WEAPONS STATION YORKTOWN, CHEATHAM ANNEX
WILLIAMSBURG, VIRGINIA**



—————> Potentially complete, significant pathway (evaluated)
 - - - - -> Potentially complete, significant pathway (not evaluated)

● Receptor/pathway quantitatively evaluated
 ○ Receptor/pathway not quantitatively evaluated
 ◐ Receptor/pathway qualitatively evaluated

Response to Comments



CH2MHILL

CH2M HILL
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Tel 757.518.9666

August 2, 2010

389659.RP.DR

Ms. Susanne Haug
Remedial Project Manager
United States Environmental Protection Agency, Region 3
1650 Arch Street (3HS11)
Philadelphia, PA 19103-2029

Subject: Response to Comments on the *Draft Record of Decision, Site 11: Bone Yard, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*

Dear Ms. Haug:

On behalf of the U.S. Department of the Navy's Naval Facilities Engineering Command (NAVFAC), CH2M HILL has prepared this letter in response to your July 19, 2010 e-mail that provided comments for the subject document via track changes in the document's Word file. Comments received are shown in italics, followed by the Navy's response in blue. All individual editorial changes have been made and are not discussed on a case by case basis within this letter.

❖ *Comment #1 - [Section 2.2, Table 1] Full citations to all the studies summarized here must be in the references. They were relied on to make the remedial decisions.*

Response: Citations have been provided in the References Table located at the end of the ROD for all documents discussed within Table 1.

❖ *Comment #2 - [Section 2.2, Table 1] [Dames and Moore, 1986] not in references*

Response: As requested, Table 1 and the References Table were updated to cite this study, the Step 1 A Confirmation Study Round 1.

❖ *Comment #3 - [Section 2.2, Table 1] [Dames and Moore, 1988] not in references*

Response: As requested, Table 1 and the References Table were updated to cite this study, the Step 1 A Confirmation Study Round 2.

❖ *Comment #4 - [Section 2.2, Table 1] COPC = "Contaminant of Potential Concern" in the NCP. Why do Navy RODs change "contaminant" to "constituent." Is there a Navy guidance document instructing remedial staff to do that?*

Response: All instances of 'Constituent of Potential Concern' have been changed to 'Contaminant of Potential Concern.'

- ❖ Comment #5 - [Section 2.2, Table 1] Define Abbreviations [in the] legend of Figure 3.

Response: The requested changes to Figure 3 have been made in order to clarify the legend.

- ❖ Comment #6 - [Section 2.2, Table 1] [The Technical Memorandum Consensus for No Further Action in Soil and Groundwater] needs to be included in [the] references. (It's the most important basis for the decision in the ROD).

Response: As requested, Table 1 and the References Table were updated to cite this document.

- ❖ Comment #7 - [Section 2.5, 4th sentence] We've deleted [the] sentence ["Future industrial, recreational, and operational land use activities may be implemented on the site provided that activities remain protective of human health and the environment."] because it includes a risk evaluation conclusion that is premature in the document (the risk section is the next section). Also, the conclusion of the sentence deleted implies a conflict with the ROD as a whole. The ROD concludes that there is no unacceptable risk posed to human health or the environment by site conditions under any land use scenario but the sentence implies that there exists land uses that may not remain protective of [human health] and the [environment]. I assume that the sentence is wrong and the ROD conclusion is correct??

Response: Correct, the conclusions stated in the ROD are accurate. The text has been updated to reflect that current site conditions allow for unrestricted future land use.

- ❖ Comment #9 - [Section 2.6] [The No Further Action Technical Memorandum] needs to be in the references.

Response: As with Comment #6, Table 1 and the References Table were updated to cite this document.

- ❖ Comment #10 - [Section 2.6.1, 4th paragraph, 3rd to last sentence] Please spell out [the RSL] acronym or define here if needed.

Response: The requested changes have been made to the text.

- ❖ Comment #11 - [Section 2.6.1, 4th paragraph, last sentence] Please make ["agreed to eliminate arsenic, iron and manganese as COCs"] bold, italic and include in references.

Response: As requested, Table 1 and the References table were updated to cite the signature page of the *Technical Memorandum Consensus for No Further Action in Soil and Groundwater*.

- ❖ Comment #12 - [Section 2.6.1, Table 3] Need a reference to the background study.

Response: As requested, Table 3 and the References Table were updated to cite the Background Investigation.

- ❖ Comment #13 - [Section 2.6.1, Table 3] Delete the line of space [between "*Dissolved fraction" and the J qualifier definition].

Response: The requested changes have been made to the text.

- ❖ Comment #14 - [Section 2.6.1, last paragraph, 2nd sentence] Why would [“and the fact that the source of contamination at Site 11 was removed during the NTCRA”] be relevant for the HHRA? The driver for the NTCRA was ecological risk.

Response: The removal of the source area within Site 11 was included in the discussion of the HHRA because it presents an additional line of evidence supporting the absence of unacceptable risk to human health.

- ❖ Comment #15 - [Section 2.6.2, 1st paragraph, 1st sentence] Not clear what the significance of [“consisted of Steps 1 through 3b’] is. How many steps is an ERA? Is this all the steps or only a few of them?

Response: As outlined in Navy and USEPA ERA policy and/or guidance, Steps 1 through 3 are only part of the three-tiered, eight- step process to evaluate the potential risks to ecological receptors. Steps 1 and 2 are the Screening Level ERA [or SERA (or SLERA)], while Step 3 is the first step in a Baseline ERA (or BERA). Starting with Step 2, as each step is completed, it is decided (by risk assessors and/or the Partnering Team) if future courses of action (i.e., additional steps) are necessary. For Site 11, Steps 1 to 3 were sufficient to characterize the ecological risks and further steps were not needed. It is common to cite how far in the ERA process a site progressed. However, since the ROD presents no discussion of the ERA step process, the sentence was revised as follows to avoid any confusion:

“The Ecological Risk Assessment (ERA) for Site 11 was conducted in accordance with Navy and USEPA policy and guidance.”

- ❖ Comment #16 - [References, Ref. 6] The [AR] number [hasn’t] been assigned yet?? It’s been 3 years since the document was put into the AR.

Response: The References Table has been updated with the current list of AR numbers for all documents, as available.

- ❖ Comment #17 - [References, Ref. 8] [2008 or] 2009? As in table 1?

Response: Yes, the date is 2009, as shown in Table 1, and the References table has been corrected.

Ms. Susanne Haug

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August 2, 2010

If you have any questions or comments regarding the above response to comments, please feel free to contact me at 757-671-6273.

Sincerely,
CH2M HILL

A handwritten signature in blue ink, appearing to read 'Stephanie Sawyer', is written over the typed name.

Stephanie Sawyer
Project Manager

cc: Mr. Christopher Murray /NAVFAC
Mr. Wade Smith/VDEQ
Ms. Marlene Ivester/CH2M HILL



CH2MHILL

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

August 2, 2010

389659.RP.DR

Mr. Wade Smith
Remedial Project Manager
Office of Remediation Programs
Virginia Department of Environmental Quality (VDEQ)
P.O. Box 1105
Richmond, Virginia 23218

Subject: Response to Comments on the *Draft Record of Decision, Site 11: Bone Yard, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*

Dear Mr. Smith:

On behalf of the U.S. Department of the Navy's Naval Facilities Engineering Command (NAVFAC), CH2M HILL has prepared this letter in response to your July 19, 2010 e-mail that provided comments for the subject document via track changes in the document's Word file. Comments received are shown in italics, followed by the Navy's response in blue.

❖ *Comment #1 - [Document-wide] sediment vs. sediments...please use consistently throughout the document.*

Response: The text has been updated to consistently reference the media as 'sediment.'

❖ *Comment #2 - [Section 1, 1st sentence] As mentioned during the July 13, 2010 CAX Partnering Meeting, I was curious as to why the Proposed Plan made no reference to Site 11 as OU 5.*

Response: The USEPA tracks sites in their CERCLIS database as Operable Units (OU). The EPA RPM requested that the site's OU designation be included on the ROD cover and within Section 1 so if someone is looking for ROD in USEPA's archive, they will be able to find it easier. Therefore, it is included on the ROD as a courtesy and will not be included in any other site document. The sudden reference to an OU on a site's ROD can lead to confusion, so the following changes will occur:

1. Front Cover: From "Operable Unit 5, Site 11: Bone Yard" to "Site 11: Bone Yard (USEPA Operable Unit 5).
2. Section 1, first sentence changed to: "... No Further Action (NFA) for all media (soil, groundwater, surface water, and sediment) at Environmental Restoration Program (ERP) Site 11, Bone Yard (also known as USEPA Operable Unit 5), at Naval Weapons Station ..."

- ❖ Comment #3 - [Section 2.1, 1st paragraph, 3rd sentence] *If CAX was not commissioned until 1943, please indicate how the property was used differently between 1940 and 1943.*

Response: The 1984 Initial Assessment Study (IAS) for CAX states after the Penniman Shell Loading Plant closed (1918), the property was used for farming or left idle until 1942 when construction began for a new Navy supply facility. Table 2-1 of the IAS reports the Site 11 period of operation as "1940-1978." However, later in the document when providing the site description (Chapter 8), it states:

"It is not known how long the site had been used for waste disposal, as no records are available regarding its operation. Available information indicates that the site was active from the World War II era until as recently as 1978."

Consequently, the following changes to the ROD text will occur:

1. Section 2.1, first paragraph, third sentence will change to: "Between 1923 and 1942, the property was used for farming or left idle until construction began in 1942 for a new Navy supply facility. CAX was commissioned in 1943 as a satellite unit of the Naval Supply Depot in Norfolk, VA to provide . . ."
 2. Section 2.1, second paragraph, fifth sentence will change to: "The 1984 Initial Assessment Study (IAS) reported Site 11's period of operation as from 1940 to 1978; however, it also stated it was unknown how long Site 11 was used for waste disposal, but available information indicated the site was active from the World War II era until 1978. Site 11 was reportedly used by the CAX Department of Public Works . . ." (rest of the paragraph will remain the same)
- ❖ Comment #4 - [Section 2.1, 2nd paragraph, second to last paragraph] *Whose Public Works?*

Response: The Department of Public Works, adjacent to Site 11, is a part of CAX. The text was revised to clarify (see above).

- ❖ Comment #5 - [Section 2.1, Figure 2] *Please consider using Figure 3-5 from the June 2010 Draft SMP (which includes Focus Areas and Sampling Locations) instead of the current figure.*

Response: Figure 3-5 was not directly used as it is not a comprehensive representation of site activities. The intent of Figure 2, as indicated in the text, is to depict Site 11 as it is related to site characteristics and pertinent landmarks. Information shown in SMP Figure 3-5 is provided in subsequent figures in the ROD. No changes were made to the text.

- ❖ Comment #6 - [Section 2.3, 1st paragraph, last sentence] *Additional sites or an additional AOC?*

Response: Since the FFA was signed, additional AOCs have been added to the ERP, but not additional sites. The sentence has been revised to:

"However, since the FFA was signed, two additional AOCs (AOCs 8 and 9) have been added to the ERP."

The sentence a few sentences prior to the one above has also been revised to:

"Subsequently, the Navy, USEPA, and VDEQ identified seven additional potential source areas and designated them as AOCs 1 through 7."

Mr. Wade Smith

Page 3

August 2, 2010

- ❖ Comment #7 - [Section 2.3, 2nd paragraph] Please include a reference to AOC 9 in the paragraph above.

Response: Done. Please see the response to Comment #6.

- ❖ Comment #8 - [Section 2.6.1, Table 3] Please define [$\mu\text{g}/\text{L}$].

Response: The definition for " $\mu\text{g}/\text{L}$ " has been added underneath the table.

- ❖ Comment #9 - [Section 2.6.2, last paragraph] Please include [Ref. 22] in References.

Response: The reference has been added.

- ❖ Comment #10 - [Section 2.8, 3rd paragraph] [Please verify the Public Affairs Office phone number, as different from one in Proposed Plan (757 322-4785).]

Response: The phone number cited in the Proposed Plan is actually the number for the Administrative Record File and not the Public Affairs Office. The Public Affairs Office phone number listed in the ROD is correct.

- ❖ Comment #11 - [Section 3, References Table] Please indicate why AR numbers are "Pending" for every document referenced after 2000.

Response: These AR numbers were not readily available for some of the documents, but have since been added to the table.

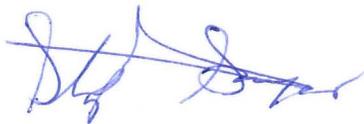
- ❖ Comment #12 - [Section 3, References Table] Move [Ref. 10] to after Ref. 11.

Response: This reference has been moved in the table to be after Ref. 12, since that is how it falls within the main document text, and References 10, 11, and 12 have been renumbered accordingly, in the table and the main document text. In addition, the reference text in the table has been revised as necessary to match its citation within the main document.

With the exception of the request to delete "42 U.S.C §§9601 et seq.," from the second sentence of Section 1, all editorial changes were made and are not discussed on a case by case basis within this letter. The requested deletion was not retained, as it is a USEPA addition to the document. If you have any questions or comments regarding the above responses, please feel free to contact me at 757-671-6273.

Sincerely,

CH2M HILL



Stephanie Sawyer
Project Manager

cc: Ms. Susanne Haug/USEPA
Mr. Christopher Murray /NAVFAC
Ms. Marlene Ivester/CH2M HILL

VDEQ Concurrence



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L. Preston Bryant, Jr.
Secretary of Natural Resources

August 26, 2010

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

**RE: Final Record of Decision
Site 11 – Bone Yard
Naval Weapons Station Yorktown
Cheatham Annex
Williamsburg, Virginia**

Dear Mr. Sokolowski:

The Virginia Department of Environmental Quality (DEQ) staff has reviewed the Final Record of Decision (Final ROD) for Site 11 – Bone Yard located at Naval Weapons Station Yorktown, Cheatham Annex (CAX), Williamsburg, Virginia. The DEQ concurs with the No Further Action determination, as described in the August 2010 Final ROD, which was signed by Charles B. Marks, III (Captain, U.S. Navy, Commanding Officer) on August 25, 2010.

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

Sincerely,

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

Durwood H. Willis
Director, Office of Remediation Programs

cc: Chris Murray, CAX
Milt Johnston, DEQ, TRO
Wade Smith, DEQ, CO
Susanne Haug, EPA



**For access to the Administrative Record or
additional information on the IR Program, contact:**

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