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FINAL PHASE II REMEDIAL INVESTIGATION REPORT SITE 6 NWS YORKTOWN VA
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CH2M HILL

Final

Phase II Remedial Investigation Report, Site 6

Naval Weapons Station Yorktown
Yorktown, Virginia

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Abbreviations and Acronyms

1,1,1-TCA	1,1,1-trichloroethane
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
1,2-DCA	1,2-dichloroethane
2,4-DNT	2,4-dinitrotoluene
2,6-DNT	2,6-dinitrotoluene
2a-DNT	2-amino-4,6-dinitrotoluene
2-NT	2-nitrotoluene
3-NT	3-nitrotoluene
4a-DNT	4-amino-2,6-dinitrotoluene
4-NT	4-nitrotoluene
AF	adherence factor
amsl	above mean sea level
atm-m^3/M	atmosphere-cubic meter per mole
AUF	Area Use Factor
AVS	acid volatile sulfide
AWQC	Ambient Water Quality Criteria
BAF	bioaccumulation factor
BCF	bioconcentration factor
BERA	baseline ecological risk assessment
bgs	below ground surface
Cal EPA	California Environmental Protection Agency
cells/mL	cells per milliliter
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-dichloroethene
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
CNO	Chief of Naval Operations
COC	chemical of concern
COPC	chemical of potential concern
CSF	cancer slope factor
CSM	conceptual site model
CTO	Contract Task Order
°C	degrees Celsius
°F	degrees Fahrenheit
DI	deionized

DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
DQO	data quality objective
ELCR	excess lifetime carcinogenic risk
EOD	Explosives and Ordnance Disposal
EPC	exposure point concentration
EqP	equilibrium partitioning
ER	Environmental Restoration
ERA	ecological risk assessment
ESQD	Explosive Safety Quantity Distance
FFA	Federal Facility Agreement
FFS	Focused Feasibility Study
FS	Feasibility Study
ft	foot/feet
ft/day	foot per day
ft/ft	feet per foot
g/cm^3	grams per cubic centimeter
HAS	hollow-stem auger
HHRA	Human Health Risk Assessment
HI	hazard index
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HQ	hazard quotient
HRSD	Hampton Roads Sanitation District
IAS	Initial Assessment Study
ID	inside diameter
IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
IR	Installation Restoration
IUR	inhalation unit risk factor
LOAEL	Lowest Observed Adverse Effect Level
LTM	long-term monitoring
LUC	Land use controls
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
m^3/L	cubic meter per liter
MATC	Maximum Acceptable Toxicant Concentration
MCL	maximum contaminant level
mg/kg-BW/day	milligrams per kilogram body weight per day
mL	milliliter
mL/g	milliliters per gram
MS	Matrix Spike
MSD	Matrix Spike Duplicate

mV	millivolts
NACIP	Navy Assessment and Control of Installation Pollutants
NAVFAC	Naval Facilities Engineering Command
Navy	United States Department of the Navy
NCEA	National Center for Environmental Assessment
NERP	Naval Environmental Restoration Program
NEESA	Naval Energy and Environmental Support Activity
NOAEL	No Observed Adverse Effect Level
NOEC	No Observed Effect Concentration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRWQC	national recommended water quality criteria
NTU	nephelometric turbidity unit
ORP	oxidation/reduction potential
OSWER	Office of Solid Waste and Emergency Response
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PID	photo-ionization detector
ppm	parts per million
PPRTV	Provisional Peer Reviewed Toxicity Value
ppt	parts per thousand
PRAP	Proposed Remedial Action Plan
PVC	polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAA	remedial action alternative
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RfC	inhalation reference concentration
RfD	reference dose
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
RSL	Regional Screening Level
SEM	simultaneously extractable metals
SERA	screening ecological risk assessment
SMDP	Scientific Management Decision Point
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
TAL	target analyte list
TCE	trichloroethene

TCL	target compound list
TCLP	Toxicity Characteristic Leachate Procedure
TDS	total dissolved solids
TNT	trinitrotoluene
TOC	total organic carbon
trans-1,2-DCE	trans-1,2-dichloroethene
UCL	upper confidence limit
UF	uncertainty factors
USEPA	United States Environmental Protection Agency
VC	vinyl chloride
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound
VRP	Voluntary Remediation Program
WPNSTA	Naval Weapons Station

SECTION 1

Introduction

This Remedial Investigation (RI) report presents the data and findings obtained from Phase II investigation activities conducted to characterize the nature and extent of contamination and to assess potential risks to human health and the environment at the Naval Environmental Restoration Program (NERP) Installation Restoration (IR) Site 6, located at the Naval Weapons Station (WPNSTA) Yorktown, in Yorktown, Virginia (**Figure 1-1**). Site 6, the Explosives Contaminated Wastewater Impoundment, Flume Area, Excavation Area, and Buildings 109, 110, and 501 discharged wastewater potentially containing explosives and solvents from 1942 to 1975.

This report was prepared under the United States Department of the Navy (Navy), Naval Facilities Engineering Command (NAVFAC) Atlantic Division, Comprehensive Long-Term Environmental Action Navy (CLEAN) 1000, Contract N62470-08-D-1000, Contract Task Order (CTO) WE-18, for submittal to NAVFAC, United States Environmental Protection Agency (USEPA) Region 3, and Virginia Department of Environmental Quality (VDEQ). The Navy, USEPA, and VDEQ work jointly as the WPNSTA Yorktown Tier I Partnering Team.

Historical investigations conducted at Site 6 from 1984 to 1998 led to a Record of Decision (ROD) for soil and sediment in 1998 (Baker, 1998d). However, the ROD specified that the remedy of long-term monitoring (LTM) for groundwater, surface water, and sediment would not be the final remedy for these media. The Partnering Team agreed to further address groundwater at WPNSTA Yorktown using a two-phase approach. The Site 6 Phase I RI was conducted in 2004, and included a comparison of site data to background values and screening criteria to determine if the site needed further characterization. The Phase I RI report concluded that groundwater at Site 6 is contaminated with chlorinated volatile organic compounds (VOCs), explosives, and inorganic constituents and that these chemicals had not been fully characterized at the site. The report recommended additional characterization and quantification of potential risks. Results of the Phase I RI were included in the report titled *Final Phase I Remedial Investigation Report for Groundwater at Sites 1, 3, 6, 7, 11, 17, 24, and 25* (CH2M HILL, 2007).

Phase II RI investigation activities were conducted from March to September 2009 to further characterize the extent of contamination and support an assessment of potential environmental and human health risks associated with exposure to site media at Site 6. Field activities were conducted in accordance with the work plan titled *Phase II Remedial Investigation Work Plan for Groundwater at Sites 1, 3, and 6 and Long-term Monitoring Work Plan for Site 7, Naval Weapons Station Yorktown, Yorktown, Virginia* (CH2M HILL, 2008).

1.1 Objectives and Approach

The objective of the Phase II RI was to sufficiently characterize the nature and extent of potential contamination in groundwater, surface water, and sediment, and to assess the potential risks posed by this contamination to human health and the environment. This

evaluation will support the consideration of risk-based cleanup decisions and evaluation of interim, if applicable, and long-term solutions to address impacts to groundwater, surface water, and sediment.

The activities completed to support the objectives of the Phase II RI activities were as follows:

- Installation of 10 permanent monitoring wells in the previously excavated area, the flume source area, the impoundment area, and the areas west of the coffer dam
- Completion of a groundwater-level survey and collection of groundwater samples from all new and existing monitoring wells
- Collection of surface water and sediment samples
- Collection of sediment pore-water samples to evaluate potential chlorinated VOC discharge from groundwater to surface water
- Completion of hydraulic conductivity testing
- Quantitative assessment of the potential human health and ecological risks associated with exposure to contaminated site media, where identified

1.2 Site Background

This subsection provides a general summary of WPNSTA Yorktown and Site 6, including site descriptions and environmental history.

1.2.1 Naval Weapons Station Yorktown

WPNSTA Yorktown is a 10,624-acre installation located on the Virginia Peninsula in York and James City Counties and the City of Newport News, Virginia (**Figure 1-1**). WPNSTA Yorktown is bounded on the northwest by WPNSTA Yorktown Cheatham Annex and the King's Creek Commerce Center; on the northeast by the York River and the Colonial National Historic Parkway; on the southwest by Route 143 and Interstate 64; and on the southeast by Route 238 and the town of Lackey.

Originally named the U.S. Mine Depot, WPNSTA Yorktown was established in 1918 to support the laying of mines in the North Sea during World War I. For 20 years after World War I, the depot continued to receive, reclaim, store, and issue mines, depth charges, and related materials. During World War II, the facility was expanded to include three trinitrotoluene (TNT) loading plants and new torpedo overhaul facilities. A research and development laboratory for experimentation with high explosives was established in 1944. In 1947, a quality evaluation laboratory was developed to monitor special tasks assigned to the facility that included the design and development of depth charges and advanced underwater weapons. On August 7, 1959, the depot was renamed the U.S. Naval Weapons Station. Today, the primary mission of WPNSTA Yorktown is to provide ordnance, technical support, and related services to sustain the war-fighting capability of the armed forces in support of national military strategy.

Comprehensive environmental restoration activities at WPNSTA Yorktown began in 1984 under the Navy Assessment and Control of Installation Pollutants (NACIP) and

Environmental Restoration (ER) Programs. On October 15, 1992, WPNSTA Yorktown was added to the National Priorities List (NPL), which required all subsequent environmental restoration activities to be conducted under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Navy and USEPA executed a Federal Facility Agreement (FFA) in August 1994, which incorporated the Resource Conservation and Recovery Act (RCRA) Solid Waste Management Units (SWMUs) and identified 16 sites, which included Site 6.

1.2.2 Site 6

Site 6, the Explosives Contaminated Wastewater Impoundment, Flume Area, Excavation Area, and Buildings 109, 110, and 501, is approximately 18 acres in size and located in the northern portion of WPNSTA Yorktown adjacent to an unnamed tributary of Felgates Creek (**Figure 1-2**). The site consists of three areas surrounding Buildings 109, 110, and 501: a flume area, an impoundment area, and an excavated pit.

The flume area is a network of flumes connected to an impoundment area, where wastewater possibly containing explosives (TNT, hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX], and 2,4-dinitrotoluene [2,4-DNT]) and solvents (trichloroethene [TCE], 1,1,1-trichloroethane [1,1,1-TCA], and cyclohexanone) was discharged between 1942 and 1975. The wastewater was generated from explosives reclamation at Building 109 (R-1) and from explosives loading, mixing, and casting at Building 110 (Plant 2).

In 1975, a carbon adsorption tower was installed to treat the contaminated wastewater prior to discharge into the drainage way. A National Pollutant Discharge Elimination System (NPDES) permit was granted to allow the discharge of effluent from the carbon adsorption tower containing acceptable concentrations of nitramines/nitroaromatics. In 1986, the effluent from the carbon adsorption tower was diverted to the sanitary sewer and ultimately to the Hampton Roads Sanitation District (HRSD) (Baker, 1998b).

The impoundment area is a 3-acre, unlined, surface impoundment adjacent to wetlands along a small tributary to the main branch of Felgates Creek. The surface impoundment was created by building a coffer dam across the headwaters of the small tributary. After 1986, the surface impoundment collected only surface runoff from the area around Buildings 109 and 110. Wastewater discharges ceased in 2003, when operations in Buildings 109 and 110 terminated (Baker, 1998b).

The excavated area may have been the soil borrow pit for construction of the coffer dam for the impoundment and may have also been used to contain packed explosives. Concrete rubble and miscellaneous debris are evident. Cadmium and zinc contaminated soil was previously excavated from this area (Shaw, 2008). The excavated area is located northwest of former Building 501 and is currently wooded.

1.3 Report Organization

The RI Report is organized as follows:

- Section 1 – Introduction
- Section 2 – Summary of Previous Investigations
- Section 3 – Field Investigation Methods

- Section 4 – Physical Characteristics
- Section 5 – Nature and Extent of Contamination
- Section 6 – Chemical Fate and Transport
- Section 7 – Human Health Risk Assessment
- Section 8 – Ecological Risk Assessment
- Section 9 – Summary, Conclusions, and Proposed Future Actions
- Section 10 - References

Tables and figures are provided at the end of each respective section. Appendixes are included at the end of the report with Appendix E provided electronically in PDF format on CD.

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE1-1_SITE6_LOCATION.MXD MUNWIN 5/6/2010 11:50:34

Legend

- Yorktown Naval Weapons Station Base Boundary
- Site 6 Boundary
- Camp Peary Scarp
- Buildings and Structures
- Shoreline and Water Bodies
- Interstate 64
- Magazines
- Kings Creek Commerce Center
- County Lines

N

0 3,500 7,000 Feet

Figure 1-1
Base and Site 6 Location Map
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

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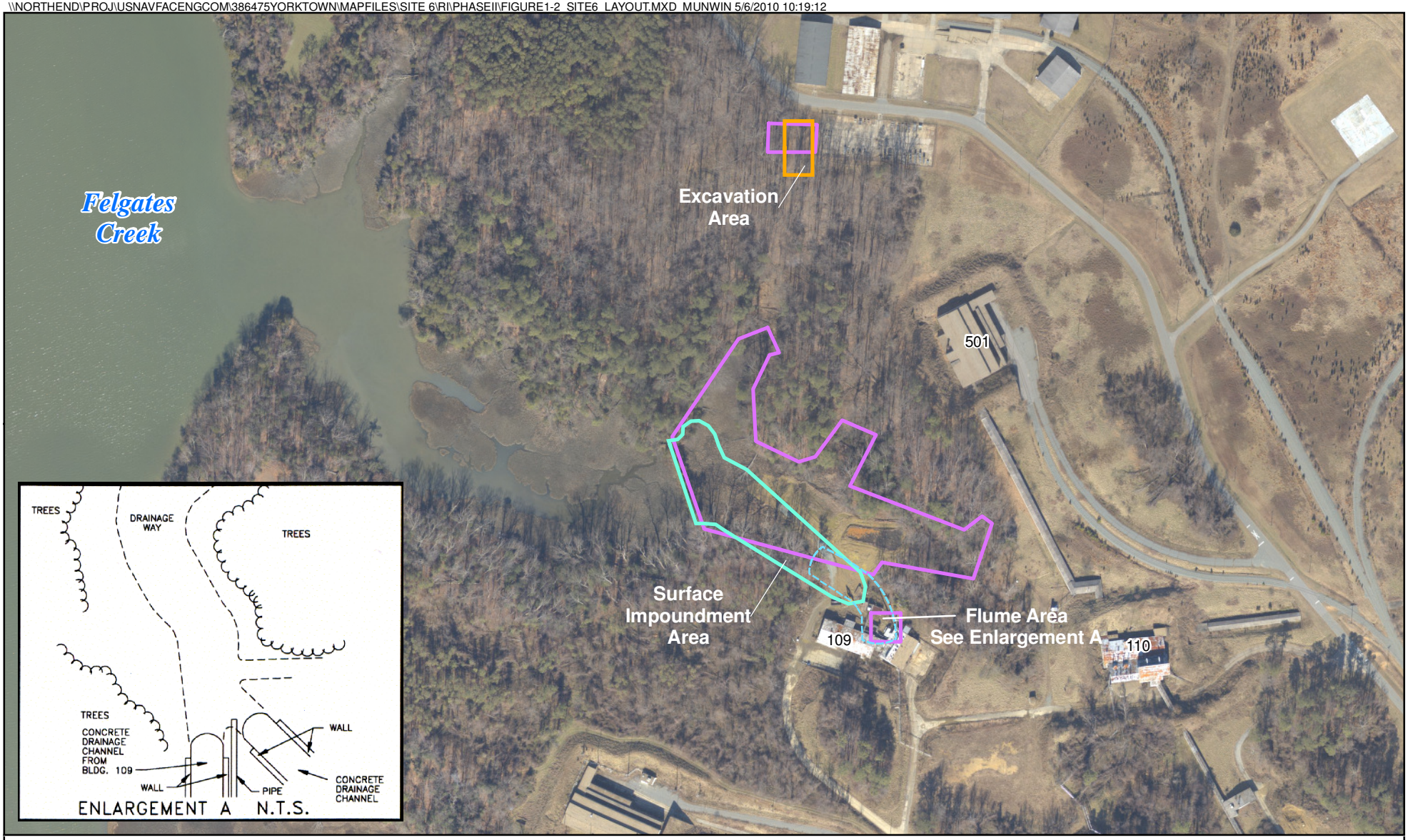
\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE1-2_SITE6_LAYOUT.MXD MUNWIN 5/6/2010 10:19:12



Legend

- Surface Impoundment Area
- Flume Drainage Way
- Excavation Area (Cadmium and Zinc Contaminated Soil)
- Land Use Control Boundary

N
W E
S

0 150 300
Feet

Figure 1-2
Site 6 Layout
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

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SECTION 2

Summary of Previous Investigations

This section presents a summary of the results and findings from previous investigations conducted at Site 6 prior to the field investigation activities presented in this Phase II RI. Previous investigations included the collection of soil, groundwater, surface water, and sediment samples. **Figures 2-1** through **2-2** present locations of samples collected prior to this Phase II RI investigation.

2.1 Initial Assessment Study (1984)

The Initial Assessment Study (IAS) at WPNSTA Yorktown was documented in the report titled *Initial Assessment Study (IAS) of Naval Weapons Station Yorktown, Virginia* (NEESA, 1984). The IAS was conducted to identify and assess sites posing a potential threat to human health and the environment because of contamination from prior waste management activities, which included Site 6. Activity records relating to waste generation, handling, and disposal were reviewed, physical conditions at the site were characterized, and migration pathways and potential receptors were identified. The results of the data evaluation were used to develop recommendations concerning the need for a confirmation study at Site 6. The IAS concluded that sampling of Site 6 surface water, sediment, and soil samples would be needed to evaluate possible explosives and VOC contamination within these media.

2.2 Confirmation Study Round One (1986)

In 1986, consistent with the recommendations in the IAS, four soil (6S01 through 6S04) and three co-located surface water and sediment samples (6SD/SW01 through 6SD/SW03) were collected from Site 6 as part of the Confirmation Study Round I (**Figure 2-1**). Samples were analyzed for VOCs, semi-volatile organic compounds (SVOCs), and explosives. This effort was documented in the *Confirmation Study Step IA (Verification), Round One*, (Dames & Moore, 1986).

Toluene was detected in all four soil samples at concentrations less than 10 micrograms per kilogram (µg/kg). TCE and trans-1,2-dichloroethene (trans-1,2-DCE) were detected at concentrations of 35 µg/kg and 9 µg/kg, respectively, in soil sample 6S02, located within the impoundment. 1,1,1-TCA and trans-1,2-DCE were observed at concentrations of 11 µg/kg and 14 µg/kg, respectively, in sample 6S04, located just south of the impoundment. With the exception of methylene chloride (a common laboratory contaminant), these were the only detections of VOCs in Round I soil samples. Two SVOCs, chrysene and phenanthrene, were detected at concentrations of 90 µg/kg and 70 µg/kg, respectively, in sample 6S03, located outside the northwest corner of Building 109. TNT was detected in three of the four soil samples: 6S01 (1,340 µg/kg), 6S02 (127,000 µg/kg), and 6S04 (727,000 µg/kg). 4-amino-2,6-dinitrotoluene (4a-DNT), 2-amino-4,6-dinitrotoluene (2a-DNT), 2,4-diamino-6 nitrotoluene, and 2,6-diamino-4-nitrotoluene were detected in soil samples 6S02 and 6S04 (in or adjacent to the impoundment) at maximum concentrations of 64,000 µg/kg, 222,000 µg/kg, 2,120 µg/kg, and 1,630 µg/kg, respectively.

Toluene, 1,1,1-TCA, and methylene chloride (a common lab contaminant) were detected in the three sediment samples (6SD01 through 6SD03) at maximum concentrations of 2 µg/kg, 14 µg/kg, and 105 µg/kg, respectively. The highest concentrations of these constituents were detected in sample 6SD01, collected just upgradient of the coffer dam (**Figure 2-1**). There were no SVOCs detected in sediment samples collected during the Round I event. One explosive (2,4-diamino-6-nitrotoluene) was detected in one sample (6SD02) at a concentration of 186 µg/kg. Sediment sample 6SD02 is located just downgradient of the coffer dam. This was the only detection of an explosive in sediments collected during the Round I event.

With the exception of methylene chloride, there were no detections of VOCs, SVOCs, or explosives in surface water collected in Felgates Creek, just downgradient of Site 6 (7SW03). However, VOCs were detected in surface water samples collected just upgradient (7SW01) and downgradient (7SW02) of the coffer dam. 1,1,1-TCA, trichloroethene (TCE), and trans-1,2-DCE were detected at maximum concentrations of 4 µg/L, 4 µg/L, and 3 µg/L, respectively. Explosives were also detected in these surface water samples at maximum concentrations of: RDX (2.01 µg/L), octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) (8.17 µg/L), 4a-DNT (0.24 µg/L), and 2,4-diamino-4-nitrotoluene (0.078 µg/L). There were no detections of SVOCs in surface water.

In general, the Confirmation Study Round I indicated elevated levels of contaminants (primarily explosives) confined to the impoundment or immediately downgradient of the dam. Additional sediment and surface water sampling was recommended to determine the extent of the contamination.

2.3 Confirmation Study Round Two (1988)

Consistent with the recommendations in the Confirmation Study Round I, three surface water samples were collected in the same locations as those previously sampled and seven sediment samples (6SD01 through 6SD07) were collected at Site 6 in November and December 1987 as part of Round II of the Confirmation Study (**Figure 2-1**). This effort was documented in the *Confirmation Study Step IA (Verification), Round Two*, (Dames & Moore, 1988). Samples were analyzed for VOCs, SVOCs, and explosives. With the exception of laboratory contaminants (acetone and methylene chloride), there were no detections of these constituents in surface water. Acetone and methylene chloride were also detected in sediment samples, but no other VOCs were detected.

TNT was detected in impoundment sediment samples 6SD01, 6SD02, and 6SD05 at concentrations of 2.44 µg/kg, 21 µg/kg, and 1,240 µg/kg, respectively. HMX was detected in the same three samples at concentrations ranging from 1.41 µg/kg (6SD01) to 44.3 µg/kg (6SD02). 4a-DNT was detected in these three samples at concentrations ranging from 5.39 µg/L to 543 µg/L. 2,4-DNT, 2-aDNT, and 2,6-diamino-4-nitrotoluene were detected in one impoundment area sediment sample each at concentrations of 17 µg/kg, 15 µg/kg, and 8 µg/kg, respectively. There were no detections of explosives in the samples collected on the north side of the impoundment (6SD04 and 6SD06) or from the bottom of Felgates Creek, (6SD03). Based on these results, it was recommended that additional sediment, surface water, and biota data be collected and analyzed for VOCs, SVOCs, and explosives to further evaluate site conditions, site-related contaminants, and the extent of contaminant migration.

2.4 Remedial Investigation Interim Report (1991)

The *RI Interim Report* (Versar, 1991) was drafted by Dames & Moore in 1989 and revised by Versar in 1991. The purpose of this report was to facilitate movement of the sites into the RI process. The report summarized available data from the Confirmation Studies for those sites recommended for further investigation in the IAS and based on these data, provided recommendations for additional efforts to be conducted to complete the RI. The Interim RI recommended that benthic and fish communities in the tributary to Felgates Creek be sampled nearby Site 6, and additional surface water samples be collected and analyzed for target compound list (TCL) VOCs, explosives, and TCL SVOCs. The Interim RI also recommended that the existing and additional data be used to conduct a risk assessment (Versar, 1991).

2.5 Round One Remedial Investigation (1993)

Round One RI activities took place during the spring/summer 1992 based on recommendations made in the Interim RI Report. This information is documented in the *Final Round One RI for Sites 1-9, 11, 12, 16-19, and 21* (Baker and Weston, 1993b). The objectives of the RI were to assess the nature and extent of contamination and to perform human health and ecological risk assessments to evaluate the impacts on human health and the environment. Field activities included the collection of geophysical data, aquifer testing, installation and sampling of one groundwater monitoring well (6GW01), surface and subsurface soil sampling at six locations (6S05 through 6S09), surface water sampling at eight locations (6SW02 and 6SW08 through 6SW14), and sediment sampling at eight locations (6SD02 and 6SD08 through 6SD14) (**Figure 2-1**).

Explosives and VOCs were detected in sediments near the discharge area from Building 109 at similar concentrations to those detected during the Confirmation Studies. Additionally, RDX, HMX, TNT, and chlorinated VOCs were detected in the surface water adjacent to Building 109. RDX, HMX, and chlorinated VOCs were also detected in site groundwater. The concentration of TCE in groundwater was 380 µg/L (well 6GW01). As only one groundwater monitoring well was installed at Site 6, the Round One RI provided limited information on the subsurface conditions, including both subsurface soil and groundwater. Several SVOCs were detected in surface soil, surface water, and sediment, but not in the groundwater. Concentrations of TCE and explosives were highest near Building 109 and decreased further downgradient.

The Round One RI recommended that Site 6 be a candidate for an accelerated remedial action under a Focused Feasibility Study (FFS) upon confirmation that the contamination was localized in the upstream portion of the ditch. In order to evaluate if the contamination was localized, the Round One RI recommended that additional surface soil and sediment samples be collected in the area north of Building 109 to define the extent of contamination and additional groundwater sampling be conducted to delineate the extent of VOC and explosives contaminated groundwater in the area (Baker and Weston, 1993a).

2.6 Round Two Remedial Investigation (1998)

A Round Two RI field program was conducted between July 1994 and February 1996 at Site 6 to assess the nature and extent of contamination at the site and to address potential data gaps observed following the Round One RI. Efforts from this field event are documented in the *Final Round Two RI Report, Sites 6 and 7* (Baker, 1998a). Surface soils (6S11 through 6S25), subsurface soils (6SB02 through 6SB08), temporary groundwater (6HP02 through 6HP09), groundwater (6GW01 through 6GW03, and 6GW01A), surface water (6SW16 through 6SW21, 6SW24, and 6SW25), and sediment (6SD15 through 6SD25) samples were collected (**Figure 2-1**).

No chlorinated VOCs were identified in surface soil samples. Chlorinated VOCs were detected in subsurface soil immediately downgradient of Building 109. Concentrations and the number of compounds increased with depth. Nitramines were detected during a soil characterization study that focused on the Site 6 discharge point of two concrete drainage channels, which formerly conveyed wastewater from Buildings 109 and 110 and was suspected of having high concentrations of nitramines. Sediment samples indicated the presence of SVOCs within the drainage ways to the impoundment area and VOCs, SVOCs and nitramine compounds within the impoundment area itself. Chlorinated VOCs and explosive constituents were detected in the groundwater samples from both Hydropunch™ (temporary groundwater) locations and four new permanent monitoring wells (6GW02 through 6GW05). The highest concentrations of TCE (37,000 µg/L), cis-1,2-dichloroethene (cis-1,2-DCE) (26,000 µg/L), and vinyl chloride (21,000 µg/L) were detected at Hydropunch™ location 6HP08, located within the impoundment just north of the impoundment boundary and northwest of Building 109 (**Figure 2-1**).

Surface water and sediment samples indicated the presence of chlorinated VOCs and nitramines within the impoundment area, but these constituents were not detected in surface water and sediment collected at the mouth of the tributary to Felgates Creek or in Felgates Creek itself (6SD/SW17 through 6SD/SW21).

2.7 Focused Feasibility Study (1998)

The purpose of the *Final v2 Focused Feasibility Study for Sites 6 and 7* (Baker, 1998b) was to identify remedial action alternatives (RAAs) to address soil and sediment contamination at Site 6. The FFS involved the development, screening, and detailed analysis of RAAs. The FFS examined five RAAs to address contamination at Site 6: (1) no action; (2) no action with monitoring and sludge removal; (3) *in situ* biological treatment, soil cover, and sludge removal; (4) *ex situ* biological treatment, limited excavation, and offsite disposal and sludge removal; and (5) excavation with thermal treatment and sludge removal, and *ex situ* biological treatment, soil cover, limited excavation, and sludge removal (Baker, 1998b). Alternative 4 was identified as the preferred alternative.

2.8 Proposed Remedial Action Plan/Record of Decision (1998)

The *Final v2 Proposed Remedial Action Plan (PRAP)* for Sites 6 and 7 (Baker, 1998c) was released to the public in May 1998 presenting the preferred alternative identified in the FFS. The *Final ROD for Sites 6 and 7* (Baker, 1998d) was signed in October 1998. The ROD

documented the *ex situ* biological treatment, limited excavation, off-site disposal and sludge removal remedial action to reduce the risks posed by soil and sediments at Site 6.

2.9 Long-Term Monitoring

LTM for VOCs, nitramine compounds, and TAL inorganic constituents (including cyanide) of groundwater and the impoundment area surface water and sediment began in May 2000. Based on the *Long-Term Monitoring Report* (CH2M HILL and Baker, 2006), following the baseline round of sampling, LTM at Site 6 was suspended pending completion of the remedial action.

2.10 Phase I Remedial Investigation Report (2007)

The purpose of the Phase I RI activities was to provide additional data to evaluate the nature and extent of chlorinated VOCs in groundwater. This information is documented in the *Phase I Remedial Investigation Report for Groundwater at Sites 1, 3, 6, 7, 11, 17, 24, and 25* (CH2M HILL, 2007). Nine additional wells were installed and samples were collected from 13 Yorktown-Eastover aquifer monitoring wells as part of this RI (**Figure 2-2**). The groundwater samples collected were analyzed for VOCs, SVOCs, pesticides/ polychlorinated biphenyls (PCBs), explosives, and total and dissolved inorganic constituents and cyanide. The analytical results were compared against the Yorktown-Eastover aquifer background data set and the maximum contaminant levels (MCLs), if available.

TCE concentrations exceeded the MCL of 5 micrograms per liter (µg/L) in samples from wells 6GW08 (36,000 µg/L) and 6GW01 (94 µg/L). Concentrations of 1,1-DCE exceeded the MCL of 7 µg/L in the samples from wells 6GW01 (15 µg/L) and 6GW06 (23 µg/L). Concentrations of cis-1,2-DCE (550J µg/L) and vinyl chloride (8K µg/L) both exceeded MCLs of 70 µg/L and 2 µg/L, respectively, in the sample from well 6GW08. No SVOCs exceeded the MCLs. Concentrations of the pesticide heptachlor epoxide in the samples from wells 6GW04 (13 µg/L), 6GW05B (0.59 µg/L), 6GW09 (1.2 µg/L) were above the MCL of 0.2 µg/L.

Ten explosives were observed in groundwater collected during the Phase I RI: 1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4,6-TNT, 2,4-DNT, 2-aDNT, 2-nitrotoluene (2-NT), 4a-DNT, HMX, RDX, and tetryl. The highest concentrations of these constituents were detected in the sample from well 6GW04.

Concentrations of total arsenic (17.5 µg/L) and dissolved arsenic (15.8 µg/L) in 6GW05 exceeded the MCL of 10 µg/L. The background concentration of arsenic in the unfiltered sample was 3.5J µg/L, but arsenic was not detected in the filtered sample.

Only one pesticide (heptachlor epoxide) and one SVOC [bis(2-ethylhexyl)phthalate] were detected at concentrations slightly above screening values. Heptachlor epoxide concentrations suggest it is attributable to normal pesticide use and not a CERCLA-related release. Pesticides and herbicides were commonly applied at DoD facilities to control pests and weeds, which may have resulted in pesticides and herbicides accumulating in environmental media. Bis(2-ethylhexyl)phthalate is a common laboratory contaminant and not likely a site related constituent. Therefore, SVOCs and pesticide analysis would not be

included in further investigations. The Phase I recommended that additional investigations be conducted within the impoundment area to define the extent and concentration of contaminants within the Yorktown-Eastover aquifer. New and existing wells would be sampled for VOCs, explosives, inorganic constituents, and natural attenuation parameters. In addition, additional surface water, sediment, and sediment pore-water samples were recommended to further evaluate groundwater discharge to surface water.

2.11 Remedial Action/Construction Completion Report (2008)

A Site 6 remedial action of contaminated soil/sediment and decontamination of Building 109 trenches and drains was initiated in 1999 and completed in 2006. Remedial activities in 1998 and 1999 included decontamination of the interior and exterior flumes and trench drains in Building 109, excavation and treatment of 1,000 tons of impacted soil/sediment, and excavation and disposal of polycyclic aromatic hydrocarbon (PAH)-contaminated soil, and was documented in the report titled *Contractor Closeout Report for Site 6 Remediation* (OHM, 1999). The remedial activities from 2000 to 2006 included excavation and ex-situ bioremediation of soil and sediment contaminated with VOCs, explosives, and inorganics (cadmium, nickel, and zinc) (**Figure 2-1**), and was documented in the report titled *Final Construction Completion Report for Site 6 Bioremediation* (Shaw, 2008).

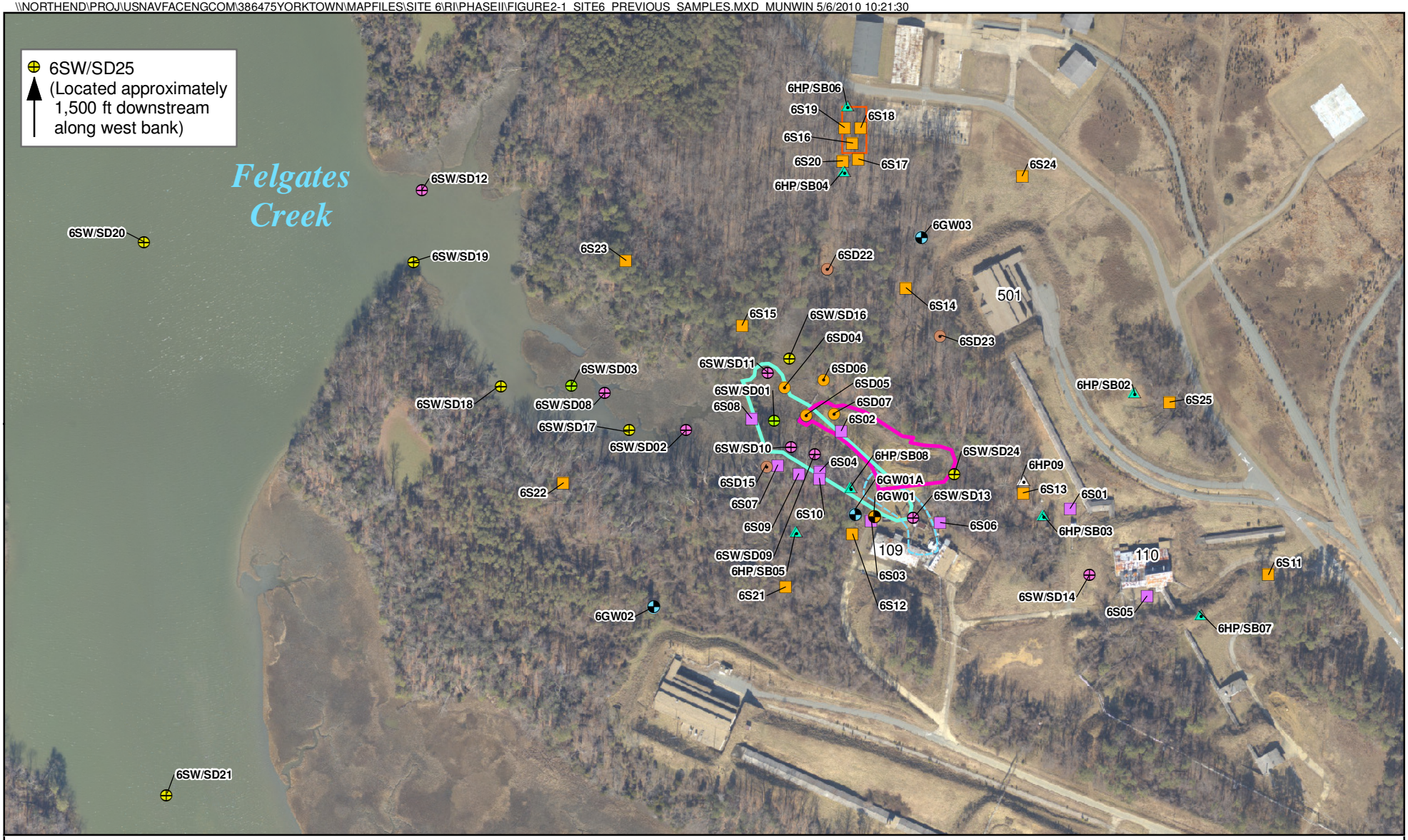
TNT contamination within the flume and drain systems at Building 109 was decontaminated using a low-pressure wet steam to melt the TNT and initiate flow of TNT downstream to a collection area. TNT sludge was collected at downstream collection points and transferred to explosive-handling cardboard boxes for disposal by Base Explosives and Ordnance Disposal (EOD) personnel. Soil and debris recovered from the exterior flume at Building 109 were transported to a bioremediation treatment cell. PAH-impacted soil was excavated into two 55-gallon drums and disposed. Approximately 1,000 tons of explosive-contaminated soil from the impoundment area was excavated to a depth of 4 feet (ft) and transported to a bioremediation treatment cell, located adjacent to Site 6 at Aviation Field (Site 24). Following the removal action, the site was restored by seeding disturbed areas (OHM, 1999).

Approximately 11,800 tons of chlorinated VOCs, explosives, and inorganic contaminated soil and sediment was excavated within an area of 310 ft by 100 ft to a depth of 6 ft from Site 6 (**Figure 2-1**), and transported and disposed at a bioremediation treatment cell at Aviation Field (Site 24). Confirmation samples were collected in the excavation areas and confirmed that the remedial goals were met. Remediation goals met during the 2006 removal action are listed below.

Medium/ Chemical of Concern	Final Remediation Goal (mg/kg)
Sediment	
Trichloroethene	1.6
1,2-Dichloroethene (total)	3.5
Tetrachloroethene	7
1,1-Dichloroethane	6,500
1,1,1-Trichloroethane	2,700
Carcinogenic Polycyclic Aromatic Hydrocarbons (PAHs)	0.15
Total PAHs	44
Amino-DNTs	6.0
2,4-Dinitrotoluene	60
2,6-Dinitrotoluene	29
HMX	5.7
RDX	1.0
1,3,5-TNB	1.0
2,4,6-TNT	8.0
Cadmium	9.6
Nickel	52
Zinc	410
Soil	
Cadmium	4.0
Zinc	48.4

Soil was treated at the bioremediation treatment cell using Daramend™, iron amendments, and tilling of the soil/sediment. After the results of two consecutive composite soil/sediment sampling events demonstrated that VOCs and explosive concentrations were less than the remediation goals, the material was transported to a consolidation area located adjacent to the bioremediation treatment cell and later disposed of at a Navy-approved disposal facility. Site 6 restoration activities including planting of native vegetation, removal of erosion control measures, and removal of the temporary access road (Shaw, 2008).

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE2-1_SITE6_PREVIOUS_SAMPLES.MXD MUNWIN 5/6/2010 10:21:30



Legend

- Confirmation Study Round I (1986) and Round One RI (1993) Surface Soil Sample
- Confirmation Study Round I (1986) and Confirmation Study Round II (1988) Surface Water/Sediment Sample
- Confirmation Study Round II (1988) Sediment Sample
- Round One RI (1993) and Round Two RI (1998) Monitoring Well
- Round One RI (1993) Surface Water/Sediment Sample
- Round Two RI (1998) Surface Soil Sample
- Round Two RI (1998) Monitoring Well
- Round Two RI (1998) Hydropunch and Subsurface Soil Sample
- Round Two RI (1998) Hydropunch Sample
- Round Two RI (1998) Surface Water/Sediment Sample
- Round Two RI (1998) Sediment Sample
- Surface Impoundment Area
- Approximate Limits of Excavation
- Flume Drainage Way
- Excavation Area (Cadmium and Zinc Contaminated Soil)

N
W E
S

0 175 350
Feet

Figure 2-1
Previous Investigation Sample Locations
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

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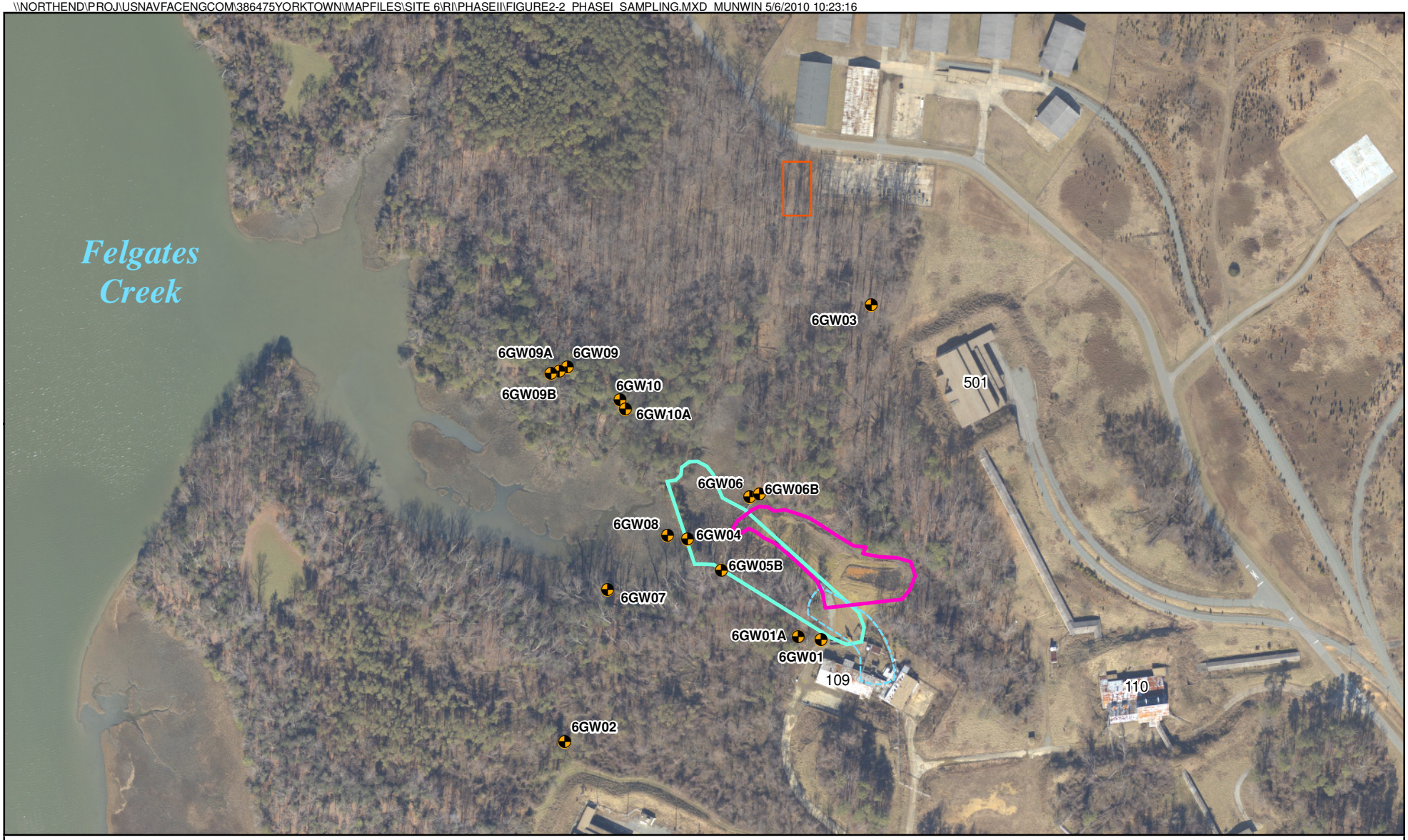
\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE2-2_PHASEI_SAMPLING.MXD MUNWIN 5/6/2010 10:23:16



Legend

- Yorktown-Eastover Aquifer Monitoring Well
- Surface Impoundment Area
- Approximate Limits of Excavation
- Flume Drainage Way
- Excavation Area (Cadmium and Zinc Contaminated Soil)

N
W E
S

0 150 300
Feet

Figure 2-2
Phase I Remedial Investigation Sample Locations
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

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SECTION 3

Field Investigation Methods

This section describes the approach and methodology of the field investigation activities conducted as part of the Phase II RI at Site 6. Field activities were conducted from March to September 2009, and included monitoring well installation, groundwater monitoring and sampling, hydraulic conductivity testing, dense non-aqueous phase liquid (DNAPL) field testing, and surface water, sediment, and sediment pore water sampling. Specific details of the sampling rationale and objectives are provided in the Phase II RI Work Plan (CH2M HILL, 2008).

Table 3-1 summarizes the environmental data collected to characterize the nature and extent of contamination, including the number of samples that were collected, the media sampled, analyses performed, sample nomenclature, and sample rationale. **Figures 3-1** and **3-2** present the locations of the samples collected in the various environmental media.

The investigation activities were implemented to support:

- Development of the hydrogeologic conceptual model of Site 6, as discussed in Section 4
- Assessment of the nature, extent, fate, and transport of contamination, potential sources of contamination, and development of a contaminant conceptual site model (CSM), as discussed in Section 5 and 6
- Assessment of potential risks to human health and the environment, as discussed in Sections 7 and 8
- Information required for the development of a future feasibility study, as discussed in Section 9

3.1 Groundwater

3.1.1 Monitoring Well Installation

Ten monitoring wells were installed within the Yorktown-Eastover aquifer (at depths ranging from 25 to 60 ft below ground surface [bgs]) at Site 6 to further characterize potential groundwater quality impacts at the site. Monitoring wells were installed at the previously excavated area, the flume source area, the surface impoundment area, and the areas west of the coffer dam, as summarized below (**Figure 3-1**).

- One monitoring well (6GW11) was installed in the former area of excavation of the cadmium and zinc contaminated soil to determine potential source zone groundwater impacts.
- Two nested monitoring well pairs (6GW12, 6GW12A, 6GW13, and 6GW13A) were installed in the flume source area and the impoundment area to evaluate potential source zone concentrations and vertical distribution of contamination.

- Four monitoring wells (6GW14, 6GW15, 6GW16, and 6GW17) were installed west of the coffer dam to better determine the vertical and horizontal extent of contamination in this area.
- One monitoring well (6GW18) was installed downgradient of the site adjacent to Felgates Creek.

Each monitoring well was installed according to the specifications outlined in Section 3.9.1 of *Master Project Plans* (Baker, 2005). The monitoring well construction details (including the existing monitoring well network) are summarized in **Table 3-2**.

Parratt Wolff Inc. of Hillsborough, North Carolina provided hollow-stem auger (HSA) well drilling and installation services using a 4.25-inch inside diameter (ID) and 4-ft long acetate sleeves to provide lithologic descriptions. During soil logging, soil descriptions including grain size, color, moisture content, relative density, consistency, soil structure, mineralogy, and other relevant information such as possible evidence of contamination were recorded. Soil boring logs are included in **Appendix A**. Monitoring wells 6GW14, 6GW15 and 6GW17 were installed in marsh wetland areas that could not be accessed with standard drilling equipment. Consequently, they were installed using a tripod by pushing/hammering the pre-screened well directly into the subsurface. Samples for lithology could not be collected and no boring logs are available for these wells. The depths of the wells were selected based on surrounding lithology and anticipated contaminant distribution.

Photo-ionization detector (PID) readings were collected to identify depths of potential contamination during borehole drilling. A DNAPL field test using Indigo Blue® test kits was conducted at the highest PID reading interval of each new borehole. The required amount of soil in the selected interval was placed into the prepared styrene test bottle. Deionized (DI) water was then placed into the test bottle and shaken to dissolve the water-soluble Anthraquinone dye cube already in the bottle. A polystyrene bead indicated whether DNAPL was detected by turning blue. Only three monitoring wells (6GW12 at 10 and 25 ft bgs, 6GW12A in the 44-48 ft bgs interval, and 6GW13A in the 32-36 ft bgs interval) could be tested due to weather conditions, drilling technique, PID malfunction, and color of soil encountered. The PID is only one tool used to aid in the identification of potential contamination with depth. Lithologic samples collected are also logged to identify any signs of potential contamination such as staining, free product, or odor. The Indigo Blue® test did not indicate the presence of DNAPL at these locations; however, the soil color was also blue in these areas, which could have interfered with interpretation of the test.

New monitoring wells were constructed with either 2-inch ID Schedule 40 polyvinyl chloride (PVC) casing and well screen or 2-inch stainless-steel casing and well screen (**Table 3-2**). The well screen consisted of 0.010-inch slot size and ranged from 10 to 20 ft, based on the rationale presented in the Phase II RI Work Plan (CH2M HILL, 2008). A silica sand filter pack was placed around the annular space of the well screen from the bottom of the boring/well screen to a depth of approximately 2 to 4 ft above the top of the screen. A bentonite layer (approximately 2 to 3 ft) was placed at the top of the sand pack. After the bentonite was hydrated, a cement-bentonite grout was placed in the remaining annular space. However, monitoring wells 6GW14, 6GW15, and 6GW17 were constructed with pre-packed stainless-steel screens because of site accessibility. All monitoring wells were completed with steel stick-up casings since they were located in grassy or wooded areas. A

locking watertight cap was placed on the top of each casing and the well identification numbers were clearly marked on the well with waterproof paint. Monitoring well completion diagrams are also provided in **Appendix A**.

3.1.2 Monitoring Well Development

All newly installed monitoring wells were developed prior to sampling. Monitoring well development was performed after the grout used to construct the new monitoring wells had been allowed to adequately set (at least 24 hours or more) to prevent grout contamination of the screened interval. Wells were developed using a submersible pump. Between 30 and 80 gallons of water were evacuated from each well. Development continued until either five successive measurements of pH, specific conductivity, and temperature were stable (i.e., the readings for each measurement were within 10 percent of each other), until water was visibly clear, or until the well was pumped dry. Development information is included in the **Appendix A** well construction logs.

3.1.3 Groundwater Monitoring

A groundwater level survey was conducted at all 25 monitoring wells during the investigation (**Figure 3-1**). **Table 3-3** summarizes the groundwater level measurements from each well. An electronic water level meter was used to measure the depth to water from the top of casing to the nearest 0.01 ft.

A total of 25 groundwater samples were collected from all new and existing monitoring wells using low-flow sampling methodology. The analyses included VOCs, explosives, total and dissolved inorganic constituents, and natural attenuation parameters. In addition, monitoring well YS06-GW012 was analyzed for nitroguanidine, perchlorate, and ammonia; monitoring wells YS06-GW012, YS06-GW016, YS06-GW017, and YS06-GW018 were analyzed for nitroglycerin; and wells YS06-GW012 and YS06-014 were analyzed for nitrosodiphenylamine. **Table 3-1** presents a summary of monitoring wells sampled and lists all analyzed constituents.

Groundwater samples were collected from wells with total depths of less than 30 ft using a peristaltic pump and disposable tubing, and from wells with depths of greater than 30 ft using a Monsoon® submersible pump and disposable tubing. Groundwater quality parameters comprising pH, conductivity, turbidity, dissolved oxygen (DO), temperature, salinity, and oxidation/reduction potential (ORP) were collected during purging of each well using a Horiba U-22 water quality meter and a flow-through cell. DO was also analyzed CHEMets® kits. CHEMets® are used to confirm the results of the Horiba U-22 in the event of a DO probe malfunction. The DO probe in the Horiba U-22 is a separate device from the other probes and can malfunction if dirt collects around the probe or if a hole is made in the membrane of the probe, thus providing erroneous readings. The Horiba U-22 historically is more likely to provide a false reading then the CHEMets® kits. For the purposes of this document, the CHEMets® DO results will be used. However, field parameters could not be measured at well GW09B due to high turbidity.

Purging was continued until water quality readings collected 5 minutes apart were stabilized to within 10 percent of one another or until three well volumes were purged. Once the parameters had stabilized, the flow-through cell was disconnected and samples were collected into laboratory-prepared, pre-preserved sample bottles and packed on ice for

overnight shipment to the appropriate laboratory. Dissolved inorganic samples were field-filtered prior to collection into the sample containers.

DO, nitrite, nitrate, and sulfide were field tested at 20 monitoring wells, and the results are summarized in Section 5. The DO CHEMet® test was used to determine the level of DO in groundwater and to confirm the DO results of the Horiba-U22 (Model Numbers K-7501 for 0-1 parts per million [ppm] and K-7512 for 1-12 ppm). A CHEMet® ampoule containing reagent was filled by being immersed into the sample to allow the correct volume of sample to be drawn in. After the sample was well mixed with the reagent in the ampoule, the result was quantified by comparing the filled ampoule to the appropriate color standards. Nitrite, nitrate, and sulfide were field tested using HACH® test kits (Model Numbers NI-15, NI-14, and HS-WR, respectively). For each test, the sample was filled in a test tube and mixed with specific reagents to develop a color. The concentration was estimated by comparing the tube to the appropriate color standards provided with the kit.

All samples collected during the RI were submitted for analysis to CompuChem Labs, Inc. of Cary, North Carolina, for analysis of VOCs, explosives, total and dissolved inorganic constituents, alkalinity, chloride, methane, ethane, ethane, sulfate, total organic carbon (TOC), total dissolved solids (TDS), acid volatile sulfide/simultaneously extractable metals (AVS/SEM), and pH. The groundwater samples were submitted for dechlorinating bacteria analysis (*Dehalococcoides*) to Microbial Insights Inc. of Rockford, Tennessee.

3.1.4 Hydraulic Conductivity Testing

Aquifer hydraulic conductivity properties were estimated through slug testing. Rising and falling-head slug tests were conducted at three selected monitoring wells (6GW06, 6GW13, and 6GW15). The monitoring wells were selected for spatial distribution and at varying depths in the Yorktown-Eastover aquifer to provide data throughout the extent of the aquifer at the site and generate an overall estimate of the horizontal hydraulic conductivity of the aquifer.

Due to the limited area of influence, the slug test data provide a rough estimate of the hydrogeologic parameters of the unit proximal to the individual monitoring wells. The tests were conducted by rapidly introducing a solid displacement device (slug) into the well for the falling head test and rapid removal of the slug from the well for the rising head test. The slug consisted of a 5-ft length of solid PVC, and the water level data was recorded using a Mini TROLL® pressure transducer.

Both falling head and rising head tests were recorded for each monitoring well. However, at those wells where the static water level is below the top of the screen, the falling head test can result in the water draining from the well into the gravel pack and vadose zone providing an overestimate of the hydraulic conductivity. Therefore, under these circumstances, only the rising head test data was analyzed. Data were recorded for each test until the water level had recovered to 90 percent of the pre-test level. The slug tests were analyzed using the Bouwer and Rice Method included in *A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrative Wells. Water Resources Research 12:423-28* (Bouwer and Rice, 1976).

3.1.5 Surveying

Precision Measurements Inc. of Virginia Beach, Virginia (a Virginia-licensed and registered surveyor) conducted a survey of the new monitoring wells. Each of the monitoring wells was surveyed for vertical and horizontal control to an accuracy of 0.01 ft and 0.1 ft, respectively. Monitoring wells were surveyed at the top of the PVC casing and at the ground surface. The vertical elevations were referenced to National Geodetic Vertical Datum 88 to remain consistent with the existing WPNSTA Yorktown vertical datum. Horizontal coordinates conformed to North American Datum 83 with ties to the Virginia State Plane Coordinate System. The survey report for these sites is included as **Appendix B**

3.2 Surface Water and Sediment

Sediment and surface water samples were collected from 11 sample locations within the channel of the Eastern Branch of Felgates Creek and the unnamed tributary to the Eastern Branch of Felgates Creek that flows into Site 6, to evaluate potential impacts and potential exposure pathways from sediment and surface water. Sediment samples were also collected from the marsh sediment along the water bodies. Surface water and sediment sample locations are shown in **Figure 3-2**.

Surface water and sediment samples were collected starting with downstream locations and working upstream. Surface water samples were collected prior to the collection of sediment samples.

Prior to surface water sample collection, water quality data was measured using a Horiba U-22 water quality meter and the time of high and low tides in the York River tidal cycle for the date of sampling was also recorded. Tidal levels and time for each sample collected are included in **Table 3-4**. Sediment samples were collected from the top 4 inches of sediment using a stainless steel hand-auger and were transferred into laboratory prepared sample containers. Surface water samples were analyzed for TCL VOCs, total and dissolved TAL inorganic constituents and TDS. Sediment samples were analyzed for TCL VOCs, TAL inorganics, pH, TOC, AVS/SEM, grain size, and alkalinity (**Table 3-1**).

3.3 Sediment Pore-Water

Sediment pore-water samples were collected within the channel of the Eastern Branch of Felgates Creek and the unnamed tributary to the Eastern Branch of Felgates Creek that flows into Site 6 in order to assist in evaluating potential impacts to and potential exposure pathways from groundwater to sediment and surface water. Sample locations are shown in **Figure 3-2**.

Sediment diffusion samplers were filled with 150 milliliters (mL) of DI water and placed into protective casings with 10-inch-long slotted screens. The samplers were marked and placed in the sediment by hand so that the top of the protective casing was flush with the sediment. The samplers were left for three weeks and then sampled.

One proposed pore water sample location was unable to be sampled due to a lack of standing water. Four sediment pore-water samples were collected and analyzed for TCL VOCs (**Table 3-1**).

3.4 Quality Assurance/Quality Control

Samples collected for this field investigation were analyzed using Contract Laboratory Program (CLP) methods with Level IV Quality Assurance/Quality Control (QA/QC).

Field QA/QC samples were collected during the sampling program. These samples were obtained to: (1) ensure that disposable and reusable sampling equipment were free of contaminants, (2) evaluate field methodology, (3) establish ambient field background conditions, and (4) evaluate whether cross-contamination occurred during sampling and/or shipping.

Several types of field QA/QC samples were collected and analyzed in accordance with the Quality Assurance Project Plan (QAPP) of the Phase II RI Work plan (CH2M HILL, 2008) and are defined below:

- Equipment Rinsate Blank: Twenty-two equipment rinsate blank samples were collected. These samples were obtained by running laboratory grade DI water over/through sample collection equipment after the piece of equipment was decontaminated (for reusable equipment) or prior to the equipment's use (for disposable equipment). These samples were used to determine if decontamination procedures for reusable equipment were adequate and/or if disposable, one-time use equipment was contaminant-free prior to use.
- Duplicate Sample: Duplicate samples were collected at the same time and under identical conditions as their associated sample. These samples were collected to evaluate reproducibility of sample results. One duplicate sample was collected for every 10 environmental samples collected (or 10 percent).
- Field Blank: Seven field blank samples were collected. Field blanks were collected to evaluate potential impacts to samples due to ambient air conditions in the field. Samples were collected using laboratory grade DI water, which was poured into sample bottles in the field under the same conditions under which environmental samples were collected.
- Trip Blank: Fourteen trip blank samples were collected. Trip blanks were prepared at the laboratory, shipped with the sample containers, and stored onsite near the empty sample containers. Any time VOC samples were packed and shipped to the laboratory, a trip blank sample was included inside the shipping cooler. The trip blanks were analyzed for VOCs, along with the other VOC samples. Trip blanks were used to evaluate whether or not cross-contamination may have occurred during sampling and/or shipping.

In addition to samples collected to monitor field quality control, samples were also collected to monitor quality within the laboratory. These included the following:

- Matrix Spike (MS): An aliquot of a matrix (either soil/sediment or water) was spiked with known quantities of specific compounds and subjected to the entire analytical procedure. By measuring recovery, the appropriateness of the method for the matrix was determined.

- Matrix Spike Duplicate (MSD): These samples were collected as second aliquots of the same matrix as the matrix spike to determine the precision of the method.

One MS sample and one MSD sample were collected for every twenty environmental samples collected (or 5 percent of the samples collected) per media per site.

3.5 Decontamination and Waste Management

Decontamination procedures for heavy equipment (e.g., drilling augers), sampling equipment, and personnel were followed as per Section 3.23 of the Master Field Sampling Plan (Baker, 2005). An industrial-grade steam cleaner was used to decontaminate heavy equipment. Liquinox®, distilled water, a 10 percent methanol rinse, and DI water were used to decontaminate the submersible pump motor lead between well sampling of individual wells and the stainless-steel hand auger between sediment sampling locations. All other equipment used for sample collection was disposable.

Solid investigation-derived waste (IDW) generated during the field investigation (soil cuttings) were contained in 55-gallon steel drums. Liquid IDW was contained in a portable Baker tank and 55-gallon steel drums. One soil and one liquid composite sample were collected from drums/tank for Full Toxicity Characteristic Leachate Procedure (TCLP) [VOCs, SVOCs, pesticides, and inorganics] and ignitability, corrosivity, and reactivity analysis. After receipt of analyses, the solid IDW was determined to be non-hazardous and was removed from the site by Potomac Environmental Services. The aqueous IDW was determined to be hazardous and was removed from the site by Potomac Environmental Services. The IDW disposal documentation is contained in **Appendix C**.

Health and safety expendables, such as sampling gloves, paper towels, polyethylene sheeting, and other materials that came into contact with potential contamination were contained in large plastic bags and placed in municipal waste containers for disposal.

3.6 Environmental Data and Management

3.6.1 Data Validation

Data validation was performed by Data Qual Environmental Services of St. Louis, Missouri. The data qualifiers used were those presented in USEPA Region 3 Modifications to National Functional Guidelines for Organic Data Review, MultiMedia, Multi Concentration (USEPA, 1994) and USEPA Region 3 Modification to Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (USEPA, 1993a).

The data validation qualifiers, or flags, used for this RI comprise:

- A "B" flag by the data validator indicates that the analytes have also been detected in a field, equipment, or trip blank, or in a laboratory QA/QC sample. The concentration of a "B"-qualified result is less than 5 or 10 times the concentration of the constituent for an associated QA/QC result. If the sample concentration is less than 5 or 10 times the associated blank concentration, the conclusion is that the analyte is not present in the sample.
- A "D" flag indicates that the analyte is identified at a secondary dilution factor.

- A "J" flag indicates that the analyte is present but the value is estimated.
- A "K" flag indicates that the analyte is present, but the reported value may be biased high and the actual value is expected to be lower.
- An "L" flag indicates that the analyte is present, but the reported value may be biased low and the actual value is expected to be higher.
- An "NJ" flag indicates that the qualitative identification is questionable due to poor resolution, presumptively present at approximate quantity.
- An "R" flag indicates unreliable result.
- A "U" flag indicates that the analyte was not detected and the associated value indicates the approximate sample concentration necessary to be quantified.
- A "UJ" flag indicates that the analyte was not detected and the quantitation limit may be inaccurate or imprecise.
- A "UL" flag indicates that the analyte was not detected and the quantitation limit is probably higher.

3.6.2 Regulatory Standards and Risk-Based Screening Values

The screening process used to evaluate risks to human and ecological receptors and the consideration of a constituent as a chemical of concern (COC) is discussed in Sections 7 and 8. Groundwater is compared to human health screening criteria and not to ecological risk since there are no ecological exposures to groundwater until it discharges to a water body or surfaces as a seep. However, to determine the nature of groundwater, surface water, and sediment contamination within Site 6, each analyte was compared to the following regulatory and risk-based screening values, as discussed in the Phase II RI Work plan (CH2M HILL, 2008).

- Groundwater sample results were screened against:
  - Yorktown-Eastover aquifer background criteria for inorganic constituents (Base-wide background inorganic concentrations)
  - USEPA Regional Screening Levels (RSLs) for Tap Water (USEPA, 2009d), adjusted for non-carcinogens by dividing the RSL by 10 to account for cumulative effects
  - Federal Safe Drinking Water Act (Title 40 of the Code of Federal Regulations [CFR], Part 141 MCLs and Secondary MCLs
- Surface water sample results were screened against:
  - USEPA RSLs for Tap Water (USEPA, 2009d), adjusted for non-carcinogens by dividing the RSL by 10 to account for cumulative effects
  - Ecological screening values were established using methods described in Section 8 of the report.

- Sediment sample results were screened against the following (CH2M HILL, 2008):
  - USEPA RSLs for Residential Soil (USEPA, 2009d), adjusted as appropriate (10 times the RSL values); adjusted for noncarcinogens to account for exposure to multiple constituents. Screening values were adjusted for non-carcinogens by dividing the RSL by 10 to account for cumulative effects.
  - Ecological screening values were established using methods described in Section 8 of the report.

TABLE 3-1
Site 6 Sample Summary
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Media Samples[1]	Analytes	Date	Sample Identification[2]	Sample Rationale
25 GW	VOCs, Total and Dissolved Metals, Explosives	03/2009, 04/2009, 06/2009, and 07/2009	YS06-GW001, YS06-GW001A, YS06-GW002, YS06-GW003, YS06-GW004, YS06-GW005B, YS06-GW006, YS06-GW006B, YS06-GW007, YS06-GW008, YS06-GW009, YS06-GW009A, YS06-GW009B, YS06-GW010, YS06-GW010A, YS06-GW011, YS06-GW012, YS06-GW012A, YS06-GW013, YS06-GW013A, YS06-GW014, YS06-GW015, YS06-GW016, YS06-GW017, YS06-GW018	Characterize the nature and extent of COPCs at the site
3 GW	Chloride, Sulfate, MEE, Alkalinity, TOC, Dehalococcoides	03/2009 and 04/2009	YS06-GW008, YS06-GW012, YS06-GW012A	Evaluate the potential for natural attenuation at the site. In addition, nitrite, nitrate, and sulfide were field tested at 20 monitoring wells
1 GW	Nitroguanidine, Perchlorate, Ammonia	04/2009	YS06-GW012	Verify the presense of the constituents because it was possibly discharged at the site based on the historical operations
2 GW	n-Nitrosodiphenylamine	03/2009 and 04/2009	YS06-GW012, YS06-GW014	Verify the presense of the constituent because it was possibly discharged at the site based on the historical operations. Analysis was added to one downgradient well (YS06-GW014) to characterize the downgradient extent of contamination and potential for discharge to Felgates Creek
4 GW	Nitroglycerin	04/2009, 06/2009, and 07/2009	YS06-GW012, YS06-GW016, YS06-GW017, YS06-GW018	Verify the presense of the constituent because it was possibly discharged at the site based on the historical operation. Analysis was added to three downgradient wells (YS06-GW016, YS06-GW017, YS06-GW018) to characterize the extent of downgradient contamination
11 SW	VOCs, Total and Dissolved Metals, Explosives, TDS	08/2009	YS06-SW068, YS06-SW069, YS06-SW070, YS06-SW071, YS06-SW072, YS06-SW073, YS06-SW074, YS06-SW075, YS06-SW076, YS06-SW077, YS06-SW078	Evaluate potential impacts to Felgates Creek
11 SD	VOCs, Total Metals, AVS/SEM - 7 metals, Explosives, Alkalinity, TOC, pH, Grain Size	08/2009	YS06-SD068, YS06-SD069, YS06-SD070, YS06-SD071, YS06-SD072, YS06-SD073, YS06-SD074, YS06-SD075, YS06-SD076, YS06-SD077, YS06-SD078	Evaluate potential impacts to Felgates Creek and support the ecological risk evaluation
4 PW	VOCs	09/2009	YS06-WN01, YS06-WN02, YS06-WN03, YS06-WN04	Determine the potential for contaminated groundwater to discharge to the creek

[1] GW=Groundwater sample, SW=Surface water sample, SD=Sediment sample (0 to 4 inches bls), PW=Sediment pore water sample.
[2] No duplicate samples are included in this table.
bls. = below land surface.
COPCs - chemicals of potential concern
NA - Not applicable
VOCs - volatile organic compounds
MEE - methane, ethane, ethene
TOC - total organic carbon
TDS - total dissolved solids
AVS/SEM - acid volatile sulfide/simultaneously extractable metals

TABLE 3-2
Monitoring Well Construction Summary
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Monitoring Well	Installation Date	Ground Elevation (ft msl)	TOC Elevation (ft msl)	Well Type	Length of Screen (ft)	Depth of Top of Screen (ft bgs)	Depth of Bottom of Screen (ft bgs)	Elevation of Top of Screen (ft msl)	Elevation of Bottom of Screen (ft msl)
Existing Monitoring Wells									
6GW01	6/15/1992	10.45	12.80	4" Sch 40 PVC	15	5	20	5.45	-9.55
6GW01A	9/9/1994	10.01	12.10	2" Sch 40 PVC	14	48	62	-37.99	-51.89
6GW02	9/23/1994	35.97	38.37	2" Sch 40 PVC	15	40	55	-4.03	-19.03
6GW03	10/20/1994	28.31	30.67	2" Sch 40 PVC	9	38	47	-9.59	-18.59
6GW04*	6/10/1992	3.36	5.23	2" Sch 40 PVC	5	5	10	-1.64	-6.64
6GW05B	9/14/2004	6.83	8.59	2" Sch 40 PVC	10	5	15	1.83	-8.17
6GW06	5/12/2000	10.66	11.77	2" Sch 40 PVC	10	8	18	2.66	-7.34
6GW06B	9/18/2004	9.20	11.46	2" Sch 40 PVC	10	28	38	-18.80	-28.80
6GW07	9/14/2004	6.84	8.66	2" Sch 40 PVC	10	8	18	-1.16	-11.16
6GW08	9/20/2004	3.07	5.61	1.5" Sch 40 PVC	5	31	36	-27.93	-32.93
6GW09	9/17/2004	11.83	14.38	2" Sch 40 PVC	10	20	30	-8.17	-18.17
6GW09A	9/16/2004	12.76	15.17	2" Sch 40 PVC	10	40	50	-27.24	-37.24
6GW09B	9/16/2004	13.53	15.11	2" Sch 40 PVC	10	65	75	-51.47	-61.47
6GW10	9/18/2004	13.30	15.52	2" Sch 40 PVC	10	12	22	1.30	-8.70
6GW10A	9/16/2004	13.43	15.66	2" Sch 40 PVC	10	30	40	-16.57	-26.57
Newly Installed Monitoring Wells									
6GW11	2/18/2009	28.64	32.16	2" Sch 40 PVC	10	28	38	0.64	-9.36
6GW12	2/20/2009	3.33	5.50	2" Stainless Steel	20	5	25	-1.67	-21.67
6GW12A	2/23/2009	3.44	5.69	2" Stainless Steel	20	40	60	-36.56	-56.56
6GW13	3/6/2009	2.10	4.53	2" Stainless Steel	20	10	30	-7.90	-27.90
6GW13A	3/3/2009	1.94	4.85	2" Stainless Steel	20	40	60	-38.06	-58.06
6GW14	3/3/2009	0.60	3.91	2" Stainless Steel	10	15	25	-14.40	-24.40
6GW15	3/9/2009	0.90	4.17	2" Stainless Steel	20	40	60	-39.10	-59.10
6GW16	6/16/2009	5.26	7.23	2" Sch 40 PVC	20	10	30	-4.74	-24.74
6GW17	6/18/2009	0.80	3.95	2" Stainless Steel	20	10	30	-9.20	-29.20
6GW18	6/22/2009	29.06	32.35	2" Sch 40 PVC	20	40	60	-10.94	-30.94

Notes:
ft msl - feet mean sea level
ft bgs - feet below ground surface
TOC - top of casing
* Drive point, no sand pack

TABLE 3-3
Groundwater Elevations
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Monitoring Well ID	Date of Survey	TOC Elevation (ft msl)	Elevation of Top of Screen (ft msl)	Elevation of Bottom of Screen (ft msl)	Depth to Water (ft btoc)	Water Level Elevation (ft msl)
6GW01	6/15/1992*	12.80	5.45	-9.55	7.85	4.95
6GW01A	9/9/1994*	12.10	-37.99	-51.89	7.11	4.99
6GW02	9/23/1994*	38.37	-4.03	-19.03	35.70	2.67
6GW03	10/20/1994*	30.67	-9.59	-18.59	21.68	8.99
6GW04	6/10/1992	5.23	-1.64	-6.64	2.00	3.23
6GW05B	2/8/2005	8.59	1.83	-8.17	5.02	3.57
6GW06	5/12/2000*	11.77	2.66	-7.34	8.93	2.84
6GW06B	2/8/2005	11.46	-18.80	-28.80	7.75	3.71
6GW07	2/8/2005	8.66	-1.16	-11.16	5.90	2.76
6GW08	2/8/2005	5.61	-27.93	-32.93	2.42	3.19
6GW09	2/8/2005	14.38	-8.17	-18.17	11.62	2.76
6GW09A	2/8/2005	15.17	-27.24	-37.24	12.41	2.76
6GW09B	2/8/2005	15.11	-51.47	-61.47	12.24	2.87
6GW10	2/8/2005	15.52	1.30	-8.70	12.89	2.63
6GW10A	2/8/2005	15.66	-16.57	-26.57	12.91	2.75
6GW11	8/31/2009	32.16	0.64	-9.36	28.46	3.70
6GW12	8/31/2009	5.50	-1.67	-21.67	2.30	3.20
6GW12A	8/31/2009	5.69	-36.56	-56.56	2.64	3.05
6GW13	8/31/2009	4.53	-7.90	-27.90	2.30	2.23
6GW13A	8/31/2009	4.85	-38.06	-58.06	2.47	2.38
6GW14	8/31/2009	3.91	-14.40	-24.40	2.85	1.06
6GW15	8/31/2009	4.17	-39.10	-59.10	2.70	1.47
6GW16	8/31/2009	7.23	-4.74	-24.74	5.83	1.40
6GW17	8/31/2009	3.95	-9.20	-29.20	2.55	1.40
6GW18	8/31/2009	32.35	-10.94	-30.94	31.50	0.85

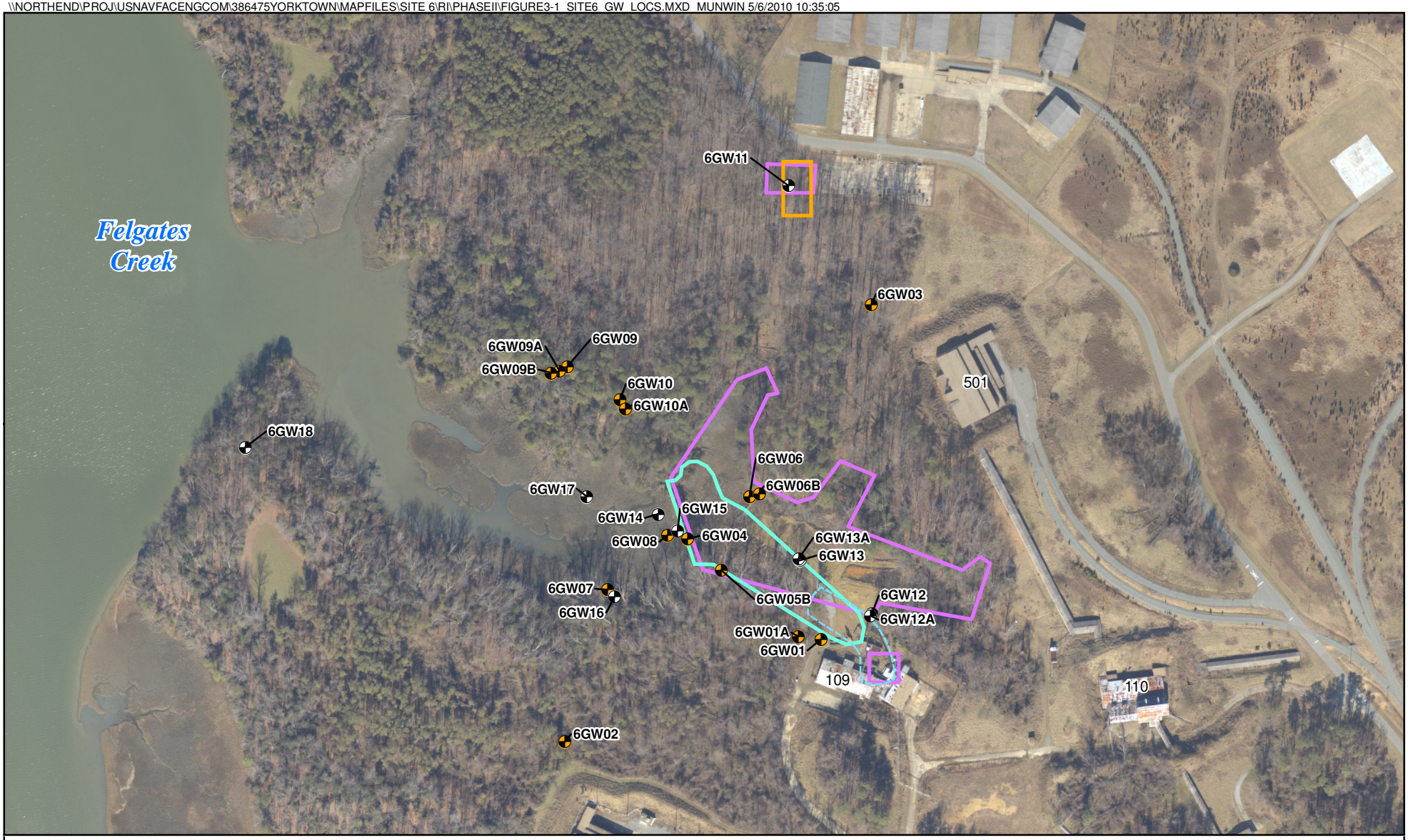
Notes:
ft msl - feet mean sea level
ft btoc - feet below top of casing
* - date on the Test Boring and Well Construction Record

TABLE 3-4
Tide Levels During Sediment and Surface Water Sampling
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Site 6 Surface Water Samples			
Sample Number	Date	Time	Tide
YS06-SW68-0809	8/4/2009	1100	High
YS06-SW69-0809	8/4/2009	1040	High
YS06-SW70-0809	8/4/2009	930	High
YS06-SW71-0809	8/4/2009	955	High
YS06-SW72-0809	8/4/2009	1020	High
YS06-SW73-0809	8/5/2009	1035	High
YS06-SW74-0809	8/5/2009	1135	High
YS06-SW75-0809	8/5/2009	1215	High
YS06-SW76-0809	8/6/2009	1020	High
YS06-SW77-0809	8/6/2009	1045	High
YS06-SW78-0809	8/6/2009	1145	High

*Source: http://tidesandcurrents.noaa.gov/

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE3-1_SITE6_GW_LOCS.MXD MUNWIN 5/6/2010 10:35:05



Legend

- Existing Yorktown-Eastover Aquifer Monitoring Well
- Newly Installed Yorktown-Eastover Aquifer Monitoring Well
- Surface Impoundment Area
- Flume Drainage Way
- Excavation Area (Cadmium and Zinc Contaminated Soil)
- Land Use Control Boundary

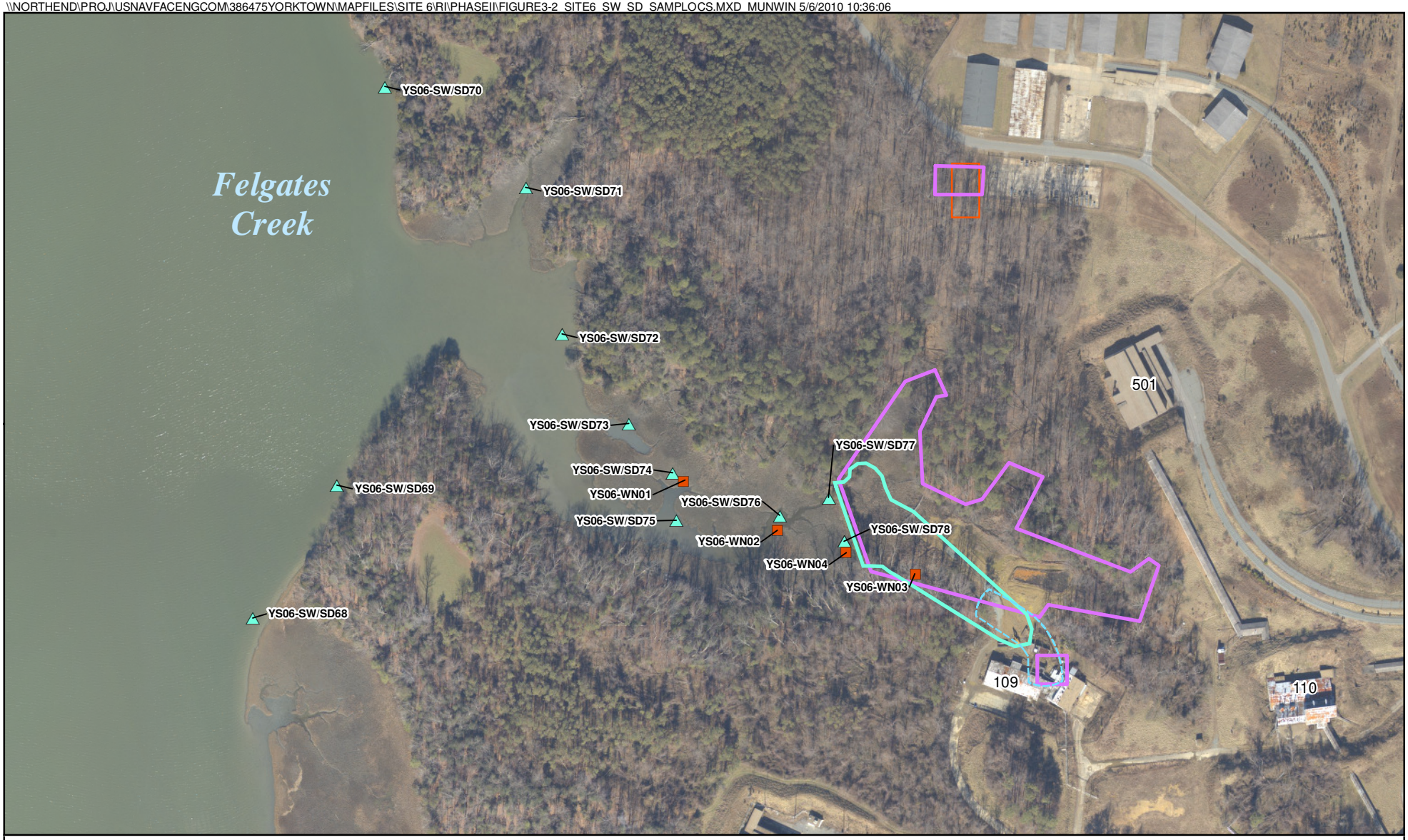
N
W E
S

0 150 300
Feet

Figure 3-1
Groundwater Sample Locations
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE3-2_SITE6_SW_SD_SAMPLOCS.MXD MUNWIN 5/6/2010 10:36:06



Legend

- Surface Water and Sediment Sample Locations
- Sediment Pore Water Sample Locations
- Flume Drainage Way
- Surface Impoundment Area
- Excavation Area (Cadmium and Zinc Contaminated Soil)
- Land Use Control Boundary

N
W E
S

0 150 300 Feet

Figure 3-2
Surface Water, Sediment, and Sediment Pore Water Sample Locations
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

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SECTION 4

Physical Characteristics

This section presents an evaluation of the Site 6 physical characteristics pertaining to the surface features and conceptual hydrogeology of the site. The physical setting of Site 6 including meteorology, topography, land and groundwater use, surface water drainage, and the geology and hydrogeology are summarized in this section.

A detailed hydrogeologic conceptual model is important to describe the primary mechanisms that control the fate and migration of contaminants in groundwater. The hydrogeologic conceptual model provides the foundation for the development of the overall CSM for Site 6. The physical characteristics also support the human health and ecological risk assessments.

4.1 Meteorology

The climate of the Virginia Peninsula is influenced by the moderating effects of the Atlantic Ocean, resulting in mild winters and long, warm summers. High humidity occurs frequently along the coast and less frequently inland. The average relative humidity in mid-afternoon is approximately 60 percent. Humidity is higher at night, and the average humidity at dawn is approximately 80 percent. Ground fog is a frequent weather occurrence in late summer, especially during early morning hours.

Freezing temperatures occur intermittently from October through March. The average monthly temperatures in the area range from approximately 40 degrees Fahrenheit (°F) in January to 80°F in July.

York County is subject to easterly storms throughout late summer and early fall, which cause high tides and coastal flooding. Intense tropical hurricanes occasionally sweep the coast. Winter storms that move along the eastern seaboard are often associated with high winds and precipitation, occasionally in the form of snow, ice pellets, or rain; however, the snow is seldom prolonged or heavy. The average annual precipitation is approximately 45 inches, with the summer months being the wettest and the winter months being the driest.

4.2 Topography and Surface Features

Site 6 is generally wooded with some open areas near the existing buildings. As of March 2009, the buildings had been scheduled to be demolished and are currently unoccupied. The topography ranges in elevation from approximately 40 ft above mean sea level (amsl) to less than 10 ft amsl, and generally slopes downward from south to north and downward east to west towards the impoundment area (**Figure 4-1**). Surface runoff from the site is conveyed to Felgates Creek either directly by overland flow or via tributaries located adjacent to the site.

4.3 Land and Water Use

WPNSTA Yorktown is a secure military installation that occupies 10,624 acres. Site 6 is located within a restricted area of WPNSTA and a special access badge is required to enter the area. The site is also located inside an area encumbered by the Explosive Safety Quantity Distance (ESQD) and cannot be developed for real estate purposes. Currently, there are no activities at the site. The future site use is expected to remain the same as the current site use.

The predominant source of domestic water supply for WPNSTA Yorktown and surrounding communities is from the City of Newport News Waterworks through a series of surface water reservoirs. Individual homes may obtain water from private wells installed within the Yorktown-Eastover aquifer, but groundwater at the base flows towards the York River and its tributaries. There are no drinking water wells at WPNSTA Yorktown; four water supply wells have been abandoned.

Surface water bodies adjacent to Site 6 are not potable.

4.4 Surface Water Hydrology

WPNSTA Yorktown is situated within two major drainage basins, the York River Basin to the north and the James River Basin to the south. Site 6 is situated within the York River Basin along Felgates Creek and its unnamed tributary (**Figure 4-1**). Each is salt-water, tidally influenced by the York River and surface water flow reverses due to the tidal fluctuation. Flow from Felgates Creek discharges to the York River, which flows southeast to the Chesapeake Bay.

4.5 Hydrogeology

4.5.1 Geology

WPNSTA Yorktown is situated within the Virginia Coastal Plain Physiographic Province. The Virginia Coastal Plain is characterized by unconsolidated sediments of Quaternary, Tertiary, and Cretaceous ages. The sediments thicken eastward from the Fall Line (approximately 70 miles west of WPNSTA) and are approximately 6,000 ft thick below the Eastern Shore Peninsula (Meng and Harsh, 1988).

Deposition and erosion associated with fluctuating sea levels resulted in terraces that decrease in topographic elevation in a stair-step pattern with scarps oriented north to south, that delineate the eroded shoreline along the toe of each terrace (Brockman et al., 1997). Two terraces (Lackey Plain and Croaker Flat) are divided by one scarp (the Camp Peary Scarp) within the boundaries of WPNSTA Yorktown. Site 6 is located on the lower terrace, Croaker Flat (**Figure 4-1**).

Ten geologic formations have been identified beneath WPNSTA, and are shown in **Figure 4-2** (Brockman et al., 1997). The upper most geologic formations consist of alluvial, colluvial, and marsh deposits composed of silt, sand, and pebbles with some clay. The majority of the surficial unconsolidated sediment has been mapped as the Pleistocene (Quaternary) Windsor Formation (Mixon et al., 1989).

Monitoring well lithologic data from the previous investigations and the RI provide descriptions of the Site 6 subsurface geology. Two simplified hydrogeologic cross-sections of the site, oriented to facilitate correlation among the monitoring wells (**Figure 4-3**), are shown in **Figures 4-4** and **4-5**. Soil boring logs are provided in **Appendix A**.

The uppermost subsurface geology in the area of Site 6 is characterized by the Pleistocene (Quaternary) Shirley Formation and the Pliocene (Tertiary) Yorktown Formation (Mixon et al., 1989). The Shirley Formation is relatively thin, only occurs within topographically higher areas located adjacent to the site, and consists of sand, gravel, silt, clay, and organics. The uppermost portion of the Yorktown Formation (Yorktown confining unit) consists of clayey silty sand to clay and generally only occurs within the topographically higher areas located adjacent to the site. The lower portion of the Yorktown Formation (Yorktown-Eastover aquifer) consists of silty sand to sand.

4.5.2 Hydrostratigraphy

Each geologic unit was grouped into hydrostratigraphic units based upon their hydrologic characteristics (Lazniak and Meng, 1988 and Brockman et al., 1997). Based upon the hydraulic characteristics of the geologic units present, the uppermost eight (Cobham Bay Member of the Eastover Formation through the Tabb Formation) of the 10 geologic formations have been identified as the York County Shallow Aquifer System. As shown in **Figure 4-2**, the following five hydrogeologic units make up the York County Shallow Aquifer System at WPNSTA Yorktown:

- Columbia aquifer (consisting of the Windsor through Tabb Formations)
- Cornwallis Cave confining unit (consisting of the Bacons Castle Formation)
- Cornwallis Cave aquifer (consisting of the upper Moore House Member of the Yorktown Formation and the Sedley Formation)
- Yorktown confining unit (consisting of the upper Morgarts Beach and lower Moore House Members of the Yorktown Formation)
- Yorktown-Eastover aquifer (consisting of the Cobham Bay through Rushmere Members of the Yorktown Formation)

In the area of Site 6, the silts and sands associated with the Columbia aquifer are present at the ground surface to a maximum depth of approximately 20 ft bgs in the topographically higher areas. However, the aquifer is generally unsaturated. Underlying the Columbia aquifer is the Yorktown confining unit. Within the Croaker Flat Terrace, the Cornwallis Cave aquifer and confining unit are absent, as they were eroded prior to the deposition of the sands of the Columbia aquifer.

The Yorktown confining unit is generally 10 to 20 ft thick and generally occurs in the topographically higher areas within Site 6 (**Figure 4-4**). The confining unit separates the underlying Yorktown aquifer from the Columbia aquifer. During recent drilling of monitoring wells at Site 6, the Yorktown confining unit was found to be characterized by clay or silty clay.

Underlying the Yorktown confining unit in the topographically higher areas or exposed at the ground surface in topographically lower areas in the Site 6 area is the coarse-grained to fine-grained sand, silty sand, and shell of the Yorktown-Eastover aquifer. The aquifer is generally the first encountered groundwater at the site (from depths ranging from 2 to 28 ft bgs), is confined to semi-confined where it underlies the Yorktown confining unit and is unconfined where the Yorktown confining unit does not exist. The saturated thickness is approximately 80 ft thick in the vicinity of Site 6 and overlies the approximately 100- to 200-ft-thick Eastover-Calvert confining unit. Recharge to the aquifer is by precipitation infiltration. No groundwater production from the Yorktown-Eastover aquifer occurs in the area.

Due to the thickness of the Eastover-Calvert confining unit, it is unlikely that deeper units have been influenced by historic releases at WPNSTA.

4.5.3 Aquifer Properties

Aquifer hydraulic conductivity ("slug") testing was performed at three monitoring wells completed within the Yorktown-Eastover aquifer. **Table 4-1** summarizes the results of the testing. The slug test data sets were analyzed by AQTESOLV™ using the Bouwer-Rice solution method and the plots are provided in **Appendix D**.

The groundwater level response data from the slug tests displayed a concave-upward curvature, which is most likely a result of the filter pack having a higher hydraulic conductivity then the natural formation. The initial groundwater level response is likely related to drainage from the filter pack, whereas the later response is representative of the aquifer.

The average horizontal hydraulic conductivity values were estimated at 0.05, 0.2, and 0.4 foot per day (ft/day) for the upper (8-18 ft bgs), middle (10-30 ft bgs), and lower (40-60 ft bgs) Yorktown-Eastover Aquifer. These values are consistent with the aquifer hydraulic characteristics presented in the Phase I RI (CH2M HILL, 2007). The hydraulic conductivity values reported for the upper Yorktown Aquifer were less than those for the lower Yorktown-Eastover aquifer.

4.5.4 Groundwater Flow

Groundwater elevations measured during the RI are presented in **Table 3-3**. The groundwater elevation contour map is presented in **Figure 4-6**. The contour map for the Yorktown-Eastover aquifer represents the first encountered groundwater beneath Site 6.

Groundwater flow within the Yorktown-Eastover aquifer is predominantly westward (ranging from southwest to northwest) towards the Eastern Branch of Felgates Creek at an average horizontal hydraulic gradient of approximately 0.01 foot per foot (ft/ft). Groundwater flow discharges to the Eastern Branch of Felgates Creek.

Assuming the maximum hydraulic conductivity value discussed in Section 4.5.3 (also see **Table 4-1**), an effective porosity of 30 percent, and the average horizontal hydraulic gradient described above, the average linear horizontal groundwater velocity is approximately 0.01 ft/day.

4.5.5 Vertical Gradients

In addition to horizontal groundwater flow, groundwater also flows in the vertical direction, such as from the vertical discharge of groundwater. Vertical gradients calculated from the groundwater levels are presented in **Table 4-2.** No vertical gradient patterns were apparent within the Yorktown-Eastover aquifer at Site 6. In general, monitoring wells located adjacent to the Eastern Branch of Felgates Creek showed a slight upward vertical gradient.

TABLE 4-1
Slug Test Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Well ID	Test Type/ID	Horizontal Hydraulic Conductivity (ft/day)	Average Horizontal Hydraulic Conductivity (ft/day)	Comments
6GW06 Screen: 8-18 feet bgs	Rising Head #1	0.05	0.05	Geometric Mean
	Rising Head #2	0.05		
	Falling Head #1	0.06		
	Falling Head #2	0.03		
6GW13 Screen: 10-30 feet bgs	Rising Head #1	0.37	0.21	Geometric Mean
	Rising Head #2	0.20		
	Falling Head #1	0.23		
	Falling Head #2	0.12		
6GW15 Screen: 40-60 feet bgs	Rising Head #1	0.73	0.37	Geometric Mean
	Rising Head #2	0.26		
	Falling Head #1	0.30		
	Falling Head #2	0.33		

TABLE 4-2
Vertical Gradient
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Well ID	Reference Point Elevation[1] (ft msl)	Screened Interval (ft bgs)	Aquifer	Depth to Water (ft btoc)	Groundwater Elevation (ft msl)	Vertical Gradient (ft/ft)	Upward or Downward Gradient
Downward Vertical Gradients within the Yorktown Eastover Aquifer							
6GW12	5.5	5 - 25	Upper Yorktown Eastover Aquifer	2.3	3.20	-0.004	Downward
6GW12A	5.69	40 - 60	Lower Yorktown Eastover Aquifer	2.64	3.05		
6GW07	8.66	8 - 18	Upper Yorktown Eastover Aquifer	5.9	2.76	-0.194	
6GW16	7.23	10 - 30	Lower Yorktown Eastover Aquifer	5.83	1.40		
6GW04	5.23	5 - 10	Upper Yorktown Eastover Aquifer	2.00	3.23	-0.002	
6GW08	5.61	31 - 36	Middle Yorktown Eastover Aquifer	2.42	3.19		
6GW08	5.61	31 - 36	Middle Yorktown Eastover Aquifer	2.42	3.19	-0.104	
6GW15	4.17	40 - 60	Lower Yorktown Eastover Aquifer	2.70	1.47		
6GW04	5.23	5 - 10	Upper Yorktown Eastover Aquifer	2.00	3.23	-0.041	
6GW15	4.17	40 - 60	Lower Yorktown Eastover Aquifer	2.70	1.47		
Upward Vertical Gradients within the Yorktown Eastover Aquifer							
6GW01	12.8	5 - 20	Upper Yorktown Eastover Aquifer	7.85	4.95	0.001	Upward
6GW01A	12.1	48 - 61.9	Lower Yorktown Eastover Aquifer	7.11	4.99		
6GW13	4.53	10 - 30	Upper Yorktown Eastover Aquifer	2.3	2.23	0.005	
6GW13A	4.85	40 - 60	Lower Yorktown Eastover Aquifer	2.47	2.38		
6GW06	11.77	8 - 18	Upper Yorktown Eastover Aquifer	8.93	2.84	0.044	
6GW06B	11.46	28 - 38	Lower Yorktown Eastover Aquifer	7.75	3.71		
6GW10	15.52	12 - 22	Upper Yorktown Eastover Aquifer	12.89	2.63	0.007	
6GW10A	15.66	30 - 40	Lower Yorktown Eastover Aquifer	12.91	2.75		
6GW09	14.38	20 - 30	Upper Yorktown Eastover Aquifer	11.62	2.76	0.000	
6GW09A	15.17	40 - 50	Middle Yorktown Eastover Aquifer	12.41	2.76		
6GW09A	15.17	40 - 50	Middle Yorktown Eastover Aquifer	12.41	2.76	0.004	
6GW09B	15.11	65 - 75	Lower Yorktown Eastover Aquifer	12.24	2.87		
6GW09	14.38	20 - 30	Upper Yorktown Eastover Aquifer	11.62	2.76	0.002	
6GW09B	15.11	65 - 75	Lower Yorktown Eastover Aquifer	12.24	2.87		

Notes:
ft bgs - feet below ground surface
ft msl - feet (relative) mean sea level
ft btoc - feet below top of casing

Vertical gradient indicated is between identified and next lowest screen interval. Negative values indicate a downward vertical gradient.
1. Reference Point Elevation = top of casing elevation

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE4-1_SITELOCATION_GEOLOGY.MXD MUNWIN 5/6/2010 11:49:50

Legend

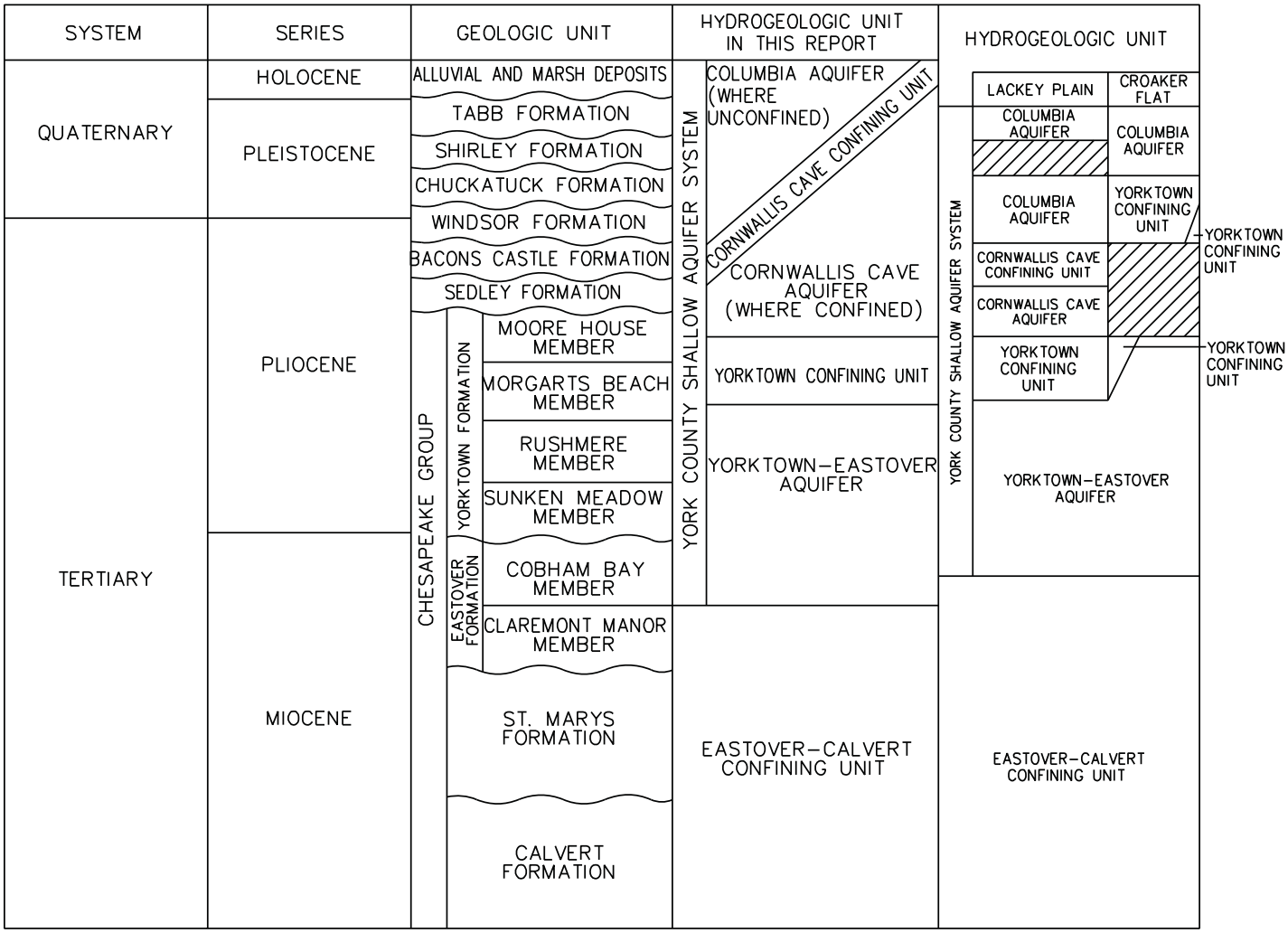
- WPNSTA Boundary
- Camp Peary Scarp
- Site 6
- Elevation Contours (20 ft interval)

N
W E
S

0 750 1,500
Feet

Figure 4-1
Site Location and Major Geologic Features
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

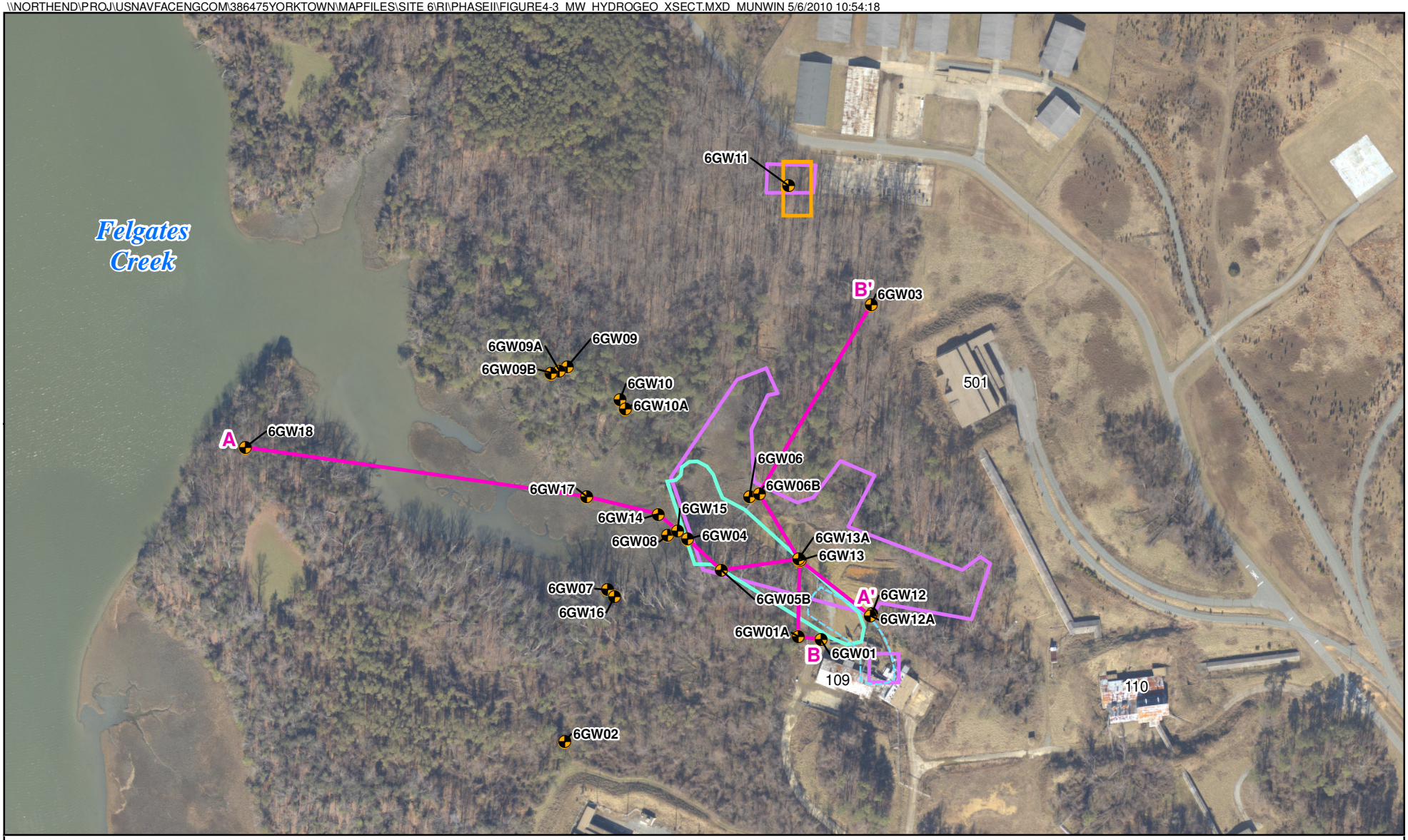


SOURCE: BROCKMAN, ET AL 1997 GEOHYDROLOGY OF THE SHALLOW AQUIFER SYSTEM, NAVAL WEAPONS STATION YOURTOWN, YORKTOWN, VIRGINIA

Figure 4-2
Hydrogeologic Units in York County
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE4-3_MW_HYDROGEO_XSECT.MXD MUNWIN 5/6/2010 10:54:18



Legend

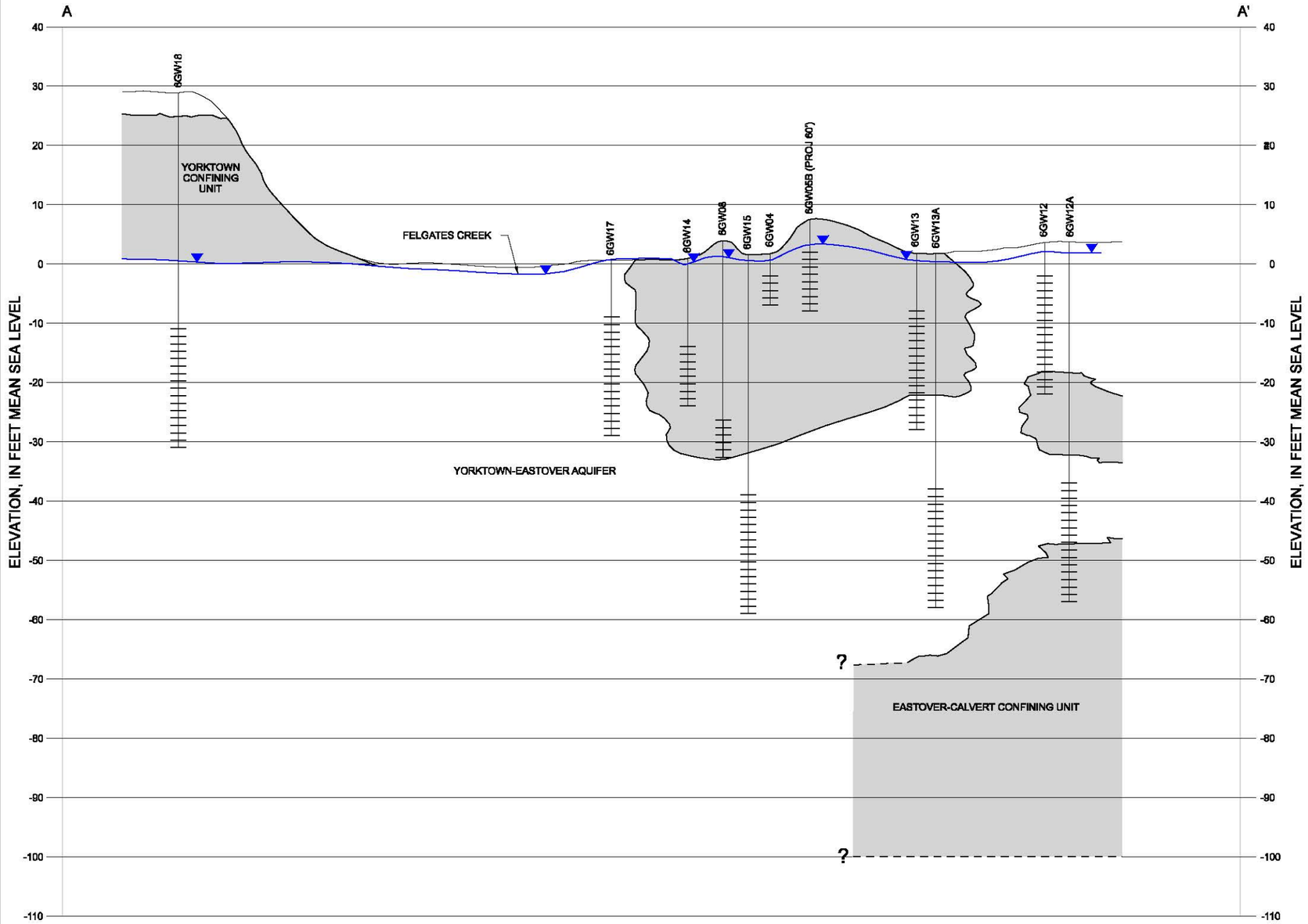
- Yorktown-Eastover Aquifer Monitoring Well
- Surface Impoundment Area
- Flume Drainage Way
- Excavation Area
- Land Use Control Boundary
- Cross-Section Transects

N
W E
S

0 150 300 Feet

Figure 4-3
Monitoring Well Network and Location of Hydrogeologic Cross-Sections
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

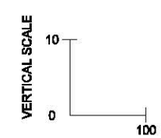


LEGEND

- WELL SCREEN INTERVAL
- GROUNDWATER ELEVATION
- PREDOMINANTLY COARSE-GRAINED MATERIAL (SAND)
- PREDOMINANTLY FINE-GRAINED MATERIAL (SILT AND CLAY)
- INFERRED

NOTES:

1. WATER LEVELS COLLECTED ON AUGUST 31, 2009.



APPROXIMATE HORIZONTAL SCALE (SCALE IN FEET)

VERTICAL EXAGGERATION = 10

FIGURE 4-4
CONCEPTUAL HYDROGEOLOGIC CROSS SECTION A-A'
Phase II Remedial Investigation Report, Site 6
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

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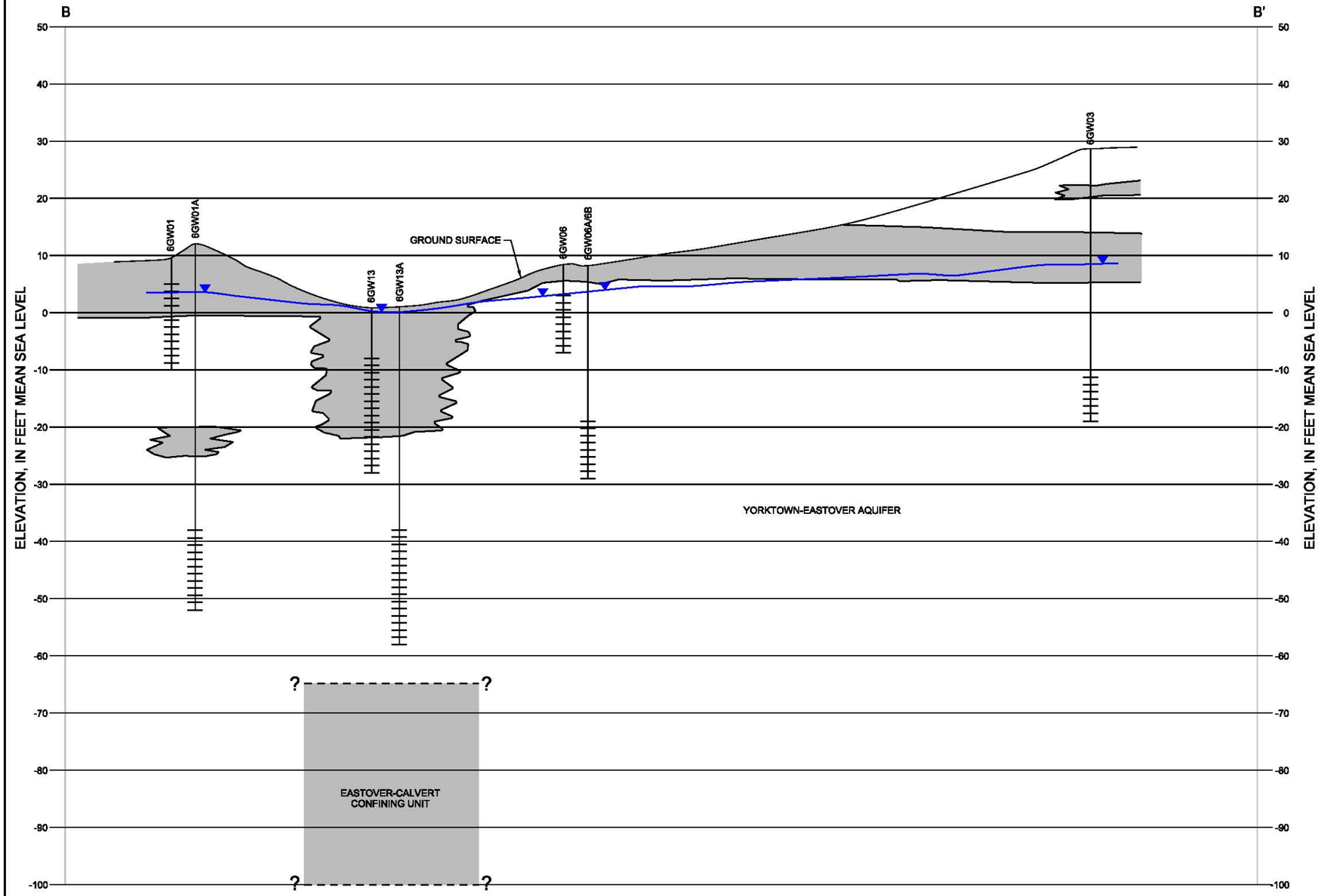
FILENAME: fn01g005_395486.dgn PLOT DATE: 1/12/2011

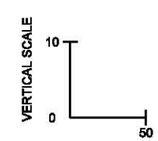


LEGEND

- WELL SCREEN INTERVAL
- GROUNDWATER ELEVATION
- PREDOMINANTLY COARSE-GRAINED MATERIAL (SAND)
- PREDOMINANTLY FINE-GRAINED MATERIAL (SILT AND CLAY)
- INFERRED

NOTES:

1. WATER LEVELS TAKEN ON AUGUST 31, 2009.



APPROXIMATE
HORIZONTAL SCALE
(SCALE IN FEET)

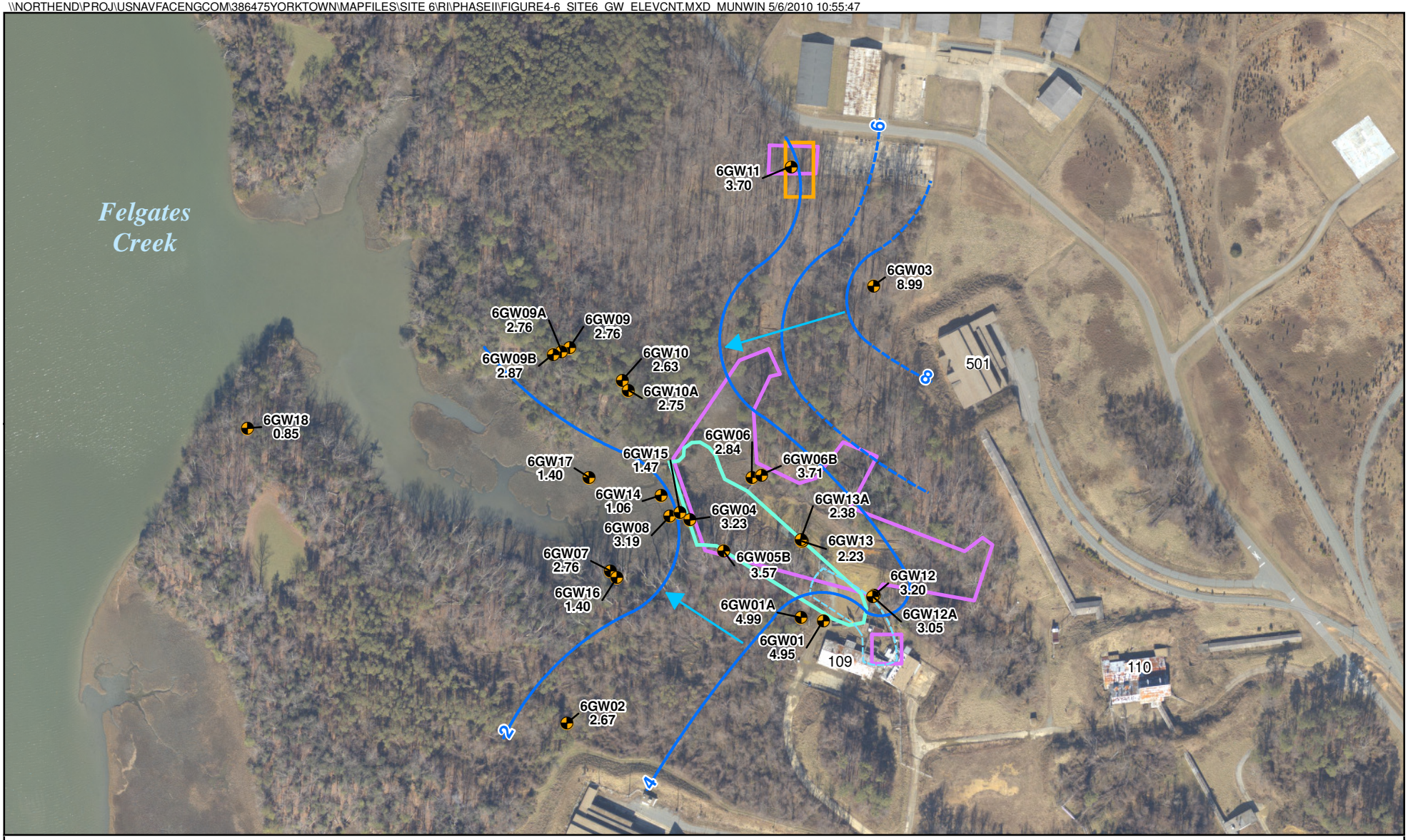
VERTICAL EXAGGERATION = 5

FIGURE 4-5
CONCEPTUAL HYDROGEOLOGIC
CROSS SECTION B-B'
Phase II Remedial Investigation Report, Site 6
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

CH2MHILL

FILENAME: fn01g006_395486.dgn PLOT DATE: 5/5/2010

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE4-6_SITE6_GW_ELEVCNT.MXD MUNWIN 5/6/2010 10:55:47



Legend

- Yorktown-Eastover Aquifer Monitoring Well
- Surface Impoundment Area
- Flume Drainage Way
- Excavation Area
- Land Use Control Boundary
- Groundwater Elevation
- Inferred Groundwater Elevation
- Groundwater Flow Direction

N W E S

0 150 300 Feet

Figure 4-6
Yorktown-Eastover Aquifer Groundwater Elevation Contour
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

SECTION 5

Nature and Extent of Contamination

This section presents an evaluation of the nature and extent of contamination within groundwater, surface water, sediment, and sediment pore water at Site 6. Environmental samples were collected in areas to better define the vertical and horizontal extent of contamination and to assess if the contaminants are migrating to Felgates Creek. In total, 25 groundwater, 11 surface water, 11 sediment, and 4 sediment pore water primary samples were collected at Site 6. In addition, 4 groundwater, 2 surface water, 2 sediment, and 1 sediment pore water duplicate samples were also collected.

A fundamental understanding of the nature and extent of contamination at Site 6 can facilitate effective decision-making mitigation of site contamination. The nature and extent of contamination provides fundamental information to the evaluation of contaminant fate and transport, the potential exposure pathways for risk, and the evaluation and selection of remedial alternatives, if appropriate.

Constituent concentrations detected in environmental media during the Phase II RI at Site 6 are summarized in **Tables 5-1** through **5-6**, and shown spatially in **Figures 5-1** through **5-6**. Laboratory analytical reports are included in **Appendix E**. **Tables 5-1** through **5-3** also present the historical analytical results from previous investigations. However, the nature and extent of contamination discussed below is based on the results of the Phase II RI.

5.1 Groundwater

The monitoring well network at Site 6 consists of 25 monitoring wells that provide the basis for defining the nature and extent of contamination in groundwater. **Table 5-1** and **Figures 5-1** and **5-2** present the VOCs, explosives, and inorganic constituents that were observed in groundwater at Site 6 and identify the chemicals of potential concern (COPCs) (i.e., screening criteria exceedances).

Concentration contour maps were prepared for TCE, 2,4-DNT, and RDX in relation to the appropriate, most protective regulatory standard (tap water RSL), as shown in **Figures 5-7** through **5-9**, respectively. The depicted contours in the figures represent concentrations exceeding the tap water RSL by less than 10 times (green), from 10 to less than 100 times (yellow), from 100 to less than 1,000 times (orange), from 1,000 times to 1 percent of the solubility of the chemical (that is, 11,000 µg/L for TCE, discussed in more detail in Section 6) (red), and greater than the 1 percent of the solubility (purple).

Figure 5-10 presents the locations of the conceptual cross-sections and **Figures 5-11** and **5-12** present conceptual cross-sections A-A′ and B-B′ that show the horizontal and vertical distribution of TCE beneath Site 6.

Natural attenuation parameters including the geochemical parameters alkalinity, chloride, nitrate, nitrite, sulfate, sulfide, methane, ethane, ethene, and TOC, and the microbial parameter *Dehalococcoides species* were analyzed from three select monitoring wells and are summarized in **Table 5-1**. Field measurements collected during the purging of all

monitoring wells included DO, ORP, pH, temperature, conductivity, turbidity, salinity, nitrate, nitrite, and sulfide and are summarized in **Table 5-5**.

A discussion of the nature and extent of contamination by contaminant type in groundwater, and a summary of the results of the natural attenuation parameters are discussed below. A discussion of the significance of each natural attenuation parameter and geochemical conditions within groundwater is discussed in Section 6.

Groundwater is compared to human health screening criteria and not to ecological risk since there are no ecological exposures to groundwater until it discharges to a water body or surfaces as a seep.

5.1.1 General Groundwater Geochemistry

Field measurements collected during the purging of all monitoring wells are summarized in **Table 5-5**. Specific conductivity values provide an indication of the TDS within groundwater. Specific conductivity values generally indicate low TDS concentrations within the upgradient portion of the site and adjacent to Building 109 to higher TDS concentrations indicative of brackish conditions in the downgradient portion of the site adjacent to Felgates Creek. Groundwater is tidally influenced with saline water of Felgates Creek in the downgradient portion of the site. Further detail on groundwater geochemistry and its applicability to fate and transport is discussed in Section 6.2.

5.1.2 Volatile Organic Compounds

A total of 25 VOCs were observed in groundwater at Site 6 (**Table 5-1**). Ten VOCs exceeded one or more screening criteria, and are discussed from most frequently observed to less frequent below (**Figure 5-1**).

- TCE is the most widespread COPC within Site 6 exceeded screening criteria (tap water RSL of 2 µg/L and MCL of 5 µg/L) at eight monitoring wells, with a maximum concentration of 280,000 µg/L (well 6GW13) (**Figure 5-1**). The TCE plume generally occurs within and slightly beyond the surface impoundment area as shown in **Figure 5-7**. The lateral extent of the plume to the southwest is estimated due to the spacing between monitoring wells. Although the upgradient extent of the plume has not been completely delineated, the plume extends approximately 780 ft from adjacent to Building 109 to Felgates Creek.

- TCE concentrations above 11,000 µg/L (1 percent of the solubility of TCE) generally indicate the likely presence of TCE as DNAPL (Bedient et al., 1994). DNAPL is discussed in more detail in Section 6 and is important as it acts as a continuous source of groundwater contamination. Two monitoring wells (6GW08 and 6GW13) contained TCE concentrations above 11,000 µg/L, but product was not observed during drilling. It is unknown if these concentrations indicative of DNAPL continuously extend from wells 6GW13 to 6GW08, as there are no monitoring wells that are located between these two data points. However, based on contaminant discharge at the site, it is possible the area is continuous as there was no point of discharge out by the coffer dam.

- TCE has a decreasing concentration trend in YS06-GW001 (Graph 5-1) and YS06-GW008 (Graph 5-2), both above the MCL, following implementation of the removal action in 2006.

- As shown in **Figures 5-11** and **5-12**, the TCE plume extends from the groundwater table to the top of the Eastover-Calvert confining unit. As discussed in Section 4, the Eastover-Calvert confining unit is approximately 100 to 200 ft thick. TCE is not expected to migrate through this confining unit to deeper aquifers. Elevated concentrations indicative of DNAPL were observed within the upper and middle portion of the Yorktown-Eastover aquifer.
- cis-1,2-DCE exceeded screening criteria (tap water RSL of 37 µg/L and MCL of 70 µg/L) at six monitoring wells, with a maximum concentration of 7,800J µg/L (well 6GW13). 1,2-DCE generally occurred at similar monitoring wells as those with high concentrations of TCE and is a result of the biodegradation of TCE, as discussed in more detail in Section 6.
- Vinyl chloride exceeded screening criteria (RSL for tap water of 0.016 µg/L and/or MCL of 2 µg/L) at six monitoring wells, with a maximum concentration of 73L µg/L (well 6GW13A). Vinyl chloride generally occurred at similar monitoring wells with concentrations of TCE and 1,2-DCE and is a biodegradation product of the two, as discussed in more detail in Section 6. However, vinyl chloride was not observed at 6GW13, where the highest concentrations of TCE and cis-1,2-DCE were observed.
- Vinyl chloride has an increasing concentration trend in YS06-GW001 (Graph 5_3) and a steadily decreasing concentration trend in YS06-GW008 (Graph 5_4), both above the MCL, following implementation of the removal action in 2006.
- 1,1-Dichloroethene (1,1-DCE) exceeded a screening criterion (MCL of 7 µg/L) at two monitoring wells (6GW08 and 6GW12), with a maximum concentration of 9.2 µg/L (well 6GW08).
- trans-1,2,DCE was observed at only one location (well 6GW08) with a concentration of 28J µg/L, exceeding a screening criterion (tap water RSL of 11 µg/L).
- Tetrachloroethene (PCE) was observed at only one location (well 6GW13) with a concentration of 3,000J µg/L, exceeding screening criteria (tap water RSL of 0.11 µg/L and MCL of 5 µg/L).
- 1,1-Dichloroethane (1,1-DCA) exceeding a screening criterion (tap water RSL of 2.4 µg/L) at only one location (well 6GW06) with a concentration of 5.5 µg/L.
- 1,2-Dichloroethane (1,2-DCA) exceeding a screening criterion (tap water RSL of 0.15 µg/L) at only one location (well 6GW08) with a concentration of 0.25J µg/L.
- Benzene was observed at only one location (well 6GW04) with a concentration of 1.6J µg/L, slightly exceeding a screening criterion (tap water RSL of 0.41 µg/L).

5.1.3 Explosives

A total of 14 Explosives were observed in groundwater at Site 6 (**Table 5-1**). Explosives were generally observed within the upper to middle portion of the Yorktown-Eastover aquifer. Seven explosives exceeded one or more screening criteria, and are discussed from most frequently observed to less frequent below (**Figure 5-1**).

- 2,4-DNT exceeded a screening criterion (tap water RSL of 0.22 µg/L) at four monitoring wells, with a maximum concentration of 51K* µg/L (well 6GW09). 2,4-DNT occurred in two separate areas at Site 6; as a plume in the downgradient portion of the surface impoundment area and adjacent to Felgates Creek; and within the northwestern portion of the site at one monitoring well (6GW09) (**Figure 5-8**). *K is a laboratory notation indicating the results may be biased high, where the actual value is likely lower.
- RDX exceeded a screening criterion (tap water RSL of 0.61 µg/L) at four monitoring wells, with a maximum concentration of 70K µg/L at well6GW09. RDX occurred in two separate areas at Site 6; as a plume within the middle and upgradient portion of the surface impoundment area; and within the northwestern portion of the site at one monitoring well (6GW09) (**Figure 5-9**). Following implementation of the removal action in 2006, a slight increasing concentration trend above the MCL occurs in 6GW09 (Graph 5-5). Concentrations of RDX from two monitoring wells, 6GW04 (Graph 5-6) and 6GW06 (Graph 5-7), were inconclusive because the detection levels were above the MCL.
- Nitrobenzene exceeded a screening criterion (tap water RSL of 0.12 µg/L) at two monitoring wells (6GW16 and 6GW17), with a maximum concentration of 1.4K µg/L (6GW17).
- 1,3-Dinitrobenzene exceeded a screening criterion (tap water RSL of 0.37 µg/L) at two monitoring wells, with a maximum concentration of 18K µg/L (6GW09).
- 2-aDNT was observed at only one location (6GW04) downgradient of the surface impoundment area and adjacent to Felgates Creek with a concentration of 7,400 µg/L, exceeding a screening criterion (tap water RSL of 7.3 µg/L). This compound is generally a result of the biodegradation of TNT, as discussed in more detail in Section 6. Elevated concentrations of 2,4,6-TNT was historically observed at 6GW04; however, 2,4,6-TNT was not detected at 6GW04 during the Phase II RI.
- 3-Nitrotoluene (3-NT) was observed at only one location (6GW17) with a concentration of 2.7 µg/L, exceeding a screening criterion (tap water RSL of 0.37 µg/L).
- 4-Nitrotoluene (4-NT) was observed at only one location (6GW16) with a concentration of 5.9K µg/L, exceeding a screening criterion (tap water RSL of 4.2 µg/L).

5.1.4 Inorganic Constituents

Inorganic constituent concentrations were compared against the WPNSTA Yorktown background criteria for the Yorktown-Eastover aquifer. Thirteen inorganics were observed above one or more screening criteria (**Table 5-1** and **Figure 5-2**). When there is a large discrepancy between total inorganics and dissolved inorganics and the turbidity is relatively high (i.e., greater than about 10 nephelometric turbidity units [NTU]), the dissolved inorganics data likely are more representative of inorganic constituents migrating in groundwater. Monitoring wells located adjacent to Felgates Creek are likely tidally influenced and have brackish TDS concentrations. Elevated inorganic concentrations observed in this area may also likely be related to the intrusion of brackish water. Each detected inorganic constituent above screening criteria from most frequently observed to less frequent is discussed below:

- Total and/or dissolved arsenic exceeded screening criteria (RSL for tap water of 0.045 µg/L and/or MCL 10 µg/L) at 24 monitoring wells, with a maximum dissolved concentration of 20.8 µg/L (well 6GW04). Arsenic concentrations that occur with elevated iron and manganese concentrations may be naturally occurring, as arsenic is commonly adsorbed to or co-precipitated with iron and manganese oxides, adsorbed to clay mineral surfaces, and associated with sulfide minerals. Natural dissolving or desorbing of arsenic from these source materials releases arsenic to groundwater.
- Total and/or dissolved iron concentrations exceeded a screening criterion (tap water RSL of 2,600 µg/L) at 15 monitoring wells. Dissolved iron concentrations were generally significantly lower that total iron concentrations. The maximum dissolved iron concentration of 19,900 µg/L was observed at well 6GW01. Iron oxide minerals are common in volcanic derived soils such as the sediment of the Yorktown-Eastover aquifer. Iron is naturally occurring at the site.
- Total and/or dissolved chromium concentrations exceeded screening criteria (tap water RSL of 0.043 µg/L and/or MCL 100 µg/L) at 13 monitoring wells, with a maximum total concentration of 353 µg/L (well 6GW09B) and a maximum dissolved concentration of 18µg/L (GW01A).
- Total and/or dissolved manganese concentrations exceeded a screening criterion (tap water RSL of 88 µg/L) at 12 monitoring wells, similar monitoring wells with exceedances of iron. The maximum dissolved manganese concentration of 551 µg/L was also observed at well 6GW01. Manganese oxide minerals are also common as a result of oxidation to volcanic soils.
- Total and/or dissolved antimony concentrations exceeded screening criteria (tap water RSL of 1.5 µg/L and/or MCL of 6 µg/L) at 9 monitoring wells, with a maximum dissolved concentration of 97.6 µg/L (well 6GW01); dissolved antimony only exceeded screening criteria at one monitoring well.
- Total and/or dissolved cobalt concentrations exceeded a screening criterion (tap water RSL of 1.1 µg/L) at six monitoring wells, with a maximum dissolved concentration of 88.9 µg/L (well 6GW01A).
- Total and/or dissolved zinc exceeded a screening criterion (tap water RSL of 1,100 µg/L) at four monitoring wells, with a maximum dissolved concentration of 5,290 µg/L (well GW04).
- Other inorganic constituents that exceeded a screening criterion at three monitoring wells or less included aluminum, beryllium, cadmium, lead, nickel, selenium, thallium, and vanadium. Dissolved concentrations of aluminum, lead, and nickel were below screening criteria.

5.2 Surface Water, Sediment, and Sediment Pore-Water

Surface water, sediment, and sediment pore-water samples were collected from Felgates Creek to determine if any impacts were associated from potential groundwater discharge or from transport and deposition by overland flow. **Tables 5-2** through **5-3** and **Figures 5-3** through **5-5** summarize the VOCs, explosives, and inorganic constituents that were

observed in surface water and sediment at Site 6. **Table 5-4** and **Figure 5-6** summarize the VOCs observed in sediment pore-water at the site.

5.2.1 Surface Water Quality

Surface water quality parameters are summarized in **Table 5-2** and **Table 5-6**. Sediment samples were also analyzed for AVS/SEM, hardness, TDS, TOC, and grain sizes and the results are summarized in **Table 5-3**. Surface water TDS concentrations ranged from 17,700 to 24,200 mg/L, which indicate saline conditions. DO concentrations are aerobic and range from 4.9 to 7.4 mg/L

5.2.2 VOCs

No VOCs exceeded screening criteria in surface water or sediment at Site 6. Only carbon disulfide was detected in surface water, which is a naturally occurring constituent commonly observed in marsh sediments. Detected concentrations in sediment include carbon disulfide and trans-1,2-DCE. The concentrations of trans-1,2-DCE (7.4J µg/kg from SD77) was significantly below the adjusted residential soil RSL (150,000 µg/kg).

A total of 11 VOCs were observed in the sediment pore-water samples (**Table 5-4** and **Figure 5-6**). Carbon disulfide is likely naturally occurring and 2-butanone, acetone, cyclohexane, methylene chloride, and toluene are likely laboratory related contaminants and not site related. Total, cis-, and trans-1,2-DCE, vinyl chloride, and chloroethane concentrations were higher within the surface impoundment area and were significantly lower or not detected adjacent to or within Felgates Creek. TCE was not observed in any of the sediment pore-water samples, including sample WN01 that was collected adjacent to elevated TCE concentrations observed in the historical surface water sample SW060 and sample WN03 that was collected in the area where potential DNAPL is suspected. The absence of TCE and presence of TCE daughter compounds in sediment pore-water suggests that significant biodegradation may be occurring within the plume prior to discharge to surface water.

5.2.3 Explosives

No explosives exceeded screening criteria within surface water. HMX and 2-NT were observed in two (SW69 and SW72) and one (SW78) surface water samples, respectively (**Table 5-2**).

Nitrobenzene and tetryl were observed in one sediment sample location (SD77) above a screening criterion (ecological screening value of 21 and 72 µg/kg, respectively) with concentrations of 120J µg/kg and 150J µg/kg, respectively (**Table 5-3** and **Figure 5-4**). Other detected explosives included 2,6-dinitrotoluene (2,6-DNT) and 2-NT, but below screening criteria.

5.2.4 Inorganic Constituents

No background data are available for the surface water and sediment inorganic constituents within Felgates Creek. The creek is also a depositional environment for naturally occurring eroded soils and has brackish conditions. To determine potential impacts in sediment and surface water from potential groundwater discharge, concentrations of inorganics observed in groundwater at the site are considered in the discussion of those observed in Felgates Creek media.

Inorganics detected above screening criteria within surface water and/or sediments include aluminum, arsenic, chromium, manganese, nickel, selenium, silver, and vanadium (**Tables 5-2** and **5-3** and **Figures 5-3** and **5-5**). These constituents will be evaluated further in the FS as noted in Section 9.3, Proposed Future Actions. Each inorganic constituent above screening criteria is discussed below.

- Aluminum exceeded a screening criterion (ecological screening value of 18,000 mg/kg) at five sediment sample locations, with a maximum concentration of 24,100 mg/kg (SD74). Aluminum concentrations within sediment are most likely attributable to background due to the weathering of the volcanic nature of the soils.
- Total and/or dissolved arsenic exceeded a screening criterion (adjusted tap water RSL of 0.45 µg/L) at all 11 surface water samples, with a maximum dissolved concentration of 6.9J µg/L (SW73). Arsenic exceeded screening criteria (adjusted residential soil RSL of 3.9 mg/kg and/or ecological screening value of 8.2 mg/kg) in eight sediment samples, with a maximum concentration of 10.8 mg/kg (SD75). As discussed in Section 5.1.4, arsenic concentrations are likely attributable to background.
- Total chromium exceeded a screening criterion (adjusted tap water RSL of 0.43 µg/L) at three surface water samples, with a maximum concentration of 3.8J µg/L (SW76). Dissolved chromium did not exceed any screening criteria. The background total chromium concentration within WPNSTA Yorktown groundwater was 4.7L µg/L. Chromium exceeded a screening criterion (adjusted residential soil RSL of 2.9 mg/kg) at 11 sediment sample locations, with a maximum concentration of 47.8 mg/kg (SD74).
- Total and/or dissolved manganese exceeded a screening criterion (ecological screening value of 100 µg/L) at nine surface water samples, with a maximum dissolved concentration of 175 µg/L (SW78). Manganese exceeded a screening criterion (ecological screening value of 260 mg/kg) at three sediment samples, with a maximum concentration of 322 mg/kg (SD77). As discussed in Section 5.1.4, manganese concentrations are likely attributable to background.
- Selenium exceeded a screening criterion (ecological screening value of 1 mg/kg) at two sediment sample locations (SD73 and SD77), with a maximum concentration of 1.2L mg/kg (SD73 and SD77). Selenium occurrence is believed to be naturally occurring related to its association with iron oxides.
- Total and/or dissolved silver exceeded a screening criterion (ecological screening value of 0.23 µg/L) at 11 surface water sample locations, with a maximum dissolved concentration of 1.1L µg/L (SW74). Silver is believed to be naturally occurring and not likely a constituent historically used at the site.
- Vanadium exceeded a screening criterion (ecological screening value of 57 mg/kg) at three sediment sample locations, with a maximum concentration of 66.9 mg/kg (SD75). The occurrence of vanadium in sediment is most likely naturally occurring as there were no exceedances of screening criteria in groundwater.

TABLE 5-1
Groundwater Exceedance Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	Yorktown Background Criteria - Yorktown-Eastover Aquifer	CLEAN MCL-Groundwater	Adjusted Tap Water RSLs	YS06-GW001							YS06-GW001A				YS06-GW002			
Aquifer				Yorktown-Eastover														
Sample ID				YS06-MW001-0994	YS06-MW001P-0994	YS06-MW001-0600	YS06-MW001P-0600	YS06-MW001-0904	YS06-GW01-0309	YS06-GW01P-0309	YS06-MW001A-1094	YS06-MW001A-0600	YS06-MW001A-0904	YS06-GW01A-0309	YS06-MW002-1094	YS06-MW002-0600	YS06-MW002P-0600	YS06-GW02-0309
Sample Date				09/11/94	09/11/94	06/19/00	06/19/00	09/15/04	03/23/09	03/23/09	10/12/94	06/19/00	09/14/04	03/23/09	10/10/94	06/21/00	06/21/00	03/24/09
Chemical Name																		
Volatile Organic Compounds (µg/l)																		
1,1,1-Trichloroethane	--	200	910	13	14 J	1 J	NA	10 U	0.5 U	0.5 U	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
1,1-Dichloroethane	--	--	2.4	**14**	**14 J**	**9 J**	NA	**3 J**	1.8	2	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
1,1-Dichloroethene	--	7	34	**36**	**45**	**22 J**	NA	**15**	5.3	6.1	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
1,2,4-Trichlorobenzene	--	70	0.41	10 U	10 U	10 U	NA	10 U	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U	10 U	10 U	10 U	0.15 J
1,2-Dichloroethane	--	5	0.15	1 U	25 U	10 U	NA	10 U	0.5 U	0.5 U	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
1,2-Dichloroethene (total)	--	70	33	NA	NA	NA	NA	NA	21	24	NA	NA	NA	0.5 U	NA	NA	NA	0.5 U
2-Butanone	--	--	710	5 R	120 R	10 U	NA	10 U	2.5 R	2.5 R	5 R	10 U	10 U	2.5 R	5 R	10 U	10 U	2.5 R
2-Hexanone	--	--	4.7	5 R	120 R	10 U	NA	10 U	2.5 U	2.5 U	5 R	10 U	10 U	2.5 U	5 R	10 U	10 U	2.5 U
Benzene	--	5	0.41	1 U	25 U	10 U	NA	10 U	0.5 U	0.5 U	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
Carbon disulfide	--	--	100	1 U	25 U	10 UJ	NA	10 U	0.5 U	0.5 U	1 U	10 UJ	10 U	0.5 U	1 U	10 U	10 U	0.5 U
Chloroethane	--	--	2,100	1 U	25 U	10 U	NA	10 U	0.16 J	0.5 U	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
Chloroform	--	80	0.19	**2**	25 U	10 U	NA	10 U	0.5 U	0.5 U	1 U	10 U	10 U	0.5 U	0.6 B	10 U	10 U	0.5 U
Chloromethane	--	--	19	1 U	25 U	10 U	NA	10 U	0.19 B	0.17 B	1 UJ	10 U	10 U	0.22 B	1 U	10 U	10 U	0.23 B
cis-1,2-Dichloroethene	--	70	37	**110**	**98**	**56**	NA	**46**	18	21	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
cis-1,3-Dichloropropene	--	--	0.43	1 U	25 U	10 U	NA	10 U	0.5 U	0.5 U	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
Ethylbenzene	--	700	1.5	1 U	25 U	10 U	NA	10 U	0.5 U	0.5 U	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
Isopropylbenzene	--	--	68	NA	NA	10 U	NA	10 U	0.5 U	0.5 U	NA	10 U	10 U	0.5 U	NA	10 U	10 U	0.5 U
Methyl acetate	--	--	3,700	NA	NA	10 U	NA	10 U	0.5 U	0.5 U	NA	10 U	10 U	0.5 U	NA	10 U	10 U	0.5 U
Methylcyclohexane	--	--	--	NA	NA	10 U	NA	10 U	0.5 U	0.5 U	NA	10 U	10 U	0.5 U	NA	10 U	10 U	0.5 U
Methylene chloride	--	5	4.8	2 U	50 U	3 B	NA	10 U	0.5 U	0.5 U	0.6 B	2 B	10 U	0.5 U	1 B	2 B	3 B	0.5 U
Methyl-tert-butyl ether (MTBE)	--	--	13	NA	NA	10 U	NA	10 U	0.5 U	0.5 U	NA	10 U	10 U	0.5 U	NA	10 U	10 U	0.5 U
o-Xylene	--	--	120	NA	NA	NA	NA	NA	0.5 U	0.5 U	NA	NA	NA	0.5 U	NA	NA	NA	0.5 U
Tetrachloroethene	--	5	0.11	1 U	25 U	10 U	NA	10 U	0.5 U	0.5 U	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
trans-1,2-Dichloroethene	--	100	11	1	25 U	10 U	NA	2 J	3.3	3.6	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
Trichloroethene	--	5	2	**320**	**350**	**120**	NA	**94**	**13**	**14**	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
Vinyl chloride	--	2	0.016	1 U	25 U	10 U	NA	10 U	**4.1**	**3.9**	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
Xylene, total	--	10,000	20	1 U	25 U	10 U	NA	10 U	0.5 U	0.5 U	1 U	10 U	10 U	0.5 U	1 U	10 U	10 U	0.5 U
Semivolatile Organic Compounds (µg/l)																		
2,4-Dinitrotoluene	--	--	0.22	1 U	1 U	2 UL	NA	2.5 U	1 U	0.98 U	1 U	4 U	2.5 U	0.93 U	1 U	5 U	3.25 U	0.94 U
bis(2-Ethylhexyl)phthalate	--	6	4.8	10 U	10 U	NA	NA	11 U	NA	NA	1 J	NA	10 U	NA	10 U	NA	NA	NA
Nitrobenzene	--	--	0.12	0.73 U	0.73 U	1.2 UL	NA	2.5 U	1 U	0.98 U	0.73 U	2.4 U	2.5 U	0.93 U	0.73 U	3 U	1.95 U	0.94 U
Pesticide/Polychlorinated Biphenyls (µg/l)																		
4,4'-DDE	--	--	0.2	NA	NA	NA	NA	0.1 U	NA	NA	NA	NA	0.1 U	NA	NA	NA	NA	NA
beta-BHC	--	--	0.037	NA	NA	NA	NA	0.051 U	NA	NA	NA	NA	0.05 U	NA	NA	NA	NA	NA
delta-BHC	--	--	0.037	NA	NA	NA	NA	0.051 U	NA	NA	NA	NA	0.05 U	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	--	0.2	0.061	NA	NA	NA	NA	0.051 U	NA	NA	NA	NA	0.05 U	NA	NA	NA	NA	NA
Heptachlor epoxide	--	0.2	0.0074	NA	NA	NA	NA	0.21 B	NA	NA	NA	NA	0.05 U	NA	NA	NA	NA	NA
Explosives (µg/l)																		
1,3,5-Trinitrobenzene	--	--	110	0.66 U	0.66 U	0.8 UL	NA	2.5 U	1 U	0.98 U	0.66 U	1.6 U	2.5 U	0.93 U	0.66 U	2 U	1.3 U	0.069 B
1,3-Dinitrobenzene	--	--	0.37	1.1 U	1.1 U	0.8 UL	NA	2.5 U	1 U	0.98 U	1.1 U	1.6 U	2.5 U	0.93 U	1.1 U	2 U	1.3 U	0.94 U
2,4,6-Trinitrotoluene	--	--	1.8	0.62 U	0.62 U	1.6 UL	NA	2.5 U	1 U	0.98 U	0.62 U	3.2 U	2.5 U	0.93 U	0.62 U	4 U	2.6 U	0.07 J
2-Amino-4,6-dinitrotoluene	--	--	7.3	NA	NA	2.4 UL	NA	5 U	1 U	0.98 U	NA	4.8 U	5 U	0.93 U	NA	6 U	3.9 U	0.94 U
2-Nitrotoluene	--	--	0.31	0.75 U	0.75 U	2 UL	NA	5 U	1 U	0.98 U	0.75 U	4 U	5 U	0.93 U	0.75 U	5 U	3.25 U	0.94 U
3,5-Dinitroaniline	--	--	--	NA	NA	NA	NA	NA	1 UJ	0.98 UJ	NA	NA	NA	0.93 UJ	NA	NA	NA	0.94 U
3-Nitrotoluene	--	--	0.37	0.91 U	0.91 U	1.6 UL	NA	5 U	1 U	0.98 U	0.91 U	3.2 U	5 U	0.93 U	0.91 U	4 U	2.6 U	0.94 U
4-Amino-2,6-dinitrotoluene	--	--	7.3	1.2	1.4	1.6 UL	NA	5 U	1 U	0.98 U	1 U	3.2 U	5 U	0.93 U	1 U	4 U	2.6 U	0.94 U
4-Nitrotoluene	--	--	4.2	NA	NA	2 UL	NA	5 U	1 U	0.98 U	NA	4 U	5 U	0.93 U	NA	5 U	3.25 U	0.94 U
HMX	--	--	180	3.2	4.1	1.6 UL	NA	19	0.24 J	0.38 J	0.61 U	3.2 U	2.5 U	0.93 U	0.61 U	4 U	2.6 U	0.94 U
PETN	--	--	--	NA	NA	NA	NA	NA	3 U	2.9 U	NA	NA	NA	2.8 U	NA	NA	NA	2.8 U
RDX	--	--	0.61	**63**	**80**	**39.6 L**	NA	**32**	**0.88 J**	**1.3**	0.59 U	4 UJ	2.5 U	0.93 U	0.59 U	5 U	3.25 U	0.081 J
Tetryl	--	--	15	1 U	1 U	1.6 UL	NA	5 U	1 UJ	0.98 UJ	1 U	3.2 U	5 U	0.93 UJ	1 U	4 U	2.6 U	0.94 UJ
Total Metals (µg/l)																		
Aluminum	1,160	--	3,700	466	666	37 U	37 U	80.7 U	53.4 U	53.4 U	233 J	38.4 J	80.7 U	373	1,510 J	248	250	1,780
Antimony	ND	6	1.5	12.4 U	12.4 U	2.1 U	2.1 U	1.9 U	**6.9 J**	**5.2 J**	12.2 U	2.1 U	1.9 U	8.2 B	12.2 U	2.1 U	2.1 U	**4.8 J**
Arsenic	3.5 J	10	0.045	**37.1**	**36.7**	**7.6 J**	7.85 B	9.3 B	**9.2 J**	**9.1 J**	2.3 U	2.3 U	2.1 U	2.2 U	**3.3**	2.3 U	**3.8 J**	2.2 U
Barium	43.6 J	2,000	730	22.5	23	24.1 J	22.3 B	18 B	23.7 J	22.6 J	35.2	26.8 J	26.5 B	31.5 J	38.4	36.4 J	36.2 J	42.9 J
Beryllium	ND	4	7.3	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U	0.42 U	0.42 U	1 U	0.2 U	0.1 U	0.42 UL	1 U	0.2 U	0.2 U	0.42 U
Cadmium	ND	5	1.8	2.3 U	2.3 U	0.2 U	0.2 U	0.2 U	0.64 U	0.64 U	1.5 U	0.2 U	0.2 U	0.64 U	1.5 U	0.2 U	0.2 U	0.64 U
Chromium	4.7 L	100	0.043	**2**	**1.8**	0.4 U	0.454 B	0.9 U	**1.2 J**	**0.93 J**	1.8 U	**0.51 J**	0.9 U	4.4 B	**4.7**	**23.1**	**24**	**8.3 J**
Cobalt	ND	--	1.1	2.1 U	2.1 U	0.7 J	0.5 U	0.5 U	1.6 U	1.6 U	1.9 U	0.5 U	0.5 U	1.6 UL	**2.2**	0.88 J	0.5 U	1.6 U
Copper	4.5 J	1,300	150	3.8	3.9	0.69 J	0.836 B	3.9 B	0.84 U	0.84 U	1.4 U	0.72 J	0.6 U	1.9 B	2.8	1.6 J	1.2 J	0.88 J
Cyanide	ND	200	73	5 UL	5 UL	1 J	0.9 U	3.1 B	NA	NA	5 U	0.9 U	1.1 U	NA	5 U	0.9 U	0.9 U	NA
Iron	2,350	--	2,600	**10,900**	**10,900**	**6,990**	**6,803**	**8,830**	**23,500**	**21,600**	1,000	831	794	1,300	**3,610**	1,350	1,370	**4,150**
Lead	ND	15	--	1.5 U	1.5 U	1.3 U	1.3 U	1.1 U	1.9 J	2.2 J	1.4 U	1.3 U	1.1 U	2.1 J	2 K	1.3	1.3 U	3.3
Manganese	18.4	--	88	**240**	**239**	**161**	**157**	**180**	**583**	**566**	25.8	24.2	23.8	30	79	44.2	43.5	47.4
Mercury	ND	2	1.1	0.2 UL	0.2 UL	0.15 L	0.154 B	0.1 UJ	0.1 U	0.1 U	0.2 UL	0.15 L	0.1 UJ	0.1 U	0.2 UL	0.16 L	0.14 L	0.1 U
Nickel	ND	--	73	5.2 U	5.2 U	0.88 J	1.63 B	0.6 U	0.79 J	0.82 J	4.3 U	1.3 B	0.6 U	1.6 B	4.3 U	17.7 B	17.9 J	3.4 J
Selenium	2.9 J	50	18	2.4 U	4.4 K	2.7 B	2.2 U	2.4 U	2.2 U	2.2 U	2.6 U	2.2 U	2.4 U	2.2 U	2.6 U	2.2 U	2.2 U	2.2 U
Vanadium	7.5 J	--	18	5.2	5.6	1.1 J	0.644 B	0.6 U	1.4 J	1.6 J	1.4 U	0.6 J	0.6 U	2.2 B	6.9	0.56 J	0.66 J	5.3 J
Zinc	14.9 J	--	1,100	24.1 B	17.9 B	0.97 B	0.8 U	6.9 B	5.5 J	5.2 U	8.2 B	0.8 U	4.1 U	9.1 J	15.9 B	0.9 B	1.6 B	11.9 J
Dissolved Metals (µg/l)																		

TABLE 5-1
Groundwater Exceedance Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	Yorktown Background Criteria - Yorktown-Eastover Aquifer	CLEAN MCL-Groundwater	Adjusted Tap Water RSLs	YS06-GW001							YS06-GW001A				YS06-GW002			
Aquifer											Yorktown-Eastover							
Sample ID				YS06-MW001-0994	YS06-MW001P-0994	YS06-MW001-0600	YS06-MW001P-0600	YS06-MW001-0904	YS06-GW01-0309	YS06-GW01P-0309	YS06-MW001A-1094	YS06-MW001A-0600	YS06-MW001A-0904	YS06-GW01A-0309	YS06-MW002-1094	YS06-MW002-0600	YS06-MW002P-0600	YS06-GW02-0309
Sample Date				09/11/94	09/11/94	06/19/00	06/19/00	09/15/04	03/23/09	03/23/09	10/12/94	06/19/00	09/14/04	03/23/09	10/10/94	06/21/00	06/21/00	03/24/09
Chemical Name																		
Aluminum, Dissolved	146 J	--	3,700	11.5 U	11.5 U	37 U	37 U	80.7 U	53.4 U	53.4 U	11 U	37 U	80.7 U	379	11 U	37 U	37 U	53.4 U
Antimony, Dissolved	18.5 J	6	1.5	**20.6**	**17.1**	2.1 U	2.1 U	1.9 U	2.4 U	2.4 U	12.2 U	2.1 U	1.9 U	**97.6**	12.2 U	2.1 U	2.1 U	2.4 U
Arsenic, Dissolved	ND	10	0.045	**12.6**	**11.8**	**8 J**	7 B	7 B	**13.3 L**	**12.4 L**	**3**	2.3 U	2.1 U	**20.3 L**	2.3 U	**4.1 J**	**3.2 J**	**3.2 L**
Barium, Dissolved	30.9 J	2,000	730	13.6	13.4	19.9 J	20 B	17.5 B	19.7 L	19.2 L	32	27 J	25.1 B	387 L	32.7	33.3 J	33.7 J	32.2 L
Beryllium, Dissolved	ND	4	7.3	0.2 U	0.2 U	0.2 U	0.2 U	0.1 U	0.42 B	0.42 UL	1 U	0.2 U	0.1 U	**9.1 L**	1 U	0.2 U	0.2 U	0.42 UL
Cadmium, Dissolved	ND	5	1.8	2.3 U	2.3 U	0.2 U	0.2 U	0.2 U	0.64 U	0.64 U	1.5 UL	0.22 J	0.2 U	**8.5**	1.5 UL	0.2 U	0.2 U	0.64 U
Chromium, Dissolved	ND	100	0.043	1.5 U	1.5 U	0.4 U	0.4 U	0.9 U	0.7 U	0.7 U	1.8 U	0.4 U	0.9 U	**18**	1.8 U	**1.1 J**	0.4 U	0.7 U
Cobalt, Dissolved	ND	--	1.1	2.1 U	2.1 U	0.5 U	0.5 U	0.5 U	1.6 U	1.6 U	1.9 U	0.5 U	0.5 U	**88.9**	1.9 U	0.5 U	0.5 U	1.6 U
Copper, Dissolved	4 J	1,300	150	3.9	2.9	1.2 J	0.6 U	0.6 U	0.84 U	0.84 UL	1.4 U	1.3 J	0.6 U	49	1.4 U	1.9 J	1.7 J	0.84 UL
Iron, Dissolved	5.8 J	--	2,600	509	329	**5,270**	**5,282**	**8,450**	**19,900**	**19,000**	231	262	627	382	153	58.9 J	14.3 U	397
Lead, Dissolved	ND	15	--	1.5 U	1.5 U	1.3 U	1.3 U	1.1 U	1.4 UL	1.4 UL	1.4 U	1.3 U	1.1 U	5.5 L	1.4 U	1.3 U	1.3 U	1.4 UL
Manganese, Dissolved	12.2 J	--	88	**229**	**233**	**147**	**147**	**174**	**551**	**533**	23	25	23	49.5	61.9	38.4	38.4	27.6
Mercury, Dissolved	ND	2	1.1	0.2 UL	0.2 UL	NA	0.138 B	0.1 UJ	0.1 U	0.1 U	0.2 UL	0.15 L	0.1 UJ	0.1 U	0.2 UL	0.14 L	0.16 L	0.1 U
Nickel, Dissolved	ND	--	73	5.2 U	5.2 U	1.8 B	0.7 U	0.6 U	0.67 U	0.67 U	4.3 U	0.98 B	0.7 J	**74.5**	4.3 U	10.6 J	10 J	0.72 B
Selenium, Dissolved	3.9 K	50	18	2.4 U	2.4 U	2.2 U	2.2 U	2.4 U	4.1 B	2.6 B	2.6 UL	2.2 U	2.4 U	9.8 B	2.6 UL	2.2 U	2.2 U	2.2 R
Silver, Dissolved	ND	--	18	1.7 U	1.7 U	0.6 U	0.6 U	0.8 U	0.62 UL	0.62 UL	2 U	0.6 U	0.8 U	15.7 L	2 U	0.6 U	0.6 U	0.62 UL
Thallium, Dissolved	ND	2	0.24	5.7 U	**6.3 K**	**3.9 J**	4 B	2.8 U	3.3 UL	3.3 UL	4 UL	3.2 U	2.8 U	**21.9 L**	4 UL	3.2 U	3.2 U	3.3 UL
Vanadium, Dissolved	6.3 J	--	18	1.8 U	2.5	0.53 J	0.61 B	0.6 U	1.2 L	1.1 L	1.4 U	0.4 U	0.6 U	**90.8 L**	1.4 U	0.4 U	0.4 U	0.57 UL
Zinc, Dissolved	5.9 J	--	1,100	19.3 B	8.8 B	1.9 J	0.8 U	4.1 U	5.2 U	7.8 J	6.3 B	0.8 U	4.1 U	41.7	7.4 B	0.92 J	0.89 J	5.2 U
Wet Chemistry																		
Alkalinity (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ammonia (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethane (ug/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethene (ug/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methane (ug/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate/Nitrite (mg/l)	--	--	--	0.06	0.06	NA	NA	NA	NA	NA	0.02 U	NA	NA	NA	0.05	NA	NA	NA
Sulfate (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	--	--	--	330	330	NA	NA	NA	NA	NA	330	NA	NA	NA	240	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total suspended solids (TSS) (mg/l)	--	--	--	46	51	NA	NA	NA	NA	NA	230	NA	NA	NA	72	NA	NA	NA
	--																	
Dechlorinating Bacteria (cells/ml)	--																	
Dehalococcoides	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed MCLs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed both MCLs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

NJ - Qualitative identification questionable due to poor resolution, presumptively present at approximate quantity

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

cells/ml - Cells per milliliter

mg/l - Milligrams per liter

µg/l - Micrograms per liter

TABLE 5-1
Groundwater Exceedance Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	Yorktown Background Criteria - Yorktown-Eastover Aquifer	CLEAN MCL-Groundwater	Adjusted Tap Water RSLs	YS06-GW003		YS06-GW004			YS06-GW005	YS06-GW005B				YS06-GW006			
Aquifer				Yorktown-Eastover													
Sample ID				YS06-MW003-1194	YS06-GW03-0309	YS06-MW004-0600	YS06-MW004-1004	YS06-GW04-0309	YS06-MW005-0600	YS06-MW005B-1004	YS06-MW005BP-1004	YS06-GW05B-0309	YS06-GW05BP-0309	YS06-MW006-0600	YS06-MW006-0904	YS06-MW006P-0904	YS06-GW06-0309
Sample Date				11/09/94	03/25/09	06/23/00	10/05/04	03/31/09	06/22/00	10/04/04	10/04/04	03/26/09	03/26/09	06/23/00	09/20/04	09/20/04	03/26/09
Chemical Name																	
Volatile Organic Compounds (µg/l)																	
1,1,1-Trichloroethane	--	200	910	1 U	0.5 U	10 U	10 U	0.5 UJ	10 U	10 U	NA	0.28 J	0.29 J	52	8 J	10	0.39 J
1,1-Dichloroethane	--	--	2.4	1 U	0.5 U	10 U	10 U	0.5 UJ	1 J	10 U	NA	0.82	0.76	**39**	**16**	**19**	**5.5**
1,1-Dichloroethene	--	7	34	1 U	0.5 U	10 U	10 U	0.5 UJ	1 J	2 J	NA	2.2	2.2	**64**	19	**23**	2.3
1,2,4-Trichlorobenzene	--	70	0.41	10 U	0.5 U	10 U	10 U	0.5 UJ	10 U	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
1,2-Dichloroethane	--	5	0.15	1 U	0.5 U	10 U	10 U	0.5 UJ	10 U	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
1,2-Dichloroethene (total)	--	70	33	NA	0.5 U	NA	NA	0.15 J	NA	NA	NA	3.7	3.7	NA	NA	NA	0.5 U
2-Butanone	--	--	710	5 R	2.5 R	10 U	10 U	1.3 L	10 U	10 U	NA	2.5 R	2.5 R	10 U	10 U	10 U	2.5 R
2-Hexanone	--	--	4.7	5 R	2.5 U	10 U	10 U	2.5 UJ	10 U	10 U	NA	2.5 U	2.5 U	10 U	10 U	10 U	2.5 U
Benzene	--	5	0.41	1 U	0.5 U	10 U	10 U	**1.6 J**	10 U	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
Carbon disulfide	--	--	100	52	0.5 U	10 U	10 U	0.5 UJ	10 U	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
Chloroethane	--	--	2,100	1 U	0.5 U	10 U	10 U	0.5 UJ	10 UJ	10 U	NA	0.5 U	0.5 U	10 UJ	10 U	10 U	0.5 U
Chloroform	--	80	0.19	**0.6 J**	0.5 U	10 U	10 U	0.5 UJ	10 U	10 U	NA	0.54 B	0.5 B	**9 J**	10 U	10 U	0.72 B
Chloromethane	--	--	19	1 UJ	0.21 B	10 U	10 U	0.24 B	10 U	10 U	NA	0.15 B	0.24 B	10 U	10 U	10 U	0.21 B
cis-1,2-Dichloroethene	--	70	37	1 U	0.5 U	10 U	10 U	0.15 J	**41**	10 U	NA	3.7	3.8	10 U	10 U	10 U	0.5 U
cis-1,3-Dichloropropene	--	--	0.43	1 U	0.5 U	10 U	10 U	0.5 UJ	10 U	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
Ethylbenzene	--	700	1.5	1 U	0.5 U	10 U	10 U	0.5 UJ	10 U	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
Isopropylbenzene	--	--	68	NA	0.5 U	10 U	10 U	0.26 J	10 U	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
Methyl acetate	--	--	3,700	NA	0.5 U	10 U	10 U	0.5 UJ	10 U	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
Methylcyclohexane	--	--	--	NA	0.5 U	10 U	10 U	0.38 J	10 U	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
Methylene chloride	--	5	4.8	2 U	0.5 U	3 B	10 U	0.31 B	3 B	2 J	NA	0.5 U	0.5 U	4 B	10 U	10 U	0.5 U
Methyl-tert-butyl ether (MTBE)	--	--	13	NA	0.5 U	10 U	10 U	0.5 UJ	10 U	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
o-Xylene	--	--	120	NA	0.5 U	NA	NA	0.14 J	NA	NA	NA	0.5 U	0.5 U	NA	NA	NA	0.5 U
Tetrachloroethene	--	5	0.11	1 U	0.5 U	10 U	10 U	0.5 UJ	10 U	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
trans-1,2-Dichloroethene	--	100	11	1 U	0.5 U	10 U	10 U	0.5 UJ	4 J	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
Trichloroethene	--	5	2	1 U	0.5 U	10 U	10 U	0.5 UJ	**13**	**5 J**	NA	**6**	**6.9**	10 U	10 U	10 U	0.11 J
Vinyl chloride	--	2	0.016	1 U	0.5 U	10 U	10 U	0.5 UJ	10 U	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
Xylene, total	--	10,000	20	1 U	0.5 U	10 U	10 U	0.14 J	10 U	10 U	NA	0.5 U	0.5 U	10 U	10 U	10 U	0.5 U
Semivolatile Organic Compounds (µg/l)																	
2,4-Dinitrotoluene	--	--	0.22	1 U	1.1 U	500 U	**40**	**36 K**	**5 U**	**13**	NA	**2.6 J**	**4 NJ**	2.5 UL	2.5 U	2.5 U	0.98 UL
bis(2-Ethylhexyl)phthalate	--	6	4.8	10 U	NA	NA	20 U	NA	NA	10 U	NA	NA	NA	NA	10 U	5 B	NA
Nitrobenzene	--	--	0.12	0.73 U	1.1 U	300 U	2.5 U	1 U	3 U	2.5 U	NA	0.95 U	0.94 U	1.5 UL	2.5 U	2.5 U	0.98 UL
Pesticide/Polychlorinated Biphenyls (µg/l)																	
4,4'-DDE	--	--	0.2	NA	NA	NA	0.038 J	NA	NA	0.1 U	NA	NA	NA	NA	0.1 U	0.1 U	NA
beta-BHC	--	--	0.037	NA	NA	NA	0.05 U	NA	NA	**0.063 J**	NA	NA	NA	NA	0.05 U	0.05 U	NA
delta-BHC	--	--	0.037	NA	NA	NA	0.05 U	NA	NA	0.05 U	NA	NA	NA	NA	0.05 U	0.05 U	NA
gamma-BHC (Lindane)	--	0.2	0.061	NA	NA	NA	0.018 J	NA	NA	0.05 U	NA	NA	NA	NA	0.05 U	0.05 U	NA
Heptachlor epoxide	--	0.2	0.0074	NA	NA	NA	**13**	NA	NA	**0.59**	NA	NA	NA	NA	0.05 U	0.05 U	NA
Explosives (µg/l)																	
1,3,5-Trinitrobenzene	--	--	110	0.66 U	0.12 B	200 U	4	1.6 K	2 U	0.68 J	NA	0.98 B	0.77 B	1 UL	2.5 U	2.5 U	0.98 UL
1,3-Dinitrobenzene	--	--	0.37	1.1 U	1.1 U	200 U	**2.6**	1 U	2 U	**0.74 J**	NA	0.34 J	0.37 J	1 UL	2.5 U	2.5 U	0.98 UL
2,4,6-Trinitrotoluene	--	--	1.8	0.62 U	1.1 U	**15,270 J**	**4,100**	1 U	4 U	1.2 J	NA	1 J	0.99	2 UL	2.5 U	2.5 U	0.98 UL
2-Amino-4,6-dinitrotoluene	--	--	7.3	NA	1.1 U	**4,073**	**2,300**	**7,400**	6 U	6.6	NA	5.4	5.4	3 UL	5 U	5 U	0.98 UL
2-Nitrotoluene	--	--	0.31	0.75 U	1.1 U	500 U	**17**	1 U	5 U	5 U	NA	0.95 U	0.94 U	2.5 UL	5 U	5 U	0.98 UL
3,5-Dinitroaniline	--	--	--	NA	1.1 U	NA	NA	1 U	NA	NA	NA	0.95 U	0.94 U	NA	NA	NA	0.98 UL
3-Nitrotoluene	--	--	0.37	0.91 U	1.1 U	400 U	5 U	1 U	4 U	5 U	NA	0.95 U	0.94 U	2 UL	5 U	5 U	0.98 UL
4-Amino-2,6-dinitrotoluene	--	--	7.3	1 U	1.1 U	**2,797**	**1,900**	1 U	4 U	**9.1**	NA	0.95 U	0.94 U	2 UL	5 U	5 U	0.98 UL
4-Nitrotoluene	--	--	4.2	NA	1.1 U	500 U	5 U	1 U	5 U	5 U	NA	0.95 U	0.94 U	2.5 UL	5 U	5 U	0.98 UL
HMX	--	--	180	0.61 U	1.1 U	**665**	2.5 U	1 U	2.74 J	8.2	NA	7.2	8.3	2 UL	2.5 U	2.5 U	0.98 UL
PETN	--	--	--	NA	3.3 U	NA	NA	3 U	NA	NA	NA	2.8 U	2.8 U	NA	NA	NA	2.9 UL
RDX	--	--	0.61	0.59 U	1.1 U	500 U	2.5 U	1 U	5 U	**28**	NA	**20**	**23**	2.5 UL	2.5 U	2.5 U	0.98 UL
Tetryl	--	--	15	1 U	1.1 UJ	400 U	5 U	1 U	4 U	2.3 J	NA	0.95 UJ	0.94 UJ	2 UL	5 U	5 U	0.98 UL
Total Metals (µg/l)																	
Aluminum	1,160	--	3,700	794 J	710	869	154 B	207	133 J	18.6 B	21.5 B	1,770	1,690	1,080	80.7 U	80.7 U	**4,440**
Antimony	ND	6	1.5	12.2 U	10.5 B	2.1 U	2 U	1.8 U	2.1 U	4.6 B	2 U	11.4 B	10 B	2.1 U	1.9 U	1.9 U	1.8 U
Arsenic	3.5 J	10	0.045	**2.5**	**3 J**	**13.3**	**2.9 J**	2.4 U	**17.5**	1.8 U	1.8 U	**6 J**	**5 J**	**8.2 J**	2.1 U	2.1 U	**10.2**
Barium	43.6 J	2,000	730	32.3	30.1 J	305 J	319	222	11.8 J	22.4 J	21.3 B	32.3 J	31.8 J	32.5 J	20.6 B	19.4 B	55.1 J
Beryllium	ND	4	7.3	0.1 U	0.42 UL	0.2 U	0.14 B	0.35 U	0.2 U	0.1 U	0.1 U	0.42 UL	0.42 UL	0.22 J	0.1 U	0.1 U	0.61 B
Cadmium	ND	5	1.8	1.5 U	0.64 U	0.2 U	0.61 B	**2.5 L**	0.2 U	0.23 B	0.2 U	0.64 U	0.64 U	0.6 J	0.2 U	0.2 U	0.27 UL
Chromium	4.7 L	100	0.043	**2.5**	5.2 B	**1.2 J**	0.5 U	**31.9**	**1.2 J**	0.86 B	0.5 U	9.7 B	9.6 B	**5.6 J**	0.9 U	0.9 U	**25.9**
Cobalt	ND	--	1.1	1.9 U	1.6 UL	**1.6 J**	0.95 B	**2.4 J**	0.5 U	0.88 B	0.37 B	1.6 UL	1.6 UL	**1.9 J**	0.5 U	0.5 U	**3 J**
Copper	4.5 J	1,300	150	4.8	1.5 B	3.4 J	0.5 U	2.9 B	1.1 J	0.53 B	0.5 U	2.6 B	2.6 B	2.2 J	0.6 U	0.6 U	2.4 J
Cyanide	ND	200	73	5 U	NA	**156**	**189**	NA	0.9 U	1.6 U	1.6 B	NA	NA	0.9 U	1.1 U	1.1 U	NA
Iron	2,350	--	2,600	2,120 J	**3,950**	**7,480**	**21,300**	**18,600**	1,870	25.1 B	25.3 B	**3,890**	**3,540**	**3,100**	43 U	43 U	**6,490**
Lead	ND	15	--	1.9 K	3	10.5	0.9 U	4.1 B	2.1 J	0.9 U	0.9 U	3.9	4.6	1.3 U	1.1 U	1.1 U	3.5 B
Manganese	18.4	--	88	86.2	21.1	**223**	**200**	**376**	**119**	64.4	64.9	41	38.9	**306**	**220**	**207**	**248**
Mercury	ND	2	1.1	0.2 U	0.1 U	0.17 L	0.1 UJ	0.1 U	0.17 L	0.1 UJ	0.1 U	0.1 U	0.1 U	0.15 L	0.1 UJ	0.1 UJ	0.1 U
Nickel	ND	--	73	4.3 U	1.8 B	0.95 J	3 B	29.9 J	2.7 J	1.4 B	1.38 B	5.1 J	4.9 J	6.4 J	0.6 U	0.6 U	13.8 J
Selenium	2.9 J	50	18	2.6 U	2.2 U	2.2 U	2.6 U	2.9 U	2.2 U	2.6 U	2.6 U	2.2 U	2.2 U	2.2 U	2.4 U	2.4 U	2.9 U
Vanadium	7.5 J	--	18	4.4	3.8 B	3.6 J	0.62 B	0.7 J	1.3 J	0.87 B	0.59 B	15.5 J	15.3 J	8.8 J	0.6 U	0.6 U	**21**
Zinc	14.9 J	--	1,100	36 B	8.6 J	**16,700**	**5,540**	**8,340**	**13,100**	1.8 B	1.7 B	13.4 J	12.7 J	4.8 J	4.1 U	4.1 U	25.7
Dissolved Metals (µg/l)																	

TABLE 5-1
Groundwater Exceedance Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	Yorktown Background Criteria - Yorktown-Eastover Aquifer	CLEAN MCL-Groundwater	Adjusted Tap Water RSLs	YS06-GW003		YS06-GW004			YS06-GW005	YS06-GW005B				YS06-GW006			
Aquifer				Yorktown-Eastover													
Sample ID				YS06-MW003-1194	YS06-GW03-0309	YS06-MW004-0600	YS06-MW004-1004	YS06-GW04-0309	YS06-MW005-0600	YS06-MW005B-1004	YS06-MW005BP-1004	YS06-GW05B-0309	YS06-GW05BP-0309	YS06-MW006-0600	YS06-MW006-0904	YS06-MW006P-0904	YS06-GW06-0309
Sample Date				11/09/94	03/25/09	06/23/00	10/05/04	03/31/09	06/22/00	10/04/04	10/04/04	03/26/09	03/26/09	06/23/00	09/20/04	09/20/04	03/26/09
Chemical Name																	
Aluminum, Dissolved	146 J	--	3,700	596 J	53.4 U	37 U	5.8 B	39.2 B	37 U	5.4 B	4.4 U	53.4 U	53.4 U	37 U	80.7 U	80.7 U	33 U
Antimony, Dissolved	18.5 J	6	1.5	12.2 U	2.4 U	2.1 U	2 U	1.8 U	2.1 U	2 U	2 U	2.4 U	2.4 U	2.1 U	1.9 U	1.9 U	1.8 U
Arsenic, Dissolved	ND	10	0.045	2.3 U	**2.3 L**	**3.7 J**	**5.3 J**	**20.8**	**15.8**	1.8 U	1.81 B	**4 L**	**3.6 L**	**3.3 J**	2.1 U	2.1 U	**4.5 J**
Barium, Dissolved	30.9 J	2,000	730	30.9	23.1 L	280	332	206	10.2 J	21.8 J	21.2 B	24.4 L	24.1 L	27.5 J	18.5 B	18.7 B	35.7 J
Beryllium, Dissolved	ND	4	7.3	0.1 U	0.42 UL	0.2 U	0.15 B	0.35 U	0.2 U	0.1 U	0.1 U	0.42 UL	0.42 UL	0.2 U	0.1 U	0.1 B	0.35 U
Cadmium, Dissolved	ND	5	1.8	1.5 U	0.64 U	1 J	0.2 U	1.3 J	0.2 U	0.2 U	0.2 U	0.64 U	0.64 U	0.2 U	0.2 U	0.2 U	0.27 U
Chromium, Dissolved	ND	100	0.043	1.8 U	0.7 U	**2.4 J**	0.5 U	**1.9 J**	0.4 U	0.5 U	0.5 U	0.7 U	0.7 U	0.4 U	0.9 U	0.9 U	0.64 U
Cobalt, Dissolved	ND	--	1.1	1.9 U	1.6 U	0.5 U	1.2 B	**1.9 J**	0.5 U	0.71 B	0.59 B	1.6 U	1.6 U	**1.2 J**	0.5 U	0.5 U	**1.3 J**
Copper, Dissolved	4 J	1,300	150	14.6	0.84 UL	0.78 J	0.5 U	0.88 U	1.2 J	0.5 U	0.5 U	0.84 UL	0.84 UL	1.6 J	0.6 U	0.6 U	0.88 U
Iron, Dissolved	5.8 J	--	2,600	794 J	236	14.3 U	**11,000**	**6,420**	380	10.7 U	10.7 U	24.6 U	24.6 U	20.9 J	43 U	43 U	172
Lead, Dissolved	ND	15	--	2.1 K	1.4 UL	1.3 U	0.9 U	1.8 UL	1.3 U	0.9 U	0.9 U	1.4 UL	1.4 UL	1.3 U	1.1 U	1.1 U	1.8 UL
Manganese, Dissolved	12.2 J	--	88	**110 J**	9.4 J	**206**	**187**	**346**	**126**	56.2	55.9	8.5 J	12.3	**298**	**199**	**201**	**188**
Mercury, Dissolved	ND	2	1.1	0.2 U	0.1 U	0.18 L	0.1 UJ	0.1 UL	0.14 L	0.1 UJ	0.1 U	0.1 U	0.1 U	0.15 L	0.1 UJ	0.1 UJ	0.1 UL
Nickel, Dissolved	ND	--	73	4.3 U	0.94 B	3.1 J	1.3 B	12.7 J	1.9 B	0.91 B	0.63 B	1.5 B	0.67 U	3.2 B	1.6 J	1.5 J	3.1 L
Selenium, Dissolved	3.9 K	50	18	2.6 U	2.4 B	2.2 U	2.6 U	**28**	2.2 U	2.6 U	2.6 U	3.3 L	4 L	2.2 U	2.4 U	2.4 U	2.9 U
Silver, Dissolved	ND	--	18	2 U	0.62 UL	0.6 U	0.7 U	0.33 U	0.6 U	0.7 U	0.7 U	0.62 UL	0.62 UL	0.6 U	0.8 U	0.8 U	0.35 B
Thallium, Dissolved	ND	2	0.24	4 U	**4.1 L**	**4.2 J**	1.9 U	3.7 U	3.2 U	3 B	1.9 U	3.3 UL	3.3 UL	3.2 U	2.8 U	2.8 U	3.7 U
Vanadium, Dissolved	6.3 J	--	18	1.4 U	0.57 UL	0.4 U	0.4 U	0.46 U	0.56 J	0.73 B	0.4 U	0.57 UL	0.87 B	0.56 J	0.6 U	0.6 U	0.52 J
Zinc, Dissolved	5.9 J	--	1,100	**1,740 J**	5.2 U	**20,000**	**1,980**	**5,290**	**13,300**	0.7 U	0.7 U	5.2 U	5.2 U	53.5	4.1 U	4.1 U	3.9 B
Wet Chemistry																	
Alkalinity (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ammonia (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethane (ug/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethene (ug/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methane (ug/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate/Nitrite (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	--	--	--	250	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total suspended solids (TSS) (mg/l)	--	--	--	230	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	--																
Dechlorinating Bacteria (cells/ml)	--																
Dehalococcoides	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed MCLs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed both MCLs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

NJ - Qualitative identification questionable due to poor resolution, presumptively present at approximate quantity

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

cells/ml - Cells per milliliter

mg/l - Milligrams per liter

µg/l - Micrograms per liter

TABLE 5-1
Groundwater Exceedance Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	Yorktown Background Criteria - Yorktown-Eastover Aquifer	CLEAN MCL-Groundwater	Adjusted Tap Water RSLs	YS06-GW006B		YS06-GW007		YS06-GW008				YS06-GW009		YS06-GW009A		YS06-GW009B	
Aquifer				Yorktown-Eastover													
Sample ID				YS06-MW006B-1004	YS06-GW06B-0309	YS06-MW007-1004	YS06-GW07-0309	YS06-MW008-1004	YS06-MW008-0305	YS06-MW008P-0305	YS06-GW08-0309	YS06-MW009-1004	YS06-GW09-0309	YS06-MW009A-1004	YS06-GW09A-0309	YS06-MW009B-1004	YS06-GW09B-0409
Sample Date				10/07/04	03/26/09	10/07/04	03/26/09	10/05/04	03/17/05	03/17/05	03/31/09	10/05/04	03/25/09	10/05/04	03/25/09	10/07/04	04/03/09
Chemical Name																	
Volatile Organic Compounds (µg/l)																	
1,1,1-Trichloroethane	--	200	910	10 U	0.5 U	10 U	0.5 U	5,000 U	0.5 U	0.5 U	0.5 U	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
1,1-Dichloroethane	--	--	2.4	10 U	0.5 U	10 U	0.5 U	5,000 U	0.5 U	0.5 U	0.5 U	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
1,1-Dichloroethene	--	7	34	10 U	0.5 U	10 U	0.1 J	5,000 U	5.9 K	5.6 K	9.2	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
1,2,4-Trichlorobenzene	--	70	0.41	10 U	0.5 U	10 U	0.5 U	5,000 U	0.5 U	0.5 U	0.5 U	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
1,2-Dichloroethane	--	5	0.15	10 U	0.5 U	10 U	0.5 U	5,000 U	0.26 K	0.24 K	0.25 J	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
1,2-Dichloroethene (total)	--	70	33	NA	0.5 U	NA	1	NA	NA	NA	1,400	NA	0.11 J	NA	0.5 U	NA	0.5 U
2-Butanone	--	--	710	10 U	2.5 R	10 U	2.5 R	5,000 U	5 U	5 U	2.5 R	10 U	2.5 R	10 U	2.5 R	10 U	2.5 R
2-Hexanone	--	--	4.7	10 U	2.5 U	10 U	2.5 U	5,000 U	5 U	5 U	2.5 U	10 U	2.5 U	10 U	2.5 U	10 U	2.5 U
Benzene	--	5	0.41	10 U	0.5 U	10 U	0.5 U	5,000 U	0.5 U	0.5 U	0.5 U	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
Carbon disulfide	--	--	100	10 U	0.5 U	10 U	0.5 U	5,000 U	0.17 K	0.23 K	0.39 J	10 U	0.5 U	10 U	0.5 U	10 U	0.25 J
Chloroethane	--	--	2,100	10 U	0.5 U	10 U	0.5 U	5,000 U	0.5 U	0.5 U	0.5 U	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
Chloroform	--	80	0.19	10 U	0.5 U	10 U	0.5 U	5,000 U	0.5 U	0.5 U	0.5 U	10 U	0.11 B	10 U	0.5 U	10 U	0.5 U
Chloromethane	--	--	19	10 U	0.5 U	10 U	0.1 B	5,000 U	0.5 U	0.17 K	0.62 B	10 U	0.18 B	10 U	0.22 B	10 U	0.5 U
cis-1,2-Dichloroethene	--	70	37	10 U	0.5 U	10 U	1.1	5,000 U	550 J	530 J	1,400	10 U	0.11 J	10 U	0.5 U	10 U	0.5 U
cis-1,3-Dichloropropene	--	--	0.43	10 U	0.5 U	10 U	0.5 U	5,000 U	0.15 K	0.17 B	0.5 U	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
Ethylbenzene	--	700	1.5	10 U	0.5 U	10 U	0.5 U	5,000 U	0.5 U	0.5 U	0.5 U	10 U	0.5 U	10 U	0.5 U	10 U	0.3 J
Isopropylbenzene	--	--	68	10 U	0.5 U	10 U	0.5 U	5,000 U	0.5 U	0.5 U	0.5 U	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
Methyl acetate	--	--	3,700	10 U	0.5 U	10 U	0.5 U	5,000 U	0.5 UJ	0.5 UJ	0.5 U	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
Methylcyclohexane	--	--	--	10 U	0.5 U	10 U	0.5 U	5,000 U	0.5 U	0.5 U	0.5 U	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
Methylene chloride	--	5	4.8	10 U	0.5 U	10 U	0.5 U	5,000 U	0.34 B	0.31 B	0.23 J	10 U	0.5 U	3 J	0.5 U	10 U	0.5 U
Methyl-tert-butyl ether (MTBE)	--	--	13	10 U	0.5 U	10 U	0.5 U	5,000 U	0.5 U	0.5 U	0.5 U	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
o-Xylene	--	--	120	NA	0.5 U	NA	0.5 U	NA	NA	NA	0.5 U	NA	0.5 U	NA	0.5 U	NA	0.5 U
Tetrachloroethene	--	5	0.11	10 U	0.5 U	10 U	0.5 U	5,000 U	0.5 U	0.5 U	0.5 U	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
trans-1,2-Dichloroethene	--	100	11	10 U	0.5 U	10 U	0.5 U	5,000 U	7.7 K	7.3 K	28 J	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
Trichloroethene	--	5	2	10 U	0.5 U	3 J	1.8	36,000	17,000 J	19,000 J	22,000	10 U	0.87	3 J	0.5 U	10 U	0.5 U
Vinyl chloride	--	2	0.016	10 U	0.5 U	10 U	0.5 U	5,000 U	8 K	7.8 K	9.3	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
Xylene, total	--	10,000	20	10 U	0.5 U	10 U	0.5 U	5,000 U	0.5 U	0.5 U	0.5 U	10 U	0.5 U	10 U	0.5 U	10 U	0.5 U
Semivolatile Organic Compounds (µg/l)																	
2,4-Dinitrotoluene	--	--	0.22	2.5 U	0.95 U	17	6.4	2.5 U	2.5 U	2.5 U	0.98 U	130	51 K	2.5 U	1 U	2.5 U	1.1 U
bis(2-Ethylhexyl)phthalate	--	6	4.8	10 U	NA	3 J	NA	13	10 U	10 U	NA	6 J	NA	10 U	NA	10 U	NA
Nitrobenzene	--	--	0.12	2.5 U	0.95 U	2.5 U	1 U	2.5 U	2.5 U	2.5 U	0.98 U	2.5 U	0.98 U	2.5 U	1 U	2.5 U	1.1 U
Pesticide/Polychlorinated Biphenyls (µg/l)																	
4,4'-DDE	--	--	0.2	0.1 U	NA	0.1 U	NA	0.1 U	0.1 U	0.1 U	NA	0.1 U	NA	0.1 U	NA	0.1 U	NA
beta-BHC	--	--	0.037	0.013 J	NA	0.036 J	NA	0.05 U	0.05 U	0.05 U	NA	0.26 J	NA	0.036 J	NA	0.036 J	NA
delta-BHC	--	--	0.037	0.05 U	NA	0.05 U	NA	0.05 U	0.05 U	0.05 U	NA	0.016 J	NA	0.05 U	NA	0.05 U	NA
gamma-BHC (Lindane)	--	0.2	0.061	0.05 U	NA	0.05 U	NA	0.05 U	0.05 U	0.05 U	NA	0.05 U	NA	0.05 U	NA	0.05 U	NA
Heptachlor epoxide	--	0.2	0.0074	0.05 U	NA	0.029 B	NA	0.05 U	0.05 U	0.05 U	NA	1.2	NA	0.05 U	NA	0.05 U	NA
Explosives (µg/l)																	
1,3,5-Trinitrobenzene	--	--	110	2.5 U	0.088 B	2.5 U	0.36 B	2.5 U	2.5 U	2.5 U	0.98 UL	1.9 J	0.98 U	2.5 U	1 U	2.5 U	0.11 B
1,3-Dinitrobenzene	--	--	0.37	2.5 U	0.95 U	2.5 U	1 U	2.5 U	2.5 U	2.5 U	0.98 U	57	18 K	2.5 U	1 U	2.5 U	1.1 U
2,4,6-Trinitrotoluene	--	--	1.8	2.5 U	0.3 J	2.5 U	0.11 J	2.5 U	2.5 U	2.5 U	0.98 U	2.5 U	0.98 U	2.5 U	1 U	2.5 U	1.1 U
2-Amino-4,6-dinitrotoluene	--	--	7.3	5 U	0.44 J	5 U	0.24 J	5 U	5 U	5 U	0.98 U	16	5 K	5 U	1 U	5 U	1.1 U
2-Nitrotoluene	--	--	0.31	5 U	0.95 U	5 U	1 U	5 U	5 U	5 U	0.98 U	5 U	0.98 U	5 U	1 U	5 U	1.1 U
3,5-Dinitroaniline	--	--	--	NA	0.95 U	NA	1 U	NA	NA	NA	0.98 U	NA	0.78 J	NA	1 U	NA	1.1 U
3-Nitrotoluene	--	--	0.37	5 U	0.95 U	5 U	1 U	5 U	5 U	5 U	0.98 U	5 U	0.98 U	5 U	1 U	5 U	1.1 U
4-Amino-2,6-dinitrotoluene	--	--	7.3	5 U	0.95 U	5 U	1 U	5 U	5 U	5 U	0.98 U	17	0.98 U	5 U	1 U	5 U	1.1 U
4-Nitrotoluene	--	--	4.2	5 U	0.95 U	5 U	1 U	5 U	5 U	5 U	0.98 U	5 U	0.98 U	5 U	1 U	5 U	1.1 U
HMX	--	--	180	2.5 U	0.95 U	2.5 U	0.1 B	2.5 U	2.5 U	2.5 U	0.98 U	2.5 U	4.1 K	2.5 U	1 U	2.5 U	1.1 U
PETN	--	--	--	NA	2.8 U	NA	3 U	NA	NA	NA	2.9 U	NA	2.9 U	NA	3 U	NA	3.3 U
RDX	--	--	0.61	2.5 U	0.95 U	2.5 U	0.32 J	2.5 U	2.5 U	2.5 U	0.98 U	84	70 K	2.5 U	0.13 B	2.5 U	1.1 U
Tetryl	--	--	15	5 U	0.95 UJ	5 U	1 UJ	5 U	5 U	5 U	0.98 U	5 U	0.98 UJ	5 U	1 UJ	5 U	1.1 U
Total Metals (µg/l)																	
Aluminum	1,160	--	3,700	600	602	56.9 B	1,050	226	97.1 B	88.5 B	57.3 B	12.9 B	54.2 J	364	131 J	3,770	68,000
Antimony	ND	6	1.5	2.7 B	1.8 U	2.3 B	9.9 B	2.5 B	3.9 B	2.1 U	1.8 U	2 U	9.6 B	2 U	8.8 B	2.3 B	5.2 J
Arsenic	3.5 J	10	0.045	1.8 U	2.4 U	1.8 U	5.4 J	1.8 U	2.1 U	2.1 U	2.4 U	1.8 U	3.1 J	1.8 U	2.8 J	2.9 J	37.2
Barium	43.6 J	2,000	730	53.1 J	55.6 J	49.8 J	43.8 J	30.3 J	26.6 B	27 B	32.8 J	57.7 J	59.3 J	59.4 J	96.5 J	33.1 J	137 J
Beryllium	ND	4	7.3	0.36 B	0.35 U	0.1 U	0.42 UL	0.1 U	0.1 U	0.1 U	0.35 U	0.1 U	0.42 UL	0.1 U	0.42 UL	0.28 B	4.7 J
Cadmium	ND	5	1.8	0.34 B	0.27 UL	0.24 B	0.64 U	0.2 U	0.3 U	0.3 U	0.27 UL	0.23 B	0.64 U	0.2 U	0.64 U	0.23 B	0.27 UL
Chromium	4.7 L	100	0.043	3.3 B	3.6 J	0.52 B	6.3 B	1.5 B	0.63 B	0.6 U	0.8 B	0.5 U	2 B	2.5 B	3.9 B	18.9 B	353
Cobalt	ND	--	1.1	3.3 B	0.58 U	0.81 B	1.6 UL	0.3 U	0.6 U	0.6 U	0.58 U	1.6 B	2.5 UL	0.38 B	1.6 UL	3.2 B	29.6
Copper	4.5 J	1,300	150	1.9 B	0.98 J	0.5 U	2.1 B	0.52 B	0.4 U	0.4 U	0.88 U	0.5 U	0.84 U	0.5 U	1.1 B	1.9 B	53.8
Cyanide	ND	200	73	1.6 U	NA	1.6 U	NA	1.6 U	0.8 U	0.8 U	NA	2.4 B	NA	1.6 U	NA	1.6 U	NA
Iron	2,350	--	2,600	2,550	5,710	66.3 B	2,360	1,010 B	700	689	307	10.7 U	562	822 B	298	6,320	137,000
Lead	ND	15	--	0.9 U	3.4 B	0.9 U	2.9 J	0.9 U	1.3 U	1.3 U	1.8 B	0.9 U	3.3	0.9 U	2.5 J	1.1 B	45.5
Manganese	18.4	--	88	45.4	35.3	169	89.7	58.4	55.1	55.5	53.2	97	125	204	12.8	324	474
Mercury	ND	2	1.1	0.1 UJ	0.1 U	0.1 UJ	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U	0.1 UJ	0.1 U	0.1 UJ	0.1 U	0.1 UJ	0.1 U
Nickel	ND	--	73	3.5 B	1.1 U	2.3 B	4.9 J	0.5 U	0.8 U	0.8 U	1.1 U	1.1 B	2.7 B	1 B	1.9 B	6.9 B	104
Selenium	2.9 J	50	18	2.6 U	2.9 U	2.6 U	2.2 U	2.6 U	2.7 U	2.7 U	2.9 U	2.6 U	2.2 U	2.6 U	2.2 U	2.6 U	2.9 U
Vanadium	7.5 J	--	18	5.3 J	2.1 J	0.71 B	6.9 J	0.8 B	0.5 U	0.5 U	0.46 U	0.64 B	1.3 B	1.1 B	1.5 B	11.2 J	198
Zinc	14.9 J	--	1,100	6.3 B	10.2 B	2.6 B	15.1 J	6 B	1.6 B	1.5 B	7 B	2.9 B	5.2 U	5 B	6.4 J	39.6	496
Dissolved Metals (µg/l)																	

TABLE 5-1
Groundwater Exceedance Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	Yorktown Background Criteria - Yorktown-Eastover Aquifer	CLEAN MCL-Groundwater	Adjusted Tap Water RSLs	YS06-GW006B		YS06-GW007		YS06-GW008				YS06-GW009		YS06-GW009A		YS06-GW009B	
Aquifer				Yorktown-Eastover													
Sample ID				YS06-MW006B-1004	YS06-GW06B-0309	YS06-MW007-1004	YS06-GW07-0309	YS06-MW008-1004	YS06-MW008-0305	YS06-MW008P-0305	YS06-GW08-0309	YS06-MW009-1004	YS06-GW09-0309	YS06-MW009A-1004	YS06-GW09A-0309	YS06-MW009B-1004	YS06-GW09B-0409
Sample Date				10/07/04	03/26/09	10/07/04	03/26/09	10/05/04	03/17/05	03/17/05	03/31/09	10/05/04	03/25/09	10/05/04	03/25/09	10/07/04	04/03/09
Chemical Name																	
Aluminum, Dissolved	146 J	--	3,700	5.2 B	33 U	4.4 U	53.4 U	9.3 B	29.1 B	24.3 U	33 U	20.1 B	53.4 U	8.2 B	53.4 U	7.5 B	1,280
Antimony, Dissolved	18.5 J	6	1.5	2 U	1.8 U	2 U	2.4 U	2 U	2.5 U	2.5 U	1.8 U	2 U	2.4 U	2 U	2.4 U	2 U	1.8 U
Arsenic, Dissolved	ND	10	0.045	1.8 U	**5.5 J**	1.8 U	**3.3 L**	1.8 U	3.6 U	3.6 U	**5.7 J**	1.8 U	2.2 UL	**2 J**	**6.2 L**	**3 J**	**5.9 J**
Barium, Dissolved	30.9 J	2,000	730	38.3 J	49.4 J	50.6 J	37.4 L	30.4 J	35.6 J	34 J	32 J	59 J	55.9 UL	58.1 J	63.4 L	24.2 J	30.1 J
Beryllium, Dissolved	ND	4	7.3	0.1 U	0.35 U	0.1 U	0.42 UL	0.1 U	0.32 B	0.28 B	0.35 U	0.1 B	0.42 UL	0.1 U	0.42 UL	0.1 U	0.42 B
Cadmium, Dissolved	ND	5	1.8	0.2 U	0.27 U	0.2 U	0.64 U	0.2 U	0.3 U	0.3 U	0.27 U	0.2 U	0.64 U	0.2 U	0.64 U	0.2 U	0.95 J
Chromium, Dissolved	ND	100	0.043	0.5 U	0.64 U	0.5 U	0.7 U	0.5 U	0.9 U	0.9 U	0.64 U	0.5 U	0.7 U	0.5 U	0.7 U	0.5 U	**5.6 J**
Cobalt, Dissolved	ND	--	1.1	0.87 B	0.58 U	0.93 B	1.6 U	0.3 B	0.6 U	0.6 U	0.58 U	2 B	1.6 U	0.82 B	1.6 U	5.4 B	**2.4 J**
Copper, Dissolved	4 J	1,300	150	0.5 U	0.88 U	0.5 U	0.84 UL	0.5 U	0.5 U	0.5 U	0.88 U	0.5 U	0.84 UL	0.5 U	4.1 UL	0.5 U	4.6 J
Iron, Dissolved	5.8 J	--	2,600	1,760	1,590	10.7 U	24.6 U	647 B	646	631	194	10.7 U	254	217 B	24.6 U	10.7 U	**6,390**
Lead, Dissolved	ND	15	--	0.9 U	1.8 UL	0.9 U	1.4 UL	0.9 U	1.7 U	1.7 U	1.8 UL	1.1 B	1.4 UL	0.9 U	1.4 UL	0.9 U	3.4 L
Manganese, Dissolved	12.2 J	--	88	42.9	27.8	**157**	45.8	59.2	56.1	54	49.2	**103**	**119**	**200**	8.7 J	**287**	**125**
Mercury, Dissolved	ND	2	1.1	0.1 UJ	0.18 L	0.1 UJ	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 UL	0.1 UJ	0.1 U	0.1 UJ	0.1 U	0.1 UJ	0.1 UL
Nickel, Dissolved	ND	--	73	0.5 U	1.1 UL	1.8 B	1.8 B	0.5 U	1 U	1 U	1.1 UL	0.86 B	1.6 B	0.5 U	1.3 B	1.8 B	6.9 L
Selenium, Dissolved	3.9 K	50	18	2.6 U	7.8 B	2.6 U	3 L	2.6 U	3.9 U	3.9 U	8.1	2.6 U	2.2 R	2.6 U	2.2 R	2.6 U	2.9 U
Silver, Dissolved	ND	--	18	0.7 U	0.33 U	0.7 U	0.62 UL	0.7 U	0.7 U	0.7 U	0.45 B	0.7 U	0.62 UL	0.7 U	0.62 UL	0.7 U	0.33 U
Thallium, Dissolved	ND	2	0.24	1.9 U	3.7 U	1.9 U	3.7 B	1.9 U	6.2 U	6.2 U	3.7 U	1.9 U	3.3 UL	1.9 U	3.3 UL	1.9 U	3.7 U
Vanadium, Dissolved	6.3 J	--	18	0.4 U	0.46 U	0.48 B	0.62 B	0.4 U	0.4 U	0.4 U	0.46 U	0.79 B	0.78 B	0.4 U	0.9 B	0.4 U	4.3 J
Zinc, Dissolved	5.9 J	--	1,100	0.7 U	4.6 B	0.7 U	6 J	0.7 U	3.6 U	3.6 U	3.7 B	0.7 U	5.2 U	0.7 U	9.7 J	0.7 U	45.3
Wet Chemistry																	
Alkalinity (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	288	NA	NA	NA	NA	NA	NA
Ammonia (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	26 D	NA	NA	NA	NA	NA	NA
Ethane (ug/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	2 U	NA	NA	NA	NA	NA	NA
Ethene (ug/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	0.8 J	NA	NA	NA	NA	NA	NA
Methane (ug/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	61 BD	NA	NA	NA	NA	NA	NA
Nitrate/Nitrite (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	14 JD	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	0.72 J	NA	NA	NA	NA	NA	NA
Total suspended solids (TSS) (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	--																
Dechlorinating Bacteria (cells/ml)	--																
Dehalococcoides	--	--	--	NA	NA	NA	NA	NA	NA	NA	19	NA	NA	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed MCLs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed both MCLs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

NJ - Qualitative identification questionable due to poor resolution, presumptively present at approximate quantity

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

cells/ml - Cells per milliliter

mg/l - Milligrams per liter

µg/l - Micrograms per liter

TABLE 5-1
Groundwater Exceedance Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	Yorktown Background Criteria - Yorktown-Eastover Aquifer	CLEAN MCL-Groundwater	Adjusted Tap Water RSLs	YS06-GW010		YS06-GW010A		YS06-GW011	YS06-GW012		YS06-GW012A	YS06-GW013	YS06-GW013A	YS06-GW014	YS06-GW015	YS06-GW016	YS06-GW017	YS06-GW018	
Aquifer				Yorktown-Eastover															
Sample ID				YS06-MW010-1004	YS06-GW10-0309	YS06-MW010A-1004	YS06-GW10A-0309	YS06-GW11-0309	YS06-GW12-0409	YS06-GW12P-0409	YS06-GW12A-0409	YS06-GW13-0409	YS06-GW13A-0409	YS06-GW14-0309	YS06-GW15-0309	YS06-GW16-0609	YS06-GW17-0709	YS06-GW18-0709	YS06-GW18P-0709
Sample Date				10/04/04	03/24/09	10/05/04	03/24/09	03/24/09	04/02/09	04/02/09	04/01/09	04/01/09	04/01/09	03/31/09	03/31/09	06/30/09	07/14/09	07/09/09	07/09/09
Chemical Name																			
Volatile Organic Compounds (µg/l)																			
1,1,1-Trichloroethane	--	200	910	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	--	--	2.4	10 U	0.5 U	10 U	0.5 U	0.5 U	1.4 J	1.2 J	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	--	7	34	10 U	0.5 U	10 U	0.5 U	0.5 U	7.4	6.2	0.5 U	8,300 U	130 UL	0.91	0.65	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	--	70	0.41	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	--	5	0.15	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethene (total)	--	70	33	NA	0.5 U	NA	0.5 U	0.5 U	61	59	1.1	7,700 J	4,600 L	63	86	0.25 J	0.5 U	0.5 U	0.12 J
2-Butanone	--	--	710	10 U	2.5 R	10 U	2.5 R	2.5 R	8.9 R	10 R	2.5 R	42,000 R	630 R	2.5 R	86 L	2.5 R	15 B	2.5 U	2.5 U
2-Hexanone	--	--	4.7	10 U	2.5 U	10 U	2.5 U	2.5 U	8.9 U	10 U	2.5 U	42,000 U	630 UL	2.5 U	2.5 U	2.5 U	1.4 J	2.5 U	2.5 U
Benzene	--	5	0.41	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Carbon disulfide	--	--	100	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.63	8,300 U	130 UL	0.61	0.12 J	0.5 U	0.22 J	0.5 U	0.5 U
Chloroethane	--	--	2,100	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloroform	--	80	0.19	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Chloromethane	--	--	19	10 U	0.3 B	10 U	0.22 B	0.23 B	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.19 B	0.14 B	0.5 U	0.21 J	0.5 U	0.5 U
cis-1,2-Dichloroethene	--	70	37	10 U	0.5 U	10 U	0.5 U	0.5 U	60	58	1.1	7,800 J	4,700 L	63	88	0.25 J	0.5 U	0.5 U	0.12 J
cis-1,3-Dichloropropene	--	--	0.43	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	--	700	1.5	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Isopropylbenzene	--	--	68	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methyl acetate	--	--	3,700	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	1.3	0.5 U	0.5 U
Methylcyclohexane	--	--	--	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Methylene chloride	--	5	4.8	3 J	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.13 B	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.16 B	0.1 B	0.1 B
Methyl-tert-butyl ether (MTBE)	--	--	13	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.11 J	0.5 U	0.5 U
o-Xylene	--	--	120	NA	0.5 U	NA	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethene	--	5	0.11	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	3,000 J	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
trans-1,2-Dichloroethene	--	100	11	10 U	0.5 U	10 U	0.5 U	0.5 U	1.2 J	1.3 J	0.5 U	8,300 U	130 UL	1.9	3.1	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	--	5	2	1 J	0.5 U	10 U	0.5 U	0.5 U	76 J	75	0.72	280,000	3,000 L	1,700	1,600	1.9	0.5 U	0.84	0.94
Vinyl chloride	--	2	0.016	10 U	0.5 U	10 U	0.5 U	0.5 U	0.73 J	0.7 J	0.5 U	8,300 U	73 L	2	0.86	0.5 U	0.5 U	0.5 U	0.5 U
Xylene, total	--	10,000	20	10 U	0.5 U	10 U	0.5 U	0.5 U	1.8 U	2.1 U	0.5 U	8,300 U	130 UL	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Semivolatile Organic Compounds (µg/l)																			
2,4-Dinitrotoluene	--	--	0.22	2.5 U	0.98 U	2.5 U	0.94 U	1 U	1 U	1 U	1.2 U	1 UL	0.98 U	1 U	1 U	7.5 J	0.38 UJ	0.38 UJ	0.38 UJ
bis(2-Ethylhexyl)phthalate	--	6	4.8	10 U	NA	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	--	--	0.12	2.5 U	0.98 U	2.5 U	0.94 U	1 U	1 U	1	1.2 U	1 UL	0.98 U	1 U	1 U	0.28 J	1.4 K	0.54 B	0.58 B
Pesticide/Polychlorinated Biphenyls (µg/l)																			
4,4'-DDE	--	--	0.2	0.1 U	NA	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
beta-BHC	--	--	0.037	0.05 U	NA	0.028 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
delta-BHC	--	--	0.037	0.05 U	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
gamma-BHC (Lindane)	--	0.2	0.061	0.05 U	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	--	0.2	0.0074	0.062	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (µg/l)																			
1,3,5-Trinitrobenzene	--	--	110	2.5 U	8.9	2.5 U	0.064 B	0.056 B	0.11 B	1 UL	1.2 UL	1 UL	0.98 UL	1 UL	1 UL	0.38 U	0.38 J	0.38 U	0.38 U
1,3-Dinitrobenzene	--	--	0.37	2.5 U	0.98 U	2.5 U	0.94 U	1 U	1 U	1 U	1.2 U	1 UL	0.98 U	1 U	1 U	0.38 U	0.11 B	0.45 J	0.44 J
2,4,6-Trinitrotoluene	--	--	1.8	0.95 J	1.3	2.5 U	0.94 U	1 U	1 U	1 U	0.21 J	1 UL	0.98 U	1 U	1 U	0.14 B	0.38 U	0.38 U	0.38 U
2-Amino-4,6-dinitrotoluene	--	--	7.3	5 U	0.7 J	5 U	0.94 U	1 U	1 U	1 U	1.2 U	1 UL	0.98 U	1 U	1 U	0.18 J	0.38 U	0.38 U	0.38 U
2-Nitrotoluene	--	--	0.31	5 U	0.98 U	5 U	0.94 U	0.052 J	1 U	1 U	1.2 U	1 UL	0.98 U	1 U	1 U	0.38 U	0.38 U	0.38 U	0.38 U
3,5-Dinitroaniline	--	--	--	NA	0.59 J	NA	0.94 U	1 U	1 U	1 U	1.2 U	1 UL	0.98 U	1 U	1 U	0.61	0.1 J	0.38 U	0.38 U
3-Nitrotoluene	--	--	0.37	5 U	0.98 U	5 U	0.94 U	1 U	1 U	1 U	1.2 U	1 UL	0.98 U	1 U	1 U	0.38 U	2.7	0.38 U	0.38 U
4-Amino-2,6-dinitrotoluene	--	--	7.3	5 U	0.98 U	5 U	0.94 U	1 U	1 U	1 U	1.2 U	1 UL	0.98 U	1 U	1 U	0.17 J	0.38 J	0.38 UJ	0.38 UJ
4-Nitrotoluene	--	--	4.2	5 U	0.98 U	5 U	0.94 U	1 U	1 U	1 U	1.2 U	1 UL	0.98 U	1 U	1 U	5.9 K	0.38 U	0.2 B	0.25 B
HMX	--	--	180	2.5 U	0.98 U	2.5 U	0.94 U	1 U	0.47 J	0.52 J	1.2 U	1 UL	0.98 U	1 U	1 U	0.38 U	0.38 U	0.38 U	0.38 U
PETN	--	--	--	NA	2.9 U	NA	2.8 U	3 U	6 U	3 U	3.5 U	3.2 UL	2 J	3 U	3 U	2.8 U	2.8 U	2.8 U	2.8 U
RDX	--	--	0.61	2.5 U	0.1 J	2.5 U	0.94 U	0.56 J	0.91 J	0.9 J	1.2 U	1 UL	0.28 B	1 U	1 U	0.19 K	0.1 B	0.38 U	0.38 U
Tetryl	--	--	15	5 U	0.98 UJ	5 U	0.94 UJ	1 UJ	1 U	1 U	1.2 U	1 UL	0.98 U	1 U	1 U	0.38 U	0.38 UJ	0.38 UJ	0.38 UJ
Total Metals (µg/l)																			
Aluminum	1,160	--	3,700	70.3 B	1,790	49.3 B	363	123 J	700 J	449 J	167 B	649	1,780	650	422	500	5,630	551 B	1,390 J
Antimony	ND	6	1.5	2 U	5.2 J	2.1 B	4.3 J	3.9 J	1.8 U	1.8 U	1.8 U	1.8 U	2 J	1.8 U	1.8 U	2.3 B	10 U	10 U	1.9 J
Arsenic	3.5 J	10	0.045	1.8 U	2.3 J	1.8 U	2.2 U	2.2 U	7.1 J	6.3 J	2.4 U	2.4 U	2.4 U	2.4 U	2.4 U	10 UL	10 U	10 U	10 U
Barium	43.6 J	2,000	730	29.4 J	40.6 J	24 J	24.2 J	32.4 J	37.1 J	36.6 J	28 J	29.6 J	35.6 J	24.2 J	35 J	49.6 J	36.9 J	44.9 J	50.1 J
Beryllium	ND	4	7.3	0.1 U	0.57 B	0.1 U	0.42 U	0.42 U	0.44 B	0.35 U	0.35 U	0.35 U	0.44 B	0.35 U	0.35 U	5 U	0.98 B	0.8 B	0.88 B
Cadmium	ND	5	1.8	0.2 U	0.64 U	0.2 U	0.64 U	0.64 U	0.27 UL	0.27 UL	0.27 UL	0.27 UL	0.27 UL	0.27 UL	0.27 UL	5 UL	5 U	5 U	5 U
Chromium	4.7 L	100	0.043	0.68 B	7.5 J	0.5 U	2.5 J	1.6 J	2.5 B	2.7 B	2.4 B	9.4 B	28.9	2.5 B	4 B	1.4 B	26.3	3.1 B	8.4 B
Cobalt	ND	--	1.1	0.3 U	1.6 U	0.38 B	1.6 U	1.6 U	0.58 U	0.58 U	1.1 J	2.6 J	1.5 J	0.58 U	0.58 U	5 U	1.3 J	5 U	5 U
Copper	4.5 J	1,300	150	0.5 U	0.84 U	0.5 U	0.84 U	0.84 U	0.88 U	0.88 U	1.3 J	3.6 J	5.5	1.9 B	0.95 B	5 UL	10.2	5 UL	5 UL
Cyanide	ND	200	73	1.6 U	NA	1.6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	2,350	--	2,600	147 B	3,050	923 B	2,470	3,860	2,560	2,440	3,270	3,290	9,900	1,440	1,230	1,110	9,960	1,310 B	4,520 J
Lead	ND	15	--	0.9 U	2.6 J	0.9 U	1.4 U	1.4 U	2.4 B	2 B	2.1 B	3.2	5.2 B	13.3 B	2.8 B	5.2 B	79.9	4.7 B	6 B
Manganese	18.4	--	88	6.7 J	64	59.3	17.7	120	137	140	80.8	110	148	36.8	82.9	148	129	46.1	54.1
Mercury	ND	2	1.1	0.1 UJ	0.1 U	0.1 UJ	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	0.2 UL	0.2 UL	0.2 UL
Nickel	ND	--	73	0.94 B	6.5 J	1.1 B	1.8 J	1.1 J	3.5 J	4 J	31.8 J	125	30.5 J	1.1 U	1.1 J	40 UL	10.6 J	40 U	1.6 J
Selenium	2.9 J	50	18	2.6 U	2.2 U	2.6 U	2.2 U	2.2 U	3.4 J	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	2.9 U	5 U	5 U	5 U	5.4 B
Vanadium	7.5 J	--	18	0.84 B	9.2 J	0.4 U	1.7 J	0.57 U	3.5 J	3 J	0.88 J	1.6 J	5.4 J	1.9 J	0.93 J	1.9 B	11.6 J	2.1 B	5.5 J
Zinc	14.9 J	--	1,100	2.1 B	10.2 J	3.4 B	11.8 J	5.2 U	4.6 B	11.1 B	5 B	16.3 B	40.2	1,480	4,140	48.3	38,700	27 B	28.1 B
Dissolved Metals (µg/l)																			

TABLE 5-1
Groundwater Exceedance Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	Yorktown Background Criteria - Yorktown-Eastover Aquifer	CLEAN MCL-Groundwater	Adjusted Tap Water RSLs	YS06-GW010		YS06-GW010A		YS06-GW011	YS06-GW012		YS06-GW012A	YS06-GW013	YS06-GW013A	YS06-GW014	YS06-GW015	YS06-GW016	YS06-GW017	YS06-GW018	
Aquifer				Yorktown-Eastover															
Sample ID				YS06-MW010-1004	YS06-GW10-0309	YS06-MW010A-1004	YS06-GW10A-0309	YS06-GW11-0309	YS06-GW12-0409	YS06-GW12P-0409	YS06-GW12A-0409	YS06-GW13-0409	YS06-GW13A-0409	YS06-GW14-0309	YS06-GW15-0309	YS06-GW16-0609	YS06-GW17-0709	YS06-GW18-0709	YS06-GW18P-0709
Sample Date				10/04/04	03/24/09	10/05/04	03/24/09	03/24/09	04/02/09	04/02/09	04/01/09	04/01/09	04/01/09	03/31/09	03/31/09	06/30/09	07/14/09	07/09/09	07/09/09
Chemical Name																			
Aluminum, Dissolved	146 J	--	3,700	8.7 B	53.4 U	6 B	53.4 U	53.4 U	33 U	33 U	33 U	33 U	40.4 B	33 U	33 U	133 J	95.9 B	96.3 B	44.8 B
Antimony, Dissolved	18.5 J	6	1.5	2 U	2.4 U	2 U	2.4 U	2.4 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	10 U	10 U	10 U	10 U
Arsenic, Dissolved	ND	10	0.045	1.8 U	**4.5 L**	1.8 U	**3.4 L**	**2.4 L**	**8.1 J**	**10.1**	**4.8 J**	**4.3 J**	**6.2 J**	**4.2 J**	**5.3 J**	10 UL	**5.8 J**	10 U	**2.9 J**
Barium, Dissolved	30.9 J	2,000	730	29.6 J	31.8 L	26.1 J	20.8 L	30.7 L	34.7 J	35.6 J	26.9 J	25.5 J	25.2 J	19.6 J	32.9 J	41.4 J	23 J	43 J	41.7 J
Beryllium, Dissolved	ND	4	7.3	0.1 U	0.42 UL	0.1 U	0.42 UL	0.92 B	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	0.35 U	5 U	0.69 B	0.79 B	0.51 B
Cadmium, Dissolved	ND	5	1.8	0.2 U	0.64 U	0.2 U	0.64 U	0.64 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.56 B	0.27 B	5 U	5 U
Chromium, Dissolved	ND	100	0.043	0.5 U	0.7 U	0.5 U	0.7 U	0.7 U	0.64 U	0.64 U	**0.66 J**	0.64 U	**2.6 J**	0.64 U	0.64 U	10 U	10 U	10 U	**0.71 J**
Cobalt, Dissolved	ND	--	1.1	0.67 B	1.6 U	0.72 B	1.6 U	1.6 U	0.58 U	0.58 U	1.1 J	**1.4 J**	0.58 U	0.58 U	0.58 U	0.89 J	5 U	5 U	5 U
Copper, Dissolved	4 J	1,300	150	0.5 U	0.84 UL	0.5 U	0.84 UL	0.84 UL	0.88 U	0.88 U	0.88 U	0.88 U	0.88 U	0.88 U	0.88 U	5 U	5 UL	5 UL	5 UL
Iron, Dissolved	5.8 J	--	2,600	10.7 U	24.6 U	1,240	382	**3,100**	1,270	1,090	**2,960**	1,210	706	32.8 U	389	299	51.4 B	114	87.5 J
Lead, Dissolved	ND	15	--	0.9 U	1.4 UL	0.9 U	1.4 UL	1.4 UL	1.8 UL	1.8 UL	1.8 UL	1.8 UL	1.8 UL	1.8 UL	1.8 UL	3 UL	2 B	3 U	3 U
Manganese, Dissolved	12.2 J	--	88	7.1 J	3 J	72.3	10.6	**112**	**138**	**121**	85.3	88	**110**	18.6	76.2	**133**	64.9	40.8	41.2
Mercury, Dissolved	ND	2	1.1	0.1 UJ	0.14 J	0.1 UJ	0.1 U	0.1 U	0.1 UL	0.1 UL	0.1 UL	0.1 UL	0.1 UL	0.1 UL	0.1 UL	0.2 U	0.2 UL	0.2 UL	0.2 UL
Nickel, Dissolved	ND	--	73	0.5 U	0.67	0.89 B	0.96 B	0.7 B	1.1 UL	1.1 UL	26.9 J	69	1.1 UL	1.1 UL	1.1 UL	2.7 J	40 U	1.7 J	1.2 J
Selenium, Dissolved	3.9 K	50	18	2.6 U	4.3 B	2.6 U	2.2 R	2.2 R	2.9 U	4.5 J	2.9 U	2.9 U	7.3	5.7	3.7 J	5 U	8.7 B	8.5 B	5.3 B
Silver, Dissolved	ND	--	18	0.7 U	0.62 UL	0.7 U	0.62 UL	0.62 UL	0.45 B	0.33 U	0.33 U	0.33 U	0.45 B	0.34 B	0.33 U	0.38 B	5 UL	5 UL	5 UL
Thallium, Dissolved	ND	2	0.24	1.9 U	3.3 UL	1.9 U	3.3 UL	3.3 UL	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	10 U	10 U	10 U	10 U
Vanadium, Dissolved	6.3 J	--	18	0.59 B	0.57 UL	0.4 U	0.57 UL	0.57 UL	0.46 U	0.46 U	0.48 J	0.46 U	0.72 J	0.46 U	0.46 U	1.1 B	20 U	0.65 B	20 U
Zinc, Dissolved	5.9 J	--	1,100	0.7 U	5.2 U	0.7 U	7.5 J	5.2 U	1.3 B	1.9 B	1.2 J	3.5 J	1.2 J	518	**3,860**	7 B	**4,520**	28.3 B	23.4 B
Wet Chemistry																			
Alkalinity (mg/l)	--	--	--	NA	NA	NA	NA	NA	236	NA	220	NA	NA	NA	NA	NA	NA	NA	NA
Ammonia (mg/l)	--	--	--	NA	NA	NA	NA	NA	0.06 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride (mg/l)	--	--	--	NA	NA	NA	NA	NA	9.2 JD	NA	12 D	NA	NA	NA	NA	NA	NA	NA	NA
Ethane (ug/l)	--	--	--	NA	NA	NA	NA	NA	2 U	NA	0.05 J	NA	NA	NA	NA	NA	NA	NA	NA
Ethene (ug/l)	--	--	--	NA	NA	NA	NA	NA	2 U	NA	2 U	NA	NA	NA	NA	NA	NA	NA	NA
Methane (ug/l)	--	--	--	NA	NA	NA	NA	NA	57 B	NA	23 B	NA	NA	NA	NA	NA	NA	NA	NA
Nitrate/Nitrite (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate (mg/l)	--	--	--	NA	NA	NA	NA	NA	24 JD	NA	27 D	NA	NA	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	--	--	NA	NA	NA	NA	NA	1.3 J	NA	3.3 J	NA	NA	NA	NA	NA	NA	NA	NA
Total suspended solids (TSS) (mg/l)	--	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	--																		
Dechlorinating Bacteria (cells/ml)	--																		
Dehalococcoides	--	--	--	NA	NA	NA	NA	NA	15.9	NA	1.1	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed MCLs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed both MCLs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

D - Compound identified in an analysis at a secondary dilution factor

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

NJ - Qualitative identification questionable due to poor resolution, presumptively present at approximate quantity

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

cells/ml - Cells per milliliter

mg/l - Milligrams per liter

µg/l - Micrograms per liter

TABLE 5-2
Surface Water Exceedance Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	ERA Marine SW Screening Value	CLEAN RSLs Tap X 10 for SW Adjusted	YS06-SW016	YS06-SW017	YS06-SW018	YS06-SW019	YS06-SW020		YS06-SW021	YS06-SW024		YS06-SW025		YS06-SW048	YS06-SW049	YS06-SW050	YS06-SW051	YS06-SW052
Sample ID			YS06-SW016-0794	YS06-SW017-0794	YS06-SW018-0794	YS06-SW019-0794	YS06-SW020-0794	YS06-SW020P-0794	YS06-SW021-0794	YS06-SW024-0794	YS06-SW024P-0794	YS06-SW025-A-0794	YS06-SW025-B-0794	YS06-SW048-0500	YS06-SW049-0500	YS06-SW050-0500	YS06-SW051-0500	YS06-SW052-0500
Sample Date			07/26/94	07/24/94	07/24/94	07/24/94	07/21/94	07/21/94	07/21/94	07/26/94	07/26/94	07/21/94	07/21/94	05/11/00	05/11/00	05/11/00	05/11/00	05/11/00
Chemical Name																		
Volatile Organic Compounds (µg/l)																		
1,1,1-Trichloroethane	312	9,100	6 J	10 U	10 U	10 U	1 U	1 U	1 U	98	99	1 U	1 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethane	--	24	10 U	10 U	10 U	10 U	1 U	1 U	1 U	4 J	4 J	1 U	1 U	10 U	10 U	10 U	10 U	10 U
1,1-Dichloroethene	2,240	340	10 U	10 U	10 U	10 U	1 U	1 U	1 U	5 J	6 J	1 U	1 U	10 U	10 U	10 U	10 U	10 U
Acetone	564,000	22,000	10	10 U	10 U	10 U	5 R	5 R	5 R	10 U	10 U	5 R	5 R	3 J	10 UJ	3 J	10 U	10 U
Carbon disulfide	--	1,000	10 U	10 U	10 U	10 U	1 U	1 U	1 U	10 U	10 U	1 U	1 U	10 U	10 U	10 U	10 U	10 U
cis-1,2-Dichloroethene	680	370	10 U	10 U	10 U	10 U	1 U	1 U	1 U	10 U	10 U	1 U	1 U	10 U	10 U	10 U	10 U	10 U
Toluene	215	2,300	10 U	10 U	10 U	10 U	1 U	1 U	1 U	10 U	10 U	1 U	1 U	10 U	10 U	10 U	10 U	10 U
trans-1,2-Dichloroethene	680	110	10 U	10 U	10 U	10 U	1 U	1 U	1 U	10 U	10 U	1 U	1 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	1940	20	10 U	10 U	10 U	10 U	1 U	1 U	1 U	10 U	10 U	1 U	1 U	2 J	10 U	10 U	10 U	10 U
Vinyl chloride	--	0.16	10 U	10 U	10 U	10 U	1 U	1 U	1 U	10 U	10 U	1 U	1 U	10 U	10 U	10 U	10 U	10 U
Semivolatile Organic Compounds (µg/l)																		
2,4-Dinitrotoluene	48.5	2.2	1 U	1 U	1 U	10 U	1 U	10 U	1 U	1 U	1 U	1 U	1 U	3 U	3 U	3 U	4.75 UL	3 U
bis(2-Ethylhexyl)phthalate	360	48	10 U	6 J	10 U	9 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	NA
Nitrobenzene	66.8	1.2	0.73 U	0.73 U	0.73 U	10 U	0.73 U	10 U	0.73 U	0.73 U	0.73 U	0.73 U	0.73 U	1.8 U	1.8 U	1.8 U	2.85 UL	1.8 U
Phenol	58	11,000	10 U	10 U	10 U	6 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (µg/l)																		
No Detections																		
Explosives (µg/l)																		
1,3-Dinitrobenzene	180	3.7	1.1 U	1.1 U	1.1 U	1.1 UJ	1.1 U	NA	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.2 U	1.2 U	1.2 U	1.9 UL	1.2 U
2,4,6-Trinitrotoluene	100	18	0.62 U	0.62 U	0.62 U	0.62 UJ	0.62 U	NA	0.62 U	0.62 U	0.62 U	0.62 U	0.62 U	2.4 U	2.4 U	2.4 U	3.8 UL	2.4 U
2-Amino-4,6-dinitrotoluene	--	73	1 U	1 U	1 U	1 UJ	1 U	NA	1 U	1 U	1 U	1 U	1 U	3.6 U	3.6 U	1.42 J	5.7 UL	3.6 U
2-Nitrotoluene	--	3.1	0.75 UJ	0.75 U	0.75 U	0.75 UJ	0.75 U	NA	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	3 U	3 U	3 U	4.75 UL	3 U
4-Amino-2,6-dinitrotoluene	--	73	1 U	1 U	1 U	1 UJ	1 U	NA	1 U	1 U	1 U	1 U	1 U	2.4 U	2.4 U	2.26 J	3.8 UL	2.4 U
HMX	--	1,800	0.61 UJ	0.61 UJ	0.61 UJ	0.61 UJ	0.61 UJ	NA	0.61 UJ	0.61 UJ	0.61 UJ	0.61 UJ	0.61 UJ	2.4 U	2.4 U	2.4 U	3.8 UL	2.4 U
RDX	5000	6.1	0.59 U	0.59 U	0.59 U	0.59 UJ	0.59 U	NA	0.59 U	0.59 U	0.59 U	0.59 U	0.59 U	3 U	3 U	2.99 J	4.75 UL	3 U
Total Metals (µg/l)																		
Aluminum	--	37,000	491	872	911	1,130	1,360 J	1,200 J	975 J	66.7	36.3	666 J	838 J	1,430	753	6,520	5,790	415
Antimony	500	15	37 UL	37 UL	37 UL	37 UL	37 UL	37 UL	37 UL	37 UL	**38.9 L**	37 UL	37 UL	3 J	2.1 J	4 J	2.1 U	2.1 U
Arsenic	36	0.45	**1.8 J**	2.3 B	1.3 B	1.2 B	**1.3 L**	1 UL	**1.3 L**	**1.2 J**	**1.6 J**	1 UL	1 UL	2.3 U	2.3 U	**5.3 J**	**4.2 J**	2.3 U
Barium	200	7,300	33.1	33	34.1	34.1	37.6	36.2	38	19.3	19.2	35	33.5	26 J	24.2 J	54.5 J	45.9 J	24.2 J
Beryllium	100	73	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.29 J	0.28 J	0.78 J	0.57 J	0.2 U
Cadmium	8.85	18	5 UL	5 U	5 U	5 U	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	0.44 J	0.2 U	2.4 J	0.45 J	0.2 U
Chromium	50.4	0.43	**3.1**	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	**3.9 J**	**2.3 J**	**17.1**	**14.1**	1.6 B
Cobalt	--	11	4 U	4 U	4 U	4 U	4 U	4.6	4 U	4 U	4 U	4 U	4 U	0.79 J	0.5 U	3.7 J	2.7 J	0.66 J
Copper	3.73	1,500	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	**7 J**	2.2 J	**23.7 J**	**6.7 J**	1.6 J
Cyanide	1	730	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	0.9 U	0.9 U	0.9 U	0.9 U	**1.6 J**
Iron	--	26,000	1,520	1,200	1,360	1,530	1,980 J	1,700 J	1,560 J	569	514	957 J	1,350 J	3,090	1,500	15,700	8,980	1,060
Lead	8.52	--	2.1	1.3 L	1 UL	1 UL	1.9 L	1.2 L	2.2 L	1 U	1 U	1 UL	1 L	5.7	2.5 J	**40.6**	4.9	2.8 J
Manganese	100	880	53.2	86.1	75.5	76.4	**141 J**	**133 J**	**168 J**	15.8	15.8	**115 J**	98.4 J	64.5	46	**184**	**308**	21.7
Mercury	1.11	11	0.1 UL	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 UL	0.1 UL	0.1 U	0.1 U	0.1 J	0.1 U	0.23	0.13 J	0.1 U
Nickel	8.28	730	16 U	16 U	**19.8**	**49.6**	16 U	16 U	**27.8 K**	16 U	16 U	**21.6 K**	16 U	3.8 J	2 J	**19.6 J**	7.5 J	1.5 J
Selenium	71.1	180	1.5	10 UL	5 UL	10 UL	1.3 L	1 UL	1 UL	1.5	1.5	1.3 L	1.7 L	3.6 J	2.2 U	2.2 U	2.2 U	2.2 U
Silver	0.23	180	4 U	4 U	4 U	4 U	4 UL	4 UL	4 UL	4 U	4 U	4 UL	4 UL	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
Vanadium	50	180	12.6	4 U	4.2	4 U	5	4 U	5.4	4 U	4 U	5.9	4 U	14.1 J	12.7 J	**55.5**	25.7 J	14.5 J
Zinc	85.6	11,000	11.1	3 U	3 U	3 U	3 U	5.5 B	3 U	12.6	11.1	3 U	3 U	23.4	11 J	**188**	28.6	10 J
Dissolved Metals (µg/l)																		
Aluminum, Dissolved	--	37,000	18 U	61.7	47.1	44.6	18 U	18 U	18.3 J	18 U	18 U	33.5 J	18 U	NA	NA	NA	NA	NA
Arsenic, Dissolved	36	0.45	**1.5 J**	2.3 B	1 U	1 UL	1 UL	1 UL	1 UL	**1.2 J**	**1.5 L**	1 UL	1 UL	NA	NA	NA	NA	NA
Barium, Dissolved	200	7,300	29.6	31.4	30.8	30.7	33.2	34.4	33.7	18.1	17.8	33.4	31.9	NA	NA	NA	NA	NA
Cobalt, Dissolved	--	11	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	NA	NA	NA	NA	NA
Copper, Dissolved	3.1	1,500	5 U	**5.9**	**11.1**	**8.6**	**9**	**8.1**	5 U	5 U	**7.6**	5 U	**7.4**	NA	NA	NA	NA	NA
Iron, Dissolved	--	26,000	27.6	31.5	44.3	38	3.6 J	4.2 J	4.6 J	20.4	14.3	3 U	5.9 J	NA	NA	NA	NA	NA
Lead, Dissolved	8.1	--	1 U	1 UL	1 UL	3.6 L	1 UL	1 UL	1 UL	1 U	1 U	1 UL	1 UL	NA	NA	NA	NA	NA
Manganese, Dissolved	100	880	44.4	33.4	21.1	18.6	52.8 J	51.8 J	99.7 J	15.2	14.1	50.5 J	36.7 J	NA	NA	NA	NA	NA
Nickel, Dissolved	8.2	730	16 U	**27.6**	**48.3**	**27**	16 U	21.9 K	**20.6 K**	16 U	16 U	**19.3 K**	**34.8 K**	NA	NA	NA	NA	NA
Selenium, Dissolved	71	180	1 U	1 UL	5 UL	1 UL	1 UL	1 UL	1.1 L	1 U	1.2	1.8 L	1.6 L	NA	NA	NA	NA	NA
Silver, Dissolved	0.23	180	4 U	4 U	4 U	4 U	**8.6 L**	4 UL	4 UL	4 U	4 U	4 UL	4 UL	NA	NA	NA	NA	NA
Vanadium, Dissolved	50	180	10.3	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	NA	NA	NA	NA	NA
Zinc, Dissolved	81	11,000	3 U	7.1 B	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	NA	NA	NA	NA	NA
Wet Chemistry																		
Hardness (mg/l)	--	--	340	3,300	3,400	3,400	3,200	NA	2,900	240	NA	3,200	3,400	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/l)	--	--	4.97	4.56	3.45	3.17	4.42	4.24	5.84	3.18	NA	5.53	5.48	NA	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed ERA Marine SW SVs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed ERA Marine SW SVs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

NA - Not analyzed

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

mg/l - Milligrams per liter

µg/l - Micrograms per liter

TABLE 5-2
Surface Water Exceedance Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	ERA Marine SW Screening Value	CLEAN RSLs Tap X 10 for SW Adjusted	YS06-SW053	YS06-SW054	YS06-SW055	YS06-SW056	YS06-SW057	YS06-SW058	YS06-SW059	YS06-SW060		YS06-SW062		YS06-SW065	YS06-SW066	YS06-SW068		YS06-SW069
Sample ID			YS06-SW053-0500	YS06-SW054-0500	YS06-SW055-0500	YS06-SW056-0500	YS06-SW057-0500	YS06-SW058-0500	YS06-SW059-0500	YS06-SW060-0500	YS06-SW060P-0500	YS06-SW062-0500	YS06-SW062P-0500	YS06-SW065-0500	YS06-SW066-0500	YS06-SW68-0809	YS06-SW68P-0809	YS06-SW69-0809
Sample Date			05/11/00	05/11/00	05/11/00	05/11/00	05/11/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	08/04/09	08/04/09	08/04/09
Chemical Name																		
Volatile Organic Compounds (µg/l)																		
1,1,1-Trichloroethane	312	9,100	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	3 J	2 J	1 J	1 J	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	--	24	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	2 J	10 U	10 U	10 U	10 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	2,240	340	10 U	10 U	10 U	10 U	10 U	10 U	10 U	3 J	2 J	10 U	10 U	10 U	10 U	0.5 U	0.5 U	0.5 U
Acetone	564,000	22,000	6 J	5 J	10 U	10 U	5 J	10 U	10 U	10 U	10 UJ	10 UJ	10 UJ	10 U	10 UJ	3.1 B	3.2 B	4.8 B
Carbon disulfide	--	1,000	10 U	10 U	10 U	4 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	680	370	10 U	10 U	3 J	10 U	6 J	20	73	230	170 J	10 U	10 U	3 J	10 U	0.5 U	0.5 U	0.5 U
Toluene	215	2,300	10 U	10 U	10 U	2 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	0.11 B	0.1 B	0.5 U
trans-1,2-Dichloroethene	680	110	10 U	10 U	10 U	10 U	10 U	10 U	10 U	2 J	3 J	10 U	10 U	10 U	10 U	0.5 U	0.5 U	0.5 U
Trichloroethene	1940	20	10 U	10 U	1 J	10 U	4 J	6 J	**22**	**74**	**55**	10 U	10 U	10 U	10 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	--	0.16	10 U	10 U	10 U	10 U	10 U	**1 J**	**5 J**	**15**	**15**	10 U	10 U	10 U	10 U	0.5 U	0.5 U	0.5 U
Semivolatile Organic Compounds (µg/l)																		
2,4-Dinitrotoluene	48.5	2.2	2 U	2 UL	3 U	2.5 UJ	3 U	3 UL	5 U	3.5 U	3 U	3 UL	0.49 J	3 UL	2.5 UL	0.38 U	0.37 U	0.38 U
bis(2-Ethylhexyl)phthalate	360	48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	66.8	1.2	1.2 U	1.2 UL	1.8 U	0.97 J	1.8 U	1.8 UL	3 U	2.1 U	1.8 U	1.8 UL	1.5 U	1.8 UL	1.5 UL	0.38 U	0.37 U	0.38 U
Phenol	58	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (µg/l)																		
No Detections																		
Explosives (µg/l)																		
1,3-Dinitrobenzene	180	3.7	0.8 U	0.8 UL	1.2 U	1 UJ	1.2 U	1.2 UL	2 U	2.10 J	1.2 UJ	1.2 UL	1 U	1.2 UL	1 UL	0.38 U	0.37 U	0.38 U
2,4,6-Trinitrotoluene	100	18	1.6 U	1.6 UL	2.4 U	1.41 J	2.4 U	2.4 UL	3.53 J	13.2 J	6.02 J	0.86 L	3.71 J	2.4 UL	2 UL	0.38 U	0.37 U	0.49 B
2-Amino-4,6-dinitrotoluene	--	73	2.4 U	2.4 UL	3.6 U	2 J	3.6 U	1.42 L	**83.9 J**	50.8 J	**108 J**	3.6 UL	1.01 J	4.71 L	3 UL	0.38 U	0.37 U	0.38 U
2-Nitrotoluene	--	3.1	2 U	2 UL	3 U	2.5 UJ	3 U	3 UL	5 U	3.5 U	3 U	3 UL	2.5 U	3 UL	2.5 UL	0.38 U	0.37 U	0.38 U
4-Amino-2,6-dinitrotoluene	--	73	1.6 U	1.6 UL	1.17 J	2 UJ	2.4 U	2.4 UL	4 U	2.8 R	2.4 U	2.4 UL	2 U	2.4 UL	2 UL	0.38 U	0.37 U	0.38 U
HMX	--	1,800	1.6 U	1.6 UL	2.4 U	2 UJ	1.46 J	2.4 UL	28.9 J	46.1 J	35 J	2.4 UL	2 U	1.47 L	2 UL	0.38 U	0.37 U	0.32 J
RDX	5000	6.1	1.88 J	2 UL	2.43 J	2.5 UJ	3 U	2.13 L	**12.3 J**	**13.1 J**	**9.02 J**	3 UL	5.23 J	5.38 L	2.5 UL	0.38 U	0.37 U	3.4 B
Total Metals (µg/l)																		
Aluminum	--	37,000	**42,800**	32,500	2,160	**136,000**	33,900	2,560	1,740	832	775	64.6 J	108 J	1,450	218	699 K	732 K	492 K
Antimony	500	15	4.6 J	2.1 U	2.1 U	**35.8 J**	**15.6 J**	5 J	6.2 J	13.2 J	7.5 J	2.1 U	2.1 U	3.9 J	2.1 U	10 U	10 U	10 U
Arsenic	36	0.45	**17.5**	**15.5**	2.3 U	**85.9**	**16.9**	**2.3 J**	**3 J**	**3.1 J**	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	**3.9 J**	**3.4 J**	**2.9 J**
Barium	200	7,300	**202**	89.8 J	62.2 J	**750**	**625**	76.4 J	68.4 J	71.9 J	70 J	19.3 J	19.7 J	36.9 J	23.3 J	28.3 J	28.5 J	26.8 J
Beryllium	100	73	4.9 J	2.4 J	0.46 J	15.8	3.9 J	0.33 J	0.39 J	0.28 J	0.2 U	0.21 J	0.32 J	0.25 J	0.2 U	0.86 B	0.97 B	0.64 B
Cadmium	8.85	18	5.4	2.6 J	1 J	**36.5**	**16.1**	1.3 J	0.91 J	0.51 J	0.62 J	0.2 U	0.24 J	0.65 J	0.2 U	5 UL	5 UL	5 UL
Chromium	50.4	0.43	**92.7**	**75.4**	**6.3 J**	**320**	**87.2**	**7.2 J**	**5.4 J**	**3.4 J**	**2.9 J**	0.43 B	0.73 B	**4.7 J**	1.3 B	1.1 B	1.5 B	0.94 B
Cobalt	--	11	**18.8 J**	**14.3 J**	1.2 J	**58.5**	**16.5 J**	1.9 J	1.3 J	1.1 J	0.83 J	0.5 U	0.5 U	1.1 J	0.5 U	5 U	0.77 J	5 U
Copper	3.73	1,500	**74.8**	**45.3**	**13.4 J**	**518**	**144**	**15.2 J**	**10.1 J**	**9.6 J**	**7.8 J**	0.6 U	0.6 U	**10.1 J**	0.82 J	1.3 J	1.4 J	1.1 J
Cyanide	1	730	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U	0.9 U	**1.8 J**	1.6 J	0.9 U	**1.7 J**	0.9 U	**1.3 J**	NA	NA	NA
Iron	--	26,000	**88,900**	**59,700**	4,730	**327,000**	**85,100**	7,630	6,090	2,490	2,770	291	450	4,580	724	972 J	1,050 J	768 J
Lead	8.52	--	**121**	**71.3**	**13.9**	**699**	**195**	**20.3**	**12.7**	**11.8**	**12.7**	1.3 U	1.3 U	**14.4**	1.5 J	3 UL	3 UL	3 UL
Manganese	100	880	**929**	**465**	**243**	**1,870**	**1,210**	**420**	**238**	**113**	**214**	11.1 J	15.7	60.6	49.4	**116**	**116**	84.8
Mercury	1.11	11	0.59	0.36	0.14 J	**1.5**	1.1	0.23	0.15 J	0.15 J	0.14 J	0.1 U	0.1 U	0.19 J	0.1 U	0.2 U	0.2 U	0.2 U
Nickel	8.28	730	**78.8**	**43.2**	**9.2 J**	**398**	**123**	**11.4 J**	7.4 J	7.4 J	5.7 J	0.7 U	0.7 U	8.1 J	2 J	40 U	1.3 B	40 U
Selenium	71.1	180	6.2	3.4 J	2.2 U	18.2	5.8	2.2 U	2.7 J	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	2.2 U	5 U	5 U	5 U
Silver	0.23	180	0.6 U	0.6 U	0.6 U	**1.4 J**	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	**0.68 L**	**1 L**	**0.68 L**
Vanadium	50	180	**315**	**128**	29.8 J	**1,200**	**395**	42.8 J	32.9 J	**54.9**	39.3 J	1.8 J	2 J	28.5 J	9 J	5 J	5.6 J	3.8 J
Zinc	85.6	11,000	**907**	**314**	69.5	**3,740**	**1,870**	**98.9**	72.7	40.4	47.8	0.8 U	5.5 J	63.9	4 J	6.8 B	7.6 B	5.2 B
Dissolved Metals (µg/l)																		
Aluminum, Dissolved	--	37,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	49.7 J	200 U	200 U
Arsenic, Dissolved	36	0.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**5.9 J**	**2.9 J**	**2.8 J**
Barium, Dissolved	200	7,300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	25.8 J	25.5 J	24.1 J
Cobalt, Dissolved	--	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	5 U
Copper, Dissolved	3.1	1,500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	5 U
Iron, Dissolved	--	26,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	87.5 J	55.9 J	37 J
Lead, Dissolved	8.1	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3 U	3 U	3 U
Manganese, Dissolved	100	880	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	61.3 J	47.2 J	5.7 J
Nickel, Dissolved	8.2	730	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	40 UL	40 UL	40 UL
Selenium, Dissolved	71	180	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	5 U	5 U
Silver, Dissolved	0.23	180	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.55 L**	5 UL	5 UL
Vanadium, Dissolved	50	180	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2 J	3.5 J	2.2 B
Zinc, Dissolved	81	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.5 J	2.1 J	3.4 J
Wet Chemistry																		
Hardness (mg/l)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	22,000	NA	23,100
Total organic carbon (TOC) (mg/l)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed ERA Marine SW SVs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed ERA Marine SW SVs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

NA - Not analyzed

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

mg/l - Milligrams per liter

µg/l - Micrograms per liter

TABLE 5-2
Surface Water Exceedance Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	**ERA Marine SW Screening Value**	**CLEAN RSLs Tap X 10 for SW Adjusted**	YS06-SW070	YS06-SW071	YS06-SW072	YS06-SW073	YS06-SW074		YS06-SW075	YS06-SW076	YS06-SW077	YS06-SW078
Sample ID			YS06-SW70-0809	YS06-SW71-0809	YS06-SW72-0809	YS06-SW73-0809	YS06-SW74-0809	YS06-SW74P-0809	YS06-SW75-0809	YS06-SW76-0809	YS06-SW77-0809	YS06-SW78-0809
Sample Date			08/04/09	08/04/09	08/04/09	08/05/09	08/05/09	08/05/09	08/05/09	08/06/09	08/06/09	08/06/09
Chemical Name												
Volatile Organic Compounds (µg/l)												
1,1,1-Trichloroethane	312	9,100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	--	24	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethene	2,240	340	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Acetone	564,000	22,000	3.6 B	6 B	5.1 B	7.6 B	10 B	12 B	11 B	3.4 B	3.1 B	4.4 B
Carbon disulfide	--	1,000	0.5 U	0.12 J	0.5 U	0.11 J	0.35 J	0.48 J	0.28 J	0.12 J	0.12 J	0.24 J
cis-1,2-Dichloroethene	680	370	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	215	2,300	0.12 B	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.11 B	0.5 U	0.5 U
trans-1,2-Dichloroethene	680	110	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	1940	20	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Vinyl chloride	--	0.16	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Semivolatile Organic Compounds (µg/l)												
2,4-Dinitrotoluene	48.5	2.2	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.38 U	0.38 U	0.38 U
bis(2-Ethylhexyl)phthalate	360	48	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	66.8	1.2	0.37 U	0.35 B	0.37 U	0.37 U	0.17 B	0.16 B	0.087 B	0.38 U	0.38 U	0.38 U
Phenol	58	11,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (µg/l)												
No Detections												
Explosives (µg/l)												
1,3-Dinitrobenzene	180	3.7	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.38 U	0.38 U	0.38 U
2,4,6-Trinitrotoluene	100	18	0.075 B	0.37 U	0.11 B	0.37 U	0.1 B	0.37 U	0.37 U	0.38 U	0.38 U	0.38 U
2-Amino-4,6-dinitrotoluene	--	73	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.38 U	0.38 U	0.38 U
2-Nitrotoluene	--	3.1	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.38 U	0.38 U	0.36 J
4-Amino-2,6-dinitrotoluene	--	73	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.37 U	0.38 U	0.38 U	0.38 U
HMX	--	1,800	0.37 U	0.37 U	0.36 J	0.37 U	0.37 U	0.37 U	0.37 U	0.38 U	0.38 U	0.38 U
RDX	5000	6.1	0.37 U	0.37 U	3.1 B	0.48 B	0.33 B	0.37 U	0.37 U	0.38 U	0.38 U	0.45 B
Total Metals (µg/l)												
Aluminum	--	37,000	472 K	655 K	436 K	1,280 K	1,380 K	1,240 K	823 K	2,280 K	806 K	575 K
Antimony	500	15	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	2.5 B	10 U
Arsenic	36	0.45	10 U	10 U	10 U	**5 J**	**2.9 J**	**2.9 J**	**2.9 J**	**3.9 J**	**3 J**	10 U
Barium	200	7,300	26.7 J	28.2 J	27.6 J	30 J	29.8 J	29.2 J	28.1 J	30.4 J	28.6 J	28.4 J
Beryllium	100	73	0.51 B	0.47 B	0.53 B	5 U	1.7 B	1.9 B	1.6 B	1.7 B	0.44 B	0.46 B
Cadmium	8.85	18	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL	5 UL
Chromium	50.4	0.43	1.2 B	1.1 B	0.91 B	**2.8 J**	2.5 B	2.2 B	1.7 B	**3.8 J**	**0.92 L**	10 UL
Cobalt	--	11	5 U	5 U	5 U	0.96 J	0.86 J	0.63 J	5 U	5 U	5 U	5 U
Copper	3.73	1,500	2 J	1.4 J	1.5 J	2.1 J	2 J	1.3 J	1 J	2 J	1.2 J	5 U
Cyanide	1	730	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	--	26,000	753 J	1,130 J	724 J	1,680 J	2,200 J	1,870 J	982 J	3,020 J	1,410 J	787 J
Lead	8.52	--	3 UL	3 UL	3 UL	3 UL	3 UL	2.2 B	3 UL	3.5 B	4.2 B	2.2 B
Manganese	100	880	59.1	**155**	**127**	**138**	**148**	**150**	**139**	**198**	**193**	**199**
Mercury	1.11	11	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	8.28	730	1.6 B	40 U	40 U	2 B	2.1 B	1.6 B	40 U	1.9 J	40 U	40 U
Selenium	71.1	180	5 U	4.1 K	5 U	5 U	5 U	5 U	5 U	5 U	5 UL	5 UL
Silver	0.23	180	**1.1 L**	**0.92 L**	**0.98 L**	**1.1 L**	**0.38 L**	5 UL	**0.47 L**	5 UL	5 UL	5 UL
Vanadium	50	180	3.2 J	4.6 J	4.2 J	6.6 J	7.6 J	7 J	5.4 J	8.3 J	6.2 J	6.4 J
Zinc	85.6	11,000	9.6 B	6.5 B	6.6 B	22.3	14.9 J	13.1 J	10.5 B	19.5 J	10.9 J	10 B
Dissolved Metals (µg/l)												
Aluminum, Dissolved	--	37,000	200 U	200 U	200 U	66.6 B	34.2 J	57.4 J	38.6 J	200 U	72.7 J	96 J
Arsenic, Dissolved	36	0.45	**4.7 J**	**5.7 J**	**4.6 J**	**6.9 J**	**4.7 J**	**5.8 J**	**3.8 J**	**3.4 J**	**5.5 J**	**4.5 J**
Barium, Dissolved	200	7,300	24 J	25.3 J	24.8 J	25.8 J	26.4 J	26.7 J	26 J	26.6 J	26.2 J	26.2 J
Cobalt, Dissolved	--	11	5 U	0.68 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Copper, Dissolved	3.1	1,500	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Iron, Dissolved	--	26,000	60.8 J	69.1 J	54.6 J	63 J	76.8 J	86.7 J	66.1 J	56.2 J	99 J	93.4 J
Lead, Dissolved	8.1	--	3 U	3 U	3 U	3 UL	3 U	3 U	3 U	3 U	3 U	3 U
Manganese, Dissolved	100	880	6.7 J	57.7	24.5	45.4	89.6	95.5	73.2	**122**	**135**	**175**
Nickel, Dissolved	8.2	730	40 UL	40 UL	40 UL	40 U	40 UL	40 UL	40 UL	40 UL	40 UL	40 UL
Selenium, Dissolved	71	180	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Silver, Dissolved	0.23	180	**0.83 L**	**0.97 L**	**0.69 L**	5 UL	**1.1 L**	**0.98 L**	**0.52 L**	**0.63 L**	**0.97 L**	**0.64 L**
Vanadium, Dissolved	50	180	2.2 B	3.8 J	3 J	3.8 J	4.7 J	4.8 J	3.8 J	3.8 J	4.4 J	4.9 J
Zinc, Dissolved	81	11,000	1.5 J	1.2 J	20 U	5.1 B	2.5 B	4.3 B	6.9 B	2.5 B	5.2 B	3 B
Wet Chemistry												
Hardness (mg/l)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total dissolved solids (TDS) (mg/l)	--	--	24,200	22,300	22,200	22,400	22,200	NA	20,600	19,800	19,200	17,700
Total organic carbon (TOC) (mg/l)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed ERA Marine SW SVs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed ERA Marine SW SVs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

NA - Not analyzed

L - Analyte present, value may be biased low, actual value may be higher

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

mg/l - Milligrams per liter

µg/l - Micrograms per liter

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	ERA Marine SD Screening Value	CLEAN RSLs Res Soil X 10 for SD Adjusted	YS06-SD015		YS06-SD016		YS06-SD017		YS06-SD018		YS06-SD019		YS06-SD020		
Sample ID			YS06-SD015-A-0794	YS06-SD015-B-0794	YS06-SD016-A-0794	YS06-SD016-B-0794	YS06-SD017-A-0794	YS06-SD017-B-0794	YS06-SD018-A-0794	YS06-SD018-B-0794	YS06-SD019-A-0794	YS06-SD019-B-0794	YS06-SD020-A-1294	YS06-SD020P-A-1294	YS06-SD020-B-1294
Sample Date			07/26/94	07/26/94	07/26/94	07/26/94	07/24/94	07/24/94	07/24/94	07/24/94	07/24/94	07/24/94	12/01/94	12/01/94	12/01/94
Chemical Name															
Volatile Organic Compounds (µg/kg)															
1,1-Dichloroethane	--	33,000	240 U	170 U	22 UJ	170 U	42 U	24 U	NA	NA	NA	NA	33 U	34 U	34 U
1,1-Dichloroethene	2,782	240,000	240 U	170 U	22 UJ	170 U	42 U	24 U	NA	NA	NA	NA	33 U	34 U	34 U
1,2-Dichloroethene (total)	--	700,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	33 U	34 U	34 U
2-Butanone	--	28,000,000	240 U	150 J	22 UJ	170 U	34 J	21 J	NA	NA	NA	NA	33 U	34 U	34 U
Acetone	--	61,000,000	150 J	760 J	27 J	220 J	180 J	120	NA	NA	NA	NA	33 U	34 U	34 U
Carbon disulfide	--	740,000	240 U	170 U	22 UJ	110 J	42 U	12 J	NA	NA	NA	NA	33 U	34 U	34 U
Chloroethane	--	2,100,000	240 U	170 U	22 UJ	170 U	42 U	24 U	NA	NA	NA	NA	33 U	34 U	34 U
Chloromethane	--	120,000	240 U	170 U	22 UJ	170 U	42 U	24 U	NA	NA	NA	NA	33 U	34 U	34 U
cis-1,2-Dichloroethene	--	780,000	240 U	170 U	22 UJ	170 U	42 U	24 U	NA	NA	NA	NA	NA	NA	NA
Methyl acetate	--	29,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	--	110,000	240 U	170 U	22 UJ	170 U	42 U	40	NA	NA	NA	NA	33 U	34 U	34 U
Toluene	1,086	820,000	240 U	170 U	22 UJ	170 U	42 U	24 U	NA	NA	NA	NA	33 U	34 U	34 U
trans-1,2-Dichloroethene	--	150,000	240 U	170 U	22 UJ	170 U	42 U	24 U	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	41	28,000	240 U	170 U	22 UJ	170 U	42 U	24 U	NA	NA	NA	NA	33 U	34 U	34 U
Vinyl chloride	--	600	240 U	170 U	22 UJ	170 U	42 U	24 U	NA	NA	NA	NA	33 U	34 U	34 U
Semivolatile Organic Compounds (µg/kg)															
2,4-Dinitrotoluene	--	16,000	450 U	450 U	450 U	450 U	450 U	450 U	450 U	450 U	450 U	450 U	250 U	250 U	250 U
2,6-Dinitrotoluene	549	61,000	1,000 U	870 U	1,000 U	1,000 U	1,000 U	780 U	1,000 U	1,000 U	1,000 U	1,000 U	260 U	260 U	260 U
2-Methylnaphthalene	70	310,000	1,100 U	870 U	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
4-Methylphenol	670	310,000	1,100 U	870 U	1,100 U	1,000 U	1,100 U	780 U	1,100 U	870 U	1,100 U	820 U	1,000 U	1,200 U	1,200 U
Acenaphthene	16	3,400,000	**440 J**	870 U	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Anthracene	85.3	17,000,000	1,100 U	870 U	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Benzo(a)anthracene	261	1,500	**700 J**	**350 J**	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Benzo(a)pyrene	430	150	**570 J**	870 UJ	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Benzo(b)fluoranthene	1,800	1,500	1,300 J	660 J	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Benzo(g,h,i)perylene	670	1,700,000	1,100 UJ	870 UJ	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Benzo(k)fluoranthene	1,800	15,000	350 J	210 J	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
bis(2-Ethylhexyl)phthalate	182	350,000	**1,500**	870 U	1,100 U	680 J	1,100 U	180 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Carbazole	--	--	1,100 U	870 U	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Chrysene	384	150,000	**670 J**	**540 J**	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Dibenz(a,h)anthracene	63.4	150	1,100 UJ	870 UJ	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Di-n-butylphthalate	58	6,100,000	1,100 U	870 U	1,100 U	1,000 U	1,100 U	780 U	**6,800 J**	870 UJ	1,100 U	820 UJ	**3,800**	**5,800**	**16,000**
Fluoranthene	600	2,300,000	**1,400**	400 J	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Fluorene	19	2,300,000	1,100 U	870 U	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Indeno(1,2,3-cd)pyrene	600	1,500	1,100 UJ	870 UJ	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Naphthalene	160	36,000	1,100 U	870 U	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Nitrobenzene	21	48,000	580 U	580 U	580 U	580 U	580 U	580 U	580 U	580 U	580 U	580 U	260 U	260 U	260 U
Phenanthrene	240	17,000,000	**1,200**	870 U	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Phenol	420	18,000,000	1,100 U	870 U	1,100 U	1,000 U	1,100 U	780 U	**890 J**	870 U	1,100 U	820 U	1,000 U	1,200 U	1,200 U
Pyrene	665	1,700,000	**2,000**	**850 J**	1,100 U	1,000 U	1,100 U	780 U	1,100 UJ	870 UJ	1,100 U	820 UJ	1,000 U	1,200 U	1,200 U
Pesticide/Polychlorinated Biphenyls (µg/kg)															
Aroclor-1260	48	2,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**51 J**	38 J	**52 J**
Methoxychlor	30	310,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.2 J	61 U	61 U
Explosives (µg/kg)															
1,3,5-Trinitrobenzene	7,000	2,200,000	560 U	560 U	560 U	560 U	560 U	560 U	560 U	560 U	560 U	560 U	250 U	250 U	250 U
1,3-Dinitrobenzene	--	6,100	420 U	420 U	420 U	420 U	420 U	420 U	420 U	420 U	420 U	420 U	250 U	250 U	250 U
2,4,6-Trinitrotoluene	20,000	36,000	440 U	440 U	440 U	440 U	440 U	440 U	440 U	440 U	440 U	440 U	250 U	250 U	250 U
2-Amino-4,6-dinitrotoluene	--	150,000	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	250 U	250 U	250 U
2-Nitrotoluene	--	29,000	820 U	820 U	820 U	820 U	820 U	820 U	820 U	820 U	820 U	820 U	NA	NA	NA
4-Amino-2,6-dinitrotoluene	--	150,000	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	250 U	250 U	250 U
HMX	115,000	3,900,000	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U
RDX	891,000	55,000	590 U	590 U	590 U	590 U	590 U	590 U	590 U	590 U	590 U	590 U	500 U	500 U	500 U
Tetryl	72	240,000	1,200 U	1,200 U	1,200 U	1,200 U	1,200 U	1,200 U	1,200 U	1,200 U	1,200 U	1,200 U	750 U	650 U	870 U
Total Metals (mg/kg)															
Aluminum	18,000	77,000	18,800	**38,900**	9,430	**21,700**	**33,300**	**27,900**	**31,100**	**21,000**	**30,700**	**21,100**	13,700	**20,900**	27,200
Antimony	2	31	35.9 UL	24.7 UL	16 UL	24.9 UL	30.3 UL	19.8 B	26.7 UL	18.3 UL	24.7 UL	22.1 B	7.4 UL	8.3 UL	8.3 UL
Arsenic	8.2	3.9	**8.9**	**22.1**	**4.5**	**8.8**	**8.3**	**11.2**	**9.8**	**10.9**	**7.7 K**	**8.7 K**	**6.7**	**12.5**	**14.9**
Barium	48	15,000	47.2	**178**	24.1	44.1	**61.5**	**48.5**	**56.4**	40.6	**56.7**	40.3	31	41.7	**53.2**
Beryllium	--	160	1.4	1.4	0.43 U	1.1	1.5	1.3	1.4	1.1	1.3	1.1	0.88	1.2	1.3
Cadmium	1.2	70	4.9 U	3.3 U	**2.4**	3.4 U	4.1 UL	2.3 UL	3.6 UL	2.5 UL	3.3 UL	2.5 UL	0.91 U	1 U	1 U
Chromium	81	2.9	**44.4**	**66.3**	**20.2**	**40.7**	**58.8**	**49.6**	**53.8**	**43.1**	**56**	**44.3**	**29.4**	**45.8**	**54.3**
Cobalt	10	23	**11.5**	**12.4**	2.6	6.8	**11.5**	8.4	9.6	8.1	**12.5**	8.2	7.7	**11.4**	**12.2**
Copper	34	3,100	**48.1**	24	14.1	14.1	24	23.5	23.8	25.8	25.5	21.6	15.6	23.8	26.1
Cyanide	--	1,600	2.4 U	1.7 U	1.1 U	1.7 U	2 U	1.2 U	1.8 U	1.2 U	1.7 U	1.3 U	7.7 U	8.9 U	8.9 U
Iron	220,000	55,000	33,400	**61,600**	19,000	31,500	39,100	39,900	37,100	32,500	38,800	34,100	25,100	37,000	43,800
Lead	47	4,000	42.8 L	**49.7 L**	20.3 L	20.1 L	28.2 L	31.5 L	31.3 L	33.8 L	24.6 L	29.6 L	17.1	31.5	36.9
Manganese	260	1,800	245	150	67.1	197	248	**286**	224	195	255	232	202	**272**	**327**
Mercury	0.15	24	0.23 U	**0.22 K**	0.11 U	0.17 U	0.19 UL	0.11 UL	0.18 UL	0.12 UL	0.16 UL	0.12 UL	0.31 U	0.36 U	0.35 U
Nickel	21	1,600	**59.6**	**31**	13.4	**21.5**	**29.9**	**32.2**	**30.2**	**25.7**	**36.1**	**27.1**	13.2	**21.4**	**23.3**
Selenium	1	390	0.97 UL	0.64 UL	0.82 B	0.66 UL	0.81 UL	0.47 UL	0.72 UL	0.55 L	0.67 UL	0.49 UL	**2.3 K**	**2.5 K**	1.8 U
Silver	1	390	3.9 U	2.7 U	1.7 U	2.7 U	3.3 U	1.9 U	2.9 U	2 U	2.7 U	2 U	1.2 U	1.4 U	1.4 U
Thallium	--	5.1	0.97 U	0.64 U	0.42 U	0.66 U	0.81 U	0.47 U	0.72 U	0.49 U	0.67 U	0.49 U	2.4 U	2.8 U	2.7 U
Vanadium	57	390	**273**	**69.5**	37.2	51.5	**67.2**	**81.9**	**68.4**	54	**65.2**	54.3	36.2	56.2	**69**

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	**ERA Marine SD Screening Value**	**CLEAN RSLs Res Soil X 10 for SD Adjusted**	YS06-SD015		YS06-SD016		YS06-SD017		YS06-SD018		YS06-SD019		YS06-SD020		
Sample ID			YS06-SD015-A-0794	YS06-SD015-B-0794	YS06-SD016-A-0794	YS06-SD016-B-0794	YS06-SD017-A-0794	YS06-SD017-B-0794	YS06-SD018-A-0794	YS06-SD018-B-0794	YS06-SD019-A-0794	YS06-SD019-B-0794	YS06-SD020-A-1294	YS06-SD020P-A-1294	YS06-SD020-B-1294
Sample Date			07/26/94	07/26/94	07/26/94	07/26/94	07/24/94	07/24/94	07/24/94	07/24/94	07/24/94	07/24/94	12/01/94	12/01/94	12/01/94
Chemical Name															
Zinc	150	24,000	**282**	**173**	119	79.6	**153**	145	144	133	149	129	101 J	**172 J**	**169 J**
Acid Volatile Sulfide/Simultaneously Extractable Metals (µmol/g)															
Zinc, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acid volatile sulfide	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry															
Alkalinity (mg/kg)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	--	--	6.64	6.94	6.76	6.19	7.19	7.55	6.85	7.32	7.21	6.51	8.43	8.4	8.26
Total organic carbon (TOC) (mg/kg)	--	--	81,400	71,900	18,800	44,600	33,400	27,500	27,800	2,300	25,800	20,100	NA	NA	NA
Grain Size (pct/p)															
Sieve No. 004 (4.75 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 010 (2.00 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 020 (850 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 040 (425 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 060 (250 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 080 (180 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 100 (150 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 230 (63-UM)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 200 (75 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed ERA Marine SD SVs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed both ERA Marine SD SVs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

N - Tentative Identification, consider present, special methods may be needed to confirm its presence or absence in future sampling efforts

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

mg/kg - Milligrams per kilogram

pct/p - Percent Passed

ph - pH units

µg/kg - Micrograms per kilogram

µmol/g - Micromoles per gram

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	ERA Marine SD Screening Value	CLEAN RSLs Res Soil X 10 for SD Adjusted	YS06-SD021		YS06-SD022		YS06-SD023			YS06-SD024			YS06-SD025		YS06-SD026	YS06-SD027
Sample ID			YS06-SD021-A-1294	YS06-SD021-B-1294	YS06-SD022-A-0794	YS06-SD022-B-0794	YS06-SD023-A-0794	YS06-SD023P-A-0794	YS06-SD023-B-0794	YS06-SD024-A-0794	YS06-SD024P-A-0794	YS06-SD024-B-0794	YS06-SD025-A-1294	YS06-SD025-B-1294	YS06-SD026-0296	YS06-SD027-0296
Sample Date			12/01/94	12/01/94	07/26/94	07/26/94	07/27/94	07/27/94	07/27/94	07/26/94	07/26/94	07/26/94	12/01/94	12/01/94	02/12/96	02/12/96
Chemical Name																
Volatile Organic Compounds (µg/kg)																
1,1-Dichloroethane	--	33,000	28 U	26 U	NA	NA	20 U	19 UJ	17 U	14 U	21 UJ	22 UJ	26 U	24 U	52 U	44 UJ
1,1-Dichloroethene	2,782	240,000	28 U	26 U	NA	NA	20 U	19 UJ	17 U	14 U	21 UJ	22 UJ	26 U	24 U	52 U	44 UJ
1,2-Dichloroethene (total)	--	700,000	28 U	26 U	NA	NA	NA	NA	NA	NA	NA	NA	26 U	24 U	52 U	44 UJ
2-Butanone	--	28,000,000	28 U	26 U	NA	NA	23	19 UJ	17 U	14 U	21 UJ	22 UJ	26 U	24 U	52 U	44 UJ
Acetone	--	61,000,000	28 U	26 U	NA	NA	96	24 B	24 B	14 U	21 UJ	52 J	26 U	24 U	160 J	300 J
Carbon disulfide	--	740,000	28 U	26 U	NA	NA	20 U	19 UJ	17 U	14 U	21 UJ	22 UJ	26 U	24 U	52 UJ	44 UJ
Chloroethane	--	2,100,000	28 U	26 U	NA	NA	15 J	24 J	17 U	14 U	21 UJ	22 UJ	26 U	24 U	52 U	44 UJ
Chloromethane	--	120,000	28 U	26 U	NA	NA	20 U	16 J	17 U	14 U	21 UJ	22 UJ	26 U	24 U	52 U	44 UJ
cis-1,2-Dichloroethene	--	780,000	NA	NA	NA	NA	20 U	19 UJ	17 U	14 U	21 UJ	22 UJ	NA	NA	NA	NA
Methyl acetate	--	29,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	--	110,000	28 U	26 U	NA	NA	20 U	19 UJ	17 U	14 U	21 UJ	12 J	26 U	24 U	52 U	44 UJ
Toluene	1,086	820,000	28 U	26 U	NA	NA	20 U	19 UJ	12 J	14 UJ	21 UJ	22 UJ	26 U	24 U	52 U	44 UJ
trans-1,2-Dichloroethene	--	150,000	NA	NA	NA	NA	20 U	19 UJ	17 U	14 U	21 UJ	22 UJ	NA	NA	NA	NA
Trichloroethene	41	28,000	28 U	26 U	NA	NA	20 U	19 U	17 U	14 U	21 UJ	22 U	26 U	24 U	52 U	44 U
Vinyl chloride	--	600	28 U	26 U	NA	NA	20 U	19 UJ	17 U	14 U	21 UJ	22 UJ	26 U	24 U	52 U	44 UJ
Semivolatile Organic Compounds (µg/kg)																
2,4-Dinitrotoluene	--	16,000	250 U	250 U	450 U	450 U	450 U	450 U	450 U	430 U	450 U	450 U	250 U	250 U	1,700 U	1,400 U
2,6-Dinitrotoluene	549	61,000	260 U	260 U	920 U	460 U	610 U	540 U	490 U	430 U	450 U	470 U	260 U	260 U	1,700 U	1,400 U
2-Methylnaphthalene	70	310,000	940 U	840 U	920 U	460 U	610 U	540 U	490 U	430 U	450 U	470 U	820 U	730 U	1,700 U	1,400 U
4-Methylphenol	670	310,000	940 U	840 U	920 U	460 U	610 U	540 U	490 U	430 U	450 U	470 U	820 U	730 U	1,700 U	1,400 U
Acenaphthene	16	3,400,000	940 U	840 U	920 U	460 U	610 U	540 U	490 U	430 U	450 U	470 U	820 U	730 U	1,700 U	1,400 U
Anthracene	85.3	17,000,000	940 U	840 U	920 U	460 U	610 U	540 U	490 U	430 U	450 U	470 U	820 U	730 U	1,700 U	1,400 U
Benzo(a)anthracene	261	1,500	940 U	840 U	920 U	460 U	610 U	540 U	490 U	210 J	**450 J**	470 U	820 U	730 U	1,700 U	1,400 U
Benzo(a)pyrene	430	150	940 U	840 U	920 UJ	460 U	610 U	540 U	490 U	**180 J**	**400 J**	470 U	820 U	730 U	1,700 U	1,400 U
Benzo(b)fluoranthene	1,800	1,500	940 U	840 U	920 UJ	460 U	610 U	540 U	490 U	290 J	630	470 U	820 U	730 U	1,700 U	1,400 U
Benzo(g,h,i)perylene	670	1,700,000	940 U	840 U	920 UJ	460 U	610 U	540 U	490 U	430 UJ	450 U	470 U	820 U	730 U	1,700 U	1,400 U
Benzo(k)fluoranthene	1,800	15,000	940 U	840 U	920 UJ	460 U	610 U	540 U	490 U	83 J	210 J	470 U	820 U	730 U	1,700 U	1,400 U
bis(2-Ethylhexyl)phthalate	182	350,000	940 U	840 U	920 U	460 U	**16,000**	**35,000**	**620**	430 U	**630**	**220 J**	820 U	730 U	1,700 U	1,400 U
Carbazole	--	--	940 U	840 U	920 U	460 U	610 U	540 U	490 U	430 U	450 U	470 U	820 U	730 U	1,700 U	1,400 U
Chrysene	384	150,000	940 U	840 U	920 U	460 U	610 U	540 U	490 U	220 J	**500**	470 U	820 U	730 U	1,700 U	1,400 U
Dibenz(a,h)anthracene	63.4	150	940 U	840 U	920 UJ	460 U	610 U	540 U	490 U	430 UJ	450 U	470 U	820 U	730 U	1,700 U	1,400 U
Di-n-butylphthalate	58	6,100,000	**3,500**	**5,300**	920 U	460 U	610 U	540 U	490 U	430 U	**170 J**	470 U	**3,800**	**4,100**	1,700 U	1,400 U
Fluoranthene	600	2,300,000	940 U	840 U	920 U	460 U	610 U	540 U	490 U	480	**930**	470 U	820 U	730 U	1,700 U	1,400 U
Fluorene	19	2,300,000	940 U	840 U	920 U	460 U	610 U	540 U	490 U	430 U	450 U	470 U	820 U	730 U	1,700 U	1,400 U
Indeno(1,2,3-cd)pyrene	600	1,500	940 U	840 U	920 UJ	460 U	610 U	540 U	490 U	430 UJ	170 J	470 U	820 U	730 U	1,700 U	1,400 U
Naphthalene	160	36,000	940 U	840 U	920 U	460 U	610 U	540 U	490 U	430 U	450 U	470 U	820 U	730 U	1,700 U	1,400 U
Nitrobenzene	21	48,000	260 U	260 U	580 U	460 U	580 U	540 U	490 U	430 U	450 U	470 U	260 U	260 U	210 U	210 U
Phenanthrene	240	17,000,000	940 U	840 U	920 U	460 U	610 U	540 U	490 U	**400 J**	**550**	470 U	820 U	730 U	1,700 U	1,400 U
Phenol	420	18,000,000	940 U	840 U	920 U	460 U	610 U	540 U	490 U	430 U	450 U	470 U	820 U	730 U	1,700 U	1,400 U
Pyrene	665	1,700,000	940 U	840 U	920 U	460 U	610 U	540 U	490 U	400 J	**790**	470 U	820 U	730 U	1,700 U	1,400 U
Pesticide/Polychlorinated Biphenyls (µg/kg)																
Aroclor-1260	48	2,200	94 U	39 J	NA	NA	NA	NA	NA	NA	NA	NA	82 U	73 U	NA	NA
Methoxychlor	30	310,000	48 U	44 U	NA	NA	NA	NA	NA	NA	NA	NA	42 U	38 U	NA	NA
Explosives (µg/kg)																
1,3,5-Trinitrobenzene	7,000	2,200,000	250 U	250 U	560 U	560 U	560 U	560 U	560 U	560 U	560 U	560 U	250 U	250 U	130 U	130 U
1,3-Dinitrobenzene	--	6,100	250 U	250 U	420 U	420 U	420 U	420 U	420 U	420 U	420 U	420 U	250 U	250 U	120 U	120 U
2,4,6-Trinitrotoluene	20,000	36,000	250 U	250 U	440 U	440 U	440 U	440 U	440 U	440 U	440 U	440 U	250 U	250 U	120 U	120 U
2-Amino-4,6-dinitrotoluene	--	150,000	250 U	250 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	250 U	250 U	NA	NA
2-Nitrotoluene	--	29,000	NA	NA	820 U	820 U	820 U	820 U	820 U	820 U	820 U	820 U	NA	NA	500 U	500 U
4-Amino-2,6-dinitrotoluene	--	150,000	250 U	250 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	1,000 U	250 U	250 U	200 U	200 U
HMX	115,000	3,900,000	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	1,100 U	1,100 U
RDX	891,000	55,000	500 U	500 U	590 U	590 U	590 U	590 U	590 U	590 U	590 U	590 U	500 U	500 U	540 U	540 U
Tetryl	72	240,000	650 U	650 U	1,200 U	1,200 U	1,200 U	1,200 U	1,200 U	1,200 U	1,200 U	1,200 U	880 U	650 U	380 U	380 U
Total Metals (mg/kg)																
Aluminum	18,000	77,000	16,700	**22,000**	10,100	11,200	5,420	6,410	4,080	2,560	10,800	16,000	15,000	14,300	NA	NA
Antimony	2	31	6.7 UL	6 UL	23 UL	9.6 UL	14.5 UL	13.6 UL	12.2 UL	9.9 UL	15.7 UL	15.6 UL	5.9 UL	5.3 UL	NA	NA
Arsenic	8.2	3.9	**9.8**	**9.6**	**13.5**	3.8	1.7	1.5	**4.4**	**6.8**	**18.2**	**23.8**	**8.9**	**10.7**	NA	NA
Barium	48	15,000	33.7	41.8	**54.8**	28.3	20.8	24.3	16.2	17.3	47.1	**48.9**	29	28.9	NA	NA
Beryllium	--	160	0.93	1	0.62 U	0.5	0.39 U	0.45	0.33	0.27 U	0.86	0.69	0.91	1	NA	NA
Cadmium	1.2	70	0.93 K	0.74 U	3.1 U	1.3 U	2 UL	1.8 UL	1.6 UL	1.3 U	2.1 U	2.1 U	0.73 U	0.65 U	NA	NA
Chromium	81	2.9	**35**	**42.2**	**21.7**	**21.2**	**31.4**	**33.1**	**14.8**	**12.5**	**33.1**	**35.7**	**34.1**	**32.7**	NA	NA
Cobalt	10	23	9.2	**10.4**	4.7	2.8	1.6	2.1	2.7	1.1 U	5.4	4.6	8.8	**10.5**	NA	NA
Copper	34	3,100	17.1	19.7	13.5	3.1	21.2	15	2.3	10.3	28.2	12.8	14.6	14.9	NA	NA
Cyanide	--	1,600	7.1 U	6.4 U	1.6 U	0.65 U	0.97 U	0.92 U	0.83 U	0.67 U	1.1 U	1.1 U	6.3 U	5.5 U	NA	NA
Iron	220,000	55,000	30,200	33,000	20,100	11,900 J	8,130	8,810	8,450	17,400	25,400	27,000	27,400	31,500	NA	NA
Lead	47	4,000	24.2	30.8	**47.6 L**	6.2 L	**59.4**	40.8	6.1	20.4 L	**49.7 L**	**48.4 L**	20.8	18.7	NA	NA
Manganese	260	1,800	222	239	29.8	20.8	13.6	17.1	10.7	28	47.4	68.3	207	227	NA	NA
Mercury	0.15	24	0.28 U	**0.31 K**	0.14 U	0.06 U	0.1 UL	0.09 UL	0.08 UL	0.06 U	0.1 U	0.1 U	0.25 U	0.22 U	NA	NA
Nickel	21	1,600	16.8	18.8	**21.9**	8 K	6.3 U	6.4	5.8	4.9 K	**24.1**	17.2	13	16.1	NA	NA
Selenium	1	390	1.5 U	1.3 U	1.1 B	0.37 B	0.43 L	0.39 L	0.36 L	0.31 B	**1.2 L**	1.1 B	1.3 U	**1.4 K**	NA	NA
Silver	1	390	1.1 U	0.99 U	2.5 U	1 U	1.6 U	1.5 U	1.3 U	1.1 U	1.7 U	1.7 U	0.97 U	0.87 U	NA	NA
Thallium	--	5.1	2.3 U	2 U	0.63 U	0.26 U	0.4 U	37 U	0.33 U	0.27 U	0.42 U	0.42 U	2 U	1.7 U	NA	NA
Vanadium	57	390	44.8	53.9	30.5	22.2	16	14.5	9.2	21.8	**81.6**	37.4	40.7	44.7	NA	NA

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	**ERA Marine SD Screening Value**	**CLEAN RSLs Res Soil X 10 for SD Adjusted**	YS06-SD021		YS06-SD022		YS06-SD023			YS06-SD024			YS06-SD025		YS06-SD026	YS06-SD027
Sample ID			YS06-SD021-A-1294	YS06-SD021-B-1294	YS06-SD022-A-0794	YS06-SD022-B-0794	YS06-SD023-A-0794	YS06-SD023P-A-0794	YS06-SD023-B-0794	YS06-SD024-A-0794	YS06-SD024P-A-0794	YS06-SD024-B-0794	YS06-SD025-A-1294	YS06-SD025-B-1294	YS06-SD026-0296	YS06-SD027-0296
Sample Date			12/01/94	12/01/94	07/26/94	07/26/94	07/27/94	07/27/94	07/27/94	07/26/94	07/26/94	07/26/94	12/01/94	12/01/94	02/12/96	02/12/96
Chemical Name																
Zinc	150	24,000	106 J	126 J	90.8	22.8	63	56	22.6	101	**207**	139	101 J	99.7 J	NA	NA
Acid Volatile Sulfide/Simultaneously Extractable Metals (µmol/g)																
Zinc, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acid volatile sulfide	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry																
Alkalinity (mg/kg)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	--	--	8.41	8.43	4.85	5.15	6.06	5.71	5.24	6.97	6.67	7.11	8.57	8.7	NA	NA
Total organic carbon (TOC) (mg/kg)	--	--	NA	NA	55,100	15,600	31,300	NA	26,200	6,280	NA	28,400	NA	NA	NA	NA
Grain Size (pct/p)																
Sieve No. 004 (4.75 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 010 (2.00 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 020 (850 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 040 (425 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 060 (250 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 080 (180 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 100 (150 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 230 (63-UM)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 200 (75 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed ERA Marine SD SVs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed both ERA Marine SD SVs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

N - Tentative Identification, consider present, special methods may be needed to confirm its presence or absence in future sampling efforts

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

mg/kg - Milligrams per kilogram

pct/p - Percent Passed

ph - pH units

µg/kg - Micrograms per kilogram

µmol/g - Micromoles per gram

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	ERA Marine SD Screening Value	CLEAN RSLs Res Soil X 10 for SD Adjusted	YS06-SD028	YS06-SD029		YS06-SD030				YS06-SD031	YS06-SD032		
Sample ID			YS06-SD028-0296	YS06-SD029-A-0296	YS06-SD029-B-0296	YS06-SD030-A-0296	YS06-SD030P-A-0296	YS06-SD030-B-0296	YS06-SD030-C-0296	YS06-SD031-0296	YS06-SD032-A-0296	YS06-SD032P-A-0296	YS06-SD032-B-0296
Sample Date			02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/12/96	02/12/96	02/12/96	02/12/96
Chemical Name													
Volatile Organic Compounds (µg/kg)													
1,1-Dichloroethane	--	33,000	41 U	58 U	25 U	34 U	35 U	32 U	23 U	40 U	17 U	17 U	16 U
1,1-Dichloroethene	2,782	240,000	41 U	58 U	25 U	34 U	35 U	32 U	23 U	40 U	17 U	17 U	16 U
1,2-Dichloroethene (total)	--	700,000	41 U	58 U	25 U	34 U	35 U	32 U	23 U	40 U	17 U	17 U	16 U
2-Butanone	--	28,000,000	62 J	58 U	25 U	71 J	62 J	32 U	23 U	67 J	17 U	17 U	16 U
Acetone	--	61,000,000	250 J	160 J	44 J	270 J	260 J	50 J	23 UJ	230 J	17 UJ	17 UJ	16 UJ
Carbon disulfide	--	740,000	41 UJ	58 U	66 J	40 J	47 J	67 J	35 J	40 UJ	17 UJ	17 UJ	16 UJ
Chloroethane	--	2,100,000	41 U	58 U	25 U	34 U	35 U	32 U	23 U	40 U	17 U	17 U	16 U
Chloromethane	--	120,000	41 U	58 U	25 U	34 U	35 U	32 U	23 U	40 U	17 U	17 U	16 U
cis-1,2-Dichloroethene	--	780,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl acetate	--	29,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	--	110,000	41 U	58 U	25 U	34 U	35 U	32 U	23 U	40 U	17 U	17 U	16 U
Toluene	1,086	820,000	41 U	58 U	25 U	34 U	35 U	32 U	23 U	40 U	17 U	17 U	16 U
trans-1,2-Dichloroethene	--	150,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	41	28,000	41 U	58 U	25 U	34 U	35 U	32 U	23 U	40 U	17 U	17 U	16 U
Vinyl chloride	--	600	41 U	58 U	25 U	34 U	35 U	32 U	23 U	40 U	17 U	17 U	16 U
Semivolatile Organic Compounds (µg/kg)													
2,4-Dinitrotoluene	--	16,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	540 U	540 U	540 U
2,6-Dinitrotoluene	549	61,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	540 U	540 U	540 U
2-Methylnaphthalene	70	310,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	540 U	540 U	540 U
4-Methylphenol	670	310,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	540 U	540 U	540 U
Acenaphthene	16	3,400,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	540 U	**240 J**	**610**
Anthracene	85.3	17,000,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	540 U	540 U	540 U
Benzo(a)anthracene	261	1,500	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	210 J	180 J	110 J
Benzo(a)pyrene	430	150	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	**230 J**	**220 J**	94 J
Benzo(b)fluoranthene	1,800	1,500	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	420 J	590	240 J
Benzo(g,h,i)perylene	670	1,700,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	230 J	200 J	94 J
Benzo(k)fluoranthene	1,800	15,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	190 J	170 J	88 J
bis(2-Ethylhexyl)phthalate	182	350,000	1,300 UJ	1,900 U	820 U	1,100 UJ	1,200 UJ	1,000 U	770 U	1,300 U	540 UJ	540 U	540 U
Carbazole	--	--	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	540 U	540 U	540 U
Chrysene	384	150,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	280 J	240 J	120 J
Dibenz(a,h)anthracene	63.4	150	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	62 J	540 U	540 U
Di-n-butylphthalate	58	6,100,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	540 U	540 U	540 U
Fluoranthene	600	2,300,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	200 J	320 J	570
Fluorene	19	2,300,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	540 U	540 U	540 U
Indeno(1,2,3-cd)pyrene	600	1,500	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	220 J	190 J	100 J
Naphthalene	160	36,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	540 U	540 U	540 U
Nitrobenzene	21	48,000	200 U	210 U	210 U	210 U	210 U	210 U	210 U	210 U	210 U	210 U	210 U
Phenanthrene	240	17,000,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	110 J	540 U	540 U
Phenol	420	18,000,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	540 U	540 U	540 U
Pyrene	665	1,700,000	1,300 U	1,900 U	820 U	1,100 U	1,200 U	1,000 U	770 U	1,300 U	420 J	530 J	520 J
Pesticide/Polychlorinated Biphenyls (µg/kg)													
Aroclor-1260	48	2,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	30	310,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (µg/kg)													
1,3,5-Trinitrobenzene	7,000	2,200,000	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U	130 U
1,3-Dinitrobenzene	--	6,100	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,4,6-Trinitrotoluene	20,000	36,000	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2-Amino-4,6-dinitrotoluene	--	150,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrotoluene	--	29,000	490 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	490 U	500 U
4-Amino-2,6-dinitrotoluene	--	150,000	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U	200 U
HMX	115,000	3,900,000	1,100 U	1,100 U	1,100 U	1,100 U	1,100 U	1,100 U	1,100 U	1,100 U	1,100 U	1,100 U	1,100 U
RDX	891,000	55,000	530 U	540 U	530 U	530 U	540 U	530 U	530 U	540 U	540 U	530 U	540 U
Tetryl	72	240,000	370 U	380 U	380 U	380 U	380 U	380 U	380 U	380 U	380 U	370 U	380 U
Total Metals (mg/kg)													
Aluminum	18,000	77,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	2	31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	8.2	3.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	48	15,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	1.2	70	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	81	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	10	23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	34	3,100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	--	1,600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	220,000	55,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	47	4,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	260	1,800	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.15	24	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	21	1,600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	1	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	1	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	--	5.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	57	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	**ERA Marine SD Screening Value**	**CLEAN RSLs Res Soil X 10 for SD Adjusted**	YS06-SD028	YS06-SD029		YS06-SD030				YS06-SD031	YS06-SD032		
Sample ID			YS06-SD028-0296	YS06-SD029-A-0296	YS06-SD029-B-0296	YS06-SD030-A-0296	YS06-SD030P-A-0296	YS06-SD030-B-0296	YS06-SD030-C-0296	YS06-SD031-0296	YS06-SD032-A-0296	YS06-SD032P-A-0296	YS06-SD032-B-0296
Sample Date			02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/12/96	02/12/96	02/12/96	02/12/96
Chemical Name													
Zinc	150	24,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acid Volatile Sulfide/Simultaneously Extractable Metals (µmol/g)													
Zinc, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acid volatile sulfide	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry													
Alkalinity (mg/kg)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/kg)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Grain Size (pct/p)													
Sieve No. 004 (4.75 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 010 (2.00 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 020 (850 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 040 (425 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 060 (250 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 080 (180 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 100 (150 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 230 (63-UM)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 200 (75 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed ERA Marine SD SVs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed both ERA Marine SD SVs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

N - Tentative Identification, consider present, special methods may be needed to confirm its presence or absence in future sampling efforts

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

mg/kg - Milligrams per kilogram

pct/p - Percent Passed

ph - pH units

µg/kg - Micrograms per kilogram

µmol/g - Micromoles per gram

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	ERA Marine SD Screening Value	CLEAN RSLs Res Soil X 10 for SD Adjusted	YS06-SD033				YS06-SD034			YS06-SD035	YS06-SD036				YS06-SD037
Sample ID			YS06-SD033-A-0296	YS06-SD033P-A-0296	YS06-SD033-B-0296	YS06-SD033P-B-0296	YS06-SD034-C-0296	YS06-SD034-A-0296	YS06-SD034-B-0296	YS06-SD035-0296	YS06-SD036-A-0296	YS06-SD036P-A-0296	YS06-SD036-B-0296	YS06-SD036-C-0296	YS06-SD037-0296
Sample Date			02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96
Chemical Name															
Volatile Organic Compounds (µg/kg)															
1,1-Dichloroethane	--	33,000	44 U	43 U	16 U	16 U	NA	24 U	16 U	53 U	48 U	51 U	31 U	27 U	46 U
1,1-Dichloroethene	2,782	240,000	44 U	43 U	16 U	16 U	NA	24 U	16 U	53 U	48 U	51 U	31 U	27 U	46 U
1,2-Dichloroethene (total)	--	700,000	44 U	43 U	16 U	16 U	NA	24 U	16 U	53 U	48 U	51 U	31 U	27 U	46 U
2-Butanone	--	28,000,000	44 U	43 UJ	16 UJ	16 UJ	NA	24 UJ	16 UJ	53 U	48 U	51 UJ	31 U	27 UJ	46 U
Acetone	--	61,000,000	44 UJ	390 J	80 J	78 J	NA	24 UJ	16 UJ	53 UJ	48 UJ	130 J	31 U	180 J	280 J
Carbon disulfide	--	740,000	44 U	43 U	16 U	16 U	NA	24 U	16 U	53 U	48 U	51 U	31 U	66 J	46 U
Chloroethane	--	2,100,000	44 U	43 U	16 U	16 U	NA	24 U	16 U	53 U	48 U	51 U	31 U	27 U	46 U
Chloromethane	--	120,000	44 U	43 U	16 U	16 U	NA	24 U	16 U	53 U	48 U	51 U	31 U	27 U	46 U
cis-1,2-Dichloroethene	--	780,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl acetate	--	29,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	--	110,000	44 U	43 U	16 U	16 U	NA	24 U	16 U	53 U	48 U	51 U	31 U	27 U	46 U
Toluene	1,086	820,000	44 U	43 U	16 U	16 U	NA	24 U	16 U	53 U	48 U	51 U	31 U	27 U	46 U
trans-1,2-Dichloroethene	--	150,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	41	28,000	44 U	43 U	16 U	16 U	NA	24 U	16 U	53 U	48 U	51 U	31 U	27 U	46 U
Vinyl chloride	--	600	44 U	43 U	16 U	16 U	NA	24 U	16 U	53 U	48 U	51 U	31 U	27 U	46 U
Semivolatile Organic Compounds (µg/kg)															
2,4-Dinitrotoluene	--	16,000	1,400 U	1,400 U	520 U	540 U	NA	790 U	530 U	1,800 U	1,600 U	1,700 U	1,000 U	860 U	1,500 U
2,6-Dinitrotoluene	549	61,000	1,400 U	1,400 U	520 U	540 U	NA	790 U	530 U	1,800 U	1,600 U	1,700 U	1,000 U	860 U	1,500 U
2-Methylnaphthalene	70	310,000	1,400 U	1,400 U	520 U	540 U	NA	790 U	530 U	**210 J**	1,600 U	1,700 U	1,000 U	860 U	1,500 U
4-Methylphenol	670	310,000	1,400 U	1,400 U	520 U	540 U	NA	790 U	530 U	1,800 U	1,600 U	**1,500 J**	1,000 U	860 U	1,500 U
Acenaphthene	16	3,400,000	1,400 U	1,400 U	**170 J**	540 U	NA	790 U	530 U	1,800 U	1,600 U	1,700 U	1,000 U	860 U	1,500 U
Anthracene	85.3	17,000,000	1,400 U	1,400 U	69 J	76 J	NA	790 U	530 U	1,800 U	1,600 U	1,700 U	1,000 U	860 U	1,500 U
Benzo(a)anthracene	261	1,500	**500 J**	**350 J**	200 J	**280 J**	NA	94 J	530 U	**280 J**	1,600 U	1,700 U	1,000 U	860 U	1,500 U
Benzo(a)pyrene	430	150	**640 J**	**600 J**	**160 J**	**210 J**	NA	150 J	140 J	**290 J**	1,600 U	1,700 U	**180 J**	99 J	1,500 U
Benzo(b)fluoranthene	1,800	1,500	**1,900**	**1,600**	400 J	480 J	NA	310 J	530 U	380 J	200 J	1,700 U	1,000 U	860 U	1,500 U
Benzo(g,h,i)perylene	670	1,700,000	490 J	520 J	86 J	120 J	NA	130 J	530 U	1,800 U	1,600 U	1,700 U	1,000 U	860 U	1,500 U
Benzo(k)fluoranthene	1,800	15,000	530 J	570 J	140 J	190 J	NA	110 J	530 U	1,800 U	1,600 U	1,700 U	1,000 U	860 U	1,500 U
bis(2-Ethylhexyl)phthalate	182	350,000	1,400 U	1,400 U	520 U	540 U	NA	790 U	530 U	**760 J**	**360 J**	**280 J**	1,000 U	860 U	1,500 U
Carbazole	--	--	1,400 U	1,400 U	80 J	540 U	NA	790 U	530 U	1,800 U	1,600 U	1,700 U	1,000 U	860 U	1,500 U
Chrysene	384	150,000	**1,200 J**	**740 J**	350 J	**420 J**	NA	160 J	530 U	380 J	1,600 U	1,700 U	1,000 U	860 U	1,500 U
Dibenz(a,h)anthracene	63.4	150	1,400 U	**140 J**	520 U	540 U	NA	790 U	530 U	1,800 U	1,600 U	1,700 U	1,000 U	860 U	1,500 U
Di-n-butylphthalate	58	6,100,000	1,400 U	1,400 U	520 U	540 U	NA	790 U	530 U	1,800 U	**580 J**	**280 J**	1,000 U	860 U	1,500 U
Fluoranthene	600	2,300,000	**1,700**	**960 J**	**1,200**	**1,100**	NA	220 J	530 U	570 J	1,600 U	1,700 U	1,000 U	860 U	170 J
Fluorene	19	2,300,000	1,400 U	1,400 U	520 U	540 U	NA	790 U	530 U	1,800 U	1,600 U	1,700 U	1,000 U	860 U	1,500 U
Indeno(1,2,3-cd)pyrene	600	1,500	**620 J**	600 J	97 J	140 J	NA	790 U	530 U	1,800 U	1,600 U	1,700 U	1,000 U	860 U	1,500 U
Naphthalene	160	36,000	1,400 U	1,400 U	520 U	540 U	NA	790 U	530 U	1,800 U	1,600 U	1,700 U	1,000 U	860 U	1,500 U
Nitrobenzene	21	48,000	200 U	210 U	210 U	210 U	NA	210 U	210 U	210 U	210 U	220 U	230 U	210 U	210 U
Phenanthrene	240	17,000,000	**260 J**	180 J	**260 J**	84 J	NA	790 U	530 U	**350 J**	1,600 U	1,700 U	1,000 U	860 U	1,500 U
Phenol	420	18,000,000	1,400 U	1,400 U	520 U	540 U	NA	790 U	530 U	1,800 U	1,600 U	1,700 U	1,000 U	860 U	1,500 U
Pyrene	665	1,700,000	**1,600**	**1,100 J**	**1,200**	**1,300**	NA	240 J	530 U	650 J	300 J	1,700 U	1,000 U	860 U	160 J
Pesticide/Polychlorinated Biphenyls (µg/kg)															
Aroclor-1260	48	2,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	100 U	NA	NA
Methoxychlor	30	310,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	50 U	NA	NA
Explosives (µg/kg)															
1,3,5-Trinitrobenzene	7,000	2,200,000	130 U	130 U	130 U	130 U	NA	130 U	130 U	130 U	130 U	140 U	140 U	130 U	130 U
1,3-Dinitrobenzene	--	6,100	120 U	120 U	120 U	120 U	NA	120 U	120 U	120 U	120 U	130 U	130 U	120 U	120 U
2,4,6-Trinitrotoluene	20,000	36,000	120 U	320 N	120 U	120 U	NA	130 N	120 U	1,200 N	200 N	140 N	140 U	120 U	120 U
2-Amino-4,6-dinitrotoluene	--	150,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrotoluene	--	29,000	490 U	500 U	500 U	500 U	NA	500 U	500 U	500 U	500 U	530 U	540 U	500 U	500 U
4-Amino-2,6-dinitrotoluene	--	150,000	200 U	200 UJ	200 U	200 U	NA	200 UJ	200 U	1,000 N	190 JN	220 N	220 U	200 U	200 U
HMX	115,000	3,900,000	1,100 U	1,100 U	1,100 U	1,100 U	NA	1,100 U	1,100 U	1,100 U	1,100 U	1,200 U	1,200 U	1,100 U	1,100 U
RDX	891,000	55,000	530 U	540 U	540 U	540 U	NA	540 U	530 U	540 U	540 U	570 U	580 U	540 U	540 U
Tetryl	72	240,000	370 U	380 U	380 U	380 U	NA	380 U	380 U	380 U	380 U	400 U	410 U	380 U	380 U
Total Metals (mg/kg)															
Aluminum	18,000	77,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	2	31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	8.2	3.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	48	15,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	1.2	70	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	81	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	10	23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	34	3,100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	--	1,600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	220,000	55,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	47	4,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	260	1,800	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.15	24	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	21	1,600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	1	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	1	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	--	5.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	57	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	**ERA Marine SD Screening Value**	**CLEAN RSLs Res Soil X 10 for SD Adjusted**	YS06-SD033				YS06-SD034			YS06-SD035	YS06-SD036				YS06-SD037
Sample ID			YS06-SD033-A-0296	YS06-SD033P-A-0296	YS06-SD033-B-0296	YS06-SD033P-B-0296	YS06-SD034-C-0296	YS06-SD034-A-0296	YS06-SD034-B-0296	YS06-SD035-0296	YS06-SD036-A-0296	YS06-SD036P-A-0296	YS06-SD036-B-0296	YS06-SD036-C-0296	YS06-SD037-0296
Sample Date			02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/13/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96
Chemical Name															
Zinc	150	24,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acid Volatile Sulfide/Simultaneously Extractable Metals (µmol/g)															
Zinc, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acid volatile sulfide	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry															
Alkalinity (mg/kg)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/kg)	--	--	NA	NA	NA	NA	4,400	NA	NA	NA	NA	NA	NA	NA	NA
Grain Size (pct/p)															
Sieve No. 004 (4.75 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 010 (2.00 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 020 (850 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 040 (425 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 060 (250 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 080 (180 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 100 (150 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 230 (63-UM)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 200 (75 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed ERA Marine SD SVs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed both ERA Marine SD SVs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

N - Tentative Identification, consider present, special methods may be needed to confirm its presence or absence in future sampling efforts

R - Unreliable Result

U - The material was analyzed for, but not detected

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UL - Analyte not detected, quantitation limit is probably higher

mg/kg - Milligrams per kilogram

pct/p - Percent Passed

ph - pH units

µg/kg - Micrograms per kilogram

µmol/g - Micromoles per gram

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	ERA Marine SD Screening Value	CLEAN RSLs Res Soil X 10 for SD Adjusted	YS06-SD038			YS06-SD039	YS06-SD040	YS06-SD041			YS06-SD042				YS06-SD043	YS06-SD044
Sample ID			YS06-SD038-A-0296	YS06-SD038-B-0296	YS06-SD038-C-0296	YS06-SD039-0296	YS06-SD040-0296	YS06-SD041-A-0296	YS06-SD041-B-0296	YS06-SD041-C-0296	YS06-SD042-A-0296	YS06-SD042P-A-0296	YS06-SD042-B-0296	YS06-SD042-C-0296	YS06-SD043-0296	YS06-SD044-0296
Sample Date			02/13/96	02/13/96	02/13/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96
Chemical Name																
Volatile Organic Compounds (µg/kg)																
1,1-Dichloroethane	--	33,000	35 U	16 U	19 U	62 U	52	65 U	28 U	23 U	31 U	35 U	15 U	16 U	54 U	19 U
1,1-Dichloroethene	2,782	240,000	35 U	16 U	19 U	62 U	14 UJ	65 U	28 U	23 U	31 U	35 U	15 U	16 U	54 U	19 U
1,2-Dichloroethene (total)	--	700,000	35 U	9 J	50	62 U	20 U	65 U	28 U	23 U	31 U	35 U	15 U	27	54 U	19 U
2-Butanone	--	28,000,000	35 UJ	16 UJ	19 UJ	62 U	20 U	65 U	28 U	23 U	42 J	50 J	15 U	16 U	54 U	19 U
Acetone	--	61,000,000	35 UJ	48 J	37 J	64 J	20 U	370 J	28 U	23 U	96 J	93 J	31 J	16 UJ	54 UJ	19 U
Carbon disulfide	--	740,000	35 U	16 U	19 U	62 U	20 U	65 U	28 U	23 U	31 UJ	35 UJ	15 UJ	16 UJ	54 U	19 U
Chloroethane	--	2,100,000	35 U	16 U	19 U	62 U	20 U	65 U	28 U	23 U	31 U	35 U	15 U	16 U	54 U	19 U
Chloromethane	--	120,000	35 U	16 U	19 U	62 U	20 U	65 U	28 U	23 U	31 U	35 U	15 U	16 U	54 U	19 U
cis-1,2-Dichloroethene	--	780,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl acetate	--	29,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	--	110,000	35 U	16 U	19 U	62 U	20 U	65 U	28 U	23 U	31 U	35 U	15 U	16 U	54 U	19 U
Toluene	1,086	820,000	35 U	16 U	19 U	62 U	20 U	65 U	28 U	23 U	31 U	35 U	15 U	16 U	54 U	19 U
trans-1,2-Dichloroethene	--	150,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	41	28,000	35 U	16 U	19 U	62 U	20 U	65 U	28 U	23 U	31 U	35 U	15 U	5 J	54 U	19 U
Vinyl chloride	--	600	35 U	63	19 U	62 U	20 U	65 U	28 U	23 U	31 U	35 U	15 U	16 U	54 U	19 U
Semivolatile Organic Compounds (µg/kg)																
2,4-Dinitrotoluene	--	16,000	1,200 U	540 U	650 U	2,000 U	650 U	2,100 U	930 U	770 U	1,000 U	1,100 U	480 U	1,900	1,800 U	630 U
2,6-Dinitrotoluene	549	61,000	1,200 U	540 U	650 U	2,000 U	650 U	2,100 U	930 U	770 U	1,000 U	1,100 U	480 U	540 U	1,800 U	630 U
2-Methylnaphthalene	70	310,000	1,200 U	540 U	650 U	2,000 U	650 U	2,100 U	930 U	770 U	1,000 U	1,100 U	**170 J**	540 U	1,800 U	630 U
4-Methylphenol	670	310,000	1,200 U	540 U	650 U	2,000 U	650 U	2,100 U	930 U	770 U	1,000 U	1,100 U	480 U	540 U	1,800 U	630 U
Acenaphthene	16	3,400,000	1,200 U	540 U	650 U	2,000 U	650 U	2,100 U	930 U	770 U	1,000 U	1,100 U	**68 J**	540 U	1,800 U	630 U
Anthracene	85.3	17,000,000	1,200 U	540 U	650 U	2,000 U	650 U	2,100 U	930 U	770 U	**120 J**	**130 J**	**170 J**	540 U	1,800 U	630 U
Benzo(a)anthracene	261	1,500	1,200 U	540 U	650 U	**540 J**	650 U	2,100 U	930 U	770 U	**840 J**	**810 J**	**640**	540 U	190 J	630 U
Benzo(a)pyrene	430	150	1,200 U	**410 J**	**570 J**	**530 J**	650 U	2,100 U	**160 J**	95 J	**620 J**	**730 J**	**580**	540 UJ	**230 J**	630 U
Benzo(b)fluoranthene	1,800	1,500	1,200 U	540 U	650 U	690 J	650 U	2,100 U	930 U	770 U	1,100	1,000 J	730	540 UJ	300 J	630 U
Benzo(g,h,i)perylene	670	1,700,000	1,200 U	540 U	650 U	340 J	650 U	2,100 U	930 U	770 U	460 J	430 J	340 J	540 UJ	230 J	630 U
Benzo(k)fluoranthene	1,800	15,000	1,200 U	540 U	650 U	270 J	650 U	2,100 U	930 U	770 U	410 J	370 J	340 J	540 UJ	1,800 U	630 U
bis(2-Ethylhexyl)phthalate	182	350,000	1,200 U	540 U	650 U	**470 J**	**430 J**	2,100 U	930 U	770 U	1,000 UJ	1,100 UJ	480 UJ	540 U	**1,400 J**	630 U
Carbazole	--	--	1,200 U	540 U	650 U	2,000 U	650 U	2,100 U	930 U	770 U	1,000 U	1,100 U	58 J	540 U	1,800 U	630 U
Chrysene	384	150,000	1,200 U	540 U	650 U	**610 J**	650 U	2,100 U	930 U	770 U	**920 J**	**930 J**	**670**	540 U	260 J	630 U
Dibenz(a,h)anthracene	63.4	150	1,200 U	540 U	650 U	2,000 U	650 U	2,100 U	930 U	770 U	**120 J**	**120 J**	**85 J**	540 UJ	1,800 U	630 U
Di-n-butylphthalate	58	6,100,000	1,200 U	540 U	650 U	2,000 U	**330 J**	2,100 U	930 U	770 U	1,000 U	1,100 U	480 U	540 U	1,800 U	630 U
Fluoranthene	600	2,300,000	1,200 U	540 U	67 J	**990 J**	650 U	2,100 U	930 U	770 U	**1,300**	**1,300**	**1,100**	69 J	370 J	630 U
Fluorene	19	2,300,000	1,200 U	540 U	650 U	2,000 U	650 U	2,100 U	930 U	770 U	1,000 U	1,100 U	**70 J**	540 U	1,800 U	630 U
Indeno(1,2,3-cd)pyrene	600	1,500	1,200 U	540 U	650 U	340 J	650 U	2,100 U	930 U	770 U	520 J	460 J	420 J	540 UJ	200 J	630 U
Naphthalene	160	36,000	1,200 U	540 U	650 U	2,000 U	650 U	2,100 U	930 U	770 U	1,000 U	1,100 U	67 J	540 U	1,800 U	630 U
Nitrobenzene	21	48,000	210 U	200 U	210 U	220 U	200 U	200 U	210 U	210 U	210 U	210 U	210 U	210 U	210 U	210 U
Phenanthrene	240	17,000,000	1,200 U	540 U	650 U	**410 J**	650 U	2,100 U	930 U	770 U	**620 J**	**560 J**	**790**	540 U	**260 J**	630 U
Phenol	420	18,000,000	1,200 U	540 U	650 U	2,000 U	650 U	2,100 U	930 U	770 U	1,000 U	1,100 U	480 U	540 U	1,800 U	630 U
Pyrene	665	1,700,000	1,200 U	540 U	67 J	**1,100 J**	650 U	2,100 U	930 U	770 U	**1,300**	**1,400**	**1,100**	120 J	500 J	630 U
Pesticide/Polychlorinated Biphenyls (µg/kg)																
Aroclor-1260	48	2,200	NA	NA	NA	NA	NA	NA	94 U	NA	NA	NA	47 U	NA	NA	NA
Methoxychlor	30	310,000	NA	NA	NA	NA	NA	NA	47 U	NA	NA	NA	24 U	NA	NA	NA
Explosives (µg/kg)																
1,3,5-Trinitrobenzene	7,000	2,200,000	130 U	130 U	130 U	140 U	130 U	120 U	130 U	130 U	130 U	130 U	130 U	450 N	130 U	130 U
1,3-Dinitrobenzene	--	6,100	120 U	120 U	120 U	130 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	210 N	120 U	120 U
2,4,6-Trinitrotoluene	20,000	36,000	120 U	120 U	120 U	6,200	120 U	120 U	120 U	120 U	150 N	240 N	130 N	**2,500,000 N**	120 U	120 U
2-Amino-4,6-dinitrotoluene	--	150,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrotoluene	--	29,000	490 U	490 U	500 U	530 U	490 U	480 U	490 U	500 U	490 U	490 U	490 U	500 U	500 U	500 U
4-Amino-2,6-dinitrotoluene	--	150,000	200 U	200 U	200 U	3,000 N	200 U	190 U	200 U	200 U	98 N	270 N	450 N	**520,000 N**	200 U	200 U
HMX	115,000	3,900,000	1,100 U	1,100 U	1,100 U	1,200 U	1,100 U	1,000 U	1,100 U	1,100 U	1,100 U	1,100 U	1,100 U	1,100 U	1,100 U	1,100 U
RDX	891,000	55,000	530 U	530 U	530 U	580 U	530 U	520 U	530 U	540 U	530 U	530 U	530 U	540 U	540 U	530 U
Tetryl	72	240,000	370 U	370 U	380 U	410 U	370 U	360 U	370 U	380 U	370 U	370 U	370 U	380,000 U	380 U	380 U
Total Metals (mg/kg)																
Aluminum	18,000	77,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	2	31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	8.2	3.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	48	15,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	--	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	1.2	70	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	81	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	10	23	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	34	3,100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	--	1,600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	220,000	55,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	47	4,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	260	1,800	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.15	24	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	21	1,600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	1	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	1	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	--	5.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	57	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	**ERA Marine SD Screening Value**	**CLEAN RSLs Res Soil X 10 for SD Adjusted**	YS06-SD038			YS06-SD039	YS06-SD040	YS06-SD041			YS06-SD042				YS06-SD043	YS06-SD044
Sample ID			YS06-SD038-A-0296	YS06-SD038-B-0296	YS06-SD038-C-0296	YS06-SD039-0296	YS06-SD040-0296	YS06-SD041-A-0296	YS06-SD041-B-0296	YS06-SD041-C-0296	YS06-SD042-A-0296	YS06-SD042P-A-0296	YS06-SD042-B-0296	YS06-SD042-C-0296	YS06-SD043-0296	YS06-SD044-0296
Sample Date			02/13/96	02/13/96	02/13/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96	02/12/96
Chemical Name																
Zinc	150	24,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acid Volatile Sulfide/Simultaneously Extractable Metals (µmol/g)																
Zinc, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acid volatile sulfide	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry																
Alkalinity (mg/kg)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/kg)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Grain Size (pct/p)																
Sieve No. 004 (4.75 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 010 (2.00 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 020 (850 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 040 (425 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 060 (250 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 080 (180 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 100 (150 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 230 (63-UM)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 200 (75 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed ERA Marine SD SVs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed both ERA Marine SD SVs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

N - Tentative Identification, consider present, special methods may be needed to confirm its presence or absence in future sampling efforts

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

mg/kg - Milligrams per kilogram

pct/p - Percent Passed

ph - pH units

µg/kg - Micrograms per kilogram

µmol/g - Micromoles per gram

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	ERA Marine SD Screening Value	CLEAN RSLs Res Soil X 10 for SD Adjusted	YS06-SD045			YS06-SD046	YS06-SD047	YS06-SD048	YS06-SD049	YS06-SD050	YS06-SD051	YS06-SD052	YS06-SD053	YS06-SD054	YS06-SD055	YS06-SD056	YS06-SD057
Sample ID			YS06-SD045-A-0296	YS06-SD045-B-0296	YS06-SD045-C-0296	YS06-SD046-0296	YS06-SD047-0296	YS06-SD048-0500	YS06-SD049-0500	YS06-SD050-0500	YS06-SD051-0500	YS06-SD052-0500	YS06-SD053-0500	YS06-SD054-0500	YS06-SD055-0500	YS06-SD056-0500	YS06-SD057-0500
Sample Date			02/12/96	02/12/96	02/12/96	02/12/96	02/13/96	05/11/00	05/11/00	05/11/00	05/11/00	05/11/00	05/11/00	05/11/00	05/11/00	05/11/00	05/11/00
Chemical Name																	
Volatile Organic Compounds (µg/kg)																	
1,1-Dichloroethane	--	33,000	52 U	34 U	17 U	NA	NA	24 U	24 U	42 U	33 U	62 U	67 U	50 U	40 U	71 U	45 U
1,1-Dichloroethene	2,782	240,000	52 U	34 U	17 U	NA	NA	24 U	24 U	42 U	33 U	62 U	67 U	50 U	40 U	71 U	45 U
1,2-Dichloroethene (total)	--	700,000	52 U	34 U	17 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	--	28,000,000	52 U	34 U	17 U	NA	NA	24 U	24 U	42 U	33 U	17 J	17 J	19 J	10 J	50 J	14 J
Acetone	--	61,000,000	52 UJ	34 UJ	17 UJ	NA	NA	37	19 J	30 B	31 B	62 B	78 B	89 B	41 B	140 B	58 B
Carbon disulfide	--	740,000	52 U	34 U	17 U	NA	NA	24 U	24 U	42 U	33 U	62 U	67 U	5 J	40 U	71 U	45 U
Chloroethane	--	2,100,000	52 U	34 U	17 U	NA	NA	24 U	24 U	42 U	33 U	62 U	67 U	50 U	40 U	71 U	45 U
Chloromethane	--	120,000	52 U	34 U	17 U	NA	NA	24 U	24 U	42 U	33 U	62 U	67 U	50 U	40 U	71 U	45 U
cis-1,2-Dichloroethene	--	780,000	NA	NA	NA	NA	NA	2 J	24 U	42 U	33 U	62 U	67 U	50 U	40 U	71 U	45 U
Methyl acetate	--	29,000,000	NA	NA	NA	NA	NA	24 U	24 U	42 U	33 U	62 U	67 U	8 J	40 U	71 U	45 U
Methylene chloride	--	110,000	52 U	34 U	17 U	NA	NA	9 B	10 B	8 B	10 B	18 B	16 B	17 B	29 B	50 B	42 B
Toluene	1,086	820,000	52 U	34 U	17 U	NA	NA	24 U	24 U	42 U	33 U	62 U	67 U	50 U	40 U	71 U	45 U
trans-1,2-Dichloroethene	--	150,000	NA	NA	NA	NA	NA	24 U	24 U	42 U	33 U	62 U	67 U	50 U	40 U	71 U	45 U
Trichloroethene	41	28,000	52 U	34 U	17 U	NA	NA	24 U	24 U	42 U	33 U	62 U	67 U	50 U	40 U	71 U	45 U
Vinyl chloride	--	600	52 U	34 U	17 U	NA	NA	24 U	24 U	42 U	33 U	62 U	67 U	50 U	40 U	71 U	45 U
Semivolatile Organic Compounds (µg/kg)																	
2,4-Dinitrotoluene	--	16,000	1,700 U	11,000 U	540 U	1,200 U	1,700 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U
2,6-Dinitrotoluene	549	61,000	1,700 U	11,000 U	540 U	1,200 U	1,700 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U
2-Methylnaphthalene	70	310,000	**220 J**	11,000 U	540 U	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	670	310,000	1,700 U	11,000 U	540 U	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	16	3,400,000	1,700 U	2,600 J	540 U	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	85.3	17,000,000	**520 J**	**6,800 J**	540 U	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	261	1,500	**2,100**	**9,100 J**	120 J	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	430	150	**2,000**	**9,600 J**	120 J	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	1,800	1,500	**2,400**	11,000 U	79 J	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	670	1,700,000	**1,600 J**	**2,300 J**	540 U	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1,800	15,000	960 J	11,000 U	540 U	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	182	350,000	**490 J**	11,000 U	540 U	**36,000**	1,700 UJ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	--	--	340 J	11,000 U	540 U	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	384	150,000	**2,400**	**11,000**	150 J	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	63.4	150	**330 J**	11,000 U	540 U	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	58	6,100,000	1,700 U	11,000 U	540 U	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	600	2,300,000	**3,900**	11,000 U	98 J	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	19	2,300,000	**220 J**	**5,000 J**	**65 J**	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	600	1,500	**1,800**	11,000 U	540 U	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	160	36,000	1,700 U	11,000 U	540 U	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	21	48,000	210 U	210 U	210 U	210 U	210 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U
Phenanthrene	240	17,000,000	**2,400**	**15,000**	120 J	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	420	18,000,000	1,700 U	11,000 U	540 U	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	665	1,700,000	**4,000**	**22,000**	350 J	1,200 U	1,700 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (µg/kg)																	
Aroclor-1260	48	2,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	30	310,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (µg/kg)																	
1,3,5-Trinitrobenzene	7,000	2,200,000	130 U	130 U	130 U	130 U	130 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U
1,3-Dinitrobenzene	--	6,100	120 U	120 U	120 U	120 U	120 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U
2,4,6-Trinitrotoluene	20,000	36,000	120 U	120 U	120 U	120 U	120 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	4,480 J
2-Amino-4,6-dinitrotoluene	--	150,000	NA	NA	NA	NA	NA	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	460 J
2-Nitrotoluene	--	29,000	500 U	500 U	500 U	500 U	500 U	4,760 U	4,760 U	4,760 U	4,760 U	4,760 U	4,760 U	4,760 U	4,760 U	4,760 U	4,760 U
4-Amino-2,6-dinitrotoluene	--	150,000	200 U	200 U	200 U	200 U	200 U	480 U	480 U	480 U	480 U	480 U	480 U	480 U	480 U	480 U	480 U
HMX	115,000	3,900,000	1,100 U	1,100 U	1,100 U	1,100 U	1,100 U	3,000 U	3,000 U	3,000 U	3,000 U	3,000 U	3,000 U	3,000 U	3,000 U	3,000 U	3,000 U
RDX	891,000	55,000	540 U	540 U	540 U	540 U	540 U	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U
Tetryl	72	240,000	380 U	380 U	380 U	380 U	380 U	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U
Total Metals (mg/kg)																	
Aluminum	18,000	77,000	NA	NA	NA	NA	NA	8,530 J	9,460 J	17,200 J	**19,500 J**	13,600 J	14,900 J	**19,600 J**	7,750 J	14,300 J	11,500 J
Antimony	2	31	NA	NA	NA	NA	NA	0.9 UL	1 UL	**2.2 L**	1.4 UL	**3.7 L**	**3 L**	2.1 UL	**6.2 L**	**4.4 L**	**19.9 L**
Arsenic	8.2	3.9	NA	NA	NA	NA	NA	**7.4**	**7**	**9.4**	**9.8**	**6.8 J**	**8.2 J**	**7.1 J**	**6.1 J**	**7.3 J**	**12.2**
Barium	48	15,000	NA	NA	NA	NA	NA	35.7 J	21.8 J	**57.4 J**	39.8 J	**55.4 J**	**59 J**	40.8 J	**54.8 J**	**52.4 J**	**139 J**
Beryllium	--	160	NA	NA	NA	NA	NA	1.4 J	0.84 J	1.4 J	1.3 J	1.3 J	1.5 J	1.3 J	1 J	1.4 J	1.7 J
Cadmium	1.2	70	NA	NA	NA	NA	NA	0.44 J	0.93 J	**3.8 J**	0.51 J	**5.1 J**	**2.9 J**	0.62 J	**4.4**	**3.6 J**	**15.3**
Chromium	81	2.9	NA	NA	NA	NA	NA	**25.5**	**26.5**	**42**	**42.7**	**38**	**38.7**	**42.3**	**25.4**	**38**	**44.7**
Cobalt	10	23	NA	NA	NA	NA	NA	5.3 J	4	7.1 J	7.4	5.9 J	8.6 J	7.6 J	4.4 J	5.7 J	6.7 J
Copper	34	3,100	NA	NA	NA	NA	NA	14.3	17.8	**48.1**	25.2	**54**	**46.4**	28.3	**49.2**	**56.1**	**122**
Cyanide	--	1,600	NA	NA	NA	NA	NA	0.11 U	0.11 U	0.32 J	0.15 U	2.2 J	0.29 U	0.29 J	0.2 J	0.69 J	0.42 J
Iron	220,000	55,000	NA	NA	NA	NA	NA	25,200 J	25,000 J	36,800 J	35,400 J	35,200 J	34,100 J	34,300 J	21,500 J	30,800 J	27,700 J
Lead	47	4,000	NA	NA	NA	NA	NA	20.8 J	26.8 J	**69 J**	37.6 J	**74.6 J**	**74.8 J**	44.5 J	**57.8 J**	**83 J**	**117 J**
Manganese	260	1,800	NA	NA	NA	NA	NA	81	131	208	**264**	172	**267**	**307**	210	138	150
Mercury	0.15	24	NA	NA	NA	NA	NA	0.11 U	0.11 J	**0.32 J**	0.17 U	**0.52 J**	**0.37 J**	0.24 U	**0.34 J**	**0.56**	**0.58**
Nickel	21	1,600	NA	NA	NA	NA	NA	15.4 J	18.9 J	**39.9**	**22.8 J**	**42.6 J**	**50.2 J**	**24.2 J**	**51.8**	**42.8 J**	**74.6**
Selenium	1	390	NA	NA	NA	NA	NA	0.94 U	1.1 U	1.8 U	1.4 U	2.8 U	2.8 U	2.2 U	**2 J**	3.1 U	**2.2 J**
Silver	1	390	NA	NA	NA	NA	NA	0.26 U	0.29 U	0.5 U	0.39 U	0.77 U	0.78 U	0.61 U	0.45 U	0.85 U	0.52 U
Thallium	--	5.1	NA	NA	NA	NA	NA	3.9 J	3.4 J	3.6 J	3.8 J	4.1 U	4.1 U	4.3 J	2.4 U	4.6 U	3.1 J
Vanadium	57	390	NA	NA	NA	NA	NA	29.9 J	55.9 J	**107 J**	**81.2 J**	**130 J**	**236 J**	**83.4 J**	**202 J**	**131 J**	**454 J**

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	**ERA Marine SD Screening Value**	**CLEAN RSLs Res Soil X 10 for SD Adjusted**	YS06-SD045			YS06-SD046	YS06-SD047	YS06-SD048	YS06-SD049	YS06-SD050	YS06-SD051	YS06-SD052	YS06-SD053	YS06-SD054	YS06-SD055	YS06-SD056	YS06-SD057
Sample ID			YS06-SD045-A-0296	YS06-SD045-B-0296	YS06-SD045-C-0296	YS06-SD046-0296	YS06-SD047-0296	YS06-SD048-0500	YS06-SD049-0500	YS06-SD050-0500	YS06-SD051-0500	YS06-SD052-0500	YS06-SD053-0500	YS06-SD054-0500	YS06-SD055-0500	YS06-SD056-0500	YS06-SD057-0500
Sample Date			02/12/96	02/12/96	02/12/96	02/12/96	02/13/96	05/11/00	05/11/00	05/11/00	05/11/00	05/11/00	05/11/00	05/11/00	05/11/00	05/11/00	05/11/00
Chemical Name																	
Zinc	150	24,000	NA	NA	NA	NA	NA	95.9 J	116 J	**297 J**	132 J	**368 J**	**285 J**	140 J	**331 J**	**338 J**	**496 J**
Acid Volatile Sulfide/Simultaneously Extractable Metals (µmol/g)																	
Zinc, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acid volatile sulfide	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Wet Chemistry																	
Alkalinity (mg/kg)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pH (ph)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total organic carbon (TOC) (mg/kg)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Grain Size (pct/p)																	
Sieve No. 004 (4.75 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 010 (2.00 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 020 (850 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 040 (425 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 060 (250 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 080 (180 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 100 (150 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 230 (63-UM)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sieve No. 200 (75 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed ERA Marine SD SVs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed both ERA Marine SD SVs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed
B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
N - Tentative Identification, consider present, special methods may be needed to confirm its presence or absence in future sampling efforts
R - Unreliable Result
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher
mg/kg - Milligrams per kilogram
pct/p - Percent Passed
ph - pH units
µg/kg - Micrograms per kilogram
µmol/g - Micromoles per gram

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	ERA Marine SD Screening Value	CLEAN RSLs Res Soil X 10 for SD Adjusted	YS06-SD058	YS06-SD059	YS06-SD060		YS06-SD061	YS06-SD062		YS06-SD063	YS06-SD064	YS06-SD065	YS06-SD066		YS06-SD067	YS06-SD068	
Sample ID			YS06-SD058-0500	YS06-SD059-0500	YS06-SD060-0500	YS06-SD060P-0500	YS06-SD061-0500	YS06-SD062-0500	YS06-SD062P-0500	YS06-SD063-0500	YS06-SD064-0500	YS06-SD065-0500	YS06-SD066-0500	YS06-SD066P-0500	YS06-SD067-0500	YS06-SD68-0809	YS06-SD68P-0809
Sample Date			05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	08/04/09	08/04/09
Chemical Name																	
Volatile Organic Compounds (µg/kg)																	
1,1-Dichloroethane	--	33,000	28 U	21 U	59 U	27 U	48 U	18 U	16 U	22 U	42 U	170 U	21 J	NA	30 J	8.3 U	8.5 U
1,1-Dichloroethene	2,782	240,000	28 U	21 U	59 U	27 U	48 U	18 U	16 U	22 U	42 U	170 U	4 J	NA	32 U	8.3 U	8.5 U
1,2-Dichloroethene (total)	--	700,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	--	28,000,000	13 J	20 J	79 J	21 J	55	18 U	3 J	7 J	42 U	170 U	12 J	NA	8 J	21 U	21 U
Acetone	--	61,000,000	47 B	66 B	290 J	65 B	180 B	25 B	8 B	27 B	73	160 B	45 B	NA	38 B	28 B	21 R
Carbon disulfide	--	740,000	28 U	21 U	59 U	27 U	48 U	18 U	16 U	22 U	8 J	170 U	24 U	NA	32 U	8.3 U	8.5 U
Chloroethane	--	2,100,000	28 U	21 U	59 U	27 U	48 U	18 U	16 U	22 U	42 U	170 U	23 J	NA	32 U	8.3 U	8.5 U
Chloromethane	--	120,000	28 U	21 U	59 U	27 U	48 U	18 U	16 U	22 U	42 U	170 U	24 U	NA	32 U	8.3 U	8.5 U
cis-1,2-Dichloroethene	--	780,000	28 U	21 U	59 U	27 U	48 U	230 J	16 UJ	22 U	42 U	170 U	24 U	NA	32 U	8.3 U	8.5 U
Methyl acetate	--	29,000,000	28 U	21 U	59 U	27 U	48 U	18 U	16 U	22 U	42 U	170 U	24 U	NA	32 U	8.3 U	8.5 U
Methylene chloride	--	110,000	19 B	13 B	41 B	16 B	21 B	18 B	14 B	5 B	16 B	58 B	6 B	NA	10 B	8.3 U	8.5 U
Toluene	1,086	820,000	28 U	21 U	8 J	27 U	48 U	4 J	16 U	22 U	42 U	30 J	24 U	NA	32 U	8.3 U	8.5 U
trans-1,2-Dichloroethene	--	150,000	28 U	21 U	59 U	27 U	48 U	18 U	16 U	22 U	42 U	170 U	24 U	NA	32 U	8.3 U	8.5 U
Trichloroethene	41	28,000	28 U	21 U	59 U	27 U	48 U	**130 J**	16 UJ	22 U	42 U	170 U	24 U	NA	32 U	8.3 U	8.5 U
Vinyl chloride	--	600	28 U	21 U	59 U	27 U	48 U	29 J	16 UJ	22 U	42 U	170 U	4 J	NA	32 U	8.3 U	8.5 U
Semivolatile Organic Compounds (µg/kg)																	
2,4-Dinitrotoluene	--	16,000	500 U	500 U	500 U	500 U	500 U	500 U	250,000 U	500 U	500 U	500 U	500 U	NA	500 U	500 U	500 U
2,6-Dinitrotoluene	549	61,000	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	750,000 U	1,500 U	1,500 U	1,500 U	1,500 U	NA	1,500 U	500 U	500 U
2-Methylnaphthalene	70	310,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	670	310,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	16	3,400,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	85.3	17,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	261	1,500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	430	150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	1,800	1,500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	670	1,700,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1,800	15,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	182	350,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	384	150,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	63.4	150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	58	6,100,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	600	2,300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	19	2,300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	600	1,500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	160	36,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	21	48,000	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	750,000 U	1,500 U	1,500 U	1,500 U	1,500 U	NA	1,500 U	500 U	500 U
Phenanthrene	240	17,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	420	18,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	665	1,700,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (µg/kg)																	
Aroclor-1260	48	2,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	30	310,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (µg/kg)																	
1,3,5-Trinitrobenzene	7,000	2,200,000	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	750,000 U	1,500 U	1,500 U	1,500 U	1,500 U	NA	1,500 U	500 U	500 U
1,3-Dinitrobenzene	--	6,100	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	1,500 U	750,000 U	1,500 U	1,500 U	1,500 U	1,500 U	NA	1,500 U	500 U	500 U
2,4,6-Trinitrotoluene	20,000	36,000	4,180 J	1,820 J	1,500 U	1,500 U	220 J	560 J	**3,686,000 J**	1,150 J	1,500 U	100 J	1,500 UJ	NA	1,500 UJ	500 U	500 U
2-Amino-4,6-dinitrotoluene	--	150,000	5,740 J	1,026 J	1,500 U	1,500 U	1,500 U	1,500 U	750,000 U	1,500 U	1,500 U	1,500 U	1,500 U	NA	1,500 U	500 U	500 U
2-Nitrotoluene	--	29,000	4,760 U	4,760 U	4,760 U	4,760 U	4,760 U	4,760 U	2,400,000 U	4,760 U	**40,520 J**	4,760 U	4,760 U	NA	4,760 U	500 U	500 U
4-Amino-2,6-dinitrotoluene	--	150,000	480 U	480 U	480 U	480 U	480 U	480 U	250,000 U	480 U	480 U	480 U	480 U	NA	480 U	500 U	500 U
HMX	115,000	3,900,000	3,000 U	3,000 U	3,000 U	3,000 U	3,000 U	3,000 U	1,500,000 U	3,000 U	3,000 U	1,460 J	3,000 U	NA	3,000 U	500 U	500 U
RDX	891,000	55,000	590 J	660 J	2,500 U	2,500 U	2,500 U	2,500 U	1,250,000 U	2,500 U	2,500 U	2,500 U	2,500 U	NA	2,500 U	500 U	500 U
Tetryl	72	240,000	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U	2,500 U	1,250,000 U	2,500 U	2,500 U	2,500 U	2,500 U	NA	2,500 U	500 U	500 U
Total Metals (mg/kg)																	
Aluminum	18,000	77,000	17,200 J	15,800 J	13,200 J	9,045	12,900 J	1,790 J	14,900 J	12,100 J	9,840 J	**53,000 J**	7,380	7,417	8,920	8,230	9,550
Antimony	2	31	**2.3 L**	0.94 L	**50 L**	**44.8**	**18.7 L**	1.6 L	0.71 L	0.92 UL	2 L	**3.4 L**	1.1 L	1.03	1.3 UL	0.42 B	0.45 B
Arsenic	8.2	3.9	**28.4**	**11.5**	**19.8**	**11.0**	**11.4**	2.6 J	**6.9**	**9.5**	**11.2**	**33.4**	**5.5**	**5.63**	**7.1**	**4**	**5.1**
Barium	48	15,000	**185**	**230**	**80.8 J**	**57.1**	**80.5 J**	24 J	**1,750**	**77.7 J**	43.9 J	**293**	19.8 J	19.8	36.6 J	16.2 J	18.5 J
Beryllium	--	160	1.6 J	1.1 J	1.5 J	1.18	1.3 J	0.38 J	0.91 J	0.87 J	1 J	3.2 J	0.58 J	0.6	0.67 J	0.57 B	0.66 B
Cadmium	1.2	70	**17.1**	**4.9**	**12.2**	**13.3**	**6.2**	0.69 J	1.1 J	1.2 J	1.2 J	**4.7 J**	0.5 J	0.5	0.89 J	0.85 UL	0.92 UL
Chromium	81	2.9	**37.3**	**37.6**	**51.5**	**36.8**	**37.7**	**10.6**	**30.6**	**27.7**	**36.5**	**109**	**22.6**	**23.0**	**25.1**	**17.1**	**20.6**
Cobalt	10	23	7.1 J	6.4 J	8.6 J	4.22	6.6 J	1 J	5.5 J	5.3 J	4.4 J	**19.7 J**	2.9 J	2.85	3.5 J	3.2	3.6
Copper	34	3,100	**95.5**	**48.6**	**172**	**143**	**91.3**	5.8 J	19.7	22.6	25.8	**75.3**	11.4 J	11.4	17.9	4.5	6.1
Cyanide	--	1,600	0.69 J	0.5 J	0.51 J	0.63	0.21 U	0.08 U	0.25 J	0.24 J	0.38 J	0.86 J	0.18 J	0.11	0.17 J	NA	NA
Iron	220,000	55,000	28,100 J	27,100 J	33,500 J	16,525	30,100 J	9,030 J	20,000 J	22,000 J	30,400 J	**68,400 J**	19,900	20,147	21,200	15,200	18,000
Lead	47	4,000	**151 J**	**101 J**	**242 J**	**168**	**120 J**	21.8 J	36.7 J	32.7 J	**49.5 J**	**132 J**	18.9	19.9	36.3	7.8	9.3
Manganese	260	1,800	197	**333**	149	108	145	56.5	121	140	86.4	**331**	39.7	39.4	105	127	124
Mercury	0.15	24	**0.59**	**0.2**	**0.77**	**0.85**	**0.53**	0.08 U	0.092 J	**0.16 J**	**0.26 J**	**0.76**	0.14 J	**0.17**	**0.17 J**	0.05 U	0.061 U
Nickel	21	1,600	**24.2**	14.8 J	**133**	**78.3**	**74.6**	3.6 J	11.6 J	16.6 J	**23.3 J**	**51.2 J**	9 J	9.14	12.2 J	6.8 J	8.4
Selenium	1	390	**2 J**	0.89 U	2.6 U	2.56 U	**2 J**	0.78 U	0.72 U	0.96 U	1.8 U	3 U	1.1 U	**1.08**	1.4 U	0.85 UL	0.58 L
Silver	1	390	0.33 U	0.24 U	0.7 U	0.7 U	0.54 U	0.21 U	0.2 U	0.26 U	0.5 U	0.81 U	0.29 U	0.29	0.38	0.85 UL	0.92 UL
Thallium	--	5.1	3.9 J	4.3	4.1 J	3.72 U	2.9 U	1.1 U	3 J	2.9 J	2.7 U	**9.7 J**	4.3 J	4.12	3.4 J	1.7 UL	1.8 UL
Vanadium	57	390	**76.6 J**	42.9 J	**772 J**	**475**	**360 J**	18.5 J	33.4 J	**82.6 J**	**91.5 J**	**176 J**	31.4	32.0	39.1	20.6	25.2

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	**ERA Marine SD Screening Value**	**CLEAN RSLs Res Soil X 10 for SD Adjusted**	YS06-SD058	YS06-SD059	YS06-SD060		YS06-SD061	YS06-SD062		YS06-SD063	YS06-SD064	YS06-SD065	YS06-SD066		YS06-SD067	YS06-SD068	
Sample ID			YS06-SD058-0500	YS06-SD059-0500	YS06-SD060-0500	YS06-SD060P-0500	YS06-SD061-0500	YS06-SD062-0500	YS06-SD062P-0500	YS06-SD063-0500	YS06-SD064-0500	YS06-SD065-0500	YS06-SD066-0500	YS06-SD066P-0500	YS06-SD067-0500	YS06-SD68-0809	YS06-SD68P-0809
Sample Date			05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	05/12/00	08/04/09	08/04/09
Chemical Name																	
Zinc	150	24,000	**392 J**	**214 J**	**871 J**	**483**	**558 J**	79.9 J	**162 J**	130 J	**170 J**	**438 J**	70.5	74.9	106	21.1 J	29.2 J
Acid Volatile Sulfide/Simultaneously Extractable Metals (µmol/g)																	
Zinc, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.113 J	0.0529 J
Acid volatile sulfide	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.56 J	2.69 J
Cadmium, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0012 U	0.0015 U
Copper, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0044 U	0.0053 U
Lead, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.007 U	0.008 U
Mercury, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.10E-04 U	1.30E-04 U
Nickel, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.009 U	0.011 U
Silver, SEM	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0025 U	0.0031 U
Wet Chemistry																	
Alkalinity (mg/kg)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	314	NA
pH (ph)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.1	NA
Total organic carbon (TOC) (mg/kg)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	13,810	NA
Grain Size (pct/p)																	
Sieve No. 004 (4.75 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	98.1	NA
Sieve No. 010 (2.00 mm)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	83.9	NA
Sieve No. 020 (850 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	61.9	NA
Sieve No. 040 (425 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	36.8	NA
Sieve No. 060 (250 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	13.8	NA
Sieve No. 080 (180 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.9	NA
Sieve No. 100 (150 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.2	NA
Sieve No. 230 (63-UM)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.9	NA
Sieve No. 200 (75 um)	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.9	NA

Notes:

Concentrations shaded blue exceed ERA Marine SD SVs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed both ERA Marine SD SVs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

N - Tentative Identification, consider present, special methods may be needed to confirm its presence or absence in future sampling efforts

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

mg/kg - Milligrams per kilogram

pct/p - Percent Passed

ph - pH units

µg/kg - Micrograms per kilogram

µmol/g - Micromoles per gram

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	**ERA Marine SD Screening Value**	**CLEAN RSLs Res Soil X 10 for SD Adjusted**	YS06-SD069	YS06-SD070	YS06-SD071	YS06-SD072	YS06-SD073	YS06-SD074		YS06-SD075	YS06-SD076	YS06-SD077	YS06-SD078	YS06-SDC01			YS06-SDC02
Sample ID			YS06-SD69-0809	YS06-SD70-0809	YS06-SD71-0809	YS06-SD72-0809	YS06-SD73-0809	YS06-SD74-0809	YS06-SD74P-0809	YS06-SD75-0809	YS06-SD76-0809	YS06-SD77-0809	YS06-SD78-0809	YS06-SDC01-B-0894	YS06-SDC01-A-0894	YS06-SDC01P-A-0894	YS06-SDC02-0894
Sample Date			08/04/09	08/04/09	08/04/09	08/04/09	08/05/09	08/05/09	08/05/09	08/05/09	08/06/09	08/06/09	08/06/09	08/19/94	08/19/94	08/19/94	08/19/94
Chemical Name																	
Volatile Organic Compounds (µg/kg)																	
1,1-Dichloroethane	--	33,000	7.6 U	11 U	17 U	19 U	21 U	26 U	23 U	18 U	19 U	24 U	18 U	NA	NA	NA	NA
1,1-Dichloroethene	2,782	240,000	7.6 U	11 U	17 U	19 U	21 U	26 U	23 U	18 U	19 U	24 U	18 U	NA	NA	NA	NA
1,2-Dichloroethene (total)	--	700,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone	--	28,000,000	6.9 B	9.4 B	14 B	48 U	52 U	31 B	56 U	46 U	47 U	62 B	45 U	NA	NA	NA	NA
Acetone	--	61,000,000	41 B	52 B	70 B	120 B	94 B	94 B	52 B	110 B	150 B	370 B	67 B	NA	NA	NA	NA
Carbon disulfide	--	740,000	7.6 U	11 U	17 U	19 U	21 U	11 J	23 U	18 U	21	21 J	18 U	NA	NA	NA	NA
Chloroethane	--	2,100,000	7.6 U	11 U	17 U	19 U	21 U	26 U	23 U	18 U	19 U	24 U	18 U	NA	NA	NA	NA
Chloromethane	--	120,000	7.6 U	11 U	17 U	19 U	21 U	26 U	23 U	18 U	19 U	24 U	18 U	NA	NA	NA	NA
cis-1,2-Dichloroethene	--	780,000	7.6 U	11 U	17 U	19 U	21 U	26 U	23 U	18 U	19 U	24 U	18 U	NA	NA	NA	NA
Methyl acetate	--	29,000,000	7.6 U	11 U	17 U	19 U	21 U	26 U	23 U	18 U	19 U	24 U	18 U	NA	NA	NA	NA
Methylene chloride	--	110,000	7.6 U	11 U	17 U	19 U	21 U	26 U	23 U	18 U	19 U	24 U	18 U	NA	NA	NA	NA
Toluene	1,086	820,000	7.6 U	11 U	17 U	19 U	21 U	26 U	23 U	18 U	19 U	24 U	18 U	NA	NA	NA	NA
trans-1,2-Dichloroethene	--	150,000	7.6 U	11 U	17 U	19 U	21 U	26 U	23 U	18 U	19 U	7.4 J	18 U	NA	NA	NA	NA
Trichloroethene	41	28,000	7.6 U	11 U	17 U	19 U	21 U	26 U	23 U	18 U	19 U	24 U	18 U	NA	NA	NA	NA
Vinyl chloride	--	600	7.6 U	11 U	17 U	19 U	21 U	26 U	23 U	18 U	19 U	24 U	18 U	NA	NA	NA	NA
Semivolatile Organic Compounds (µg/kg)																	
2,4-Dinitrotoluene	--	16,000	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	1,000 U	1,000 R	1,000 U	1,000 U
2,6-Dinitrotoluene	549	61,000	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	200 J	500 U	1,000 U	1,000 R	1,000 U	1,000 U
2-Methylnaphthalene	70	310,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol	670	310,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthene	16	3,400,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	85.3	17,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	261	1,500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	430	150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	1,800	1,500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(g,h,i)perylene	670	1,700,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	1,800	15,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	182	350,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	--	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	384	150,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	63.4	150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butylphthalate	58	6,100,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	600	2,300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	19	2,300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	600	1,500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	160	36,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene	21	48,000	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	**120 J**	500 U	**2,100 J**	580 R	580 U	580 R
Phenanthrene	240	17,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	420	18,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	665	1,700,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (µg/kg)																	
Aroclor-1260	48	2,200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor	30	310,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (µg/kg)																	
1,3,5-Trinitrobenzene	7,000	2,200,000	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	6,900	**37,000 J**	**59,000 J**	**120,000 J**
1,3-Dinitrobenzene	--	6,100	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	420 U	420 U	420 U	4,600 J
2,4,6-Trinitrotoluene	20,000	36,000	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	**79,000**	**1,500,000**	**4,400,000**	**93,000,000**
2-Amino-4,6-dinitrotoluene	--	150,000	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	**160,000**	1,000 U	1,000 U	1,000 U
2-Nitrotoluene	--	29,000	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	270 J	500 U	450 U	450 U	450 U	450 U
4-Amino-2,6-dinitrotoluene	--	150,000	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	**160,000**	1,000 U	1,000 U	1,000 U
HMX	115,000	3,900,000	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	18,000	84,000 J	**230,000 J**	**730,000**
RDX	891,000	55,000	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	500 U	**190,000**	**800,000 J**	**3,800,000 J**	7,900 J
Tetryl	72	240,000	500 U	500 U	500 U	500 U	500 U	500 UJ	500 UJ	500 UJ	500 UJ	**150 J**	500 UJ	**5,200 J**	1,200 U	1,200 U	**70,000 J**
Total Metals (mg/kg)																	
Aluminum	18,000	77,000	5,920	10,400	17,600	**19,500**	**20,100**	**22,800**	**24,100**	**23,500**	14,500	**19,300**	8,150	NA	NA	NA	NA
Antimony	2	31	1.4 UL	0.58 B	2.3 UL	0.48 B	0.59 B	2.9 UL	0.56 B	0.66 B	2.2 UL	0.93 B	0.97 B	NA	NA	NA	NA
Arsenic	8.2	3.9	2.9	**5.5**	**8.3**	**9.1**	**8**	**8.2**	**8.9**	**10.8**	**8.5**	**9.6**	2.8	NA	NA	NA	NA
Barium	48	15,000	12 J	22.6 J	35.2 J	41.2 J	40.1 J	43.5 J	45.8 J	47 J	29.6 J	38.6 J	24.8 J	NA	NA	NA	NA
Beryllium	--	160	0.46 B	0.7 B	1.1 B	1.2 B	1.2 B	1.4 B	1.4 B	1.4 B	0.99 B	1.3 B	0.69 B	NA	NA	NA	NA
Cadmium	1.2	70	0.72 UL	0.88 UL	1.2 UL	1.3 UL	1.5 UL	1.4 UL	1.4 UL	1.3 UL	1.1 UL	1.4 UL	1.3 UL	NA	NA	NA	NA
Chromium	81	2.9	**14**	**23.1**	**36.3**	**40.1**	**44.7**	**46.6**	**47.8**	**47.2**	**32.1**	**40.1**	**19.6**	NA	NA	NA	NA
Cobalt	10	23	2.3	4.1	6.7	7.4	7.4	8.3	8.4	8.4	5.6	7.2	3.1	NA	NA	NA	NA
Copper	34	3,100	5.8	11.3	19	21.4	21.5	25.3	26.1	27.4	18.9	26	8.2	NA	NA	NA	NA
Cyanide	--	1,600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	220,000	55,000	11,700	19,000	31,200	32,600	34,100	38,000	39,000	39,800	28,600	33,000	14,100	NA	NA	NA	NA
Lead	47	4,000	8.6	15	23.3	26.6	26.6	30.5	31.2	33.9	22.1	36.3	12.3	NA	NA	NA	NA
Manganese	260	1,800	75.4	159	237	215	253	**267**	**290**	**276**	197	**322**	106	NA	NA	NA	NA
Mercury	0.15	24	0.028 J	0.053 J	0.067 J	0.095	0.099 U	0.095	0.086 J	0.11	0.079	0.11	0.047 J	NA	NA	NA	NA
Nickel	21	1,600	5.3 J	9.8	16.4	17.9	19	**21.2**	**21.7**	**22.5**	15.6	20.1	8.6 J	NA	NA	NA	NA
Selenium	1	390	0.72 UL	0.88 UL	0.87 L	1.3 UL	**1.2 L**	0.93 L	0.86 L	0.91 L	0.75 L	**1.2 L**	1.3 UL	NA	NA	NA	NA
Silver	1	390	0.72 UL	0.88 UL	1.2 UL	1.3 UL	1.5 UL	1.4 UL	1.4 UL	1.3 UL	1.1 UL	1.4 UL	1.3 UL	NA	NA	NA	NA
Thallium	--	5.1	1.4 UL	1.8 UL	2.3 UL	2.6 UL	3 UL	2.9 UL	2.8 UL	2.7 UL	2.2 UL	2.9 UL	2.6 UL	NA	NA	NA	NA
Vanadium	57	390	16.7	28.8	44.8	52.2	49.1	54.8	**58.5**	**66.9**	44.6	**62.1**	26.7	NA	NA	NA	NA

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	**ERA Marine SD Screening Value**	**CLEAN RSLs Res Soil X 10 for SD Adjusted**	YS06-SD069	YS06-SD070	YS06-SD071	YS06-SD072	YS06-SD073	YS06-SD074		YS06-SD075	YS06-SD076	YS06-SD077	YS06-SD078	YS06-SDC01			YS06-SDC02
Sample ID			YS06-SD69-0809	YS06-SD70-0809	YS06-SD71-0809	YS06-SD72-0809	YS06-SD73-0809	YS06-SD74-0809	YS06-SD74P-0809	YS06-SD75-0809	YS06-SD76-0809	YS06-SD77-0809	YS06-SD78-0809	YS06-SDC01-B-0894	YS06-SDC01-A-0894	YS06-SDC01P-A-0894	YS06-SDC02-0894
Sample Date			08/04/09	08/04/09	08/04/09	08/04/09	08/05/09	08/05/09	08/05/09	08/05/09	08/06/09	08/06/09	08/06/09	08/19/94	08/19/94	08/19/94	08/19/94
Chemical Name																	
Zinc	150	24,000	33.3	62.9	100	106	110	128	132	138	99.7	127	46.7	NA	NA	NA	NA
Acid Volatile Sulfide/Simultaneously Extractable Metals (µmol/g)																	
Zinc, SEM	--	--	0.21	0.238	0.34	0.376	0.412	0.422	0.54	0.33	0.552	0.411	0.304	NA	NA	NA	NA
Acid volatile sulfide	--	--	4.88	1.89	2.53	3.75	15.3	1.71 J	2.68 J	2.66	10.7	62.5	4.75	NA	NA	NA	NA
Cadmium, SEM	--	--	0.0013 U	0.0014 U	0.0025 U	0.0023 U	0.0026 U	0.0026 U	0.0025 U	0.0021 U	0.0018 U	0.0027 U	0.0046	NA	NA	NA	NA
Copper, SEM	--	--	0.0216	0.0222	0.0202	0.0624	0.0104	0.0094 U	0.0735	0.0219	0.0082	0.0625	0.0842	NA	NA	NA	NA
Lead, SEM	--	--	0.016	0.019	0.014 U	0.029	0.014 U	0.014 U	0.014 U	0.022	0.013	0.028	0.013	NA	NA	NA	NA
Mercury, SEM	--	--	1.10E-04 U	1.30E-04 U	2.30E-04 U	2.10E-04 U	2.40E-04 U	2.30E-04 U	2.30E-04 U	1.90E-04 U	1.70E-04 U	2.40E-04 U	1.50E-04 U	NA	NA	NA	NA
Nickel, SEM	--	--	0.01 U	0.011 U	0.019 U	0.028	0.023	0.02 U	0.606	0.024	0.014 U	0.318	2.42	NA	NA	NA	NA
Silver, SEM	--	--	0.0027 U	0.0029 U	0.0053 U	0.0048 U	0.0055 U	0.0055 U	0.0053 U	0.0044 U	0.0039 U	0.0056 U	0.0035 U	NA	NA	NA	NA
Wet Chemistry																	
Alkalinity (mg/kg)	--	--	894	392	200 U	1,180	172 J	533	NA	1,290	391	531	200 U	NA	NA	NA	NA
pH (ph)	--	--	7.7	7.6	7.6	7.6	7.7	7.2	NA	8.1	7.8	7.3	7.2	NA	NA	NA	NA
Total organic carbon (TOC) (mg/kg)	--	--	9,428	11,250	22,370	20,700	23,130	25,810	NA	33,390	25,580	50,270	38,460	NA	NA	NA	NA
Grain Size (pct/p)																	
Sieve No. 004 (4.75 mm)	--	--	97.9	98.8	98.1	94.2	98.4	97.7	NA	97.3	99.0	97.9	98.8	NA	NA	NA	NA
Sieve No. 010 (2.00 mm)	--	--	82.3	81.2	65.3	60.3	66.6	69.8	NA	66.3	73.1	70.3	94.1	NA	NA	NA	NA
Sieve No. 020 (850 um)	--	--	67.1	61.6	38.2	36.6	40.4	43.5	NA	39.4	46.7	47.9	85.6	NA	NA	NA	NA
Sieve No. 040 (425 um)	--	--	53.9	44.9	23.3	23.5	26	27.5	NA	25.3	31.3	34.6	76.6	NA	NA	NA	NA
Sieve No. 060 (250 um)	--	--	25.6	23.1	15.1	19.5	18.4	18.4	NA	17.2	22.3	24.5	61.9	NA	NA	NA	NA
Sieve No. 080 (180 um)	--	--	14.6	14.6	11	12.6	14.6	13	NA	13.1	17.2	18.5	38.9	NA	NA	NA	NA
Sieve No. 100 (150 um)	--	--	12.1	12.4	9.7	11.5	12.9	11.2	NA	11.7	15.4	15.8	28.9	NA	NA	NA	NA
Sieve No. 230 (63-UM)	--	--	4.2	5	2.9	3.7	4.1	1.7	NA	1.9	4.69	5.6	8.79	NA	NA	NA	NA
Sieve No. 200 (75 um)	--	--	5.8	7	4.8	5.3	5.9	2.7	NA	5.7	8.2	8.3	13.1	NA	NA	NA	NA

Notes:

Concentrations shaded blue exceed ERA Marine SD SVs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed both ERA Marine SD SVs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

J - Analyte present, value may or may not be accurate or precise

K - Analyte present, value may be biased high, actual value may be lower

L - Analyte present, value may be biased low, actual value may be higher

N - Tentative Identification, consider present, special methods may be needed to confirm its presence or absence in future sampling efforts

R - Unreliable Result

U - The material was analyzed for, but not detected

UJ - Analyte not detected, quantitation limit may be inaccurate

UL - Analyte not detected, quantitation limit is probably higher

mg/kg - Milligrams per kilogram

pct/p - Percent Passed

ph - pH units

µg/kg - Micrograms per kilogram

µmol/g - Micromoles per gram

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	**ERA Marine SD Screening Value**	**CLEAN RSLs Res Soil X 10 for SD Adjusted**	YS06-SDC03	YS06-SDC04	YS06-SDC05
Sample ID			YS06-SDC03-0894	YS06-SDC04-0894	YS06-SDC05-0894
Sample Date			08/19/94	08/19/94	08/19/94
Chemical Name					
Volatile Organic Compounds (µg/kg)					
1,1-Dichloroethane	--	33,000	NA	NA	NA
1,1-Dichloroethene	2,782	240,000	NA	NA	NA
1,2-Dichloroethene (total)	--	700,000	NA	NA	NA
2-Butanone	--	28,000,000	NA	NA	NA
Acetone	--	61,000,000	NA	NA	NA
Carbon disulfide	--	740,000	NA	NA	NA
Chloroethane	--	2,100,000	NA	NA	NA
Chloromethane	--	120,000	NA	NA	NA
cis-1,2-Dichloroethene	--	780,000	NA	NA	NA
Methyl acetate	--	29,000,000	NA	NA	NA
Methylene chloride	--	110,000	NA	NA	NA
Toluene	1,086	820,000	NA	NA	NA
trans-1,2-Dichloroethene	--	150,000	NA	NA	NA
Trichloroethene	41	28,000	NA	NA	NA
Vinyl chloride	--	600	NA	NA	NA
Semivolatile Organic Compounds (µg/kg)					
2,4-Dinitrotoluene	--	16,000	1,000 U	1,000 U	1,000 U
2,6-Dinitrotoluene	549	61,000	1,000 U	1,000 U	1,000 U
2-Methylnaphthalene	70	310,000	NA	NA	NA
4-Methylphenol	670	310,000	NA	NA	NA
Acenaphthene	16	3,400,000	NA	NA	NA
Anthracene	85.3	17,000,000	NA	NA	NA
Benzo(a)anthracene	261	1,500	NA	NA	NA
Benzo(a)pyrene	430	150	NA	NA	NA
Benzo(b)fluoranthene	1,800	1,500	NA	NA	NA
Benzo(g,h,i)perylene	670	1,700,000	NA	NA	NA
Benzo(k)fluoranthene	1,800	15,000	NA	NA	NA
bis(2-Ethylhexyl)phthalate	182	350,000	NA	NA	NA
Carbazole	--	--	NA	NA	NA
Chrysene	384	150,000	NA	NA	NA
Dibenz(a,h)anthracene	63.4	150	NA	NA	NA
Di-n-butylphthalate	58	6,100,000	NA	NA	NA
Fluoranthene	600	2,300,000	NA	NA	NA
Fluorene	19	2,300,000	NA	NA	NA
Indeno(1,2,3-cd)pyrene	600	1,500	NA	NA	NA
Naphthalene	160	36,000	NA	NA	NA
Nitrobenzene	21	48,000	580 U	580 U	580 R
Phenanthrene	240	17,000,000	NA	NA	NA
Phenol	420	18,000,000	NA	NA	NA
Pyrene	665	1,700,000	NA	NA	NA
Pesticide/Polychlorinated Biphenyls (µg/kg)					
Aroclor-1260	48	2,200	NA	NA	NA
Methoxychlor	30	310,000	NA	NA	NA
Explosives (µg/kg)					
1,3,5-Trinitrobenzene	7,000	2,200,000	560 U	**110,000 J**	560 U
1,3-Dinitrobenzene	--	6,100	420 U	420 U	420 U
2,4,6-Trinitrotoluene	20,000	36,000	17,000	**14,000,000**	6,400
2-Amino-4,6-dinitrotoluene	--	150,000	1,000 U	1,000 U	1,000 U
2-Nitrotoluene	--	29,000	450 U	450 U	450 U
4-Amino-2,6-dinitrotoluene	--	150,000	1,000 U	1,000 U	1,000 U
HMX	115,000	3,900,000	500 U	95,000 J	9,200
RDX	891,000	55,000	590 U	**3,900,000 J**	710
Tetryl	72	240,000	1,200 U	1,200 U	**890 J**
Total Metals (mg/kg)					
Aluminum	18,000	77,000	NA	NA	NA
Antimony	2	31	NA	NA	NA
Arsenic	8.2	3.9	NA	NA	NA
Barium	48	15,000	NA	NA	NA
Beryllium	--	160	NA	NA	NA
Cadmium	1.2	70	NA	NA	NA
Chromium	81	2.9	NA	NA	NA
Cobalt	10	23	NA	NA	NA
Copper	34	3,100	NA	NA	NA
Cyanide	--	1,600	NA	NA	NA
Iron	220,000	55,000	NA	NA	NA
Lead	47	4,000	NA	NA	NA
Manganese	260	1,800	NA	NA	NA
Mercury	0.15	24	NA	NA	NA
Nickel	21	1,600	NA	NA	NA
Selenium	1	390	NA	NA	NA
Silver	1	390	NA	NA	NA
Thallium	--	5.1	NA	NA	NA
Vanadium	57	390	NA	NA	NA

TABLE 5-3
Sediment Exceedance Results
Phase II Remedial Investigation Report at Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	**ERA Marine SD Screening Value**	**CLEAN RSLs Res Soil X 10 for SD Adjusted**	YS06-SDC03	YS06-SDC04	YS06-SDC05
Sample ID			YS06-SDC03-0894	YS06-SDC04-0894	YS06-SDC05-0894
Sample Date			08/19/94	08/19/94	08/19/94
Chemical Name					
Zinc	150	24,000	NA	NA	NA
Acid Volatile Sulfide/Simultaneously Extractable Metals (µmol/g)					
Zinc, SEM	--	--	NA	NA	NA
Acid volatile sulfide	--	--	NA	NA	NA
Cadmium, SEM	--	--	NA	NA	NA
Copper, SEM	--	--	NA	NA	NA
Lead, SEM	--	--	NA	NA	NA
Mercury, SEM	--	--	NA	NA	NA
Nickel, SEM	--	--	NA	NA	NA
Silver, SEM	--	--	NA	NA	NA
Wet Chemistry					
Alkalinity (mg/kg)	--	--	NA	NA	NA
pH (ph)	--	--	NA	NA	NA
Total organic carbon (TOC) (mg/kg)	--	--	NA	NA	NA
Grain Size (pct/p)					
Sieve No. 004 (4.75 mm)	--	--	NA	NA	NA
Sieve No. 010 (2.00 mm)	--	--	NA	NA	NA
Sieve No. 020 (850 um)	--	--	NA	NA	NA
Sieve No. 040 (425 um)	--	--	NA	NA	NA
Sieve No. 060 (250 um)	--	--	NA	NA	NA
Sieve No. 080 (180 um)	--	--	NA	NA	NA
Sieve No. 100 (150 um)	--	--	NA	NA	NA
Sieve No. 230 (63-UM)	--	--	NA	NA	NA
Sieve No. 200 (75 um)	--	--	NA	NA	NA

Notes:

Concentrations shaded blue exceed ERA Marine SD SVs

Concentrations shaded green exceed RSLs

Concentrations shaded red exceed both ERA Marine SD SVs and RSLs

RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents

NA - Not analyzed

B - Analyte not detected above the level reported in blanks

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UL - Analyte not detected, quantitation limit is probably higher

mg/kg - Milligrams per kilogram

pct/p - Percent Passed

ph - pH units

µg/kg - Micrograms per kilogram

µmol/g - Micromoles per gram

TABLE 5-4
Sediment Pore Water Detections
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	YS06-WN01	YS06-WN02	YS06-WN03	YS06-WN04	
Sample ID	YS06-WN01-0909	YS06-WN02-0909	YS06-WN03-0909	YS06-WN04-0909	YS06-WN04P-0909
Sample Date	09/01/09	09/01/09	09/01/09	09/01/09	09/01/09
Chemical Name					
Volatile Organic Compounds (µg/l)					
1,2-Dichloroethene (total)	0.15 J	0.11 J	170	0.5 U	0.5 U
2-Butanone	9.1	8.9	8.9	8.8	5.9
Acetone	18	15	8.1	16	13
Carbon disulfide	26	6.7	5.8	14	11
Chloroethane	0.5 U	0.5 U	0.14 J	0.5 U	0.5 U
cis-1,2-Dichloroethene	0.16 J	0.12 J	160	0.5 U	0.5 U
Cyclohexane	0.96	1	0.76	1	0.79
Methylene chloride	0.24 J	0.2 J	1.9 J	0.21 J	0.34 J
Toluene	0.14 J	0.14 J	0.12 J	0.22 J	0.5 U
trans-1,2-Dichloroethene	0.5 U	0.5 U	0.68	0.5 U	0.5 U
Vinyl chloride	0.5 U	0.5 U	150	0.5 U	0.5 U

Notes:

Shading indicates detections

NA - Not analyzed

J - Analyte present, value may or may not be accurate or precise

U - The material was analyzed for, but not detected

µg/l - Micrograms per liter

TABLE 5-5
Groundwater Field Parameter Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	YS06-GW01	YS06-GW01A	YS06-GW02	YS06-GW03	YS06-GW04	YS06-GW5B
Sample ID	YS06-GW01-0309	YS06-GW01A-0309	YS06-GW02-0309	YS06-GW03-0309	YS06-GW04-0309	YS06-GW05B-0309
Sample Date	3/23/09	3/23/09	3/24/09	3/25/09	3/31/09	3/26/09
Field Parameter						
Dissolved Oxygen (mg/L)	2.32	2.89	3.5	2.91	4.1	3.7
Chemets Dissolved Oxygen[1] (mg/L)	5	1	1.5	2.5	NR	5
Oxidation Reduction Potential (mV)	-88	-67	-79	-48	-82	295
pH	5.92	8.54	8.1	7.89	6.7	6.54
Salinity (pct)	0	4 *	2.6	4 *	1.7	4 *
Specific Conductivity (mS/cm)	0.578	99.9 *	39.7	99.9 *	27.9	99.9 *
Temperature (°C)	14.4	15.16	14.77	15.07	11.5	13.56
Turbidity (NTU)	9.1	48.9	80.3	64.9	550	253
Nitrite (mg/L)	0.022	0	0	0.01	NA	0.013
Nitrate (mg/L)	0	0	0	0	NA	0
Sulfide (mg/L)	0	0.005	0	0	NA	0

Station ID	YS06-GW06	YS06-GW06B	YS06-GW07	YS06-GW08	YS06-GW09	YS06-GW09A
Sample ID	YS06-GW06-0309	YS06-GW06B-0309	YS06-GW07-0309	YS06-GW08-0309	YS06-GW09-0309	YS06-GW09A-0309
Sample Date	3/26/2009	3/26/2009	3/26/2009	3/31/2009	3/25/2009	3/25/2009
Field Parameter						
Dissolved Oxygen (mg/L)	2.57	2.21	2.97	2.14	2.2	2.2
Chemets Dissolved Oxygen[1] (mg/L)	5.5	5	3	3	4	3
Oxidation Reduction Potential (mV)	40	-111	195	-79	-24	-172
pH	6.15	6.37	6.58	6.9	6.46	7.86
Salinity (pct)	4 *	0	2.3	0	1.1	0
Specific Conductivity (mS/cm)	99.9 *	0.99	41.1	0.9	20.3	0.999
Temperature (°C)	14.6	15.6	13.8	14.1	15.4	15.3
Turbidity (NTU)	41.3	18.2	139	0	3.4	9.2
Nitrite (mg/L)	0.022	0.024	0.024	0.016	0.002	0
Nitrate (mg/L)	0	0	0	0	0	0
Sulfide (mg/L)	0	0	0	0	0	0

TABLE 5-5
Groundwater Field Parameter Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	YS06-GW09B[2]	YS06-GW10	YS06-GW10A	YS06-GW11	YS06-GW12	YS06-GW12A
Sample ID	YS06-GW09B-0409	YS06-GW10-0309	YS06-GW10A-0309	YS06-GW11-0309	YS06-GW12-0409	YS06-GW12-0409
Sample Date	4/3/2009	3/24/2009	3/24/2009	3/24/2009	4/2/2009	4/1/2009
Field Parameter						
Dissolved Oxygen (mg/L)	NR	4.18	4.05	2.26	2.13	2.31
Chemets Dissolved Oxygen[1] (mg/L)	NR	3	3	4	0.9	3.5
Oxidation Reduction Potential (mV)	NR	88	-74	-133	-132	-166
pH	NR	6.69	8.21	6.77	6.7	8.18
Salinity (pct)	NR	4 *	4 *	0	0.1	0.1
Specific Conductivity (mS/cm)	NR	99.9 *	99.9 *	0.9	2.08	2.18
Temperature (°C)	NR	15.3	16.01	14.7	16.12	17.24
Turbidity (NTU)	NR	24.4	56	10.9	129	16.3
Nitrite (mg/L)	NR	0	0.016	0.025	0.018	0
Nitrate (mg/L)	NR	0	0	0	0	0
Sulfide (mg/L)	NR	0	0	0	0	0

Station ID	YS06-GW13	YS06-GW13A	YS06-GW14	YS06-GW15	YS06-GW16	YS06-GW17
Sample ID	YS06-GW13-0409	YS06-GW13A-0409	YS06-GW14-0309	YS06-GW15-0309	YS06-GW16-0609	YS06-GW17-0709
Sample Date	4/1/2009	4/1/2009	3/31/2009	3/31/2009	6/30/2009	7/13/2009
Field Parameter						
Dissolved Oxygen (mg/L)	2.38	1.99	3.65	2.7	0.25	0.41
Chemets Dissolved Oxygen[1] (mg/L)	NR	NR	NR	1	1	1
Oxidation Reduction Potential (mV)	-126	-287	-262	-171	113	-241
pH	7.84	6.96	7.87	7.63	6.82	8.39
Salinity (pct)	0.1	0	4 *	0.8	0	0.5
Specific Conductivity (mS/cm)	2.18	1.03	99.9 *	12.3	0.652	9.74
Temperature (°C)	16.57	17	17.55	17.05	15.4	27.2
Turbidity (NTU)	0	0	67.5	28.1	80.8	94.1
Nitrite (mg/L)	NR	NR	NR	0.007	0	0
Nitrate (mg/L)	NR	NR	NR	0	0	0
Sulfide (mg/L)	NR	NR	NR	0	0	1.3

TABLE 5-5

Groundwater Field Parameter Results

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Station ID	YS06-GW18
Sample ID	YS06-GW18-0709
Sample Date	7/9/2009
Field Parameter	
Dissolved Oxygen (mg/L)	0.37
Chemets Dissolved Oxygen[1] (mg/L)	1
Oxidation Reduction Potential (mV)	-24
pH	6.83
Salinity (pct)	0
Specific Conductivity (mS/cm)	0.636
Temperature (°C)	16.8
Turbidity (NTU)	50.4
Nitrite (mg/L)	0
Nitrate (mg/L)	0
Sulfide (mg/L)	0

Notes:

[1] - Some samples were not evaluated using the CHEMets DO kits

[2] - Water quality parameters were not collected at monitoring well 6GW09B because the well was purged dry before parameters could be collected and was then allowed to recharge and immediately sampled to ensure that there would be enough sample volume

C - Degrees centigrade

mg/L - Milligrams per liter

mS/cm - Milliseimens per centimeter

mV - Millivolts

NTU - Nephelometric turbidity unit

pct - Percent

NR - Not Recorded

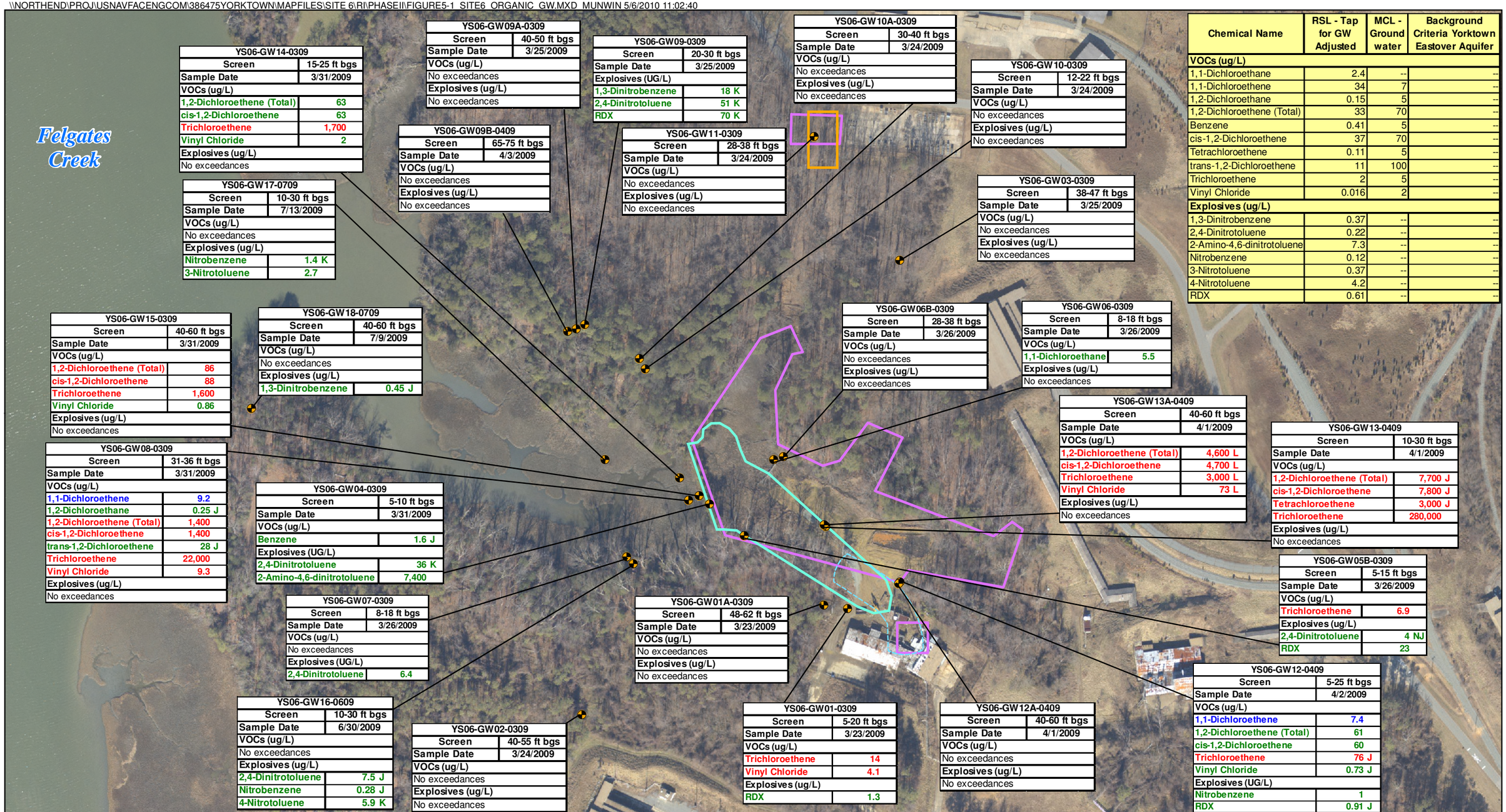
* - Instrumental malfunction

TABLE 5-6
Surface Water Field Parameter Results
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Station ID	YS06-SW/SD68	YS06-SW/SD69	YS06-SW/SD70	YS06-SW/SD71	YS06-SW/SD72	YS06-SW/SD73
Sample ID	YS06-SW/SD68-0809	YS06-SW/SD69-0809	YS06-SW/SD70-0809	YS06-SW/SD71-0809	YS06-SW/SD72-0809	YS06-SW/SD73-0809
Sample Date	8/4/2009	8/4/2009	8/4/2009	8/4/2009	8/4/2009	8/5/2009
Field Parameter						
Dissolved Oxygen (mg/L)	7.27	7.4	6.64	6.3	7.3	7.08
Oxidation Reduction Potential (mV)	164	169	228	203	179	235
pH	7.77	7.7	5.58	6.64	7.4	5.83
Salinity (pct)	1.7	1.7	1.8	1.7	1.7	1.5
Specific Conductivity (mS/cm)	28	28.2	29.2	27.6	27.5	24.8
Temperature (°C)	29.9	29.8	28.3	28.3	29.2	29
Turbidity (NTU)	10.7	0	3.1	28.8	37.3	7.9

Station ID	YS06-SW/SD74	YS06-SW/SD75	YS06-SW/SD76	YS06-SW/SD77	YS06-SW/SD78
Sample ID	YS06-SW/SD74-0809	YS06-SW/SD75-0809	YS06-SW/SD76-0809	YS06-SW/SD77-0809	YS06-SW/SD78-0809
Sample Date	8/5/2009	8/5/2009	8/6/2009	8/6/2009	8/6/2009
Field Parameter					
Dissolved Oxygen (mg/L)	7.18	7.04	4.9	5.78	4.98
Oxidation Reduction Potential (mV)	183	169	238	199	149
pH	6.78	7.34	5.73	6.45	6.8
Salinity (pct)	1.5	1.5	1.4	1.4	1.2
Specific Conductivity (mS/cm)	24.8	24.5	22.3	22.1	20
Temperature (°C)	30.6	30.4	27.2	27.2	26.5
Turbidity (NTU)	59.4	2.5	34.4	30.7	0

Notes:
C - Degrees centigrade
mg/L - Milligrams per liter
mS/cm - Milliseimens per centimeter
mV - Millivolts
NTU - Nephelometric turbidity unit
pct - Percent



Chemical Name	RSL - Tap for GW Adjusted	MCL - Ground water	Background Criteria Yorktown Eastover Aquifer
VOCs (ug/L)			
1,1-Dichloroethane	2.4	--	--
1,1-Dichloroethene	34	7	--
1,2-Dichloroethane	0.15	5	--
1,2-Dichloroethene (Total)	33	70	--
Benzene	0.41	5	--
cis-1,2-Dichloroethene	37	70	--
Tetrachloroethene	0.11	5	--
trans-1,2-Dichloroethene	11	100	--
Trichloroethene	2	5	--
Vinyl Chloride	0.016	2	--
Explosives (ug/L)			
1,3-Dinitrobenzene	0.37	--	--
2,4-Dinitrotoluene	0.22	--	--
2-Amino-4,6-dinitrotoluene	7.3	--	--
Nitrobenzene	0.12	--	--
3-Nitrotoluene	0.37	--	--
4-Nitrotoluene	4.2	--	--
RDX	0.61	--	--

Legend

- Yorktown-Eastover Aquifer Monitoring Well
- Surface Impoundment Area
- Excavation Area
- Land Use Control Boundary
- Flume Drainage Way

Concentrations shaded **blue** exceed MCLs
Concentrations shaded **green** exceed RSLs
Concentrations shaded **red** exceed both MCLs and RSLs
Where duplicate samples taken, most conservative concentration
J - Analyte present. Value may or may not be accurate or precise
K- Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
NJ - Qualitative identification questionable due to poor resolution, presumptively present at approximate quantity
ug/L - micrograms per Liter

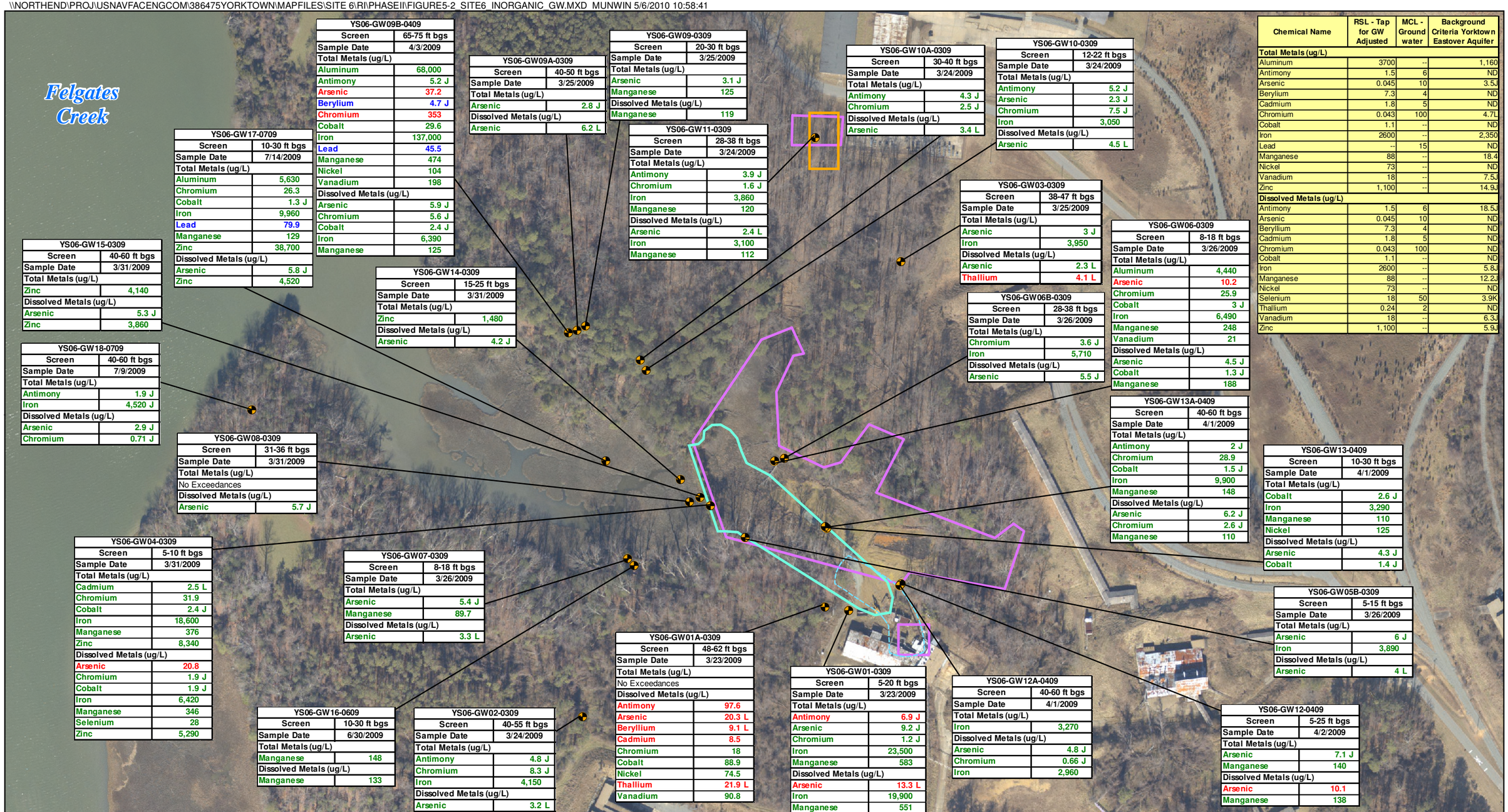
N W E S

0 200 400 Feet

Figure 5-1
Organic Exceedances in Groundwater
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE5-2_SITE6_INORGANIC_GW.MXD MUNWIN 5/6/2010 10:58:41



YS06-GW09B-0409	
Screen	65-75 ft bgs
Sample Date	4/3/2009
Total Metals (ug/L)	
Aluminum	68,000
Antimony	5.2 J
Arsenic	37.2
Beryllium	4.7 J
Chromium	353
Cobalt	29.6
Iron	137,000
Lead	45.5
Manganese	474
Nickel	104
Vanadium	198
Dissolved Metals (ug/L)	
Arsenic	5.9 J
Chromium	5.6 J
Cobalt	2.4 J
Iron	6,390
Manganese	125

YS06-GW09A-0309	
Screen	40-50 ft bgs
Sample Date	3/25/2009
Total Metals (ug/L)	
Arsenic	2.8 J
Dissolved Metals (ug/L)	
Arsenic	6.2 L

YS06-GW09-0309	
Screen	20-30 ft bgs
Sample Date	3/25/2009
Total Metals (ug/L)	
Arsenic	3.1 J
Manganese	125
Dissolved Metals (ug/L)	
Manganese	119

YS06-GW10A-0309	
Screen	30-40 ft bgs
Sample Date	3/24/2009
Total Metals (ug/L)	
Antimony	4.3 J
Chromium	2.5 J
Dissolved Metals (ug/L)	
Arsenic	3.4 L

YS06-GW10-0309	
Screen	12-22 ft bgs
Sample Date	3/24/2009
Total Metals (ug/L)	
Antimony	5.2 J
Arsenic	2.3 J
Chromium	7.5 J
Iron	3,050
Dissolved Metals (ug/L)	
Arsenic	4.5 L

YS06-GW17-0709	
Screen	10-30 ft bgs
Sample Date	7/14/2009
Total Metals (ug/L)	
Aluminum	5,630
Chromium	26.3
Cobalt	1.3 J
Iron	9,960
Lead	79.9
Manganese	129
Zinc	38,700
Dissolved Metals (ug/L)	
Arsenic	5.8 J
Zinc	4,520

YS06-GW11-0309	
Screen	28-38 ft bgs
Sample Date	3/24/2009
Total Metals (ug/L)	
Antimony	3.9 J
Chromium	1.6 J
Iron	3,860
Manganese	120
Dissolved Metals (ug/L)	
Arsenic	2.4 L
Iron	3,100
Manganese	112

YS06-GW03-0309	
Screen	38-47 ft bgs
Sample Date	3/25/2009
Total Metals (ug/L)	
Arsenic	3 J
Iron	3,950
Dissolved Metals (ug/L)	
Arsenic	2.3 L
Thallium	4.1 L

YS06-GW06-0309	
Screen	8-18 ft bgs
Sample Date	3/26/2009
Total Metals (ug/L)	
Aluminum	4,440
Arsenic	10.2
Chromium	25.9
Cobalt	3 J
Iron	6,490
Manganese	248
Vanadium	21
Dissolved Metals (ug/L)	
Arsenic	4.5 J
Cobalt	1.3 J
Manganese	188

YS06-GW15-0309	
Screen	40-60 ft bgs
Sample Date	3/31/2009
Total Metals (ug/L)	
Zinc	4,140
Dissolved Metals (ug/L)	
Arsenic	5.3 J
Zinc	3,860

YS06-GW14-0309	
Screen	15-25 ft bgs
Sample Date	3/31/2009
Total Metals (ug/L)	
Zinc	1,480
Dissolved Metals (ug/L)	
Arsenic	4.2 J

YS06-GW06B-0309	
Screen	28-38 ft bgs
Sample Date	3/26/2009
Total Metals (ug/L)	
Chromium	3.6 J
Iron	5,710
Dissolved Metals (ug/L)	
Arsenic	5.5 J

YS06-GW18-0709	
Screen	40-60 ft bgs
Sample Date	7/9/2009
Total Metals (ug/L)	
Antimony	1.9 J
Iron	4,520 J
Dissolved Metals (ug/L)	
Arsenic	2.9 J
Chromium	0.71 J

YS06-GW13A-0409	
Screen	40-60 ft bgs
Sample Date	4/1/2009
Total Metals (ug/L)	
Antimony	2 J
Chromium	28.9
Cobalt	1.5 J
Iron	9,900
Manganese	148
Dissolved Metals (ug/L)	
Arsenic	6.2 J
Chromium	2.6 J
Manganese	110

YS06-GW08-0309	
Screen	31-36 ft bgs
Sample Date	3/31/2009
Total Metals (ug/L)	
No Exceedances	
Dissolved Metals (ug/L)	
Arsenic	5.7 J

YS06-GW13-0409	
Screen	10-30 ft bgs
Sample Date	4/1/2009
Total Metals (ug/L)	
Cobalt	2.6 J
Iron	3,290
Manganese	110
Nickel	125
Dissolved Metals (ug/L)	
Arsenic	4.3 J
Cobalt	1.4 J

YS06-GW04-0309	
Screen	5-10 ft bgs
Sample Date	3/31/2009
Total Metals (ug/L)	
Cadmium	2.5 L
Chromium	31.9
Cobalt	2.4 J
Iron	18,600
Manganese	376
Zinc	8,340
Dissolved Metals (ug/L)	
Arsenic	20.8
Chromium	1.9 J
Cobalt	1.9 J
Iron	6,420
Manganese	346
Selenium	28
Zinc	5,290

YS06-GW07-0309	
Screen	8-18 ft bgs
Sample Date	3/26/2009
Total Metals (ug/L)	
Arsenic	5.4 J
Manganese	89.7
Dissolved Metals (ug/L)	
Arsenic	3.3 L

YS06-GW05B-0309	
Screen	5-15 ft bgs
Sample Date	3/26/2009
Total Metals (ug/L)	
Arsenic	6 J
Iron	3,890
Dissolved Metals (ug/L)	
Arsenic	4 L

YS06-GW01A-0309	
Screen	48-62 ft bgs
Sample Date	3/23/2009
Total Metals (ug/L)	
No Exceedances	
Dissolved Metals (ug/L)	
Antimony	97.6
Arsenic	20.3 L
Beryllium	9.1 L
Cadmium	8.5
Chromium	18
Cobalt	88.9
Nickel	74.5
Thallium	21.9 L
Vanadium	90.8

YS06-GW01-0309	
Screen	5-20 ft bgs
Sample Date	3/23/2009
Total Metals (ug/L)	
Antimony	6.9 J
Arsenic	9.2 J
Chromium	1.2 J
Iron	23,500
Manganese	583
Dissolved Metals (ug/L)	
Arsenic	13.3 L
Iron	19,900
Manganese	551

YS06-GW12A-0409	
Screen	40-60 ft bgs
Sample Date	4/1/2009
Total Metals (ug/L)	
Iron	3,270
Dissolved Metals (ug/L)	
Arsenic	4.8 J
Chromium	0.66 J
Iron	2,960

YS06-GW16-0609	
Screen	10-30 ft bgs
Sample Date	6/30/2009
Total Metals (ug/L)	
Manganese	148
Dissolved Metals (ug/L)	
Manganese	133

YS06-GW02-0309	
Screen	40-55 ft bgs
Sample Date	3/24/2009
Total Metals (ug/L)	
Antimony	4.8 J
Chromium	8.3 J
Iron	4,150
Dissolved Metals (ug/L)	
Arsenic	3.2 L

YS06-GW12-0409	
Screen	5-25 ft bgs
Sample Date	4/2/2009
Total Metals (ug/L)	
Arsenic	7.1 J
Manganese	140
Dissolved Metals (ug/L)	
Arsenic	10.1
Manganese	138

Chemical Name	RSL - Tap for GW Adjusted	MCL - Ground water	Background Criteria Yorktown Eastover Aquifer
Total Metals (ug/L)			
Aluminum	3700	--	1,160
Antimony	1.5	6	ND
Arsenic	0.045	10	3.5J
Beryllium	7.3	4	ND
Cadmium	1.8	5	ND
Chromium	0.043	100	4.7L
Cobalt	1.1	--	ND
Iron	2600	--	2,350
Lead	--	15	ND
Manganese	88	--	18.4
Nickel	73	--	ND
Vanadium	18	--	7.5J
Zinc	1,100	--	14.9J
Dissolved Metals (ug/L)			
Antimony	1.5	6	18.5J
Arsenic	0.045	10	ND
Beryllium	7.3	4	ND
Cadmium	1.8	5	ND
Chromium	0.043	100	ND
Cobalt	1.1	--	ND
Iron	2600	--	5.8J
Manganese	88	--	12.2J
Nickel	73	--	ND
Selenium	18	50	3.9K
Thallium	0.24	2	ND
Vanadium	18	--	6.3J
Zinc	1,100	--	5.9J

Legend

- Yorktown-Eastover Aquifer Monitoring Well
- Surface Impoundment Area
- Excavation Area
- Land Use Control Boundary
- Flume Drainage Way

Concentrations shaded **blue** exceed MCLs
Concentrations shaded **green** exceed RSLs
Concentrations shaded **red** exceed both MCLs and RSLs
Where duplicate samples taken, most conservative concentration value given
J - Analyte present. Value may or may not be accurate or precise
K- Analyte present, value may be biased high, actual value may be lower
L - Analyte present, value may be biased low, actual value may be higher
NA - Not Analyzed
ug/L - micrograms per Liter

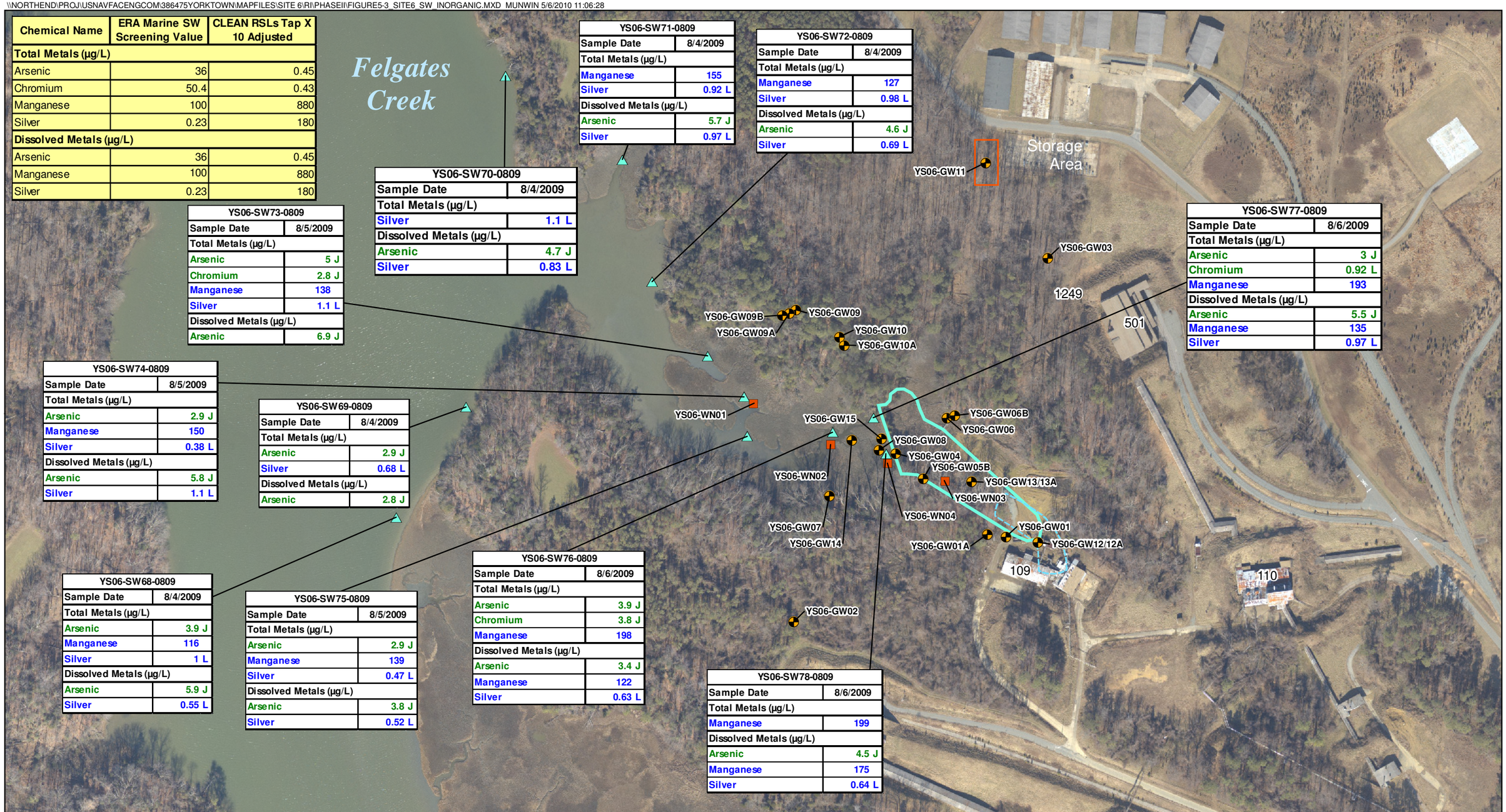
N
W E
S

0 200 400
Feet

Figure 5-2
Inorganic Exceedances in Groundwater
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE5-3_SITE6_SW_INORGANIC.MXD MUNWIN 5/6/2010 11:06:28



Chemical Name	ERA Marine SW Screening Value	CLEAN RSLs Tap X 10 Adjusted
Total Metals (µg/L)		
Arsenic	36	0.45
Chromium	50.4	0.43
Manganese	100	880
Silver	0.23	180
Dissolved Metals (µg/L)		
Arsenic	36	0.45
Manganese	100	880
Silver	0.23	180

YS06-SW71-0809	
Sample Date	8/4/2009
Total Metals (µg/L)	
Manganese	155
Silver	0.92 L
Dissolved Metals (µg/L)	
Arsenic	5.7 J
Silver	0.97 L

YS06-SW72-0809	
Sample Date	8/4/2009
Total Metals (µg/L)	
Manganese	127
Silver	0.98 L
Dissolved Metals (µg/L)	
Arsenic	4.6 J
Silver	0.69 L

YS06-SW70-0809	
Sample Date	8/4/2009
Total Metals (µg/L)	
Silver	1.1 L
Dissolved Metals (µg/L)	
Arsenic	4.7 J
Silver	0.83 L

YS06-SW73-0809	
Sample Date	8/5/2009
Total Metals (µg/L)	
Arsenic	5 J
Chromium	2.8 J
Manganese	138
Silver	1.1 L
Dissolved Metals (µg/L)	
Arsenic	6.9 J

YS06-SW77-0809	
Sample Date	8/6/2009
Total Metals (µg/L)	
Arsenic	3 J
Chromium	0.92 L
Manganese	193
Dissolved Metals (µg/L)	
Arsenic	5.5 J
Manganese	135
Silver	0.97 L

YS06-SW74-0809	
Sample Date	8/5/2009
Total Metals (µg/L)	
Arsenic	2.9 J
Manganese	150
Silver	0.38 L
Dissolved Metals (µg/L)	
Arsenic	5.8 J
Silver	1.1 L

YS06-SW69-0809	
Sample Date	8/4/2009
Total Metals (µg/L)	
Arsenic	2.9 J
Silver	0.68 L
Dissolved Metals (µg/L)	
Arsenic	2.8 J

YS06-SW68-0809	
Sample Date	8/4/2009
Total Metals (µg/L)	
Arsenic	3.9 J
Manganese	116
Silver	1 L
Dissolved Metals (µg/L)	
Arsenic	5.9 J
Silver	0.55 L

YS06-SW75-0809	
Sample Date	8/5/2009
Total Metals (µg/L)	
Arsenic	2.9 J
Manganese	139
Silver	0.47 L
Dissolved Metals (µg/L)	
Arsenic	3.8 J
Silver	0.52 L

YS06-SW76-0809	
Sample Date	8/6/2009
Total Metals (µg/L)	
Arsenic	3.9 J
Chromium	3.8 J
Manganese	198
Dissolved Metals (µg/L)	
Arsenic	3.4 J
Manganese	122
Silver	0.63 L

YS06-SW78-0809	
Sample Date	8/6/2009
Total Metals (µg/L)	
Manganese	199
Dissolved Metals (µg/L)	
Arsenic	4.5 J
Manganese	175
Silver	0.64 L

Legend

- Surface Water and Sediment Sample Location
- Sediment Pore Water Sample Location
- Yorktown-Eastover Aquifer Monitoring Well
- Flume Drainage Way
- Surface Impoundment Area
- Excavation Area

Concentrations shaded **blue** exceed ERA Marine SW SVs
Concentrations shaded **green** exceed RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
J - Analyte present, value may or may not be accurate or precise
L - Analyte present, value may be biased low, actual value may be higher
µg/L - micrograms per Liter
Where duplicate samples taken, most conservative concentration value given

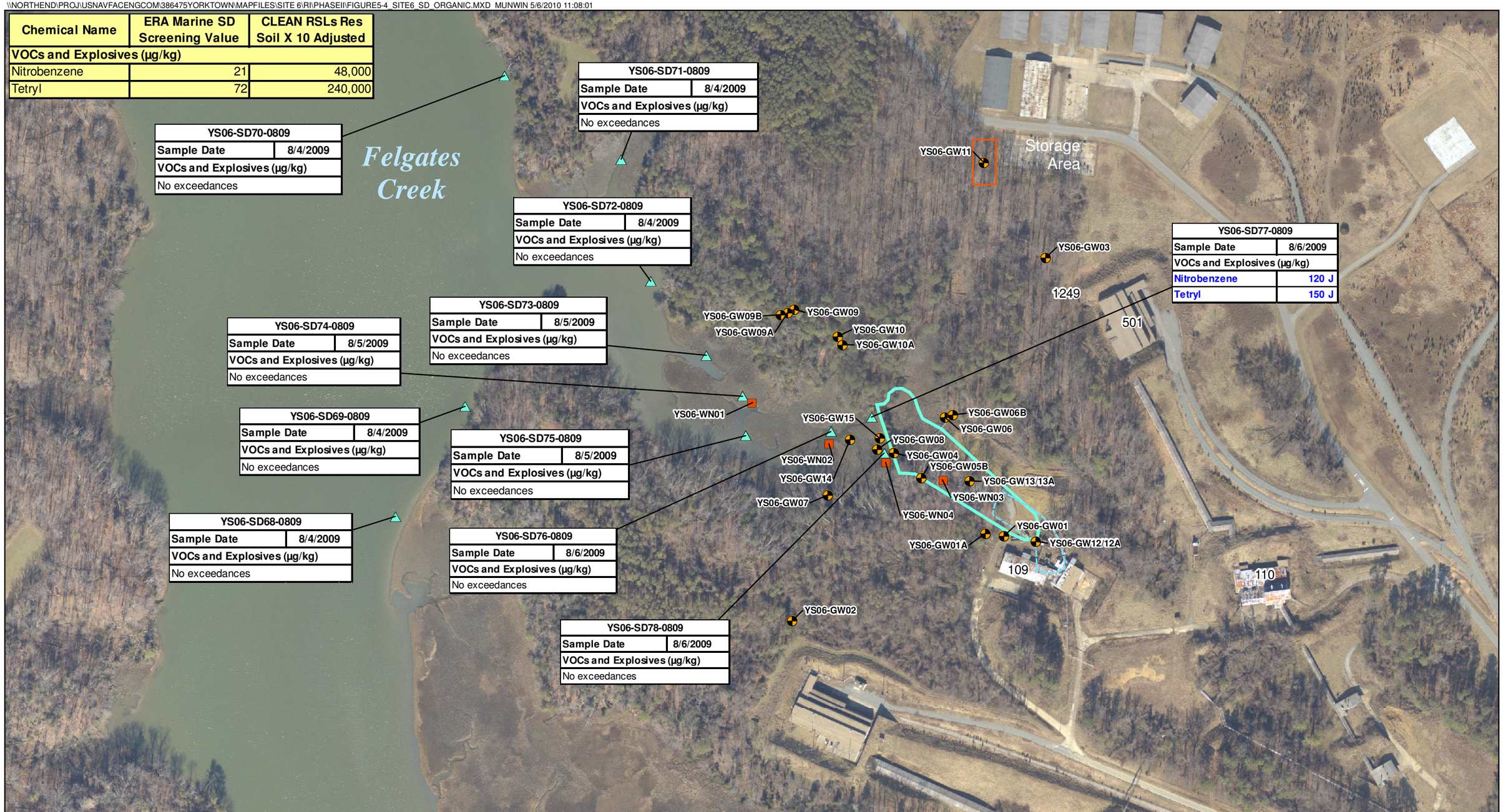
N
W E
S

0 250 500 Feet

Figure 5-3
Inorganic Exceedances in Surface Water
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE5-4_SITE6_SD_ORGANIC.MXD MUNWIN 5/6/2010 11:08:01



Chemical Name	ERA Marine SD Screening Value	CLEAN RSLs Res Soil X 10 Adjusted
VOCs and Explosives (µg/kg)		
Nitrobenzene	21	48,000
Tetryl	72	240,000

YS06-SD70-0809	
Sample Date	8/4/2009
VOCs and Explosives (µg/kg)	
No exceedances	

YS06-SD71-0809	
Sample Date	8/4/2009
VOCs and Explosives (µg/kg)	
No exceedances	

YS06-SD72-0809	
Sample Date	8/4/2009
VOCs and Explosives (µg/kg)	
No exceedances	

YS06-SD73-0809	
Sample Date	8/5/2009
VOCs and Explosives (µg/kg)	
No exceedances	

YS06-SD74-0809	
Sample Date	8/5/2009
VOCs and Explosives (µg/kg)	
No exceedances	

YS06-SD69-0809	
Sample Date	8/4/2009
VOCs and Explosives (µg/kg)	
No exceedances	

YS06-SD75-0809	
Sample Date	8/5/2009
VOCs and Explosives (µg/kg)	
No exceedances	

YS06-SD68-0809	
Sample Date	8/4/2009
VOCs and Explosives (µg/kg)	
No exceedances	

YS06-SD76-0809	
Sample Date	8/6/2009
VOCs and Explosives (µg/kg)	
No exceedances	

YS06-SD78-0809	
Sample Date	8/6/2009
VOCs and Explosives (µg/kg)	
No exceedances	

YS06-SD77-0809	
Sample Date	8/6/2009
VOCs and Explosives (µg/kg)	
Nitrobenzene	120 J
Tetryl	150 J

Legend

- Surface Water and Sediment Sample Location
- Sediment Pore Water Sample Location
- Yorktown-Eastover Aquifer Monitoring Well
- Flume Drainage Way
- Surface Impoundment Area
- Excavation Area

Concentrations shaded **blue** exceed ERA Marine SD SVs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
J - Analyte present, value may or may not be accurate or precise
µg/kg - micrograms per kilogram
Where duplicate samples taken, most conservative concentration value given

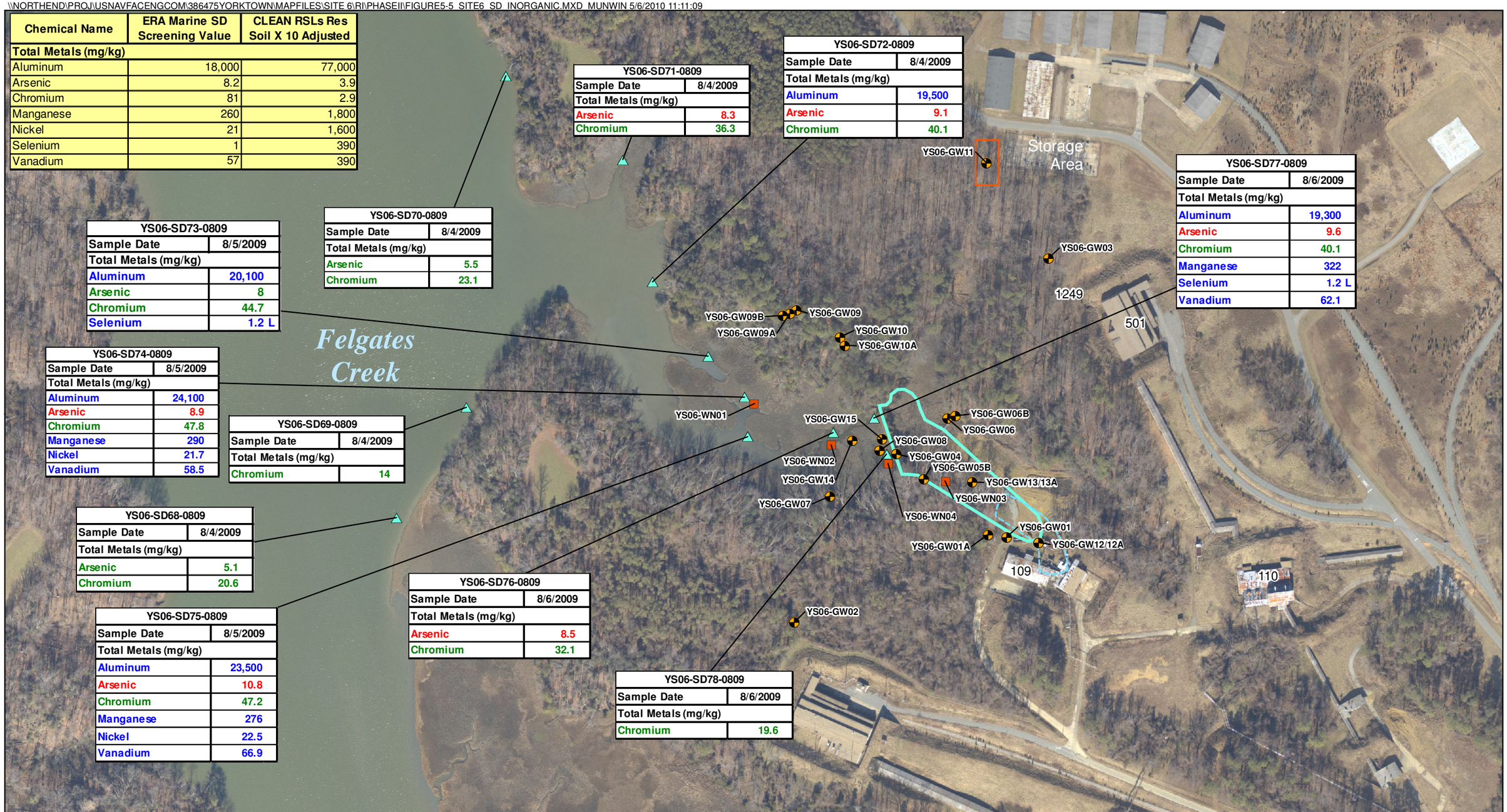
N W E S

0 250 500 Feet

Figure 5-4
Organic Exceedances in Sediment
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE5-5_SITE6_SD_INORGANIC.MXD MUNWIN 5/6/2010 11:11:09



Chemical Name	ERA Marine SD Screening Value	CLEAN RSLs Res Soil X 10 Adjusted
Total Metals (mg/kg)		
Aluminum	18,000	77,000
Arsenic	8.2	3.9
Chromium	81	2.9
Manganese	260	1,800
Nickel	21	1,600
Selenium	1	390
Vanadium	57	390

YS06-SD71-0809	
Sample Date	8/4/2009
Total Metals (mg/kg)	
Arsenic	8.3
Chromium	36.3

YS06-SD72-0809	
Sample Date	8/4/2009
Total Metals (mg/kg)	
Aluminum	19,500
Arsenic	9.1
Chromium	40.1

YS06-SD77-0809	
Sample Date	8/6/2009
Total Metals (mg/kg)	
Aluminum	19,300
Arsenic	9.6
Chromium	40.1
Manganese	322
Selenium	1.2 L
Vanadium	62.1

YS06-SD70-0809	
Sample Date	8/4/2009
Total Metals (mg/kg)	
Arsenic	5.5
Chromium	23.1

YS06-SD73-0809	
Sample Date	8/5/2009
Total Metals (mg/kg)	
Aluminum	20,100
Arsenic	8
Chromium	44.7
Selenium	1.2 L

YS06-SD74-0809	
Sample Date	8/5/2009
Total Metals (mg/kg)	
Aluminum	24,100
Arsenic	8.9
Chromium	47.8
Manganese	290
Nickel	21.7
Vanadium	58.5

YS06-SD69-0809	
Sample Date	8/4/2009
Total Metals (mg/kg)	
Chromium	14

YS06-SD68-0809	
Sample Date	8/4/2009
Total Metals (mg/kg)	
Arsenic	5.1
Chromium	20.6

YS06-SD76-0809	
Sample Date	8/6/2009
Total Metals (mg/kg)	
Arsenic	8.5
Chromium	32.1

YS06-SD75-0809	
Sample Date	8/5/2009
Total Metals (mg/kg)	
Aluminum	23,500
Arsenic	10.8
Chromium	47.2
Manganese	276
Nickel	22.5
Vanadium	66.9

YS06-SD78-0809	
Sample Date	8/6/2009
Total Metals (mg/kg)	
Chromium	19.6

Legend

- Surface Water and Sediment Sample Location
- Sediment Pore Water Sample Location
- Yorktown-Eastover Aquifer Monitoring Well
- Flume Drainage Way
- Surface Impoundment Area
- Excavation Area

Concentrations shaded **blue** exceed ERA Marine SD SVs
Concentrations shaded **green** exceed RSLs
Concentrations shaded **red** exceed both ERA Marine SD SVs and RSLs
RSLs were adjusted for noncarcinogens to account for exposure to multiple constituents
mg/kg - milligrams per kilogram
Where duplicate samples taken, most conservative concentration value given

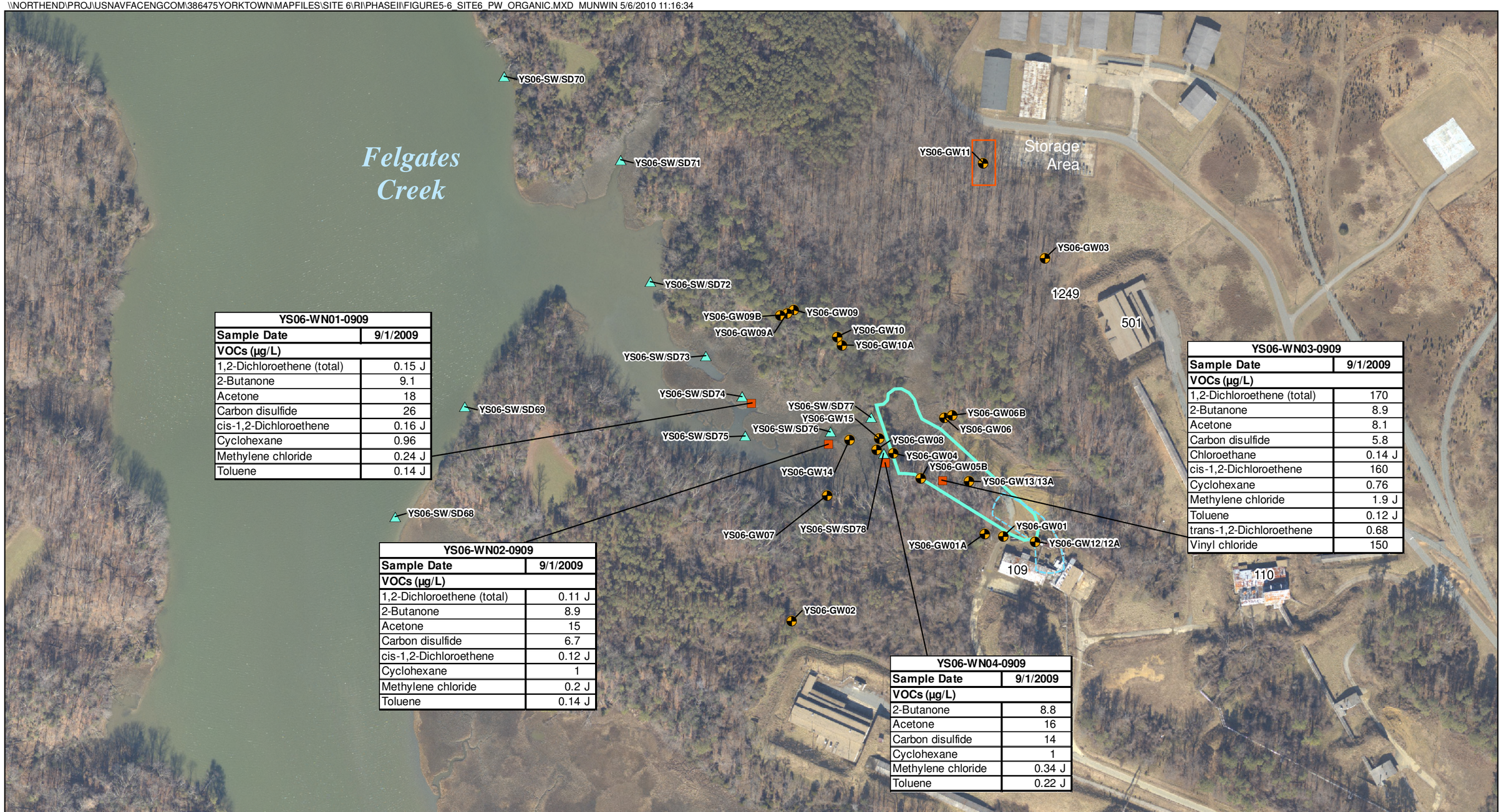
N
W E
S

0 250 500 Feet

Figure 5-5
Inorganic Exceedances in Sediment
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE5-6_SITE6_PW_ORGANIC.MXD MUNWIN 5/6/2010 11:16:34



YS06-WN01-0909	
Sample Date	**9/1/2009**
VOCs (µg/L)	
1,2-Dichloroethene (total)	0.15 J
2-Butanone	9.1
Acetone	18
Carbon disulfide	26
cis-1,2-Dichloroethene	0.16 J
Cyclohexane	0.96
Methylene chloride	0.24 J
Toluene	0.14 J

YS06-WN02-0909	
Sample Date	**9/1/2009**
VOCs (µg/L)	
1,2-Dichloroethene (total)	0.11 J
2-Butanone	8.9
Acetone	15
Carbon disulfide	6.7
cis-1,2-Dichloroethene	0.12 J
Cyclohexane	1
Methylene chloride	0.2 J
Toluene	0.14 J

YS06-WN03-0909	
Sample Date	**9/1/2009**
VOCs (µg/L)	
1,2-Dichloroethene (total)	170
2-Butanone	8.9
Acetone	8.1
Carbon disulfide	5.8
Chloroethane	0.14 J
cis-1,2-Dichloroethene	160
Cyclohexane	0.76
Methylene chloride	1.9 J
Toluene	0.12 J
trans-1,2-Dichloroethene	0.68
Vinyl chloride	150

YS06-WN04-0909	
Sample Date	**9/1/2009**
VOCs (µg/L)	
2-Butanone	8.8
Acetone	16
Carbon disulfide	14
Cyclohexane	1
Methylene chloride	0.34 J
Toluene	0.22 J

Legend

- Surface Water and Sediment Sample Location
- Sediment Pore Water Sample Location
- Yorktown-Eastover Aquifer Monitoring Well
- Flume Drainage Way
- Surface Impoundment Area
- Excavation Area

µg/l - micrograms per Liter

Where duplicate samples taken, most conservative concentration value given

J - Analyte present, value may or may not be accurate or precise

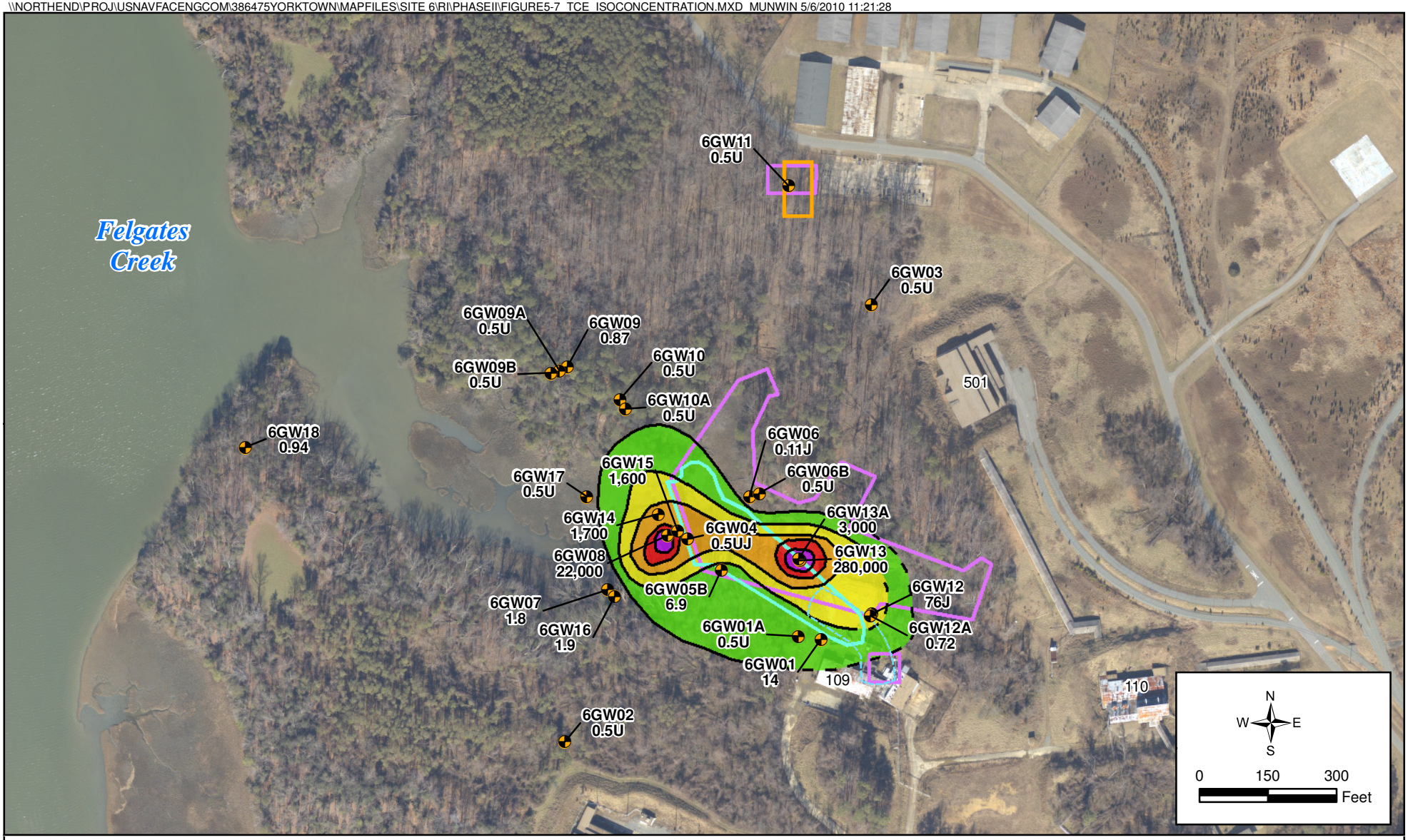
N W E S

0 250 500 Feet

Figure 5-6
Sediment Pore Water Organic Detections
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE5-7_TCE_ISOCONCENTRATION.MXD MUNWIN 5/6/2010 11:21:28



Legend

- Yorktown-Eastover Aquifer Monitoring Well
- Surface Impoundment Area
- Flume Drainage Way
- Excavation Area
- Land Use Control Boundary

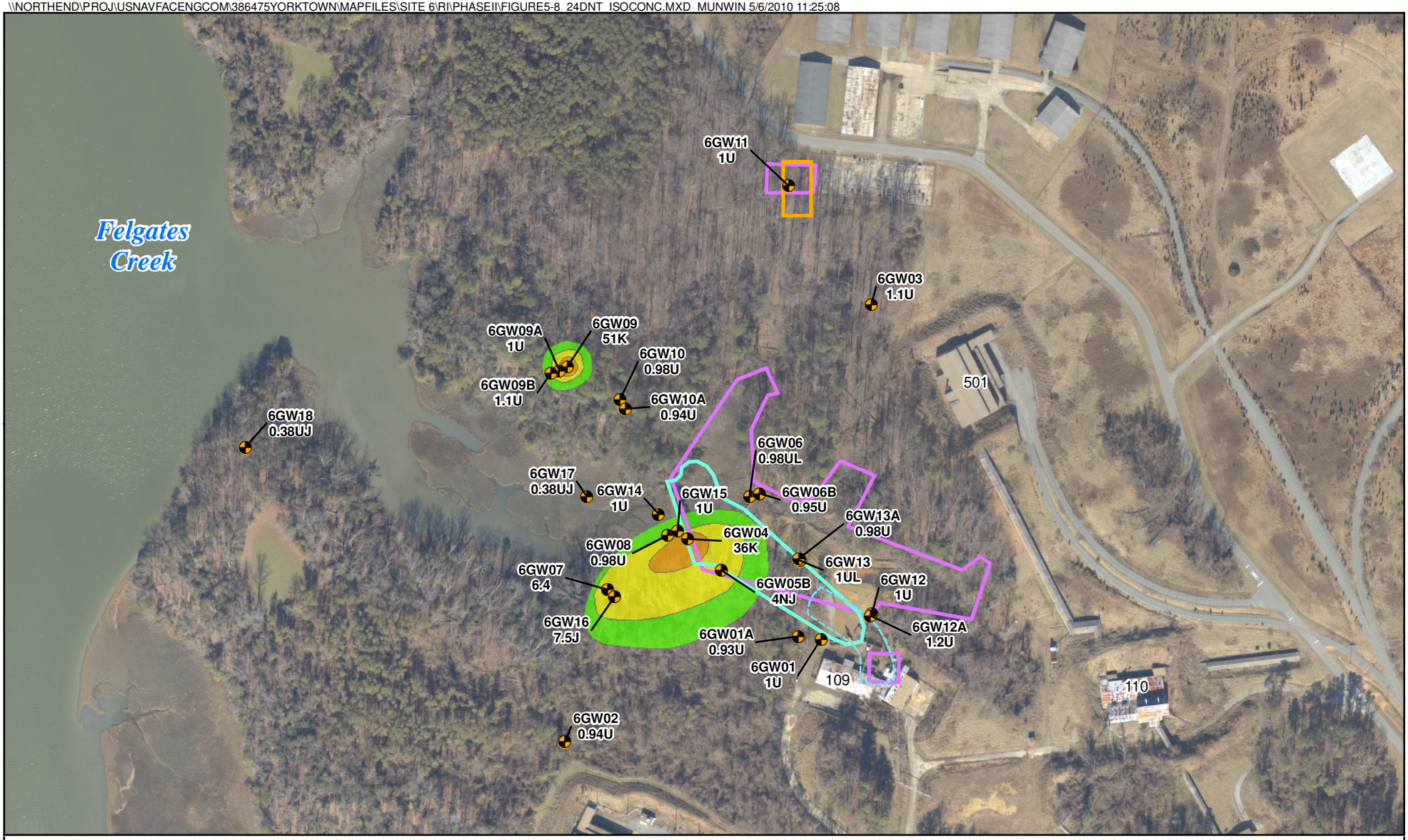
- 2 µg/L - 20 µg/L
- 20 µg/L - 200 µg/L
- 200 µg/L - 2,000 µg/L
- 2,000 µg/L - 11,000 µg/L
- > 11,000 µg/L
- Inferred

Tap Water RSL = 2 µg/L
Drinking Water MCL = 5 µg/L
J - concentration is estimated
U - analyte not detected above detection limit

Figure 5-7
Trichloroethene (TCE) Isoconcentration Map
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE5-8_24DNT_ISOCONC.MXD MUNWIN 5/6/2010 11:25:08



Legend

- Yorktown-Eastover Monitoring Wells
- Surface Impoundment Area
- Flume Drainage Way
- Excavation Area
- Land Use Control Boundary
- 0.22 - 2.2 µg/L
- 2.2 - 22 µg/L
- > 22 µg/L

J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
NJ - Qualitative identification questionable due to poor resolution, presumptively present at approximate quantity
U - The material was analyzed for, but not detected
UJ - Analyte not detected, quantitation limit may be inaccurate
UL - Analyte not detected, quantitation limit is probably higher

Tap Water RSL for 2.4-DNT = 0.22 µg/L

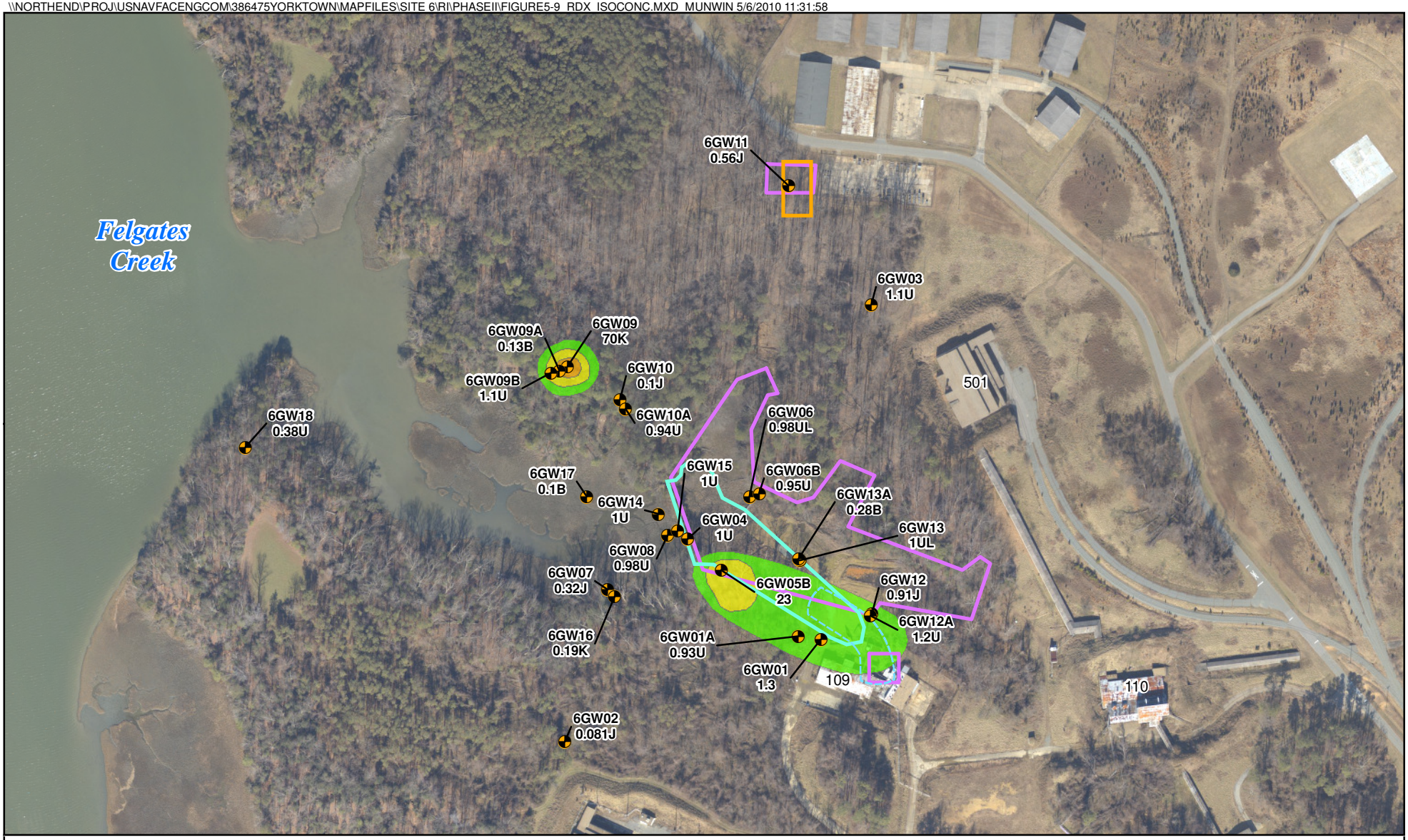
N W E S

0 150 300 Feet

Figure 5-8
2,4-Dinitrotoluene (2,4-DNT) Isoconcentration Map
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE5-9_RDX_ISOCONC.MXD MUNWIN 5/6/2010 11:31:58



Legend

- Yorktown-Eastover Monitoring Wells
- Surface Impoundment Area
- Flume Drainage Way
- Excavation Area
- Land Use Control Boundary
- 0.61 - 6.1 µg/L
- 6.1 - 61 µg/L
- > 61 µg/L

B - Analyte not detected above the level reported in blanks
J - Analyte present, value may or may not be accurate or precise
K - Analyte present, value may be biased high, actual value may be lower
U - The material was analyzed for, but not detected
UL - Analyte not detected, quantitation limit is probably higher

Tap Water RSL for RDX = 0.61 µg/L

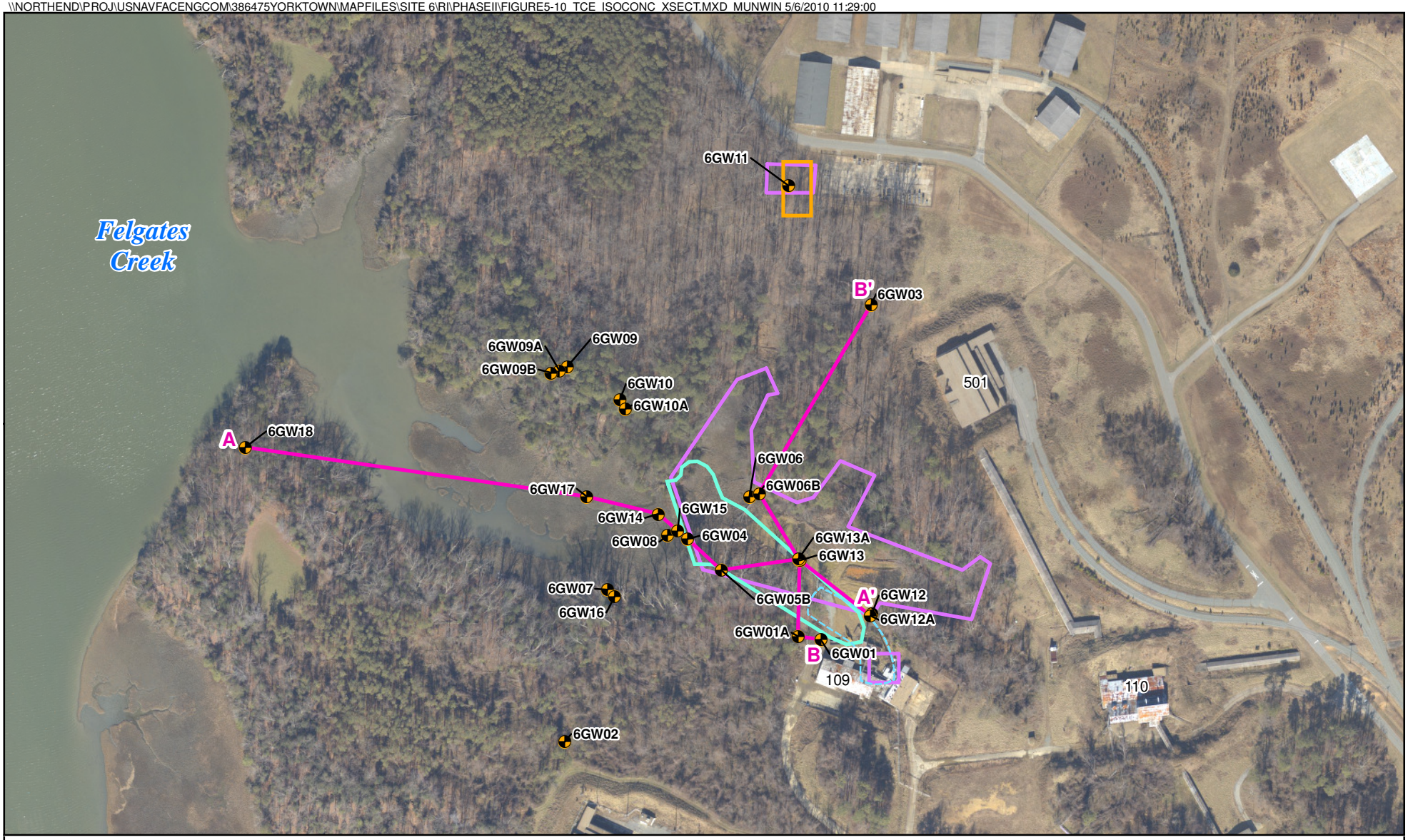
N W E S

0 150 300 Feet

Figure 5-9
RDX Isoconcentration Map
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\386475YORKTOWN\MAPFILES\SITE 6\RI\PHASEII\FIGURE5-10_TCE_ISOCONC_XSECT.MXD MUNWIN 5/6/2010 11:29:00



Legend

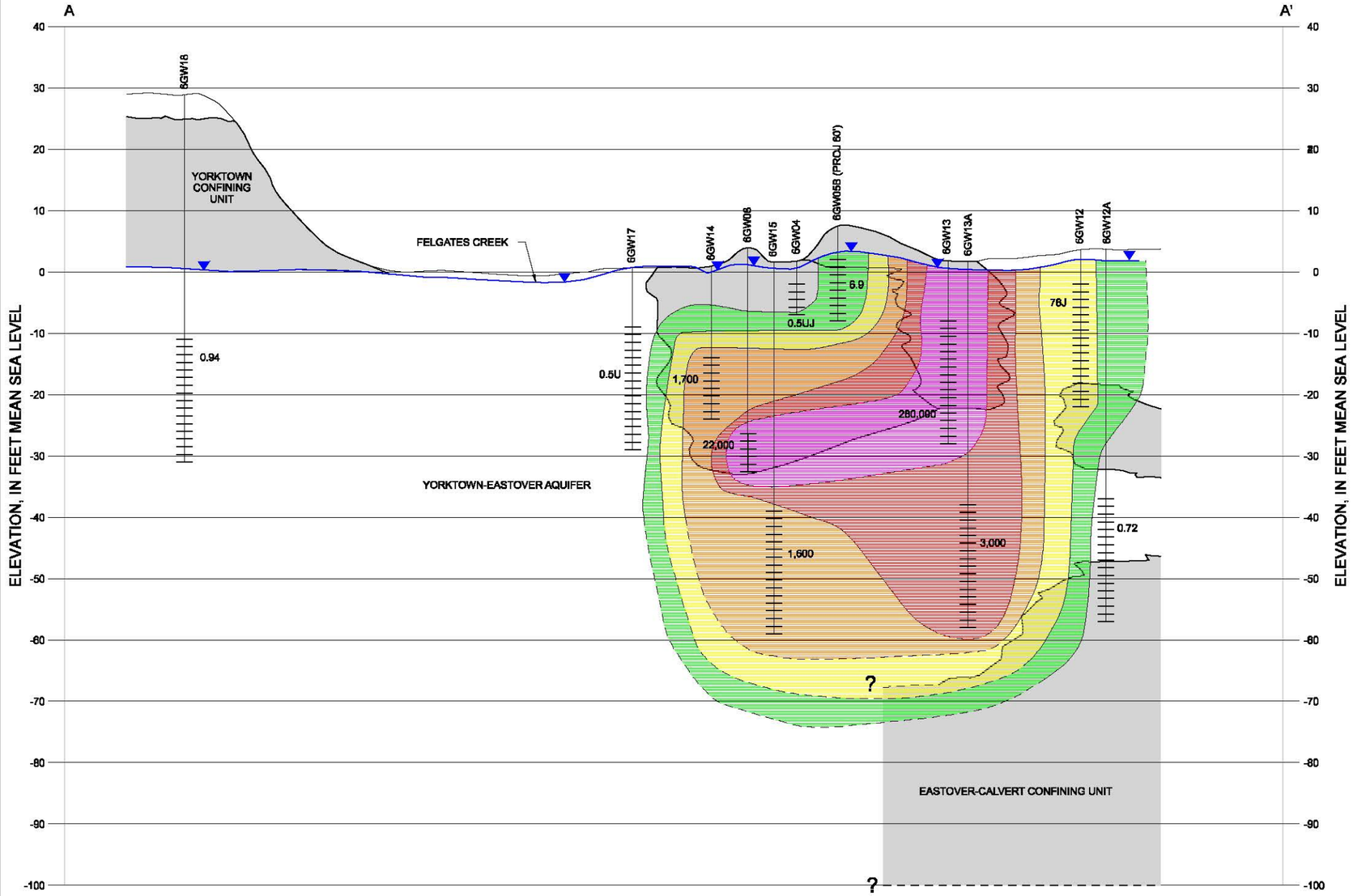
- Yorktown-Eastover Aquifer Monitoring Well
- Surface Impoundment Area
- Flume Drainage Way
- Excavation Area
- Land Use Control Boundary
- Cross-Section Transects

N
W E
S

0 150 300
Feet

Figure 5-10
TCE Isoconcentration Cross-Section Lines
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL



LEGEND

- 6.9 — WELL SCREEN INTERVAL AND TCE CONCENTRATION IN ug/L
- GROUNDWATER ELEVATION
- PREDOMINANTLY COARSE-GRAINED MATERIAL (SAND)
- PREDOMINANTLY FINE-GRAINED MATERIAL (SILT AND CLAY)
- INFERRED

TCE ISOCONCENTRATION CONTOURS

- 2 ug/L - 20 ug/L
- 20 ug/L - 200 ug/L
- 200 ug/L - 2,000 ug/L
- 2,000 ug/L - 11,000 ug/L
- >11,000 ug/L

NOTES:

1. WATER LEVELS COLLECTED ON AUGUST 31, 2009.

ug/L = MICROGRAMS PER LITER
J = ESTIMATED VALUE
U = NOT DETECTED
TAP WATER RSL FOR TCE = 2 ug/L

VERTICAL SCALE: 10 — 0

100

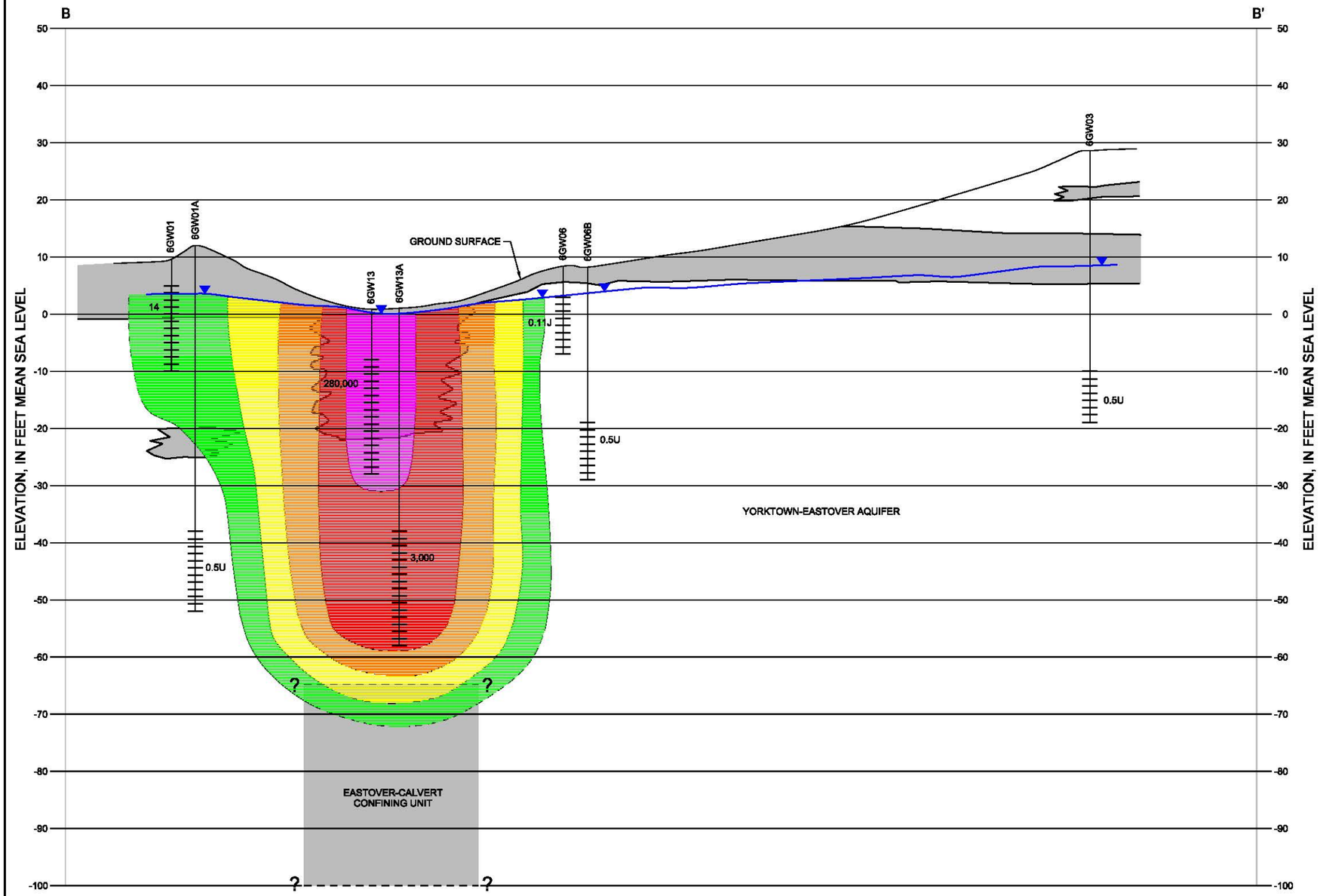
APPROXIMATE HORIZONTAL SCALE (SCALE IN FEET)

VERTICAL EXAGGERATION = 10

FIGURE 5-11
TCE ISOCONCENTRATIONS
CROSS SECTION A-A'
Phase II Remedial Investigation Report, Site 6
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

CH2MHILL

FILENAME: fn01g007_395486.dgn PLOT DATE: 1/12/2011



LEGEND

- 14 — WELL SCREEN INTERVAL AND TCE CONCENTRATION IN ug/L
- GROUNDWATER ELEVATION
- PREDOMINANTLY COARSE-GRAINED MATERIAL (SAND)
- PREDOMINANTLY FINE-GRAINED MATERIAL (SILT AND CLAY)
- INFERRED

TCE ISOCONCENTRATION CONTOURS

- 2 ug/L - 20 ug/L
- 20 ug/L - 200 ug/L
- 200 ug/L - 2,000 ug/L
- 2,000 ug/L - 11,000 ug/L
- >11,000 ug/L

NOTES:

1. WATER LEVELS COLLECTED ON AUGUST 31, 2009.

ug/L = MICROGRAMS PER LITER
J = ESTIMATED VALUE
U = NOT DETECTED
TAP WATER RSL FOR TCE = 2 ug/L

VERTICAL SCALE: 10 – 0

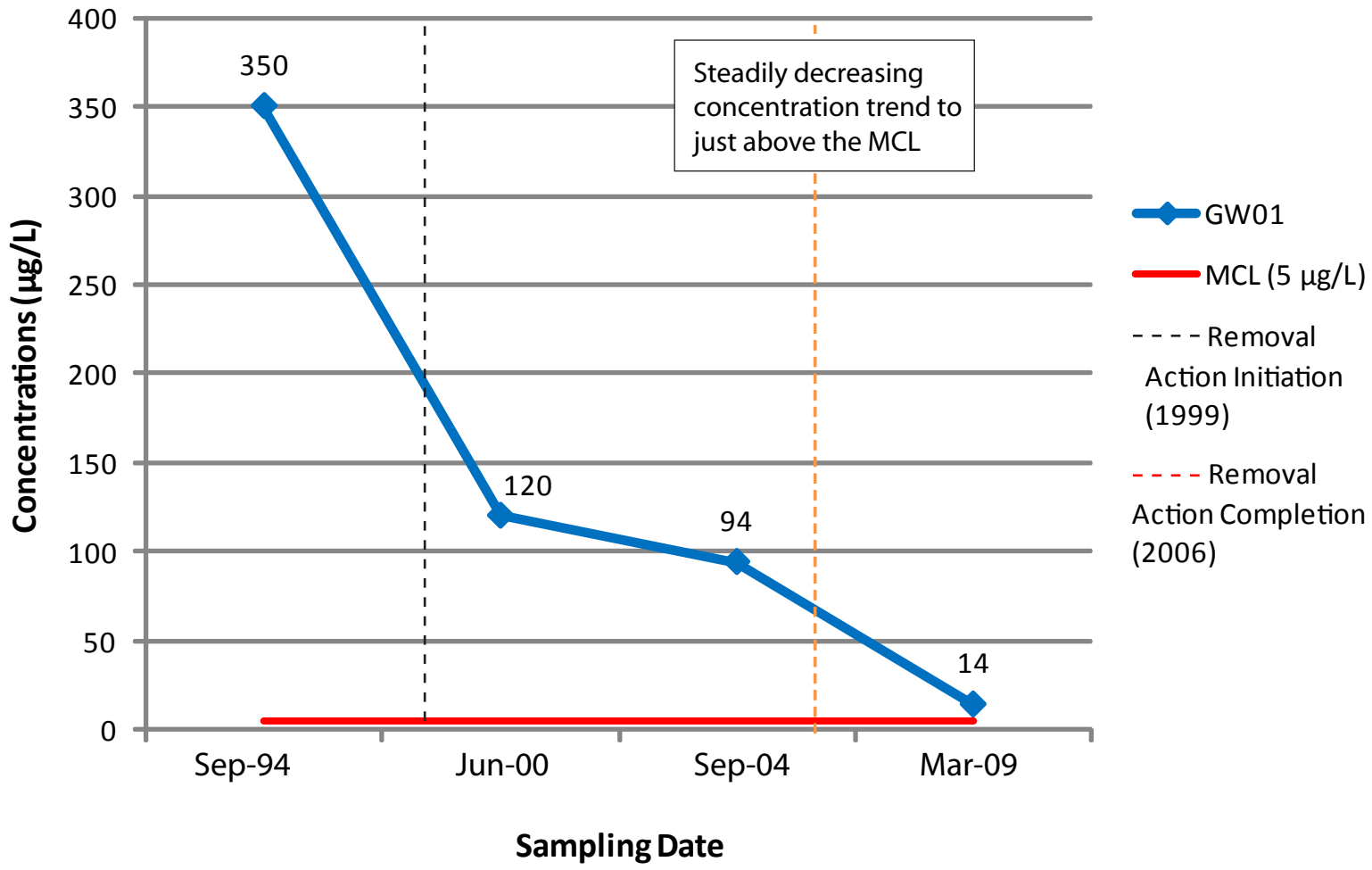
APPROXIMATE HORIZONTAL SCALE (SCALE IN FEET): 0 – 50

VERTICAL EXAGGERATION = 5

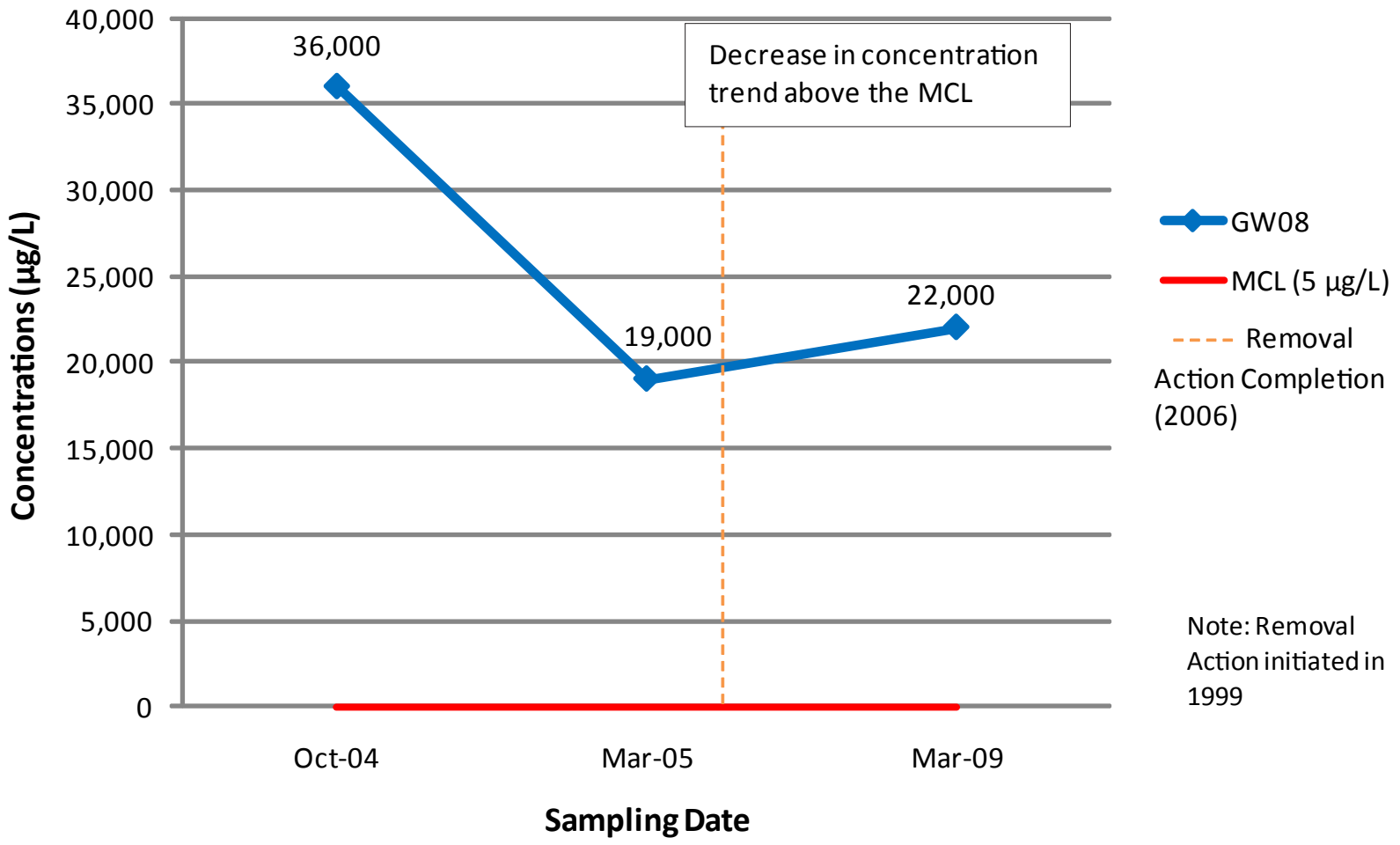
FIGURE 5-12
TCE ISOCONCENTRATIONS
CROSS SECTION B-B'
Phase II Remedial Investigation Report, Site 6
NAVAL WEAPONS STATION YORKTOWN
YORKTOWN, VIRGINIA

CH2MHILL

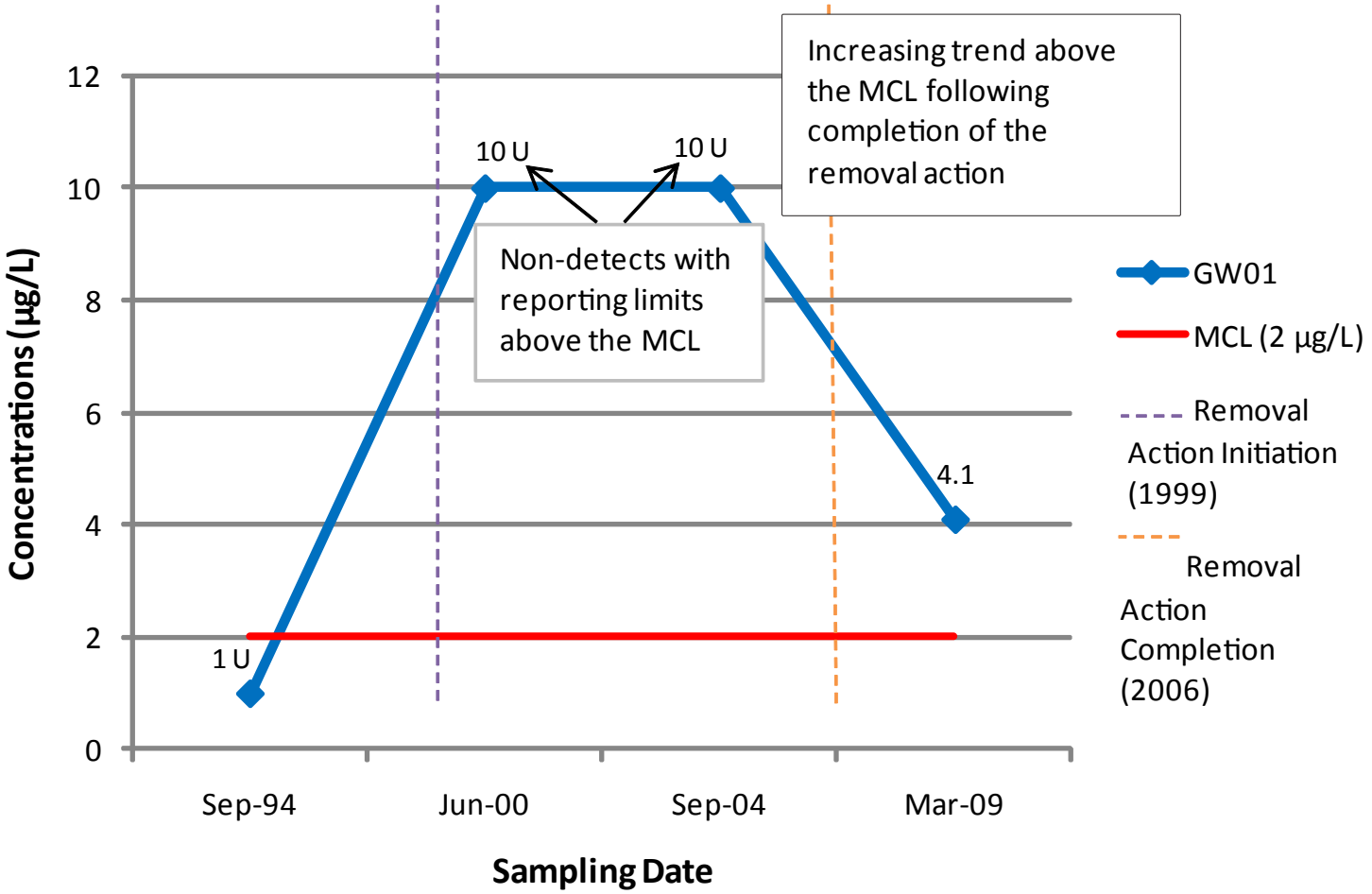
FILENAME: fn01g008_395486.dgn PLOT DATE: 5/5/2010



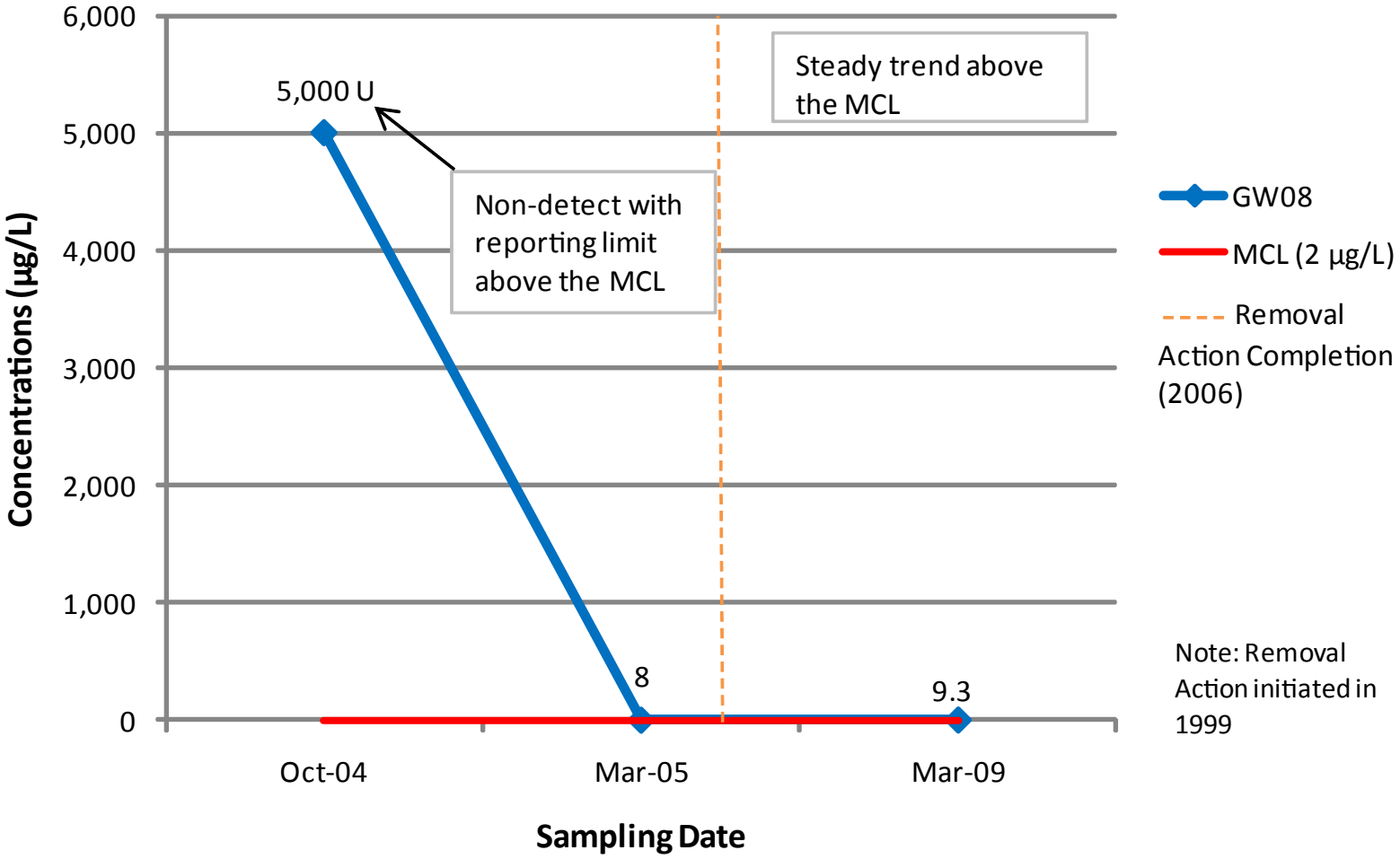
Graph 5-1
GW-01 Trichloroethene Trend Analysis
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia



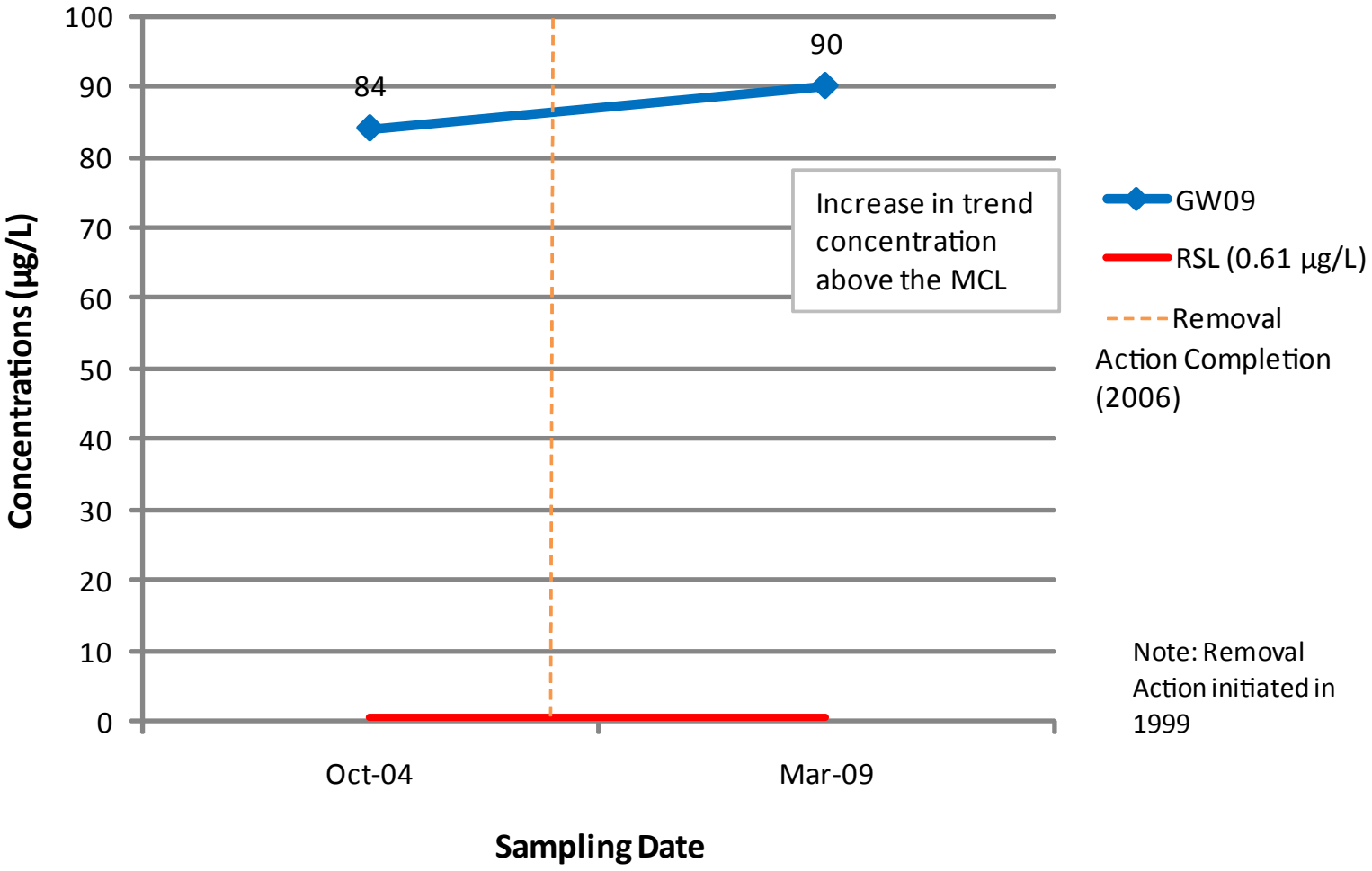
Graph 5-2
GW-08 Trichloroethene Trend Analysis
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia



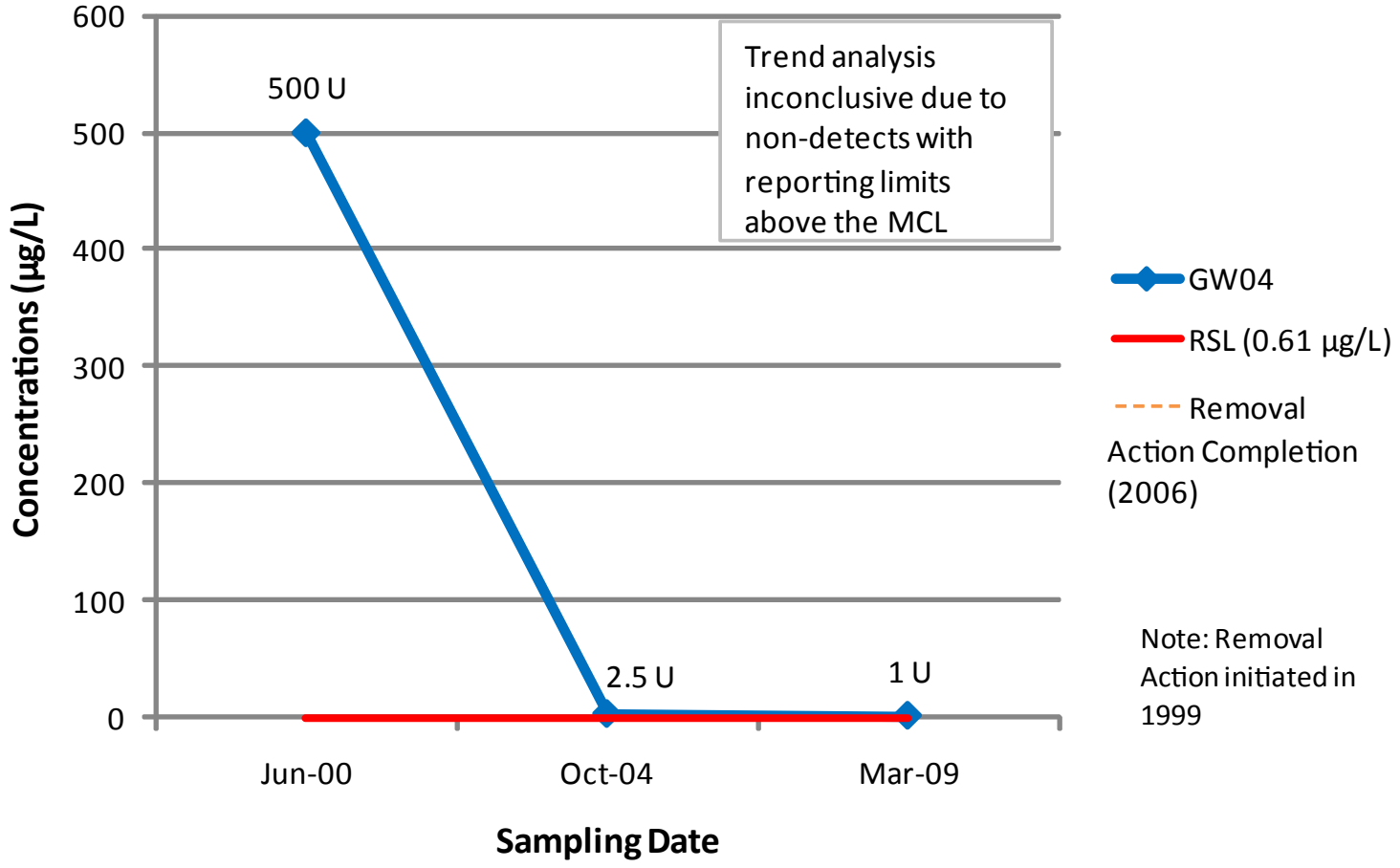
Graph 5-3
GW-01 Vinyl Chloride Trend Analysis
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia



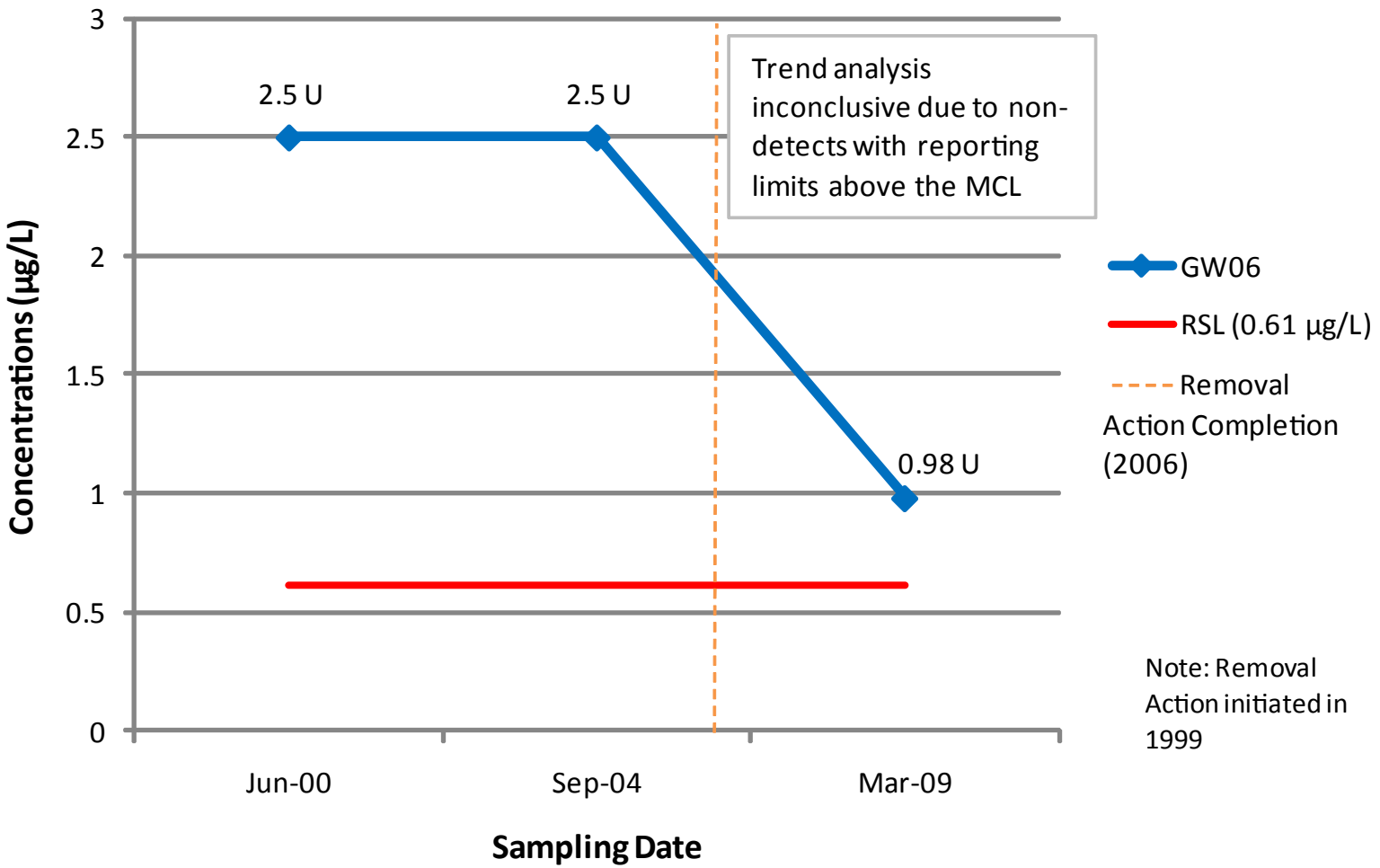
Graph 5-4
GW-08 Vinyl Chloride Trend Analysis
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia



Graph 5-5
GW-09 RDX Trend Analysis
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia



Graph 5-6
GW-04 RDX Trend Analysis
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia



Graph 5-7
GW-06 RDX Trend Analysis
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

SECTION 6

Chemical Fate and Transport

This section discusses the fate and transport of chemicals observed in groundwater, surface water, sediment, and sediment pore-water at Site 6. Fate and transport consists of identification of theoretical chemical phases and migration and degradation pathways. An understanding of the mobility and persistence of a chemical in the subsurface is part of the overall assessment of the potential for that chemical to cause an adverse human health or environmental effect.

This section also includes the CSM of the various media at Site 6 (**Figure 6-1**). The CSM qualitatively combines and interprets the information presented in this section and earlier sections of the report, including the hydrogeologic conceptual model, contaminant sources, potential migration of the contaminants, and the potential exposure and receptor pathways. The CSM is used to support potential risk management decisions and aids in defining the effectiveness of remedial alternatives, if necessary.

Chemical groups detected in environmental media at Site 6 include VOCs, explosives, and inorganics, as discussed in Section 5. SVOCs and pesticides/PCBs were not included here for additional study because the one SVOC detection, bis(2-ethylhexyl)phthalate, was determined to be a common laboratory contaminant and the one pesticide detection, heptachlor epoxide, was from a legal application, not related to previous site activities, and not subject to regulation under CERCLA.

These chemicals are also discussed as part of this section. The constituents detected that exceed screening criteria in the various media at Site 6 are summarized in **Table 6-1**. Constituents considered COPCs and their chemical properties are summarized in **Table 6-2**.

6.1 Chemical Mobility and Persistence

The mobility and persistence of the potential contaminants at the site are determined by their physical, chemical, and biological interaction with the environment. Mobility is the potential for a chemical to migrate from a site, and persistence is a measure of how long a chemical will remain in the environment. Because physical and chemical properties of contaminants and the environment affect the movement of a contaminant in groundwater, predicting contaminant behavior and migration can be difficult. Some of the mechanisms controlling mobility and persistence are described below.

6.1.1 Solubility

Solubility is a measure of the degree to which a constituent will dissolve in water. Highly soluble chemicals are more likely to be leached from soil by precipitation or runoff that infiltrates into the subsurface. The VOCs of interest generally have high water solubilities (greater than 1,000 mg/L), except for PCE with a water solubility of 150 mg/L. The explosives of interest have moderate to high water solubilities.

Due to the complex nature of DNAPLs, their fate and transport is difficult to understand. DNAPLs are separate-phase hydrocarbon liquids that are denser than water, and exist in the soil and aquifer matrix as free-phase DNAPL or residual DNAPL. Limited degradation of some DNAPLs in the subsurface allows them to persist for long periods of time. Dissolution causes soluble organic constituents in the DNAPL to slowly release into the groundwater, which causes DNAPLs to be a continuous source of groundwater contamination (Bedient et al., 1994).

Dissolved concentrations of chlorinated VOCs in groundwater at approximately 1 to 10 percent of a compound's solubility would suggest the presence of DNAPL in the subsurface (Bedient et al., 1994). Two monitoring wells (6GW08 and 6GW13) contained TCE at concentrations above 11,000 µg/L (**Figure 5-1**). However, free-phase DNAPL or residual DNAPL was not identified during the installation of the monitoring wells.

The solubilities of inorganics are dependent on several factors and are, therefore, not included in **Table 6-2**. In general, solubility is highly dependent on the oxidation state of the inorganic, which is dependent on subsurface conditions. The solubility of cations decreases as pH increases. Some cations may complex with oxygen and hydroxide, forming insoluble oxyhydroxides, or phosphate, sulfate, and carbonate, forming insoluble mineral precipitates. Metal sulfide complexes, which form in reducing environments, are extremely insoluble and tend to reduce the total metals concentrations (USEPA, 1979).

6.1.2 Sorption

Sorption occurs when a constituent adheres to and becomes associated with solid particles in the formation. The subsurface materials likely to sorb chemicals are clays and organic matter. Silty clay is present in the Yorktown confining unit. In addition, some inorganic constituents, such as arsenic species, can sorb to iron and oxyhydroxide or oxide coatings on soil and sediment grains.

The conventional measure of sorption is the distribution coefficient (K_d). The K_d for organic chemicals is the product of the soil organic carbon partition coefficient (K_{oc}) of the chemical and the fraction of organic carbon (f_{oc}) in the soil. The f_{oc} content in Site 6 soil is assumed to be 0.0025 and is estimated based on the average TOC concentrations detected in historical samples. In general, chemicals with a K_{oc} greater than 10,000 milliliters per gram (mL/g) have high degrees of adsorption and consequentially low mobility, whereas chemicals with a K_{oc} lower than 1,000 mL/g have lower degrees of adsorption and consequentially higher mobility. All VOCs and explosives of interest at Site 6 have moderate to low K_{oc} values (log K_{oc} values ranging from 0.26 to 2.45 mL/g).

The K_d for inorganic chemicals is a complex function of pH, organic content, oxide coatings, and other factors; therefore, K_d is not easily estimated by methods other than site-specific testing. Due to the number of factors that impact the K_d values for inorganics, these values range from 0.063 mL/g to 100,000 mL/g (**Table 6-2**). Generally, inorganic adsorption increases with pH. Inorganics most often sorb to clay minerals, organic matter, and iron and manganese oxyhydroxides. Inorganics may be sorbed on the surface of the soil or fixed to the interior of the soil, where they are unavailable for release to water. After available sorption sites are filled, most inorganics are incorporated into the structures of major mineral precipitates, as coprecipitates.

6.1.3 Volatilization

Volatilization occurs when a compound transfers from the aqueous phase to the gas phase. Measures of a chemical's tendency to volatilize from water and soil include its vapor pressure and Henry's Law Constant (K_h). Compounds with K_h values higher than 10^{-3} atmosphere-cubic meter per mole (atm-m^3/M) are expected to volatilize readily from water to air, whereas those with K_h values lower than 10^{-5} atm-m^3/M are relatively non-volatile. Compounds with K_h values in between these values are expected to be moderately volatile. At a given temperature, the higher the vapor pressure of a compound, the higher the volatility of that compound.

Volatilization tends to occur more readily from surface water, sediment, or shallow soil than from deeper soil or groundwater. In groundwater, volatilization can occur only at the air/water interface between the saturated and unsaturated zones, and movement of aqueous-phase contaminants from bulk groundwater to the interface is largely diffusion-limited. In unsaturated shallow soil, the soil gas pressure generally approximates the ambient air pressure. With depth, the soil gas pressure tends to increase and it becomes more difficult for the gas to escape and equalize with the ambient air pressure.

Values of vapor pressure and K_h for the site COPCs are provided in **Table 6-2**. The K_h values indicate that the VOCs of interest have properties indicative of high volatility while the explosives generally had limited to moderate volatility. Due to the complexity of inorganics and their variable forms in the environment, no K_h values can be provided. However, these constituents are typically not volatile under normal temperature and pressure conditions.

6.1.4 Transformation

Transformation occurs when the valence state of inorganics is increased (oxidation) or decreased (reduction). It can be caused by changes in E_h (oxidation potential) and/or pH and by microbial or nonmicrobial (abiotic) processes. Transformation may have a significant effect on the mobility of an inorganic, either increasing or decreasing it.

Aluminum, Iron, and Manganese

The solid form of iron (iron hydroxides), aluminum (aluminum hydroxides and imogolite) and manganese (manganese oxides) are usually present in the natural soil matrix. If sufficient amounts of oxygen and nitrate are not present in the subsurface, iron hydroxides and manganese oxides will be used as electron acceptors by metabolic activity and reductively dissolved into soluble forms. Sulfides present in groundwater can also reductively dissolve iron hydroxides. The soluble form of aluminum can be released to groundwater through either complexation to organic acids or dissolution of aluminum minerals. As the pH of the subsurface decreases, the amount of soluble aluminum is generally increased.

Several inorganics (such as arsenic) have a tendency to sorb to these iron and aluminum hydroxides and manganese oxides. If these compounds are reductively dissolved, then the inorganics which are bound to these hydroxides and oxides will also be released.

Arsenic, Antimony, Chromium, Selenium, and Vanadium

In oxidizing environments, these constituents primarily exist as oxyanions (hard anions that contain oxygen) and are relatively mobile. However, they can be adsorbed by clays, iron hydroxides, aluminum hydroxides, manganese compounds, and organic material at acidic and neutral pHs.

Arsenic, chromium, and vanadium can be reduced from higher to lower valance states by organic matter, divalent inorganics, and dissolved sulfide. Under reducing conditions, insoluble arsenic and antimony sulfides are precipitated in the presence of sulfides. Chromium will form insoluble chromium hydroxide or be sorbed by manganese oxides. Selenium will react with metal cations to form insoluble metal selenides.

Cadmium, Cobalt, Nickel, Lead, Silver, and Zinc

These inorganics form insoluble metal sulfides in anaerobic environments. They tend to sorb and will be transported in water primarily with suspended colloidal particles (ERG, 2003). The concentrations of cadmium, nickel, and zinc in groundwater are usually controlled by the adsorption or coprecipitation of these metals with iron, manganese, and aluminum. However, cadmium and zinc carbonates are relatively soluble at a pH level below 8. Lead is relatively immobile in all matrices due to its strong tendency to be sorbed by iron and manganese oxides and the insolubility of many lead minerals. Silver may form complex ions with chlorides, ammonium, and sulfates, and strongly precipitates as a sulfide in areas of decaying plants and animals.

Thallium

The mobility of thallium in water is limited by the low solubility of thallium oxides. It is only soluble in highly reduced environments in the charged ionic form. Thallium is strongly adsorbed by montmorillonite clays and manganese oxides.

6.1.5 Degradation

Degradation is the deterioration or destruction of a chemical either biologically (biodegradation) or abiotically through such processes as hydrolysis and photolysis. Biodegradation of chemicals by microbial organisms occurs through metabolic or enzymatic processes. Hydrolysis is the reaction of a chemical with water and photolysis is the result of exposing the chemical to light. The rate of degradation can be expressed as a half-life and is dependent on the existing chemical, biological, and physical conditions of the media in which the contaminant is located.

VOCs

Benzene and chlorinated VOCs were detected in groundwater at concentrations exceeding screening values. Benzene biodegradation occurs readily under aerobic conditions. Chlorinated VOCs can undergo biodegradation through use as an electron acceptor (reductive dechlorination), use as an electron donor (oxidation), or co-metabolism. PCE and TCE typically can be biodegraded via reductive dechlorination. Reductive dechlorination occurs in a series of reactions in which the parent compound is reduced to daughter compounds; each reaction forms a daughter compound with sequentially fewer chlorine atoms. The reductive degradation pathway for PCE and TCE is as follows:

$$\text{PCE} \rightarrow \text{TCE} \rightarrow \text{cis-1,2-DCE} \rightarrow \text{vinyl chloride} \rightarrow \text{ethene}$$

This reaction is often limited by the amount of an available carbon source (electron donor) in the groundwater system. Additionally, the rate of reductive dechlorination appears to decrease as the degree of chlorination decreases. The reduced daughter products of TCE (especially vinyl chloride) can also be biodegraded via aerobic degradation pathways.

Explosives

Eight explosive constituents were detected in groundwater and sediment at concentrations exceeding screening values. Explosives of interest at Site 6 can potentially biodegrade under aerobic conditions. RDX can also biodegrade under anaerobic conditions. Tetryl can be biodegraded if a carbon source is introduced to facilitate the process. Both explosives can undergo hydrolysis and photolysis in water. 2-amino-4,6-dinitrotoluene is an aerobic biotransformation product of TNT, and is generally persistent in the environment. Biodegradation of 2,4-DNT can occur rapidly in surface water.

6.1.6 Bioaccumulation

Bioaccumulation is the extent to which a chemical will partition from water into the lipophilic parts (e.g., fat) of an organism. Bioaccumulation commonly is estimated by the octanol-water partition coefficient (K_{ow}). Chemicals with high values of K_{ow} tend to avoid the aqueous phase and remain in soil longer or bioaccumulate in the lipid tissue of exposed organisms. Accumulation of a chemical in the tissue of the organism can be quantified by a bioconcentration factor (BCF), which is the ratio of the concentration of the chemical in the tissue to the concentration in the water. BCFs are both contaminant-specific and species-specific.

Table 6-2 lists some bioaccumulation values for the constituents of interest. The VOCs and explosives generally had lower values of K_{ow} and BCF, which indicates a lower potential to bioaccumulate. Factors that influence the speciation and solubility of inorganics in soils also affect bioconcentration. The pH of soils can also affect the amount of plant uptake of certain elements.

6.2 Natural Attenuation Evaluation

As discussed in Section 6.1.5, biodegradation of chlorinated solvents occurs when naturally occurring microorganisms break down the chlorinated solvents into less toxic or non-toxic substances through an electron transfer process. Under anaerobic conditions, anaerobic bacteria use additional electron acceptors in the following order of preference: nitrate (“nitrate reduction”), ferric iron (“iron reduction”), sulfate (“sulfate reduction”), and carbon dioxide (“methanogenesis”). Reductive dechlorination has been demonstrated under nitrate-reducing and sulfate-reducing conditions, but is most efficient under metanogenic conditions. Because reductive dechlorination occurs under similar conditions to the processes mentioned above, the concentrations of constituents can provide an indication of the potential for reductive dechlorination.

Natural attenuation indicator parameters and the microbe parameter *Dehalococcoides species* were analyzed from groundwater samples collected from three monitoring wells and are summarized in **Table 5-1**. Additional sample collection during the pre-FS investigation will provide more data for an adequate evaluation. This is discussed further in Section 9.3,

Proposed Future Actions. Field measurements collected from all monitoring wells are summarized in **Table 5-5**.

Specific groundwater geochemical parameters are discussed in detail below.

6.2.1 Dissolved Oxygen

DO is the most thermodynamically favored electron acceptor used by microbes for the biodegradation of organic carbon. Generally, reductive dechlorination can occur with DO concentrations less than 5 mg/L. However, concentrations below 1 mg/L are considered to be indicative of anaerobic conditions, which is favorable for reductive dechlorination. DO concentrations less than 0.5 mg/L are considered ideal for reductive dechlorination.

DO concentrations ranged from 0.25 (well 6GW16) to 4.18 mg/L (well 6GW10). In general, the low DO concentrations observed may be indicative that reductive dechlorination is possible at the site.

6.2.2 Nitrate/Nitrite

After DO has been depleted, nitrate may be used as an electron acceptor during anaerobic biodegradation of organic carbon via denitrification. In this process, nitrate is reduced and nitrite is produced. Nitrate/nitrite was detected at two monitoring wells with a maximum concentration of 0.06 mg/L. Nitrate reduction does not appear to be a significant electron acceptor process at the site

6.2.3 Ferric Iron/Ferrous Iron

In some cases, ferric iron (iron III) is used as an electron acceptor during anaerobic degradation. During this process ("iron reduction"), ferric iron is reduced to iron (II) or ferrous iron. As a result, measurable concentrations of ferrous iron are an indicator of iron reduction. In general, ferrous iron concentrations greater than 1 mg/L are considered to be an indicator of iron reduction.

Dissolved iron concentrations were greater than 1 mg/L at nine monitoring wells with a maximum dissolved iron concentration of 19.9 mg/L (well 6GW01). The presence of high ferrous iron within the aquifer may suggest that iron reduction is a significant electron acceptor process.

6.2.4 Sulfate/Sulfide

After DO and nitrate have been depleted, sulfate may be used as the electron acceptor in anaerobic degradation. This process is termed "sulfate reduction" and results in the production of sulfide. Sulfide concentrations increase within the aquifer when sulfate reduction is occurring.

Sulfate and sulfide concentrations ranged from 14JD to 27D mg/L and non-detect to 1.3 mg/L, respectively. Sulfate reduction does not appear to be a significant electron acceptor process.

6.2.5 Ethene/Ethane

Ethene is a daughter product of vinyl chloride, and ethane is a daughter product of ethene. Concentrations of ethene above 0.01 µg/L and ethane above 0.1 µg/L indicate reductive

dechlorination is proceeding to completion. Ethene and ethane were observed at one monitoring well (analyzed from three locations) at a concentration of 0.8J (well 6GW08) and 0.05J µg/L (well 6GW12A), respectively. The detected concentrations indicate that reductive dechlorination may be occurring to completion at the site.

6.2.6 Total Organic Carbon

Organic carbon is used as an electron donor (or may produce hydrogen, which can serve as the electron donor) in the reductive dechlorination process and, therefore, is needed to drive the process. The presence of TOC at concentrations greater than 20 mg/L indicates ideal conditions for reductive dechlorination. The maximum TOC concentration observed was 3.3J mg/L (well 6GW12A), which does not indicate favorable conditions for reductive dechlorination.

6.2.7 Oxidation-Reduction Potential

The ORP of groundwater is a measure of electron activity and is an indicator of the relative tendency of a solution to accept or transfer electrons. Reductive dechlorination is most efficient in the ORP range corresponding to sulfate reduction and methanogenesis (<-100 millivolts [mV]); however, dechlorination of TCE also occurs in the ORP range associated with nitrate, manganese, and ferric iron reduction (-50 to 740 mV).

ORP values ranged from -287 mV to 295 mV, with 20 of the 24 monitoring wells showing negative ORP values. ORP values are indicative of conditions favorable for reductive dechlorination.

6.2.8 Temperature and pH

Groundwater temperature directly affects the solubility of oxygen and other geochemical species. Reductive dechlorination can occur at groundwater temperatures between 5 degrees Celsius (°C) and 20°C, while temperatures greater than 20°C are considered ideal for reductive dechlorination. Groundwater temperatures ranged from 11.5 to 27.2°C.

The pH of groundwater has an effect on the presence and activity of microbial populations in groundwater. The optimal pH range for reductive dechlorination is 5 to 9. The pH in groundwater ranged from 5.92 to 8.39.

6.2.9 Reductive Dechlorination Daughter Products

Reductive dechlorination daughter products of TCE include cis-1,2-DCE, vinyl chloride, ethane, and ethene. The presence of these compounds indicates biodegradation is occurring. During biodegradation of chlorinated hydrocarbons, chloride is released into the groundwater. Elevated chloride concentrations relative to background may indicate reductive dechlorination is taking place in the aquifer.

Reductive dechlorination daughter products cis-1,2-DCE and vinyl chloride are present throughout the Yorktown-Eastover aquifer at significant concentrations, as discussed in Section 5. The widespread presence of reductive dechlorination daughter products indicates reductive dechlorination is occurring. Additionally, the presence of vinyl chloride is significant because vinyl chloride is near the end of the reductive dechlorination process.

6.2.10 Microbial Results

Dehalorespiring organisms such as *Dehalococcoides* can facilitate dechlorination of chlorinated solvents to ethene/ethane. In general, a density of less than 1 cell per milliliter (mL) is suboptimal to sustain dechlorination rates. Concentrations of *Dehalococcoides* ranged from 1.1 to 19 cells per milliliter (cells/mL) at Site 6, which is indicative of a culture that may sustain appreciable dechlorination rates.

6.2.11 Summary

The geochemical data collected from Site 6 groundwater generally indicate favorable conditions for reductive dechlorination. These conditions include low DO and ORP, the presence of significant concentrations of ferrous iron, the presence of ethene and ethane, and ideal groundwater temperatures. In addition, the presence of TCE daughter product vinyl chloride indicates advanced reductive dechlorination is occurring in the Yorktown-Eastover aquifer. The concentration of dehalorespiring organisms may also sustain appreciable dechlorination rates at the site.

6.3 Contaminant Migration at Site 6

This subsection discusses the site-specific sources and potential mechanisms for contaminant release and migration from these sources. **Figure -6-1,** the Site 6 CSM, supports the discussion in this section.

6.3.1 Potential Sources of Contamination

The sources of potential contamination at Site 6 are historical discharges of wastewater containing explosives and solvents from Buildings 109 and 110 to the impoundment area via the flume system, and the excavated area possibly used to contain packed explosives.

The flume area is a network of flumes connected to an impoundment area, where wastewater possibly containing explosives (TNT, RDX, and 2,4-DNT) and solvents (TCE, 1,1,1-TCA, and cyclohexanone) was discharged between 1942 and 1975. The wastewater was generated from explosives reclamation at Building 109 (R-1) and from explosives loading, mixing, and casting at Building 110 (Plant 2).

The excavated area may have been the soil borrow pit for construction of the coffer dam for the impoundment and may have also been used to contain packed explosives. Cadmium and zinc contaminated soil was previously excavated from this area. The excavated area is located northwest of former Building 501 and is currently wooded.

Removal actions were implemented within the excavated area (soils), the flume system (soils and sediments), and the upper portion of the impoundment area (sediments). The majority of the remaining chlorinated solvents and explosives at the site likely exist within the saturated soils of the Yorktown-Eastover aquifer.

6.3.2 Migration from Potential Source Areas

The migration pathways at Site 6 were assessed by identifying potential sources of contamination, evaluating the COPC horizontal and vertical distributions, and incorporating the hydrogeologic conceptual model. A generalized description of the potential contaminant migration pathways are discussed below.

Migration from Surface Release to Groundwater

Any surface release would cause contaminants to migrate downward, as either a free-phase liquid or dissolved in water, through the thin vadose zone to groundwater. Since removal actions of soil and sediment were previously conducted in the potential source areas, the vadose zone is not expected to be a continuous source of contamination.

Migration in Groundwater

Contaminant transport in groundwater is primarily by advection and dispersion. Advection is the primary transport mechanism and includes the transport of dissolved contaminants by the bulk motion of flowing groundwater. Dispersion is the spreading of dissolved contaminants from the path they would be expected to follow during advection, due to the spatial variation in aquifer permeability, fluid mixing, and molecular diffusion.

Contaminants typically will not move as rapidly as groundwater because of retardation, or the adsorption of the contaminant to the solid media. The advective migration rates of different dissolved contaminants vary depending on the K_d and the rate of groundwater flow. For each contaminant detected at the site, it is theoretically possible to calculate a retardation coefficient, which is an estimate of the degree to which the contaminant is slowed by adsorption in relation to the groundwater flow velocity. The retardation coefficient is calculated according to the following equation:

$$R = 1 + p_b \times K_d / n_e$$

Where :

R = Retardation coefficient (dimensionless)
p_b = Bulk density (grams per cubic centimeter [g/cm^3])
K_d = Distribution coefficient (mL/g)
n_e = effective porosity (dimensionless)

Assuming a bulk density of 1.3 g/cm^{3}and an effective porosity of 0.3, the estimated retardation coefficients are listed in **Table 6-2**. The retardation coefficients for the VOCs and explosives ranged from 1.0 to 4.1. The retardation of inorganics is variable depending on the form of the chemical in the subsurface and may range from 1.2 to 288,900. The effect of retardation is estimated by dividing the groundwater flow velocity by R, which provides a value of migration that is either equal to (in the case of no retardation) or less than (in the presence of retardation) the groundwater flow velocity (**Table 6-2**). Based on the information presented in Section 4.5.4, the average groundwater flow velocity was estimated at 0.01 ft/day.

TCE as a DNAPL is denser than water and will migrate vertically downward to perch and spread atop fine-grained units in the subsurface. In addition, residual droplets and globules of DNAPL will be left behind as the DNAPL migrates downward through the porous medium. The residual DNAPL form continuing sources of dissolved-phase TCE contamination as migrating groundwater comes in contact with the DNAPL. Dissolved-phase TCE will spread laterally, generally following the stronger horizontal groundwater flow direction to the west. At two separate areas within the impoundment area, TCE concentrations suggest the presence of TCE as DNAPL within the upper and middle

portions of the Yorktown-Eastover aquifer (to a depth of 36 ft bgs). It is unknown if the DNAPL occurrence is continuous between these two areas.

The TCE, 1,2-DCE, and vinyl chloride plume extends from adjacent to Building 109 approximately 780 ft westward to Felgates Creek. Contamination within the Yorktown-Eastover aquifer is not expected to migrate to deeper aquifers because of the 100- to 200-ft-thick Eastover-Calvert confining unit. Groundwater in the Yorktown-Eastover aquifer discharges and mixes with the saline water of Felgates Creek.

Geochemical and microbial conditions are favorable for reductive dechlorination, which degrades TCE, 1,2-DCE, and vinyl chloride to ethene and ethane. TCE was not observed in surface water and sediment pore-water, which may suggest that TCE has degraded before discharge to Felgates Creek.

The explosives 2,4-DNT and RDX occur as two separate plumes within the Yorktown-Eastover aquifer. RDX occurs within the upgradient portion of the surface impoundment; and 2,4-DNT occurs within the downgradient portion of the surface impoundment area and adjacent to Felgates Creek. The presence of 2-aminio-4,6-dinitrobenzene suggests that TNT has biodegraded at the site.

Transport and partitioning of inorganics in water is dependent on the oxidation state of the inorganic and on interactions with other materials present. Inorganics most frequently exceeding screening criteria were iron, manganese, chromium, and arsenic.

Migration in Vapor Phase

The potential for the migration of VOC vapors into the vadose zone exists at Site 6. VOCs located in subsurface soils or in groundwater can volatilize, migrate through soil gas, and transport into indoor spaces, potentially producing inhalation exposure. VOCs in soil gas will primarily migrate and spread out by vapor diffusion. Advective transport of VOC vapors (i.e., by the convective flow of soil gas) is expected to occur near the ground surface as a result of atmospheric pressure variations. A secondary spreading mechanism for VOCs in the vadose zone is the migration of soil moisture due to infiltration or evapotranspiration.

The nature, extent, and migration of contamination within the vapor phase was not investigated as part of the Phase II RI. However, the existing Building 109 is no longer operational and is proposed for demolition, and no buildings are planned in the future at the site. The potential for vapor intrusion risk was evaluated in Section 7. 1.3.

Runoff, Surface Water, and Sediment Transport

Since COPCs were released to native soil during the operation between 1942 and 1975, one of the primary pathways for transport at Site 6 includes surface runoff or wind erosion from previously contaminated surface soil or contaminated soil residue to surface water or sediment in the unnamed tributary of Felgates Creek. Surface runoff follows the topography, which slopes toward the unnamed tributary of Felgates Creek. Both surface runoff and wind erosion are limited by the thick vegetation present at the site. Surface water may potentially infiltrate into the subsurface and recharge groundwater.

Inorganics were detected above screening levels in all surface water samples. Inorganics exceeding screening criteria were manganese, silver, arsenic, and chromium. Mobility of the dissolved components of these inorganics will be limited if sufficient sorption sites are

available. Although the total concentration of chromium was above the screening level, the dissolved concentration of chromium was below the screening value. This indicates that the presence of chromium in surface water is predominantly due to sorption onto suspended sediment or organic matter particles.

In sediment, explosives, and inorganics were detected above screening values. Explosives in sediment will tend not to partition to surface water due to their relatively low water solubilties and moderate to high sorption. However, they can be suspended with small particles and transported downgradient via surface water.

Potential Exposure and Receptor Pathways

Potential exposure media at Site 6 include groundwater, surface water, and sediment (including pore water). Exposure at Site 6 may occur under current and future land use scenarios. However, Site 6 cannot be developed for real estate because it is located inside an area encumbered by the ESQD.

Human receptors include potential current/future trespassers/visitors (adults and adolescents), future industrial workers, future adult/child residents, and future construction workers. The upper trophic level ecological receptors selected for exposure modeling include belted kingfisher, great blue heron, mallard, marsh wren, mink, muskrat, and raccoon. Lower trophic level ecological receptors include aquatic plants, benthic invertebrates, fish, amphibians, and reptiles. The receptors are discussed in more detail in the human health and ecological risk assessments in Sections 7 and 8, respectively.

TABLE 6-1
Constituents of Interest by Media
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Constituents of Interest (COIs)	Groundwater	Surface Water	Sediment
Volatile Organic Compounds			
1,1-Dichloroethane	X		
1,1-Dichloroethene	X		
1,2-Dichloroethane	X		
1,2-Dichloroethene (Total)	X		
Benzene	X		
cis-1,2-Dichloroethene	X		
Tetrachloroethene	X		
trans-1,2-Dichloroethene	X		
Trichloroethene	X		
Vinyl Chloride	X		
Explosives			
1,3-Dinitrobenzene	X		
2,4-Dinitrotoluene	X		
2-Amino-4,6-dinitrotoluene	X		
Nitrobenzene	X		X
3-Nitrotoluene	X		
4-Nitrotoluene	X		
RDX	X		
Tetryl			X
Inorganics			
Aluminum	X		X
Antimony	X		
Arsenic	X	X	X
Beryllium	X		
Cadmium	X		
Chromium	X	X	X
Cobalt	X		
Iron	X		
Lead	X		
Manganese	X	X	X
Nickel	X		X
Selenium	X		X
Silver		X	
Thallium	X		
Vanadium	X		X
Zinc	X		

TABLE 6-2
Physical and Chemical Data of Constituents of Potential Concern
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Constituents of Potential Concern	CAS #	Molecular Weight (g/mole)	Density (g/cm^3)	Water Solubility (mg/L)	Vapor Pressure (mm Hg)	K_h (atm-m3/mole)	Log K_{oc} (---)	K_d (mL/g)	R (---)	V_c (ft/day)	Log K_{ow} (---)	Log BCF (---)
Volatile Organic Compounds												
1,1-Dichloroethane	75-34-3	98.96	1.2	5,040	227	5.62E-03	1.62	0.10	1.5	0.007	1.79	0.82
1,1-Dichloroethene	75-35-4	96.94	1.2	2,420	600	2.61E-02	0.26	0.00	1.0	0.010	2.13	Low
1,2-Dichloroethane	107-06-2	98.96	1.235	8,600	78.9	1.18E-03	1.62	0.10	1.5	0.007	1.48	Low
1,2-Dichloroethene (Total)	540-59-0	96.94	1.28	3,500	201	4.08E-03	1.69	0.12	1.5	0.007	2	1.36
Benzene	71-43-2	78.11	0.88	1,880	75	5.50E-03	1.85	0.18	1.8	0.006	2.13	1
cis-1,2-Dichloroethene	156-59-2	96.94	1.28	6,410	200	4.08E-03	1.69	0.12	1.5	0.007	1.86	1.36
Tetrachloroethene	127-18-4	165.8	1.62	150	20	1.53E-02	2.43	0.67	3.9	0.003	2.53	2
trans-1,2-Dichloroethene	156-60-5	96.94	1.28	4,520	331	9.38E-03	1.69	0.12	1.5	0.007	2.09	1.36
Trichloroethene	79-01-6	131.4	1.46	1,100	74	9.10E-03	1.92	0.21	1.9	0.005	2.53	2
Vinyl Chloride	75-01-4	62.50	0.91	1,100	2,531	2.78E-02	0.39	0.01	1.0	0.010	0.60	3.04
Explosives												
1,3-Dinitrobenzene	99-65-0	168.11	1.6	533	0.0009	4.90E-08	2.33	0.53	3.3	0.003	1.49	1.87
2,4-Dinitrotoluene	121-14-2	182.14	1.32	270	1.10E-04	8.79E-08	2.45	0.71	4.1	0.002	1.98	NA
2-Amino-4,6-dinitrotoluene	35572-78-2	197.15	NA	1,220	1.07E-05	3.27E-11	NA	NA	NA	NA	1.84	NA
Nitrobenzene	98-95-3	123.11	1.2	2,090	0.245	2.40E-05	1.7	0.13	1.5	0.006	1.85	1.18
3-Nitrotoluene	88-72-2	137.14	1.16	650	0.188	1.25E-05	NA	NA	NA	NA	2.3	NA
4-Nitrotoluene	99-99-0	137.14	1.29	442	0.0157	5.63E-06	NA	NA	NA	NA	2.37	NA
RDX	121-82-4	222.26	1.82	38	1.00E-09	2.00E-11	1.80	0.16	1.7	0.006	0.85	NA
Tetryl	479-45-8	287.15	1.57	74	1.20E-07	2.70E-09	2.37	0.59	3.5	0.003	1.87	NA

TABLE 6-2
Physical and Chemical Data of Constituents of Potential Concern
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Constituents of Potential Concern	CAS #	Molecular Weight (g/mole)	Density (g/cm^3)	Water Solubility (mg/L)	Vapor Pressure (mm Hg)	K_h (atm-m3/mole)	Log K_{oc} (---)	K_d (mL/g)	R (---)	V_c (ft/day)	Log K_{ow} (---)	Log BCF (---)
Metals												
Aluminum	7429-90-5	26.98	2.70	U	U	U	NA	NA	NA	NA	U	U
Antimony	7440-36-0	121.75	6.68	U	U	U	NA	1.3 - 500	4.7 - 1,400	0.140 - 43	U	U
Arsenic	7440-38-2	74.92	5.78	U	U	U	NA	2.0 - 20,000	6.8 - 57,800	0.004 - 30	U	U
Beryllium	7440-41-7	9.01	1.85	U	U	U	NA	50 - 12,600	145 - 36,400	0.006 - 1.4	U	U
Cadmium	7440-43-9	112.41	8.65	U	U	U	NA	1.3 - 100,000	4.8 - 288,900	7.03E-04 - 43	U	U
Chromium	16065-83-1 & 18540-29-9	52.00	7.14	U	U	U	NA	0.20 - 63,000	1.6 - 182,000	0.001 - 129	U	U
Cobalt	7440-48-4	59.00	8.90	U	U	U	NA	0.063 - 12,600	1.2 - 36,400	0.006 - 172	U	U
Iron	7439-89-6	55.85	7.87	U	U	U	NA	1.4 - 10,000	5.0 - 28,900	0.007 - 40	U	U
Lead	7439-92-1	207.20	11.34	U	U	U	NA	5.0 - 100,000	15 - 288,900	7.03E-04 - 13	U	U
Manganese	7439-96-5	54.94	7.26	U	U	U	NA	NA	NA	NA	U	U
Nickel	7440-02-0	58.69	8.91	U	U	U	NA	10 - 6,300	30 - 18,200	0.011 - 6.8	U	U
Selenium	7782-49-2	78.96	4.39	U	U	U	NA	0.5 - 250	2.4 - 723	0.281 - 83	U	U
Silver	7440-22-4	107.86	10.50	U	U	U	NA	10 - 31,600	30 - 91,300	0.002 - 6.8	U	U
Thallium	7440-28-0	204.38	11.85	U	U	U	NA	1,000 - 3,200	2,900 - 9.200	0.022 - 0.070	U	U
Vanadium	7440-62-2	50.94	6.11	U	U	U	NA	4.0 - 500	13 - 1,400	0.140 - 16	U	U
Zinc	7440-66-6	65.39	7.13	U	U	U	NA	0.1 - 100,000	1.3 - 288,900	7.03E-04 - 158	U	U

BCF = Bioconcentration Factor

foc = fraction organic carbon = 0.0025 (assumed)

K_d = Soil-Water partition coefficient = K_{oc} x foc for organics

K_h= Henry's Law Constant

K_{oc} = Organic carbon partition coefficient

K_{ow} = Octanol-water partition coefficient

NA = no information available

n_e = Effective porosity = 0.3

R = Retardation coefficient = 1 + K_d x p_b / n_e

p_b = Soil bulk density = 1.3 grams per cubic centimeter (sandy clay)

U = No value is provided because of the uncertainty in the form of these chemicals in the environment.

Vc = Contaminant velocity = seepage velocity (estimated at 0.01 ft/day) / R

Data sources (Sources 3 and 6 are primary references):

(1) Agency of Toxic Substances and Disease Registry. 2009. Toxicological Profiles.*http://www.atsdr.cdc.gov/toxpro2.html*

(2) Dragun, James. 1998. *The Soil Chemistry of Hazardous Materials 2nd Edition*.

(3) Interstate Technology and Regulatory Council. 2002.*A Systematic Approach to In Situ Bioremediation in Groundwater Including Decision Trees on In Situ Bioremediation for Nitrates, Carbon Tetrachloride, and Perchlorate.*In Situ Bioremediation Team.

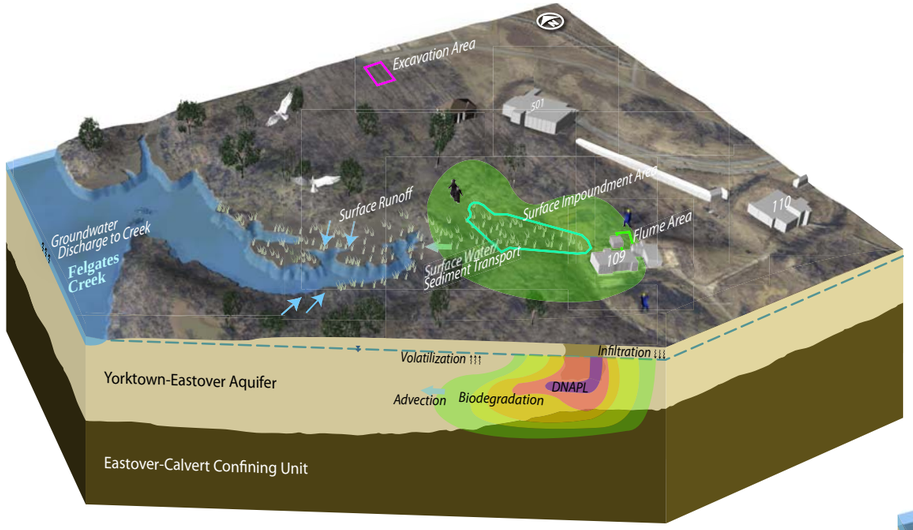
(4) Montgomery. 2000. *Groundwater Chemicals Desk Reference. Third Edition.*

(5) SRC. 2009. Interactive PhysProp Database Demo.*http://www.srcinc.com/what-we-do/databaseforms.aspx?id=386*

(6) United States Environmental Protection Agency. 1999.*Partition Coefficients for Metals in Surface Water, Soil, and Waste.*

(7) United States National Library of Medicine. 2009. Hazardous Substances Data Bank (HSDB)*http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB*

(8) IPCS. 2010. *http://www.inchem.org/*



Current/Future Trespasser/Visitor:
Ingestion of surface water/sediment. Dermal contact of surface water/sediment.

Future Resident:
Ingestion, dermal contact, and inhalation of indoor air from groundwater.

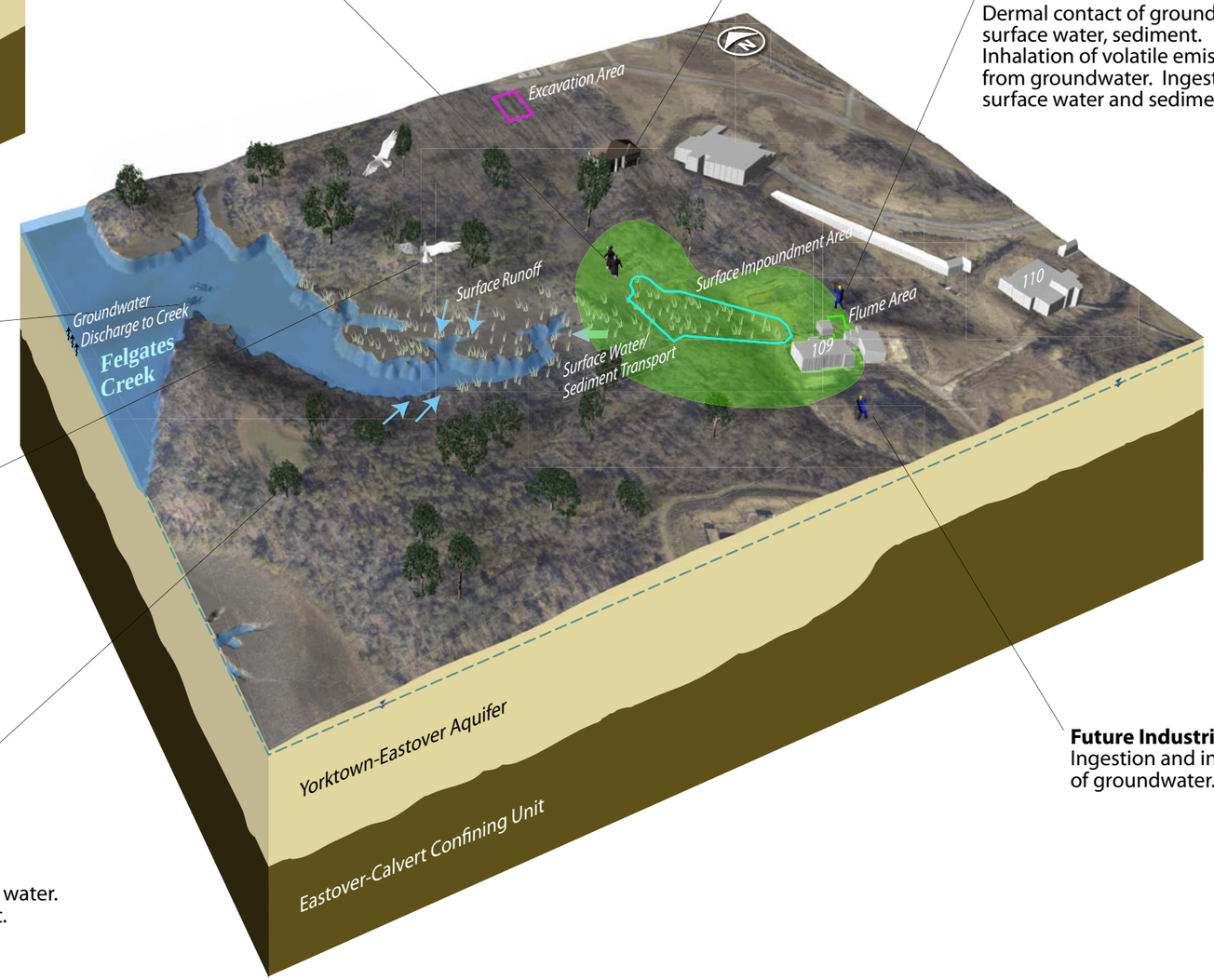
Future Construction Worker:
Dermal contact of groundwater, surface water, sediment. Inhalation of volatile emissions from groundwater. Ingestion of surface water and sediment.

Fish:
Direct contact of surface water. Ingestion and direct contact of sediment.

Animal:
Direct contact of surface water. Ingestion and direct contact of sediment.

Plants:
Direct contact of surface water. Root update of sediment.

Future Industrial Worker:
Ingestion and inhalation of groundwater.



LEGEND

- Water Table
- Excavation Area
- Surface Impoundment Area
- Flume Area
- DNAPL Dense Non-Aqueous Phase Liquid
- TCE Concentration ≥ 2 µg/L

FIGURE 6-1
Simplified Conceptual Site Model
Phase II Remediation Investigation Report, Site 6
Naval Weapons Station Yorktown, Yorktown, Virginia

SECTION 7

Human Health Risk Assessment

This section presents the Human Health Risk Assessment (HHRA) for Site 6. The baseline risk assessment was conducted to assess the potential human health impacts associated with potentially site-related contamination in groundwater, surface water, and sediment. Soil and sediment removal and remediation actions have been conducted at Site 6, and therefore, soil was not evaluated in the HHRA. A detailed description and history of the site is presented in Section 2. The data evaluated in this risk assessment are discussed in Section 5 and a discussion of the fate and transport of contamination at Site 6 is discussed in Section 6.

This risk assessment has been prepared using conservative assumptions. Exposure pathways based on current site conditions and current and potential future site use were evaluated. Guidance documents used for preparing the risk assessment include *Risk Assessment Guidance for Superfund (RAGS) Part A* (USEPA, 1989), *RAGS Part D* (USEPA, 2001), and *RAGS Part E* (USEPA, 2004).

The HHRA consists of the following components:

- Identification of COPCs
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization
- Uncertainty Assessment

These components are described in the following sections. Spreadsheets were prepared in accordance with *RAGS, Volume 1, Human Health Evaluation Manual, Part D* (USEPA, 2001) to screen for COPCs and to calculate risk estimates associated with the COPCs. These spreadsheets are presented in **Appendix F**.

7.1 Identification of COPCs

The identification of COPCs includes data collection, data evaluation, and data screening. The data collection and evaluation involve gathering and reviewing the available site data and identifying a set of data for the risk assessment that meets project-specific data quality objectives (DQOs). This data set is then further screened against concentrations that are protective of human health to reduce the data set to those constituents and media of potential concern.

7.1.1 Data Summary

Detailed results of the sampling that was performed at Site 6 are presented in Section 5 of this report. All of the data used in the risk assessment have been fully validated and are assumed to represent current conditions. **Table 7-1** lists the groundwater, surface water, and sediment samples that were evaluated in the HHRA. Monitoring wells at Site 6 are screened in the Yorktown aquifer. Unfiltered groundwater data were used to evaluate construction worker exposure to groundwater. Filtered groundwater inorganic data were used to

evaluate residential exposure to groundwater, following USEPA Region 3 guidance (USEPA, 1992), since there were significant differences (over an order of magnitude) between the filtered and unfiltered data for aluminum and iron in many of the samples. Unfiltered surface water data were used to evaluate all exposures to surface water.

Two groundwater data exposure groupings were evaluated in the risk assessment. The first group of wells was selected to evaluate exposure to groundwater from the most contaminated area of the groundwater plume (however, for screening to identify COPCs for this data grouping, all of the monitoring wells sampled at the site were included). Because several explosives were detected at high concentrations in monitoring well GW09, and GW09 is separated from the identified plume by several monitoring wells with lower concentrations, groundwater sample results from this well were evaluated separately from the plume data grouping.

7.1.2 Data Evaluation

The data collected during site investigations were evaluated to determine reliability for use in the quantitative risk assessments. A review of the data and past discussions with USEPA and the Navy identified the following criteria for data usability and usage of qualified data:

- Data qualified with a J, K, or L (estimated) were treated as unqualified detected concentrations.
- Data qualified with an R (unreliable result) were not used in the risk assessment.
- Data qualified with a B (blank contamination) were used in the risk assessment as if the results were non-detects, with the blank-related concentrations of each constituent used as the sample detection limit.
- For duplicate samples, the maximum concentration between the two samples was used as the sample concentration.

7.1.3 Selection of COPCs

All of the detected constituents were screened following the procedures described below. The selection of COPCs was based on the criteria presented in the USEPA Region 3 *Technical Guidance Manual, Selection Exposure Routes and Contaminants of Concern by Risk-Based Screening* (USEPA, 1993b) and *RAGS Part D* (USEPA, 2001).

The maximum detected concentration of each constituent for each media and data grouping was compared to the criteria discussed below to select the COPCs. If the maximum concentration exceeded the criteria, the constituent was identified as a COPC. Constituents that were not detected in any of the samples or were detected at concentrations less than the criteria were not identified as COPCs. Detection limits for constituents that were not detected were also compared to the screening levels as discussed in Section 8.5, the uncertainty assessment. The COPC screening is presented in **Appendix F**, Tables 2.1 through 2.7.

- **Comparison with Health-Based Criteria for Surface Water:** Surface water data were compared to 10 times the USEPA tap water RSLs (USEPA, 2009d). This was done following USEPA Region 3 guidance because exposure to surface water is expected to be significantly less than exposure to groundwater, and there are no human health

screening levels specifically for surface water. RSLs based on non-carcinogenic effects were divided by 10 to account for exposure to multiple constituents. RSLs based on carcinogenic effects were not adjusted. Therefore, RSLs based on non-carcinogenic effects were used as presented in the RSL table (10 times the tap water RSL divided by 10), and RSLs based on carcinogenic effects were multiplied by 10. Lead concentrations in surface water were compared to the federal action level for drinking water of 15 µg/L (USEPA, 2002a). Surface water data were also compared to national recommended water quality criteria (NRWQC) for ingestion of water and organisms. However, as the surface water is not used as a water supply, and the surface water body (a recently constructed wetland and Felgates Creek) supports fishing only as a "catch and release" program. The NRWQC are overly conservative and were not used to identify COPCs.

- **Comparison with Health-Based Criteria for Sediment:** Sediment data were compared to 10 times the USEPA residential soil RSLs (USEPA, 2009d). This was done following USEPA Region 3 guidance because exposure to sediment is expected to be significantly less than exposure to soil, and there are no human health screening levels specifically for sediment. RSLs based on non-carcinogenic effects were divided by 10 to account for exposure to multiple constituents. RSLs based on carcinogenic effects were not adjusted. Therefore, RSLs based on non-carcinogenic effects were used as presented in the RSL table (10 times the residential soil RSL divided by 10), and RSLs based on carcinogenic effects were multiplied by 10.

- **Comparison with Health-Based Criteria for Groundwater:** Groundwater data were compared to the USEPA tap water RSLs (USEPA, 2009d). RSLs that are based on non-carcinogenic effects were divided by 10 to account for exposure to multiple constituents. RSLs based on carcinogenic effects were used as presented in the RSL table. Lead concentrations in groundwater were compared to the federal action level for drinking water of 15 µg/L (USEPA, 2002a). Groundwater data were also compared to MCLs; however, this comparison was not used to identify the COPCs.

- **Comparison with Health-based Criteria for Vapor Intrusion from Groundwater to Indoor Air:** Groundwater risk-based screening levels protective of the vapor intrusion exposure pathway were calculated using the methodology described in Appendix D of the *Office of Solid Waste and Emergency Response (OSWER) Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)* (USEPA 2002b). The target groundwater concentration was calculated by dividing the target indoor air concentration by an attenuation factor (equal to 0.001) that accounts for the diffusion resistance across the capillary fringe, and then converting the vapor concentration to an equivalent groundwater concentration, assuming the equilibrium partitioning obeys Henry's Law:

$$\text{Generic Groundwater RBSL } (\mu g/L) = \frac{\text{Target air concentration } (\mu g/m^3) \times 10^{-3}\ (m^3/L)}{\text{Henry's Law Constant} \times \text{Attenuation Factor } (0.001)}$$

µg/L = micrograms per liter
µg/m^3 = micrograms per cubic meter
m^3/L = cubic meter per liter

- The target air concentrations are the USEPA residential air RSLs (USEPA, 2009a), based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens. The Henry's Law Constant is specific to each constituent and was adjusted to be consistent with the groundwater temperature. The groundwater risk-based screening levels were calculated for noncarcinogenic and carcinogenic endpoints, and for constituents with both, the lower value was selected as the screening level. Additionally, if the constituent has an MCL, the MCL was selected as the screening level when it was greater than the calculated risk-based screening level. The calculations and resulting screening levels are included in **Appendix F**, in Table 2.4 Supplement A.
- **Essential Human Nutrients:** Constituents that are considered essential nutrients, present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and toxic only at very high doses were eliminated from the quantitative risk analysis. These constituents are calcium, magnesium, potassium, and sodium. Although iron and manganese are also considered essential nutrients and are only toxic at very high doses, they were included in the HHRA because toxicity values are available.

7.1.4 Constituents of Potential Concern

Table 7-2 summarizes the constituents that were selected as COPCs. Eight VOCs, five explosives, twelve dissolved metals (residential scenario), and eleven total metals (construction worker scenario) were identified as COPCs for groundwater. Three additional explosives (3,5-dinitroaniline, 3-nitrotoluene, and 4-nitrotoluene) were identified as COPCs based on data from all of the monitoring wells; however, they were not detected in the wells from the center of the groundwater contamination plume used to estimate the human health risks, and were therefore not carried forward in the risk assessment. 3,5-Dinitrotoluene was included as a COPC for groundwater at GW09. The detected concentration of 3-nitrotoluene exceeds the adjusted tap water RSL, but does not exceed the RSL. The detected concentration of 4-nitrotoluene exceeds the tap water RSL based on a cancer risk of 10-6, but does not exceed a 10-5 risk level (is within an order of magnitude of the tap water RSL). Concentrations of total-1,2-dichlorothene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene were screened to identify the COPCs for groundwater. All three were identified as COPCs. In order not to overestimate the risks associated with exposure to 1,2-dichloroethene, only cis-1,2-DCE and trans-1,2-DCE were carried through the risk assessment. Four explosives, one dissolved metal (residential scenario), and two total metals (construction worker scenario) were identified as COPCs for groundwater at GW09. The groundwater data were also screened against concentrations protective of vapor intrusion into a future residential home. Three VOCs were selected as COPCs for vapor intrusion. Two metals, arsenic and chromium, were identified as COPCs for both the surface water and sediment.

7.2 Exposure Assessment

Exposure refers to the potential contact of an individual with a constituent. The exposure assessment identifies pathways and routes by which an individual may be exposed to the COPCs, and estimates the magnitude, frequency, and duration of potential exposure. Constituent intakes and associated health risks are only quantified for complete exposure pathways. The following sections discuss the components of exposure assessment:

- Develop the CSM for human health
- Calculate exposure point concentrations
- Develop exposure assumptions for potentially complete exposure pathways
- Calculate intake of COPCs

7.2.1 Conceptual Site Model for Human Health

This section provides the basis for developing the CSM for human exposures at Site 6. **Figure 7-1** presents the CSM showing potential human health exposure scenarios identified for current and potential future site use conditions.

Physical Characteristics

Site 6 is located within WPNSTA Yorktown. WPNSTA Yorktown is located on the York-James Peninsula, which is an embayed portion of the Atlantic Coastal Plain physiographic province. Site 6 is located in the northern portion of WPNSTA Yorktown and consists of three areas: a flume area, an impoundment area, and an excavated pit (**Figure 3-1**). Site 6 is generally wooded with some open areas near the existing buildings. Site topography generally slopes from east to west toward the impoundment area. Surface water runoff from the site is conveyed to Felgates Creek either directly by overland flow or via tributaries located adjacent to Site 6.

The potential source of contamination at the site is wastewater, possibly contaminated with explosives and solvents from nearby buildings that were discharged through the flumes to the impoundment area. The excavated pit may have been used historically to contain packed explosives. More specific information is included in Section 1.2.2.

Soil and sediment removal and remediation actions have been conducted at Site 6. Following the Record of Decision for Sites 6 and 7, soil and sediment from the flume area were removed and treated, and the lower portions of the flume were removed in 1999, along with pressure washing the trenches beneath Building 109. Soil in the excavated area of the site was covered to prevent contact with cadmium and zinc, and soil with nitramine/ nitroaromatic chlorinated volatile, and inorganic contaminated soils and sediment were excavated between 1999 and 2006. Soils within the impoundment were treated *in-situ*, and soils within the Biocell were treated *ex-situ*, and the impoundment was restored as a wetland with *spartina* marsh grass. Therefore, risks associated with exposure to soil at Site 6 were not evaluated.

Characterization of Land Use

The mission of WPNSTA is to provide ordnance, technical support, and related services to sustain the war-fighting capability of the armed forces in support of national military strategy. Site 6 is located within a restricted area of WPNSTA and a special access badge is required to enter this area. Furthermore, the site is located inside an area encumbered by the ESQD and cannot be developed for real estate purposes. Currently, there are no activities at Site 6. The surface water body near the site supports fishing only as a "catch and release" program; therefore, it is assumed that fish is not consumed from Felgates Creek and its tributaries.

Groundwater Use

The predominant source of domestic water supply for WPNSTA Yorktown and surrounding communities is from the City of Newport News Waterworks. Individual homes are able to obtain water from private wells installed into the Yorktown-Eastover shallow aquifer. However, because the groundwater at the base flows towards the York River and its tributaries, there is no potential for groundwater at WPNSTA Yorktown to migrate to these private wells. On WPNSTA Yorktown, there are no drinking water wells, and the shallow aquifer system is not used for any domestic water supply. There were four water supply wells on WPNSTA Yorktown; three have been abandoned and the fourth has been destroyed.

Potentially Exposed Populations

Potentially exposed populations are identified based on their locations relative to the site, their activity patterns, and the presence of potential sensitive subpopulations. The potentially exposed populations evaluated by the risk assessment are summarized on **Table 7-3** and shown on the CSM (**Figure 71**) and in **Appendix F,** Table 1.

Current site use could allow for exposure to surface water and sediment. Potential receptors exposed to surface water and sediment are assumed to be current/future adult and adolescent trespassers/visitors. These receptors would not swim in the creek or its tributaries near Site 6, as it is either too shallow or too difficult to access deeper waters, but would be exposed to these media during wading.

Potential future site use will likely stay the same as the current site use. However, for a conservative evaluation of potential risks, residential and industrial uses were evaluated in addition to the current site use scenarios. Although groundwater would most likely not be used as a future potable water supply by industrial workers because the Station already has a potable water supply, this pathway was conservatively evaluated as potentially complete. Additionally, it was conservatively assumed that shallow groundwater might be used as a future residential potable water supply, although this is highly unlikely. Construction workers could also be exposed to shallow groundwater during excavation activities. Unfiltered groundwater samples were used to evaluate the construction worker scenario, and filtered groundwater samples were used to evaluate the residential exposure scenarios, following USEPA Region 3 *Guidance on the Selection of Analytical Metal Results from Monitoring Well Samples for Use in Quantitative assessment of Risk* (USEPA, 1992).

Additionally, future industrial workers or residents could be exposed to COPCs in indoor air from vapor intrusion from the shallow groundwater into a future building or residence constructed on the site. As of March 2009, the buildings at Site 6 had been scheduled to be demolished and are currently unoccupied.

It is also assumed that in addition to the current receptors for surface water and sediment, future construction workers could be exposed to surface water and sediment in Felgates Creek.

In summary, the exposure routes for quantitative evaluation are:

- Current/Future Trespasser/Visitor (adult and adolescent): ingestion of and dermal contact with surface water and sediment (while wading)

- Future resident (adult and child): ingestion of and dermal contact with shallow groundwater, inhalation of volatile COPCs from shallow groundwater while showering, and inhalation of indoor air (vapor intrusion from shallow groundwater into residence)
- Future industrial worker: ingestion of groundwater, and inhalation of indoor air (vapor intrusion from shallow groundwater into site building)
- Future construction worker: dermal contact with and inhalation of volatile emissions from shallow groundwater from an open excavation, ingestion of and dermal contact with surface water and sediment

Residential exposures to surface water and sediment were not evaluated in the risk assessment. It was assumed that the trespasser/visitor scenario would also be representative of future residents exposed to surface water and sediment during recreational activities.

7.2.2 Calculation of Exposure Point Concentrations

Exposure is quantified by estimating the exposure point concentrations (EPCs) of COPCs in environmental media and constituent intake by the receptor. EPCs are estimated constituent concentrations that a receptor may contact and are specific to each exposure medium and data grouping. EPCs may be directly monitored or estimated using environmental models. Constituent concentrations in groundwater, surface water, and sediment were measured for this assessment. Fate and transport modeling was used to estimate constituent concentrations in vapors from groundwater while showering, in vapors volatilized from groundwater in an open excavation, and in indoor air from vapor intrusion from groundwater into a building. Volatilization while showering was estimated using the Foster and Chrostowski shower model (Foster and Chrostowski, 1987). Concentrations of VOCs in air resulting from volatilization of constituents in shallow groundwater in an open excavation were calculated using the Calculation of Inhalation Concentration in Excavation Trench methodology from the Virginia Voluntary Remediation Program (VRP). The Foster and Chrostowski shower model and the VRP model calculations are presented in **Appendix F**, Table 7 series. Indoor air concentrations resulting from vapor intrusion from shallow groundwater were calculated using the methodology described in Appendix D of the *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)* (USEPA 2002b). Indoor air concentrations are calculated in **Appendix F**, Table 3.4.

Two groundwater data exposure groupings were selected to evaluate risks associated with groundwater at the site, and to estimate the groundwater EPCs. The first grouping includes the wells from the center of the contamination plume. These wells are identified in **Table 8-1**. The second groundwater data grouping is the sample from monitoring well GW09. Monitoring well GW09 was evaluated separately from the site plume since several of the explosive COPCs were detected at high concentrations in this well, but it is located in a non-contiguous area from the identified plume. The vapor intrusion evaluation was performed using a third groundwater data grouping. Monitoring wells located in the terrestrial area of the site and wells in the wetland area which are located within 100 ft of the terrestrial portion were included in the data set. Monitoring wells located in the wetland area (except those within 100 feet of the terrestrial portion of the site) were not included in

the vapor intrusion evaluation data set as structures are not expected to be build in wetland areas. Additionally, the vapor intrusion pathway is only considered for structures within100 feet of a groundwater plume. If buildings are not located near (i.e., within 100 feet) areas of concern, vapor intrusion is not likely and no further consideration of the exposure pathway should be needed (OEPA, 2010). The monitoring wells excluded from the vapor intrusion evaluation data set are identified in **Table 7-1**.

ProUCL software Version 4.00.04 (USEPA 2009c) was used to determine the distribution that the data fit and to calculate the 95 percent upper confidence limit (UCLs) used as the RME and CTE EPC. ProUCL identifies three possible data distributions: normal distribution, log-normal distribution, and gamma distribution. The UCL calculation method is then selected based on the data distribution (normal, lognormal, gamma, or nonparametric if the data do not fit any of the distributions). The recommendations outlined in the ProUCL software documentation were followed to select the appropriate UCL to use as the EPC (USEPA 2009c). The maximum detected concentration was used as the EPC in cases where the estimated 95 percent UCL was greater than the maximum detected concentration or less than five samples were available for the data set (i.e. the GW09 data set).

For COPCs that were only detected in one of the samples within the data set, the one-half detection limit method (concentration in samples in which the constituent was not detected were assumed to equal one-half the detection limit) was used to estimate the EPC. In all but one case (total cadmium in groundwater for the construction worker), the maximum detected concentration was used as the EPC since the estimated 95 percent UCL was greater than the maximum detected concentration. This occurred primarily for the VOCs as the detection limit in two of the samples (from monitoring wells GW13 and GW13A) was very elevated due to high detections of 1,2-DCE, PCE, and TCE. For COPCs that were detected in two or more samples within a data set, the UCL calculation method with non-detects was used to estimate the EPC.

The EPCs for the COPCs for each medium and the rationale for the selected EPC are presented in **Appendix F**, Tables 3.1 through 3.8

7.2.3 Estimation of Chemical Intakes for Individual Pathways

Chemical intake is the amount of the chemical constituent entering the receptor's body. The intake equation requires specific exposure parameters for each exposure pathway. Exposure parameters are often assumed values, and the magnitude influences the estimates of potential exposure (and risk). The reliability of the values chosen can also contribute to the uncertainty of the resulting risk estimates. Many of the exposure parameters have default values suggested by the USEPA, which were used for this assessment. These assumptions, based on estimates of body weights, media intake levels, and exposure frequencies and duration are provided by USEPA guidance (USEPA, 1989; 1991; 1997b; 2004). Other assumptions (e.g., exposure frequency for the trespasser/visitor exposure scenarios) required consideration of location-specific information and were determined using professional judgment. The exposure factors used for different scenarios at the site are provided in **Appendix F**, Tables 4.1.RME through 4.4.RME, 4.1CTE, and 4.2.CTE.

Sediment was treated as soil to estimate exposure via dermal contact. Two additional parameters are necessary to estimate dermal contact with soil or sediment. The first

parameter, the dermal absorption fraction, estimates the amount of a constituent in soil or sediment that would be absorbed by the skin. The USEPA (2004) guidance for absorption fractions was used, which recommends 3 percent for arsenic and 1 percent for chromium, the only COPCs for sediment. These values are estimates based on available experimental data for dermal absorption from contaminated soil. The actual amount absorbed is dependent on soil (or sediment) characteristics. The second additional parameter necessary to estimate dermal expose to constituents in sediment is the sediment (soil) to skin adherence factor (AF). The AF estimates the amount of sediment that adheres to the skin per unit of surface area. The AFs used in this assessment were obtained from USEPA guidance (USEPA, 2004). The AFs for reed gatherers were used for the adult receptor, as the reed gatherers are assumed to be exposed to wet soil or muddy conditions, which is more representative of exposure to sediment than a drier soil exposure. The AFs for children playing in wet soil were used for the adolescent and receptor exposed to sediment.

The dermal exposure model presented in USEPA's dermal exposure assessment guidance (USEPA, 2004) was used to estimate dermal exposure to groundwater and surface water. The values for parameters used in this model (i.e., permeability constant) were obtained from this guidance document and are included in the RAGS Part D Table 4 (USEPA, 2001) series in **Appendix F**.

7.3 Toxicity Assessment

Toxicity assessment defines the relationship between the magnitude of exposure and possible severity of adverse effects, and weighs the quality of available toxicological evidence. Toxicity assessment generally consists of two steps: hazard identification and dose-response assessment. Hazard identification is the process of determining the potential adverse effects from exposure to the constituent along with the type of health effect involved. Dose-response assessment is the process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the constituent administered or received and the incidence of adverse health effects in the exposed population. Toxicity criteria (e.g., reference doses and slope factors) are derived from the dose-response relationship.

The USEPA recommends that a tiered approach be used to obtain the toxicity values, the reference doses (RfDs), inhalation reference concentrations (RfCs), cancer slope factors (CSFs), and inhalation unit risk factors (IURs) used to calculate non-cancer and cancer risks, respectively (USEPA, 2003). The sources of toxicity values are as follows:

- The USEPA's Integrated Risk Information System database (USEPA, 2009a).
- The Provisional Peer Reviewed Toxicity Value (PPRTV) database maintained by the USEPA's National Center for Environmental Assessment (NCEA) and the Superfund Health Risk Technical Support Center.
- Other USEPA and non-USEPA sources including: NCEA, Agency for Toxic Substances and Disease Registry, Health Effects Assessment Summary Tables (USEPA, 1997c), California Environmental Protection Agency (Cal EPA), USEPA's Office of Water, and World Health Organization.

The use of provisional toxicity values, such as those from the PPRTV database, increases the uncertainty of the quantitative risk estimate.

USEPA-derived oral and inhalation chronic and subchronic RfDs and RfCs, and associated uncertainty factors (UFs) and modifying factors, for the COPCs are listed in the Tables 5.1 and 5.2 in **Appendix F**. USEPA-derived oral and inhalation CSFs and IURs are listed in the Tables 6.1 and 6.2 in **Appendix F**.

7.3.1 Toxicity Information for Non-carcinogenic Effects

Non-carcinogenic health effects include a variety of toxic effects on body systems, ranging from toxicity to the kidneys to central nervous system disorders. The toxicity of a chemical is assessed through a review of toxic effects noted in short-term (acute) animal studies, long-term (chronic) animal studies, and epidemiological investigations.

USEPA (1989) defines the chronic RfD or RfC as a dose that is likely to be without appreciable risk of deleterious effects during a lifetime of exposure. Chronic RfDs and RfCs are specifically developed to be protective for long-term exposure to a compound (for example, 7 years to a lifetime), and consider uncertainty in the toxicological database and sensitive receptors. Subchronic RfDs and RfCs (applicable for exposures less than 7 years), which are all provisional values (i.e., not verified by USEPA), were used for the construction worker scenario.

In the development of RfDs and RfCs, all available studies examining the toxicity of a chemical following exposure are considered on the basis of scientific merit. The lowest dose level at which an observed toxic effect occurs is identified as the Lowest Observed Adverse Effect Level (LOAEL), and the dose at which no effect is observed is identified as the No Observed Adverse Effect Level (NOAEL). Several UFs may be applied to account for uncertainties such as poor data quality, extrapolation of data from animal studies to human exposures, or the use of subchronic studies to develop chronic criteria. These UFs range from 3 to 3,000, and are based on professional judgment. Consequently, there are varying degrees of uncertainty in the toxicity criteria.

Per USEPA guidance, oral RfDs were adjusted from administered dose (oral) to absorbed dose (dermal) to evaluate dermal toxicity. When appropriate, the RfDs were adjusted using oral absorption factors (USEPA, 2004). This adjustment is shown in Table 5.1 in **Appendix F**.

7.3.2 Toxicity Information for Carcinogenic Effects

Potential carcinogenic effects are quantified using oral CSFs or inhalation IURs, CSFs and IURs may be derived from the results of chronic animal bioassays, human epidemiological studies, or both. Animal bioassays are usually conducted at dose levels that are much higher than are likely to be encountered in the environment. This design detects possible adverse effects in the relatively small test populations used in the studies. The actual risks from exposure to a potential carcinogen are not likely to exceed the estimated risks and are probably much lower or even zero.

As was done for oral RfDs, oral CSFs were adjusted from administered dose (oral) to absorbed dose (dermal) to evaluate dermal toxicity. When appropriate, the CSFs were adjusted using oral absorption factors (USEPA, 2004). This adjustment is shown in the Table 6.1 in **Appendix F**.

7.3.3 Constituents for Which USEPA Toxicity Values Are Not Available

Most of the constituents detected at Site 6 have toxicity factors and USEPA RSLs. Detected constituents that did not have RSLs were compared to RSLs for appropriate surrogate constituents during the COPC selection process, when applicable. Surrogates were selected based on previous recommendations from USEPA Region 3. The surrogates are identified in the RAGS Table 2 series in **Appendix F**. Lead, which does not have an RSL or applicable surrogate, is evaluated by USEPA based on blood-lead uptake using a physiologically based pharmacokinetic model called the Integrated Exposure Uptake Biokinetic (IEUBK) Model. As a screening tool, lead is screened at 400 mg/kg in sediment, and 15 µg/L in groundwater and surface water based on residential exposure. Additional constituents detected in site groundwater without appropriate surrogates include methylcyclohexane, PETN, and thallium, however, methylcylcohexane and PETN were only detected in one of the 25 groundwater samples, and thallium was only detected in two of the 25 filtered groundwater samples. These three constituents were not identified as COPCs for the groundwater. Additionally, calcium, magnesium, potassium, and sodium were detected in site media but do not have RSLs, however, they are considered essential human nutrients and not carried forward in the HHRA process.

7.4 Risk Characterization

Risk characterization combines the results of the previous elements of the risk assessment to evaluate the potential health risks associated with exposure to the COPCs. The risk characterization is then used as an integral component in remedial decision-making and selection of potential remedies or actions, as necessary.

7.4.1 Methods for Estimating Risks

Potential human health risks are discussed independently for carcinogenic and non-carcinogenic constituents because of the different toxicological endpoints, relevant exposure duration, and methods used to characterize risk. Exposure to some constituents may result in both non-carcinogenic and carcinogenic effects (i.e., arsenic), and therefore, these constituents were evaluated in both groups. The methodology used to estimate non-carcinogenic hazards and carcinogenic risks are described below.

Non-carcinogenic Hazard Estimation Non-carcinogenic health risks are estimated by comparing the calculated exposures to RfDs (or RfCs). The calculated intake divided by the RfD (or RfC) is equal to the hazard quotient (HQ):

$$HQ = Intake / RfD \text{ (or RfC)}$$

The intake and RfD represent the same exposure route (that is, oral intakes are divided by oral RfDs). An HQ that exceeds 1.0 (that is, intake exceeds the RfD) indicates that there is a potential for adverse health effects associated with exposure to that constituent.

To assess the potential for non-carcinogenic health effects posed by exposure to multiple constituents, a hazard index (HI) approach is used (USEPA, 1986). This approach assumes that non-carcinogenic hazards associated with exposure to more than one constituent are additive (HI = sum of the HQs). Synergistic or antagonistic interactions between constituents are not considered. The HI may exceed 1.0 even if all of the individual HQs are

less than 1. HIs may be added across exposure routes to estimate the total non-carcinogenic health effects to a receptor posed by exposure through multiple routes. An HI greater than 1 indicates that there is some potential for adverse non-carcinogenic health effects associated with exposure to the COPCs, possibly warranting remedial action. If the HI is greater than 1, separate HIs are calculated for each target organ/effect to determine if the HI for a specific target organ/effect is greater than 1. If the HI for each target organ does not exceed 1, it can be assumed that there is no non-carcinogenic hazard to the receptor above USEPA's acceptable level.

Carcinogenic Risk Estimation The potential for carcinogenic effects due to exposure to site-related constituents is evaluated by estimating the excess lifetime carcinogenic risk (ELCR). ELCR is the incremental increase in the probability of developing cancer during one's lifetime in addition to the background probability of developing cancer.

Carcinogenic risk for ingestion and dermal exposure is calculated by multiplying the intake by the CSF.

$$ELCR = Intake \times CSF$$

Carcinogenic risk for inhalation exposure is calculated by multiplying the intake by the IUR:

$$ELCR = Intake \times IUR$$

These equations are only valid at low risk levels, levels below 0.01. When the calculated COPC risk is above 0.01, the one-hit equation is used.

$$ELCR = 1 - \exp(-Intake \times CSF)$$

Or for inhalation-

$$ELCR = 1 - \exp(-Intake \times URF)$$

The combined risk from exposure to multiple constituents was evaluated by adding the risks from individual constituents. Risks were also added across the exposure routes if an individual would be exposed through multiple routes.

When a cumulative carcinogenic risk to an individual receptor under the assumed reasonable maximum exposure (RME) conditions at the site exceeds 100 in a million (i.e., 10^{-4} excess carcinogenic risk), CERCLA generally requires remedial action to reduce risks at the site (USEPA, 1991). If the cumulative risk is less than 10^{-4}, action generally is not required, but may be warranted if a chemical-specific standard (for example, MCL) is exceeded. A risk-based remedial decision could be superseded by the presence of non-carcinogenic impact or environmental impact requiring action at the site.

7.4.2 Risk Characterization for Site 6

The results of the risk characterization are presented below by receptor. The risk calculations are presented in **Appendix F**, Tables 7.1.RME through 7.12.RME, and 7.1.CTE through 7.9.CTE. A summary of the RME results is presented in **Table 7-4** and a summary of the CTE results is shown in **Table 7-5**. CTE risks were calculated only when the RME hazards exceeded 1 or the RME carcinogenic risks exceeded 10^{-4}.

Future Adult Resident (Non-carcinogenic Hazard), Tables 9.1.RME, 9.6.RME, 9.1.CTE, and 9.6.CTE, Appendix F

The risk assessment assumed that a future adult resident could be exposed to groundwater through ingestion, and dermal contact and inhalation while showering, and inhalation of vapors that have migrated from the groundwater to indoor air through vapor intrusion. As discussed earlier, two different data sets were evaluated for potable use of groundwater (ingestion and exposure while showering), the wells from the center of the plume, and well GW09. Carcinogenic risks were not calculated for an adult resident but were calculated for a lifetime child/adult resident, following USEPA guidance.

The RME non-carcinogenic hazard associated with groundwater from the center of the plume (HI = 160) is above the acceptable HI of 1.0. The hazard is primarily associated with cis-1,2-dichloroethene (HI = 17), tetrachloroethene (HI = 14), 2-amino-4,6-dinitrotoluene (HI = 110), antimony (HI = 6.9), arsenic (HI = 1.7), beryllium (HI = 1.1), and cobalt (HI = 8.1). The CTE non-carcinogenic hazard from combined exposure to groundwater (HI = 73) also exceeds the acceptable HI.

The RME non-carcinogenic hazard associated with groundwater from well GW09 (HI = 6.7) is above the acceptable HI of 1.0. The hazard is primarily associated with 1,3-dinitrobenzene (HI = 5.1). The CTE non-carcinogenic hazard from combined exposure to groundwater (HI = 3.1) also exceeds the acceptable HI.

The RME non-carcinogenic hazard associated with vapor intrusion from shallow groundwater to indoor air and inhalation of the indoor air (HI = 0.012) is below USEPA's acceptable HI.

Future Child Resident (Non-carcinogenic Hazard), Tables 9.2.RME, 9.7.RME, 9.2.CTE, and 9.7.CTE, Appendix F

The risk assessment assumed that a future child resident could be exposed to groundwater through ingestion, and dermal contact and inhalation while bathing, and inhalation of vapors that have migrated from the groundwater to indoor air through vapor intrusion. As discussed earlier, two different data sets were evaluated for potable use of groundwater (ingestion and exposure while showering), the wells from the center of the plume, and well GW09. Carcinogenic risks were not calculated for a child resident but were calculated for a lifetime child/adult resident, following USEPA guidance.

The RME non-carcinogenic hazard associated with exposure to groundwater from the center of the plume (HI = 370) is above the acceptable HI of 1.0. The hazard is primarily associated with cis-1,2-dichloroethene (HI = 39), tetrachloroethene (HI = 32), 2,4-dinitrotoluene (HI = 1.2), 2-amino-4,6-dinitrotoluene (HI = 250), antimony (HI = 16), arsenic (HI = 4.0), beryllium (HI = 3.0), cadmium (HI = 1.2), cobalt (HI = 19), and vanadium (HI = 1.5). The CTE non-carcinogenic hazard from combined exposure to groundwater (HI = 240) also exceeds the acceptable HI.

The RME non-carcinogenic hazard associated with groundwater from GW09 (HI = 16) is above the acceptable HI of 1.0. The hazard is primarily associated with 2,4-dinitrotoluene (HI = 1.8), 1,3-dinitrobenzene (HI = 12) and RDX (HI = 1.5). The CTE non-carcinogenic hazard from combined exposure to groundwater (HI = 10) also exceeds the acceptable HI.

The RME non-carcinogenic hazard associated with vapor intrusion from shallow groundwater to indoor air and inhalation of the indoor air (HI = 0.04) is below USEPA's acceptable HI.

Future Lifetime Resident (Carcinogenic Risk), Tables 9.3.RME, 9.8.RME, 9.3.CTE, and 9.8.CTE, Appendix F

The risk assessment assumes that a lifetime child/adult resident could be exposed to groundwater through ingestion, and dermal contact and inhalation while bathing, and inhalation of vapors that have migrated from the groundwater to indoor air through vapor intrusion. As discussed earlier, two different data sets were evaluated for potable use of groundwater (ingestion and exposure while showering), the wells from the center of the plume, and well GW09.

The RME carcinogenic risk associated with exposure to groundwater for the plume (CR = $6.8x10^{-2}$) and the CTE carcinogenic risk (CR = $1.9x10^{-2}$) are above USEPA's target risk range of 10^{-6} to 10^{-4}. Chlorinated VOCs (trichloroethene, tetrachloroethene, and vinyl chloride), 2,4-DNT, and arsenic in groundwater are the primary contributors to estimated risks for groundwater.

The RME carcinogenic risk associated with groundwater from well GW09 (CR = $3.7x10^{-4}$) and the CTE carcinogenic risk (CR = $1.3x10^{-4}$) are above USEPA's target risk range of 10^{-6} to 10^{-4}. 2,4-DNT and RDX are the primary contributors to estimated risks.

The RME carcinogenic risk associated with vapor intrusion from shallow groundwater to indoor air and inhalation of the indoor air (CR = $2.3x10^{-5}$) is within USEPA's target risk range.

Future Industrial Worker, Tables 9.4.RME, 9.9.RME, 9.4.CTE, and 9.9.CTE, Appendix F

The risk assessment assumed that a future industrial worker could be exposed to groundwater used as a potable water supply through ingestion, and inhalation of vapors that have migrated from the groundwater to indoor air through vapor intrusion. As discussed earlier, two different data sets were evaluated for potable use of groundwater (ingestion), the wells from the center of the plume, and well GW09.

The RME non-carcinogenic hazard associated with the plume (HI = 52) is above the acceptable HI of 1.0. The hazard is primarily associated with cis-1,2-DCE (HI = 5.5), PCE (HI = 2.9), 2a-DNT (HI = 36), antimony (HI = 2.4), and cobalt (HI = 2.9). The RME carcinogenic risk (CR = $9.4x10^{-3}$) exceeds USEPA's target risk range of $1x10^{-6}$ to $1x10^{-4}$. The risk to the future industrial worker is primarily associated with PCE (CR = $5.7x10^{-3}$), TCE (CR = $3.5x10^{-3}$), vinyl chloride (CR = $7.4x10^{-5}$), and arsenic (CR = $9.9x10^{-5}$). The CTE non-carcinogenic hazard (HI = 45) exceeds the acceptable HI, and the CTE carcinogenic risk ($3.0x10^{-3}$) also exceeds USEPA's target risk range.

The RME non-carcinogenic hazard associated with GW09 (HI = 2.3) is above the acceptable HI of 1.0. The hazard is primarily associated with 1,3-dinitrobenzene (HI = 1.8). The RME carcinogenic risk ($8.2x10^{-5}$) is within USEPA's target risk range of $1x10^{-6}$ to $1x10^{-4}$. The CTE non-carcinogenic hazard (HI = 2.0) also exceeds the acceptable HI.

The RME noncarcinogenic hazard and carcinogenic risk associated with vapor intrusion from shallow groundwater to indoor air and inhalation of the indoor air (HI = 0.009, CR = 4.5×10^{-6}) are below or within USEPA's target risk levels.

Future Construction Worker, Tables 9.5.RME, 9.10.RME, and 9.5.CTE, Appendix F

The risk assessment assumes that a future construction worker could be exposed to groundwater (through dermal contact and inhalation of volatiles during excavation and construction activities) and surface water and sediment (through ingestion and dermal contact). As discussed earlier, two different data sets were evaluated for exposure to groundwater, the wells from the center of the plume, and well GW09.

The total RME non-carcinogenic hazard associated with the groundwater plume and surface water and sediment (HI = 3.2) is above USEPA's target HI of 1.0. The non-carcinogenic hazard from exposure to surface water and sediment were below the USEPA's target HI of 1.0. The RME non-carcinogenic hazard from exposure to groundwater alone (HI = 3.2) exceeds USEPA's target HI of 1.0. The RME non-carcinogenic hazard from exposure to groundwater is primarily associated with 2-amino-4,6-dinitrotoluene (HI = 2.6). The RME carcinogenic risk from exposure to groundwater in the plume and surface water and sediment (CR=2.6×10^{-4}) exceeds USEPA's acceptable carcinogenic risk range of 10^{-6} to 10^{-4}. The RME carcinogenic risk is from groundwater (surface water and sediment risks are below USEPA's target risk range) and is primarily associated with tetrachloroethene (CR = 2.0×10^{-4}) and trichloroethene (CR = 6.5×10^{-5}).

The RME non-carcinogenic hazard associated with well GW09 (HI = .06) is below the acceptable HI of 1.0. The RME carcinogenic risk (2.0×10^{-7}) is below USEPA's target risk range of 1×10^{-6} to 1×10^{-4}.

Current/Future Adult Trespasser/Visitor, Table 9.11.RME, Appendix F

The risk assessment assumed that a current/future adult trespasser/visitor could be exposed to surface water and sediment through ingestion and dermal contact.

The RME non-carcinogenic hazard from exposure to surface water and sediment (HI = 0.03) is below the acceptable HI of 1.0. The RME carcinogenic risk from exposure to surface water and sediment (1.9×10^{-6}) is within the USEPA's acceptable carcinogenic risk range of 10^{-6} to 10^{-4}.

Current/Future Adolescent Trespasser/Visitor, Table 9.12.RME, Appendix F

The risk assessment assumed that a current/future adolescent trespasser/visitor could be exposed to surface water and sediment through ingestion, and dermal contact.

The RME non-carcinogenic hazard from exposure to surface water and sediment (HI = 0.02) is below the acceptable HI of 1.0. The RME carcinogenic risk from exposure to surface water and sediment (8.4×10^{-7}) is below the USEPA's acceptable carcinogenic risk range of 10^{-6} to 10^{-4}.

7.5 Uncertainty Associated with Human Health Assessment

The risk measures used in CERCLA site risk assessments are not fully probabilistic estimates of risk, but are conditional estimates given that a set of assumptions about

exposure and toxicity are realized. Thus, it is important to specify the assumptions and uncertainties inherent in the risk assessment to place the risk estimates in proper perspective.

7.5.1 General Uncertainty in COPC Selection

A comparison of site concentrations to background concentrations was not used to select the COPCs in accordance with USEPA Region 3 guidance. Following the USEPA approach may result in the inclusion of risks that may be associated with background conditions and are not necessarily site-related.

Three constituents detected in site groundwater, methylcyclohexane, PETN, and thallium, do not have RSLs and no appropriate surrogates have been identified, which may result in an underestimation of risks associated with exposure to the groundwater. However, methylcylcohexane and PETN were only detected in one of the 25 groundwater samples, and thallium was only detected in two of the 25 filtered groundwater samples. Although the maximum detected concentrations of 3-NT, 4-NT, and 3,5-dinitroaniline slightly exceeded the RSL, they were not retained as COPCs since they were not detected in any of the monitoring wells in the most contaminated area of the site that were included in the data set used to calculate risks. 3-NT and 4-NT were only detected in one of the 25 wells, and 3,5-dinitroaniline was only detected in four of the 25 wells. Not quantifying the risks associated with these three constituents may result in a slight under-estimation of risk.

The detection limits for non-detected constituents were compared with the RSLs to determine if detection limits were above the RSLs and constituents that were not detected could be present at the site at concentrations below the detection limit but above the RSL. The comparison indicated that there were a few non-detected VOCs, SVOCs, PCBs, explosives, and metals in the groundwater with detection limits above adjusted RSLs. With the exception of the detection limits from wells GW13 and GW13A, which were very high, the majority of these detection limits were below the non-adjusted RSLs for noncarcinogens, and within 10 times (10^{-5} to 10^{-6} risk level) or 100 times (10^{-4} to 10^{-5} risk level) the RSL for carcinogens. The detection limits for the non-detected constituents in wells GW 13 and GW13A were elevated because these samples needed to be diluted due to the high detections of 1,2-DCE, PCE, and TCE. It is possible additional VOCs may be present in these samples at concentrations above the RSLs but below the elevated detection limits. This may result in an under-estimation of risks from groundwater. However, it would not change the results of the risk assessment, as risks above USEPA acceptable levels have already been identified, largely associated with the concentrations of these three constituents in these samples. Tables comparing the detection limits for the non-detected constituents to RSLs are provided in **Appendix F**.

In addition, the detection limits for non-detected constituents in surface water and sediment were compared with the RSLs. The majority of non-detected surface and sediment constituent had detection limits which were below or within an order of magnitude of the non-adjusted RSLs for noncarcinogens, and within 10 times (10^{-5} to 10^{-6} risk level) or 100 times (10^{-4} to 10^{-5} risk level) the RSL for carcinogens.

The method used to screen groundwater data for vapor intrusion into indoor building air was very conservative. It most likely results in a greater number of chemicals selected as COPCs than would actually be a concern for the vapor intrusion exposure pathway.

Additionally, the screening values used to select the COPCs are based on conservative assumptions.

7.5.2 Uncertainty Associated with Exposure Assessment

Uncertainty in the exposure assessment was generally treated with conservative decision rules and assumptions, and therefore the uncertainty likely overestimates actual exposure to COPCs. Several exposure pathways evaluated by this HHRA, such as residential land use and potable use of shallow groundwater, are hypothetical and are not anticipated to occur in the future at Site 6. It is not likely that groundwater from the shallow aquifer would ever be used as a potable or industrial water supply because of the availability of better water supplies with respect to both water quality and quantity. Most of the exposure factors used for quantification of exposure are generally conservative and reflect worst-case, or upper-bound, assumptions for the exposure.

The percent of a constituent absorbed through the skin is likely to be affected by many parameters, including soil loading, moisture content, organic content, pH, and presence of other constituents. The availability of a constituent for absorption through the skin depends on site-specific fate and transport properties of the chemical species available for eventual absorption. Constituent concentrations, specific properties of the constituent, and the kinetics of constituents being released from sediment all affect the amount of a constituent that is absorbed. These factors contribute to the uncertainty associated with dermal absorption estimates, and make it difficult to quantify the amount of certain constituents absorbed through the skin from soil, and even more for sediment.

The method used to screen groundwater data for vapor intrusion into indoor building air was very conservative. It most likely results in a greater number of chemicals selected as COPCs than would actually be a concern for the vapor intrusion exposure pathway.

Although Felgates Creek near the site supports fishing, risks associated with ingestion of fish were not evaluated in the risk assessment since only "catch and release" fishing is designated for this water body. This assumption may underestimate the potential risk to receptors since the potential does exist for the fish to be consumed.

7.5.3 Uncertainty Associated with Toxicity Assessment

Uncertainty associated with the non-carcinogenic toxicity factors is included in the toxicity tables (**Appendix F**, Tables 5.1 and 5.2). Several UFs were applied to extrapolate dose points from animal studies to humans. These UFs range between 3 and 3,000. Additional modification factors are used on the basis of USEPA's professional judgment. Therefore, there is a high degree of uncertainty in the non-carcinogenic toxicity criteria based on the available scientific data for each constituent. The non-carcinogenic toxicity factors are most likely an overestimate of actual toxicity.

Use of provisional or withdrawn toxicity factors increases the uncertainty of the quantitative hazard and risk estimates. These provisional values were used to provide a quantitative estimate rather than a merely qualitative risk discussion; however, these values should be interpreted cautiously because USEPA has not approved these toxicity values.

CSFs developed by USEPA represent upper-bound estimates. Carcinogenic risks generated in this assessment should be regarded as an upper-bound estimate of the potential

carcinogenic risks rather than an accurate representation of carcinogenic risk. The true carcinogenic risk is likely to be less than the predicted value (USEPA, 1989).

Additional uncertainty lies in the prediction of relative sensitivities of different species of animals and the applicability of animal data to humans.

A large degree of uncertainty is associated with the oral-to-dermal adjustment factors (based on constituent-specific gastrointestinal absorption factors) used to transform the oral RfDs based on administered doses to dermal RfDs based on absorbed doses. It is not known if the adjustment factor results in an underestimate or overestimate of the actual toxicity associated with dermal exposure.

7.5.4 Uncertainty in Risk Characterization

The uncertainties identified in each component of risk assessment ultimately contribute to uncertainty in risk characterization. The addition of risks and HIs across pathways and constituents contributes to uncertainty based on chemical interactions such as additivity, synergism, potentiation, and susceptibility of exposed receptors.

7.6 Human Health Risk Summary

The HHRA was conducted to evaluate the potential human health risks associated with groundwater, surface water, and sediment at Site 6. This baseline risk assessment was conducted to characterize potential current and future human health risks on the basis of potential and unlikely (but conservative) receptor populations and exposure scenarios if no remedial action is implemented.

Appendix F, Tables 9.1.RME through 9.12.RME and Tables 9.1.CTE through 9.9.CTE summarize the RME and CTE potential hazards and risks to each receptor as described in Section 7.4.2. **Appendix F**, Tables 10.1.RME through 10.9.RME and 10.1.CTE through 10.9.CTE show the receptor scenarios with a total HI greater than 1.0 or total carcinogenic risks greater than 10^{-4}. Constituents that contribute HIs greater than 0.1 or carcinogenic risks greater than 10^{-6} are included in the table. These constituents are considered the COCs for the media and site.

Estimated non-carcinogenic hazards and carcinogenic risks to the current/future adult and adolescent and future construction worker exposed to surface water and sediment are less than the acceptable risk levels. Additionally, the non-carcinogenic hazards and carcinogenic risks to the future construction worker exposed to groundwater from well GW09 are all below USEPA target risk levels.

Potable use of groundwater (ingestion and use of water for showering) by residents and industrial worker from the groundwater plume and construction worker exposure to groundwater from the plume would result in non-carcinogenic hazards and carcinogenic risks above USEPA's acceptable levels. The RME non-carcinogenic hazards are primarily associated with 2a-DNT, 2,4-DNT, cis-1,2-DCE, PCE, and several metals. The carcinogenic risks are primarily associated with PCE, TCE, vinyl chloride, 2,4-DNT, and arsenic. The CTE scenarios for these potential future receptors also exceed the acceptable non-carcinogenic hazard index of 1.0 or the carcinogenic risk range of 10^{-6} to 10^{-4}. The future residential land use scenario evaluated in this assessment is very conservative because it is assumed that

land use will not change in the future, and if it did, it is unlikely that the Yorktown-Eastover aquifer groundwater would be used as a potable water supply.

Potable use of groundwater (ingestion and use of water for showering) by residents and industrial worker from GW09 exceed USEPA acceptable risk levels. With the exception of the carcinogenic risk to the industrial worker, the CTE scenarios for these potential future receptors also exceed the acceptable non-carcinogenic hazard index of 1.0 or the carcinogenic risk range of 10^{-6} to 10^{-4}. The hazards and risks are associated with 2,4-DNT, 1,3-dinitrobenzene, and RDX.

TABLE 7-1
Summary of Data Quantitatively Used in HHRA
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Medium	Date of Sampling	Sample Location	Sample	Parameters
Groundwater	3/23/2009	YS06-GW001	YS06-GW01-0309	VOCs, Explosives,Total Metals, Dissolved Metals
	3/23/2009	YS06-GW001	YS06-GW01P-0309[1]	VOCs, Explosives,Total Metals, Dissolved Metals
	3/23/2009	YS06-GW001A	YS06-GW01A-0309[2]	VOCs, Explosives,Total Metals, Dissolved Metals
	3/24/2009	YS06-GW002	YS06-GW02-0309	VOCs, Explosives,Total Metals, Dissolved Metals
	3/54/2009	YS06-GW003	YS06-GW03-0309	VOCs, Explosives,Total Metals, Dissolved Metals
	3/31/2009	YS06-GW004	YS06-GW04-0309[2, 3]	VOCs, Explosives,Total Metals, Dissolved Metals
	3/26/2009	YS06-GW005B	YS06-GW05B-0309[2]	VOCs, Explosives,Total Metals, Dissolved Metals
	3/26/2009	YS06-GW005B	YS06-GW05BP-0309[1,2]	VOCs, Explosives,Total Metals, Dissolved Metals
	3/26/2009	YS06-GW006	YS06-GW06-0309	VOCs, Explosives,Total Metals, Dissolved Metals
	3/26/2009	YS06-GW006B	YS06-GW06B-0309	VOCs, Explosives,Total Metals, Dissolved Metals
	3/26/2009	YS06-GW007	YS06-GW07-0309	VOCs, Explosives,Total Metals, Dissolved Metals
	3/31/2009	YS06-GW008	YS06-GW08-0309[2, 3]	VOCs, Explosives,Total Metals, Dissolved Metals
	3/25/2009	YS06-GW009	YS06-GW09-0309	VOCs, Explosives,Total Metals, Dissolved Metals
	3/25/2009	YS06-GW009A	YS06-GW09A-0309	VOCs, Explosives,Total Metals, Dissolved Metals
	4/3/2009	YS06-GW009B	YS06-GW09B-0409	VOCs, Explosives,Total Metals, Dissolved Metals
	3/24/2009	YS06-GW010	YS06-GW10-0309	VOCs, Explosives,Total Metals, Dissolved Metals
	3/24/2009	YS06-GW010A	YS06-GW10A-0309	VOCs, Explosives,Total Metals, Dissolved Metals
	3/24/2009	YS06-GW011	YS06-GW11-0309	VOCs, Explosives,Total Metals, Dissolved Metals
	4/2/2009	YS06-GW012	YS06-GW12-0409[2]	VOCs, Explosives,Total Metals, Dissolved Metals
	4/2/2009	YS06-GW012	YS06-GW12P-0409[1,2]	VOCs, Explosives,Total Metals, Dissolved Metals
	4/1/2009	YS06-GW012A	YS06-GW12A-0409	VOCs, Explosives,Total Metals, Dissolved Metals
	4/1/2009	YS06-GW013	YS06-GW13-0409[2, 3]	VOCs, Explosives,Total Metals, Dissolved Metals
	4/1/2009	YS06-GW013A	YS06-GW13A-0409[2, 3]	VOCs, Explosives,Total Metals, Dissolved Metals
	3/31/2009	YS06-GW014	YS06-GW14-0309[2, 3]	VOCs, Explosives,Total Metals, Dissolved Metals
	3/31/2009	YS06-GW015	YS06-GW15-0309[2, 3]	VOCs, Explosives,Total Metals, Dissolved Metals
	6/30/2009	YS06-GW016	YS06-GW16-0609	VOCs, Explosives,Total Metals, Dissolved Metals
	7/14/2009	YS06-GW017	YS06-GW17-0709[3]	VOCs, Explosives,Total Metals, Dissolved Metals
	7/9/2009	YS06-GW018	YS06-GW18-0709	VOCs, Explosives,Total Metals, Dissolved Metals
	7/9/2009	YS06-GW018	YS06-GW18P-0709[1]	VOCs, Explosives,Total Metals, Dissolved Metals
Surface Water	8/4/2009	YS06-SW068	YS06-SW68-0809	VOCs, Explosives,Total Metals, Dissolved Metals
	8/4/2009	YS06-SW068	YS06-SW68P-0809[1]	VOCs, Explosives,Total Metals, Dissolved Metals
	8/4/2009	YS06-SW069	YS06-SW69-0809	VOCs, Explosives,Total Metals, Dissolved Metals
	8/4/2009	YS06-SW070	YS06-SW70-0809	VOCs, Explosives,Total Metals, Dissolved Metals
	8/4/2009	YS06-SW071	YS06-SW71-0809	VOCs, Explosives,Total Metals, Dissolved Metals
	8/4/2009	YS06-SW072	YS06-SW72-0809	VOCs, Explosives,Total Metals, Dissolved Metals
	8/4/2009	YS06-SW073	YS06-SW73-0809	VOCs, Explosives,Total Metals, Dissolved Metals
	8/5/2009	YS06-SW074	YS06-SW74-0809	VOCs, Explosives,Total Metals, Dissolved Metals
	8/5/2009	YS06-SW074	YS06-SW74P-0809[1]	VOCs, Explosives,Total Metals, Dissolved Metals
	8/5/2009	YS06-SW075	YS06-SW75-0809	VOCs, Explosives,Total Metals, Dissolved Metals
	8/6/2009	YS06-SW076	YS06-SW76-0809	VOCs, Explosives,Total Metals, Dissolved Metals
	8/6/2009	YS06-SW077	YS06-SW77-0809	VOCs, Explosives,Total Metals, Dissolved Metals
	8/6/2009	YS06-SW078	YS06-SW78-0809	VOCs, Explosives,Total Metals, Dissolved Metals

TABLE 7-1
Summary of Data Quantitatively Used in HHRA
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Medium	Date of Sampling	Sample Location	Sample	Parameters
Sediment	8/4/2009	YS06-SD068	YS06-SD68-0809	VOCs, Explosives,Total Metals
	8/4/2009	YS06-SD068	YS06-SD68P-0809[1]	VOCs, Explosives,Total Metals
	8/4/2009	YS06-SD069	YS06-SD69-0809	VOCs, Explosives,Total Metals
	8/4/2009	YS06-SD070	YS06-SD70-0809	VOCs, Explosives,Total Metals
	8/4/2009	YS06-SD071	YS06-SD71-0809	VOCs, Explosives,Total Metals
	8/4/2009	YS06-SD072	YS06-SD72-0809	VOCs, Explosives,Total Metals
	8/5/2009	YS06-SD073	YS06-SD73-0809	VOCs, Explosives,Total Metals
	8/5/2009	YS06-SD074	YS06-SD74-0809	VOCs, Explosives,Total Metals
	8/5/2009	YS06-SD074	YS06-SD74P-0809[1]	VOCs, Explosives,Total Metals
	8/5/2009	YS06-SD075	YS06-SD75-0809	VOCs, Explosives,Total Metals
	8/6/2009	YS06-SD076	YS06-SD76-0809	VOCs, Explosives,Total Metals
	8/6/2009	YS06-SD077	YS06-SD77-0809	VOCs, Explosives,Total Metals
	8/6/2009	YS06-SD078	YS06-SD78-0809	VOCs, Explosives,Total Metals

Notes:
VOCs - Volatile organic constituents
[1] Duplicate of sample listed above
[2] Sample included in plume data set.
[3] Sample excluded from indoor air analysis. Sample located in wetland area.

TABLE 7-2

Summary of Chemicals of Potential Concern for the Baseline Risk Assessment

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Yorktown-Eastover Aquifer - Tap Water	
1,1-Dichloroethane	Antimony, Dissolved
1,2-Dichloroethane	Arsenic, Dissolved
Benzene	Beryllium, Dissolved
cis-1,2-Dichloroethene[1]	Cadmium, Dissolved
Tetrachloroethene	Chromium, Dissolved
trans-1,2-Dichloroethene[1]	Cobalt, Dissolved
Trichloroethene	Iron, Dissolved
Vinyl chloride	Manganese, Dissolved
2,4-Dinitrotoluene	Nickel, Dissolved
Nitrobenzene	Selenium, Dissolved
1,3-Dinitrobenzene	Vanadium, Dissolved
2-Amino-4,6-dinitrotoluene	Zinc, Dissolved
3,5-Dinitroaniline[2]	
3-Nitrotoluene[2]	
4-Nitrotoluene[2]	
RDX	

Yorktown-Eastover Aquifer - Water Vapors at Showerhead and Excavation Pit	
1,1-Dichloroethane	Tetrachloroethene
1,2-Dichloroethane	Trichloroethene
Benzene	Vinyl chloride
cis-1,2-Dichloroethene[1]	Nitrobenzene
trans-1,2-Dichloroethene[1]	

Yorktown-Eastover Aquifer - Water in Excavation Pit	
1,1-Dichloroethane	Aluminum
1,2-Dichloroethane	Antimony
Benzene	Arsenic
cis-1,2-Dichloroethene[1]	Cadmium
Tetrachloroethene	Chromium
trans-1,2-Dichloroethene[1]	Cobalt
Trichloroethene	Iron
Vinyl chloride	Manganese
2,4-Dinitrotoluene	Nickel
Nitrobenzene	Vanadium
1,3-Dinitrobenzene	Zinc
2-Amino-4,6-dinitrotoluene	
3,5-Dinitroaniline[2]	
3-Nitrotoluene[2]	
4-Nitrotoluene[2]	
RDX	

TABLE 7-2
Summary of Chemicals of Potential Concern for the Baseline Risk Assessment
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Yorktown-Eastover Aquifer - Vapor Intrustion to Indoor Air	
1,2-Dichloroethane	Vinyl chloride
Trichloroethene	
GW09 - Tap Water	
2,4-Dinitrotoluene	RDX
1,3-Dinitrobenzene	Manganese, Dissolved
3,5-Dinitroaniline	
GW09 - Water in Excavation Pit	
2,4-Dinitrotoluene	RDX
1,3-Dinitrobenzene	Arsenic
3,5-Dinitroaniline	Manganese
Surface Water	
Arsenic	Chromium
Sediment	
Arsenic	Chromium

[1]Total-1,2-dichloroethene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene were identified as COPCs. In order not to over-estimate the risk associated with 1,2-dichloroethene, only cis-1,2-dichloroethene and trans-1,2-dichloroethene were carried through the risk assessment and used to calculate the risks.

[2]Although constituent was identified as a COPC, it was not detected in any of the wells in the most contaminanted area of the site that were included in the data set used to calculate the EPC, and therefore, risks associated with constituent were not quantified in the risk assessment.

TABLE 7-3
Potentially Complete Human Health Exposure Pathways
Phase Ii Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Land Use	Media	Potentially Exposed Populations	Exposure Route (Human Health)	Pathway Selected for Evaluation	Rationale
Current/Future					
Residential or Industrial	Surface Water	Trespasser/Visitor - Adults and Adolescents	Ingestion and dermal contact	Yes	Trespassers/visitors could contact surface water.
	Sediment		Ingestion and dermal contact	Yes	Trespassers/visitors could contact sediment.
Future					
Residential or Industrial	Surface Water	Construction Worker	Ingestion and dermal contact	Yes	Construction workers could contact surface water.
	Sediment		Ingestion and dermal contact	Yes	Construction workers could contact sediment.
Residential	Yorktown-Eastover Aquifer - Tap Water	Residents - Adults and Children	Ingestion and dermal contact	Yes	Groundwater is not currently used on-site as a water supply and the site is not expected to be developed for residential use; however, a future residential scenario is included for a conservative evaluation of unrestricted land use.
	Yorktown-Eastover Aquifer - Water Vapors at Showerhead		Inhalation	Yes	Groundwater is not currently used on-site as a water supply and the site is not expected to be developed for residential use; however, a future residential scenario is included for a conservative evaluation of unrestricted land use.
	Yorktown-Eastover Aquifer - Vapor Intrusion to Indoor Air		Inhalation	Yes	Future resident could inhale vapors migrating from groundwater in indoor air if future resident constructed on site.
Industrial	Yorktown-Eastover Aquifer - Tap Water	Industrial Worker	Ingestion	Yes	Although unlikely, groundwater will be evaluated for use as a future potable water supply.
	Yorktown-Eastover Aquifer - Water Vapors at Showerhead		Inhalation	No	Industrial workers not expected to take a significant number of showers/baths at workplace.
	Yorktown-Eastover Aquifer - Vapor Intrusion to Indoor Air			Yes	Future industrial workers could inhale vapors migrating from groundwater into indoor air if future industrial building constructed on site.
Residential or Industrial	Yorktown-Eastover Aquifer - Excavation Pit	Construction Worker	Dermal contact	Yes	Construction worker may contact groundwater in an excavation during excavation and construction activities.
	Yorktown-Eastover Aquifer - Volatilization from Water in Excavation Pit		Inhalation	Yes	Construction worker may inhale volatiles from groundwater in an excavation during excavation and construction activities.

TABLE 7-4
Summary of RME Cancer Risks and Hazard Indices
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Chemicals with Cancer Risks >10^{-5} and <10^{-4}	Chemicals with Cancer Risks >10^{-6} and <10^{-5}	Hazard Index	Chemicals with HI>1
Future Resident Adult	Yorktown-Eastover Aquifer Groundwater	Ingestion	N/A				1.4E+02	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, Antimony-dissolved, Arsenic-dissolved, Cobalt-dissolved
		Dermal Contact	N/A				1.3E+01	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene
		Inhalation/Shower	N/A				5.1E-01	
		Inhalation/Indoor Air	N/A				1.2E-02	
		Total	N/A				1.6E+02	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, Antimony-dissolved, Arsenic-dissolved, Cobalt-dissolved
	Yorktown-Eastover Aquifer Groundwater at GW09	Ingestion	N/A				6.4E+00	1,3-Dinitrobenzene
		Dermal Contact	N/A				2.5E-01	
		Inhalation/Shower	N/A				N/A	
		Total	N/A				6.7E+00	1,3-Dinitrobenzene
Future Resident Child	Yorktown-Eastover Aquifer Groundwater	Ingestion	N/A				3.4E+02	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, 2,4-Dinitrotoluene, Antimony-dissolved, Arsenic-dissolved, Cadmium-dissolved, Cobalt-dissolved, Vanadium-dissolved
		Dermal Contact	N/A				3.1E+01	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, Beryllium-dissolved
		Inhalation/Shower	N/A				1.3E+00	Tetrachloroethene
		Inhalation/Indoor Air	N/A				3.6E-02	
		Total	N/A				3.7E+02	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, 2,4-Dinitrotoluene, Arsenic-dissolved, Beryllium-dissolved, Cadmium-Dissolved, Cobalt-dissolved, Vanadium-dissolved
	Yorktown-Eastover Aquifer Groundwater at GW09	Ingestion	N/A				1.5E+01	2,4-Dinitrotoluene, 1,3-Dinitrobenzene, RDX
		Dermal Contact	N/A				8.6E-01	
		Inhalation/Shower	N/A				N/A	
		Total	N/A				1.6E+01	2,4-Dinitrotoluene, 1,3-Dinitrobenzene, RDX

TABLE 7-4
Summary of RME Cancer Risks and Hazard Indices
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Chemicals with Cancer Risks >10^{-5} and <10^{-4}	Chemicals with Cancer Risks >10^{-6} and <10^{-5}	Hazard Index	Chemicals with HI>1
Future Resident Adult/Child	Yorktown-Eastover Aquifer Groundwater	Ingestion	4.0E-02	Tetrachloroethene, Trichloroethene, Vinyl chloride, 2,4-Dinitrotoluene, Arsenic-dissolved	RDX, Chromium-dissolved	Benzene	N/A	
		Dermal Contact	1.7E-02	Tetrachloroethene, Trichloroethene	Vinyl chloride, 2,4-Dinitrotoluene	Arsenic-dissolved	N/A	
		Inhalation/Shower	1.1E-02	Tetrachloroethene, Trichloroethene		Vinyl chloride	N/A	
		Inhalation/Indoor Air	2.3E-05		Trichloroethene	Vinyl chloride	N/A	
		Total	6.8E-02	Tetrachloroethene, Trichloroethene, Vinyl chloride, 2,4-Dinitrotoluene, Arsenic-dissolved	Benzene, RDX, Chromium-dissolved	1,1-Dichloroethane, 1,2-Dichloroethane	NA	
	Yorktown-Eastover Aquifer Groundwater at GW09	Ingestion	3.5E-04	2,4-Dinitrotoluene, RDX			N/A	
		Dermal Contact	1.5E-05		2,4-Dinitrotoluene	RDX	N/A	
		Inhalation/Shower	N/A				N/A	
		Total	3.7E-04	2,4-Dinitrotoluene, RDX			NA	
Future Industrial Worker - Adult	Yorktown-Eastover Aquifer Groundwater	Ingestion	9.4E-03	Tetrachloroethene, Trichloroethene	Vinyl chloride, 2,4-Dinitrotoluene, Arsenic-dissolved, Chromium-dissolved	RDX	5.2E+01	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, Antimony-dissolved, Cobalt-dissolved
		Dermal Contact	N/A				N/A	
		Inhalation	N/A				N/A	
		Inhalation/Indoor Air	4.5E-06			Trichloroethene, Vinyl Chloride	8.5E-03	
		Total	9.4E-03	Tetrachloroethene, Trichloroethene	Vinyl chloride, 2,4-Dinitrotoluene, Arsenic-dissolved, Chromium-dissolved	RDX	5.2E+01	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, Antimony-dissolved, Cobalt-dissolved
	Yorktown-Eastover Aquifer Groundwater at GW09	Ingestion	8.2E-05		2,4-Dinitrotoluene, RDX		2.3E+00	1,3-Dinitrobenzene
		Dermal Contact	N/A				N/A	
		Inhalation	N/A				N/A	
		Total	8.2E-05		2,4-Dinitrotoluene, RDX		2.3E+00	1,3-Dinitrobenzene
Future Construction Worker - Adult	Yorktown-Eastover Aquifer Groundwater	Ingestion	N/A				N/A	
		Dermal Contact	2.4E-04				3.1E+00	2-Amino-4,6-dinitrotoluene
		Inhalation	2.7E-05				4.9E-02	
		Total	2.6E-04	Tetrachloroethene	Tetrachloroethene, Trichloroethene, 1,2-Dichloroethane		3.2E+00	2-Amino-4,6-dinitrotoluene
	Yorktown-Eastover Aquifer Groundwater at GW09	Ingestion	N/A				N/A	
		Dermal Contact	2.0E-07				6.3E-02	
		Inhalation	N/A				N/A	
		Total	2.0E-07				6.3E-02	
	Surface Water	Ingestion	1.9E-09				2.0E-04	
		Dermal Contact	2.2E-09				1.3E-03	
		Inhalation	N/A				N/A	
		Total	4.1E-09				1.5E-03	
	Sediment	Ingestion	4.4E-08				3.9E-02	
		Dermal Contact	3.8E-09				1.1E-03	
		Inhalation	N/A				N/A	
		Total	4.8E-08				4.0E-02	
	All Media[1]	Total	2.6E-04				3.2E+00	

TABLE 7-4
Summary of RME Cancer Risks and Hazard Indices
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks >10^{-4}	Chemicals with Cancer Risks >10^{-5} and <10^{-4}	Chemicals with Cancer Risks >10^{-6} and <10^{-5}	Hazard Index	Chemicals with HI>1
Current/Future Trespasser/Visitor- Adult	Surface Water	Ingestion	2.4E-07				1.4E-03	
		Dermal Contact	2.4E-08				8.0E-04	
		Inhalation/Shower	N/A				N/A	
		Total	2.7E-07				2.2E-03	
	Sediment	Ingestion	1.2E-06				4.3E-03	
		Dermal Contact	4.7E-07				2.2E-02	
		Inhalation/Shower	N/A				N/A	
		Total	1.6E-06				2.6E-02	
		Total	1.9E-06				2.8E-02	
Current/Future Trespasser/Visitor- Adolescent	Surface Water	Ingestion	1.3E-07				1.9E-03	
		Dermal Contact	8.7E-09				7.8E-04	
		Inhalation/Shower	N/A				N/A	
		Total	1.3E-07				2.7E-03	
	Sediment	Ingestion	5.9E-07				5.9E-03	
		Dermal Contact	1.2E-07				1.4E-02	
		Inhalation/Shower	N/A				N/A	
		Total	7.1E-07				2.0E-02	
		Total	8.4E-07				2.3E-02	

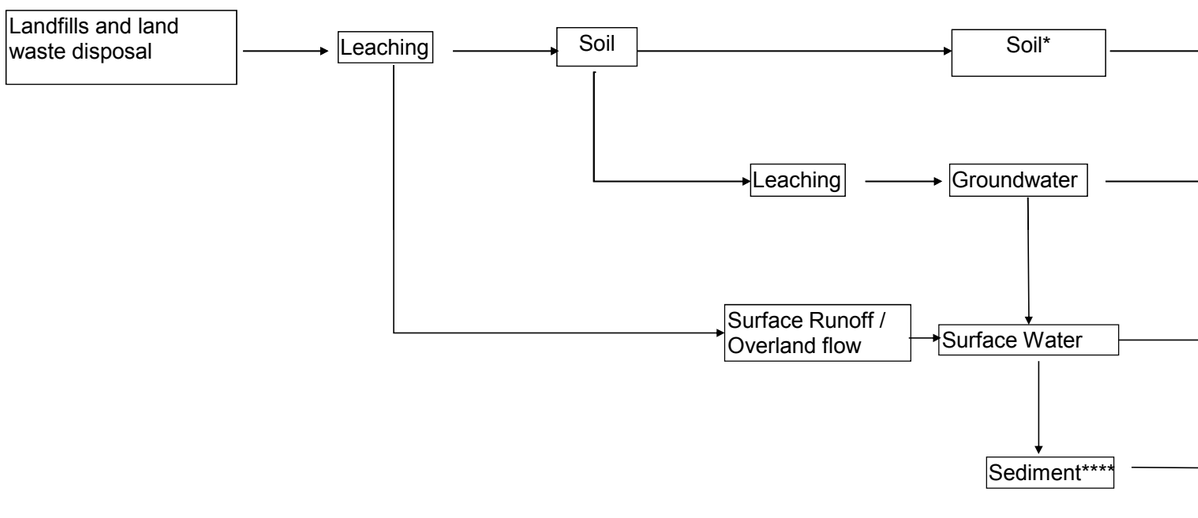
TABLE 7-5
Summary of CTE Cancer Risks and Hazard Indices
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $>10^{-4}$	Chemicals with Cancer Risks $>10^{-5}$ and $<10^{-4}$	Chemicals with Cancer Risks $>10^{-6}$ and $<10^{-5}$	Hazard Index	Chemicals with HI>1
Future Resident Adult	Yorktown-Eastover Aquifer Groundwater	Ingestion	N/A				6.8E+01	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, Antimony- Dissolved, Cobalt-Dissolved
		Dermal Contact	N/A				5.6E+00	Tetrachloroethene, 2-Amino-4,6-dinitrotoluene
		Inhalation/Shower	N/A				7.3E-02	
		Inhalation/Indoor Air	N/A				2.3E-02	
		Total	N/A				7.3E+01	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, Antimony, Dissolved, Cobalt-Dissolved
	Yorktown-Eastover Aquifer Groundwater at GW09	Ingestion	N/A				3.0E+00	1,3-Dinitrobenzene
		Dermal Contact	N/A				1.1E-01	
		Inhalation/Shower	N/A				N/A	
		Total	N/A				3.1E+00	1,3-Dinitrobenzene
Future Resident Child	Yorktown-Eastover Aquifer Groundwater	Ingestion	N/A				2.3E+02	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, Antimony-Dissolved, Arsenic-Dissolved, Beryllium-Dissolved, Cobalt-Dissolved
		Dermal Contact	N/A				1.1E+01	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, Iron-Dissolved
		Inhalation/Shower	N/A				1.2E-01	
		Inhalation/Indoor Air	N/A				3.6E-02	
		Total	N/A				2.4E+02	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, Antimony-Dissolved, Arsenic-Dissolved, Beryllium-Dissolved, Cobalt-Dissolved
	Yorktown-Eastover Aquifer Groundwater at GW09	Ingestion	N/A				1.0E+01	2,4-Dinitrotoluene, 1,3-Dinitrobenzene, RDX
		Dermal Contact	N/A				2.1E-01	
		Inhalation/Shower	N/A				N/A	
		Total	N/A				1.0E+01	2,4-Dinitrotoluene, 1,3-Dinitrobenzene, RDX
Future Resident Adult/Child	Yorktown-Eastover Aquifer Groundwater	Ingestion	1.4E-02	Tetrachloroethene, Trichloroethene, Vinyl chloride, Arsenic-dissolved	2,4-Dinitrotoluene, RDX, Chromium-dissolved		N/A	
		Dermal Contact	4.1E-03	Tetrachloroethene, Trichloroethene		Vinyl chloride, 2,4-Dinitrotoluene	N/A	
		Inhalation/Shower	1.0E-03	Trichloroethene	Tetrachloroethene		N/A	
		Inhalation/Indoor Air	7.6E-06			Trichloroethene, Vinyl chloride	N/A	
		Total	1.9E-02	Tetrachloroethene, Trichloroethene, Vinyl chloride, Arsenic-dissolved	1,2-Dichloroethane, 2,4-Dinitrotoluene, RDX, Chromium-dissolved		NA	
	Yorktown-Eastover Aquifer Groundwater at GW09	Ingestion	1.2E-04		2,4-Dinitrotoluene, RDX		N/A	
		Dermal Contact	3.7E-06			2,4-Dinitrotoluene	N/A	
		Inhalation/Shower	N/A				N/A	
		Total	1.3E-04		2,4-Dinitrotoluene, RDX		NA	

TABLE 7-5
Summary of CTE Cancer Risks and Hazard Indices
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Receptor	Media	Exposure Route	Cancer Risk	Chemicals with Cancer Risks $>10^{-4}$	Chemicals with Cancer Risks $>10^{-5}$ and $<10^{-4}$	Chemicals with Cancer Risks $>10^{-6}$ and $<10^{-5}$	Hazard Index	Chemicals with HI>1
Future Industrial Worker - Adult	Yorktown-Eastover Aquifer Groundwater	Ingestion	3.0E-03	Tetrachloroethene, Trichloroethene	Vinyl chloride, 2,4-Dinitrotouene, Arsenic-Dissolved	RDX, Chromium-dissolved	4.5E+01	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, Antimony-Dissolved, Cobalt-Dissolved
		Dermal Contact	N/A				N/A	
		Inhalation	N/A				N/A	
		Inhalation/Indoor Air	1.4E-06	Trichloethene, Vinyl Chloride			7.5E-03	
		Total	3.0E-03	Tetrachloroethene, Trichloroethene	Vinyl chloride, 2,4-Dinitrotouene, Arsenic-Dissolved	RDX, Chromium-dissolved	4.5E+01	cis-1,2-Dichloroethene, Tetrachloroethene, 2-Amino-4,6-dinitrotoluene, Antimony-Dissolved, Cobalt-Dissolved
	Yorktown-Eastover Aquifer Groundwater at GW09	Ingestion	2.6E-05		2,4-Dinitrotoluene	RDX	2.0E+00	1,3-Dinitrobenzene
		Dermal Contact	N/A				N/A	
		Inhalation	N/A				N/A	
		Total	2.6E-05				2.0E+00	1,3-Dinitrobenzene
Future Construction Worker - Adult	Yorktown-Eastover Aquifer Groundwater	Ingestion	N/A				N/A	
		Dermal Contact	1.4E-04	Tetrachloroethene	Trichloroethene		1.9E+00	2-Amino-4,6-dinitrotoluene
		Inhalation	1.3E-05		1,2-Dichloroethane		1.2E-01	
		Total	1.6E-04	Tetrachloroethene	Trichloroethene, 1,2-Dichloroethane		2.1E+00	2-Amino-4,6-dinitrotoluene
	All Media	Total	1.6E-04				2.1E+00	

N/A - Not applicable, pathway incomplete.



		Potential Human Receptors					
		Current/Future		Future			
	Exposure Route	Trespasser/ Visitor Adult	Trespasser/ Visitor Adolescent	Industrial Worker	Residential Adult	Residential Child	Construction Worker
Soil*	Ingestion	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA
	Inhalation	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	X	X	X	NA
	Dermal Contact	NA	NA	NA	X	X	X
	Inhalation**	NA	NA	X	X	X	X
Surface Water	Ingestion	X	X	NA	NA	NA	X
	Dermal Contact	X	X	NA	NA	NA	X
	Inhalation	NA	NA	NA	NA	NA	NA
Sediment****	Ingestion	X	X	NA	NA	NA	X
	Dermal Contact	X	X	NA	NA	NA	X
	Inhalation	NA	NA	NA	NA	NA	NA

*Soil and sediment removal/remediation actions have been conducted.
** Foster and Chrostowski Shower Model used for groundwater inhalation during showering
Concentration in Excavation Trench methodology from the Virginia Voluntary Remediation Program used to calculate concentration in air resulting from volatilization from shallow groundwater in an open excavation for construction workers.
Vapor intrusion from groundwater into indoor air evaluated for industrial worker and resident using Johnson and Ettinger Model.
NA - Not Applicable or pathway is incomplete
X - Potentially complete exposure pathways

FIGURE 7-1
Human Health Conceptual Model
Phase II Remedial Investigation Report, Site 6
Naval Weapons Station Yorktown
Yorktown, Virginia

DFB/Figure7-1_HHRA CSM.xls

SECTION 8

Ecological Risk Assessment

8.1 Introduction

This section contains a screening ecological risk assessment (SERA), constituting Steps 1 and 2 of the ecological risk assessment (ERA) process, and the first step (Step 3A) of a baseline ecological risk assessment (BERA) for aquatic and wetland habitats at Site 6. Terrestrial habitats are not evaluated as part of this ERA based upon the remedial actions that have occurred at this site (see Section 2.11), which have eliminated complete and significant terrestrial ecological exposure pathways.

8.1.1 Ecological Risk Assessment Process

ERAs are conducted using a tiered, step-wise approach and are punctuated with Scientific Management Decision Points (SMDPs). SMDPs represent points in the ERA process where agreement on conclusions, actions, or methodologies is needed so that the ERA process can continue (or terminate) in a technically defensible manner. The results of the ERA at a particular SMDP are used to determine how the ERA process should proceed, for example, to the next step in the process or directly to a later step. The process continues until a final decision has been reached (i.e., remedial action if unacceptable risks are identified, or no further action if risks are acceptable). The process can also be iterative if data needs are identified at any step; the needed data are collected and the process starts again at the point appropriate to the type of data collected.

This ERA was conducted in accordance with the *Navy Policy for Conducting Ecological Risk Assessments* (CNO, 1999) and the Navy guidance for implementing this ERA policy (NAVFAC, 2003). The Navy ERA policy and guidance, which describe a process consisting of eight steps organized into three tiers, are conceptually similar to the eight-step ERA process outlined in USEPA ERA guidance for the Superfund program (USEPA, 1997a). For both sets of guidance, Steps 1 and 2 involve conducting a SERA using very conservative assumptions. The BERA represents Steps 3 through 7. The BERA uses more realistic assumptions and site-specific data to refine the risk estimates from the SERA for components that fail the initial screen. Step 8 addresses risk management issues. The major differences between the Navy ERA policy/guidance and the USEPA ERA guidance are: (1) the Navy policy/guidance provides clearly defined criteria for exiting the ERA process at specific points, (2) the Navy policy/guidance divides Step 3 (the first step of the BERA) into two distinct sub-steps (Steps 3A and 3B), with a potential exit point after Step 3A, and (3) the Navy policy/guidance incorporates risk management considerations throughout all tiers of the ERA process.

The screening (preliminary) problem formulation is the first step of an ERA and establishes the goals, scope, and focus of the SERA. Step 1 of the ERA process is intended to answer two main questions: (1) do complete exposure pathways exist?; and (2) are sufficient data available to conduct the SERA? If no complete exposure pathways exist, the ERA process terminates at Step 1 with a conclusion of negligible risk. If one or more complete exposure

pathways are known to, or are likely to, exist, the ERA process continues to Step 2 but only evaluates those pathways that have been determined to be critical. An evaluation of the available data is then conducted to determine if they are adequate to support the SERA. If not, additional data are collected before the ERA process continues. The second step of the ERA process involves conducting a screening exposure assessment, a screening effects assessment, and a screening risk calculation (risk characterization).

The results of the SERA are used to evaluate the potential for unacceptable ecological risks based upon very conservative assumptions. If the results of the SERA suggest that further ecological risk evaluation is warranted, the ERA process proceeds to the BERA (Steps 3 through 7), which is a more detailed phase of the ERA process, for the pathways, chemicals, receptors, and areas identified in the SERA. As indicated above, the first step of the BERA (Step 3) is divided into two distinct sub-steps in Navy ERA guidance.

Step 3 of the USEPA ERA guidance consists of the following activities (USEPA, 1997a):

1. Refinement of the COPCs from the SERA
2. Further characterizing the potential ecological effects of contaminants
3. Refining information on contaminant fate and transport, complete exposure pathways, and receptors potentially at risk
4. Selecting assessment endpoints
5. Refining the conceptual model and risk hypotheses from the SERA

Step 3A of the Navy policy/guidance (refinement of conservative exposure assumptions) corresponds to the first activity listed above for the USEPA ERA guidance. In Step 3A, a refined evaluation of exposure estimates is conducted using more realistic assumptions and additional methodologies relative to those used in the SERA, which is intended to be a very conservative assessment. Examples of more realistic exposure assumptions include using central tendency (e.g., mean) estimates (rather than maximums) for media concentrations, bioaccumulation factors, and exposure parameters. Examples of additional methodologies include consideration of background concentrations and bioavailability (CNO, 1999; NAVFAC, 2003).

If risk estimates (and their associated uncertainty) are acceptable following Step 3A, the site will meet the conditions of the exit criterion specified in the Navy policy/guidance. If the Step 3A evaluation does not support a determination of acceptable risk within acceptable uncertainty, the site continues to Step 3B.

Step 3B of the Navy policy/guidance (problem formulation) corresponds conceptually to the last four activities listed above for Step 3 of the USEPA ERA guidance. In Step 3B, the preliminary conceptual model from the SERA is refined based upon the results of the Step 3A evaluation to develop a revised list of key receptors, critical exposure pathways, key COPCs, assessment endpoints, measurement endpoints, and risk hypotheses. Based upon the refined conceptual model, the lines of evidence to be used in characterizing risk are determined. Agreement on the refined conceptual model, COPCs, exposure pathways, endpoints, and risk hypotheses constitutes the SMDP at the end of Step 3 in both Navy and USEPA ERA guidance.

Following the completion of Step 3, a decision point is reached with two potential outcomes. If the refined risk estimates are acceptable for each selected assessment endpoint, the investigation proceeds to risk characterization (Step 7) to document this conclusion, and the ERA process terminates. If the uncertainties associated with the refined risk estimates are unacceptable and/or the risk estimates indicate that unacceptable risks may exist, site-specific studies might be required and the ERA process continues (Steps 4 through 6). Step 4 is a work planning step where additional site-specific studies are scoped and designed. Step 5 consists of the verification of the field sampling design developed in Step 4 while Step 6 constitutes the site investigation and data analysis phase of the process.

Step 7 consists of the documentation and synthesis of the information and data identified in Steps 1 through 3 (no additional study) or Steps 1 through 6 (additional study). In this step, risk is evaluated and characterized using both quantitative and qualitative methods. Conclusions are made as to whether or not there is a reasonable potential for unacceptable ecological risk, and if there is a potential for ecological risk, the magnitude of that risk. The results of the completed BERA (Step 7) are used to make any necessary risk management decisions (Step 8) related to current or future risks. Possible decisions include:

- There is adequate information to conclude that no unacceptable ecological risks exist. The assessment should stop at Step 7.
- There is adequate information to conclude that ecological risks warrant remedial action. Whether or not remedial actions are taken, and the specific actions taken, will depend upon a number of risk management factors such as the results of any human health risk assessments and the potential impact of the remedial action itself on the habitats and biota present. This analysis typically occurs as part of Step 8.
- There is not adequate information to estimate risk or the risk estimate is believed to be too conservative or uncertain to recommend remediation. The assessment should be refined.

8.2 Problem Formulation

Problem formulation establishes the goals, scope, and focus of the ERA. As part of problem formulation, the ecological setting of Site 6 is characterized in terms of the habitats and biota known or likely to be present. The types and concentrations of chemicals that are present in ecologically relevant media (surface water, sediment, and sediment pore water) are also described based upon available analytical data. A conceptual model is developed that describes source areas, transport pathways and exposure media, exposure pathways and routes, and receptors. Assessment endpoints, measurement endpoints, and risk hypotheses are developed to evaluate those receptors for which critical exposure pathways exist. The fate, transport, and toxicological properties of the chemicals present on Site 6, particularly the potential for bioaccumulation, are also considered during this process.

8.2.1 Environmental Setting

Site 6 is located in the northern portion of WPNSTA Yorktown adjacent to an unnamed tributary of Felgates Creek (**Figure 1-2**). Felgates Creek is a tidally influenced tributary to the York River. The site encompasses a surface impoundment and the area surrounding Buildings 109, 110, and 501. It consists of three areas: the impoundment area, the flume area,

and the excavated area. The impoundment area is a 3-acre, unlined, surface impoundment located adjacent to emergent estuarine wetlands along a tributary to Felgates Creek. The impoundment was created by building an earthen dam across the headwaters of the tributary. Wastewater containing explosives (primarily TNT, RDX, and 2,4-DNT) and solvents (principally PCE, TCE, and cyclohexanone) generated in Building 109 (which was used for explosives reclamation) and Building 110 (which was used for explosives loading, mixing, and casting) was discharged through a network of flumes into the Site 6 impoundment area between 1942 and 1975. The impoundment served as a settling basin for this wastewater. In 1975, a carbon adsorption tower was installed to treat the contaminated wastewater prior to discharge into the flume system and a NPDES permit was granted by USEPA to allow the discharge of this treated effluent into the surface impoundment. In 1986, the effluent from the carbon adsorption tower was diverted to the sanitary sewer and ultimately to the Hampton Roads Sanitation District. After 1986, the impoundment collected only surface runoff from the area around Buildings 109 and 110. Wastewater discharges ceased in 2003 when operations at Buildings 109 and 110 terminated.

Although not well documented, the excavated area may have been the soil borrow pit used during the construction of the earthen dam for the impoundment. The pit may also have been used historically to contain packed explosives. The excavated area is northwest of former Building 501 and is currently wooded. Soil contaminated with cadmium and zinc was previously identified in this area (Shaw, 2008).

Site 6 is generally wooded with some open areas near the existing buildings. The surface impoundment contains a sluice that permits tidal flow to enter. The area near the dam contains estuarine emergent wetland vegetation (*Spartina*) which is replaced by cattail (*Typha*) in the upper reaches of the impoundment.

The topography at Site 6 consists of steep embankments (which vary in height) surrounding the relatively flat impoundment area. Surface runoff from the site is conveyed to Felgates Creek primarily via the tributary located adjacent to Site 6 (**Figure 1-2**). The depth to groundwater ranges from 1 to 35 ft bgs and closely tracks surface topography. Groundwater generally flows westward toward the impoundment and Felgates Creek.

Felgates Creek and the tributary from Site 6 are tidal and estuarine, with measured salinities of between 12 and 18 ppt near the site and between 5 and 22 ppt further upstream (where the background samples were collected) (**Table 8-1**). The pH of the water varies between about 5.5 and 8. Substrates are composed mostly of course, medium, and fine sand (**Table 8-2**). TOC ranges from about 1 to 5 percent. The pH is neutral to slightly basic, ranging from 7.2 to 8.1 (**Table 8-2**). AVS/SEM ratios, a measure of the bioavailability of certain metals (cadmium, copper, lead, mercury, nickel, silver, and zinc), are less than one (**Table 8-2**).

Wetlands along Felgates Creek are estuarine, consisting primarily of tidal saltmarsh that is dominated by cordgrass (*Spartina*). Invertebrate species observed and expected in the estuarine aquatic habitat offered by the creek and wetlands include mussels, marsh periwinkles, fiddler crabs, blue crabs, and various benthic infaunal species. Fish, such as mummichog, are also present in the creek and bordering wetlands. Felgates Creek and the surrounding marshes additionally have the potential to support a wide range of avian, mammalian, and reptilian upper trophic level species. These species include raccoon, great

blue heron, belted kingfisher, and marsh wren. There are no known occurrences of rare, threatened, or endangered species, or sensitive habitats, on or in the immediate vicinity of Site 6 based upon previous ecological evaluations of the site. Since habitat types have not changed at the site since these previous evaluations were conducted, this likely reflects current conditions as well.

A ROD for Site 6 soil and sediment and Building 109's explosives residue (sludge) was signed in October 1998 (Baker, 1998d). This document specified soil/sediment removal and treatment as the remedial action for the flume area and the upper portion of the impoundment. The clean-up values used for the flume/impoundment area remediation were based upon the results of sediment toxicity testing (using flume sediments and a concentration gradient based upon TNT and RDX) with two species of freshwater invertebrates (*Hyalella ezteca* and *Chironomus tentans*). The results of this testing allowed a sediment clean-up value to be developed only for TNT, which was used to delineate the remediation area.

Implementation of the selected remedy was initiated in 1999. Explosives-contaminated sludge was removed from the sewer of Building 109 and the trenches/piping beneath Building 109 were pressure-washed and plugged. Soil/sediment from the flumes and the upper portion of the impoundment (where the flumes enter) was excavated. Soil in the excavated area was also removed.

Excavation of nitramine/nitroaromatic, chlorinated volatile, and inorganic contaminated soils and sediments was completed between 1999 and 2006. Soils were treated *in-situ* within the impoundment and *ex-situ* within a bioremediation cell (bio-cell) constructed at Site 24. Approximately 11,800 tons of sediment and soil were treated between 1999 and 2006 in the bio-cell. Treatment was deemed complete once two consecutive sampling events confirmed soil and sediment contained VOC and explosive concentrations below remediation levels.

Following remediation, the impoundment at Site 6 was restored as an emergent (*Spartina*) wetland. This restoration encompassed an area of approximately 0.83 acres; the planting design used for this restoration is included as **Appendix G**. A soil cover was placed over the excavated area. Although the ROD required LTM of surface water, sediment, and groundwater, it specified that this would not be the final remedy for these media. Thus groundwater, surface water, and sediment are the subjects of this RI. One round of LTM surface water and sediment samples were collected from within the impoundment in May 2000.

Land use controls (LUCs) prohibiting residential development of the Site 6 area and the disturbance of the excavated area's soil cover have been maintained through routine inspections. Access to the Site 6 impoundment area is restricted by a fence and locked gates. The LUCs will be maintained until they are no longer required to protect human health or the environment. The 2007 Five-Year Review concluded that the remedy continued to be protective of human health and the environment. A Draft RD includes periodic inspections and LTM of surface water, sediment, and groundwater.

8.2.2 Summary of Analytical Data

Only samples collected as part of this RI (in 2009) are quantitatively evaluated in this ERA. These include eight collocated surface water and sediment samples collected from the

tributary connecting the site to Felgates Creek, and three collocated surface water and sediment samples collected from Felgates Creek near its confluence with the tributary. Background conditions were represented by six collocated surface water and sediment samples collected in December 2007 from the upgradient portions of Felgates Creek as part of the evaluation of Sites 4, 21, and 22, and Sites 8 and 34 (SSA-14), where they were scoped as designed background samples. The salinities of Site 6 samples (12 to 18 ppt) were within the range of salinities measured in the background samples (5 to 28 ppt), suggesting that the background locations are also representative of conditions near Site 6.

Four pore water samples were also collected at Site 6, three from the tributary and one from the impoundment. All pore water samples except the impoundment sample were collocated with surface water and sediment sampling locations. There are no available background pore water data.

The samples used in this ERA are listed in **Table 8-3** and are shown on **Figures 3-1** and **3-2**. Groundwater data collected as part of this RI were not directly evaluated in this ERA but were considered qualitatively. All the data collected as part of this RI and used in this ERA were documented as part of the final work plan for this RI (CH2M HILL, 2008). The data collected as part of the previous RI (in 1994) and supplemental investigation (in 1996) were not considered due to their age and because they predated the remedial actions that have occurred at the site. Surface water and sediment samples collected in 2000 as part of the LTM program were not considered because of their age. Because of the past remedial actions that have occurred in the terrestrial portions of the site, an evaluation of terrestrial habitats (soil data) is not relevant to this ERA.

8.2.3 Conceptual Model

The conceptual model relates potentially exposed receptor populations with potential source areas based upon physical site characteristics and complete exposure pathways. Important components of the conceptual model are the identification of potential source areas, transport pathways, exposure media, exposure pathways and routes, and receptors. Actual or potential exposures of ecological receptors associated with a site are determined by identifying the most likely, and most important, mechanisms and pathways of contaminant release and transport. A complete exposure pathway has three components: (1) a source of chemicals that results in a release to the environment; (2) a pathway of chemical transport through an environmental medium; and (3) an exposure or contact point for an ecological receptor. **Figure 6-1** illustrates a conceptual model for Site 6. Key components of this conceptual model are discussed in the following subsections.

Source Areas

The sources of potential contamination at Site 6 are historical discharges of wastewater containing explosives and solvents from Buildings 109 and 110 to the impoundment area via the flume system, as well as possible storage of explosives within the excavated area. All operations at Buildings 109 and 110 were terminated in 2003. Removal actions have been implemented within the excavated area (soils), the flume system (soils and sediments), and the upper portion of the impoundment area (sediments), which have largely eliminated the original source areas. While these actions have addressed the primary source areas and terrestrial habitats at the site, groundwater, and past potential transport to adjacent aquatic

water bodies (tributary and Felgates Creek), have not yet been directly addressed. These media are the subject of this RI.

Transport Pathways and Exposure Media

A transport pathway describes the mechanisms whereby site-related chemicals, once released, may be transported from a source to ecologically relevant media (such as surface water) where exposures may occur. These transport pathways are shown on **Figure 6-1**.

The primary release mechanisms and transport pathways at the site include:

- Infiltration, percolation, and leaching of contaminants to groundwater and subsequent discharge to the surface water and sediment of the adjacent tributary and creek
- Historical surface runoff to the surface water and sediment of the adjacent tributary and creek
- Uptake from the surface water and sediment of the adjacent tributary and creek, and accumulation in the tissues of aquatic biota

Concentration gradients from potential source areas through the appropriate pathway(s) are evaluated in order to determine if there are any links between site contamination and potential ecological receptors (habitats and biota).

Exposure media for ecological receptors are typically limited to surface water, surface sediment, and surface soil. Surface soil is not evaluated in this ERA based upon past remedial actions, which have eliminated these potential exposure pathways. Groundwater is generally considered only as a transport medium since there are no ecological exposures to groundwater until it discharges to a water body or surfaces as a seep. Air is not addressed in this ERA since this medium is not likely to result in significant contributions to total exposures.

Exposure Pathways and Routes

An exposure pathway links a source of contamination with one or more receptors through exposure via one or more media and exposure routes. Exposure, and thus potential risk, can only occur if complete exposure pathways exist. **Figure 6-1** shows the potentially complete exposure pathways to ecological receptors associated with Site 6, which include:

- Direct contact with site-related chemicals in surface water and sediment (including pore water) by water-column dwelling aquatic life and benthic organisms
- Potential ingestion of site-related chemicals via the food chain by avian and mammalian aquatic receptors

As discussed previously, there are no complete exposure pathways for terrestrial receptors.

An exposure route describes the specific mechanism(s) by which a receptor is exposed to a chemical present in an environmental medium. The most common exposure routes are dermal contact, direct uptake, ingestion, and inhalation. Unrooted, floating aquatic plants, rooted submerged vascular aquatic plants, and algae may be exposed to chemicals directly from the water or (for rooted plants) from sediment. Aquatic invertebrates may be exposed

to chemicals in surface sediment and/or surface water through dermal contact and ingestion.

Animals may be exposed to chemicals through the: (1) inhalation of gaseous chemicals or of chemicals adhered to airborne particulate matter; (2) incidental ingestion of contaminated abiotic media (sediment) during feeding or preening activities; (3) ingestion of contaminated water; (4) ingestion of contaminated plant and/or animal tissues for chemicals that have entered food webs; and/or (5) dermal contact with contaminated abiotic media. These routes, where applicable, are depicted on **Figure 6-1**.

The contribution to the total dose from the inhalation route is generally insignificant for upper trophic level ecological receptors relative to ingestion pathways. Hence, the air pathway is not generally considered for ecological receptors. Exposure to chemicals present in sediment via dermal contact may occur but is unlikely to represent a major exposure pathway for most upper trophic level receptors because fur, feathers, and chitinous exoskeletons minimize transfer of chemicals across dermal tissue. Incidental ingestion of surface sediment during feeding, preening, or grooming activities is, however, considered in the risk estimates. Direct contact is considered for lower trophic level receptors (benthic invertebrates).

Direct ingestion of drinking water is only considered when the salinity is below 15 parts per thousand (ppt), the approximate toxic threshold for wildlife receptors (Humphreys, 1988). Based upon available data (**Table 8-1**), the salinity in the tributary and creek is typically at or above this threshold. Thus, exposure via direct ingestion of drinking water is not included in this ERA.

Receptors

Because of the complexity of natural systems, it is generally not practical to directly assess the potential impacts to all ecological receptors present within an area. Therefore, specific receptor species (e.g., great blue heron) or species groups (e.g., fish) are often selected as surrogates to evaluate potential risks to larger components of the ecological community (guilds; such as piscivorous birds) used to represent the assessment endpoints (e.g., survival and reproduction of piscivorous birds). Selection criteria typically include those species that:

- Are known to occur, or are likely to occur, in the area
- Have a particular ecological, economic, or aesthetic value
- Are representative of taxonomic groups, life history traits, and/or trophic levels in the habitats present for which complete exposure pathways are likely to exist
- Can, because of toxicological sensitivity or potential exposure magnitude, be expected to represent potentially sensitive populations

The following upper trophic level receptor species have been chosen for exposure modeling based upon the criteria listed above:

- Belted kingfisher (*Ceryle alcyon*) - aquatic avian piscivore/invertivore
- Great blue heron (*Ardea herodias*) – wading (shallow water) semi-aquatic avian piscivore
- Mallard (*Anas platyrhynchos*) - semi-aquatic avian omnivore

- Marsh wren (*Cistothorus palustris*) - semi-aquatic avian insectivore
- Mink (*Mustela vison*) - semi-aquatic mammalian piscivore
- Muskrat (*Ondatra zibethicus*) - semi-aquatic mammalian herbivore
- Raccoon (*Procyon lotor*) - semi-aquatic mammalian omnivore

Upper trophic level receptor species quantitatively evaluated in this ERA were limited to birds and mammals, the taxonomic groups with the most available information regarding exposure and toxicological effects. Lower trophic level receptor species were evaluated based upon those taxonomic groupings for which medium-specific screening values have been developed. As such, specific species of aquatic biota were not chosen as receptors because of the limited information available for specific species and because aquatic biota (fish and benthic invertebrates) are evaluated on a community level via a comparison of surface water and sediment concentrations with medium-specific screening values.

Amphibians are typically selected as a receptor group only when freshwater aquatic or wetland habitats are present on, or in the contaminant transport pathways (as defined in the conceptual model) of, a site. While this is not the typically the case at Site 6 based upon the salinity of the tributary and creek, amphibians are included as a receptor group for conservatism. Reptiles are an applicable receptor group. Individual species of amphibians and reptiles are not, however, selected for evaluation because of the general lack of available toxicological information for these taxonomic groups for direct effects (reptiles) and effects from exposures via food webs (reptiles and amphibians). Potential risks to amphibians and reptiles from food web exposures are evaluated using other fauna (birds and mammals) as surrogates. Similarly, potential risks to these groups from direct exposures to surface water and sediment are evaluated using screening values developed for other taxonomic groups (described above). This is discussed further in Section 8.6, "Uncertainties."

Endpoints and Risk Hypotheses

The conclusion of the problem formulation includes the selection of ecological endpoints and risk hypotheses, which are based upon the conceptual model. Two types of endpoints, assessment endpoints and measurement endpoints, are defined as part of the ERA process (USEPA, 1997a). An assessment endpoint is an explicit expression of the environmental component or value that is to be protected. A measurement endpoint is a measurable ecological characteristic that is related to the component or value chosen as the assessment endpoint. The considerations for selecting assessment and measurement endpoints are summarized in USEPA (1997a) and discussed in detail in Suter (1989, 1990, 1993). Risk hypotheses are testable hypotheses about the relationship among the assessment endpoints and their predicted responses when exposed to contaminants.

Endpoints define ecological attributes that are to be protected (assessment endpoints) and measurable characteristics of those attributes (measurement endpoints) that can be used to gauge the degree of impact that has or may occur. Assessment endpoints most often relate to attributes of biological populations or communities, and are intended to focus the risk assessment on particular components of the ecosystem that could be adversely affected by chemicals attributable to a site (USEPA, 1997a). Assessment endpoints contain an entity (e.g., heron population) and an attribute of that entity (e.g., survival rate). Individual assessment endpoints usually encompass a group of species or populations (the receptor) with some common characteristic, such as specific exposure route or contaminant

sensitivity, with the receptor then used to represent the assessment endpoint in the risk evaluation.

Assessment and measurement endpoints may involve ecological components from any level of biological organization, from individual organisms to the ecosystem itself. Effects on individual organisms are important for some receptors, such as rare and endangered species; population- and community-level effects are typically more relevant to ecosystems. Population- and community-level effects are usually difficult to evaluate directly without long-term and extensive study. However, measurement endpoint evaluations at the individual level, such as an evaluation of the effects of chemical exposure on reproduction, can be used to predict effects on an assessment endpoint at the population or community level. In addition, use of criteria values designed to protect the majority of the components of a community (e.g., Ambient Water Quality Criteria [AWQC] for the Protection of Aquatic Life) can be useful in evaluating potential community- and/or population-level effects.

Table 8-4 shows the assessment endpoints, risk hypotheses, and measurement endpoints used in the ERA. **Table 8-4** also shows the receptors associated with each endpoint.

8.3 Exposure Assessment

The principal activity associated with the exposure assessment is the estimation of chemical concentrations in applicable media, termed EPCs, to which the receptors may be exposed. This is accomplished through the selection of appropriate sets of the available analytical data using a set of criteria (e.g., validation status, sampling date). Once the analytical data sets are selected, EPCs are calculated as a particular point on the distribution of concentrations. At the screening level, the EPC is the maximum detected concentration. At the baseline level, EPCs are typically central tendency estimates (e.g., arithmetic mean). EPCs are then used in bioaccumulation and food web models to estimate exposures to upper trophic level receptors.

8.3.1 Selection Criteria for Analytical Data

Available analytical data (described in Section 8.2.2) were selected for use in the ERA based upon the following:

- Data must have been validated by a qualified data validator using acceptable data validation methods. Rejected (R) values were not used in the ERA. Unqualified data and data qualified as J (estimated), L (biased low), or K (biased high) were treated as detected. Data qualified as U (undetected) or B (blank contamination) were treated as non-detected.
- For samples with duplicate analyses, the higher of the two concentrations was used when both values were detects or when both values were non-detects. In cases where one result was a detection and the other a non-detect, the detected value was used in the assessment.

8.3.2 Exposure Point Concentrations

EPCs are calculated as a particular point on the distribution of concentrations. At the screening level, the EPC is the maximum detected concentration. At the baseline level, EPCs are typically central tendency estimates (e.g., median, geometric mean, or arithmetic mean),

which provide a more representative estimate of potential exposures and risks to receptor populations (the focus of the selected assessment endpoints). In this ERA, the maximum (Step 2), arithmetic mean (Step 3A), 95 percent UCL of the arithmetic mean (Step 3A), and geometric mean (Step 3A) concentrations were evaluated for direct exposures. Exposures via food webs utilized the maximum (Step 2), arithmetic mean (Step 3A), and 95 percent UCL of the arithmetic mean (Step 3A). These three medium-specific EPCs were used in bioaccumulation and food web models to estimate exposures to upper trophic level receptors. Dietary items for which tissue concentrations were modeled included aquatic plants, benthic invertebrates, and fish. Incidental ingestion of sediment, but not ingestion of drinking water (due to the salinity of the tributary and creek), was included when calculating the total exposure. The models and parameter values used for calculating these tissue concentrations are outlined in the following subsections.

Only chemicals with the potential to bioaccumulate were evaluated for exposures via food webs. This list of bioaccumulating chemicals is provided in **Table 8-5** for relevant constituents and is based upon the list of bioaccumulating chemicals provided in Table 4-2 of USEPA (2000).

For initial (screening; Step 2) exposure estimates, the uptake of chemicals from the abiotic media into these food items was based upon conservative (e.g., 90th percentile) BCFs or bioaccumulation factors (BAFs) from the literature, where available. The use of 90th percentile values is generally recommended to provide for a conservative screening assessment (Sample et al. 1998a, 1998b; Bechtel Jacobs 1998). BCFs and BAFs used for baseline (Step 3A) exposure estimates were based upon, or modeled from, central tendency estimates (e.g., median or mean). For mean values, arithmetic means were used for normally distributed parameters; when the distribution was log-normal, the geometric mean was used. Default factors of 1.0 were used only when data were not available for a chemical in the literature.

- In the BERA, using central tendency estimates (rather than high-end values or maximums) for exposure parameters such as BAFs provides a more representative estimate of potential exposures and risks to populations (the focus of the assessment endpoints) of upper trophic level receptors. Since these upper trophic level receptors are highly mobile, they would be expected to effectively average their exposure over time as they forage within the area defining their home range. Average prey concentrations are most appropriately estimated using central tendency estimates of media concentrations and accumulation factors. For example, the wildlife dietary exposure models contained in the *Wildlife Exposure Factors Handbook* (USEPA, 1993c) specify the calculation of an average daily dose. Increasing the representativeness of the exposure estimates relative to population-level effects is consistent with the intent of a BERA. In cases where adequate spatial sampling coverage exists, mean concentrations are also appropriate for evaluating potential risks to populations of lower trophic level receptors because the members of the population are expected to be found throughout an area (where suitable habitat is present), rather than concentrated in one particular location. While effects to individual organisms might be important for some receptors, such as rare and endangered species, population- and community-level effects are typically more relevant to ecosystems. Although some lower trophic level receptors have limited mobility, the evaluation of populations of these receptors (the focus of the assessment

endpoints) will encompass larger spatial scales, making an average concentration applicable. The maximum was considered during the SERA (Step 2). The maximum HQs for non-COPCs did not exceed 1.5 for any of the media (see Section 8.5), indicating that the use of the 95% UCL of the mean as the decision criterion did not result in the exclusion of any "hot spots".

Wetland/Aquatic Plants

Tissue concentrations in the above-ground vegetative portion of wetland and aquatic plants were estimated by multiplying the sediment concentration for each chemical by chemical-specific soil-to-plant BCFs (extrapolated to sediments) obtained from the literature. These BCFs are listed in **Tables 8-6** (screening) and **8-7** (baseline).

The BCF values were based upon root uptake from sediment and upon the ratio between dry-weight sediment and dry-weight plant tissue. Literature values based upon the ratio between dry-weight sediment and wet-weight plant tissue were converted to a dry-weight basis by dividing the wet-weight BCF by the estimated solids content for plants (15 percent [0.15]; Sample et al., 1997).

Benthic Invertebrates

Tissue concentrations in benthic invertebrates were estimated by multiplying the sediment concentration for each chemical by chemical-specific sediment-to-invertebrate BAF values obtained from the literature. These BCFs are listed in **Tables 8-6** (screening) and **8-7** (baseline).

The BAF values used were based upon the ratio between dry-weight sediment and dry-weight invertebrate tissue. BAFs based upon depurated analyses (sediment was purged from the gut of the organism prior to analysis) were given preference over undepurated analyses when selecting BAF values because direct ingestion of sediment was accounted for separately in the food web model.

Literature values based upon the ratio between dry-weight sediment and wet-weight invertebrate tissue were converted to a dry-weight basis by dividing the wet-weight BAF by the estimated solids content for benthic invertebrates (21 percent [0.21]; USEPA, 1993c). For chemicals without available literature-based sediment-to-invertebrate BAFs, a BAF of 1.0 was assumed, that is, it was assumed that the concentration in benthic invertebrate tissues was equal to the concentration in the sediment (a standard assumption in ERAs)

Fish

Tissue concentrations in whole-body fish were estimated by multiplying the sediment concentration for each chemical by chemical-specific sediment-to-fish BAFs obtained from the literature. These BCFs are listed in **Tables 8-6** (screening) and **8-7** (baseline).

The BAF values used were based upon the ratio between dry-weight sediment and dry-weight tissue. Literature values based upon the ratio between dry-weight sediment and wet-weight fish tissue were converted to a dry-weight basis by dividing the wet-weight BAF by the estimated solids content for fish (25 percent [0.25]; USEPA, 1993c). For chemicals without literature-based sediment-to-fish BAFs, a BAF of 1.0 was assumed.

Dietary Intakes

Upper trophic level receptor exposures via food webs to chemicals present in surface sediment were determined using estimated chemical concentrations in each relevant dietary component for each receptor, as described in the previous section. Incidental ingestion of surface sediment was also included when calculating the total exposure.

Dietary intakes for each upper trophic level receptor were calculated using the following formula (modified from USEPA [1993c]):

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

where:

DI_x	=	Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR	=	Food ingestion rate (kg/day, dry-weight)
FC_{xi}	=	Concentration of chemical x in food item i (mg/kg, dry-weight)
PDF_i	=	Proportion of diet composed of food item i (dry-weight basis)
SC_x	=	Concentration of chemical x in sediment (mg/kg, dry-weight)
PDS	=	Proportion of diet composed of sediment (dry-weight basis)
WIR	=	Water ingestion rate (L/day)
WC_x	=	Concentration of chemical x in water (mg/L)
BW	=	Body weight (kg, wet-weight)

Incidental ingestion of sediment was modeled as a dietary component rather than using a separate sediment ingestion rate. Parameter values for the selected receptors are listed in **Tables 8-8** (screening) and **8-9** (baseline). When measured food ingestion rates were not available for a receptor from the literature, the rates were estimated using allometric equations from Nagy (2001).

The exposure parameter values were selected to provide for a conservative evaluation in the initial screening. Examples of these conservative assumptions include:

- All of the dietary items consumed by the receptor are obtained from the tributary and the portion of the creek adjacent to the site (i.e., an Area Use Factor [AUF] of one is assumed) at the point of maximum concentration.
- Chemicals are 100 percent bioavailable.
- Maximum food ingestion rates are used (calculated maximum ingestion rates using allometric equations were based upon the maximum adult body weight).
- Minimum adult body weights are used.

For the refined baseline estimates:

- Central tendency estimates (e.g., mean, median, or midpoint) for body weight and ingestion rates were used. Central tendency estimates for these exposure parameters are more relevant for a BERA because they better represent the characteristics of a greater proportion of the individuals in the population. Populations or communities (rather than individual organisms) were emphasized when developing the assessment endpoints for the ERA.

8.4 Effects Assessment

The effects assessment defines the methods and data used to define an adverse ecological effect. For this ERA, effects data are available from multiple lines of evidence, as follows:

- **Screening Values for Surface Water and Sediment** - Analytical data are compared to literature-based surface water and sediment screening values. Sediment pore water data are compared to surface water screening values.
- **Screening Values for Ingestion Exposures** - Food web exposure estimates are compared to literature-based ingestion-based screening values for upper trophic level receptors.
- **Bioavailability Measures** - Additional data were collected to help evaluate chemical-specific bioavailability in abiotic media.

8.4.1 Medium-Specific Screening Values

Medium-specific screening values were established for each ecologically relevant medium and chemical analyzed. Based upon the conceptual model (**Figure 6-1**), direct exposure to surface water and sediment (including pore water) are potentially complete pathways. The screening values used in the ERA considered Region 3 BTAG screening values (USEPA, 2006) as well as additional screening values available from the literature. When more than one screening value was available (e.g., fauna and flora) from a particular source for a chemical, the lowest of these values was selected. Because the salinity of Felgates Creek and the tributary exceeded 10 ppt, marine screening values were used when available; freshwater values were used when marine values were lacking. The values used in the ERA are summarized, by medium, in **Table 8-10**.

For surface water, the screening values for chemicals known to bioaccumulate in aquatic food webs were based upon the final chronic value (rather than the final residue value) as per USEPA (1996, 2009b) and Suter and Tsao (1996). The use of final chronic values is intended to protect aquatic receptors from direct exposures to chemicals in surface water, rather than from exposure via food webs. Potential risks to upper trophic level receptors from food web exposures (tissue residues) were evaluated separately using the ingestion-based screening values outlined in Section 8.4.2.

8.4.2 Ingestion Screening Values

Ingestion screening values for dietary exposures were derived for each bioaccumulative chemical evaluated in the ERA. Screening values were derived for both mammalian and avian receptors, the only two taxonomic groups for which sufficient toxicological information was generally available for the range of chemicals evaluated. Toxicological information from the literature for wildlife species most closely related to the receptor species were used, where available, but were supplemented by laboratory studies of non-wildlife species (e.g., laboratory mice) where necessary. The ingestion screening values are expressed as milligrams of the chemical per kilogram body weight of the receptor per day (mg/kg-BW/day).

Survival, growth, and reproduction were emphasized as toxicological endpoints because they are the most relevant, ecologically, to maintaining viable populations and because they are generally the most studied toxicological endpoints for ecological receptors. If several

chronic toxicological studies were available from the literature, the most appropriate study was selected for each receptor species based upon study design, study methodology, study duration, study endpoint, and test species.

Ingestion screening values were derived for both chronic NOAEL and chronic LOAEL endpoints. The applicable uncertainty factors from **Table 8-11** were applied to derive these screening values, where necessary. Because there are no threatened or endangered species known to occur in the Site 6 area, the application of additional uncertainty factors for this class of receptors is not applicable to the ERA. Taxonomic class-type uncertainty factors were also not applied because the values in **Table 8-11** were typically derived based upon data from a broad range of taxonomic groups. Maximum Acceptable Toxicant Concentrations (MATCs), defined as the geometric mean of the NOAEL and LOAEL, were also calculated. Ingestion screening values for mammals and birds are summarized in **Tables 8-12** and **8-13**, respectively.

8.4.3 Bioavailability Measures

Data collected to evaluate the potential chemical-specific bioavailability in abiotic media included:

- **Sediment** - TOC, pH, AVS/SEM, and grain size
- **Surface Water** - Dissolved metals and pH

These data are discussed, where applicable, in Section 8.5.1.

8.5 Risk Characterization

The risk characterization portion of the ERA uses the information generated during the three previous parts of the ERA (problem formulation, exposure assessment, and effects assessment) to estimate potential risks to ecological receptors. In addition to the lines of evidence that were described in Section 8.4, the following additional factors were considered during the risk characterization:

- **Essential Nutrients.** Calcium, magnesium, potassium, and sodium were excluded from consideration because they are essential macronutrients needed for normal metabolism, growth, and reproduction.

- **Background Concentrations.** Site-specific background surface water and sediment concentrations were derived from samples collected previously from the upgradient portion of Felgates Creek. Concentrations from samples collected on and adjacent to the site were directly compared with background samples.

8.5.1 Comparison With Screening Values

Chemical concentrations in surface water, sediment, and sediment pore water are compared with the corresponding screening values to derive risk estimates using the HQ method. HQs are calculated by dividing the chemical concentration in the medium by the corresponding chemical-specific screening value. HQs equal to or exceeding one indicate the potential for unacceptable risk since the chemical concentration (exposure) equals or exceeds the screening value (effect). HQs less than one indicate that unacceptable risks are unlikely. As discussed in Section 8.3.2, maximum, mean (arithmetic and geometric), and 95 percent UCL

of the arithmetic mean concentrations from the 2009 RI sampling are compared with screening values. Chemicals were excluded from further consideration if the HQ based upon the 95 percent UCL was less than one.

Surface Water

Maximum surface water concentrations are compared to screening values in **Table 8-14**. Four metals (aluminum, iron, manganese, and silver) had HQs exceeding one based upon detected concentrations in unfiltered samples. Aluminum, manganese, and silver exceeded screening values in filtered samples based upon maximum detected concentrations. No organic chemical exceeded screening values based upon a maximum detected concentration (**Table 8-14**).

Mean concentrations in surface water are compared with screening values in **Table 8-14**. Four metals (aluminum, iron, manganese, and silver) had 95 percent UCL HQs exceeding one based upon detected concentrations in unfiltered samples. Aluminum, manganese, and silver exceeded screening values in filtered samples based upon 95 percent UCL detected concentrations, although the HQs for aluminum (1.06) and manganese (1.03) were just above one and neither of these metals exceeded screening values based upon arithmetic mean concentrations. No organic chemical exceeded screening values based upon a 95 percent UCL detected concentration (**Table 8-14**).

Bioavailability Considerations

USEPA (1996) indicates that the dissolved metal fraction should be preferentially used to the total metal fraction in surface water evaluations because dissolved metal concentrations best represent the bioavailable fraction. High levels of suspended solids and sediment-adsorbed metals, which may be present in unfiltered samples, could result in overstating bioavailable surface water concentrations and thus potential exposures and risks. Most of the surface water samples were turbid to varying degrees (**Table 8-1**). Thus, the filtered (dissolved) samples better represent potential aquatic exposures. Only aluminum, manganese, and silver exceeded screening values in filtered samples based upon 95 percent UCL detected concentrations. Thus, aluminum, manganese, and silver were identified as COPCs in surface water.

Surface Sediment

Maximum sediment concentrations are compared to screening values in **Table 8-15**. Based upon this comparison, six metals (aluminum, arsenic, manganese, nickel, selenium, and vanadium) had HQs exceeding one based upon detected concentrations. Carbon disulfide, nitrobenzene, and tetryl were the only organic chemicals that exceeded screening values based upon maximum detected concentrations.

Mean concentrations in sediment are compared with screening values in **Table 8-15**. Based upon this comparison, two metals (aluminum and arsenic) had 95 percent UCL HQs exceeding one based upon detected concentrations, although the HQs for both aluminum and arsenic (1.06) were just above one and neither of these metals exceeded screening values based upon arithmetic mean concentrations. Carbon disulfide, nitrobenzene, and tetryl were the only organic chemicals that exceeded screening values based upon a 95 percent UCL detected concentration (the maximum was used for nitrobenzene and tetryl since the 95 percent UCL exceeded the maximum) (**Table 8-15**).

Bioavailability Considerations

Aluminum and arsenic are not AVS metals. Thus, AVS/SEM ratios are not applicable to these two metals. The screening value for carbon disulfide is equilibrium partitioning (EqP) based and was normalized to the mean site-specific TOC. Thus, aluminum, arsenic, and carbon disulfide were identified as COPCs in sediment.

The sediment screening value for tetryl utilized the most conservative No Observed Effect Concentration (NOEC) from Nipper et al. (2002), which was based upon fine grained sediment. However, the sediments in the creek and tributary near Site 6 are composed mostly of sand (**Table 8-2**). The NOEC value for sandy sediments from Nipper et al. (2002) is 514 µg/kg, which is higher than the maximum detected site concentration (150 µg/kg). In addition, tetryl was not one of the primary explosive compounds that drove the sediment remediation in the flume and impoundment area, and tetryl was not detected in groundwater samples collected as part of this RI. Based upon these considerations, tetryl is not retained as a COPC in sediment.

Nitrobenzene was detected in one sediment sample (SD77) at concentrations that exceeded the conservative screening value. Calculating an EqP value for nitrobenzene using the water screening value from **Table 8-10** and the measured TOC concentration at SD77 (5.03 percent; **Table 8-2**) yields an EqP value of 216 µg/kg. The concentration of nitrobenzene at SD77 is 120 µg/kg, which is less than the calculated EqP value. In addition, nitrobenzene was not one of the primary explosive compounds that drove the sediment remediation in the flume and impoundment area. Although nitrobenzene was detected in groundwater samples collected as part of this RI, it did not exceed ecological water-based screening values in groundwater samples. Based upon these considerations, nitrobenzene is not retained as a COPC in sediment.

Sediment Pore Water

Maximum sediment pore water concentrations are compared to surface water screening values in **Table 8-16**. Based upon this comparison, carbon disulfide was the only chemical that exceeded screening values based upon maximum detected concentrations. Cyclohexane and chloroethane were detected but screening values were not available.

Mean concentrations in sediment pore water are compared with screening values in **Table 8-16**. Based upon this comparison, carbon disulfide was the only chemical that exceeded screening values based upon a 95 percent UCL detected concentration (**Table 8-16**). Thus, carbon disulfide was identified as a COPC in sediment pore water, as were cyclohexane and chloroethane, which were detected but lacked screening values.

8.5.2 Food Web Exposures

Exposure doses (based upon the maximum, arithmetic mean, and 95 percent UCL concentrations) for upper trophic level receptors from exposures via the food web are compared with the corresponding ingestion-based screening values to derive risk estimates using the HQ method. HQs are calculated by dividing the exposure dose by the corresponding chemical- and receptor-specific screening value. HQs equaling or exceeding 1 indicate the potential for unacceptable risk since the dose (exposure) equals or exceeds the screening value (effect). HQs less than 1 indicate that unacceptable risks are unlikely.

Chemicals were excluded from further consideration if the HQ based upon the 95 percent UCL was less than 1 based upon the MATC.

HQs based upon maximum exposure doses for each upper trophic level receptor are listed in **Table 8-17**. Based upon a comparison to NOAELs, arsenic, chromium, copper, lead, mercury, selenium, and zinc had HQs exceeding 1 for one or more receptors.

HQs based upon arithmetic mean exposure doses for upper trophic level receptors are listed in **Table 8-18**. Based upon a comparison to NOAELs, only zinc (marsh wren) had a HQ exceeding 1. HQs did not exceed 1 based upon the LOAEL or the MATC for any receptor.

HQs based upon 95 percent UCL exposure doses for upper trophic level receptors are listed in **Table 8-19**. Based upon a comparison to NOAELs, chromium (marsh wren), mercury (belted kingfisher), and zinc (marsh wren) had HQs exceeding 1. HQs did not exceed 1 based upon the LOAEL or the MATC for any receptor. Thus, risks from food web exposures are considered acceptable.

8.5.3 Risk Evaluation

In this section, the various lines of evidence discussed in the previous section are integrated in order to evaluate the potential for unacceptable risks.

Surface Water

Aluminum, manganese, and silver were identified as COPCs in surface water (Section 8.5.1). To evaluate the potential significance of the screening value exceedances for these chemicals, site surface water concentrations were compared with site-specific background surface water concentrations (**Table 8-20**). Aluminum concentrations in filtered site samples were less than concentrations in background samples indicating that aluminum is present at background levels. Manganese concentrations were only slightly higher in site samples than in background samples (maximum ratio of 1.38).

Silver was not detected in background surface water samples, although the detection limit in these samples was about 10 times the maximum detected site concentration. Thus, it is possible that silver could be at background levels if lower detection limits were available in background samples. The marine surface water screening value for silver (0.23 µg/L) was derived from an acute toxicity value for a single species/study. Although chronic marine data are limited, chronic values for marine invertebrates range from 15 to 87 µg/L (Wood et al., 2002). Chronic values for sheepshead minnow, a marine fish, were 449 µg/L (Wood et al., 2002). Chronic values for summer flounder were unbounded (<12 µg/L) (Wood et al., 2002). Maximum detected site concentrations of silver (both total and dissolved) were 1.1 µg/L, which are well below the bounded toxicity values.

Based upon this evaluation, no chemicals were identified as COCs in surface water and risks from exposure to this medium are considered acceptable.

Surface Sediment

Aluminum, arsenic, and carbon disulfide were identified as COPCs in sediment (Section 8.5.1). Site sediment concentrations for these chemicals are compared with site-specific background sediment concentrations in **Table 8-21**. Based upon this comparison, mean concentrations in site samples were similar to mean concentrations in background

samples for all COPCs, indicating that all of these chemicals are present at background levels. Based upon this evaluation, no chemicals were identified as COCs in sediment and risks from exposure to this medium are considered acceptable.

Sediment Pore Water

Carbon disulfide, cyclohexane, and chloroethane were identified as COPCs in sediment pore water (Section 8.5.1). No background pore water data were available. However, carbon disulfide, which can be naturally produced in wetland environments, was consistent with background in bulk sediment samples. Thus, it is expected that pore water concentrations of carbon disulfide would also be at background levels.

The acute toxicity of cyclohexane (based upon available 4-day LC_{50} values for surface water exposures) to marine organisms varies from 2,400 µg/L (shrimp) to 1,420,000 µg/L (marine bivalves) (AQUIRE, 2010). Applying an uncertainty factor of 100 to the lowest of these numbers yields a screening value of 24 µg/L, which is well above the maximum detected concentration in pore water (1.0 µg/L).

Screening values for other chlorinated ethanes ranged from 47 to 1,130 µg/L (**Table 8-10**). These screening values are well above the maximum detected concentration of chloroethane in sediment pore water (0.14 µg/L).

Based upon this evaluation, no chemicals were identified as COCs in sediment pore water and risks from exposure to this medium are considered acceptable.

Food Web Exposures

No chemical had a MATC HQ exceeding one based upon the 95 percent UCL exposure dose. Thus, risks from food web exposures are considered acceptable.

8.5.4 Risk Summary and Conclusions

No COCs were identified for surface water, sediment, or sediment pore water at Site 6. Similarly, no COCs were identified for food web exposures. Thus, risks to ecological receptors are considered acceptable. The source areas at Site 6 have been eliminated or controlled and groundwater is not a significant continuing source to the aquatic habitats adjacent to this site. The 2009 data collected for this RI indicate that chemicals are not migrating to adjacent aquatic habitats via groundwater at concentrations that present an unacceptable risk to ecological receptors. No further action is recommended for ecological receptors at Site 6.

8.6 Uncertainties

Uncertainties are present in all risk assessments because of the limitations of the available data and the need to make certain assumptions and extrapolations based upon incomplete information. The uncertainties in this ERA are mainly attributable to the following factors:

- Reporting Limits - Reporting limits for some undetected analytes exceeded applicable screening values in some media. **Table 8-22** summarize these constituents, by medium, and reports both the ratio of the minimum and maximum reporting limits to the screening value as well as the ratio of the mean value (calculated using one-half of the reporting limit for each sample) to the screening value. Because these constituents were

not detected, they are not known to be present on the site but the potential for unacceptable risks cannot be totally discounted because the reporting limits are higher than the screening values. The magnitude of the ratios can be used to qualitatively evaluate the magnitude of the associated uncertainty (e.g., there is more uncertainty in terms of the potential for risk for a ratio of 100 relative to a ratio of 10). In surface water, mean reporting limits for the one relevant chemical (nickel) were less than 2.5 times screening values. In sediment, mean reporting limits exceeded screening values only for two chemicals by ratios of 2.5 (2,4-DNT) and 15 (1,3-dinitrobenzene).

In summary, there were no chemicals with very high mean ratios, suggesting that the associated uncertainties are relatively low. Because standard analytical methods were used and the sample reporting limits were not elevated relative to the method reporting limits for the vast majority of samples and analytes, these uncertainties are considered acceptable and are unlikely to affect the conclusions of the ERA.

- Duplicate Analyses - When evaluating samples with field duplicates, the value used in the ERA was always the detect when one result was a detect and the duplicate was a non-detect, regardless of whether or not the non-detected value was higher. In these cases, the use of the detect has less uncertainty since it represents an actual measured value (versus an upper limit bound) and the two samples will have identical or similar reporting limits.
- Selection of COPCs - Chemicals without available screening values for a medium were not retained as COPCs unless they were detected. These uncertainties are unlikely to affect the conclusions of the ERA since these chemicals are not known to be present on the site as they were not detected in site samples.
- Ingestion Screening Values - Data on the toxicity of many chemicals to the receptor species were sparse or lacking, requiring the extrapolation of data from other wildlife species or from laboratory studies with non-wildlife species. This is a typical limitation and extrapolation for ERAs because so few wildlife species have been tested directly for most chemicals. The uncertainties associated with toxicity extrapolation were minimized through the selection of the most appropriate test species for which suitable toxicity data were available. The factors considered in selecting a test species to represent a receptor species included taxonomic relatedness, trophic level, foraging method, and similarity of diet. It is difficult to predict if these extrapolations would result in overestimating or underestimating potential risks.

  A second uncertainty related to the derivation of ingestion screening values applies to metals. Most of the toxicological studies on which the ingestion screening values for metals were based used forms of the metal (such as salts) that have high water solubility and high bioavailability to receptors. Because the analytical samples on which site-specific exposure estimates were based measured total metal, regardless of form, and these highly bioavailable forms are expected to compose only a fraction of the total metal concentration, this is likely to result in an overestimation of potential risks for these chemicals but not to the extent that it would unduly impact the conclusions of the ERA.

A third source of uncertainty related to the derivation of ingestion-based screening values applies to mercury and selenium. The ingestion-based screening values used for these two metals were based on organometallic (methylated) forms. Screening values for inorganic forms tend to be substantially higher. Given that inorganic forms likely contribute significantly to the total mercury and selenium, use of screening values based on organometallic forms tends to make the screening values for these metals extremely conservative and likely overestimates potential risk.

- Chemical Mixtures - Information on the toxicological effects of chemical interactions is generally lacking for ecological receptors, which required (as is standard for ERAs) that the chemicals be evaluated on a compound-by-compound basis during the comparison to screening values. This could result in an underestimation of risk (if there are additive or synergistic effects among chemicals) or an overestimation of risks (if there are antagonistic effects among chemicals).

- Receptor Species Selection - Reptiles and amphibians were selected as receptors in the ERA but were not evaluated quantitatively even when exposure pathways were likely to be complete. For food web exposures, these taxonomic groups were evaluated using other fauna (birds and mammals) as surrogates due to the general lack of taxon-specific ingestion-based toxicological data. This represents an uncertainty in the ERA. However, amphibians are not expected to be major components of the biotic community at the site due to salinity factors (all measured salinities in the tributary and creek exceeded 10 ppt), minimizing the potential impacts of this uncertainty on the conclusions of the ERA.

  It was also assumed that reptiles and amphibians were not exposed to significantly higher concentrations of chemicals and were not more sensitive to chemicals than other receptor species evaluated in the ERA. This assumption was a source of uncertainty in the ERA. Based upon limited direct comparisons of toxicity, amphibians are generally more sensitive to metals relative to fish in water exposures, but not more sensitive to organic chemicals than fish (Birge et al., 2000). For sediment exposures, amphibian-based NOEC values are higher than typical sediment screening values from the literature (such as the ones used in this ERA) that are based upon data from other aquatic receptors for selected metals (NAVFAC, 2004). There are few comparable data for reptiles.

- Food Web Exposure Modeling - Chemical concentrations in aquatic food items (plants, benthic invertebrates, and fish) were modeled from measured media concentrations and were not directly measured. The use of generic, literature-derived exposure models and bioaccumulation factors introduces some uncertainty into the resulting estimates. The values selected and methodology employed were intended to provide a conservative (SERA) or reasonable (Step 3A) estimate of potential food web exposure concentrations.

  Another source of uncertainty is the use of default assumptions for exposure parameters such as BCFs and BAFs. Although BCFs or BAFs for many bioaccumulative chemicals were readily available from the literature and were used in the ERA, the use of a default factor of 1.0 to estimate the concentration of some chemicals in receptor prey items is a source of uncertainty.

Area use factors were assumed to equal one. This is a conservative assumption since a significant percentage of each upper trophic level receptor species' time could be spent foraging off-site in unimpacted areas or in areas where chemical concentrations are expected to be significantly lower.

The modeling of tissue concentrations in wetland/aquatic plants only addressed tissue concentrations in the above-ground vegetative portions of plants. There are a number of ecological receptors, such as the muskrat, that ingest the below-ground portions of plants. There may be differences in contaminant concentrations between these two portions of plants. However, exposure for these types of receptors is typically more a function of the larger amount of incidental sediment they ingest (which is included in the food web model) rather than a higher concentration of chemicals in the plants. For example, Baes et al. (1984) provide soil bioconcentration factors (Bv) for the vegetative portion of plants and values (Br) for the reproductive portion of plants, which includes tubers. Br values are less than or equal to Bv values for arsenic, mercury, and selenium, the three chemicals whose maximum HQs exceeded one for the muskrat (**Table 8-17**). Thus, the process used in the BERA is likely to be representative of exposures from the ingestion of plant material from both above-ground and below-ground plant parts.

- Total Versus Dissolved Metals - USEPA guidance (USEPA, 1996) indicates that the dissolved metal fraction should be preferentially used to the total metal fraction in surface water screening. Both total and dissolved concentrations were used in the ERA for the surface water screen. High levels of suspended solids and sediment-adsorbed metals would result in overstating bioavailable surface water concentrations and thus potential exposures and risks.

- Mean Versus Maximum Media Concentrations - As is typical in an ERA, a finite number of samples of environmental media are used to develop the exposure estimates. The maximum measured concentration provides a conservative estimate for immobile biota or those with a limited home range. The most realistic exposure estimates for mobile species with relatively large home ranges and for species populations (even those that are immobile or have limited home ranges) are those based upon the mean chemical concentrations in each medium to which these receptors are exposed. This is reflected in the wildlife dietary exposure models contained in the *Wildlife Exposure Factors Handbook* (USEPA, 1993c), which specify the use of average media concentrations. Given the mobility of the upper trophic level receptor species used in the ERA, the use of maximum chemical concentrations (rather than mean concentrations) in the SERA to estimate the exposure via food webs is very conservative. This conservatism was reduced to more realistic levels in the values selected for use in the BERA evaluation. The 95 percent UCL of the arithmetic mean was used quantitatively in the BERA portion of this ERA to represent the average exposure scenarios.

- Comparisons to Background Concentrations - Background concentrations were used to judge the site-relatedness of individual chemicals. If site concentrations were consistent with background levels, it was assumed that the concentrations were not related to known site-related source areas. There exists the possibility that concentrations below background were indeed site-related, rendering the assumption false. However, the potential impact of this possibility is minimal since chemicals at concentrations

consistent with background should exhibit no different ecological effects than commonly occurring in areas not affected by releases, regardless of their source.

- As discussed in Section 8.2.2, background conditions were represented by six collocated surface water and sediment samples collected in December 2007 from the upgradient portions of Felgates Creek as part of the evaluation of Sites 4, 21, and 22, and Sites 8 and 34 (SSA-14), where they were scoped as designed background samples (the number of samples was considered adequate to represent background conditions). The salinities of Site 6 samples (12 to 18 ppt) were within the range of salinities measured in the background samples (5 to 28 ppt), suggesting that the background locations are also representative of conditions near Site 6. In addition, these data are recent enough (approximately three years old) to be relevant to this assessment.

TABLE 8-1
Water Column Parameter Measurements
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Area	Sample ID	Date	Temperature (°C)	pH	Conductivity (mS/cm)	Salinity (ppt)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (MV)
Felgates Creek - Upgradient	YS06-SW/SD68-0809	8/4/2009	29.9	7.77	28.0	17.0	10.7	7.27	164
Felgates Creek - Upgradient	YS06-SW/SD69-0809	8/4/2009	29.8	7.70	28.2	17.0	0	7.40	169
Felgates Creek - Downgradient	YS06-SW/SD70-0809	8/4/2009	28.3	5.58	29.2	18.0	3.1	6.64	228
Tributary	YS06-SW/SD71-0809	8/4/2009	28.3	6.64	27.6	17.0	28.8	6.30	203
Tributary	YS06-SW/SD72-0809	8/4/2009	29.2	7.40	27.5	17.0	37.3	7.30	179
Tributary	YS06-SW/SD73-0809	8/5/2009	29.0	5.83	24.8	15.0	7.9	7.08	235
Tributary	YS06-SW/SD74-0809	8/5/2009	30.6	6.78	24.8	15.0	59.4	7.18	183
Tributary	YS06-SW/SD75-0809	8/5/2009	30.4	7.34	24.5	15.0	2.5	7.04	169
Tributary	YS06-SW/SD76-0809	8/6/2009	27.2	5.73	22.3	14.0	34.4	4.90	238
Tributary	YS06-SW/SD77-0809	8/6/2009	27.2	6.45	22.1	14.0	30.7	5.78	199
Tributary	YS06-SW/SD78-0809	8/6/2009	26.5	6.80	20.0	12.0	0	4.98	149
Background - Felgates Creek	YBKG-SW01-1207	12/10/2007	17.9	7.59	9.60	5.00	166	9.67	79
Background - Felgates Creek	YBKG-SW02-1207	12/14/2007	15.9	8.01	36.5	22.0	0	9.67	165
Background - Felgates Creek	YBKG-SW03-1207	12/14/2007	15.9	7.94	33.0	21.0	0	9.69	204
Background - Felgates Creek	YBKG-SW04-1207	12/11/2007	15.4	6.39	32.0	20.0	25.6	11.30	216
Background - Felgates Creek	YBKG-SW05-1207	12/11/2007	15.6	7.87	29.4	18.0	46.6	10.30	214
Background - Felgates Creek	YBKG-SW06-1207	12/14/2007	16.0	8.00	4.56	28.0	0	9.91	209

NS - Not Sampled

TABLE 8-2

Physical Sediment Parameter Measurements

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Area	Sample ID	Date	Depth (inches)	Total Organic Carbon mg/kg	Total Organic Carbon percent	pH	SEM/AVS Ratio	Grain Size (percent) Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt/ Clay
Felgates Creek - Upgradient	YS06-SD68-0809	8/4/2009	0-4	13,810	1.38	8.10	0.08	1.90	14.20	47.10	32.90	3.90
Felgates Creek - Upgradient	YS06-SD68P-0809	8/4/2009	0-4	NS	NS	NS	0.03	NS	NS	NS	NS	NS
Felgates Creek - Upgradient	YS06-SD69-0809	8/4/2009	0-4	9,428	0.94	7.70	0.05	2.10	15.60	28.40	48.10	5.80
Felgates Creek - Downgradient	YS06-SD70-0809	8/4/2009	0-4	11,250	1.13	7.60	0.15	1.20	17.60	36.30	37.90	7.00
Tributary	YS06-SD71-0809	8/4/2009	0-4	22,370	2.24	7.60	0.15	1.90	32.80	42.00	18.50	4.80
Tributary	YS06-SD72-0809	8/4/2009	0-4	20,700	2.07	7.60	0.13	5.80	33.90	36.80	18.20	5.30
Tributary	YS06-SD73-0809	8/5/2009	0-4	23,130	2.31	7.70	0.03	1.60	31.80	40.60	20.10	5.90
Tributary	YS06-SD74-0809	8/5/2009	0-4	25,810	2.58	7.20	0.26	2.30	27.90	42.30	24.80	2.70
Tributary	YS06-SD74P-0809	8/5/2009	0-4	NS	NS	NS	0.46	NS	NS	NS	NS	NS
Tributary	YS06-SD75-0809	8/5/2009	0-4	33,390	3.34	8.10	0.15	2.70	31.00	41.00	19.60	5.70
Tributary	YS06-SD76-0809	8/6/2009	0-4	25,580	2.56	7.80	0.05	0.98	25.97	41.80	23.05	8.20
Tributary	YS06-SD77-0809	8/6/2009	0-4	50,270	5.03	7.30	0.01	2.12	27.61	35.71	26.26	8.30
Tributary	YS06-SD78-0809	8/6/2009	0-4	38,460	3.85	7.20	0.60	1.17	4.69	17.58	63.47	13.09
Background - Felgates Creek	YBKG-SD01-1207	12/10/2007	0-4	32,400	3.24	7.30	0.28	1.10	0.70	11.20	9.10	77.90
Background - Felgates Creek	YBKG-SD01P-1207	12/10/2007	0-4	NS	NS	NS	0.24	NS	NS	NS	NS	NS
Background - Felgates Creek	YBKG-SD02-1207	12/14/2007	0-4	64,700	6.47	6.90	-- a	0.00	0.90	14.00	5.50	79.60
Background - Felgates Creek	YBKG-SD03-1207	12/14/2007	0-4	54,200	5.42	6.70	0.05	0.00	1.50	9.90	5.10	83.50
Background - Felgates Creek	YBKG-SD04-1207	12/11/2007	0-4	64,100	6.41	7.00	0.14	0.00	1.90	17.70	1.70	78.70
Background - Felgates Creek	YBKG-SD05-1207	12/11/2007	0-4	68,400	6.84	6.70	0.43	0.00	1.30	14.80	3.20	80.70
Background - Felgates Creek	YBKG-SD06-1207	12/14/2007	0-4	43,700	4.37	7.30	0.27	0.00	0.70	4.70	3.10	91.50

a - AVS not detected; ratio not calculated

NS - Not Sampled

Shaded cells indicate field duplicates

TABLE 8-3

Samples Used in the Ecological Risk Assessment

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Station ID	Sample ID	Sample Date	Depth	Area
Surface Water				
YS06-SW068	YS06-SW68-0809	8/4/2009	--	Felgates Creek - Upgradient
YS06-SW068	YS06-SW68P-0809	8/4/2009	--	Felgates Creek - Upgradient
YS06-SW069	YS06-SW69-0809	8/4/2009	--	Felgates Creek - Upgradient
YS06-SW070	YS06-SW70-0809	8/4/2009	--	Felgates Creek - Downgradient
YS06-SW071	YS06-SW71-0809	8/4/2009	--	Tributary
YS06-SW072	YS06-SW72-0809	8/4/2009	--	Tributary
YS06-SW073	YS06-SW73-0809	8/5/2009	--	Tributary
YS06-SW074	YS06-SW74-0809	8/5/2009	--	Tributary
YS06-SW074	YS06-SW74P-0809	8/5/2009	--	Tributary
YS06-SW075	YS06-SW75-0809	8/5/2009	--	Tributary
YS06-SW076	YS06-SW76-0809	8/6/2009	--	Tributary
YS06-SW077	YS06-SW77-0809	8/6/2009	--	Tributary
YS06-SW078	YS06-SW78-0809	8/6/2009	--	Tributary
YBKG-SW01	YBKG-SW01-1207	12/10/2007	--	Background - Felgates Creek
YBKG-SW01	YBKG-SW01P-1207	12/10/2007	--	Background - Felgates Creek
YBKG-SW02	YBKG-SW02-1207	12/14/2007	--	Background - Felgates Creek
YBKG-SW03	YBKG-SW03-1207	12/14/2007	--	Background - Felgates Creek
YBKG-SW04	YBKG-SW04-1207	12/11/2007	--	Background - Felgates Creek
YBKG-SW05	YBKG-SW05-1207	12/11/2007	--	Background - Felgates Creek
YBKG-SW06	YBKG-SW06-1207	12/14/2007	--	Background - Felgates Creek
Pore Water				
YS06-WN01	YS06-WN01-0909	9/1/2009	--	Tributary (colocated with YS06-SW/SD74)
YS06-WN02	YS06-WN02-0909	9/1/2009	--	Tributary (colocated with YS06-SW/SD76)
YS06-WN03	YS06-WN03-0909	9/1/2009	--	Impoundment
YS06-WN04	YS06-WN04-0909	9/1/2009	--	Tributary (colocated with YS06-SW/SD78)
YS06-WN04	YS06-WN04P-0909	9/1/2009	--	Tributary (colocated with YS06-SW/SD78)
Sediment				
YS06-SD068	YS06-SD68-0809	8/4/2009	0-4	Felgates Creek - Upgradient
YS06-SD068	YS06-SD68P-0809	8/4/2009	0-4	Felgates Creek - Upgradient
YS06-SD069	YS06-SD69-0809	8/4/2009	0-4	Felgates Creek - Upgradient

Shaded samples are field duplicates

TABLE 8-3

Samples Used in the Ecological Risk Assessment

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Station ID	Sample ID	Sample Date	Depth	Area
YS06-SD070	YS06-SD70-0809	8/4/2009	0-4	Felgates Creek - Downgradient
YS06-SD071	YS06-SD71-0809	8/4/2009	0-4	Tributary
YS06-SD072	YS06-SD72-0809	8/4/2009	0-4	Tributary
YS06-SD073	YS06-SD73-0809	8/5/2009	0-4	Tributary
YS06-SD074	YS06-SD74-0809	8/5/2009	0-4	Tributary
YS06-SD074	YS06-SD74P-0809	8/5/2009	0-4	Tributary
YS06-SD075	YS06-SD75-0809	8/5/2009	0-4	Tributary
YS06-SD076	YS06-SD76-0809	8/6/2009	0-4	Tributary
YS06-SD077	YS06-SD77-0809	8/6/2009	0-4	Tributary
YS06-SD078	YS06-SD78-0809	8/6/2009	0-4	Tributary
YBKG-SD01	YBKG-SD01-1207	12/10/2007	0-4	Background - Felgates Creek
YBKG-SD01	YBKG-SD01P-1207	12/10/2007	0-4	Background - Felgates Creek
YBKG-SD02	YBKG-SD02-1207	12/14/2007	0-4	Background - Felgates Creek
YBKG-SD03	YBKG-SD03-1207	12/14/2007	0-4	Background - Felgates Creek
YBKG-SD04	YBKG-SD04-1207	12/11/2007	0-4	Background - Felgates Creek
YBKG-SD05	YBKG-SD05-1207	12/11/2007	0-4	Background - Felgates Creek
YBKG-SD06	YBKG-SD06-1207	12/14/2007	0-4	Background - Felgates Creek

Shaded samples are field duplicates

TABLE 8-4

Assessment Endpoints, Risk Hypotheses, and Measurement Endpoints

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint	Receptor
Survival, growth, and reproduction of benthic invertebrate communities	Are site-related chemical concentrations in surface water and sediment sufficient to adversely effect benthic invertebrate communities?	Comparison of chemical concentrations in surface water and sediment with medium-specific screening values	Benthic invertebrates
Survival, growth, and reproduction of aquatic plant communities	Are site-related chemical concentrations in surface water and sediment sufficient to adversely affect aquatic plant communities?	Comparison of chemical concentrations in surface water and sediment with medium-specific screening values	Aquatic plants
Survival, growth, and reproduction of fish communities	Are site-related chemical concentrations in surface water and sediment sufficient to adversely effect fish communities?	Comparison of chemical concentrations in surface water and sediment with medium-specific screening values	Fish
Survival, growth, and reproduction of aquatic reptile populations	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to aquatic reptile populations?	Comparison of chemical concentrations in surface water and sediment with medium-specific screening values	Reptiles
		Evidence of potential risk to other upper trophic level aquatic receptors evaluated in the ERA	
Survival, growth, and reproduction of aquatic amphibian populations	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to aquatic amphibian populations?	Comparison of chemical concentrations in surface water and sediment with medium-specific screening values	Amphibians
		Evidence of potential risk to other upper trophic level aquatic receptors evaluated in the ERA	
Survival, growth, and reproduction of insectivorous bird populations	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to avian receptor populations that may consume benthic invertebrates from the site?	Comparison of modeled dietary intakes using sediment concentrations with literature-based ingestion screening values; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Marsh wren

TABLE 8-4

Assessment Endpoints, Risk Hypotheses, and Measurement Endpoints

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Assessment Endpoint	Risk Hypothesis	Measurement Endpoint	Receptor
Survival, growth, and reproduction of piscivorous bird populations	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to avian receptor populations that may consume fish from the site?	Comparison of modeled dietary intakes using sediment concentrations with literature-based ingestion screening values; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Great blue heron Belted kingfisher
Survival, growth, and reproduction of omnivorous bird populations	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to avian receptor populations that may consume aquatic prey from the site?	Comparison of modeled dietary intakes using sediment concentrations with literature-based ingestion screening values; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Mallard
Survival, growth, and reproduction of herbivorous mammal populations	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian receptor populations that may consume aquatic plants from the site?	Comparison of modeled dietary intakes using sediment concentrations with literature-based ingestion screening values; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Muskrat
Survival, growth, and reproduction of omnivorous mammal populations	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian receptor populations that may consume aquatic prey from the site?	Comparison of modeled dietary intakes using sediment concentrations with literature-based ingestion screening values; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Raccoon
Survival, growth, and reproduction of piscivorous mammal populations	Are site-related chemical concentrations in surface water and sediment sufficient to cause adverse effects (on growth, survival, or reproduction) to mammalian receptor populations that may consume fish from the site?	Comparison of modeled dietary intakes using sediment concentrations with literature-based ingestion screening values; ratios >1 based upon the NOAEL-LOAEL range indicate an effect	Mink

TABLE 8-5

Bioaccumulative Chemicals List and Log K_{ow} Values for Relevant Chemicals

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Chemical	Log K_{ow} Range	Selected log K_{ow}	Reference
Inorganics			
Arsenic	-- - --	--	--
Cadmium	-- - --	--	--
Chromium	-- - --	--	--
Copper	-- - --	--	--
Lead	-- - --	--	--
Mercury	-- - --	--	--
Nickel	-- - --	--	--
Selenium	-- - --	--	--
Silver	-- - --	--	--
Zinc	-- - --	--	--
Volatile Organics			
1,1,2,2-Tetrachloroethane	2.31 - 2.64	2.39	USEPA 1995a
1,2,4-Trichlorobenzene	3.89 - 4.23	4.01	USEPA 1995a
1,2-Dichlorobenzene	3.20 - 3.61	3.43	USEPA 1995a
1,3-Dichlorobenzene	-- - --	3.50	USEPA 1996a
1,4-Dichlorobenzene	3.26 - 3.62	3.42	USEPA 1995a

TABLE 8-6

Sediment Bioaccumulation Factors For Plants, Benthic Invertebrates, and Fish - Screening

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Chemical	Sediment-Plant BCF (dry weight)		Sediment-Invertebrate BAF (dry weight)		Sediment-Fish BAF (dry weight)	
	Value	Reference	Value	Reference	Value	Reference
Inorganics						
Arsenic	1.103	Bechtel Jacobs 1998a	0.690	Bechtel Jacobs 1998b	0.126	Pascoe et al. 1996
Cadmium	3.250	Bechtel Jacobs 1998a	3.073	Bechtel Jacobs 1998b	0.164	Pascoe et al. 1996
Chromium	0.084	Bechtel Jacobs 1998a	0.186	Bechtel Jacobs 1998b	0.038	Krantzberg and Boyd 1992
Copper	0.625	Bechtel Jacobs 1998a	7.957	Bechtel Jacobs 1998b	0.100	Krantzberg and Boyd 1992
Lead	0.468	Bechtel Jacobs 1998a	0.326	Bechtel Jacobs 1998b	0.070	Krantzberg and Boyd 1992
Mercury	5.000	Bechtel Jacobs 1998a	2.868	Bechtel Jacobs 1998b	4.580	Cope et al. 1990
Nickel	1.411	Bechtel Jacobs 1998a	0.214	Bechtel Jacobs 1998b	1.000	--
Selenium	3.012	Bechtel Jacobs 1998a	1.000	--	1.000	--
Silver	0.037	Bechtel Jacobs 1998a	0.180	Hirsch 1998	1.000	--
Zinc	1.820	Bechtel Jacobs 1998a	4.759	Bechtel Jacobs 1998b	0.147	Pascoe et al. 1996
Volatile Organics						
1,1,2,2-Tetrachloroethane	2.9950	USEPA 2007	1.000	--	1.000	--
1,2,4-Trichlorobenzene	1.2747	USEPA 2007	0.480	Oliver and Niimi 1988	0.074	Parkerton et al. 1993
1,2-Dichlorobenzene	1.7307	USEPA 2007	1.000	--	0.085	Parkerton et al. 1993
1,3-Dichlorobenzene	1.6680	USEPA 2007	1.000	--	0.085	Parkerton et al. 1993
1,4-Dichlorobenzene	1.7399	USEPA 2007	1.000	--	0.085	Parkerton et al. 1993

TABLE 8-7

Sediment Bioaccumulation Factors For Plants, Benthic Invertebrates, and Fish - Baseline

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Chemical	Sediment-Plant BCF (dry weight)			Sediment-Invertebrate BAF (dry weight)			Sediment-Fish BAF (dry weight)		
	Value		Reference	Value		Reference	Value		Reference
Inorganics									
Arsenic	0.037	a	Bechtel Jacobs 1998a	0.466	a	Bechtel Jacobs 1998b	0.126	b	Pascoe et al. 1996
Cadmium	0.514	a	Bechtel Jacobs 1998a	0.679	a	Bechtel Jacobs 1998b	0.164	b	Pascoe et al. 1996
Chromium	0.048	a	Bechtel Jacobs 1998a	0.083	c	Bechtel Jacobs 1998b	0.038	b	Krantzberg and Boyd 1992
Copper	0.123	a	Bechtel Jacobs 1998a	0.919	a	Bechtel Jacobs 1998b	0.100	b	Krantzberg and Boyd 1992
Lead	0.038	a	Bechtel Jacobs 1998a	0.080	c	Bechtel Jacobs 1998b	0.070	b	Krantzberg and Boyd 1992
Mercury	0.344	a	Bechtel Jacobs 1998a	1.077	a	Bechtel Jacobs 1998b	3.250	b	Cope et al. 1990
Nickel	0.034	a	Bechtel Jacobs 1998a	0.134	c	Bechtel Jacobs 1998b	1.000	d	--
Selenium	0.567	a	Bechtel Jacobs 1998a	1.000	d	--	1.000	d	--
Silver	0.013	a	Bechtel Jacobs 1998a	0.180	b	Hirsch 1998	1.000	d	--
Zinc	0.358	a	Bechtel Jacobs 1998a	0.954	a	Bechtel Jacobs 1998b	0.147	b	Pascoe et al. 1996
Volatile Organics									
1,1,2,2-Tetrachloroethane	2.9950	e	USEPA 2007	1.000	d	--	1.000	d	--
1,2,4-Trichlorobenzene	1.2747	e	USEPA 2007	0.260	b	Oliver and Niimi 1988	0.074	c	Parkerton et al. 1993
1,2-Dichlorobenzene	1.7307	e	USEPA 2007	1.000	d	--	0.085	c	Parkerton et al. 1993
1,3-Dichlorobenzene	1.6680	e	USEPA 2007	1.000	d	--	0.085	c	Parkerton et al. 1993
1,4-Dichlorobenzene	1.7399	e	USEPA 2007	1.000	d	--	0.085	c	Parkerton et al. 1993

a - Geometric mean; b - Arithmetic mean; c - Median; d - Assumed (default) value; e - Calculated (modeled) value

TABLE 8-8

Exposure Parameters for Upper Trophic Level Ecological Receptors - Screening

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

	Body Weight (kg)		Food Ingestion Rate (kg/day - dry)		Dietary Composition (percent)				Sediment Ingestion (percent)	
Receptor	**Value**	**Reference**	**Value**	**Reference**	**Fish**	**Aquatic Plants**	**Benthic Invert.**	**Reference**	**Value**	**Reference**
Birds										
Belted kingfisher	0.125	Dunning 1993	0.0262	USEPA 1993	84.0	0	16.0	USEPA 1993	0	Sample and Suter 1994
Great blue heron	2.10	Butler 1992	0.1356	allometric equation (Nagy 2001)[a]	100	0	0	USEPA 1993; Quinney and Smith 1980	0	Sample and Suter 1994
Mallard	0.612	Bellrose 1980	0.0717	allometric equation (Nagy 2001)[b]	0	86.7	10.0	Palmer 1976	3.3	Beyer et al. 1994
Marsh wren	0.010	Dunning 1993	0.0030	USEPA 1993	0	0	95.0	USEPA 1993	5.0	Assumed based on diet
Mammals										
Mink	0.726	Silva and Downing 1995	0.0349	USEPA 1993	100.0	0.0	0.0	USEPA 1993	0	Sample and Suter 1994
Muskrat	0.750	USEPA 1993	0.0765	USEPA 1993	0	90.6	0	USEPA 1993	9.4	Beyer et al. 1994 (raccoon)
Raccoon	4.23	Silva and Downing 1995	0.1307	Conover 1989	7.0	40.0	43.6	USEPA 1993	9.4	Beyer et al. 1994

a - All birds equation: $(0.638*((BW*1000)^{0.685})/1000$ (maximum body weight used: 2.50 kg)

b - Omnivorous birds equation: $(0.670*((BW*1000)^{0.627}))/1000$ (maximum body weight used: 1.724 kg)

TABLE 8-9

Exposure Parameters for Upper Trophic Level Ecological Receptors - Baseline

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

	Body Weight (kg)		Food Ingestion Rate (kg/day - dry)		Dietary Composition (percent)				Sediment Ingestion (percent)	
Receptor	**Value**	**Reference**	**Value**	**Reference**	**Fish**	**Aquatic Plants**	**Benthic Invert.**	**Reference**	**Value**	**Reference**
Birds										
Belted kingfisher	0.148	Dunning 1993	0.0180	USEPA 1993	84.0	0	16.0	USEPA 1993	0	Sample and Suter 1994
Great blue heron	2.23	Quinney 1982	0.1254	allometric equation (Nagy 2001)[a]	100	0	0	USEPA 1993; Quinney and Smith 1980	0	Sample and Suter 1994
Mallard	1.18	Bellrose 1980	0.0564	allometric equation (Nagy 2001)[b]	0	86.7	10.0	Palmer 1976	3.3	Beyer et al. 1994
Marsh wren	0.011	Dunning 1993	0.0025	USEPA 1993	0	0	95.0	USEPA 1993	5.0	Assumed based on diet
Mammals										
Mink	0.777	Silva and Downing 1995	0.0266	USEPA 1993	100	0.0	0.0	USEPA 1993	0	Sample and Suter 1994
Muskrat	1.17	Silva and Downing 1995	0.0596	USEPA 1993	0	90.6	0	USEPA 1993	9.4	Beyer et al. 1994 (raccoon)
Raccoon	5.94	Silva and Downing 1995	0.1031	Conover 1989	7.0	40.0	43.6	USEPA 1993	9.4	Beyer et al. 1994

a - All birds equation: $(0.638*((BW*1000)^{0.685})/1000$

b - Omnivorous birds equation: $(0.670*((BW*1000)^{0.627}))/1000$

TABLE 8-10
Medium-Specific Screening Values
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Chemical	Group	Screening Value	Units	Reference	Type	TOC (percent)
Surface Water						
Aluminum	Inorganics	87.0	ug/L	USEPA 2009	Freshwater	
Antimony	Inorganics	500	ug/L	USEPA 2006	Marine	
Arsenic	Inorganics	36.0	ug/L	USEPA 2009	Marine	
Barium	Inorganics	200	ug/L	Buchman 2008	Marine	
Beryllium	Inorganics	100	ug/L	Buchman 2008	Marine	
Cadmium (total)	Inorganics	8.85	ug/L	USEPA 2009	Marine	
Cadmium (dissolved)	Inorganics	8.80	ug/L	USEPA 2009	Marine	
Chromium (total)	Inorganics	50.4	ug/L	USEPA 2009	Marine	
Chromium (dissolved)	Inorganics	50.0	ug/L	USEPA 2009	Marine	
Cobalt	Inorganics	23.0	ug/L	Suter and Tsao 1996	Freshwater	
Copper (total)	Inorganics	3.73	ug/L	USEPA 2009	Marine	
Copper (dissolved)	Inorganics	3.10	ug/L	USEPA 2009	Marine	
Cyanide	Inorganics	1.00	ug/L	USEPA 2009	Marine	
Iron	Inorganics	1,000	ug/L	USEPA 2009	Freshwater	
Lead (total)	Inorganics	8.52	ug/L	USEPA 2009	Marine	
Lead (dissolved)	Inorganics	8.10	ug/L	USEPA 2009	Marine	
Manganese	Inorganics	100	ug/L	Buchman 2008	Marine	
Mercury (total)	Inorganics	1.11	ug/L	USEPA 2009	Marine	
Mercury (dissolved)	Inorganics	0.94	ug/L	USEPA 2009	Marine	
Nickel (total)	Inorganics	8.28	ug/L	USEPA 2009	Marine	
Nickel (dissolved)	Inorganics	8.20	ug/L	USEPA 2009	Marine	
Selenium (total)	Inorganics	71.1	ug/L	USEPA 2009	Marine	
Selenium (dissolved)	Inorganics	71.0	ug/L	USEPA 2009	Marine	
Silver	Inorganics	0.23	ug/L	USEPA 2001	Marine	
Thallium	Inorganics	21.3	ug/L	USEPA 2001	Marine	
Vanadium	Inorganics	50.0	ug/L	Buchman 2008	Marine	
Zinc (total)	Inorganics	85.6	ug/L	USEPA 2009	Marine	
Zinc (dissolved)	Inorganics	81.0	ug/L	USEPA 2009	Marine	
1,3,5-Trinitrobenzene	Explosives	15.0	ug/L	Nipper et al. 2001	Marine	
1,3-Dinitrobenzene	Explosives	180	ug/L	Nipper et al. 2001	Marine	

TABLE 8-10

Medium-Specific Screening Values

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Chemical	Group	Screening Value	Units	Reference	Type	TOC (percent)
2,4,6-Trinitrotoluene	Explosives	100	ug/L	USEPA 2006	Marine	
2,4-Dinitrotoluene	Explosives	480	ug/L	Nipper et al. 2001	Marine	
2,6-Dinitrotoluene	Explosives	1,000	ug/L	Nipper et al. 2001	Marine	
2-Amino-4,6-dinitrotoluene	Explosives	1,480	ug/L	USEPA 2006	Freshwater	
2-Nitrotoluene	Explosives	750	ug/L	3-Nitrotoluene value	Freshwater	
3,5-Dinitroaniline	Explosives	59.0	ug/L	Talmage et al. 1999	Freshwater	
3-Nitrotoluene	Explosives	750	ug/L	USEPA 2006	Freshwater	
4-Amino-2,6-dinitrotoluene	Explosives	1,480	ug/L	2-Amino-4,6-dinitrotoluene value	Freshwater	
4-Nitrotoluene	Explosives	1,900	ug/L	USEPA 2006	Freshwater	
HMX	Explosives	330	ug/L	Talmage et al. 1999	Freshwater	
Nitrobenzene	Explosives	66.8	ug/L	USEPA 2001	Marine	
PETN	Explosives	85,000	ug/L	USEPA 2006	Freshwater	
RDX	Explosives	5,000	ug/L	Nipper et al. 2001	Marine	
Tetryl	Explosives	8.00	ug/L	Nipper et al. 2001	Marine	
1,1,1-Trichloroethane	VOCs	312	ug/L	USEPA 2001	Marine	
1,1,2,2-Tetrachloroethane	VOCs	90.2	ug/L	USEPA 2001	Marine	
1,1,2-Trichloroethane	VOCs	550	ug/L	USEPA 2006	Marine	
1,1-Dichloroethane	VOCs	47.0	ug/L	USEPA 1996	Freshwater	
1,1-Dichloroethene	VOCs	2,240	ug/L	USEPA 2001	Marine	
1,2,4-Trichlorobenzene	VOCs	5.40	ug/L	USEPA 2006	Marine	
1,2-Dichlorobenzene	VOCs	42.0	ug/L	USEPA 2006	Marine	
1,2-Dichloroethane	VOCs	1,130	ug/L	USEPA 2001	Marine	
1,2-Dichloroethene (total)	VOCs	680	ug/L	USEPA 2006	Marine	
1,2-Dichloropropane	VOCs	2,400	ug/L	USEPA 2001	Marine	
1,3-Dichlorobenzene	VOCs	28.5	ug/L	USEPA 2001	Marine	
1,4-Dichlorobenzene	VOCs	19.9	ug/L	USEPA 2001	Marine	
2-Butanone	VOCs	14,000	ug/L	Suter and Tsao 1996	Freshwater	
2-Hexanone	VOCs	99.0	ug/L	Suter and Tsao 1996	Freshwater	
4-Methyl-2-pentanone	VOCs	123,000	ug/L	USEPA 2006	Marine	
Acetone	VOCs	564,000	ug/L	USEPA 2006	Marine	
Benzene	VOCs	110	ug/L	USEPA 2006	Marine	

TABLE 8-10
Medium-Specific Screening Values
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Chemical	Group	Screening Value	Units	Reference	Type	TOC (percent)
Bromoform	VOCs	640	ug/L	USEPA 2001	Marine	
Bromomethane	VOCs	120	ug/L	USEPA 2001	Marine	
Carbon disulfide	VOCs	0.92	ug/L	Suter and Tsao 1996	Freshwater	
Carbon tetrachloride	VOCs	1,500	ug/L	USEPA 2001	Marine	
Chlorobenzene	VOCs	25.0	ug/L	USEPA 2006	Marine	
Chloroform	VOCs	815	ug/L	USEPA 2001	Marine	
Chloromethane	VOCs	2,700	ug/L	USEPA 2001	Marine	
cis-1,2-Dichloroethene	VOCs	680	ug/L	USEPA 2006	Marine	
cis-1,3-Dichloropropene	VOCs	7.90	ug/L	USEPA 2001	Marine	
Ethylbenzene	VOCs	25.0	ug/L	USEPA 2006	Marine	
Isopropylbenzene	VOCs	2.60	ug/L	USEPA 2006	Freshwater	
m- and p-Xylene	VOCs	19.0	ug/L	Xylenes value	Marine	
Methylene chloride	VOCs	2,560	ug/L	USEPA 2001	Marine	
Methyl-tert-butyl ether (MTBE)	VOCs	5,000	ug/L	Buchman 2008	Marine	
o-Xylene	VOCs	19.0	ug/L	Xylenes value	Marine	
Styrene	VOCs	910	ug/L	USEPA 2006	Marine	
Tetrachloroethene	VOCs	45.0	ug/L	USEPA 2001	Marine	
Toluene	VOCs	215	ug/L	USEPA 2006	Marine	
trans-1,2-Dichloroethene	VOCs	680	ug/L	USEPA 2006	Marine	
trans-1,3-Dichloropropene	VOCs	7.90	ug/L	USEPA 2001	Marine	
Trichloroethene	VOCs	1,940	ug/L	USEPA 2006	Marine	
Vinyl chloride	VOCs	930	ug/L	USEPA 2006	Freshwater	
Xylene, total	VOCs	19.0	ug/L	USEPA 2006	Marine	
Sediment						
Aluminum	Inorganics	18,000	mg/kg	Buchman 2008	Marine	
Antimony	Inorganics	2.00	mg/kg	Long and Morgan 1990	Marine	
Arsenic	Inorganics	8.20	mg/kg	Long et al. 1995	Marine	
Barium	Inorganics	48.0	mg/kg	Buchman 2008	Marine	
Cadmium	Inorganics	1.20	mg/kg	Long et al. 1995	Marine	
Chromium	Inorganics	81.0	mg/kg	Long et al. 1995	Marine	
Cobalt	Inorganics	10.0	mg/kg	Buchman 2008	Marine	

TABLE 8-10

Medium-Specific Screening Values

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Chemical	Group	Screening Value	Units	Reference	Type	TOC (percent)
Copper	Inorganics	34.0	mg/kg	Long et al. 1995	Marine	
Iron	Inorganics	220,000	mg/kg	Buchman 2008	Marine	
Lead	Inorganics	46.7	mg/kg	Long et al. 1995	Marine	
Manganese	Inorganics	260	mg/kg	Buchman 2008	Marine	
Mercury	Inorganics	0.15	mg/kg	Long et al. 1995	Marine	
Nickel	Inorganics	20.9	mg/kg	Long et al. 1995	Marine	
Selenium	Inorganics	1.00	mg/kg	Buchman 2008	Marine	
Silver	Inorganics	1.00	mg/kg	Long et al. 1995	Marine	
Vanadium	Inorganics	57.0	mg/kg	Buchman 2008	Marine	
Zinc	Inorganics	150	mg/kg	Long et al. 1995	Marine	
1,3,5-Trinitrobenzene	Explosives	7,000	ug/kg	NAVFAC 2007	Marine	
1,3-Dinitrobenzene	Explosives	16.7	ug/kg	Talmage et al. 1999	Freshwater	2.49
2,4,6-Trinitrotoluene	Explosives	20,000	ug/kg	NAVFAC 2007	Marine	
2,4-Dinitrotoluene	Explosives	104	ug/kg	USEPA 2006	Freshwater	2.49
2,6-Dinitrotoluene	Explosives	549	ug/kg	Nipper et al. 2002	Marine	
2-Nitrotoluene	Explosives	10,114	ug/kg	4-Nitrotoluene value	Freshwater	2.49
3-Nitrotoluene	Explosives	10,114	ug/kg	4-Nitrotoluene value	Freshwater	2.49
4-Nitrotoluene	Explosives	10,114	ug/kg	USEPA 2006	Freshwater	2.49
HMX	Explosives	115,000	ug/kg	NAVFAC 2007	Marine	
Nitrobenzene	Explosives	21.0	ug/kg	Buchman 1999	Marine	
RDX	Explosives	891,000	ug/kg	NAVFAC 2007	Marine	
Tetryl	Explosives	72.0	ug/kg	Nipper et al. 2002	Marine	
1,1,1-Trichloroethane	VOCs	2,131	ug/kg	USEPA 2006	Marine	2.49
1,1,2,2-Tetrachloroethane	VOCs	503	ug/kg	USEPA 2006	Marine	2.49
1,1,2-Trichloroethane	VOCs	1,419	ug/kg	USEPA 2006	Marine	2.49
1,1-Dichloroethane	VOCs	67.2	ug/kg	Jones et al. 1997	Freshwater	2.49
1,1-Dichloroethene	VOCs	6,927	ug/kg	USEPA 2006	Marine	2.49
1,2,4-Trichlorobenzene	VOCs	1,178	ug/kg	USEPA 2006	Marine	2.49
1,2-Dichlorobenzene	VOCs	2,463	ug/kg	USEPA 2006	Marine	2.49
1,2-Dichloroethane	VOCs	623	ug/kg	Jones et al. 1997	Freshwater	2.49
1,2-Dichloroethene (total)	VOCs	996	ug/kg	Jones et al. 1997	Freshwater	2.49

TABLE 8-10

Medium-Specific Screening Values

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Chemical	Group	Screening Value	Units	Reference	Type	TOC (percent)
1,3-Dichlorobenzene	VOCs	2,097	ug/kg	USEPA 2006	Marine	2.49
1,4-Dichlorobenzene	VOCs	110	ug/kg	Buchman 2008	Marine	
Benzene	VOCs	341	ug/kg	USEPA 2006	Marine	2.49
Bromoform	VOCs	3,257	ug/kg	USEPA 2006	Marine	2.49
Carbon disulfide	VOCs	2.12	ug/kg	Jones et al. 1997	Freshwater	2.49
Carbon tetrachloride	VOCs	18,038	ug/kg	USEPA 2006	Marine	2.49
Chlorobenzene	VOCs	403	ug/kg	USEPA 2006	Marine	2.49
Chloroform	VOCs	54.8	ug/kg	Jones et al. 1997	Freshwater	2.49
cis-1,2-Dichloroethene	VOCs	996	ug/kg	Jones et al. 1997	Freshwater	2.49
cis-1,3-Dichloropropene	VOCs	18.20	ug/kg	USEPA 2006	Marine	2.49
Ethylbenzene	VOCs	759	ug/kg	USEPA 2006	Marine	2.49
Isopropylbenzene	VOCs	214.1	ug/kg	USEPA 2006	Freshwater	2.49
m- and p-Xylene	VOCs	398	ug/kg	Jones et al. 1997	Freshwater	2.49
Methylene chloride	VOCs	921	ug/kg	Jones et al. 1997	Freshwater	2.49
o-Xylene	VOCs	398	ug/kg	Jones et al. 1997	Freshwater	2.49
Styrene	VOCs	17,602	ug/kg	USEPA 2006	Marine	2.49
Tetrachloroethene	VOCs	57.0	ug/kg	Buchman 2008	Marine	
Toluene	VOCs	2,704	ug/kg	USEPA 2006	Marine	2.49
trans-1,2-Dichloroethene	VOCs	996	ug/kg	Jones et al. 1997	Freshwater	2.49
trans-1,3-Dichloropropene	VOCs	18.20	ug/kg	USEPA 2006	Marine	2.49
Trichloroethene	VOCs	41.0	ug/kg	Buchman 2008	Marine	
Xylene, total	VOCs	398	ug/kg	Jones et al. 1997	Freshwater	2.49

TABLE 8-11
Uncertainty Factors Used In Food Web Models
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Convert From	Convert To	Uncertainty Factor
Chronic NOAEL	Chronic NOAEL	1
Chronic LOAEL	Chronic NOAEL	5
Subchronic NOAEL	Chronic NOAEL	10
Subchronic LOAEL	Chronic NOAEL	20
Acute NOAEL	Chronic NOAEL	30
Acute LOAEL	Chronic NOAEL	50
LD50	Chronic NOAEL	100

Uncertainty factors from Wentsel et al. (1996)
Durations are defined as follows (USEPA 1999; Sample et al. 1996):
- Acute: <14 days
- Subchronic: 14 - 90 days
- Chronic: >90 days or during critical life stage

TABLE 8-12
Ingestion Screening Values for Mammals
Remedial Investigation - Site 6
Naval Weapons Station Yorktown, Yorktown, Virginia

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference
Metals								
Arsenic	mouse	0.03	3 generations	oral in water	reproduction	1.26	0.25	Sample et al. 1996
Arsenic	dog	10.0	2 years	oral in diet	systemic	6.00	1.20	ATSDR 1993
Cadmium	rat	0.303	6 weeks	oral (gavage)	reproduction	10.0	1.00	Sample et al. 1996
Cadmium	dog	10.0	3 months	oral in diet	reproduction	3.75	0.75	ATSDR 1999
Chromium	rat	0.35	3 months	oral in water	mortality	131	26.3	Sample et al. 1996
Chromium	rat	0.35	1 year	oral in water	body weight/intake	16.4	3.28	Sample et al. 1996
Copper	mouse	0.03	1 month + GD 0-19	oral in diet	developmental	104	78.0	ATSDR 1990a
Copper	mink	1.00	357 days	oral in diet	reproduction	15.1	11.7	Sample et al. 1996
Lead	rat	0.35	3 generations	oral in diet	reproduction	80.0	8.00	Sample et al. 1996
Mercury	rat	0.35	3 generations	oral in diet	reproduction	0.16	0.032	Sample et al. 1996
Mercury	mink	1.00	93 days	oral in diet	survival/weight loss	0.25	0.15	Sample et al. 1996
Nickel	rat	0.35	3 generations	oral in diet	reproduction	80.0	40.0	Sample et al. 1996
Nickel	dog	10.0	2 years	oral in diet	systemic	62.5	25.0	ATSDR 1997
Selenium	rat	0.35	1 year	oral in water	reproduction	0.33	0.20	Sample et al. 1996
Silver	rat	0.35	2 weeks	oral in water	survival	45.3	9.06	ATSDR 1990b
Zinc	rat	0.35	GD 1-16	oral in diet	reproduction	320	160	Sample et al. 1996
Zinc	mink	1.00	25 weeks	oral	reproduction	104	20.8	ATSDR 1994
Volatile Organics								
1,1,2,2-Tetrachloroethane	rat	0.35	78 weeks	oral (gavage)	reproduction	380	76.0	ATSDR 1996
1,2,4-Trichlorobenzene	rat	0.35	3 generations	oral in water	reproduction	106	53	Coulston and Kolbye 1994
1,2-Dichlorobenzene	rat	0.35	chronic	oral (gavage)	liver/kidney	429	85.7	Coulston and Kolbye 1994
1,3-Dichlorobenzene	rat	0.35	chronic	oral (gavage)	liver/kidney	429	85.7	Coulston and Kolbye 1994
1,4-Dichlorobenzene	rat	0.35	GD 6-15	oral (gavage)	developmental	500	250	ATSDR 1998

TABLE 8-13

Ingestion Screening Values for Birds

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference
Metals								
Arsenic	brown-headed cowbird	0.049	7 months	oral in diet	survival	7.38	2.46	Sample et al. 1996
Arsenic	mallard	1.00	128 days	oral in diet	survival	12.8	5.14	Sample et al. 1996
Cadmium	mallard	1.15	90 days	oral in diet	reproduction	20.0	1.45	Sample et al. 1996
Chromium	American black duck	1.25	10 months	oral in diet	reproduction	5.00	1.00	Sample et al. 1996
Copper	chicken (chicks)	0.534	10 weeks	oral in diet	growth/survival	61.7	47.0	Sample et al. 1996
Lead	Japanese quail	0.15	12 weeks	oral in diet	reproduction	11.3	1.13	Sample et al. 1996
Lead	American kestrel	0.13	7 months	oral in diet	reproduction	19.3	3.85	Sample et al. 1996
Mercury	red-tailed hawk	1.10	12 weeks	oral in diet	survival/neurological	1.20	0.49	USEPA 1995b
Mercury	Japanese quail	0.15	1 year	oral in diet	reproduction	0.90	0.45	Sample et al. 1996
Mercury	mallard	1.00	3 generations	oral in diet	reproduction	0.078	0.026	USEPA 1997b
Nickel	mallard	0.782	90 days	oral in diet	growth/survival	107	77.4	Sample et al. 1996
Selenium	black-crowned night-heron	0.88	94 days	oral in diet	reproduction	9.00	1.80	Sample et al. 1996
Selenium	mallard	1.00	100 days	oral in diet	reproduction	0.80	0.40	Sample et al. 1996
Selenium	screech owl	0.20	13.7 weeks	oral in diet	reproduction	1.50	0.44	Sample et al. 1996
Silver	mallard	1.10	14 days	oral in diet	survival	178	35.6	USEPA 1999
Silver	chicken (chicks)	0.80	not specified	oral in diet	growth	35.0	7.00	Eisler 1996
Zinc	chicken	1.94	44 weeks	oral in diet	reproduction	131	14.5	Sample et al. 1996
Volatile Organics								
1,1,2,2-Tetrachloroethane	--	--	--	--	--	NA	NA	--
1,2,4-Trichlorobenzene	northern bobwhite	0.19	14 days	oral	survival	161	32.2	TERRETOX 2002
1,2-Dichlorobenzene	northern bobwhite	0.19	14 days	oral	survival	161	32.2	TERRETOX 2002
1,3-Dichlorobenzene	northern bobwhite	0.19	14 days	oral	survival	161	32.2	TERRETOX 2002
1,4-Dichlorobenzene	northern bobwhite	0.19	14 days	oral	survival	161	32.2	TERRETOX 2002

TABLE 8-14
Screening Statistics - Site 6 Surface Water
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Geometric Mean	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Arithmetic Mean Hazard Quotient	95% UCL Hazard Quotient	Geometric Mean Hazard Quotient	COPC?
Volatile Organic Compounds (UG/L)																
1,1,1-Trichloroethane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	312	-- / --	0.0016	0.0008	0.0008	0.0008	NO
1,1,2,2-Tetrachloroethane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	90.2	-- / --	0.006	0.003	0.003	0.003	NO
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
1,1,2-Trichloroethane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	550	-- / --	0.0009	0.0005	0.0005	0.0005	NO
1,1-Dichloroethane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	47.0	-- / --	0.011	0.005	0.005	0.005	NO
1,1-Dichloroethene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	2,240	-- / --	0.0002	0.0001	0.0001	0.0001	NO
1,2,4-Trichlorobenzene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	5.40	-- / --	0.09	0.05	0.05	0.05	NO
1,2-Dibromo-3-chloropropane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
1,2-Dibromoethane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
1,2-Dichlorobenzene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	42.0	-- / --	0.012	0.006	0.006	0.006	NO
1,2-Dichloroethane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	1,130	-- / --	0.0004	0.0002	0.0002	0.0002	NO
1,2-Dichloroethene (total)	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	680	-- / --	0.0007	0.0004	0.0004	0.0004	NO
1,2-Dichloropropane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	2,400	-- / --	0.0002	0.0001	0.0001	0.0001	NO
1,3-Dichlorobenzene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	28.5	-- / --	0.018	0.009	0.009	0.009	NO
1,4-Dichlorobenzene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	19.9	-- / --	0.025	0.013	0.013	0.013	NO
2-Butanone	1.30 - 2.50	0 / 5	--	--	--	1.13	0.27	1.39	1.10	14,000	-- / --	0.0002	0.0001	0.0001	0.0001	NO
2-Hexanone	2.50 - 2.50	0 / 11	--	--	--	1.25	0.0	1.25	1.25	99.0	-- / --	0.025	0.013	0.013	0.013	NO
4-Methyl-2-pentanone	2.50 - 2.50	0 / 11	--	--	--	1.25	0.0	1.25	1.25	123,000	-- / --	0.00002	0.00001	0.00001	0.00001	NO
Acetone	3.10 - 12.0	0 / 11	--	--	--	2.92	1.56	3.77	2.61	564,000	-- / --	0.00002	0.00001	0.00001	0.00000	NO
Benzene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	110	-- / --	0.005	0.002	0.002	0.002	NO
Bromodichloromethane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Bromoform	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	640	-- / --	0.0008	0.0004	0.0004	0.0004	NO
Bromomethane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	120	-- / --	0.004	0.002	0.002	0.002	NO
Carbon disulfide	0.50 - 0.50	7 / 11	0.11	0.48	YS06-SW74-0809	0.22	0.11	0.28	0.20	0.92	0 / 11	0.52	0.24	0.31	0.22	NO
Carbon tetrachloride	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	1,500	-- / --	0.0003	0.0002	0.0002	0.0002	NO
Chlorobenzene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	25.0	-- / --	0.02	0.01	0.01	0.01	NO
Chloroethane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Chloroform	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	815	-- / --	0.0006	0.0003	0.0003	0.0003	NO
Chloromethane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	2,700	-- / --	0.0002	0.0001	0.0001	0.0001	NO
cis-1,2-Dichloroethene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	680	-- / --	0.0007	0.0004	0.0004	0.0004	NO
cis-1,3-Dichloropropene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	7.90	-- / --	0.06	0.03	0.03	0.03	NO
Cyclohexane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Dibromochloromethane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Dichlorodifluoromethane (Freon-12)	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Ethylbenzene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	25.0	-- / --	0.02	0.01	0.01	0.01	NO
Isopropylbenzene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	2.60	-- / --	0.19	0.10	0.10	0.10	NO
m- and p-Xylene	1.00 - 1.00	0 / 11	--	--	--	0.50	0.0	0.50	0.50	19.0	-- / --	0.05	0.03	0.03	0.03	NO
Methyl acetate	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Methylcyclohexane	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Methylene chloride	0.16 - 0.35	0 / 11	--	--	--	0.13	0.039	0.15	0.12	2,560	-- / --	0.0001	0.00005	0.00006	0.00005	NO
Methyl-tert-butyl ether (MTBE)	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	5,000	-- / --	0.0001	0.00005	0.00005	0.00005	NO
o-Xylene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	19.0	-- / --	0.03	0.01	0.01	0.01	NO
Styrene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	910	-- / --	0.0005	0.0003	0.0003	0.0003	NO
Tetrachloroethene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	45.0	-- / --	0.011	0.006	0.006	0.006	NO

TABLE 8-14
Screening Statistics - Site 6 Surface Water
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Geometric Mean	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Arithmetic Mean Hazard Quotient	95% UCL Hazard Quotient	Geometric Mean Hazard Quotient	COPC?
Toluene	0.11 - 0.50	0 / 11	--	--	--	0.20	0.090	0.25	0.17	215	-- / --	0.0023	0.0009	0.0011	0.0008	NO
trans-1,2-Dichloroethene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	680	-- / --	0.0007	0.0004	0.0004	0.0004	NO
trans-1,3-Dichloropropene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	7.90	-- / --	0.06	0.03	0.03	0.03	NO
Trichloroethene	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	1,940	-- / --	0.0003	0.0001	0.0001	0.0001	NO
Trichlorofluoromethane(Freon-11)	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Vinyl chloride	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	930	-- / --	0.0005	0.0003	0.0003	0.0003	NO
Xylene, total	0.50 - 0.50	0 / 11	--	--	--	0.25	0.0	0.25	0.25	19.0	-- / --	0.03	0.01	0.01	0.01	NO
Explosives (UG/L)																
1,3,5-Trinitrobenzene	0.37 - 0.38	0 / 11	--	--	--	0.19	0.0026	0.19	0.19	15.0	-- / --	0.03	0.01	0.01	0.01	NO
1,3-Dinitrobenzene	0.37 - 0.38	0 / 11	--	--	--	0.19	0.0026	0.19	0.19	180	-- / --	0.002	0.001	0.001	0.001	NO
2,4,6-Trinitrotoluene	0.075 - 0.49	0 / 11	--	--	--	0.17	0.062	0.20	0.15	100	-- / --	0.005	0.002	0.002	0.001	NO
2,4-Dinitrotoluene	0.37 - 0.38	0 / 11	--	--	--	0.19	0.0026	0.19	0.19	480	-- / --	0.0008	0.0004	0.0004	0.0004	NO
2,6-Dinitrotoluene	0.37 - 0.38	0 / 11	--	--	--	0.19	0.0026	0.19	0.19	1,000	-- / --	0.0004	0.0002	0.0002	0.0002	NO
2-Amino-4,6-dinitrotoluene	0.37 - 0.38	0 / 11	--	--	--	0.19	0.0026	0.19	0.19	1,480	-- / --	0.0003	0.0001	0.0001	0.0001	NO
2-Nitrotoluene	0.37 - 0.38	1 / 11	0.36	0.36	YS06-SW78-0809	0.20	0.052	0.23	0.20	750	0 / 11	0.0005	0.0003	0.0003	0.0003	NO
3,5-Dinitroaniline	0.37 - 0.38	0 / 11	--	--	--	0.19	0.0026	0.19	0.19	59.0	-- / --	0.006	0.003	0.003	0.003	NO
3-Nitrotoluene	0.37 - 0.38	0 / 11	--	--	--	0.19	0.0026	0.19	0.19	750	-- / --	0.0005	0.0002	0.0003	0.0002	NO
4-Amino-2,6-dinitrotoluene	0.37 - 0.38	0 / 11	--	--	--	0.19	0.0026	0.19	0.19	1,480	-- / --	0.0003	0.0001	0.0001	0.0001	NO
4-Nitrotoluene	0.095 - 0.38	0 / 11	--	--	--	0.16	0.056	0.19	0.14	1,900	-- / --	0.0002	0.0001	0.0001	0.0001	NO
HMX	0.37 - 0.38	2 / 11	0.32	0.36	YS06-SW72-0809	0.22	0.062	0.25	0.21	330	0 / 11	0.0011	0.0007	0.0008	0.0006	NO
Nitrobenzene	0.087 - 0.38	0 / 11	--	--	--	0.16	0.051	0.19	0.15	66.8	-- / --	0.006	0.002	0.003	0.002	NO
PETN	1.80 - 1.90	0 / 11	--	--	--	0.92	0.026	0.94	0.92	85,000	-- / --	0.00002	0.00001	0.00001	0.00001	NO
RDX	0.37 - 3.40	0 / 11	--	--	--	0.46	0.58	0.77	0.29	5,000	-- / --	0.0007	0.0001	0.0002	0.0001	NO
Tetryl	0.37 - 0.38	0 / 11	--	--	--	0.19	0.0026	0.19	0.19	8.00	-- / --	0.048	0.023	0.024	0.023	NO
Total Metals (UG/L)																
Aluminum	-- - --	11 / 11	436	2,280	YS06-SW76-0809	903	553	1,205	790	87.0	11 / 11	26.2	10.4	13.8	9.08	**YES**
Antimony	2.50 - 10.0	0 / 11	--	--	--	4.66	1.13	5.28	4.41	500	-- / --	0.02	0.01	0.01	0.01	NO
Arsenic	10.0 - 10.0	7 / 11	2.90	5.00	YS06-SW73-0809	4.05	0.98	4.58	3.93	36.0	0 / 11	0.14	0.11	0.13	0.11	NO
Barium	-- - --	11 / 11	26.7	30.4	YS06-SW76-0809	28.5	1.21	29.1	28.4	200	0 / 11	0.15	0.14	0.15	0.14	NO
Beryllium	0.44 - 5.00	0 / 11	--	--	--	0.65	0.67	1.01	0.46	100	-- / --	0.050	0.006	0.010	0.005	NO
Cadmium	5.00 - 5.00	0 / 11	--	--	--	2.50	0.0	2.50	2.50	8.85	-- / --	0.56	0.28	0.28	0.28	NO
Calcium [3]	-- - --	11 / 11	190,000	224,000	YS06-SW70-0809	208,818	11,007	214,833	208,551	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Chromium	0.91 - 10.0	3 / 11	0.92	3.80	YS06-SW76-0809	1.59	1.56	2.44	1.10	50.4	0 / 11	0.08	0.03	0.05	0.02	NO
Cobalt	5.00 - 5.00	3 / 11	0.77	0.96	YS06-SW73-0809	2.05	0.77	2.47	1.87	23.0	0 / 11	0.04	--	--	--	NO
Copper	5.00 - 5.00	10 / 11	1.00	2.10	YS06-SW73-0809	1.65	0.49	1.92	1.59	3.73	0 / 11	0.56	0.44	0.51	0.43	NO
Iron	-- - --	11 / 11	724	3,020	YS06-SW76-0809	1,319	727	1,716	1,178	1,000	6 / 11	3.02	1.32	1.72	1.18	**YES**
Lead	2.20 - 4.20	0 / 11	--	--	--	1.54	0.24	1.67	1.52	8.52	-- / --	0.49	0.18	0.20	0.18	NO
Magnesium [3]	-- - --	11 / 11	542,000	678,000	YS06-SW70-0809	623,273	38,614	644,374	622,151	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Manganese	-- - --	11 / 11	59.1	199	YS06-SW78-0809	142	45.0	166	134	100	9 / 11	1.99	1.42	1.66	1.34	**YES**
Mercury	0.20 - 0.20	0 / 11	--	--	--	0.10	1.46E-17	0.10	0.10	1.11	-- / --	0.18	0.09	0.09	0.09	NO
Nickel	1.60 - 40.0	1 / 11	1.90	1.90	YS06-SW76-0809	13.2	9.50	18.3	7.02	8.28	0 / 11	0.23	--	--	--	NO
Potassium [3]	-- - --	11 / 11	272,000	348,000	YS06-SW70-0809	317,727	21,546	329,502	317,037	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Selenium	5.00 - 5.00	1 / 11	4.10	4.10	YS06-SW71-0809	2.65	0.48	2.91	2.61	71.1	0 / 11	0.06	0.04	0.04	0.04	NO
Silver	5.00 - 5.00	8 / 11	0.38	1.10	YS06-SW70-0809	1.28	0.82	1.73	1.07	0.23	8 / 11	4.78	--	--	--	**YES**

TABLE 8-14
Screening Statistics - Site 6 Surface Water
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Geometric Mean	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Arithmetic Mean Hazard Quotient	95% UCL Hazard Quotient	Geometric Mean Hazard Quotient	COPC?
Sodium [3]	-- - --	11 / 11	4,130,000	5,260,000	YS06-SW70-0809	4,834,545	372,273	5,037,984	4,821,021	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Thallium	10.0 - 10.0	0 / 11	--	--	--	5.00	0.0	5.00	5.00	21.3	-- / --	0.47	0.23	0.23	0.23	NO
Vanadium	-- - --	11 / 11	3.20	8.30	YS06-SW76-0809	5.63	1.59	6.50	5.41	50.0	0 / 11	0.17	0.11	0.13	0.11	NO
Zinc	5.20 - 10.5	4 / 11	10.9	22.3	YS06-SW73-0809	8.69	7.11	12.6	6.54	85.6	0 / 11	0.26	0.10	0.15	0.08	NO
Dissolved Metals (UG/L)																
Aluminum	66.6 - 200	5 / 11	38.6	96.0	YS06-SW78-0809	77.1	27.5	92.1	71.7	87.0	1 / 11	1.10	0.89	1.06	0.82	**YES**
Antimony	10.0 - 10.0	0 / 11	--	--	--	5.00	0.0	5.00	5.00	500	-- / --	0.02	0.01	0.01	0.01	NO
Arsenic	-- - --	11 / 11	2.80	6.90	YS06-SW73-0809	4.87	1.22	5.54	4.72	36.0	0 / 11	0.19	0.14	0.15	0.13	NO
Barium	-- - --	11 / 11	24.0	26.7	YS06-SW74-0809	25.6	0.93	26.1	25.6	200	0 / 11	0.13	0.13	0.13	0.13	NO
Beryllium	0.45 - 5.00	0 / 11	--	--	--	1.29	1.16	1.92	0.75	100	-- / --	0.050	0.013	0.019	0.007	NO
Cadmium	5.00 - 5.00	0 / 11	--	--	--	2.50	0.0	2.50	2.50	8.80	-- / --	0.57	0.28	0.28	0.28	NO
Calcium[3]	-- - --	11 / 11	188,000	222,000	YS06-SW70-0809	211,000	10,109	216,525	210,771	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Chromium	10.0 - 10.0	0 / 11	--	--	--	5.00	0.0	5.00	5.00	50.0	-- / --	0.20	0.10	0.10	0.10	NO
Cobalt	5.00 - 5.00	1 / 11	0.68	0.68	YS06-SW71-0809	2.33	0.55	2.63	2.22	23.0	0 / 11	0.03	--	--	--	NO
Copper	5.00 - 5.00	0 / 11	--	--	--	2.50	0.0	2.50	2.50	3.10	-- / --	1.61	0.81	0.81	0.81	NO
Iron	-- - --	11 / 11	37.0	99.0	YS06-SW77-0809	70.3	19.1	80.7	67.8	1,000	0 / 11	0.10	0.07	0.08	0.07	NO
Lead	3.00 - 3.00	0 / 11	--	--	--	1.50	0.0	1.50	1.50	8.10	-- / --	0.37	0.19	0.19	0.19	NO
Magnesium[3]	-- - --	11 / 11	555,000	684,000	YS06-SW70-0809	642,545	37,612	663,100	641,489	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Manganese	-- - --	11 / 11	5.70	175	YS06-SW78-0809	72.9	54.4	103	47.9	100	3 / 11	1.75	0.73	1.03	0.48	**YES**
Mercury	0.20 - 0.20	0 / 11	--	--	--	0.10	1.46E-17	0.10	0.10	0.94	-- / --	0.21	0.11	0.11	0.11	NO
Nickel	40.0 - 40.0	0 / 11	--	--	--	20.0	0.0	20.0	20.0	8.20	-- / --	4.88	2.44	2.44	2.44	NO[4]
Potassium[3]	-- - --	11 / 11	277,000	333,000	YS06-SW70-0809	317,182	16,845	326,387	316,753	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Selenium	5.00 - 5.00	0 / 11	--	--	--	2.50	0.0	2.50	2.50	71.0	-- / --	0.070	0.035	0.035	0.035	NO
Silver	5.00 - 5.00	9 / 11	0.52	1.10	YS06-SW74-0809	1.08	0.73	1.48	0.93	0.23	9 / 11	4.78	4.70	6.43	4.02	**YES**
Sodium[3]	-- - --	11 / 11	4,570,000	5,540,000	YS06-SW74-0809	5,172,727	296,651	5,334,840	5,164,729	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Thallium	10.0 - 10.0	0 / 11	--	--	--	5.00	0.0	5.00	5.00	21.3	-- / --	0.47	0.23	0.23	0.23	NO
Vanadium	2.20 - 2.20	9 / 11	3.00	4.90	YS06-SW78-0809	3.52	1.31	4.23	3.17	50.0	0 / 11	0.10	0.07	0.08	0.06	NO
Zinc	2.50 - 20.0	4 / 11	1.20	3.40	YS06-SW69-0809	2.88	2.49	4.24	2.35	81.0	0 / 11	0.04	0.04	0.05	0.03	NO
Other Parameters (MG/L)																
Total dissolved solids (TDS)	-- - --	11 / 11	17,700	24,200	YS06-SW70-0809	21,427	1,895	22,463	21,348	--	-- / --	--	--	--	--	--

NOTES:
NSV - No Screening Value
1 - Count of detected samples exceeding or equaling screening value
2 - Shaded cells indicate hazard quotient based on reporting limits
3 - Macronutrient - Not considered to be a COPC
4 - See uncertainties
MG/L - Milligrams per liter
UG/L - Micrograms per liter

TABLE 8-15
Screening Statistics - Site 6 Sediment
Phase II remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Geometric Mean	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Arithmetic Mean Hazard Quotient	95% UCL Hazard Quotient	Geometric Mean Hazard Quotient	COPC?
Volatile Organic Compounds (UG/KG)																
1,1,1-Trichloroethane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	2,131	-- / --	0.012	0.004	0.005	0.004	NO
1,1,2,2-Tetrachloroethane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	503	-- / --	0.052	0.017	0.020	0.016	NO
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
1,1,2-Trichloroethane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	1,419	-- / --	0.018	0.006	0.007	0.006	NO
1,1-Dichloroethane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	67.2	-- / --	0.39	0.13	0.15	0.12	NO
1,1-Dichloroethene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	6,927	-- / --	0.004	0.001	0.001	0.001	NO
1,2,4-Trichlorobenzene	7.20 - 26.0	0 / 11	--	--	--	8.06	3.30	9.86	7.36	1,178	-- / --	0.022	0.007	0.008	0.006	NO
1,2-Dibromo-3-chloropropane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
1,2-Dibromoethane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
1,2-Dichlorobenzene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	2,463	-- / --	0.011	0.003	0.004	0.003	NO
1,2-Dichloroethane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	623	-- / --	0.042	0.014	0.016	0.013	NO
1,2-Dichloropropane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
1,3-Dichlorobenzene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	2,097	-- / --	0.012	0.004	0.005	0.004	NO
1,4-Dichlorobenzene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	110	-- / --	0.24	0.08	0.09	0.07	NO
2-Butanone	6.90 - 62.0	0 / 11	--	--	--	18.5	10.0	24.0	14.9	NSV	-- / --	NSV	NSV	NSV	NSV	NO
2-Hexanone	19.0 - 65.0	0 / 11	--	--	--	21.5	7.46	25.6	20.1	NSV	-- / --	NSV	NSV	NSV	NSV	NO
4-Methyl-2-pentanone	14.0 - 60.0	0 / 11	--	--	--	19.5	8.00	23.9	17.7	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Acetone	28.0 - 370	0 / 11	--	--	--	54.4	46.9	80.0	42.8	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Benzene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	341	-- / --	0.08	0.03	0.03	0.02	NO
Bromodichloromethane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Bromoform	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	3,257	-- / --	0.008	0.003	0.003	0.002	NO
Bromomethane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Carbon disulfide	7.60 - 21.0	3 / 11	11.0	21.0	YS06-SD76-0809	10.3	5.82	13.5	8.95	2.12	3 / 11	9.92	4.86	6.36	4.23	**YES**
Carbon tetrachloride	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	18,038	-- / --	0.0014	0.0005	0.0006	0.0004	NO
Chlorobenzene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	403	-- / --	0.06	0.02	0.03	0.02	NO
Chloroethane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Chloroform	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	54.8	-- / --	0.47	0.16	0.19	0.15	NO
Chloromethane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
cis-1,2-Dichloroethene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	996	-- / --	0.026	0.009	0.010	0.008	NO
cis-1,3-Dichloropropene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	18.2	-- / --	1.43	0.47	0.56	0.44	NO
Cyclohexane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Dibromochloromethane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Dichlorodifluoromethane (Freon-12)	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Ethylbenzene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	759	-- / --	0.034	0.011	0.013	0.011	NO
Isopropylbenzene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	214	-- / --	0.12	0.04	0.05	0.04	NO
m- and p-Xylene	15.0 - 52.0	0 / 11	--	--	--	17.3	5.96	20.5	16.1	398	-- / --	0.13	0.04	0.05	0.04	NO
Methyl acetate	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Methylcyclohexane	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Methylene chloride	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	921	-- / --	0.028	0.009	0.011	0.009	NO
Methyl-tert-butyl ether (MTBE)	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
o-Xylene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	398	-- / --	0.065	0.022	0.026	0.020	NO
Styrene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	17,602	-- / --	0.0015	0.0005	0.0006	0.0005	NO
Tetrachloroethene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	57.0	-- / --	0.46	0.15	0.18	0.14	NO
Toluene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	2,704	-- / --	0.010	0.003	0.004	0.003	NO

TABLE 8-15
Screening Statistics - Site 6 Sediment
Phase II remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Geometric Mean	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Arithmetic Mean Hazard Quotient	95% UCL Hazard Quotient	Geometric Mean Hazard Quotient	COPC?
trans-1,2-Dichloroethene	7.60 - 26.0	1 / 11	7.40	7.40	YS06-SD77-0809	8.18	2.76	9.68	7.69	996	0 / 11	0.007	--	--	--	NO
trans-1,3-Dichloropropene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	18.2	-- / --	1.43	0.47	0.56	0.44	NO
Trichloroethene	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	41.0	-- / --	0.63	0.21	0.25	0.20	NO
Trichlorofluoromethane(Freon-11)	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Vinyl chloride	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Xylene, total	7.60 - 26.0	0 / 11	--	--	--	8.60	2.97	10.2	8.04	398	-- / --	0.07	0.02	0.03	0.02	NO
Explosives (UG/KG)																
1,3,5-Trinitrobenzene	500 - 500	0 / 11	--	--	--	250	0.0	250	250	7,000	-- / --	0.07	0.04	0.04	0.04	NO
1,3-Dinitrobenzene	500 - 500	0 / 11	--	--	--	250	0.0	250	250	16.7	-- / --	30.0	15.0	15.0	15.0	NO[4]
2,4,6-Trinitrotoluene	500 - 500	0 / 11	--	--	--	250	0.0	250	250	20,000	-- / --	0.025	0.013	0.013	0.013	NO
2,4-Dinitrotoluene	500 - 500	0 / 11	--	--	--	250	0.0	250	250	104	-- / --	4.83	2.41	2.41	2.41	NO[4]
2,6-Dinitrotoluene	500 - 500	1 / 11	200	200	YS06-SD77-0809	245	15.1	254	245	549	0 / 11	0.36	--	--	--	NO
2-Amino-4,6-dinitrotoluene	500 - 500	0 / 11	--	--	--	250	0.0	250	250	NSV	-- / --	NSV	NSV	NSV	NSV	NO
2-Nitrotoluene	500 - 500	1 / 11	270	270	YS06-SD77-0809	252	6.03	255	252	10,114	0 / 11	0.03	0.02	0.03	0.02	NO
3,5-Dinitroaniline	500 - 500	0 / 11	--	--	--	250	0.0	250	250	NSV	-- / --	NSV	NSV	NSV	NSV	NO
3-Nitrotoluene	500 - 500	0 / 11	--	--	--	250	0.0	250	250	10,114	-- / --	0.049	0.025	0.025	0.025	NO
4-Amino-2,6-dinitrotoluene	500 - 500	0 / 11	--	--	--	250	0.0	250	250	NSV	-- / --	NSV	NSV	NSV	NSV	NO
4-Nitrotoluene	500 - 500	0 / 11	--	--	--	250	0.0	250	250	10,114	-- / --	0.049	0.025	0.025	0.025	NO
HMX	500 - 500	0 / 11	--	--	--	250	0.0	250	250	115,000	-- / --	0.004	0.002	0.002	0.002	NO
Nitrobenzene	500 - 500	1 / 11	120	120	YS06-SD77-0809	238	39.2	260	234	21.0	1 / 11	5.71	--	--	--	**YES**
PETN	2,500 - 2,500	0 / 11	--	--	--	1,250	0.0	1,250	1,250	NSV	-- / --	NSV	NSV	NSV	NSV	NO
RDX	500 - 500	0 / 11	--	--	--	250	0.0	250	250	891,000	-- / --	0.0006	0.0003	0.0003	0.0003	NO
Tetryl	500 - 500	1 / 11	150	150	YS06-SD77-0809	241	30.2	257	239	72.0	1 / 11	2.08	--	--	--	**YES**
Metals (MG/KG)																
Aluminum	-- - --	11 / 11	5,920	24,100	YS06-SD74-0809	15,693	6,339	19,157	14,332	18,000	5 / 11	1.34	0.87	1.06	0.80	**YES**
Antimony	0.45 - 2.90	0 / 11	--	--	--	0.61	0.43	0.85	0.50	2.00	-- / --	1.45	0.31	0.42	0.25	NO
Arsenic	-- - --	11 / 11	2.80	10.8	YS06-SD75-0809	7.23	2.72	8.71	6.63	8.20	6 / 11	1.32	0.88	1.06	0.81	**YES**
Barium	-- - --	11 / 11	12.0	47.0	YS06-SD75-0809	32.3	11.6	38.7	30.0	48.0	0 / 11	0.98	0.67	0.81	0.63	NO
Beryllium	0.46 - 1.40	0 / 11	--	--	--	0.50	0.17	0.59	0.48	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Cadmium	0.72 - 1.50	0 / 11	--	--	--	0.59	0.12	0.66	0.58	1.20	-- / --	1.25	0.49	0.55	0.48	NO
Calcium [3]	-- - --	11 / 11	1,330	33,200	YS06-SD70-0809	6,000	9,608	11,250	3,231	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Chromium	-- - --	11 / 11	14.0	47.8	YS06-SD74-0809	33.2	12.1	39.8	30.9	81.0	0 / 11	0.59	0.41	0.49	0.38	NO
Cobalt	-- - --	11 / 11	2.30	8.40	YS06-SD74-0809	5.84	2.21	7.04	5.38	10.0	0 / 11	0.84	0.58	0.70	0.54	NO
Copper	-- - --	11 / 11	5.80	27.4	YS06-SD75-0809	17.4	8.19	21.9	15.2	34.0	0 / 11	0.81	0.51	0.64	0.45	NO
Iron	-- - --	11 / 11	11,700	39,800	YS06-SD75-0809	27,373	9,949	32,810	25,422	220,000	0 / 11	0.18	0.12	0.15	0.12	NO
Lead	-- - --	11 / 11	8.60	36.3	YS06-SD77-0809	22.3	9.79	27.6	20.0	46.7	0 / 11	0.78	0.48	0.59	0.43	NO
Magnesium [3]	-- - --	11 / 11	2,160	7,260	YS06-SD75-0809	5,076	1,768	6,043	4,752	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Manganese	-- - --	11 / 11	75.4	322	YS06-SD77-0809	205	80.2	249	188	260	3 / 11	1.24	0.79	0.96	0.72	NO
Mercury	0.061 - 0.099	9 / 11	0.028	0.11	YS06-SD75-0809	0.069	0.030	0.086	0.063	0.15	0 / 11	0.73	0.46	0.57	0.42	NO
Nickel	-- - --	11 / 11	5.30	22.5	YS06-SD75-0809	15.0	6.00	18.3	13.7	20.9	2 / 11	1.08	0.72	0.88	0.66	NO
Potassium [3]	-- - --	11 / 11	1,850	4,910	YS06-SD74-0809	3,490	1,039	4,058	3,336	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Selenium	0.72 - 1.30	7 / 11	0.58	1.20	YS06-SD73-0809	0.78	0.28	0.93	0.73	1.00	2 / 11	1.20	0.78	0.93	0.73	NO
Silver	0.72 - 1.50	0 / 11	--	--	--	0.59	0.12	0.66	0.58	1.00	-- / --	1.50	0.59	0.66	0.58	NO
Sodium [3]	-- - --	11 / 11	2,680	12,200	YS06-SD73-0809	8,195	2,852	9,754	7,605	NSV	-- / --	NSV	NSV	NSV	NSV	NO

TABLE 8-15
Screening Statistics - Site 6 Sediment
Phase II remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Geometric Mean	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Arithmetic Mean Hazard Quotient	95% UCL Hazard Quotient	Geometric Mean Hazard Quotient	COPC?
Thallium	1.40 - 3.00	0 / 11	--	--	--	1.19	0.26	1.34	1.16	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Vanadium	-- - --	11 / 11	16.7	66.9	YS06-SD75-0809	43.2	16.7	52.3	39.9	57.0	3 / 11	1.17	0.76	0.92	0.70	NO
Zinc	-- - --	11 / 11	29.2	138	YS06-SD75-0809	89.5	39.8	111	79.2	150	0 / 11	0.92	0.60	0.74	0.53	NO
Other Parameters																
Alkalinity (MG/KG)	200 - 200	9 / 11	172	1,290	YS06-SD75-0809	536	414	762	390	--	-- / --	--	--	--	--	--
pH	-- - --	11 / 11	7.20	8.10	YS06-SD68-0809	7.63	0.31	7.80	7.62	--	-- / --	--	--	--	--	--
Total organic carbon (MG/KG)	-- - --	11 / 11	9,428	50,270	YS06-SD77-0809	24,927	12,152	31,568	22,271	--	-- / --	--	--	--	--	--

NOTES:
NSV - No Screening Value
1 - Count of detected samples exceeding or equaling screening value
2 - Shaded cells indicate hazard quotient based on reporting limits
3 - Macronutrient - Not considered to be a COPC
4 - See uncertainties
MG/KG - Milligrams per kilogram
UG/KG - Micrograms per kilogram

TABLE 8-16
Screening Statistics - Site 6 Pore Water
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Geometric Mean	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Arithmetic Mean Hazard Quotient	95% UCL Hazard Quotient	Geometric Mean Hazard Quotient	COPC?
Volatile Organic Compounds (UG/L)																
1,1,1-Trichloroethane	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	312	-- / --	0.0016	0.0008	0.0008	0.0008	NO
1,1,2,2-Tetrachloroethane	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	90.2	-- / --	0.0055	0.0028	0.0028	0.0028	NO
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
1,1,2-Trichloroethane	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	550	-- / --	0.0009	0.0005	0.0005	0.0005	NO
1,1-Dichloroethane	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	47.0	-- / --	0.011	0.005	0.005	0.005	NO
1,1-Dichloroethene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	2,240	-- / --	0.0002	0.0001	0.0001	0.0001	NO
1,2,4-Trichlorobenzene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	5.40	-- / --	0.093	0.046	0.046	0.046	NO
1,2-Dibromo-3-chloropropane	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
1,2-Dibromoethane	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
1,2-Dichlorobenzene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	42.0	-- / --	0.012	0.006	0.006	0.006	NO
1,2-Dichloroethane	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	1,130	-- / --	0.0004	0.0002	0.0002	0.0002	NO
1,2-Dichloroethene (total)	0.50 - 0.50	3 / 4	0.11	170	YS06-WN03-0909	42.6	84.9	143	0.92	680	0 / 4	0.25	0.06	0.21	0.001	NO
1,2-Dichloropropane	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	2,400	-- / --	0.0002	0.0001	0.0001	0.0001	NO
1,3-Dichlorobenzene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	28.5	-- / --	0.018	0.009	0.009	0.009	NO
1,4-Dichlorobenzene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	19.9	-- / --	0.025	0.013	0.013	0.013	NO
2-Butanone	-- - --	4 / 4	8.80	9.10	YS06-WN01-0909	8.93	0.13	9.07	8.92	14,000	0 / 4	0.0007	0.0006	0.0006	0.0006	NO
2-Hexanone	2.50 - 2.50	0 / 4	--	--	--	1.25	0.0	1.25	1.25	99.0	-- / --	0.025	0.013	0.013	0.013	NO
4-Methyl-2-pentanone	2.50 - 2.50	0 / 4	--	--	--	1.25	0.0	1.25	1.25	123,000	-- / --	0.00002	0.00001	0.00001	0.00001	NO
Acetone	-- - --	4 / 4	8.10	18.0	YS06-WN01-0909	14.3	4.30	19.3	13.7	564,000	0 / 4	0.00003	0.00003	0.00003	0.00002	NO
Benzene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	110	-- / --	0.0045	0.0023	0.0023	0.0023	NO
Bromodichloromethane	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Bromoform	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	640	-- / --	0.0008	0.0004	0.0004	0.0004	NO
Bromomethane	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	120	-- / --	0.0042	0.0021	0.0021	0.0021	NO
Carbon disulfide	-- - --	4 / 4	5.80	26.0	YS06-WN01-0909	13.1	9.34	24.1	10.9	0.92	4 / 4	28.3	14.3	26.2	11.9	**YES**
Carbon tetrachloride	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	1,500	-- / --	0.0003	0.0002	0.0002	0.0002	NO
Chlorobenzene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	25.0	-- / --	0.02	0.01	0.01	0.01	NO
Chloroethane	0.50 - 0.50	1 / 4	0.14	0.14	YS06-WN03-0909	0.22	0.055	0.29	0.22	NSV	-- / --	NSV	NSV	NSV	NSV	**YES**
Chloroform	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	815	-- / --	0.0006	0.0003	0.0003	0.0003	NO
Chloromethane	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	2,700	-- / --	0.0002	0.0001	0.0001	0.0001	NO
cis-1,2-Dichloroethene	0.50 - 0.50	3 / 4	0.12	160	YS06-WN03-0909	40.1	79.9	134	0.94	680	0 / 4	0.24	0.06	0.20	0.001	NO
cis-1,3-Dichloropropene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	7.90	-- / --	0.063	0.032	0.032	0.032	NO
Cyclohexane	-- - --	4 / 4	0.76	1.00	YS06-WN02-0909	0.93	0.11	1.07	0.92	NSV	-- / --	NSV	NSV	NSV	NSV	**YES**
Dibromochloromethane	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Dichlorodifluoromethane (Freon-12)	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Ethylbenzene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	25.0	-- / --	0.02	0.01	0.01	0.01	NO
Isopropylbenzene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	2.60	-- / --	0.19	0.10	0.10	0.10	NO
m- and p-Xylene	1.00 - 1.00	0 / 4	--	--	--	0.50	0.0	0.50	0.50	19.0	-- / --	0.053	0.026	0.026	0.026	NO
Methyl acetate	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Methylcyclohexane	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Methylene chloride	-- - --	4 / 4	0.20	1.90	YS06-WN03-0909	0.67	0.82	1.64	0.42	2,560	0 / 4	0.0007	0.0003	0.0006	0.0002	NO
Methyl-tert-butyl ether (MTBE)	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	5,000	-- / --	0.00010	0.00005	0.00005	0.00005	NO
o-Xylene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	19.0	-- / --	0.026	0.013	0.013	0.013	NO
Styrene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	910	-- / --	0.0005	0.0003	0.0003	0.0003	NO
Tetrachloroethene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	45.0	-- / --	0.011	0.006	0.006	0.006	NO

TABLE 8-16
Screening Statistics - Site 6 Pore Water
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Chemical	Range of Non-Detect Values	Frequency of Detection	Minimum Concentration Detected	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	Standard Deviation of Mean	95% UCL (Norm)	Geometric Mean	Screening Value	Frequency of Exceedance[1]	Maximum Hazard Quotient[2]	Arithmetic Mean Hazard Quotient	95% UCL Hazard Quotient	Geometric Mean Hazard Quotient	COPC?
Toluene	-- - --	4 / 4	0.12	0.22	YS06-WN04-0909	0.16	0.044	0.21	0.15	215	0 / 4	0.0010	0.0007	0.0010	0.0007	NO
trans-1,2-Dichloroethene	0.50 - 0.50	1 / 4	0.68	0.68	YS06-WN03-0909	0.36	0.22	0.61	0.32	680	0 / 4	0.0010	0.0005	0.0009	0.0005	NO
trans-1,3-Dichloropropene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	7.90	-- / --	0.063	0.032	0.032	0.032	NO
Trichloroethene	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	1,940	-- / --	0.0003	0.0001	0.0001	0.0001	NO
Trichlorofluoromethane(Freon-11)	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	NSV	-- / --	NSV	NSV	NSV	NSV	NO
Vinyl chloride	0.50 - 0.50	1 / 4	150	150	YS06-WN03-0909	37.7	74.9	126	1.24	930	0 / 4	0.16	0.04	0.14	0.001	NO
Xylene, total	0.50 - 0.50	0 / 4	--	--	--	0.25	0.0	0.25	0.25	19.0	-- / --	0.026	0.013	0.013	0.013	NO

NOTES:
NSV - No Screening Value
1 - Count of detected samples exceeding or equaling screening value
2 - Shaded cells indicate hazard quotient based on reporting limits
UG/L - Micrograms per liter

TABLE 8-17

Hazard Quotients for Food Web Exposures - Maximum - Aquatic Receptors

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Chemical	Raccoon		Mink		Muskrat		Marsh wren		Belted kingfisher		Great blue heron		Mallard	
	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Metals														
Arsenic	0.23	0.05	0.05	0.01	4.78	0.96	0.95	0.32	0.10	0.04	0.02	<0.01	0.26	0.10
Cadmium	0.17	0.03	0.02	<0.01	0.46	0.05	0.94	0.07	0.14	<0.01	0.01	<0.01	0.38	0.03
Chromium	0.10	0.02	0.03	<0.01	0.25	0.05	3.32	0.66	0.62	0.12	0.12	0.02	0.70	0.14
Copper	0.28	0.21	0.01	<0.01	0.02	0.02	1.36	1.03	0.17	0.13	<0.01	<0.01	0.09	0.07
Lead	0.06	<0.01	0.02	<0.01	0.24	0.02	1.04	0.21	0.22	0.04	0.04	<0.01	1.77	0.18
Mercury	0.08	0.05	0.16	0.10	1.62	0.32	3.59	1.20	3.82	1.27	1.25	0.42	2.31	0.77
Nickel	0.02	<0.01	0.04	0.02	0.08	0.04	0.02	0.02	0.05	0.04	0.02	0.01	0.04	0.03
Selenium	0.33	0.20	0.29	0.17	1.73	1.05	0.92	0.46	0.14	0.03	0.04	<0.01	0.96	0.48
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	0.60	0.12	0.05	<0.01	0.15	0.08	13.3	1.47	1.76	0.20	0.09	0.01	2.33	0.26
Volatile Organics														
1,1,2,2-Tetrachloroethane	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,2-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,3-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
1,4-Dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

NA - Screening Value Not Available

Shaded cells indicate HQ > 1

TABLE 8-18
Hazard Quotients for Food Web Exposures - Arithmetic Mean - Aquatic Receptors
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Chemical	Muskrat		Marsh wren			Belted kingfisher		Great blue heron		Mallard	
	NOAEL	LOAEL	NOAEL	MATC	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Metals											
Arsenic	0.19	0.04	0.32	0.18	0.11	0.03	0.01	<0.01	<0.01	<0.01	<0.01
Chromium	0.07	0.01	0.95	0.42	0.19	0.18	0.04	0.07	0.01	0.13	0.03
Copper	<0.01	<0.01	0.08	0.07	0.06	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead	0.02	<0.01	0.16	0.07	0.03	0.05	0.01	0.02	<0.01	0.07	<0.01
Mercury	0.04	<0.01	0.63	0.37	0.21	0.94	0.31	0.49	0.16	0.06	0.02
Selenium	0.12	0.07	0.43	0.30	0.21	0.05	0.01	0.02	<0.01	0.06	0.03
Zinc	0.01	<0.01	1.31	0.43	0.14	0.21	0.02	0.05	<0.01	0.13	0.01

Shaded cells indicate HQ > 1

TABLE 8-19

Hazard Quotients for Food Web Exposures - 95 Percent UCL of the Arithmetic Mean - Aquatic Receptors

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Chemical	Muskrat		Marsh wren			Belted kingfisher			Great blue heron		Mallard	
	NOAEL	LOAEL	NOAEL	MATC	LOAEL	NOAEL	MATC	LOAEL	NOAEL	LOAEL	NOAEL	LOAEL
Metals												
Arsenic	0.22	0.04	0.39	0.22	0.13	0.04	0.02	0.01	0.01	<0.01	<0.01	<0.01
Chromium	0.08	0.02	1.13	0.51	0.23	0.22	0.10	0.04	0.09	0.02	0.16	0.03
Copper	<0.01	<0.01	0.10	0.08	0.07	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead	0.02	<0.01	0.20	0.09	0.04	0.06	0.03	0.01	0.03	<0.01	0.09	<0.01
Mercury	0.06	0.01	0.78	0.45	0.26	1.17	0.67	0.39	0.60	0.20	0.07	0.02
Selenium	0.14	0.09	0.51	0.36	0.26	0.06	0.03	0.01	0.03	<0.01	0.07	0.03
Zinc	0.01	<0.01	1.62	0.54	0.18	0.26	0.09	0.03	0.06	<0.01	0.16	0.02

Shaded cells indicate HQ > 1

TABLE 8-20
Comparison of Site Surface Water COPC Concentrations to Background Concentrations
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Chemical	Site Samples			Background Samples			Ratio of Maximums	Ratio of Means
	Frequency of Detection	Maximum	Arithmetic Mean	Frequency of Detection	Maximum	Arithmetic Mean		
Dissolved Metals (UG/L)								
Aluminum	5 / 11	96.0	77.1	3 / 6	327	174	0.29	0.44
Manganese	11 / 11	175	72.9	6 / 6	127	48.6	1.38	1.50
Silver	9 / 11	1.10	1.08	0 / 6	--	5.00	--	0.22

TABLE 8-21

Comparison of Site Sediment COPC Concentrations to Background Concentrations

Phase II Remedial Investigation Report, Site 6

WPNSTA Yorktown, Yorktown, Virginia

Chemical	Site Samples			Background Samples			Ratio of Maximums	Ratio of Means
	Frequency of Detection	Maximum	Arithmetic Mean	Frequency of Detection	Maximum	Arithmetic Mean		
Metals (MG/KG)								
Aluminum	11 / 11	24,100	15,693	6 / 6	20,900	17,833	1.15	0.88
Arsenic	11 / 11	10.8	7.23	6 / 6	14.8	12.9	0.73	0.56
Volatile Organic Compounds (UG/KG)								
Carbon disulfide	3 / 11	21.0	10.3	1 / 6	13.0	13.3	1.62	0.77

TABLE 8-22
Reporting Limit to Screening Value Comparison
Phase II Remedial Investigation Report, Site 6
WPNSTA Yorktown, Yorktown, Virginia

Chemical	Units	Frequency of Detection	Minimum Reporting Limit	Maximum Reporting Limit	Mean Concentration	Screening Value	Minimum Ratio	Maximum Ratio	Mean Ratio
Sediment									
1,3-Dinitrobenzene	UG/KG	0 / 11	500	500	250	16.7	30.0	30.0	15.0
2,4-Dinitrotoluene	UG/KG	0 / 11	500	500	250	104	4.83	4.83	2.41
Surface Water									
Nickel (dissolved)	UG/L	0 / 11	40.0	40.0	20.0	8.20	4.88	4.88	2.44

Shaded cells indicate ratio > 1

SECTION 9

Summary, Conclusions, and Proposed Future Actions

The primary objective of this RI is to present the data and findings obtained as part of the Phase II field activities conducted to further characterize the nature and extent of contamination and to assess potential risks to human health and the environment at Site 6. The RI is intended to support the consideration of risk-based cleanup decisions and the development and evaluation of interim, if applicable, and long-term solutions to address site related impacts.

This section presents the summary and conclusions of the Phase II RI conducted at Site 6 and the proposed future actions for the site.

9.1 Summary of Remedial Investigation

Historical investigations conducted at Site 6 from 1984 to 1998 led to a ROD for soil and sediment. However, the ROD specified that the remedy of long-term monitoring for groundwater, surface water, and sediment would not be the final remedy for these media. The Partnering Team agreed to further address groundwater using a two-phase approach. The Phase I RI was conducted in 2004 and concluded that contaminants had not been fully characterized at the site and that potential risks were not quantified. Phase II RI field activities were conducted from March to September 2009 to characterize the extent of contamination and potential environmental and human health risks associated with exposure to site media.

Below is a summary of the Phase II investigation activities conducted to meet the project objectives.

- Development of a refined conceptual model for the origin of contamination in environmental media from historical operations
- Installation of 10 permanent monitoring wells in the previously excavated area, the flume source area, the impoundment area, and the areas west of the coffer dam to provide sufficient information for conservatively assessing nature and extent of contamination and potential risks
- Completion of groundwater monitoring and sampling from all new and existing monitoring wells (25 locations)
- Collection of 11 surface water, 11 sediment, and 4 sediment pore-water samples to confirm the findings of previous investigations, determine potential impacts, and assess the potential of groundwater discharge impacts to surface water
- Completion of hydraulic conductivity testing

9.2 Conclusions

9.2.1 Physical Characteristics

Hydrostratigraphy

The subsurface geology beneath Site 6 is characterized by the coarse-grained to fine-grained sand, silty sand, and shells of the Yorktown-Eastover aquifer. The aquifer is the first encountered groundwater beneath the site and is approximately 80 ft thick. Underlying the aquifer is the approximately 100- to 200-ft-thick Eastover-Calvert confining unit. In the topographically higher areas adjacent to the site, approximately 20 ft of silts and sands associated with the Columbia aquifer underlain by the 10- to 20-ft-thick clay and silty clay of the Yorktown confining unit, overlie the Yorktown-Eastover aquifer. However, the Columbia aquifer is generally not saturated in this area.

Groundwater Flow

Groundwater flow within the Yorktown-Eastover aquifer flows predominantly westward (southwest to northwest) towards Felgates Creek at an average hydraulic gradient of approximately 0.01 ft/ft. Groundwater flow discharges to Felgates Creek. Based on the maximum hydraulic conductivity (0.37 ft/day), effective porosity (0.30), and the average hydraulic gradient (0.01 ft/ft), the estimated groundwater velocity is approximately 0.01 ft/day.

Specific conductivity values generally indicate that groundwater adjacent to Felgates Creek is a transition zone where fresh water mixes with saltwater. Since Felgates Creek is tidally influenced, groundwater flow in the downgradient portion of the site may be tidally influenced.

9.2.2 Environmental Media Contamination

Analytical data collected during the Phase II RI provided the primary basis for the evaluation of the nature and extent of contamination in groundwater, surface water, sediment, and sediment pore-water. In total, 25 groundwater, 11 surface water, 11 sediment, and 4 sediment pore water primary samples were collected at Site 6. In addition, 4 groundwater, 2 surface water, 2 sediment, and 1 sediment pore water duplicate samples were also collected. A chemical was considered a COPC if the concentration exceeded background values and screening criteria. The discussions below summarize the observed contaminants at Site 6 (by analytical suite).

VOCs

The most prevalent VOCs detected above regulatory standards within the groundwater of the Yorktown-Eastover aquifer included TCE, 1,2-DCE, and vinyl chloride. One distinct TCE, 1,2-DCE, and vinyl chloride plume were delineated at Site 6. TCE was the most frequently observed and most widespread COPC within groundwater at the site. The most elevated TCE concentrations (maximum of 280,000 µg/L) occurred beneath the surface impoundment area within the upper to middle portion of the Yorktown-Eastover aquifer, at concentrations that may be indicative of the presence of DNAPL. Other VOCs detected above screening criteria in groundwater included 1,1-DCE, PCE, 1,1-DCA, 1,2-DCA, and benzene but were more localized occurrences.

Geochemical data collected from Site 6 groundwater indicate possible conditions for reductive dechlorination. These conditions include low DO and ORP, the presence of significant concentrations of ferrous iron, the presence of ethene and ethane, and ideal groundwater temperatures. Concentrations of *Dehalococcoides* ranged from 1.1 to 19 cells/mL at Site 6, which is indicative of a culture that may sustain appreciable dechlorination rates. In addition, the presence of TCE daughter product vinyl chloride indicates advanced reductive dechlorination is occurring in the Yorktown-Eastover aquifer.

No VOCs exceeded screening criteria in surface water or sediment at Site 6. Eleven VOCs were observed in the sediment pore-water samples, but the majority of which are likely naturally occurring (carbon disulfide) or laboratory related contaminants (2-butanone, methylene chloride, and toluene. Low concentrations of cyclohexane, 1,2-DCE, vinyl chloride, and chloroethane were observed in the sediment pore-water samples within Felgates Creek. Elevated concentrations of 1,2-DCE (170 μg/L) and vinyl chloride (150 μg/L) were observed in the sediment pore-water samples within the surface impoundment area. TCE was not observed in the sediment pore-water.

Explosives

Seven explosives exceeded a screening criterion within groundwater. Concentrations of 2,4-DNT and RDX were the most widespread at the site, occurring within four monitoring wells. One small 2,4-DNT plume occurred in the downgradient portion of the surface impoundment area adjacent to Felgates Creek, and one within the northwestern portion of the site (only observed at one monitoring well 6GW09). One small RDX plume occurred in the upgradient portion of the surface impoundment area, and one within the northwestern portion of the site (also only observed at well 6GW09). Other explosives observed above screening criteria at two or less monitoring wells included nitrobenzene, 1,3-dinitrobenzene, 2a-DNT, 3-NT, and 4-NT.

No explosives exceeded screening criteria within surface water. Nitrobenzene and tetryl were observed in one sediment sample location above the ecological screening criterion.

Inorganic Constituents

Inorganic constituents detected at Site 6 may be either site-related (i.e., associated with historical activities) or non-site-related (i.e., background). Concentrations of inorganics in soil were compared to the background soil inorganic dataset compiled for the Yorktown-Eastover aquifer for WPNSTA Yorktown to help distinguish site-related inorganics concentrations from background. No background data were available for surface water and sediment inorganic constituents of Felgates Creek.

Inorganic constituents detected above background concentrations (if available) and screening criteria in groundwater include:

- Groundwater – aluminum, antimony, arsenic, beryllium, cadmium, chromium, cobalt, iron, lead, manganese, nickel, selenium, thallium, vanadium, and zinc
- Surface Water and Sediment - aluminum, arsenic, chromium, manganese, nickel, selenium, silver, and vanadium

Aluminum exceeded screening criteria in three groundwater (total concentrations) and five sediment sample locations, with maximum concentrations of 68,000 µg/L and 24,100 mg/kg, respectively. However, aluminum is most likely naturally occurring at the site as clay minerals are generally rich in aluminum oxide minerals derived from the weathering of feldspars and other minerals.

Antimony exceeded screening criteria at nine groundwater sample locations (only one dissolved sample), with a maximum dissolved concentration of 97.6 µg/L. Antimony is not likely a site-related constituent and likely naturally occurring and adsorbed by clays, manganese compounds, or precipitated under reducing conditions.

Arsenic exceeded screening criteria at 24 groundwater, 11 surface water, and 8 sediment sample locations, with a maximum concentration of 20.8 µg/L (dissolved), 6.9J µg/L (dissolved), and 10.8 mg/kg, respectively. Arsenic is likely naturally occurring as the elevated concentrations occur with elevated iron and manganese concentrations. Arsenic is commonly adorbed to or co-precipitated with iron and manganese oxides, adsorbed to clay mineral surfaces, and associated with sulfide minerals.

Chromium exceeded screening criteria at 13 groundwater, 3 surface water, and 11 sediment sample locations, with a maximum concentration of 18 µg/L (dissolved), 3.8J µg/L (total, no dissolved exceedances), and 47.8 mg/kg.

Cobalt exceeded a screening criterion at six groundwater sample locations with a maximum dissolved concentration of 88.9 µg/L.

Iron exceeded a screening criterion at 15 groundwater samples with a maximum dissolved concentration of 19,900 µg/L. Iron oxide minerals are common in volcanic-derived soils, such as the sediment of the Yorktown-Eastover aquifer, and are likely naturally occurring at the site.

Manganese exceeded screening criteria at 12 groundwater, 9 surface water, and 3 sediment sample locations, with a maximum concentration of 551 µg/L (dissolved), 175 µg/L (dissolved), and 322 mg/kg, respectively. Manganese oxide minerals are common as a result of oxidation to volcanic derived soils and are likely naturally occurring at the site.

Silver exceeded a screening criterion at 11 surface water sample locations with a maximum dissolved concentration of 1.1L µg/L. Silver is likely naturally occurring and not a constituent historically used at the site.

Beryllium, cadmium, lead, nickel, selenium, thallium, and vanadium were infrequently observed at the site.

9.2.3 Contaminant Migration

The sources of potential contamination at Site 6 are historical discharges of wastewater containing explosives and solvents from Buildings 109 and 110 to the impoundment area via the flume system, and the excavated area possibly used to contain packed explosives. The flume area is a network of flumes connected to an impoundment area, where wastewater possibly containing explosives (TNT, RDX, and 2,4-DNT) and solvents (TCE, 1,1,1-TCA, and cyclohexanone) was discharged between 1942 and 1975. The excavated area may have been the soil borrow pit for construction of the coffer dam for the impoundment and may have

also been used to contain packed explosives; cadmium and zinc contaminated soil was previously excavated from this area.

Removal actions were implemented within the excavated area (soils), the flume system (soils and sediments), and the upper portion of the impoundment area (sediments). The majority of the remaining chlorinated solvents and explosives at the site likely exist within the saturated soils of the Yorktown-Eastover aquifer.

Contaminants released historically migrated downwards through the thin vadose zone by leaching from infiltration. Residual soil contamination within the vadose zone was previously removed from the site. DNAPL beneath the surface impoundment area within the aquifer sediments continues to act as a source of contamination.

Groundwater flow within the Yorktown-Eastover aquifer generally trends westward towards Felgates Creek. Contaminant transport in groundwater will primarily be by advection and dispersion and follow the westward groundwater flow direction. Adjacent to Felgates Creek, the groundwater is a transition zone where freshwater mixes with saltwater by dispersion and mechanical diffusion.

TCE extends approximately 780 ft from adjacent to Building 109 to Felgates Creek within the surface impoundment area; however, the upgradient extent of the plume has not been completely delineated. The TCE plume appears to undergo reductive dechlorination as 1,2-DCE and vinyl chloride generally occur at similar monitoring wells. TCE concentrations appear to be decreasing since the removal action was implemented in 2006 in monitoring wells GW-01 and GW-08. In addition, TCE was not observed in surface water and sediment pore-water of Felgates Creek. The smaller 2,4-DNT and RDX plumes also migrate in the westward groundwater flow direction.

The potential for the migration of VOC vapors into the vadose zone exists at Site 6. The nature, extent, and migration of contamination within the vapor phase was not investigated as part of this RI. No buildings can be developed at the site, since it is located inside an area encumbered by the ESQD.

Surface runoff or wind erosion is not expected to be a significant transport pathway as contaminated soils have been removed from the site and the site is highly vegetated. Contaminant constituents that have migrated to sediment within Felgates Creek may migrate further downstream.

9.2.4 Human Health Risk Assessment

A baseline HHRA was conducted to evaluate the magnitude and probability of actual or potential harm to public health, safety, and welfare posed by the threatened or actual release of hazardous substances at Site 6 in the absence of remedial action. The HHRA evaluated potential current and future health risks from exposure to environmental media.

An exposure assessment was performed to identify the potential pathways of human exposure, as well as an estimation of the magnitude, frequency, and duration of the exposures. Potential current/future receptors evaluated in the HHRA consisted of trespassers/visitors (adult and adolescent). Residents (adult and child), industrial workers, and construction workers were identified as potential or hypothetical future receptors. Conservative exposure pathways include (variously based on the receptor) ingestion,

dermal contact of COPCs in groundwater, surface water, sediment; inhalation exposure to bathroom air from tap water; ingestion exposure to tap water; and dermal contact and inhalation of indoor air or volatile emissions from groundwater. Future residential exposure scenarios are hypothetical since no buildings can be developed at the site because it is within the ESQD.

The potential for unacceptable human health risks was identified by comparing the results of the HHRA to both non-carcinogenic and carcinogenic health effects. The non-carcinogenic health effects were compared to the HI approach, where an HI greater than 1 indicates some potential for adverse non-cancer health effects associated with exposure to the COPC. Carcinogenic effects from exposure to site-related contamination were evaluated by estimating the excess lifetime carcinogenic risk. EPA considers action to be warranted at a site when cancer risks exceed 10^{-4}. Risks less than 10^{-6} generally are not of concern. A chemical was considered a COC if the HI was greater than 1 and/or exceeds a cancer risk of 10^{-4}.

Estimated non-carcinogenic hazards and carcinogenic risks to the current/future adult and adolescent and future construction worker exposed to surface water and sediment are less than the acceptable risk levels. Additionally, the non-carcinogenic hazards and carcinogenic risks to the future construction worker exposed to groundwater are all below USEPA target risk levels.

Potable use of groundwater (ingestion and use of water for showering) by residents and industrial worker from the groundwater plume and construction worker exposure to groundwater from the plume would result in non-carcinogenic hazards and carcinogenic risks above USEPA's acceptable levels. The RME non-carcinogenic hazards are primarily associated with 2a-DNT, 2,4-DNT, cis-1,2-DCE, PCE, and several metals. The carcinogenic risks are primarily associated with PCE, TCE, vinyl chloride, 2,4-DNT, and arsenic. The CTE scenarios for these potential future receptors also exceed the acceptable non-carcinogenic hazard index of 1.0 or the carcinogenic risk range of 10^{-6} to 10^{-4}. The future residential land use scenario evaluated in this assessment is very conservative because it is assumed that land use will not change in the future, and if it did, it is unlikely that the Yorktown-Eastover aquifer groundwater would be used as a potable water supply.

Potable use of groundwater (ingestion and use of water for showering) by residents and industrial worker exceed USEPA acceptable risk levels. With the exception of the carcinogenic risk to the industrial worker, the CTE scenarios for these potential future receptors also exceed the acceptable non-carcinogenic hazard index of 1.0 or the carcinogenic risk range of 10^{-6} to 10^{-4}. The hazards and risks are associated with 2,4-DNT, 1,3-dinitrobenzene, and RDX.

9.2.5 Ecological Risk Assessment

A SERA comprising Steps 1 and 2 of the ERA process and the first step (Step 3A) of a BERA were conducted for aquatic and wetland habitats at Site 6. Terrestrial habitats were not evaluated since the previous remedial actions have eliminated terrestrial ecological exposure pathways.

The ERA was conducted to evaluate the potential for adverse effects to the environment at the site. The objectives of the SERA were to determine if potential risks to ecological

receptors warrant additional assessment beyond the conservative screening steps of the ERA process or the removal of the site from further ecological consideration, focus subsequent steps of the ERA process on the specific chemicals, pathways, and receptors if unacceptable ecological risks are possible, and identify any data gaps.

In summary, no COCs were identified for surface water, sediment, or sediment pore-water, and no COCs were identified for food web exposure at Site 6. Therefore, no unacceptable ecological risks were identified and no further evaluation is warranted for ecological receptors.

9.3 Proposed Future Actions

Based on the data and findings from the Phase II RI, some delineation and characterization of the horizontal and vertical distribution of contamination within groundwater, surface water, and sediment at Site 6 has been completed but additional data will need to be collected to proceed with a Feasibility Study (FS) of potential remedial alternatives. The FS will address the potential human health risks related to PCE, TCE, cis-1,2-DCE, vinyl chloride, 2a-DNT, 2,4-DNT, 1,3-dinitrobenzene, RDX, and several inorganics (under the potable use scenario). However, it should be noted that hypothetical future resident scenarios and the construction of buildings at the site will not occur, since the site is located within the ESQD. Some portions of the groundwater beneath the site is brackish and would require treatment for potable use.

The FS for Site 6 will develop, screen, and evaluate potential remedial alternatives and assess the potential performance and cost of remedial alternatives under consideration. Any new data collected since the Phase II RI will be evaluated and the CSM will be updated.

To support the development of the FS, the following data needs and activities are recommended by media:

Soil

- Additional soil borings within the surface impoundment may be needed to further delineate the subsurface geology and the extent of DNAPL for support of FS source area treatment alternatives.
- Additional soil borings may be needed to further delineate the geology and the source and extent of explosives for support of FS source area treatment alternatives.
- Nickel will be considered a site-related contaminant of concern in soil and will be addressed in future documents.

Groundwater

- Additional monitoring wells should be installed upgradient and to the southeast of well 6GW12 to further characterize the upgradient extent of the chlorinated VOC plume.

Additional monitoring wells within the surface impoundment may be needed to further delineate the subsurface geology and the extent of DNAPL for support of FS source area treatment alternatives.

- An additional monitoring well should be installed between wells 6GW07 and 6GW17 (or sediment pore-water samples) in the area where the elevated concentrations of the chlorinated VOC plume may be discharging to Felgates Creek, if possible.
- Additional monitoring wells may be needed to further delineate the geology and the source and extent of explosives for support of FS source area treatment alternatives. Nickel will be considered a site-related contaminant of concern in groundwater and will be addressed in future documents.
- Arsenic will be considered a site-related contaminant of concern in groundwater and will be evaluated as part of the pre-FS investigation to verify the RI results. There is concern regarding the RI arsenic results due to high turbidity and the total versus dissolved results.
- Additional monitoring wells may be needed to further delineate the extent of the VOC plume within the impoundment near the discharge of the flume for support of FS source area treatment alternatives.
- Additional groundwater natural attenuation indicator parameters and the microbe parameter *Dehalococcoides species* data may need to be collected to provide a more adequate analysis.
- Collection of at least one complete round of groundwater level measurements and groundwater samples from the Site 6 monitoring well network in the future to update Site 6 conditions and establish baseline conditions prior to the implementation of the Feasibility Study.

Surface Water and Sediment

- Arsenic, magnesium, silver, and nickel will be considered a site-related contaminant of concern in soil and will be addressed in future documents.

During the sampling event(s), groundwater should be analyzed for COCs identified in this RI and natural attenuation parameters.

The EPA and VDEQ will be involve with the planning process for future sampling activities.

SECTION 10

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Appendix A
Boring Logs and Well Diagrams

Borehole Location Data **ROY F. WESTON, Inc.**

BOREHOLE ID : 6GW01 SITE NAME/NO: WPNSTA YORKTOWN
BEGIN DATE : 06/15/92 END DATE : 06/15/92

LOGGER/COMPANY : W. BREW

BOREHOLE COMPLETED IN (<O>verburden <B>edrock) : O

TOTAL DEPTH : 22.00 DEPTH TO BEDROCK : 0.00

BOREHOLE DIAMETER #1: 12.00
INTERVAL: 0.00 ft. to 22.00 ft. BGS
METHOD : HSA FLUID : NONE
BOREHOLE DIAMETER #2:
INTERVAL:
METHOD : FLUID :
BOREHOLE DIAMETER #3:
INTERVAL:
METHOD : FLUID :

DRILLING COMPANY : HARDIN-HUBER
DRILLER : ROYCE KEENAN
DRILL RIG TYPE : B-61

	ESTIMATED	SURVEYED
SURFACE ELEVATION :	0.000	9.800
N. COORDINATE :	0.0000	345079.0000
E. COORDINATE :	0.0000	2559217.0000

WELL PERMIT.....(Y)es (N)o: N PERMIT # :

HOLE ABANDONED...(Y)es (N)o: N
WELL INSTALLED...(Y)es (N)o: Y
WELL CLUSTER.....(Y)es (N)o: N No. OF WELLS : 0
WELL NEST.....(Y)es (N)o: N No. OF WELLS : 0
PUMPS INSTALLED..(Y)es (N)o: N TYPE DEPTH
PURGE : 0.00
SAMPLE : 0.00

BOREHOLE TESTING
BOREHOLE GEOPHYSICS.....(Y)es (N)o: N
SLUG TESTS.....(Y)es (N)o: Y
PACKER TESTS.....(Y)es (N)o: N
PUMPING TESTS.....(Y)es (N)o: N

COMMENTS :

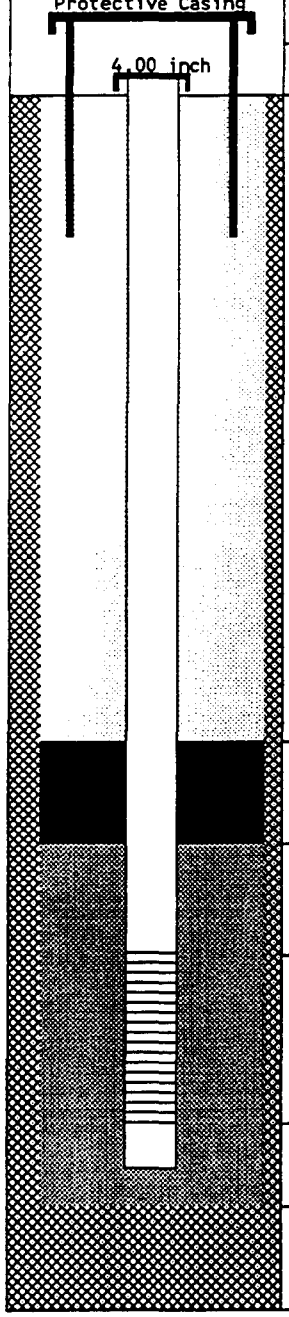
NWS-00313-03.13-07/01/93

Well Completion Summary — *ROY F. WESTON, Inc.*

CLIENT	WPNSTA YORKTOWN	*DRILLING FIRM*	HARDIN-HUBER
SITE NAME	WPNSTA YORKTOWN	*INSPECTOR*	W. BREW

WELL ID	6GW01
START DATE	06/15/92
COMPLETION DATE	06/15/92

WATER LEVELS



DEPTH		*ELEV.*
3.00	*TC*	12.80
0.00	*GS*	9.80
2.00	*BN*	7.80
4.00	*SP*	5.80
5.00	*SC*	4.80
20.00	*BS*	-10.20
20.00	*TD*	-10.20

DRILLING SUMMARY

Driller ROYCE KEENAN
Drilling Fluid NONE
Well Type SINGLE CASED SCREENED

WELL DESIGN CONSTRUCTION

Casing #1 Diameter: 4.00 *inch* *Interval:* 0.00 to 5.00 *ft.*
Type : PVC SCH 40

Stick Up Inner Casing: 3.00 *ft.* *Protective Casing:* 0.00 *ft.*

Casing Grout: CEMT/BENT *Interval:* 0.00 to 2.00 *ft.*

Seal Type: BENTONITE *Interval:* 2.00 to 3.00 *ft.*

Sand Pack Type : MORIE #2 *Interval:* 4.00 to 20.00 *ft.*
Grain Size : UNIFORM *Median Diameter:* 2-3
Screen Diameter: 4.00 *Interval:* 5.00 to 20.00 *ft.*
Type : PVC *Slots:* .020 *inches*

Silt Trap Interval: 0.00 to 0.00 *ft.*
Backfill Type : *Interval:* 0.00 to 0.00 *ft.*

WELL DEVELOPMENT

Date / /
Method
Yield *Purged Volume*

COMMENTS

TC = Top of Casing
GS = Ground Surface
BN = Top Seal
SP = Top Sand Pack
SC = Top Screen
BS = Bottom Screen
TD = Total Depth
= Grout
= Seal
= Sand Pack
= Formation

Additional Comments:

NOTE: Well Diagram not to Scale *Elevations are feet above mean sea level*

01/06/93

Borehole Log

ROY F. WESTON, Inc.

CLIENT	: WPNSTA YORKTOWN	TOTAL DEPTH	: 22.00
SITE NAME	: WPNSTA YORKTOWN	LOGGER	: W. BREW
WELL ID	: 6GW01	DRILLING COMPANY	: HARDIN-HUBER
NORTHING	: 345079.0000 surveyed	DRILLING RIG	: B-61
EASTING	: 2559217.0000 surveyed	DATE STARTED	: 06/15/92
ELEVATION	: 9.800 surveyed	DATE COMPLETED	: 06/15/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
			90	Fill	DK YLLWISH BRN	SFT	MST	3 6 8 7	OVA 0.0	
				Fill	DK YLLWISH BRN		DRY		OVA 0.0	
8	1									
7	2		5	Fill	DK YLLWISH BRN		DRY	1 2 1 1	OVA 0.0	
6	3									
5	4		55	Fill	DK OLIVE GRAY	FRM	MST		OVA 0.0	Wood 0.2' thick observed at 5.0-5.2'. Appears that fill material ends w/this spoon.
4	5									
3	6		80	Fill	DK OLIVE GRAY	FRM	MST	1 2 1 1	OVA 0.0	
				Lean clay, CL	DK OLIVE GRAY	FRM	MST		OVA 40.0	
2	7									
1	8		75	Lean clay, CL	DK OLIVE GRAY	FRM	MST	1 1 2 1	OVA 0.0	
0	9									
-1	10		90	Lean clay, CL	DK OLIVE GRAY	FRM	MST	1 2 1 2		

Borehole Log

ROY F. WESTON, Inc.

CLIENT	: WPNSTA YORKTOWN	TOTAL DEPTH	: 22.00
SITE NAME	: WPNSTA YORKTOWN	LOGGER	: W. BREW
WELL ID	: 6GW01	DRILLING COMPANY	: HARDIN-HUBER
NORTHING	: 345079.0000 surveyed	DRILLING RIG	: B-61
EASTING	: 2559217.0000 surveyed	DATE STARTED	: 06/15/92
ELEVATION	: 9.800 surveyed	DATE COMPLETED	: 06/15/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Lean clay, CL	DK OLIVE GRAY	FRM	MST			
-1	11									
				Silty sand, SM	YELLOWISH BROWN	SFT	WET		OVA 0.0	
-2	12		90	Silty sand, SM	YELLOWISH BROWN	SFT	WET	1 1 2 2	OVA 0.0	
-3	13									
-4	14		90	Silty sand, SM	YELLOWISH BROWN	SFT	WET	1 3 5 6	OVA 0.0	
-5	15									
-6	16		90	Silty sand, SM	YELLOWISH BROWN	SFT	WET		OVA 0.0	
-7	17									
-8	18									
-9	19									
-10	20		90	Silty sand, SM	YELLOWISH BROWN	SFT	WET	5 6 7 11	OVA 0.0	

Borehole Log **ROY F. WESTON, Inc.**

CLIENT	: WPNSTA YORKTOWN	TOTAL DEPTH	: 22.00
SITE NAME	: WPNSTA YORKTOWN	LOGGER	: W. BREW
WELL ID	: 6GW01	DRILLING COMPANY	: HARDIN-HUBER
NORTHING	: 345079.0000 surveyed	DRILLING RIG	: B-61
EASTING	: 2559217.0000 surveyed	DATE STARTED	: 06/15/92
ELEVATION	: 9.800 surveyed	DATE COMPLETED	: 06/15/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Silty sand, SM	YELLOWISH BROWN	SFT	WET		OVA 0.0	
				Shelly hash	YELLOWISH BROWN	SFT	WET		OVA 0.0	Gravel = shells
-11	21									
-12	22									
-13	23									
-14	24									
-15	25									
-16	26									
-17	27									
-18	28									
-19	29									
-20	30									

DATE: 12/08/92 **** LITHOLOGICAL DATA FOR - CLIENT ID: BAKER *** PAGE: 6

BOREHOLE /WELL ID	SMP NUM	LTH NUM	LITHOLOGY INT. (FT BGS)		SAMPLING METHOD	SIZE GRAVEL	GRAVEL PCT.	SIZE SAND	SAND PCT	SILT PCT	CLAY PCT	ORGANIC PCT	ROCK TYPE	PLAST	SORT	STRENGTH	MOISTURE	STRAT UNIT
6GW01	1	1	0.00	0.50	SPS	C	40	F	40	20	0	0		NON	POR	SFT	MST	
6GW01	1	2	0.50	2.00	SPS		0	F	10	30	60	0					DRY	
6GW01	2	1	2.00	4.00	SPS		0	F	10	30	60	0					DRY	
6GW01	3	1	4.00	6.00	SPS		0	F	20	10	70	0		MOD	POR	FRM	MST	
6GW01	4	1	6.00	6.20	SPS		0	F	20	10	70	0		MOD	POR	FRM	MST	
6GW01	4	2	6.20	8.00	SPS		0	F	5	15	80	0		MOD		FRM	MST	
6GW01	5	1	8.00	10.00	SPS		0	F	5	15	80	0		MOD		FRM	MST	
6GW01	6	1	10.00	11.70	SPS		0	F	5	15	80	0		MOD		FRM	MST	
6GW01	6	2	11.70	12.00	SPS		0	F	80	20	0	0		NON	POR	SFT	WET	
6GW01	7	1	12.00	14.00	SPS		0	F	80	20	0	0		NON	POR	SFT	WET	
6GW01	8	1	14.00	16.00	SPS		0	F	80	20	0	0		NON	POR	SFT	WET	
6GW01	9	1	16.00	20.00	SPS		0	F	80	20	0	0		NON	POR	SFT	WET	
6GW01	10	1	20.00	20.30	SPS		0	F	80	20	0	0		NON	POR	SFT	WET	
6GW01	10	2	20.30	22.00	SPS	CMF	50		40	10	0	0		NON	POR	SFT	WET	

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW01A

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6
COORDINATES: NORTH: 345079.25, EAST: 2559217.07
ELEVATIONS: SURFACE: 12.10

RIG: Mobile B-80	SPLIT SPOON	AUGERS	SURFACE CASING	REAMING TOOL	DATE	PROGRESS (FT.)	WEATHER	WATER DEPTH (FT.)
SIZE (DIAM.)	1 3/8	4-1/4" ID	--	--	9-9-94	64	Partly Cloudy 80°	13
LENGTH	2.0'	5.0'	--	--				
TYPE	Std.	HSA	--	--				
HAMMER WT.	140#	--	--	--				
FALL	30"	--	--	--				

REMARKS:

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

Well Information	Diam.	Type	Top Depth (ft.)	Bottom Depth (ft.)
Well Riser	2"	Sch. 40 PVC, Threaded	-2.09 Stickup	48.0
Well Screen	2"	No. 10 Slot Sch. 40 PVC, Threaded	48.0	63.0

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp.	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
1	A-N					GRASS TOPSOIL		
2	S1	1.6/2.0 80%	5 5 5 6		0.4/0.4	silty CLAY, little sand, trace roots, brown, stiff, damp	Cement Bentonite Grout	
3						Clay, little silt, sand, trace fine gravel, orange brown, stiff, damp		
4	S2	1.3/2.0 65%	1 2 1 1		0.4/0.4	silty CLAY, trace sand, roots, mottled orange & gray, soft, moist		
5						5.0	Top of Bentonite Slurry 5.0	7.1
6	S3	1.4/2.0 70%	1 1 1 5		0.4/0.4	sandy SILT, olive, soft, moist		
						6.5		5.6
7						organic SILT, trace sand, roots, dark brown, medium stiff, wet 7.0		5.1
8	S4	1.3/2.0 65%	2 1 2 1		0.3/0.3	medium to fine SAND, gray, very loose, wet 8.0		4.1
9						organic SILT, trace sand, roots, dark brown, soft, moist		
10	S5	2.0/2.0 100%	WOH/1.0 1 1		0.3/0.3	SAME except very soft		
						Match to Sheet 2		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: M. Taube
DRILLER: M. Corron WELL/BORING NO.: 6GW01A SHEET 1 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW01A

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
11						organic SILT, trace sand, roots, olive-brown, soft, moist (Continued from Sheet 1)		
11.5						11.5		0.6
12	S6	2.0/2.0 100%	1 1 1 1		0.3/0.3	SILT and clay, little sand, trace wood fragments, olive-brown to blue-gray, very soft, moist		
13						13.0		-0.9
14	S7	2.0/2.0 100%	1 2 3 4		0.3/0.3	silty fine SAND, light greenish-gray loose, wet		
15								
16	S8	2.0/2.0 100%	3 3 4 4		0.2/0.2	SAME except orange to light orange brown	Bentonite Slurry	
17								
18	S9	2.0/2.0 100%	WOH/1.5 3		0.2/0.2	SAME except little coarse to fine shell fragments		
19								
20	S10	2.0/2.0 100%	2 5 5 6		0.2/0.2	silty medium to fine SAND, trace coarse to fine shell fragments, light orange-brown to olive, medium dense, wet		
21							PVC Riser	
22	S11	1.8/2.0 90%	5 10 13 15		0.2/0.2	fine SAND, little silt, little coarse to fine shell fragments, olive to dark green-gray, medium dense, wet		
23								
24	S12	2.0/2.0 100%	2 2 3 5		0.2/0.2	SAME except and silt, dark gray, loose		
25								
26	S13	2.0/2.0 100%	2 3 5 6		0.2/0.2	SAME		
27								
28	S14	2.0/2.0 100%	3 6 6 7		0.2/0.2	silty fine SAND, trace medium to fine shell fragments, dark green gray, medium dense, wet		
29								
30	S15	2.0/2.0	4 5		0.2/0.2	SAME (Match to Sheet 3)		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: M. Taube
DRILLER: M. Corron WELL/BORING NO.: 6GW01A SHEET 2 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW01A

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
						Continued from Sheet 2		
31	S15	100%	5 6			silty fine SAND, trace fine shell fragments, dark green-gray, loose, wet		
32	S16	2.0/2.0	2 4 5		0.2/0.2			
						32.5		-20.4
33		100%	6			sandy SILT, little clay, little coarse to fine shells, dark green-gray, medium stiff moist.		
34	S17	2.0/2.0	2 3 4		0.2/0.2	SAME except little sand, trace shell fragments, moist to wet		
35		100%	4					
	S18	2.0/2.0	1 3 4		0.2/0.2	sandy SILT, trace clay, shell fragments, dark green-gray medium dense, wet	Bentonite Slurry	
37		100%	4					
						37.0		-24.9
38	S19	2.0/2.0	2 5 7		0.2/0.2	Silty fine SAND, some coarse to fine shell fragments, green-gray, medium dense, wet	2" Diameter PVC Riser	
39		100%	10					
40	S20	2.0/2.0	10 5 7		0.2/0.2	SAME except trace shell fragments, green		
41		100%	11					
						41.0	Top of SAND	-28.9
42	S21	2.0/2.0	3 3 6		0.2/0.2	SAME except little silt		
43		100%	10					
44	S22	2.0/2.0	5 7 9		0.2/0.2	SAME		
45		100%	10					
46	S23	2.0/2.0	1 4 5		0.2/0.2	SAME except silty SAND, ½" sand nodule present, loose		
47		100%	7					
48	S24	2.0/2.0	1 3 5		0.2/0.2	Silty fine SAND, little coarse to fine shell fragments, dark green, loose, wet	Top of screen 48.0	-35.9
9		100%	8					
50	S25	2.0/2.0	3 3		0.2/0.2	SAME except trace shells, clay		
						Match to Sheet 4		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: M. Taube
DRILLER: M. Corron WELL/BORING NO.: 6GW01A SHEET 3 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW01A

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
						Continued from Sheet 3		
51	S25	100%	11 19					
52	S26	2.0/2.0	4 5		0.2/0.2	silty SAND, trace medium to fine shell fragments, dark green, medium dense, wet		
53		100%	9 14					
54	S27	2.0/2.0	4 8		0.2/0.2	SAME except little shells		
55		100%	8 12				0.10 slot screen	
56	S28	2.0/2.0	5 6	6GW01A -28	0.2/0.2	SAME		
57		100%	9 9				#1 qtz sand	
58	S29	2.0/2.0	5 6		0.2/0.2	SAME except trace shell fragments		
59		100%	7 8					
60	S30	2.0/2.0	2 5		0.2/0.2	silt, SAND, dark green, medium dense, wet		
61		100%	6 10					
62	S31	2.0/2.0	3 4		0.2/0.2	silty SAND, trace shell fragments (medium to fine), trace clay, dark green, loose, wet.	Bottom of screen 61.9	-49.8
63		100%	5 5				63.0 Bottom of well	-50.9
64	A-N	100%						-51.9
5						Boring Terminated at 64' bgs	Bottom of borehole	
6								
7								
8								
9								
0						Match to Sheet		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: M. Taube
DRILLER: M. Corron WELL/BORING NO.: 6GW01A SHEET 4 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW02

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6e
COORDINATES: NORTH: 344819.89 EAST: 2558566.45
ELEVATIONS: SURFACE: 35.97

RIG: B-80 mobile	SPLIT SPOON	AUGERS	SURFACE CASING	REAMING TOOL	DATE	PROGRESS (FT.)	WEATHER	WATER DEPTH (FT.)
SIZE (DIAM.)	1 3/8	4-1/4" ID			9.20.94	25	Clear, 80°	
LENGTH	2.0'	5.0'		--	9.21.94	to 47'	Overcast, 70°s	38'
TYPE	Std.	HSA			9.23.94	to 57'	Clear, Cool, 60°s	
HAMMER WT.	140#	--	--	--				
FALL	30"	--	--	--				

REMARKS:

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

Well Information	Diam.	Type	Top Depth (ft.)	Bottom Depth (ft.)
Well Riser	2"	Sch. 40 PVC, Threaded	-2.5 stick up	40.0
Well Screen	2"	No. 10 Slot Sch. 40 PVC, Threaded	40.0	55.0

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp.	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
1, 2, 3	S1	1.0/2.0 50%	2 4 5 5		0.2 — 0.2	TOP SOIL fine to coarse SAND, little silt, trace clay, trace root hairs, brown, loose, damp	Bentonite-cement grout	
4, 5	S2	1.0/2.0 50%	4 5 5 4		0.2 — 0.2	fine to coarse SAND, trace silt, trace clay, trace fine gravel, trace roots, yellow brown, loose, damp	10" ⌀ STEEL CASING	
6, 7	S3	1.2/2.0 60%	2 3 3 4		0.2 — 0.2	fine to coarse SAND (predominantly fine), little clay, little silt, brown, loose, damp		28.97
8, 9	S4	0.8/2.0 40%	5 7 9 11		0.6 — 0.6	CLAY, some sand, little silt, yellow brown with dark brown mottling, stiff, damp; SHELLS (mostly cemented aggregates), little silty clay, trace sand, white, stiff, damp		27.27; 26.97
10	S5	1.2/2.0 60%	3 5 6 6		0.4 — 0.4	SILTY CLAY, little fine to coarse sand (flakes), trace gravel, dark brown and gray, stiff, damp		

Match to Sheet 2

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: M. Towne
DRILLER: M. Corron WELL/BORING NO.: 6GW02 SHEET 1 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW02

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA:

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
						Continued from Sheet 1		
11								
12	S6	2.0/2.0 100%	3 3 4 5		0.2/0.2	SILTY CLAY and clay silt, [illegible] layered, trace sand, dark gray [illegible] brown and gray, medium stiff, damp	Bentonite pellets	
13								
14	S7	2.0/2.0 100%	2 4 3 4		0.2/0.2	SILTY CLAY, trace carbonated shell nodules, trace sand, trace root hairs, brown with green mottling, medium stiff, damp to moist	Bentonite slurry	
15								
16	S8	2.0/2.0 100%	3 4 8 8		0.2/0.2	SILTY CLAY, trace sand, brown with grey mottling, stiff, damp to moist; fine to coarse SHELLS, trace to and silty CLAY, brn. with grey mottling, med. stiff, damp to moist		19.4
17								18.97
18	S9	2.0/2.0 100%	3 4 6 4		0.2/0.2	SILTY CLAY, trace sand, brown and grey, soft, moist; fine to medium SHELL FRAGMENTS, trace to and silty clay, brown/grey, stiff, moist to wet; SILTY CLAY, trace sand, brown/grey, soft, damp to moist		18.47
19							10" ϕ STEEL CASING	17.47
20	S10	2.0/2.0 100%	2 3 3 4		0.2/0.2	SILTY CLAY, little fine shell fragments, brown, medium stiff, moist to damp; SILTY CLAY, trace fine shell laminae, dark grey, medium stiff, moist to damp		
21								
22	S11	2.0/2.0 100%	2 3 4 7		0.2/0.2	SILTY CLAY, dark grey, soft, moist to damp; SILT, little clay, little fine sand, dk. grey, med. stiff, moist to damp; SILTY CLAY, trace fine sand, dk. grey, stiff, moist to damp		14.47
23								13.97
24	S12	2.0/2.0 100%	3 2 5 6		0.2/0.2	SILTY CLAY, trace fine sand/shell laminae, dk. grey, med. stiff, damp to moist; SILT, little sand, trace clay, dk. grey, med. stiff, damp		
25								11.27
26	S13	2.0/2.0 100%	3 4 5 8		0.3/0.3	SILTY CLAY, trace fine sand laminations, greenish grey, stiff, damp to moist		
27								
28	S14	2.0/2.0 100%	3 4 4 7		0.3/0.3	SAME, but medium stiff		
29								
30	S15	2.0/2.0	3 6		0.3/0.3	SILTY CLAY with trace to some silty sand laminae to interbeds, trace fine shell frag., increasing sand with depth, Match to Sheet 3		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: [illegible]
DRILLER: M. Conon WELL/BORING NO.: 6GW02 SHEET 2 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW02

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA:

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
31			7 13			greenish grey, stiff, Continued from Sheet 2 damp to moist	Bentonite slurry	
32	S16	2.0 / 2.0 100%	7 7 8 12		0.3 / 0.3	SILTY CLAY with some sandy silt interbeds, trace shell frag.s, greenish grey, stiff, damp to moist		
33						SILTY CLAY, trace fine sand laminae, trace fine shell frag.s, greenish grey, very stiff, damp to moist		
34	S17	2.0 / 2.0 100%	4 6 8 9		0.3 / 0.3	SAME but no shell fragments and stiff		
35								
36	S18	2.0 / 2.0 100%	11 19 15 23		0.3 / 0.3	SAME but hard and moist		-0.33
37						fine to med. SILTY SAND, little fine to coarse shell frag.s, trace clays, olive and orange, very stiff, moist	Top of Sand 37'	-1.03
38	S19	1.3 / 2.0 65%	6 11 11 16		0.3 / 0.3	SILTY CLAY, trace fine sand laminations, greenish grey to brown, med. stiff, moist to wet		-1.53
39						SILTY SAND, little fine to coarse shells, frag.s, reddish brown oxidation staining, med. dense, moist to wet		
40	S20	2.0 / 2.0 100%	6 10 10 18		0.3 / 0.3	SILTY SAND, little fine to medium shell frag.s, olive brown, medium dense, moist to wet	TOP OF SCREEN 40'	
41								
42	S21	2.0 / 2.0 100%	6 10 13 15		0.3 / 0.3	SAME but brown and grey and wet		
43								-7.03
44	S22	2.0 / 2.0 100%	14 10 12 19		0.3 / 0.3	fine SAND, some shell fragments, little silt, olive-brown, medium dense, wet		
45								
46	S23	2.0 / 2.0 100%	7 8 12 20		0.3 / 0.3	fine SAND, little silt little to trace shell fragments, olive brown, medium dense, wet		
47						SAME but dark green grey		
48	S24	1.3 / 2.0 65%	8 22 35 47		0.5 / 0.6	fine grained SAND, little silt some shell fragments, dk. greenish grey & white, very dense, wet		
49						SAME but no shell fragments		
50	S25	1.5 / 2.0	10 25			SAME but some shell fragments [illegible] Match to Sheet		

DRILLING CO.: HARDIN-HUBER, INC.
DRILLER: M. Corion

BAKER REP.: NGT [illegible] (9.20-9.21.94) JE ZIMMERM (9.23.9
WELL/BORING NO.: 6GW02 SHEET 3 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW02

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA:

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
						Continued from Sheet 3		
51		75%	28 23		0.5 / 0.5		Quartz sand	
52	S26	1.5 / 2.0	6 11 12		0.5 / 0.5	SAME but occasional shells throughout, medium dense		
53		75%	17					
54	S27	1.7 / 2.0	5 4 6		0.5 / 0.5	SAME but with shell material throughout	Bottom of screen → 55	
55		85%	9					
56	S28	1.9 / 2.0	2 3 7		0.5 / 0.5	SAME, but with only occasional shell material throughout	→ 56' Bottom of PVC well	
57		95%	14					
8						Boring terminated at 57' bgs		
9								
0								
1								
2								
3								
4								
5								
6								
7								
8								
9								
0						Match to Sheet		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: JEZIMMERMAN
DRILLER: M. Corron WELL/BORING NO.: 6GW02 SHEET 4 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW03

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6
COORDINATES: NORTH: 345777.73, EAST: 2559237.11
ELEVATIONS: SURFACE: 28.31

RIG: Mobile B-80

	SPLIT SPOON	AUGERS	SURFACE CASING	REAMING TOOL	DATE	PROGRESS (FT.)	WEATHER	WATER DEPTH (FT.)
SIZE (DIAM.)	1 3/8"	4-1/4" ID	10"	13"	9-23-94	23	Partly Cloudy 80°	— —
LENGTH	2.0'	5.0'	10'	--	10-20-94	26	Partly Cloudy 75°	29'
TYPE	Std.	HSA	steel	drag				
HAMMER WT.	140#	--	--	--				
FALL	30"	--	--	--				

REMARKS:

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

Well Information	Diam.	Type	Top Depth (ft.)	Bottom Depth (ft.)
Well Riser	2"	Sch. 40 PVC, Threaded	-2.36 stick-up	37.9
Well Screen	2"	No. 10 Slot Sch. 40 PVC, Threaded	37.9	48.0

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp.	Visual Description/Comments	Elevation (ft.)
1	A-N						
2–3	S1	1.4/2.0 70%	4 5 10 12		0.3/0.3	silty fine SAND, trace clay, brown to yellow brown, medium dense, damp	
4–5	S2	1.0/2.0 50%	7 7 8 11		0.3/0.9	SAME except no clay	
6–7	S3	1.1/2.0 55%	4 5 6 7		0.3/0.3	SAME except trace clay, orange to reddish brown staining 7.0	22.31 / 21.31
8–9	S4	1.5/2.0 75%	3 4 5 7		0.3/0.3	CLAY, trace silt, fine sand, yellow brown w/orange staining, stiff, damp 9.0	19.31
10	S5	1.5/2.0 75%	3 3 3 5		0.3/0.3	fine SAND and silt, some clay, yellow brown w/red staining, loose, damp Match to Sheet 2	

Well Installation Detail: cement-bentonite grout; 10" steel casing; Top of bentonite slurry 6.0

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: J. Zimmerman / M. Taube
DRILLER: M. Corron WELL/BORING NO.: 6GW03 SHEET 1 OF 3

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW03

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
						Continued from Sheet 1		
11								
12	S6	1.6/2.0 80%	4 4 4 4		0.3/0.3	fine SAND, some silt, little clay, brown to light gray w/ orange-red staining, loose, damp.		
13							10" Steel casing	
14	S7	1.6/2.0 80%	2 2 3 3		0.3/0.3	Same except damp to moist		
15						15.0		13.31
16	S8	1.8/2.0 90%	3 3 4 5		0.3/0.3	silty CLAY, brown w/red staining, medium stiff, damp 16.0		12.31
17						fine SAND, trace silt, dark gray w/red staining loose, moist		
18	S9	2.0/2.0 100%	1 1 3 3		0.3/0.3	Same except very loose 18.3		10.01
19						CLAY, trace silt, dark green-gray, medium stiff, moist		
20	S10	2.0/2.0 100%	3 3 6 9		0.3/0.3	SAME except stiff		
21								
22	S11	2.0/2.0 100%	3 3 5 10		0.3/0.3	SAME	Bottom of 10" Steel casing 23.0'	
23								5.31
24	S12	2.0/2.0 100%	3 6 9 12		0.3/0.3	SAME		3.61
25						fine SAND, trace shell fragments, silt dark green-gray, medium dense, moist		
26	S13	1.0/2.0 50%	7 13 14 20		0.2/0.2	SAME except, some clay, little silt, shell fragments		
27								
28	S14	1.7/2.0 85%	8 10 9 12		0.2/0.2	fine SAND, little shell fragments (coarse to fine) little silt, trace clay, green-gray, medium dense, moist to wet 28.5		-0.19
29								
30	S15	1.5/2.0	8 14		0.2/0.2	SAME except shells medium to fine grained Match to Sheet 3		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: J. Zimmerman / M. Taube
DRILLER: M. Corcoran WELL/BORING NO.: 6GW03 SHEET 2 OF 3

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW03

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
						Continued from Sheet _		
31	S15	75%	11 12				Bentonite Slurry	
32 33	S16	1.7/2.0 85%	5 9 15 16		0.2/0.2	fine SAND, little shell fragments (medium to fine), silt, trace clay green-gray, medium dense, wet.	Top of #1 quartz sand 33.0	-4.69
34 35	S17	2.0/2.0 100%	8 11 17 18		0.2/0.2	SAME except trace shell fragments		
37	S18	1.5/2.0 75%	6 9 10 17		0.2/0.2	SAME		
38 39	S19	1.7/2.0 85%	8 13 15 17		0.2/0.2	SAME except little coarse to fine shell fragments	Top of screen 37.9	-9.59
40 41	S20	1.3/2.0 65%	9 19 12 17		0.2/0.2	SAME except dense	#1 Quartz SAND	
42 43	S21	1.6/2.0 80%	9 8 9 8		0.2/0.2	fine SAND, some silt, trace shell fragments, clay, green-gray, medium dense, wet	0.10 slot pvc screen	
44 45	S22	1.8/2.0 90%	6 6 7 9		0.2/0.2	SAME		
46 47	S23	2.0/2.0 100%	6 9 5 11		0.2/0.2	SAME	Bottom of screen 46.9	-18.59
48 9	S24	2.0/2.0 100%	6 5 8 11		0.2/0.2	SAME	Bottom of pvc well 48.0	-19.69
								-20.69
0						Boring terminated at 49.0 bgs Match to Sheet _		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: M. Taube
DRILLER: M. Corron WELL/BORING NO.: 6GW03 SHEET 3 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW05B
COORDINATES	NORTHING: 345,203.46	EASTING:	2,558,990.33
ELEVATION:	GROUND SURFA 6.83	TOP OF PVC CASING:	8.59

Rig: CME-55 ATV	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/14/2004	15	Overcast, 70s°	6
Length (FT)	2.0		5.0					
Type	STD		HAS					
Hammer Wt.	140#							
Fall								

Remarks:

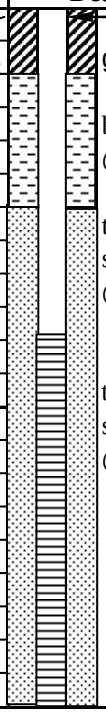
SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	5
Sch. 40 PVC (0.010 in.) screen	2"	5	15

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description
1, 2	S-1	1.1 55%	W-O-H 1 2 2			Topsoil; Damp, brown SILT, some clay, tr. organics; Damp, light gray and orange mottled CLAY, some silt, trace organic material
3, 4	S-2	1.7 85%	2 2 3 2			-trace fine sand in partings (3.8-4.0 ft)
5, 6	S-3	2 100%	W-O-H 1 2 2			Moist to wet, light blue gray CLAY, some silt, trace fine sand in partings
7, 8	S-4	0.7 35%	1 2 2 3			Wet, light yellow brown, fine SAND, some silt, trace clay; water @ 6-ft
9, 10	A-N					No sample collected 8-12 ft.



DRILLING CO.	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW05B SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW05B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	A-N					No sample collected 8-12 ft.	No. 1 Qtz sand	
12								
13	S-5	1.8 90%	1 1 2 2			Wet, light yellow- brown, fine SAND, some silt, trace clay	0.10 slot PVC screen	
14							Bottom of screen @ 15'	
15	A-N							
16						EOB @ 15-ft		
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW05B SHEET 2 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Yorktown Naval Weapon Station - Well Installation, Site 6

CTO NO.: 62470-394 BORING NO.: 6GW06

COORDINATES: EAST: NORTH:

ELEVATION: SURFACE: TOP OF PVC CASING:

Rig: Truck								
	Split Spoon	**Casing**	**Augers**	**Core Barrel**	**Date**	**Progress (Ft.)**	**Weather**	**Depth to Water (Ft.)**
Size (ID)	1.375		4.25		5/12/2000	0.0 - 18.0	Sunny, 80	8
Length	2.0		5.0					
Type	STD		HSA					
Hammer Wt.	140							
Fall	30"							

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample H=Hand Spoon

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch 40 Riser	2"	0	8
Sch 40 .010 Slot Screen	2"	8	18

Depth (feet)	Sample Type & No.	Sample Rec. (feet)	SPT	Lab ID	PID (ppm) BG/PS	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	S-1	1.5	2-4-4-5			CLAY and silt, trace very fine sand, brown, damp	cement bentonite grout	
2								
3								
4	S-2	1.5	3-4-4-6			CLAY, little silt, trace very fine		
5						sand, sand increase to little at bottom 2", red/brown mottled	Bent. Chips	
6						moist		
7							Sand pack	
8						Groundwater level		
9	S-3	1.3	1-1-1-1			Zone 1 - Same	Top of screen	
10						Zone 2 - SAND, fine, some silt, little organics (roots), gray, wet		
						Match to Sheet 2		

DRILLING CO.: Parrot Wolfe BAKER REP.: David Martin

DRILLER: Jim Lansing BORING NO.: 6GW06 SHEET 1 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Yorktown Naval Weapon Station - Well Installation, Site 6

CTO NO.: 62470-394 BORING NO.: 6GW06

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BG/PS = Background/Point Source

Depth (feet)	Sample Type & No.	Sample Rec. (feet)	SPT	Lab ID	PID (ppm) BG/PS	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11						Continued from Sheet 1		
12								
13								
14	S-4	2.0	1-1-1-1			SAND, very fine, some silt, some shell fragments, light brown, wet		
15								
16	S-5	1	1-1-1-1			Same		
17								
18						EOH = 18' bgs		
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parrot Wolfe BAKER REP.: David Martin

DRILLER: Jim Lansing BORING NO.: 6GW06 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW06B
COORDINATES	NORTHING: 345,391.17	EASTING:	2,559,034.28
ELEVATION:	GROUND SURFA 9.20	TOP OF PVC CASING:	11.46

Rig: CME-55 ATV

	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/18/2004	38	Rain, 70^0	**8
Length (FT)	2.0		5.0					
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks: *Offset from existing well 6GW06, then drilled to 18 ft (end of boring for 6GW06). See 6GW06 boring log for soil profile from 0-18 ft.
**Estimated depth from 6GW06 soil boring profile.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Dam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	28
Sch. 40 PVC (0.010 in.) screen	2"	28	38

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1								
2							Sch. 40 PVC riser	
3								
4								
5	A-N						cement bentonite grout to surface	
6								
7								
8						water @ ~8-ft		
9								
10						Match to Sheet 2		

DRILLING CO.:	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW06B SHEET 1 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW06B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11								
12								
	Sch. 40							
13							PVC Riser	
14								
15	A-N							
16								
17							cement	
18							bentonite	
19	S-1	1.5 75%	3 7			Wet, brown, fine SAND, some silt, trace clay to 19.3 ft	grout	
20			14 17			Wet, brown-gray fine SAND, some silt, trace clay, shells to 20 ft		
21	A-N							
22								
23								
24	S-2	2 100%	4 4			Wet, gray fine SAND and silt, trace clay and shells	top of bentonite @ 24'	
25			3 3					
26	A-N						top of sand @ 26'	
27								
28							top of screen @ 28'	
29	S-3	2 100%	3 5			Wet, gray, very fine SAND and silt trace clay, shells		
30			6 7					

Match to Sheet 3

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW06B SHEET 2 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW06B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
31							No. 1 Qtz sand	
32						A-N		
33								
34	S-4	2 100%	3 3 3 6			Wet, gray, very fine SAND and silt trace clay and shells	Sch. 40 PVC 0.010 in screen	
35								
36	A-N							
37							Bottom of screen @ 38'	
38						EOB @ 38		
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW06B SHEET 3 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW07
COORDINATES	NORTHING: 345,164.31	EASTING:	2,558,662.31
ELEVATION:	GROUND SURFAC 6.84	TOP OF PVC CASING:	8.66

Rig: CME-55 ATV

	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/14/2004	18	Sunny, 70°s	9.6
Length (FT)	2.0		5.0					
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Dam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	8
Sch. 40 PVC (0.010 in.) screen	2"	5	18

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1, 2	S-1	1.6 80%	W-O-H W-O-H 2 4			Topsoil; Damp, dark brown to light brown SILT, some clay, organics(plant material) trace fine sand	sch. 40 PVC riser; grout to surface	
3, 4	S-2	1.8 90%	3 4 5 5			Damp to moist, yellow brown and gray, CLAY,some silt, trace organic material	top of bentonite @ 2'	
5, 6	S-3	2 100%	W-O-H 2 2 3			Moist, blue gray and orange mottled CLAY, some silt, trace fine sand in partings		
7, 8	S-4	0.4 20%	W-O-H W-O-H W-O-H W-O-H			same	top of sand @ 6'	
9, 10	S-5	2 100%	W-O-H 2 3 5			Moist, blue gray and orange-brown mottled CLAY, some silt, trace fine sand in partings alternating with clay layers; Wet, light brown, fine SAND, some silt, trace clay water '@ 9.6-ft	top of screen @ 8'	

DRILLING CO.:	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW07 SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW07

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	S-6		W-O-H W-O-H 3			Wet, light brown, fine SAND, some silt, trace clay		
12								
13	S-7	2 100%				Wet, yellow- brown, fine SAND, some silt, little clay	No. 1 Qtz sand	
14								
15	S-8	2 100%	W-O-H 2 2 3			same	0.10 slot PVC screen	
16								
17	S-9	2 100%	1 2 3 10			Wet, yellow- brown, fine SAND, some silt, little clay, trace shell fragments @ 17.8' - 18.0'	Bottom of screen @ 18'	
18								
						EOB @ 18-ft		
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW07 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW08
COORDINATES:	NORTHING: 345,340.93	EASTING:	2,558,786.21
ELEVATION:	GROUND SURFACE 3.07	TOP OF PVC CASING:	5.61

Rig:	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	4"		--	9/21/2004	24	Sunny, 70°s	
Length (FT)	2.0	18			9/22/2004	12	Sunny, 70°s	32
Type	STD	PVC						
Hammer Wt.	140#							
Fall								

Remarks: Monitoring well installed with 4-inch outer casing to 18-ft bgs. The monitoring well was inserted through the 4" casing and installed to a depth of 36-ft bgs

SAMPLE TYPE

S = Split Spoon A = Hand Auger (6-inch length)
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Diameter	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	1.5"	0	31
Sch. 40 PVC (0.01 in.) prepacked screen	1.5"	31	36

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	S-1	1 50%	W-O-H W-O-H W-O-H W-O-H			Very wet, dark gray CLAY and SILT, some organics, swamp odor	Sch. 40 PVC riser	
2								
3	A-1	0.5 100%				same		
4	A-2	0.5 100%						
5	A-3	0.5 100%						
6	A-4	0.5 100%					cement bentonite grout to surface	
7	A-5	0.5 100%						
8	A-6	0.5 100%					4" PVC casing	
9	A-7	0.5 100%						
10	S-2	1.5 75%	1			Wet, dark gray CLAY and SILT, trace organic wood fragments Match to Sheet 2		

DRILLING CO.	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW08

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW08

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	S-3	1 50%	2 2 3				cement bentonite grout	
12								
13	S-4	1.5 75%	1 1 2 1			same		
14								
15	S-5	1.5 75%	3 2 1 3			same		
16								
17	S-6	1 50%	4 3 3 2			Wet, gray CLAY and SILT, trace fine sand	Top of bentonite @ 16' Bottom of 4" PVC casing @18'	
18								
19	S-7	1.5 75%	2 2 2 3			Wet/moist, gray CLAY and SILT, trace shells		
20								
21	S-8	0.75 38%	3 4 7 9			Moist, gray CLAY and SILT	Sch. 40 PVC Riser	
22								
23	S-9	1 50%	8 9 10 12					
24								
25	S-10	1 50%	7 9 10 11			Moist to damp, gray CLAY and SILT		
26								
27	S-11	1 50%	8 9 12 15			Damp, green/brown-gray CLAY and SILT stiff clay		
28								
29	S-12	1.2 60%	3 5 6 7			same		
30								
	S-13		3			Match to Sheet 3	Top of sand @ 30'	

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW08 SHEET 2 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW08

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
31	S-11	1.2 60%	2 2 4			same to 31.7', except clay less stiff	Top of screen @ 31'	
32						Moist, green-gray SILT & CLAY, trace fine		
33	S-12	0.7 35%	1 2 2 3			Wet, gray and brown SILT and fine sand, little shells, trace clay	Sch. 40 PVC 0.010 in. prepacked (w/ sand) screen	
34								
35	S-13	0.2 10%	1 1 2 2			Wet, gray fine sand and silt, trace clay	Bottom of screen @ 36'	
36						EOB @ 36-ft		
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW08 SHEET 3 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

PROJ. NO.: CTO-213 BORING NO.: 6GW09

COORDINATE NORTHING: 345,555.40 EASTING: 2,558,631.51

ELEVATION: GROUND SURFA 11.83 TOP OF PVC CASING: 14.38

Rig: CME-55 ATV	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/17/2004	30	Overcast, humid, 73-84°	*21.75
Length (FT)	2.0		5.0					
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks:

*Estimated depth from 6GW09B soil profile. **Note:** Soil descriptions from soil boring for 6GW09B.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	20
Sch. 40 PVC (0.010 in.) screen	2"	20	30

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1						Topsoil Damp, gray brown SILT, some clay, trace organics, fine sand		
2								
3						Damp, brown and orange mottled CLAY,some silt, trace organic material	Sch. 40 PVC riser	
4								
5	A-N					Moist, gray, brown, and orange mottled CLAY, some silt, trace fine sand		
6							cement bentonite grout ot surface	
7								
8								
9						Moist, blue gray and orange-brown mottled CLAY, some silt, trace fine sand in partings alternating with clay layers		
10						Match to Sheet 2		

DRILLING CO. Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09 SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11						Damp, blue gray and orange-brown mottled CLAY, some silt, trace fine sand		
12								
	in partings alternating with clay layers							
13								
14						Damp, blue gray, gray, and gray, CLAY, some silt, trace very fine sand in partings	cement bentonite grout	
15						Same except gray to light blue gray		
16								
17							top of bentonite @ 16'	
18								
19	A-N					Moist, brown, CLAY,some silt, little fine sand, trace to little marine shells	top of sand @ 18'	
20								
21						Wet, gray and brown, fine SAND, and silt, trace clay, trace shells	top of screen @ 20'	
22	▼					water @ ~21.75-ft		
23						Wet, gray and brown, fine SAND, and silt, trace clay, little shells	No. 1 Qtz sand	
24								
25						Wet, gray-brown, fine SAND, some silt, trace clay, shells		
26								
27						same except and silt		
28								
29						Wet, gray-brown, fine SAND and silt, trace clay, shells		
30								
						EOB @ 30-ft		

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

PROJ. NO.: CTO-213 BORING NO.: 6GW09A

COORDINATES NORTHING: 345,556.73 EASTING: 2,558,624.52

ELEVATION: GROUND SURFA 12.76 TOP OF PVC CASING: 15.17

Rig: CME-55 ATV	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/16&17/200	50	Sunny, 80°	*21.75
Length (FT)	2.0		5.0					
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks:

*Estimated depth from 6GW09B soil profile. **Note:** Soil descriptions from soil boring for 6GW09B.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Dam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	40
Sch. 40 PVC (0.010 in.) screen	2"	40	50

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1						Topsoil Damp, gray brown SILT, some clay, trace organics, fine sand		
2								
3						Damp, brown and orange mottled CLAY,some silt, trace organic material	Sch. 40 PVC riser	
4								
5	A-N					Moist, gray, brown, and orange mottled CLAY, some silt, trace fine sand		
6							cement bentonite grout to surface	
7								
8								
9						Moist, blue gray and orange-brown mottled CLAY, some silt, trace fine sand in partings alternating with clay layers		
10								

Match to Sheet 2

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09A SHEET 1 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09A

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11						Damp, blue gray and orange-brown mottled CLAY, some silt, trace fine sand		
12								
	in partings alternating with clay layers							
13								
						Damp, blue gray, gray, and gray, CLAY,		
14						some silt, trace very fine sand in partings		
15						Same except gray to light blue gray		
16								
17								
18								
						Moist, brown, CLAY,some silt, little fine		
19	A-N					sand, trace to little marine shells		
20								
21						Wet, gray and brown, fine SAND, and silt, trace clay, trace shells		
22	▼					water @ ~21.75-ft		
						Wet, gray and brown, fine SAND, and	Sch. 40	
23						silt, trace clay, little shells	PVC Riser	
24								
						Wet, gray-brown, fine SAND, some	cement	
25						silt, trace clay, shells	bentonite	
							grout	
26								
						same except and silt		
27								
28								
						Wet, gray-brown, fine SAND and		
29						silt, trace clay, shells		
30								
						Match to Sheet 3		

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09A SHEET 2 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09A

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
31						Wet, gray-brown, fine SAND and silt, trace clay, shells	Sch. 40	
32								
	Wet, gray-brown to blue SILT and							
33						Wet, blue gray very fine SAND and silt, little clay, trace shells	cement bentonite grout	
34								
						Wet, gray-brown to blue SILT and very fine sand, little clay, trace shells		
35								
36								
						Wet, blue gray very fine SAND and silt, little clay, trace shells	top of bentonite @ 36'	
37								
38								
	A-N						top of sand @ 38'	
39								
40								
						Wet, blue gray very fine SAND, some silt, little clay, shells	top of screen @ 40'	
41								
42								
43								
44							No. 1 Qtz sand	
						Same except gray		
45								
46							Sch. 40 PVC 0.010 in screen	
47								
48								
						Wet, gray fine SAND, some silt, trace shells		
49							Bottom of screen @ 50'	
50								
						EOB @ 50-ft		

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09A SHEET 3 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW09B
COORDINATES	NORTHING: 345,557.55	EASTING:	2,558,619.56
ELEVATION:	GROUND SURFA 13.53	TOP OF PVC CASING:	15.11

Rig: CME-55 ATV	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/15/2004	40	Overcast, rain, 70°s	21.75
Length (FT)	2.0		5.0		9/16/2004	36*	Overcast, 70°s	
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks: *Split-spoon sampled to 76 foot depth. Drilled to 75 foot depth. Well set at 75 feet.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Dam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	65
Sch. 40 PVC (0.010 in.) screen	2"	65	75

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
			W-O-H			Topsoil		
1	S-1	1.6 80%	1 2 4			Damp, gray brown SILT, some clay, trace organics, fine sand		
2								
3	S-2	1.2 60%	6 7 9 9			Damp, brown and orange mottled CLAY,some silt, trace organic material	Sch. 40 PVC riser	
4								
5	S-3	1.4 70%	3 3 6 10			Moist, gray, brown, and orange mottled CLAY, some silt, trace fine sand	cement bentonite grout to surface	
6								
7	S-4	1.7 85%	6 6 7 7					
8								
9	S-5	2 100%	3 3 5 8			Moist, blue gray and orange-brown mottled CLAY, some silt, trace fine sand in partings alternating with clay layers		
10								
		S-6	2			Match to Sheet 2		

DRILLING CO.:	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW09B SHEET 1 OF 5

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	S-6	2 100%	4 5 7			Damp, blue gray and orange-brown mottled CLAY, some silt, trace fine sand in partings alternating with clay layers		
12								
13	S-7	2 100%	3 5 5 7			fine sand lense from 10.6-10.9' Damp, blue gray, gray, and gray, CLAY, some silt, trace very fine sand in partings		
14								
15	S-8	2 100%	W-O-H 1 1 2			Same except gray to light blue gray		
16								
17	S-9	2 100%	3 4 3 3					
18								
19	S-10	2 100%	W-O-H/12" 4 7			Moist, brown, CLAY,some silt, little fine sand, trace to little marine shells		
20								
21	S-11	1 50%	4 8 17 20			Wet, gray and brown, fine SAND, and silt, trace clay, trace shells		
22						water @ 21.75-ft		
23	S-12	2 100%	13 14 10 13			Wet, gray and brown, fine SAND, and silt, trace clay, little shells	Sch. 40 PVC Riser	
24								
25	S-13	2 100%	4 4 7 12			Wet, gray-brown, fine SAND, some silt, trace clay, shells	cement bentonite grout	
26								
27	S-14	2 100%	2 2 6 8			same except and silt		
28								
29	S-15	2 100%	6 7 9 11			Wet, gray-brown, fine SAND and silt, trace clay, shells		
30								
	S-16		2			Match to Sheet 3		

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09B SHEET 2 OF 5

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
31	S-16		4 7 8			Wet, gray-brown, fine SAND and silt, trace clay, shells		
32						Wet, gray-brown to blue SILT and very fine sand, little clay, trace shells		
33	S-17	2 100%	4 6 8 5			Wet, blue gray very fine SAND and silt, little clay, trace shells		
34								
35	S-18	2 100%	3 3 2 7			Wet, gray-brown to blue SILT and very fine sand, little clay, trace shells		
36								
37	S-19	2 100%	4 7 5 7			Wet, blue gray very fine SAND and silt, little clay, trace shells	Sch. 40 PVC Riser	
38								
39	S-20	2 100%	3 3 9 7				cement bentonite grout	
40								
41	S-21	1.6 80%	W-O-H 1 5 12			Wet, blue gray very fine SAND, some silt, little clay, shells		
42								
43	S-22	2 100%	5 12 17 19					
44								
45	S-23	2 100%	9 10 19 17			Same except gray		
46								
47	S-24	2 100%	9 17 19 20					
48								
49	S-25	2 100%	7 7 9 9			Wet, gray fine SAND, some silt, trace shells		
50								
	S-26		W-O-H			Match to Sheet 4		

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09B SHEET 3 OF 5

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
51	S-26	2 100%	1 1 2			Wet, gray fine SAND, some silt, trace clay, shells		
52								
53	S-27	2 100%	3 3 6 7				Sch. 40 PVC Riser	
54								
55	S-28	2 100%	4 7 9 12				cement bentonite grout	
56								
57	S-29	2 100%	7 12 13 16					
58								
59	S-30	2 100%	1 3 3 8					
60								
61	S-31	2 100%	2 3 3 7				top of bentonite @ 61'	
62								
63	S-32	2 100%	2 5 8 13				top of sand @ 63'	
64								
65	S-33	2 100%	2 4 4 7				top of screen @ 65'	
66								
67	S-34	2 100%	3 4 6 6			Wet, gray, SILT and fine sand, trace clay, shells		
68								
69	S-35	2 100%	3 4 7 9			Wet, gray, SILT and fine sand, trace clay, shells	No. 1 Qtz sand	
70								
	S-36		2			Match to Sheet 5		

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09B SHEET 4 OF 5

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
71	S-36	2 100%	4 6 8			Wet, gray, SILT and fine sand, trace clay, shells	0.10 slot PVC screen	
72								
73	S-37	2 100%	4 5 9 9			Wet to moist, gray, SILT, some fine sand, little clay	No. 1 Qtz sand	
74								
75	S-38	2 100%	9 6 8 13				Bottom of screen @ 75'	
76						EOB @ 76-ft		
77								
78								
79								
80								
81								
82								
83								
84								
85								
86								
87								
88								
89								
90								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09B SHEET 5 OF 5

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW10
COORDINATES	NORTHING: 345,452.33	EASTING:	2,558,721.34
ELEVATION:	GROUND SURFA 13.30	TOP OF PVC CASING:	15.52

Rig: CME-55 ATV

	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/18/2004	22	Overcast, slight rain, 70°	*15.3
Length (FT)	2.0		5.0					
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks:

*Estimated depth from 6GW10A soil profile. **Note:** Soil descriptions from soil boring for 6GW10A.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Dam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	12
Sch. 40 PVC (0.010 in.) screen	2"	12	22

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1							Sch. 40 PVC riser	
2								
3							cement bentonite grout to surface	
4								
5	A-N					Damp, yellow brown CLAY, some silt, trace fine sand		
6						Dry, light brown, SILT, some clay, little fine sand		
7						Damp, gray, CLAY, some silt, trace fine sand in partings (oxidized stain)		
8							top of bentonite @ 8'	
9								
10						Match to Sheet 2	top of sand @ 10'	

DRILLING CO.:	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW10 SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW10

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11						same		
12	top of							
13							screen @ 12'	
14								
15						Damp, gray, CLAY, some silt, trace medium to fine sand in partings		
16	A-N					Wet, brown-gray, CLAY and coarse to fine sand sized shell fragments, some silt		
17						water @ ~15.3-ft	0.10 slot PVC screen	
18								
19								
20						Wet, light brown, fine SAND, some silt, little shell fragments, trace clay		
21						same	Bottom of screen @ 22'	
22								
						EOB @ 22'		
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW10 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW10A
COORDINATES	NORTHING: 345,448.21	EASTING:	2,558,725.19
ELEVATION:	GROUND SURF/ 13.43	TOP OF PVC CASING:	15.66

Rig: CME-55 ATV	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/17/2004	40*	Overcast, humid, 73-84°	15.3
Length (FT)	2.0		5.0		9/18/2004	(well install)	Overcast, slight rain, 70°s	
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks: *Split-spoon sample/drill in 5-foot increments until hit groundwater, then continuous split-spoon sampling to final depth.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Dam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	30
Sch. 40 PVC (0.010 in.) screen	2"	30	40

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	A-N						Sch. 40 PVC riser	
2								
3								
4								
5						Damp, yellow brown CLAY, some silt, trace fine sand	cement bentonite grout to surface	
6	S-1	2.0 100%	4 5 5 6			Dry, light brown, SILT, some clay, little fine sand		
7						Damp, gray, CLAY, some silt, trace fine sand in partings (oxidized stain)		
8	A-N							
9								
10								
	S-2		2			Match to Sheet 2		

DRILLING CO.:	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW10A SHEET 1 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW10A

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	S-2	2 100%	2 3			same		
12								
13	A-N					4		
14								
15						Damp, gray, CLAY, some silt, trace medium to fine sand in partings		
16	S-3	2 100%	8 6 6 8			Wet, brown-gray, CLAY and coarse to fine sand sized shell fragments, some silt	Sch. 40 PVC Riser	
17						water @ 15.3-ft		
18	A-N						cement bentonite grout	
19	S-4	2 100%	4 4 5 7			Wet, light brown, fine SAND, some silt, little shell fragments, trace clay		
20								
21	S-5	2 100%	W-O-H 5 5 6			same		
22								
23	S-6	2 100%	3 3 7 8			same		
24								
25	S-7	2 100%	4 8 8 7			same		
26								
27	S-8	2 100%	2 3 5 6			same	top of bentonite @ 26'	
28								
29	S-9	2 100%	3 1 4 5			same (to 28.5') Wet, light brown, fine SAND, some silt, little clay	top of sand @ 28'	
30								
	S-10		3			Match to Sheet 3	top of screen @ 30'	

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW10A SHEET 2 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW10A

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
31	S-10		2 6			same, except trace clay and shells		
32						6		
33	S-11	2 100%	3 3 5			same	No. 1 Qtz sand	
34								
35	S-12	2 100%	1 7 3 5			same (to 34.7') Wet, blue-gray SILT and very fine sand little clay		
36							0.10 slot PVC screen	
37	S-13	2 100%	3 7 3 3			Wet to moist, blue-gray SILT some very fine sand, little blue-gray clay		
38								
39	S-14	2 100%	1 3 4 7			same	Bottom of screen @ 40'	
40								
41						EOB '@40		
42								
43								
44								
45								
46								
47								
48								
49								
50								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW10A SHEET 3 OF 3

Borehole Location Data **ROY F. WESTON, Inc.**

BOREHOLE ID : 6GW01 SITE NAME/NO: WPNSTA YORKTOWN
BEGIN DATE : 06/15/92 END DATE : 06/15/92

LOGGER/COMPANY : W. BREW

BOREHOLE COMPLETED IN (<O>verburden <B>edrock) : O

TOTAL DEPTH : 22.00 DEPTH TO BEDROCK : 0.00

BOREHOLE DIAMETER #1: 12.00
INTERVAL: 0.00 ft. to 22.00 ft. BGS
METHOD : HSA FLUID : NONE
BOREHOLE DIAMETER #2:
INTERVAL:
METHOD : FLUID :
BOREHOLE DIAMETER #3:
INTERVAL:
METHOD : FLUID :

DRILLING COMPANY : HARDIN-HUBER
DRILLER : ROYCE KEENAN
DRILL RIG TYPE : B-61

	ESTIMATED	SURVEYED
SURFACE ELEVATION :	0.000	9.800
N. COORDINATE :	0.0000	345079.0000
E. COORDINATE :	0.0000	2559217.0000

WELL PERMIT.....(Y)es (N)o: N PERMIT # :

HOLE ABANDONED...(Y)es (N)o: N
WELL INSTALLED...(Y)es (N)o: Y
WELL CLUSTER.....(Y)es (N)o: N No. OF WELLS : 0
WELL NEST.....(Y)es (N)o: N No. OF WELLS : 0
PUMPS INSTALLED..(Y)es (N)o: N TYPE DEPTH
PURGE : 0.00
SAMPLE : 0.00

BOREHOLE TESTING
BOREHOLE GEOPHYSICS.....(Y)es (N)o: N
SLUG TESTS.....(Y)es (N)o: Y
PACKER TESTS.....(Y)es (N)o: N
PUMPING TESTS.....(Y)es (N)o: N

COMMENTS :

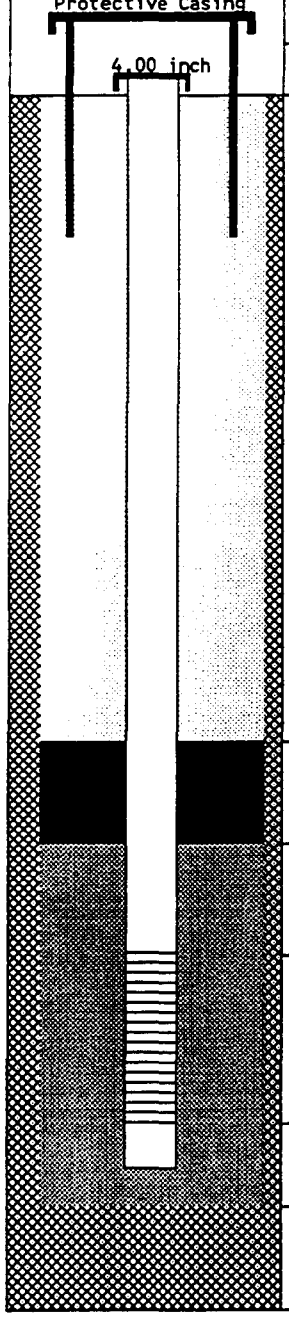
NWS-00313-03.13-07/01/93

Well Completion Summary — *ROY F. WESTON, Inc.*

CLIENT	WPNSTA YORKTOWN	*DRILLING FIRM*	HARDIN-HUBER
SITE NAME	WPNSTA YORKTOWN	*INSPECTOR*	W. BREW

WELL ID	6GW01
START DATE	06/15/92
COMPLETION DATE	06/15/92

WATER LEVELS



DEPTH		*ELEV.*
3.00	*TC*	12.80
0.00	*GS*	9.80
2.00	*BN*	7.80
4.00	*SP*	5.80
5.00	*SC*	4.80
20.00	*BS*	-10.20
20.00	*TD*	-10.20

DRILLING SUMMARY

Driller ROYCE KEENAN
Drilling Fluid NONE
Well Type SINGLE CASED SCREENED

WELL DESIGN CONSTRUCTION

Casing #1 Diameter: 4.00 *inch* *Interval:* 0.00 to 5.00 *ft.*
Type : PVC SCH 40

Stick Up Inner Casing: 3.00 *ft.* *Protective Casing:* 0.00 *ft.*

Casing Grout: CEMT/BENT *Interval:* 0.00 to 2.00 *ft.*

Seal Type: BENTONITE *Interval:* 2.00 to 3.00 *ft.*

Sand Pack Type : MORIE #2 *Interval:* 4.00 to 20.00 *ft.*
Grain Size : UNIFORM *Median Diameter:* 2-3
Screen Diameter: 4.00 *Interval:* 5.00 to 20.00 *ft.*
Type : PVC *Slots:* .020 *inches*

Silt Trap Interval: 0.00 to 0.00 *ft.*
Backfill Type : *Interval:* 0.00 to 0.00 *ft.*

WELL DEVELOPMENT

Date / /
Method
Yield *Purged Volume*

COMMENTS

TC = Top of Casing
GS = Ground Surface
BN = Top Seal
SP = Top Sand Pack
SC = Top Screen
BS = Bottom Screen
TD = Total Depth
= Grout
= Seal
= Sand Pack
= Formation

Additional Comments:

NOTE: Well Diagram not to Scale *Elevations are feet above mean sea level*

01/06/93

Borehole Log

ROY F. WESTON, Inc.

CLIENT	: WPNSTA YORKTOWN	TOTAL DEPTH	: 22.00
SITE NAME	: WPNSTA YORKTOWN	LOGGER	: W. BREW
WELL ID	: 6GW01	DRILLING COMPANY	: HARDIN-HUBER
NORTHING	: 345079.0000 surveyed	DRILLING RIG	: B-61
EASTING	: 2559217.0000 surveyed	DATE STARTED	: 06/15/92
ELEVATION	: 9.800 surveyed	DATE COMPLETED	: 06/15/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
			90	Fill	DK YLLWISH BRN	SFT	MST	3 6 8 7	OVA 0.0	
				Fill	DK YLLWISH BRN		DRY		OVA 0.0	
8	1									
7	2		5	Fill	DK YLLWISH BRN		DRY	1 2 1 1	OVA 0.0	
6	3									
5	4		55	Fill	DK OLIVE GRAY	FRM	MST		OVA 0.0	Wood 0.2' thick observed at 5.0-5.2'. Appears that fill material ends w/this spoon.
4	5									
3	6		80	Fill	DK OLIVE GRAY	FRM	MST	1 2 1 1	OVA 0.0	
				Lean clay, CL	DK OLIVE GRAY	FRM	MST		OVA 40.0	
2	7									
1	8		75	Lean clay, CL	DK OLIVE GRAY	FRM	MST	1 1 2 1	OVA 0.0	
0	9									
-1	10		90	Lean clay, CL	DK OLIVE GRAY	FRM	MST	1 2 1 2		

Borehole Log

ROY F. WESTON, Inc.

CLIENT	: WPNSTA YORKTOWN	TOTAL DEPTH	: 22.00
SITE NAME	: WPNSTA YORKTOWN	LOGGER	: W. BREW
WELL ID	: 6GW01	DRILLING COMPANY	: HARDIN-HUBER
NORTHING	: 345079.0000 surveyed	DRILLING RIG	: B-61
EASTING	: 2559217.0000 surveyed	DATE STARTED	: 06/15/92
ELEVATION	: 9.800 surveyed	DATE COMPLETED	: 06/15/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Lean clay, CL	DK OLIVE GRAY	FRM	MST			
-1	11									
				Silty sand, SM	YELLOWISH BROWN	SFT	WET		OVA 0.0	
-2	12		90	Silty sand, SM	YELLOWISH BROWN	SFT	WET	1 1 2 2	OVA 0.0	
-3	13									
-4	14		90	Silty sand, SM	YELLOWISH BROWN	SFT	WET	1 3 5 6	OVA 0.0	
-5	15									
-6	16		90	Silty sand, SM	YELLOWISH BROWN	SFT	WET		OVA 0.0	
-7	17									
-8	18									
-9	19									
-10	20		90	Silty sand, SM	YELLOWISH BROWN	SFT	WET	5 6 7 11	OVA 0.0	

Borehole Log **ROY F. WESTON, Inc.**

CLIENT	: WPNSTA YORKTOWN	TOTAL DEPTH	: 22.00
SITE NAME	: WPNSTA YORKTOWN	LOGGER	: W. BREW
WELL ID	: 6GW01	DRILLING COMPANY	: HARDIN-HUBER
NORTHING	: 345079.0000 surveyed	DRILLING RIG	: B-61
EASTING	: 2559217.0000 surveyed	DATE STARTED	: 06/15/92
ELEVATION	: 9.800 surveyed	DATE COMPLETED	: 06/15/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Silty sand, SM	YELLOWISH BROWN	SFT	WET		OVA 0.0	
				Shelly hash	YELLOWISH BROWN	SFT	WET		OVA 0.0	Gravel = shells
-11	21									
-12	22									
-13	23									
-14	24									
-15	25									
-16	26									
-17	27									
-18	28									
-19	29									
-20	30									

DATE: 12/08/92 **** LITHOLOGICAL DATA FOR - CLIENT ID: BAKER *** PAGE: 6

BOREHOLE /WELL ID	SMP NUM	LTH NUM	LITHOLOGY INT. (FT BGS)		SAMPLING METHOD	SIZE GRAVEL	GRAVEL PCT.	SIZE SAND	SAND PCT	SILT PCT	CLAY PCT	ORGANIC PCT	ROCK TYPE	PLAST	SORT	STRENGTH	MOISTURE	STRAT UNIT
6GW01	1	1	0.00	0.50	SPS	C	40	F	40	20	0	0		NON	POR	SFT	MST	
6GW01	1	2	0.50	2.00	SPS		0	F	10	30	60	0					DRY	
6GW01	2	1	2.00	4.00	SPS		0	F	10	30	60	0					DRY	
6GW01	3	1	4.00	6.00	SPS		0	F	20	10	70	0		MOD	POR	FRM	MST	
6GW01	4	1	6.00	6.20	SPS		0	F	20	10	70	0		MOD	POR	FRM	MST	
6GW01	4	2	6.20	8.00	SPS		0	F	5	15	80	0		MOD		FRM	MST	
6GW01	5	1	8.00	10.00	SPS		0	F	5	15	80	0		MOD		FRM	MST	
6GW01	6	1	10.00	11.70	SPS		0	F	5	15	80	0		MOD		FRM	MST	
6GW01	6	2	11.70	12.00	SPS		0	F	80	20	0	0		NON	POR	SFT	WET	
6GW01	7	1	12.00	14.00	SPS		0	F	80	20	0	0		NON	POR	SFT	WET	
6GW01	8	1	14.00	16.00	SPS		0	F	80	20	0	0		NON	POR	SFT	WET	
6GW01	9	1	16.00	20.00	SPS		0	F	80	20	0	0		NON	POR	SFT	WET	
6GW01	10	1	20.00	20.30	SPS		0	F	80	20	0	0		NON	POR	SFT	WET	
6GW01	10	2	20.30	22.00	SPS	CMF	50		40	10	0	0		NON	POR	SFT	WET	

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW01A

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6
COORDINATES: NORTH: 345079.25, EAST: 2559217.07
ELEVATIONS: SURFACE: 12.10

RIG: Mobile B-80	SPLIT SPOON	AUGERS	SURFACE CASING	REAMING TOOL	DATE	PROGRESS (FT.)	WEATHER	WATER DEPTH (FT.)
SIZE (DIAM.)	1 3/8	4-1/4" ID	--	--	9-9-94	64	Partly Cloudy 80°	13
LENGTH	2.0'	5.0'	--	--				
TYPE	Std.	HSA	--	--				
HAMMER WT.	140#	--	--	--				
FALL	30"	--	--	--				

REMARKS:

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

Well Information	Diam.	Type	Top Depth (ft.)	Bottom Depth (ft.)
Well Riser	2"	Sch. 40 PVC, Threaded	-2.09 Stickup	48.0
Well Screen	2"	No. 10 Slot Sch. 40 PVC, Threaded	48.0	63.0

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp.	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
1	A-N					GRASS TOPSOIL		
2	S1	1.6/2.0 80%	5 5 5 6		0.4/0.4	silty CLAY, little sand, trace roots, brown, stiff, damp	Cement Bentonite Grout	
3						Clay, little silt, sand, trace fine gravel, orange brown, stiff, damp		
4	S2	1.3/2.0 65%	1 2 1 1		0.4/0.4	silty CLAY, trace sand, roots, mottled orange & gray, soft, moist		
5						5.0	Top of Bentonite Slurry 5.0	7.1
6	S3	1.4/2.0 70%	1 1 1 5		0.4/0.4	sandy SILT, olive, soft, moist		
						6.5		5.6
7						organic SILT, trace sand, roots, dark brown, medium stiff, wet 7.0		5.1
8	S4	1.3/2.0 65%	2 1 2 1		0.3/0.3	medium to fine SAND, gray, very loose, wet 8.0		4.1
9						organic SILT, trace sand, roots, dark brown, soft, moist		
10	S5	2.0/2.0 100%	WOH/1.0 1 1		0.3/0.3	SAME except very soft		
						Match to Sheet 2		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: M. Taube
DRILLER: M. Corron WELL/BORING NO.: 6GW01A SHEET 1 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW01A

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
11						organic SILT, trace sand, roots, olive-brown, soft, moist (Continued from Sheet 1)		
11.5						11.5		0.6
12	S6	2.0/2.0 100%	1 1 1 1		0.3/0.3	SILT and clay, little sand, trace wood fragments, olive-brown to blue-gray, very soft, moist		
13						13.0		-0.9
14	S7	2.0/2.0 100%	1 2 3 4		0.3/0.3	silty fine SAND, light greenish-gray loose, wet		
15								
16	S8	2.0/2.0 100%	3 3 4 4		0.2/0.2	SAME except orange to light orange brown	Bentonite Slurry	
17								
18	S9	2.0/2.0 100%	WOH/1.5 3		0.2/0.2	SAME except little coarse to fine shell fragments		
19								
20	S10	2.0/2.0 100%	2 5 5 6		0.2/0.2	silty medium to fine SAND, trace coarse to fine shell fragments, light orange-brown to olive, medium dense, wet		
21							PVC Riser	
22	S11	1.8/2.0 90%	5 10 13 15		0.2/0.2	fine SAND, little silt, little coarse to fine shell fragments, olive to dark green-gray, medium dense, wet		
23								
24	S12	2.0/2.0 100%	2 2 3 5		0.2/0.2	SAME except and silt, dark gray, loose		
25								
26	S13	2.0/2.0 100%	2 3 5 6		0.2/0.2	SAME		
27								
28	S14	2.0/2.0 100%	3 6 6 7		0.2/0.2	silty fine SAND, trace medium to fine shell fragments, dark green gray, medium dense, wet		
29								
30	S15	2.0/2.0	4 5		0.2/0.2	SAME (Match to Sheet 3)		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: M. Taube
DRILLER: M. Corron WELL/BORING NO.: 6GW01A SHEET 2 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW01A

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
						Continued from Sheet 2		
31	S15	100%	5 6			silty fine SAND, trace fine shell fragments, dark green-gray, loose, wet		
32	S16	2.0/2.0	2 4 5		0.2/0.2			
						32.5		-20.4
33		100%	6			sandy SILT, little clay, little coarse to fine shells, dark green-gray, medium stiff moist.		
34	S17	2.0/2.0	2 3 4		0.2/0.2	SAME except little sand, trace shell fragments, moist to wet		
35		100%	4					
	S18	2.0/2.0	1 3 4		0.2/0.2	sandy SILT, trace clay, shell fragments, dark green-gray medium dense, wet	Bentonite Slurry	
37		100%	4					
						37.0		-24.9
38	S19	2.0/2.0	2 5 7		0.2/0.2	Silty fine SAND, some coarse to fine shell fragments, green-gray, medium dense, wet	2" Diameter PVC Riser	
39		100%	10					
40	S20	2.0/2.0	10 5 7		0.2/0.2	SAME except trace shell fragments, green		
41		100%	11					
						41.0	Top of SAND	-28.9
42	S21	2.0/2.0	3 3 6		0.2/0.2	SAME except little silt		
43		100%	10					
44	S22	2.0/2.0	5 7 9		0.2/0.2	SAME		
45		100%	10					
46	S23	2.0/2.0	1 4 5		0.2/0.2	SAME except silty SAND, ½" sand nodule present, loose		
47		100%	7					
48	S24	2.0/2.0	1 3 5		0.2/0.2	Silty fine SAND, little coarse to fine shell fragments, dark green, loose, wet	Top of screen 48.0	-35.9
9		100%	8					
50	S25	2.0/2.0	3 3		0.2/0.2	SAME except trace shells, clay		
						Match to Sheet 4		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: M. Taube
DRILLER: M. Corron WELL/BORING NO.: 6GW01A SHEET 3 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW01A

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
						Continued from Sheet 3		
51	S25	100%	11 19					
52	S26	2.0/2.0	4 5		0.2/0.2	silty SAND, trace medium to fine shell fragments, dark green, medium dense, wet		
53		100%	9 14					
54	S27	2.0/2.0	4 8		0.2/0.2	SAME except little shells		
55		100%	8 12				0.10 slot screen	
56	S28	2.0/2.0	5 6	6GW01A -28	0.2/0.2	SAME		
57		100%	9 9				#1 qtz sand	
58	S29	2.0/2.0	5 6		0.2/0.2	SAME except trace shell fragments		
59		100%	7 8					
60	S30	2.0/2.0	2 5		0.2/0.2	silt, SAND, dark green, medium dense, wet		
61		100%	6 10					
62	S31	2.0/2.0	3 4		0.2/0.2	silty SAND, trace shell fragments (medium to fine), trace clay, dark green, loose, wet.	Bottom of screen 61.9	-49.8
63		100%	5 5				63.0 Bottom of well	-50.9
64	A-N	100%						-51.9
5						Boring Terminated at 64' bgs	Bottom of borehole	
6								
7								
8								
9								
0						Match to Sheet		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: M. Taube
DRILLER: M. Corron WELL/BORING NO.: 6GW01A SHEET 4 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW02

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6e
COORDINATES: NORTH: 344819.89 EAST: 2558566.45
ELEVATIONS: SURFACE: 35.97

RIG: B-80 mobile	SPLIT SPOON	AUGERS	SURFACE CASING	REAMING TOOL	DATE	PROGRESS (FT.)	WEATHER	WATER DEPTH (FT.)
SIZE (DIAM.)	1 3/8	4-1/4" ID			9.20.94	25	Clear, 80°	
LENGTH	2.0'	5.0'		--	9.21.94	to 47'	Overcast, 70°s	38'
TYPE	Std.	HSA			9.23.94	to 57'	Clear, Cool, 60°s	
HAMMER WT.	140#	--	--	--				
FALL	30"	--	--	--				

REMARKS:

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

Well Information	Diam.	Type	Top Depth (ft.)	Bottom Depth (ft.)
Well Riser	2"	Sch. 40 PVC, Threaded	-2.5 stick up	40.0
Well Screen	2"	No. 10 Slot Sch. 40 PVC, Threaded	40.0	55.0

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp.	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
1, 2, 3	S1	1.0/2.0 50%	2 4 5 5		0.2 — 0.2	TOP SOIL fine to coarse SAND, little silt, trace clay, trace root hairs, brown, loose, damp	Bentonite-cement grout	
4, 5	S2	1.0/2.0 50%	4 5 5 4		0.2 — 0.2	fine to coarse SAND, trace silt, trace clay, trace fine gravel, trace roots, yellow brown, loose, damp	10" ⌀ STEEL CASING	
6, 7	S3	1.2/2.0 60%	2 3 3 4		0.2 — 0.2	fine to coarse SAND (predominantly fine), little clay, little silt, brown, loose, damp		28.97
8, 9	S4	0.8/2.0 40%	5 7 9 11		0.6 — 0.6	CLAY, some sand, little silt, yellow brown with dark brown mottling, stiff, damp; SHELLS (mostly cemented aggregates), little silty clay, trace sand, white, stiff, damp		27.27; 26.97
10	S5	1.2/2.0 60%	3 5 6 6		0.4 — 0.4	SILTY CLAY, little fine to coarse sand (flakes), trace gravel, dark brown and gray, stiff, damp		

Match to Sheet 2

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: M. Towne
DRILLER: M. Corron WELL/BORING NO.: 6GW02 SHEET 1 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW02

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA:

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
						Continued from Sheet 1		
11								
12	S6	2.0/2.0 100%	3 3 4 5		0.2/0.2	SILTY CLAY and clay silt, [illegible] layered, trace sand, dark gray [illegible] brown and gray, medium stiff, damp	Bentonite pellets	
13								
14	S7	2.0/2.0 100%	2 4 3 4		0.2/0.2	SILTY CLAY, trace carbonated shell nodules, trace sand, trace root hairs, brown with green mottling, medium stiff, damp to moist	Bentonite slurry	
15								
16	S8	2.0/2.0 100%	3 4 8 8		0.2/0.2	SILTY CLAY, trace sand, brown with grey mottling, stiff, damp to moist; fine to coarse SHELLS, trace to and silty CLAY, brn. with grey mottling, med. stiff, damp to moist		19.4
17								18.97
18	S9	2.0/2.0 100%	3 4 6 4		0.2/0.2	SILTY CLAY, trace sand, brown and grey, soft, moist; fine to medium SHELL FRAGMENTS, trace to and silty clay, brown/grey, stiff, moist to wet; SILTY CLAY, trace sand, brown/grey, soft, damp to moist		18.47
19							10" ϕ STEEL CASING	17.47
20	S10	2.0/2.0 100%	2 3 3 4		0.2/0.2	SILTY CLAY, little fine shell fragments, brown, medium stiff, moist to damp; SILTY CLAY, trace fine shell laminae, dark grey, medium stiff, moist to damp		
21								
22	S11	2.0/2.0 100%	2 3 4 7		0.2/0.2	SILTY CLAY, dark grey, soft, moist to damp; SILT, little clay, little fine sand, dk. grey, med. stiff, moist to damp; SILTY CLAY, trace fine sand, dk. grey, stiff, moist to damp		14.47
23								13.97
24	S12	2.0/2.0 100%	3 2 5 6		0.2/0.2	SILTY CLAY, trace fine sand/shell laminae, dk. grey, med. stiff, damp to moist; SILT, little sand, trace clay, dk. grey, med. stiff, damp		
25								11.27
26	S13	2.0/2.0 100%	3 4 5 8		0.3/0.3	SILTY CLAY, trace fine sand laminations, greenish grey, stiff, damp to moist		
27								
28	S14	2.0/2.0 100%	3 4 4 7		0.3/0.3	SAME, but medium stiff		
29								
30	S15	2.0/2.0	3 6		0.3/0.3	SILTY CLAY with trace to some silty sand laminae to interbeds, trace fine shell frag., increasing sand with depth, Match to Sheet 3		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: [illegible]
DRILLER: M. Conon WELL/BORING NO.: 6GW02 SHEET 2 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW02

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA:

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
31			7 13			greenish grey, stiff, Continued from Sheet 2 damp to moist	Bentonite slurry	
32	S16	2.0 / 2.0 100%	7 7 8 12		0.3 / 0.3	SILTY CLAY with some sandy silt interbeds, trace shell frag.s, greenish grey, stiff, damp to moist		
33						SILTY CLAY, trace fine sand laminae, trace fine shell frag.s, greenish grey, very stiff, damp to moist		
34	S17	2.0 / 2.0 100%	4 6 8 9		0.3 / 0.3	SAME but no shell fragments and stiff		
35								
36	S18	2.0 / 2.0 100%	11 19 15 23		0.3 / 0.3	SAME but hard and moist		-0.33
37						fine to med. SILTY SAND, little fine to coarse shell frag.s, trace clays, olive and orange, very stiff, moist	Top of Sand 37'	-1.03
38	S19	1.3 / 2.0 65%	6 11 11 16		0.3 / 0.3	SILTY CLAY, trace fine sand laminations, greenish grey to brown, med. stiff, moist to wet		-1.53
39						SILTY SAND, little fine to coarse shells, frag.s, reddish brown oxidation staining, med. dense, moist to wet		
40	S20	2.0 / 2.0 100%	6 10 10 18		0.3 / 0.3	SILTY SAND, little fine to medium shell frag.s, olive brown, medium dense, moist to wet	TOP OF SCREEN 40'	
41								
42	S21	2.0 / 2.0 100%	6 10 13 15		0.3 / 0.3	SAME but brown and grey and wet		
43								-7.03
44	S22	2.0 / 2.0 100%	14 10 12 19		0.3 / 0.3	fine SAND, some shell fragments, little silt, olive-brown, medium dense, wet		
45								
46	S23	2.0 / 2.0 100%	7 8 12 20		0.3 / 0.3	fine SAND, little silt little to trace shell fragments, olive brown, medium dense, wet		
47						SAME but dark green grey		
48	S24	1.3 / 2.0 65%	8 22 35 47		0.5 / 0.6	fine grained SAND, little silt some shell fragments, dk. greenish grey & white, very dense, wet		
49						SAME but no shell fragments		
50	S25	1.5 / 2.0	10 25			SAME but some shell fragments [illegible] Match to Sheet		

DRILLING CO.: HARDIN-HUBER, INC.
DRILLER: M. Corion

BAKER REP.: NGT [illegible] (9.20-9.21.94) JE ZIMMERM (9.23.9
WELL/BORING NO.: 6GW02 SHEET 3 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW02

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA:

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
						Continued from Sheet 3		
51		75%	28 23		0.5 / 0.5		Quartz sand	
52	S26	1.5 / 2.0	6 11 12		0.5 / 0.5	SAME but occasional shells throughout, medium dense		
53		75%	17					
54	S27	1.7 / 2.0	5 4 6		0.5 / 0.5	SAME but with shell material throughout	Bottom of screen → 55	
55		85%	9					
56	S28	1.9 / 2.0	2 3 7		0.5 / 0.5	SAME, but with only occasional shell material throughout	→ 56' Bottom of PVC well	
57		95%	14					
8						Boring terminated at 57' bgs		
9								
0								
1								
2								
3								
4								
5								
6								
7								
8								
9								
0						Match to Sheet		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: JEZIMMERMAN
DRILLER: M. Corron WELL/BORING NO.: 6GW02 SHEET 4 OF 4

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW03

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6
COORDINATES: NORTH: 345777.73, EAST: 2559237.11
ELEVATIONS: SURFACE: 28.31

RIG: Mobile B-80

	SPLIT SPOON	AUGERS	SURFACE CASING	REAMING TOOL	DATE	PROGRESS (FT.)	WEATHER	WATER DEPTH (FT.)
SIZE (DIAM.)	1 3/8"	4-1/4" ID	10"	13"	9-23-94	23	Partly Cloudy 80°	— —
LENGTH	2.0'	5.0'	10'	--	10-20-94	26	Partly Cloudy 75°	29'
TYPE	Std.	HSA	steel	drag				
HAMMER WT.	140#	--	--	--				
FALL	30"	--	--	--				

REMARKS:

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

Well Information	Diam.	Type	Top Depth (ft.)	Bottom Depth (ft.)
Well Riser	2"	Sch. 40 PVC, Threaded	-2.36 stick-up	37.9
Well Screen	2"	No. 10 Slot Sch. 40 PVC, Threaded	37.9	48.0

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp.	Visual Description/Comments	Elevation (ft.)
1	A-N						
2–3	S1	1.4/2.0 70%	4 5 10 12		0.3/0.3	silty fine SAND, trace clay, brown to yellow brown, medium dense, damp	
4–5	S2	1.0/2.0 50%	7 7 8 11		0.3/0.9	SAME except no clay	
6–7	S3	1.1/2.0 55%	4 5 6 7		0.3/0.3	SAME except trace clay, orange to reddish brown staining 7.0	22.31 / 21.31
8–9	S4	1.5/2.0 75%	3 4 5 7		0.3/0.3	CLAY, trace silt, fine sand, yellow brown w/orange staining, stiff, damp 9.0	19.31
10	S5	1.5/2.0 75%	3 3 3 5		0.3/0.3	fine SAND and silt, some clay, yellow brown w/red staining, loose, damp Match to Sheet 2	

Well Installation Detail: cement-bentonite grout; 10" steel casing; Top of bentonite slurry 6.0

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: J. Zimmerman / M. Taube
DRILLER: M. Corron WELL/BORING NO.: 6GW03 SHEET 1 OF 3

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW03

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
						Continued from Sheet 1		
11								
12	S6	1.6/2.0 80%	4 4 4 4		0.3/0.3	fine SAND, some silt, little clay, brown to light gray w/ orange-red staining, loose, damp.		
13							10" Steel casing	
14	S7	1.6/2.0 80%	2 2 3 3		0.3/0.3	Same except damp to moist		
15						15.0		13.31
16	S8	1.8/2.0 90%	3 3 4 5		0.3/0.3	silty CLAY, brown w/red staining, medium stiff, damp 16.0		12.31
17						fine SAND, trace silt, dark gray w/red staining loose, moist		
18	S9	2.0/2.0 100%	1 1 3 3		0.3/0.3	Same except very loose 18.3		10.01
19						CLAY, trace silt, dark green-gray, medium stiff, moist		
20	S10	2.0/2.0 100%	3 3 6 9		0.3/0.3	SAME except stiff		
21								
22	S11	2.0/2.0 100%	3 3 5 10		0.3/0.3	SAME	Bottom of 10" Steel casing 23.0'	
23								5.31
24	S12	2.0/2.0 100%	3 6 9 12		0.3/0.3	SAME		3.61
25						fine SAND, trace shell fragments, silt dark green-gray, medium dense, moist		
26	S13	1.0/2.0 50%	7 13 14 20		0.2/0.2	SAME except, some clay, little silt, shell fragments		
27								
28	S14	1.7/2.0 85%	8 10 9 12		0.2/0.2	fine SAND, little shell fragments (coarse to fine) little silt, trace clay, green-gray, medium dense, moist to wet 28.5		-0.19
29								
30	S15	1.5/2.0	8 14		0.2/0.2	SAME except shells medium to fine grained Match to Sheet 3		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: J. Zimmerman / M. Taube
DRILLER: M. Corcoran WELL/BORING NO.: 6GW03 SHEET 2 OF 3

Baker
Baker Environmental, Inc.

WELL/BORING NO.: 6GW03

TEST BORING AND WELL CONSTRUCTION RECORD

INSTALLATION: NAVAL WEAPONS STATION YORKTOWN CTO NO.: 0319
SITE/AREA: Site 6

SAMPLE TYPE

S = Split Spoon
T = Shelby Tube
R = Air Rotary
D = Denison
A = Auger
W = Wash
C = Core
P = Piston
N = No Sample

ACRONYMS

BG = Background
HSA = Hollow Stem Augers
ID = Inside Diameter
PID = Photoionization Detector
ppm = parts per million
SPT = Standard Penetration Test (ASTM D-1586)(Blows/0.5')
WD = While Drilling

Depth (ft.)	Samp. Type and No.	Samp. Rec. ft./%	SPT	Lab Samp. Desig.	PID (ppm) BG/Samp	Visual Description/Comments	Well Installation Detail	Elevation (ft.)
						Continued from Sheet _		
31	S15	75%	11 12				Bentonite Slurry	
32 33	S16	1.7/2.0 85%	5 9 15 16		0.2/0.2	fine SAND, little shell fragments (medium to fine), silt, trace clay green-gray, medium dense, wet.	Top of #1 quartz sand 33.0	-4.69
34 35	S17	2.0/2.0 100%	8 11 17 18		0.2/0.2	SAME except trace shell fragments		
37	S18	1.5/2.0 75%	6 9 10 17		0.2/0.2	SAME		
38 39	S19	1.7/2.0 85%	8 13 15 17		0.2/0.2	SAME except little coarse to fine shell fragments	Top of screen 37.9	-9.59
40 41	S20	1.3/2.0 65%	9 19 12 17		0.2/0.2	SAME except dense	#1 Quartz SAND	
42 43	S21	1.6/2.0 80%	9 8 9 8		0.2/0.2	fine SAND, some silt, trace shell fragments, clay, green-gray, medium dense, wet	0.10 slot pvc screen	
44 45	S22	1.8/2.0 90%	6 6 7 9		0.2/0.2	SAME		
46 47	S23	2.0/2.0 100%	6 9 5 11		0.2/0.2	SAME	Bottom of screen 46.9	-18.59
48 9	S24	2.0/2.0 100%	6 5 8 11		0.2/0.2	SAME	Bottom of pvc well 48.0	-19.69
								-20.69
0						Boring terminated at 49.0 bgs Match to Sheet _		

DRILLING CO.: HARDIN-HUBER, INC. BAKER REP.: M. Taube
DRILLER: M. Corron WELL/BORING NO.: 6GW03 SHEET 3 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW05B
COORDINATES	NORTHING: 345,203.46	EASTING:	2,558,990.33
ELEVATION:	GROUND SURFA 6.83	TOP OF PVC CASING:	8.59

Rig: CME-55 ATV	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/14/2004	15	Overcast, 70s°	6
Length (FT)	2.0		5.0					
Type	STD		HAS					
Hammer Wt.	140#							
Fall								

Remarks:

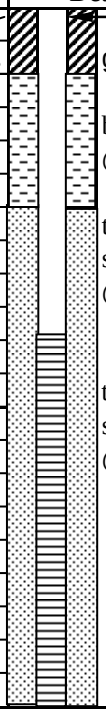
SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	5
Sch. 40 PVC (0.010 in.) screen	2"	5	15

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description
1, 2	S-1	1.1 55%	W-O-H 1 2 2			Topsoil; Damp, brown SILT, some clay, tr. organics; Damp, light gray and orange mottled CLAY, some silt, trace organic material
3, 4	S-2	1.7 85%	2 2 3 2			-trace fine sand in partings (3.8-4.0 ft)
5, 6	S-3	2 100%	W-O-H 1 2 2			Moist to wet, light blue gray CLAY, some silt, trace fine sand in partings
7, 8	S-4	0.7 35%	1 2 2 3			Wet, light yellow brown, fine SAND, some silt, trace clay; water @ 6-ft
9, 10	A-N					No sample collected 8-12 ft.



DRILLING CO.	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW05B SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW05B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	A-N					No sample collected 8-12 ft.	No. 1 Qtz sand	
12								
13	S-5	1.8 90%	1 1 2 2			Wet, light yellow- brown, fine SAND, some silt, trace clay	0.10 slot PVC screen	
14							Bottom of screen @ 15'	
15	A-N							
16						EOB @ 15-ft		
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW05B SHEET 2 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Yorktown Naval Weapon Station - Well Installation, Site 6

CTO NO.: 62470-394 BORING NO.: 6GW06

COORDINATES: EAST: NORTH:

ELEVATION: SURFACE: TOP OF PVC CASING:

Rig: Truck								
	Split Spoon	**Casing**	**Augers**	**Core Barrel**	**Date**	**Progress (Ft.)**	**Weather**	**Depth to Water (Ft.)**
Size (ID)	1.375		4.25		5/12/2000	0.0 - 18.0	Sunny, 80	8
Length	2.0		5.0					
Type	STD		HSA					
Hammer Wt.	140							
Fall	30"							

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample H=Hand Spoon

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch 40 Riser	2"	0	8
Sch 40 .010 Slot Screen	2"	8	18

Depth (feet)	Sample Type & No.	Sample Rec. (feet)	SPT	Lab ID	PID (ppm) BG/PS	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	S-1	1.5	2-4-4-5			CLAY and silt, trace very fine sand, brown, damp	cement bentonite grout	
2								
3								
4	S-2	1.5	3-4-4-6			CLAY, little silt, trace very fine		
5						sand, sand increase to little at bottom 2", red/brown mottled	Bent. Chips	
6						moist		
7							Sand pack	
8						Groundwater level		
9	S-3	1.3	1-1-1-1			Zone 1 - Same	Top of screen	
10						Zone 2 - SAND, fine, some silt, little organics (roots), gray, wet		
						Match to Sheet 2		

DRILLING CO.: Parrot Wolfe BAKER REP.: David Martin

DRILLER: Jim Lansing BORING NO.: 6GW06 SHEET 1 OF 2

Baker

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Yorktown Naval Weapon Station - Well Installation, Site 6

CTO NO.: 62470-394 BORING NO.: 6GW06

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BG/PS = Background/Point Source

Depth (feet)	Sample Type & No.	Sample Rec. (feet)	SPT	Lab ID	PID (ppm) BG/PS	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11						Continued from Sheet 1		
12								
13								
14	S-4	2.0	1-1-1-1			SAND, very fine, some silt, some shell fragments, light brown, wet		
15								
16	S-5	1	1-1-1-1			Same		
17								
18						EOH = 18' bgs		
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parrot Wolfe BAKER REP.: David Martin

DRILLER: Jim Lansing BORING NO.: 6GW06 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW06B
COORDINATES	NORTHING: 345,391.17	EASTING:	2,559,034.28
ELEVATION:	GROUND SURFA 9.20	TOP OF PVC CASING:	11.46

Rig: CME-55 ATV

	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/18/2004	38	Rain, 70^0	**8
Length (FT)	2.0		5.0					
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks: *Offset from existing well 6GW06, then drilled to 18 ft (end of boring for 6GW06). See 6GW06 boring log for soil profile from 0-18 ft.
**Estimated depth from 6GW06 soil boring profile.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Dam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	28
Sch. 40 PVC (0.010 in.) screen	2"	28	38

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1								
2							Sch. 40 PVC riser	
3								
4								
5	A-N						cement bentonite grout to surface	
6								
7								
8						water @ ~8-ft		
9								
10						Match to Sheet 2		

DRILLING CO.:	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW06B SHEET 1 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW06B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11								
12								
	Sch. 40							
13							PVC Riser	
14								
15	A-N							
16								
17							cement	
18							bentonite	
19	S-1	1.5 75%	3 7			Wet, brown, fine SAND, some silt, trace clay to 19.3 ft	grout	
20			14 17			Wet, brown-gray fine SAND, some silt, trace clay, shells to 20 ft		
21	A-N							
22								
23								
24	S-2	2 100%	4 4			Wet, gray fine SAND and silt, trace clay and shells	top of bentonite @ 24'	
25			3 3					
26	A-N						top of sand @ 26'	
27								
28							top of screen @ 28'	
29	S-3	2 100%	3 5			Wet, gray, very fine SAND and silt trace clay, shells		
30			6 7					

Match to Sheet 3

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW06B SHEET 2 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW06B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
31							No. 1 Qtz sand	
32						A-N		
33								
34	S-4	2 100%	3 3 3 6			Wet, gray, very fine SAND and silt trace clay and shells	Sch. 40 PVC 0.010 in screen	
35								
36	A-N							
37							Bottom of screen @ 38'	
38						EOB @ 38		
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW06B SHEET 3 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW07
COORDINATES	NORTHING: 345,164.31	EASTING:	2,558,662.31
ELEVATION:	GROUND SURFAC 6.84	TOP OF PVC CASING:	8.66

Rig: CME-55 ATV

	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/14/2004	18	Sunny, 70°s	9.6
Length (FT)	2.0		5.0					
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks:

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Dam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	8
Sch. 40 PVC (0.010 in.) screen	2"	5	18

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1, 2	S-1	1.6 80%	W-O-H W-O-H 2 4			Topsoil; Damp, dark brown to light brown SILT, some clay, organics(plant material) trace fine sand	sch. 40 PVC riser; grout to surface	
3, 4	S-2	1.8 90%	3 4 5 5			Damp to moist, yellow brown and gray, CLAY,some silt, trace organic material	top of bentonite @ 2'	
5, 6	S-3	2 100%	W-O-H 2 2 3			Moist, blue gray and orange mottled CLAY, some silt, trace fine sand in partings		
7, 8	S-4	0.4 20%	W-O-H W-O-H W-O-H W-O-H			same	top of sand @ 6'	
9, 10	S-5	2 100%	W-O-H 2 3 5			Moist, blue gray and orange-brown mottled CLAY, some silt, trace fine sand in partings alternating with clay layers; Wet, light brown, fine SAND, some silt, trace clay water '@ 9.6-ft	top of screen @ 8'	

DRILLING CO.:	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW07 SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW07

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	S-6		W-O-H W-O-H 3			Wet, light brown, fine SAND, some silt, trace clay		
12								
13	S-7	2 100%				Wet, yellow- brown, fine SAND, some silt, little clay	No. 1 Qtz sand	
14								
15	S-8	2 100%	W-O-H 2 2 3			same	0.10 slot PVC screen	
16								
17	S-9	2 100%	1 2 3 10			Wet, yellow- brown, fine SAND, some silt, little clay, trace shell fragments @ 17.8' - 18.0'	Bottom of screen @ 18'	
18								
						EOB @ 18-ft		
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW07 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW08
COORDINATES:	NORTHING: 345,340.93	EASTING:	2,558,786.21
ELEVATION:	GROUND SURFACE 3.07	TOP OF PVC CASING:	5.61

Rig:	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	4"		--	9/21/2004	24	Sunny, 70°s	
Length (FT)	2.0	18			9/22/2004	12	Sunny, 70°s	32
Type	STD	PVC						
Hammer Wt.	140#							
Fall								

Remarks: Monitoring well installed with 4-inch outer casing to 18-ft bgs. The monitoring well was inserted through the 4" casing and installed to a depth of 36-ft bgs

SAMPLE TYPE

S = Split Spoon A = Hand Auger (6-inch length)
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Diameter	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	1.5"	0	31
Sch. 40 PVC (0.01 in.) prepacked screen	1.5"	31	36

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	S-1	1 50%	W-O-H W-O-H W-O-H W-O-H			Very wet, dark gray CLAY and SILT, some organics, swamp odor	Sch. 40 PVC riser	
2								
3	A-1	0.5 100%				same		
4	A-2	0.5 100%						
5	A-3	0.5 100%						
6	A-4	0.5 100%					cement bentonite grout to surface	
7	A-5	0.5 100%						
8	A-6	0.5 100%					4" PVC casing	
9	A-7	0.5 100%						
10	S-2	1.5 75%	1			Wet, dark gray CLAY and SILT, trace organic wood fragments Match to Sheet 2		

DRILLING CO.	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW08

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW08

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	S-3	1 50%	2 2 3				cement bentonite grout	
12								
13	S-4	1.5 75%	1 1 2 1			same		
14								
15	S-5	1.5 75%	3 2 1 3			same		
16								
17	S-6	1 50%	4 3 3 2			Wet, gray CLAY and SILT, trace fine sand	Top of bentonite @ 16' Bottom of 4" PVC casing @18'	
18								
19	S-7	1.5 75%	2 2 2 3			Wet/moist, gray CLAY and SILT, trace shells		
20								
21	S-8	0.75 38%	3 4 7 9			Moist, gray CLAY and SILT	Sch. 40 PVC Riser	
22								
23	S-9	1 50%	8 9 10 12					
24								
25	S-10	1 50%	7 9 10 11			Moist to damp, gray CLAY and SILT		
26								
27	S-11	1 50%	8 9 12 15			Damp, green/brown-gray CLAY and SILT stiff clay		
28								
29	S-12	1.2 60%	3 5 6 7			same		
30								
	S-13		3			Match to Sheet 3	Top of sand @ 30'	

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW08 SHEET 2 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW08

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
31	S-11	1.2 60%	2 2 4			same to 31.7', except clay less stiff	Top of screen @ 31'	
32						Moist, green-gray SILT & CLAY, trace fine		
33	S-12	0.7 35%	1 2 2 3			Wet, gray and brown SILT and fine sand, little shells, trace clay	Sch. 40 PVC 0.010 in. prepacked (w/ sand) screen	
34								
35	S-13	0.2 10%	1 1 2 2			Wet, gray fine sand and silt, trace clay	Bottom of screen @ 36'	
36						EOB @ 36-ft		
37								
38								
39								
40								
41								
42								
43								
44								
45								
46								
47								
48								
49								
50								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW08 SHEET 3 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

PROJ. NO.: CTO-213 BORING NO.: 6GW09

COORDINATE NORTHING: 345,555.40 EASTING: 2,558,631.51

ELEVATION: GROUND SURFA 11.83 TOP OF PVC CASING: 14.38

Rig: CME-55 ATV	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/17/2004	30	Overcast, humid, 73-84°	*21.75
Length (FT)	2.0		5.0					
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks:

*Estimated depth from 6GW09B soil profile. **Note:** Soil descriptions from soil boring for 6GW09B.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	20
Sch. 40 PVC (0.010 in.) screen	2"	20	30

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1						Topsoil Damp, gray brown SILT, some clay, trace organics, fine sand		
2								
3						Damp, brown and orange mottled CLAY,some silt, trace organic material	Sch. 40 PVC riser	
4								
5	A-N					Moist, gray, brown, and orange mottled CLAY, some silt, trace fine sand		
6							cement bentonite grout ot surface	
7								
8								
9						Moist, blue gray and orange-brown mottled CLAY, some silt, trace fine sand in partings alternating with clay layers		
10						Match to Sheet 2		

DRILLING CO. Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09 SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11						Damp, blue gray and orange-brown mottled CLAY, some silt, trace fine sand		
12								
	in partings alternating with clay layers							
13								
14						Damp, blue gray, gray, and gray, CLAY, some silt, trace very fine sand in partings	cement bentonite grout	
15						Same except gray to light blue gray		
16								
17							top of bentonite @ 16'	
18								
19	A-N					Moist, brown, CLAY,some silt, little fine sand, trace to little marine shells	top of sand @ 18'	
20								
21						Wet, gray and brown, fine SAND, and silt, trace clay, trace shells	top of screen @ 20'	
22	▼					water @ ~21.75-ft		
23						Wet, gray and brown, fine SAND, and silt, trace clay, little shells	No. 1 Qtz sand	
24								
25						Wet, gray-brown, fine SAND, some silt, trace clay, shells		
26								
27						same except and silt		
28								
29						Wet, gray-brown, fine SAND and silt, trace clay, shells		
30								
						EOB @ 30-ft		

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

PROJ. NO.: CTO-213 BORING NO.: 6GW09A

COORDINATES NORTHING: 345,556.73 EASTING: 2,558,624.52

ELEVATION: GROUND SURFA 12.76 TOP OF PVC CASING: 15.17

Rig: CME-55 ATV	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/16&17/200	50	Sunny, 80°	*21.75
Length (FT)	2.0		5.0					
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks:

*Estimated depth from 6GW09B soil profile. **Note:** Soil descriptions from soil boring for 6GW09B.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Dam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	40
Sch. 40 PVC (0.010 in.) screen	2"	40	50

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1						Topsoil Damp, gray brown SILT, some clay, trace organics, fine sand		
2								
3						Damp, brown and orange mottled CLAY,some silt, trace organic material	Sch. 40 PVC riser	
4								
5	A-N					Moist, gray, brown, and orange mottled CLAY, some silt, trace fine sand		
6							cement bentonite grout to surface	
7								
8								
9						Moist, blue gray and orange-brown mottled CLAY, some silt, trace fine sand in partings alternating with clay layers		
10								

Match to Sheet 2

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09A SHEET 1 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09A

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11						Damp, blue gray and orange-brown mottled CLAY, some silt, trace fine sand		
12								
	in partings alternating with clay layers							
13								
						Damp, blue gray, gray, and gray, CLAY,		
14						some silt, trace very fine sand in partings		
15						Same except gray to light blue gray		
16								
17								
18								
						Moist, brown, CLAY,some silt, little fine		
19	A-N					sand, trace to little marine shells		
20								
21						Wet, gray and brown, fine SAND, and silt, trace clay, trace shells		
22	▼					water @ ~21.75-ft		
						Wet, gray and brown, fine SAND, and	Sch. 40	
23						silt, trace clay, little shells	PVC Riser	
24								
						Wet, gray-brown, fine SAND, some	cement	
25						silt, trace clay, shells	bentonite	
							grout	
26								
						same except and silt		
27								
28								
						Wet, gray-brown, fine SAND and		
29						silt, trace clay, shells		
30								
						Match to Sheet 3		

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09A SHEET 2 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09A

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
31						Wet, gray-brown, fine SAND and silt, trace clay, shells	Sch. 40	
32								
	Wet, gray-brown to blue SILT and							
33						Wet, blue gray very fine SAND and silt, little clay, trace shells	cement bentonite grout	
34								
						Wet, gray-brown to blue SILT and very fine sand, little clay, trace shells		
35								
36								
						Wet, blue gray very fine SAND and silt, little clay, trace shells	top of bentonite @ 36'	
37								
38								
	A-N						top of sand @ 38'	
39								
40								
						Wet, blue gray very fine SAND, some silt, little clay, shells	top of screen @ 40'	
41								
42								
43								
44							No. 1 Qtz sand	
						Same except gray		
45								
46							Sch. 40 PVC 0.010 in screen	
47								
48								
						Wet, gray fine SAND, some silt, trace shells		
49							Bottom of screen @ 50'	
50								
						EOB @ 50-ft		

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09A SHEET 3 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW09B
COORDINATES	NORTHING: 345,557.55	EASTING:	2,558,619.56
ELEVATION:	GROUND SURFA 13.53	TOP OF PVC CASING:	15.11

Rig: CME-55 ATV	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/15/2004	40	Overcast, rain, 70°s	21.75
Length (FT)	2.0		5.0		9/16/2004	36*	Overcast, 70°s	
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks: *Split-spoon sampled to 76 foot depth. Drilled to 75 foot depth. Well set at 75 feet.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Dam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	65
Sch. 40 PVC (0.010 in.) screen	2"	65	75

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
			W-O-H			Topsoil		
1	S-1	1.6 80%	1 2 4			Damp, gray brown SILT, some clay, trace organics, fine sand		
2								
3	S-2	1.2 60%	6 7 9 9			Damp, brown and orange mottled CLAY,some silt, trace organic material	Sch. 40 PVC riser	
4								
5	S-3	1.4 70%	3 3 6 10			Moist, gray, brown, and orange mottled CLAY, some silt, trace fine sand	cement bentonite grout to surface	
6								
7	S-4	1.7 85%	6 6 7 7					
8								
9	S-5	2 100%	3 3 5 8			Moist, blue gray and orange-brown mottled CLAY, some silt, trace fine sand in partings alternating with clay layers		
10								
		S-6	2			Match to Sheet 2		

DRILLING CO.:	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW09B SHEET 1 OF 5

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	S-6	2 100%	4 5 7			Damp, blue gray and orange-brown mottled CLAY, some silt, trace fine sand in partings alternating with clay layers		
12								
13	S-7	2 100%	3 5 5 7			fine sand lense from 10.6-10.9' Damp, blue gray, gray, and gray, CLAY, some silt, trace very fine sand in partings		
14								
15	S-8	2 100%	W-O-H 1 1 2			Same except gray to light blue gray		
16								
17	S-9	2 100%	3 4 3 3					
18								
19	S-10	2 100%	W-O-H/12" 4 7			Moist, brown, CLAY,some silt, little fine sand, trace to little marine shells		
20								
21	S-11	1 50%	4 8 17 20			Wet, gray and brown, fine SAND, and silt, trace clay, trace shells		
22						water @ 21.75-ft		
23	S-12	2 100%	13 14 10 13			Wet, gray and brown, fine SAND, and silt, trace clay, little shells	Sch. 40 PVC Riser	
24								
25	S-13	2 100%	4 4 7 12			Wet, gray-brown, fine SAND, some silt, trace clay, shells	cement bentonite grout	
26								
27	S-14	2 100%	2 2 6 8			same except and silt		
28								
29	S-15	2 100%	6 7 9 11			Wet, gray-brown, fine SAND and silt, trace clay, shells		
30								
	S-16		2			Match to Sheet 3		

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09B SHEET 2 OF 5

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
31	S-16		4 7 8			Wet, gray-brown, fine SAND and silt, trace clay, shells		
32						Wet, gray-brown to blue SILT and very fine sand, little clay, trace shells		
33	S-17	2 100%	4 6 8 5			Wet, blue gray very fine SAND and silt, little clay, trace shells		
34								
35	S-18	2 100%	3 3 2 7			Wet, gray-brown to blue SILT and very fine sand, little clay, trace shells		
36								
37	S-19	2 100%	4 7 5 7			Wet, blue gray very fine SAND and silt, little clay, trace shells	Sch. 40 PVC Riser	
38								
39	S-20	2 100%	3 3 9 7				cement bentonite grout	
40								
41	S-21	1.6 80%	W-O-H 1 5 12			Wet, blue gray very fine SAND, some silt, little clay, shells		
42								
43	S-22	2 100%	5 12 17 19					
44								
45	S-23	2 100%	9 10 19 17			Same except gray		
46								
47	S-24	2 100%	9 17 19 20					
48								
49	S-25	2 100%	7 7 9 9			Wet, gray fine SAND, some silt, trace shells		
50								
	S-26		W-O-H			Match to Sheet 4		

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09B SHEET 3 OF 5

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
51	S-26	2 100%	1 1 2			Wet, gray fine SAND, some silt, trace clay, shells		
52								
53	S-27	2 100%	3 3 6 7				Sch. 40 PVC Riser	
54								
55	S-28	2 100%	4 7 9 12				cement bentonite grout	
56								
57	S-29	2 100%	7 12 13 16					
58								
59	S-30	2 100%	1 3 3 8					
60								
61	S-31	2 100%	2 3 3 7				top of bentonite @ 61'	
62								
63	S-32	2 100%	2 5 8 13				top of sand @ 63'	
64								
65	S-33	2 100%	2 4 4 7				top of screen @ 65'	
66								
67	S-34	2 100%	3 4 6 6			Wet, gray, SILT and fine sand, trace clay, shells		
68								
69	S-35	2 100%	3 4 7 9			Wet, gray, SILT and fine sand, trace clay, shells	No. 1 Qtz sand	
70								
	S-36		2			Match to Sheet 5		

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09B SHEET 4 OF 5

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW09B

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
71	S-36	2 100%	4 6 8			Wet, gray, SILT and fine sand, trace clay, shells	0.10 slot PVC screen	
72								
73	S-37	2 100%	4 5 9 9			Wet to moist, gray, SILT, some fine sand, little clay	No. 1 Qtz sand	
74								
75	S-38	2 100%	9 6 8 13				Bottom of screen @ 75'	
76						EOB @ 76-ft		
77								
78								
79								
80								
81								
82								
83								
84								
85								
86								
87								
88								
89								
90								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW09B SHEET 5 OF 5

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW10
COORDINATES	NORTHING: 345,452.33	EASTING:	2,558,721.34
ELEVATION:	GROUND SURFA 13.30	TOP OF PVC CASING:	15.52

Rig: CME-55 ATV

	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/18/2004	22	Overcast, slight rain, 70°	*15.3
Length (FT)	2.0		5.0					
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks:

*Estimated depth from 6GW10A soil profile. **Note:** Soil descriptions from soil boring for 6GW10A.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Dam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	12
Sch. 40 PVC (0.010 in.) screen	2"	12	22

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1							Sch. 40 PVC riser	
2								
3							cement bentonite grout to surface	
4								
5	A-N					Damp, yellow brown CLAY, some silt, trace fine sand		
6						Dry, light brown, SILT, some clay, little fine sand		
7						Damp, gray, CLAY, some silt, trace fine sand in partings (oxidized stain)		
8							top of bentonite @ 8'	
9								
10						Match to Sheet 2	top of sand @ 10'	

DRILLING CO.:	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW10 SHEET 1 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW10

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11						same		
12	top of							
13							screen @ 12'	
14								
15						Damp, gray, CLAY, some silt, trace medium to fine sand in partings		
16	A-N					Wet, brown-gray, CLAY and coarse to fine sand sized shell fragments, some silt		
17						water @ ~15.3-ft	0.10 slot PVC screen	
18								
19								
20						Wet, light brown, fine SAND, some silt, little shell fragments, trace clay		
21						same	Bottom of screen @ 22'	
22								
						EOB @ 22'		
23								
24								
25								
26								
27								
28								
29								
30								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW10 SHEET 2 OF 2

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT:	Remedial Investigation - Groundwater Operable Unit I		
PROJ. NO.:	CTO-213	BORING NO.:	6GW10A
COORDINATES	NORTHING: 345,448.21	EASTING:	2,558,725.19
ELEVATION:	GROUND SURF/ 13.43	TOP OF PVC CASING:	15.66

Rig: CME-55 ATV	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 3/8"	--	4.25"	--	9/17/2004	40*	Overcast, humid, 73-84°	15.3
Length (FT)	2.0		5.0		9/18/2004	(well install)	Overcast, slight rain, 70°s	
Type	STD		HSA					
Hammer Wt.	140#							
Fall								

Remarks: *Split-spoon sample/drill in 5-foot increments until hit groundwater, then continuous split-spoon sampling to final depth.

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Direct Push P = Piston
N = No Sample

WELL INFORMATION

Type	Dam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch. 40 PVC Riser	2"	0	30
Sch. 40 PVC (0.010 in.) screen	2"	30	40

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1	A-N						Sch. 40 PVC riser	
2								
3								
4								
5						Damp, yellow brown CLAY, some silt, trace fine sand	cement bentonite grout to surface	
6	S-1	2.0 100%	4 5 5 6			Dry, light brown, SILT, some clay, little fine sand		
7						Damp, gray, CLAY, some silt, trace fine sand in partings (oxidized stain)		
8	A-N							
9								
10								
	S-2		2			Match to Sheet 2		

DRILLING CO.:	Parrott-Wolff, Inc.	BAKER REP.:	David Martin
DRILLER:	Gary Ellingworth	BORING NO.:	6GW10A SHEET 1 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW10A

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
11	S-2	2 100%	2 3			same		
12								
13	A-N					4		
14								
15						Damp, gray, CLAY, some silt, trace medium to fine sand in partings		
16	S-3	2 100%	8 6 6 8			Wet, brown-gray, CLAY and coarse to fine sand sized shell fragments, some silt	Sch. 40 PVC Riser	
17						water @ 15.3-ft		
18	A-N						cement bentonite grout	
19	S-4	2 100%	4 4 5 7			Wet, light brown, fine SAND, some silt, little shell fragments, trace clay		
20								
21	S-5	2 100%	W-O-H 5 5 6			same		
22								
23	S-6	2 100%	3 3 7 8			same		
24								
25	S-7	2 100%	4 8 8 7			same		
26								
27	S-8	2 100%	2 3 5 6			same	top of bentonite @ 26'	
28								
29	S-9	2 100%	3 1 4 5			same (to 28.5') Wet, light brown, fine SAND, some silt, little clay	top of sand @ 28'	
30								
	S-10		3			Match to Sheet 3	top of screen @ 30'	

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW10A SHEET 2 OF 3

Baker

Michael Baker Jr., Inc.

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Remedial Investigation - Groundwater Operable Unit I

CTO NO.: CTO-213 BORING NO.: 6GW10A

SAMPLE TYPE

S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS

SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
ps/bg = point source/background

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) ps/bg	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
31	S-10		2 6			same, except trace clay and shells		
32						6		
33	S-11	2 100%	3 3 5			same	No. 1 Qtz sand	
34								
35	S-12	2 100%	1 7 3 5			same (to 34.7') Wet, blue-gray SILT and very fine sand little clay		
36							0.10 slot PVC screen	
37	S-13	2 100%	3 7 3 3			Wet to moist, blue-gray SILT some very fine sand, little blue-gray clay		
38								
39	S-14	2 100%	1 3 4 7			same	Bottom of screen @ 40'	
40								
41						EOB '@40		
42								
43								
44								
45								
46								
47								
48								
49								
50								

DRILLING CO.: Parrott-Wolff, Inc. BAKER REP.: David Martin

DRILLER: Gary Ellingworth BORING NO.: 6GW10A SHEET 3 OF 3

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	6GW11	SHEET 1 OF 1

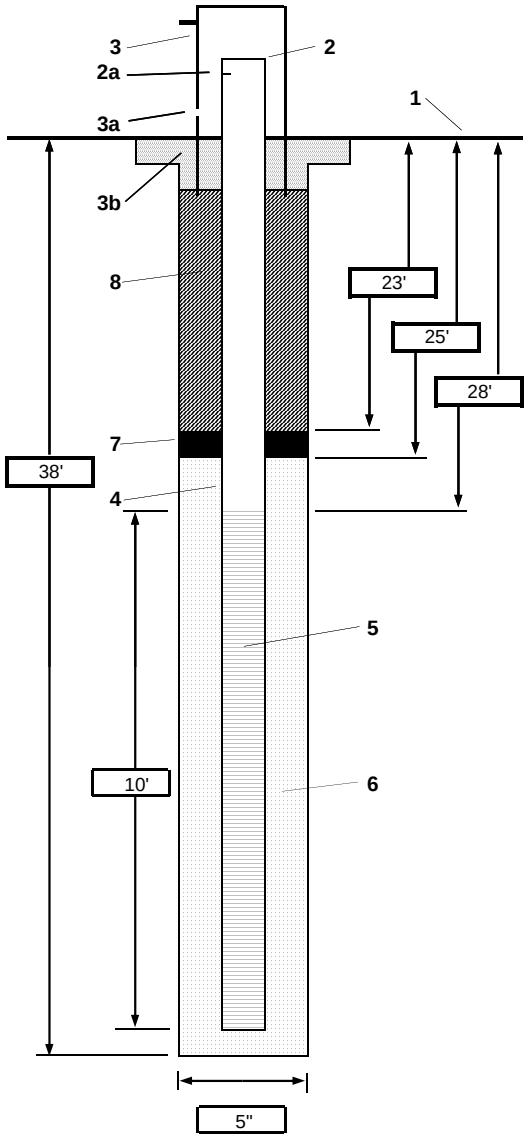
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 28.46 ft (TOC) START : 02/18/2009 END : 02/19/2009 LOGGER : C. Lippencott



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type: Stick-up
a) Bollards: Four bollards
b) concrete pad dimensions: 3' x 3'

4- Dia./type of well casing: 2" Sch 40 PVC

5- Type/slot size of screen: 2" PVC Sch 40 10 slot

6- Type screen filter: #1 silica pack
a) Quantity used: 6

7- Type of seal: Bentonite 3/8" chips
a) Quantity used

8- Grout
a) Grout mix used: Portland Cement and Bentonite
b) Method of placement: Pour
c) Vol. of well casing grout

Development method: Whale Pump

Development time: 3.0 hours

Estimated purge volume: 55 gallons

Comments

PROJECT NUMBER	WELL NUMBER
358315.FI.FS	**6GW12** SHEET 1 OF 1

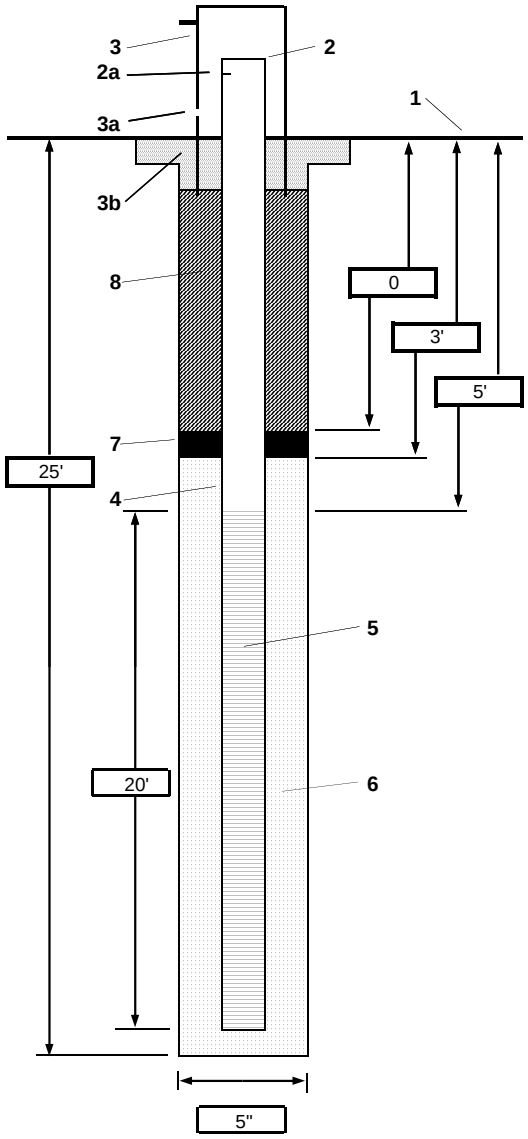
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 2.30 ft (TOC) START : 02/20/2009 END : 02/20/2009 LOGGER : C. Lippencott



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type: Stick-up
a) Bollards: Four bollards
b) concrete pad dimensions: 3' x 3'

4- Dia./type of well casing: 2" Stainless Steel

5- Type/slot size of screen: 2" Stainless Steel Screen 10-slot

6- Type screen filter: #1 silica pack
a) Quantity used: 12

7- Type of seal: Bentonite 3/8" chips
a) Quantity used

8- Grout
a) Grout mix used
b) Method of placement
c) Vol. of well casing grout

Development method: Whale Pump

Development time: 3.5 hours

Estimated purge volume: 55 gallons

Comments: No Grout was poured.

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	**6GW12A**	SHEET 1 OF 1

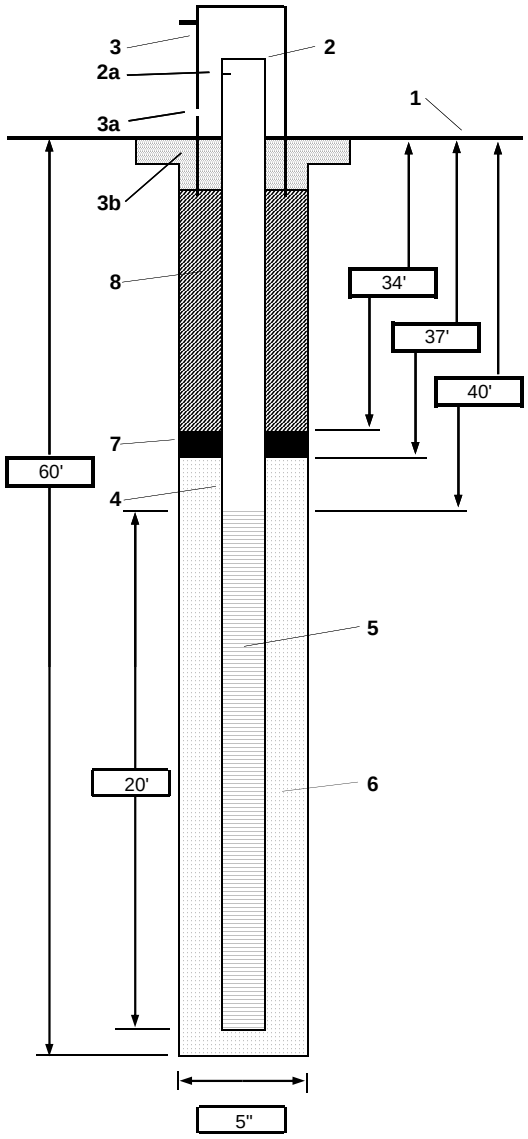
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 2.64 ft (TOC) START : 02/23/2009 END : 02/23/2009 LOGGER : M. Ost



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type: Stick-up
a) Bollards: Four bollards
b) concrete pad dimensions: 3' x 3'

4- Dia./type of well casing: 2" Stainless Steel

5- Type/slot size of screen: 2" Stainless Steel Screen 10-slot

6- Type screen filter: #1 silica pack
a) Quantity used: 28

7- Type of seal: Bentonite 3/8" chips
a) Quantity used

8- Grout
a) Grout mix used: Portland Cement and Bentonite
b) Method of placement: Pour
c) Vol. of well casing grout

Development method: Whale Pump

Development time: 3.5 hours

Estimated purge volume: 60 gallons

Comments

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	6GW13	SHEET 1 OF 1

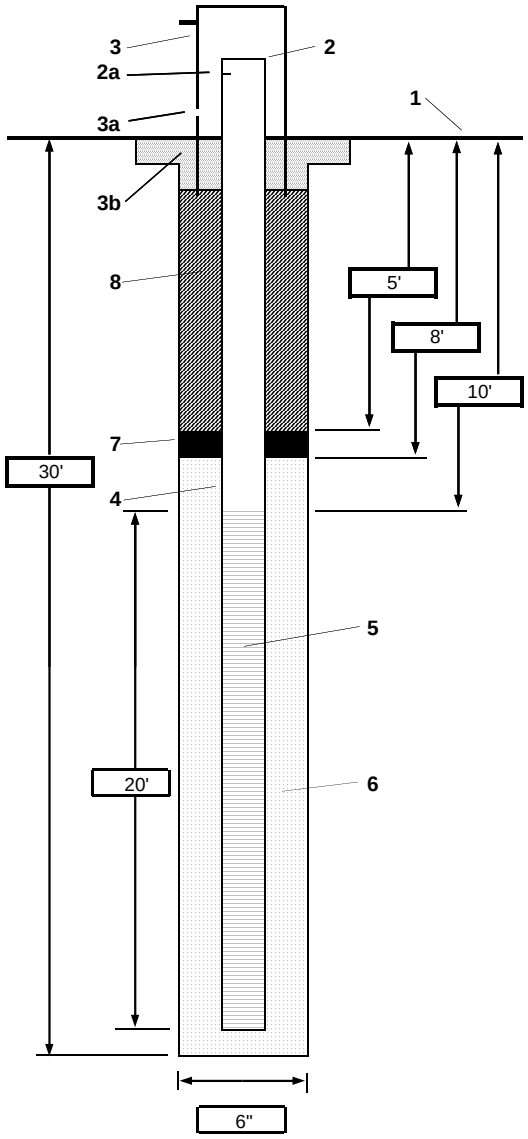
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 6" Mud Rotary on 850X ATV Rig

WATER LEVELS : 2.30 ft (TOC) START : 03/06/2009 END : 03/06/2009 LOGGER : Pat Murphy



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type: Stick-up
a) Bollards: Four bollards
b) concrete pad dimensions: 2' diameter sonotube

4- Dia./type of well casing: 2" Stainless Steel

5- Type/slot size of screen: 2" Stainless Steel Screen 10-slot

6- Type screen filter: #1 silica pack
a) Quantity used: 6.5

7- Type of seal: Bentonite 3/8" chips
a) Quantity used

8- Grout
a) Grout mix used: Portland Cement and Bentonite
b) Method of placement: Pour
c) Vol. of well casing grout

Development method: Whale Pump

Development time: 3.0 hours

Estimated purge volume: 45 gallons

Comments

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	**6GW13A**	SHEET 1 OF 1

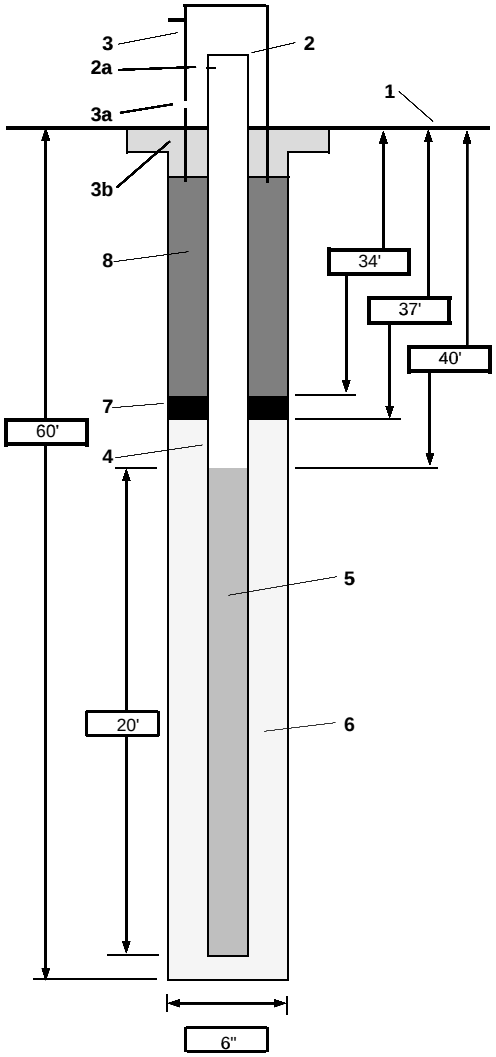
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 6" Mud Rotary on 850X ATV Rig

WATER LEVELS : 2.47 ft (TOC) START : 03/03/2009 END : 03/05/2009 LOGGER : Pat Murphy



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type: Stick-up
a) Bollards: Four bollards
b) concrete pad dimensions: 2' diameter sonotube

4- Dia./type of well casing: 2" Stainless Steel

5- Type/slot size of screen: 2" Stainless Steel Screen 10-slot

6- Type screen filter: #1 silica pack
a) Quantity used: 7

7- Type of seal: Bentonite 3/8" chips
a) Quantity used

8- Grout
a) Grout mix used: Portland Cement and Bentonite
b) Method of placement: Pour
c) Vol. of well casing grout

Development method: Whale Pump

Development time: 3.5 hours

Estimated purge volume: 55 gallons

Comments

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	6GW14	SHEET 1 OF 1

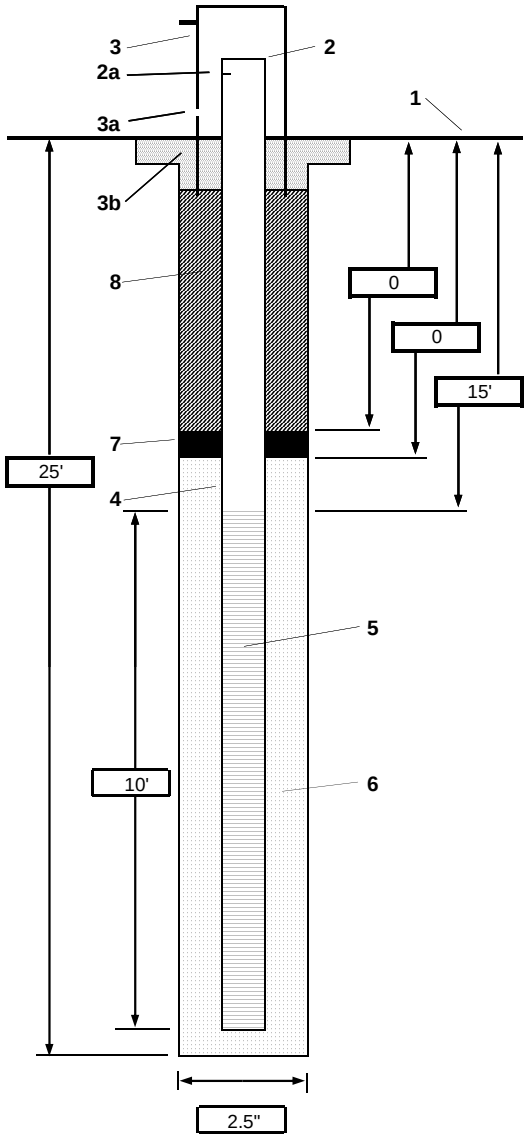
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : Manual Push/Tripod

WATER LEVELS : 2.85 ft (TOC) START : 03/03/2009 END : 03/03/2009 LOGGER : M. Ost



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type Stick-up
a) Bollards
b) concrete pad dimensions

4- Dia./type of well casing 2" Stainless Steel

5- Type/slot size of screen 2" Stainless Steel pre-packed Screen 10-sl

6- Type screen filter
a) Quantity used

7- Type of seal
a) Quantity used

8- Grout
a) Grout mix used
b) Method of placement
c) Vol. of well casing grout

Development method Whale Pump

Development time 3.5 hours

Estimated purge volume 20 gallons

Comments Well contained a pre-packed stainless steel screen with a drive point on the end.

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	6GW15	SHEET 1 OF 1

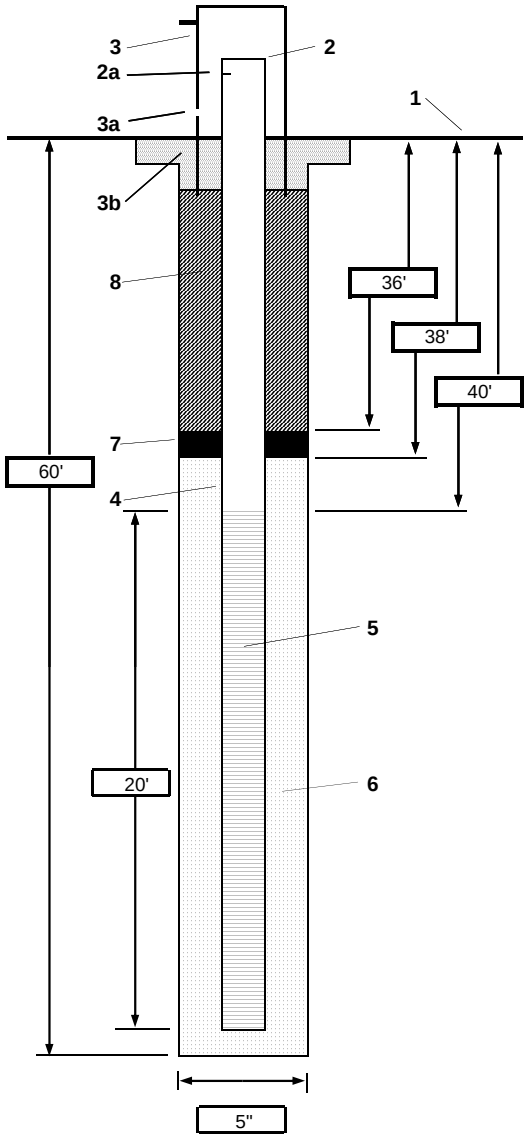
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 5" Chop and Wash with Tripod

WATER LEVELS : 2.70 ft (TOC) START : 03/09/2009 END : 03/09/2009 LOGGER : Pat Murphy



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type: Stick-up
a) Bollards: 4" PVC casing
b) concrete pad dimensions

4- Dia./type of well casing: 2" Stainless Steel

5- Type/slot size of screen: 2" Stainless Steel pre-packed screen 10-sl

6- Type screen filter: Pre-packed Screen
a) Quantity used

7- Type of seal
a) Quantity used

8- Grout
a) Grout mix used
b) Method of placement
c) Vol. of well casing grout

Development method: Whale Pump

Development time: 2.5 hours

Estimated purge volume: 30 gallons

Comments

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	6GW16	SHEET 1 OF 1

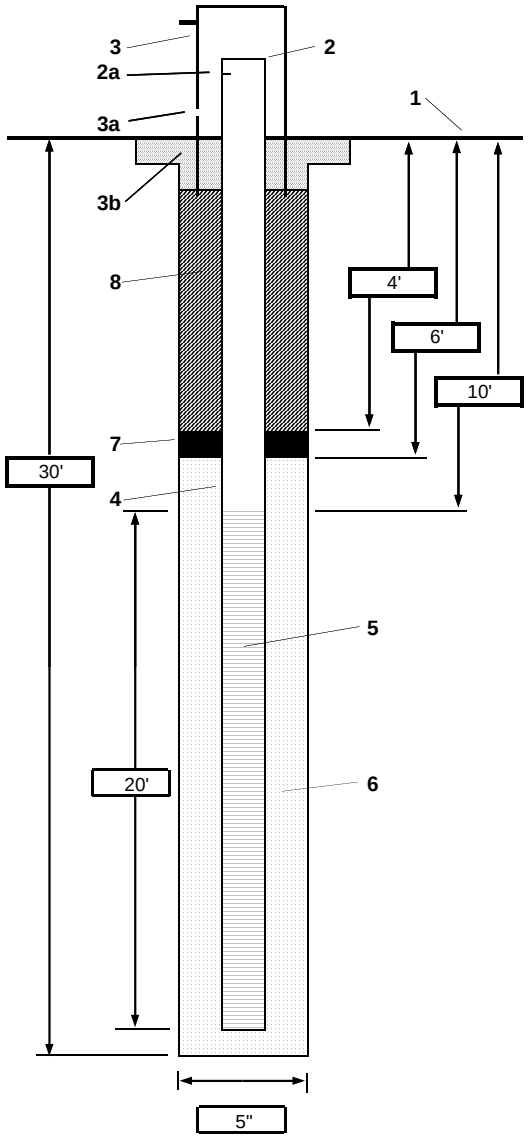
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 5" Chop and Wash with Tripod

WATER LEVELS : 5.83 ft (TOC) START : 06/16/2009 END : 06/17/2009 LOGGER : Pat Murphy



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type: Stick-up
a) Bollards: Four bollards
b) concrete pad dimensions: 2' diameter sonotube

4- Dia./type of well casing: 2" Sch 40 PVC

5- Type/slot size of screen: 2" PVC Sch 40 10 slot

6- Type screen filter: #1 silica pack
a) Quantity used: 4

7- Type of seal: Bentonite 3/8" chips
a) Quantity used

8- Grout
a) Grout mix used
b) Method of placement
c) Vol. of well casing grout

Development method: Whale Pump

Development time: 2.5 hours

Estimated purge volume: 35 gallons

Comments: No grout was used

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	6GW17	SHEET 1 OF 1

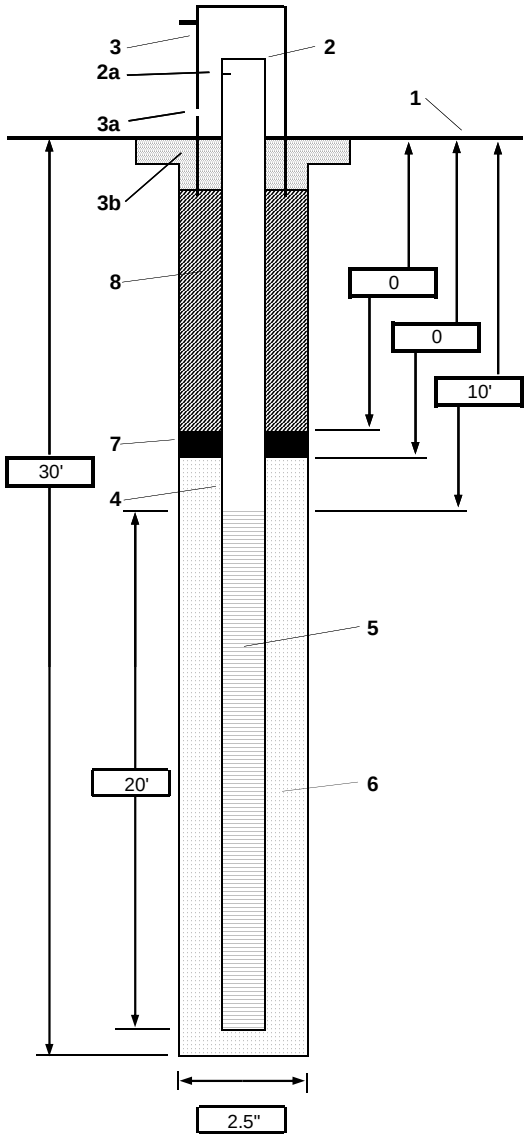
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 140 lbs Hammer/Manual Push

WATER LEVELS : 2.55 ft (TOC) START : 06/18/2009 END : 06/18/2009 LOGGER : Pat Murphy



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type None
a) Bollards
b) concrete pad dimensions

4- Dia./type of well casing 2" Stainless Steel

5- Type/slot size of screen 2" Stainless Steel pre-packed Screen 10-sl

6- Type screen filter
a) Quantity used

7- Type of seal
a) Quantity used

8- Grout
a) Grout mix used
b) Method of placement
c) Vol. of well casing grout

Development method Monsoon Pump

Development time 4.0 hours

Estimated purge volume 25 gallons

Comments Well contained a pre-packed stainless steel screen with a drive point on the end. Well was installed using a 140 lbs hammer and manual pushing. About 3' of the well was left as a stick-up and spray painted orange.

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	6GW18	SHEET 1 OF 1

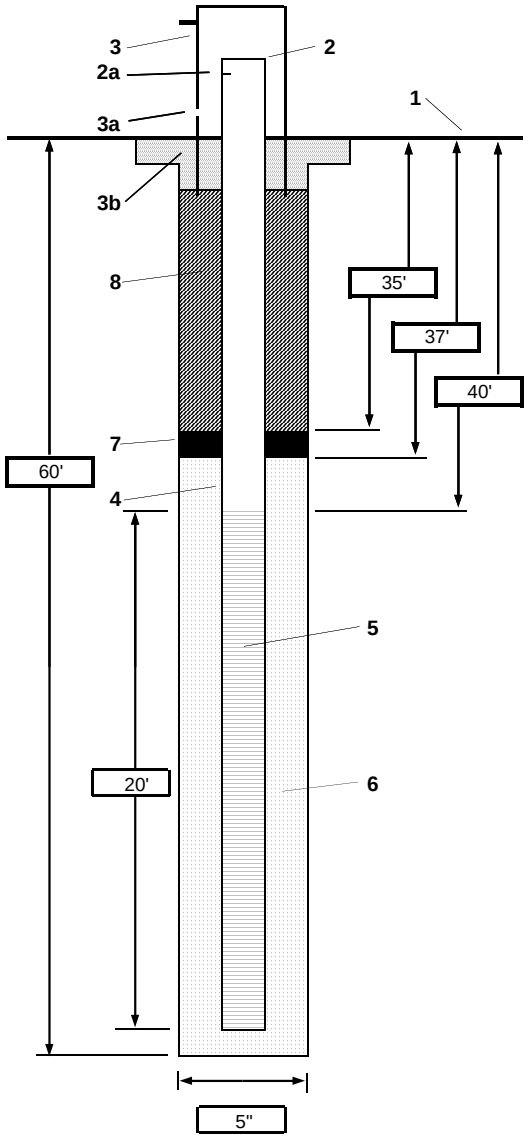
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on 850X ATV Rig

WATER LEVELS : 31.50 ft (TOC) START : 06/22/2009 END : 06/22/2009 LOGGER : Pat Murphy



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type: Stick-up
a) Bollards: Four bollards
b) concrete pad dimensions: 2' diameter sonotube

4- Dia./type of well casing: 2" Sch 40 PVC

5- Type/slot size of screen: 2" PVC Sch 40 10 slot

6- Type screen filter: #1 silica pack
a) Quantity used: 12.5

7- Type of seal: Bentonite 3/8" chips
a) Quantity used

8- Grout
a) Grout mix used: Portland Cement and Bentonite
b) Method of placement: Pour
c) Vol. of well casing grout

Development method: Whale Pump

Development time: 3.5 hours

Estimated purge volume: 40 gallons

Comments

PROJECT NUMBER	WELL NUMBER		
358315.FI.FS	6GW11	SHEET 1	OF 1

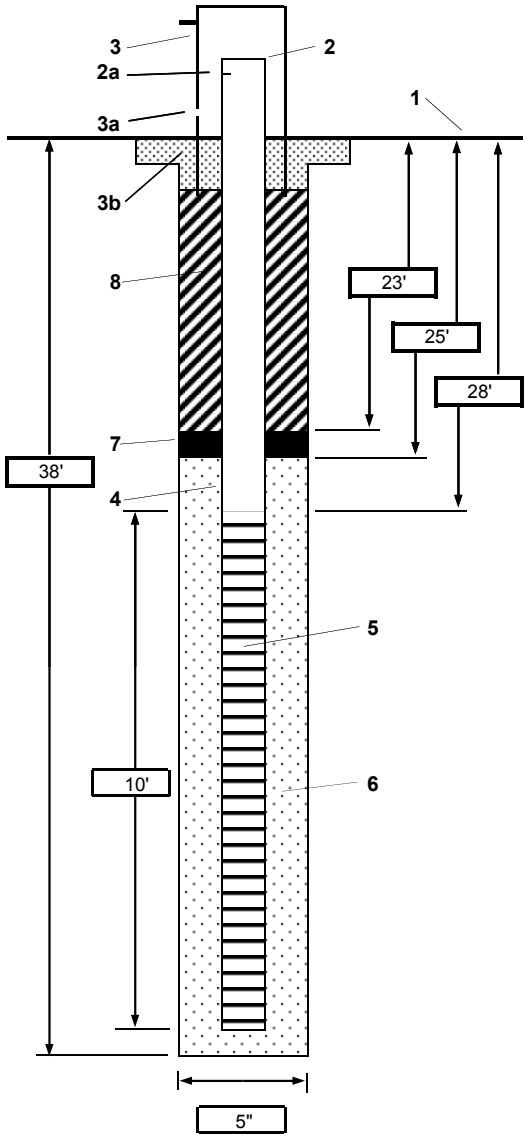
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 28.46 ft (TOC) START : 02/18/2009 END : 02/19/2009 LOGGER : C. Lippencott



1- Ground elevation at well	
2- Top of casing elevation	
a) vent hole?	
3- Wellhead protection cover type	Stick-up
a) Bollards	Four bollards
b) concrete pad dimensions	3' x 3'
4- Dia./type of well casing	2" Sch 40 PVC
5- Type/slot size of screen	2" PVC Sch 40 10 slot
6- Type screen filter	#1 silica pack
a) Quantity used	6
7- Type of seal	Bentonite 3/8" chips
a) Quantity used	
8- Grout	
a) Grout mix used	Portland Cement and Bentonite
b) Method of placement	Pour
c) Vol. of well casing grout	
Development method	Whale Pump
Development time	3.0 hours
Estimated purge volume	55 gallons

Comments

PROJECT NUMBER	WELL NUMBER		
358315.FI.FS	6GW12	SHEET 1	OF 1

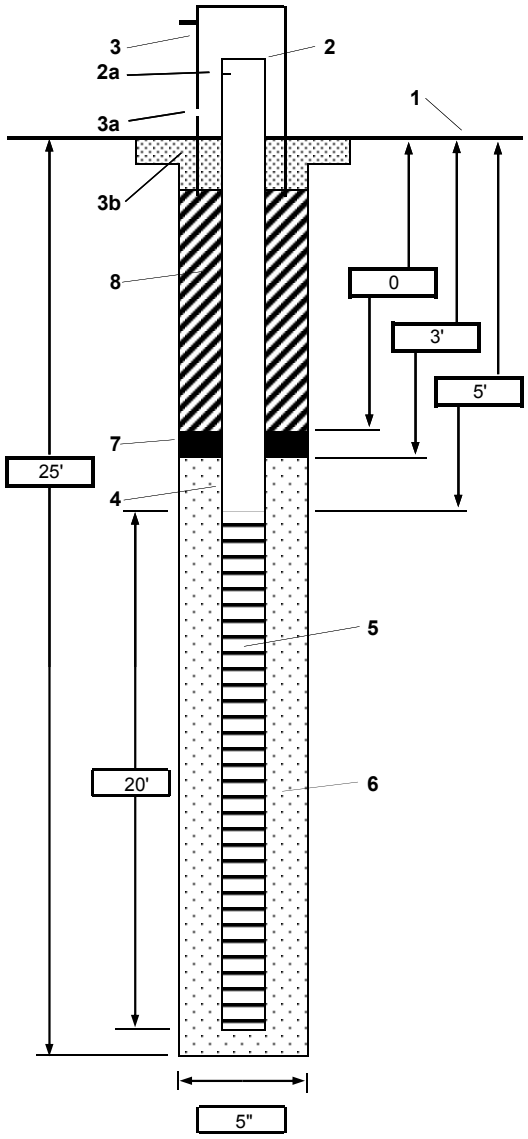
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 2.30 ft (TOC) START : 02/20/2009 END : 02/20/2009 LOGGER : C. Lippencott



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type: Stick-up
a) Bollards: Four bollards
b) concrete pad dimensions: 3' x 3'

4- Dia./type of well casing: 2" Stainless Steel

5- Type/slot size of screen: 2" Stainless Steel Screen 10-slot

6- Type screen filter: #1 silica pack
a) Quantity used: 12

7- Type of seal: Bentonite 3/8" chips
a) Quantity used

8- Grout
a) Grout mix used
b) Method of placement
c) Vol. of well casing grout

Development method: Whale Pump

Development time: 3.5 hours

Estimated purge volume: 55 gallons

Comments: No Grout was poured.

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	**6GW12A**	SHEET 1 OF 1

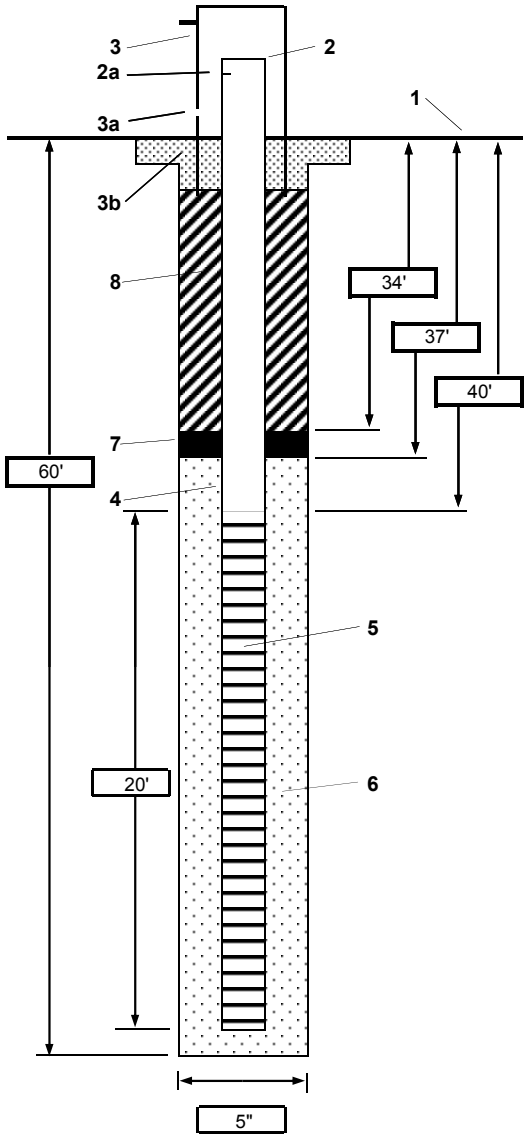
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 2.64 ft (TOC) START : 02/23/2009 END : 02/23/2009 LOGGER : M. Ost



1- Ground elevation at well	
2- Top of casing elevation	
a) vent hole?	
3- Wellhead protection cover type	Stick-up
a) Bollards	Four bollards
b) concrete pad dimensions	3' x 3'
4- Dia./type of well casing	2" Stainless Steel
5- Type/slot size of screen	2" Stainless Steel Screen 10-slot
6- Type screen filter	#1 silica pack
a) Quantity used	28
7- Type of seal	Bentonite 3/8" chips
a) Quantity used	
8- Grout	
a) Grout mix used	Portland Cement and Bentonite
b) Method of placement	Pour
c) Vol. of well casing grout	
Development method	Whale Pump
Development time	3.5 hours
Estimated purge volume	60 gallons

Comments

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	6GW13	SHEET 1 OF 1

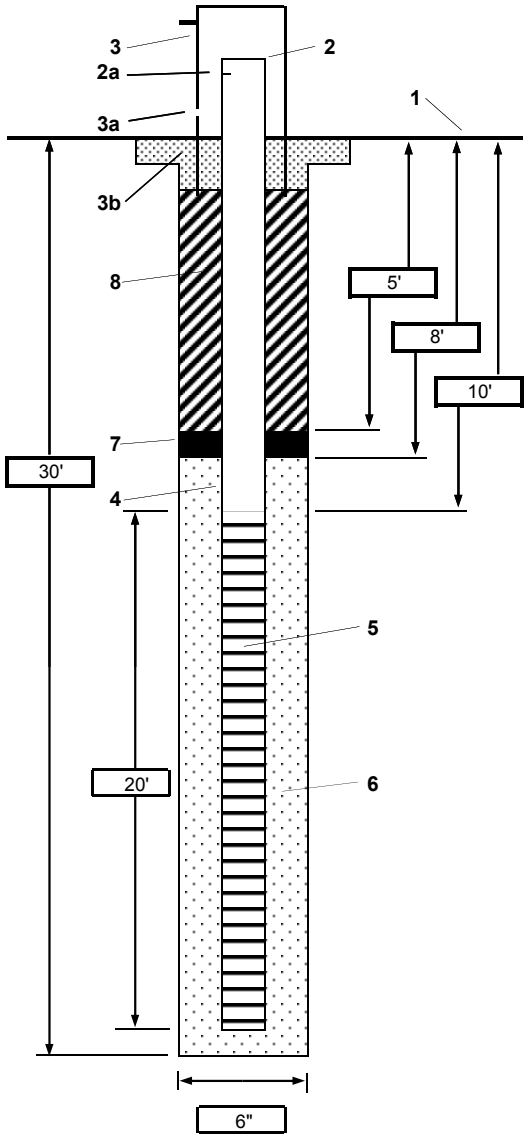
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 6" Mud Rotary on 850X ATV Rig

WATER LEVELS : 2.30 ft (TOC) START : 03/06/2009 END : 03/06/2009 LOGGER : Pat Murphy



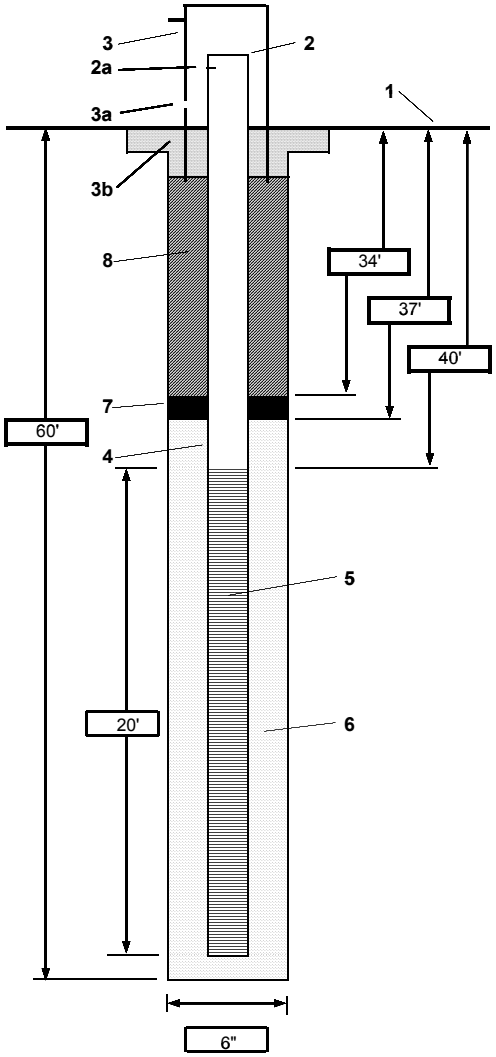
1- Ground elevation at well	
2- Top of casing elevation	
a) vent hole?	
3- Wellhead protection cover type	Stick-up
a) Bollards	Four bollards
b) concrete pad dimensions	2' diameter sonotube
4- Dia./type of well casing	2" Stainless Steel
5- Type/slot size of screen	2" Stainless Steel Screen 10-slot
6- Type screen filter	#1 silica pack
a) Quantity used	6.5
7- Type of seal	Bentonite 3/8" chips
a) Quantity used	
8- Grout	
a) Grout mix used	Portland Cement and Bentonite
b) Method of placement	Pour
c) Vol. of well casing grout	
Development method	Whale Pump
Development time	3.0 hours
Estimated purge volume	45 gallons

Comments

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	**6GW13A**	SHEET 1 OF 1

WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6
DRILLING CONTRACTOR : Parratt-Wolff
DRILLING METHOD AND EQUIPMENT USED : 6" Mud Rotary on 850X ATV Rig
WATER LEVELS : 2.47 ft (TOC) START : 03/03/2009 END : 03/05/2009 LOGGER : Pat Murphy



1- Ground elevation at well	
2- Top of casing elevation	
a) vent hole?	
3- Wellhead protection cover type	Stick-up
a) Bollards	Four bollards
b) concrete pad dimensions	2' diameter sonotube
4- Dia./type of well casing	2" Stainless Steel
5- Type/slot size of screen	2" Stainless Steel Screen 10-slot
6- Type screen filter	#1 silica pack
a) Quantity used	7
7- Type of seal	Bentonite 3/8" chips
a) Quantity used	
8- Grout	
a) Grout mix used	Portland Cement and Bentonite
b) Method of placement	Pour
c) Vol. of well casing grout	
Development method	Whale Pump
Development time	3.5 hours
Estimated purge volume	55 gallons

Comments

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	6GW14	SHEET 1 OF 1

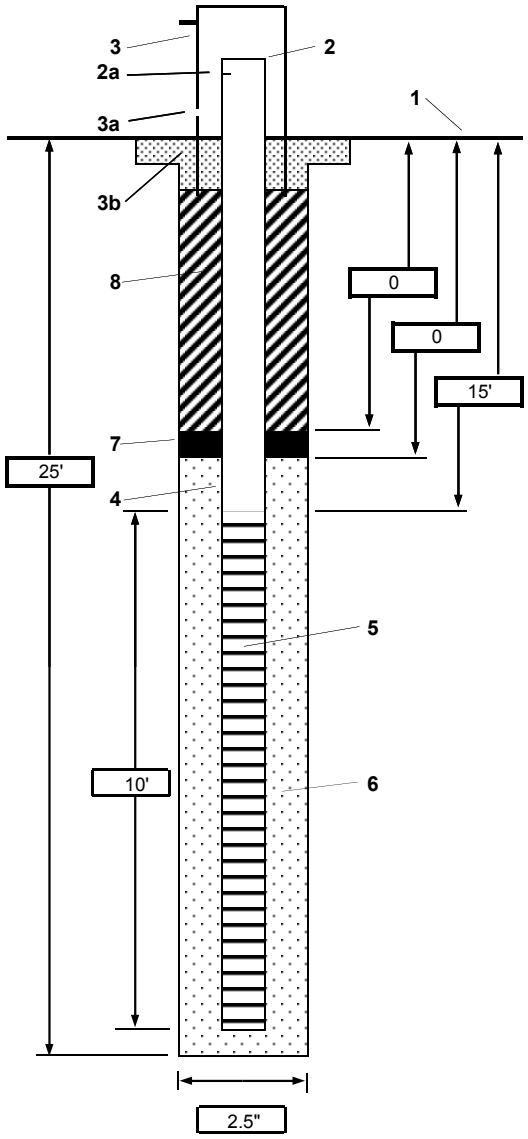
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : Manual Push/Tripod

WATER LEVELS : 2.85 ft (TOC) START : 03/03/2009 END : 03/03/2009 LOGGER : M. Ost



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type Stick-up
a) Bollards
b) concrete pad dimensions

4- Dia./type of well casing 2" Stainless Steel

5- Type/slot size of screen 2" Stainless Steel pre-packed Screen 10-sl

6- Type screen filter
a) Quantity used

7- Type of seal
a) Quantity used

8- Grout
a) Grout mix used
b) Method of placement
c) Vol. of well casing grout

Development method Whale Pump

Development time 3.5 hours

Estimated purge volume 20 gallons

Comments Well contained a pre-packed stainless steel screen with a drive point on the end.

PROJECT NUMBER	WELL NUMBER		
358315.FI.FS	6GW15	SHEET 1	OF 1

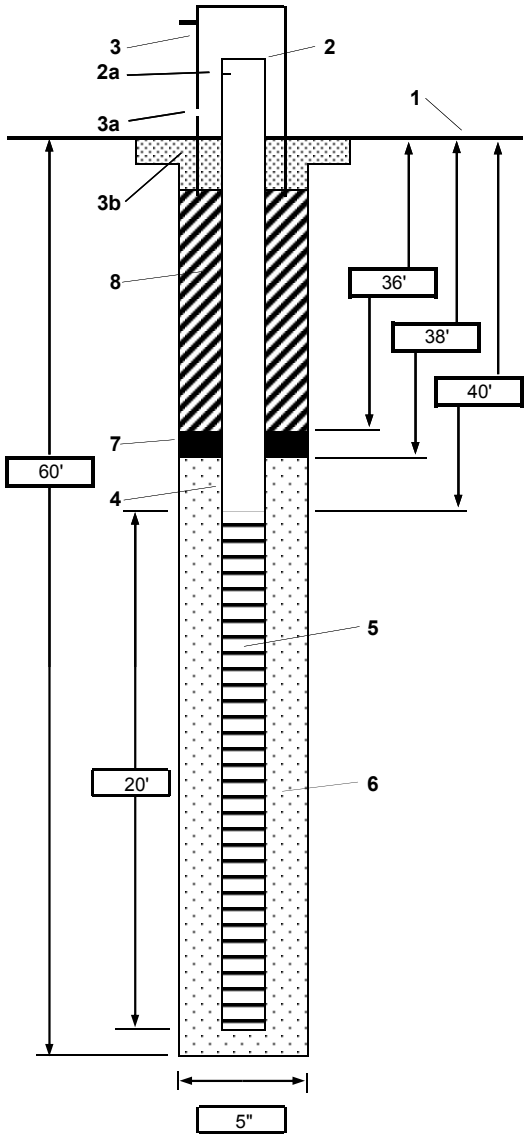
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 5" Chop and Wash with Tripod

WATER LEVELS : 2.70 ft (TOC) START : 03/09/2009 END : 03/09/2009 LOGGER : Pat Murphy



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type: Stick-up
a) Bollards: 4" PVC casing
b) concrete pad dimensions

4- Dia./type of well casing: 2" Stainless Steel

5- Type/slot size of screen: 2" Stainless Steel pre-packed screen 10-sl

6- Type screen filter: Pre-packed Screen
a) Quantity used

7- Type of seal
a) Quantity used

8- Grout
a) Grout mix used
b) Method of placement
c) Vol. of well casing grout

Development method: Whale Pump

Development time: 2.5 hours

Estimated purge volume: 30 gallons

Comments

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	6GW16	SHEET 1 OF 1

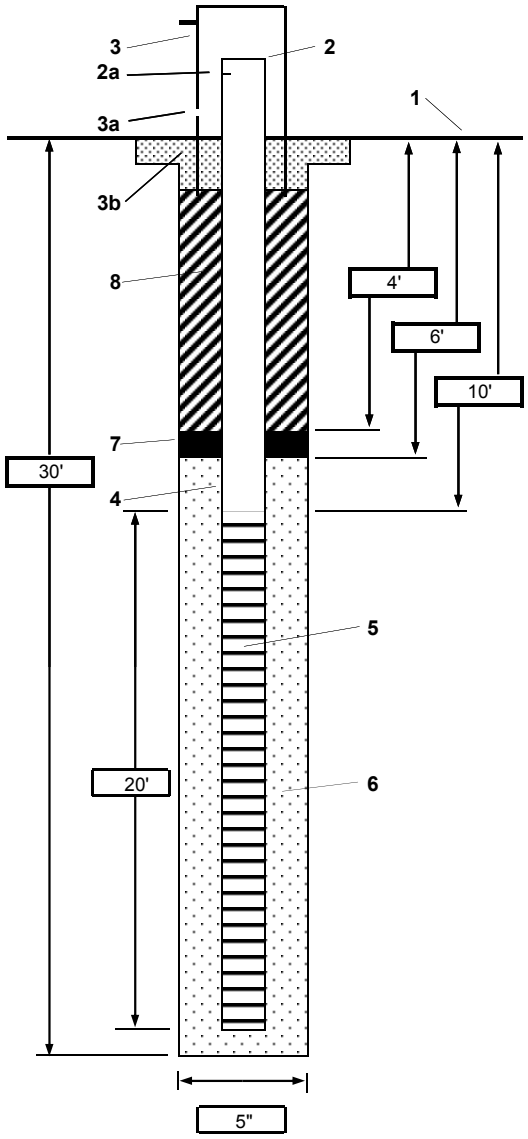
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 5" Chop and Wash with Tripod

WATER LEVELS : 5.83 ft (TOC) START : 06/16/2009 END : 06/17/2009 LOGGER : Pat Murphy



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type: Stick-up
a) Bollards: Four bollards
b) concrete pad dimensions: 2' diameter sonotube

4- Dia./type of well casing: 2" Sch 40 PVC

5- Type/slot size of screen: 2" PVC Sch 40 10 slot

6- Type screen filter: #1 silica pack
a) Quantity used: 4

7- Type of seal: Bentonite 3/8" chips
a) Quantity used

8- Grout
a) Grout mix used
b) Method of placement
c) Vol. of well casing grout

Development method: Whale Pump

Development time: 2.5 hours

Estimated purge volume: 35 gallons

Comments: No grout was used

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	6GW17	SHEET 1 OF 1

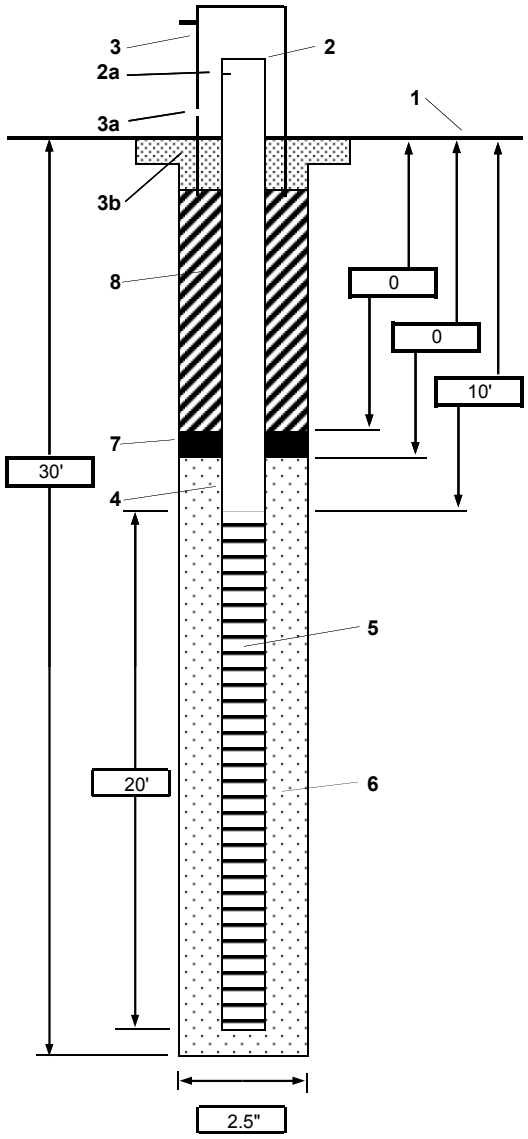
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 140 lbs Hammer/Manual Push

WATER LEVELS : 2.55 ft (TOC) START : 06/18/2009 END : 06/18/2009 LOGGER : Pat Murphy



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type None
a) Bollards
b) concrete pad dimensions

4- Dia./type of well casing 2" Stainless Steel

5- Type/slot size of screen 2" Stainless Steel pre-packed Screen 10-sl

6- Type screen filter
a) Quantity used

7- Type of seal
a) Quantity used

8- Grout
a) Grout mix used
b) Method of placement
c) Vol. of well casing grout

Development method Monsoon Pump

Development time 4.0 hours

Estimated purge volume 25 gallons

Comments Well contained a pre-packed stainless steel screen with a drive point on the end. Well was installed using a 140 lbs hammer and manual pushing. About 3' of the well was left as a stick-up and spray painted orange.

PROJECT NUMBER	WELL NUMBER	
358315.FI.FS	6GW18	SHEET 1 OF 1

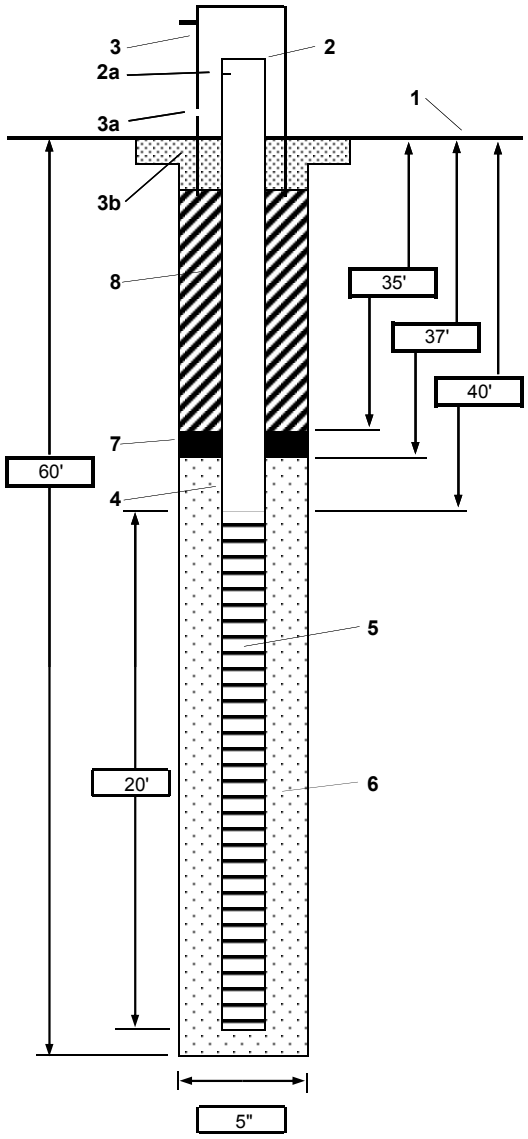
WELL COMPLETION DIAGRAM

PROJECT : Phase II RI Sites 1, 3, and 6 LOCATION : NWS Yorktown - Site 6

DRILLING CONTRACTOR : Parratt-Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on 850X ATV Rig

WATER LEVELS : 31.50 ft (TOC) START : 06/22/2009 END : 06/22/2009 LOGGER : Pat Murphy



1- Ground elevation at well

2- Top of casing elevation
a) vent hole?

3- Wellhead protection cover type: Stick-up
a) Bollards: Four bollards
b) concrete pad dimensions: 2' diameter sonotube

4- Dia./type of well casing: 2" Sch 40 PVC

5- Type/slot size of screen: 2" PVC Sch 40 10 slot

6- Type screen filter: #1 silica pack
a) Quantity used: 12.5

7- Type of seal: Bentonite 3/8" chips
a) Quantity used

8- Grout
a) Grout mix used: Portland Cement and Bentonite
b) Method of placement: Pour
c) Vol. of well casing grout

Development method: Whale Pump

Development time: 3.5 hours

Estimated purge volume: 40 gallons

Comments

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW11	SHEET 1 OF 1

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 32.16 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 28.46 ft (TOC) START : 2/18/09 END : 2/19/09 LOGGER : C. Lippincott

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	0'-4'	48"/48"	1		silty clayey SAND (SC), yellowish tan, moist, loose	No PID due to rain
5						
	4'-8'	48"/48"	2		sandy silty CLAY (CL), yellowish tan, moist, med. stiff to stiff, med. plastic	
10						
	8'-12'	48"/48"	3		SAA becoming greenish gray at 10' bgs, v. stiff, dry	
15						
	12'-16'	48"/48"	4		SAA (CL), some thin (1-2") sandy silt seems, also some reddish brown oxidized zones, softer near seems	
20	16'-20'	48"/48"	5		**16'-18':** SAA becoming softer and wet, low plastic **18'-20':** sandy clayey SILT (ML), bluish grey, moist, soft to stiff, low to no plasticity	
	20'-24'	48"/48"	6		silty CLAY (CL), bluish gray, moist-wet, stiff, med. plasticity, 6" silty fine sand seem at 20' bgs.	
25						
	24'-28'	48"/48"	7		**24'-27':** SAA interbedded silty CLAY (CL), bluish grey, moist, stiff to v. stiff, thin oxidized reddish brown seem (2" thick) at 25.5' bgs.	
30					**27'-28':** clayey silty SAND (SC), bluish gray with thin reddish brown oxidized seems, dry to moist. stiff to v. stiff, shell hash	
	28'-32'	48"/48"	8		clayey silty SAND (SC), bluish gray, wet, loose to med. stiff, few clayey siltier seems, shell hash	
35	32'-36'	48"/48"	9		**32'-34.5':** SAA, wet, shell hash **34.5'-36':** silty SAND (SP), greenish gray, moist-wet, f/g, loose to med dense SAND, very compact,	
40	36'-40'	48"/48"	10		SAA more shell hash, wet	

Well Screened from 28'-38' bgs

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW12	SHEET 1 OF 1

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 32.16 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 2.30 ft (TOC) START : 2/20/09 END : 2/20/09 LOGGER : C. Lippencott

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	0'-4'	0"/48"	1		No recovery due to loose soil sliding out of sleeve	
5						
	4'-8'	36"/48"	2		clayey silty SAND (SC), yellowish orange to ligh brown moist-wet, soft SAND w/ organics	PID=0.0 ppm
10						
	8'-12'	48"/48"	3		silty SAND (SC), light brown to yellowish orange, moist-wet, soft SAND w/ organics	PID=0.2 ppm
15						
	12'-16'	48"/48"	4		SAA except very wet w/ some shell hash	PID=0.0 ppm
20	16'-20'	48"/48"	5		SAA	PID= unavailable due to malfunction
	20'-24'	48"/48"	6		**20'-21'**: SAA **21'-24'**: silty CLAY (SM), blusih greenish gray, moist-wet, loose-med dense, little shell hash	
25						
	24'-28'	48"/48"	7		**24'-25'**: SAA **25'-28'**: sandy clayey SILT (ML), bluish greenish gray, moist, soft-stiff w/ little shells	
30						

Well Screened from 5'-25' bgs

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW12A	SHEET 1 OF 2

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 5.50 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 2.64 ft (TOC) START : 2/23/09 END : 2/23/09 LOGGER : M. Ost

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	0'-4'	0"/48"	1		No recovery due to loose soil sliding out of sleeve	
5						
	4'-8'	36"/48"	2		clayey silty SAND (SC), yellowish orange to ligh brown moist-wet, soft SAND w/ organics	PID=0.0 ppm
10						
	8'-12'	48"/48"	3		silty SAND (SC), light brown to yellowish orange, moist-wet, soft SAND w/ organics	PID=0.2 ppm
15						
	12'-16'	48"/48"	4		SAA except very wet w/ some shell hash	PID=0.0 ppm
20	16'-20'	48"/48"	5		SAA	PID= unavailable due to malfunction
	20'-24'	48"/48"	6		**20'-21'**: SAA **21'-24'**: silty CLAY (SM), blusih greenish gray, moist-wet, loose-med dense, little shell hash	
25						
	24'-28'	48"/48"	7		**24'-25'**: SAA **25'-28'**: sandy clayey SILT (ML), bluish greenish gray, moist, soft-stiff w/ little shells	
30						
	28'-32'	24"/48"	8		clayey SILT (ML), GLEY1 3/10gy, saturated, med-dense, some shell hash	
35						
	32'-36'	48"/48"	9		SAA	
40	36'-40'	48"/48"	10		sandy SILT (SM), GLEY1 3/10gy, saturated, loose SAND w/ some shell hash and dark mottling	
	40'-44'	48"/48"	11		SAA except silty SAND (SM)	
45						
	44'-48'	48"/48"	12		SAA	
50						
	48'-52'	48"/48"	13		**48'-50'**: SAA **50'-52-:** clayey SILT (ML), saturated, med dense shell hash	
55						

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW12A	SHEET 2 OF 2

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 5.50 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 2.64 ft (TOC) START : 2/23/09 END : 2/23/09 LOGGER : M. Ost

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	52'-56'	48"/48"	14		SILT (ML), GLEY1 3/10gy, saturated, loose, shell hash strong in first two feet w/ no shells in last two ft.	
60	56'-60'	48"/48"	15		**56'-59':** clayey SILTY (ML), GLEY2 3/10B, saturated v. loose w/ no shell hash **59'-60':** silty CLAY (CL), GLEY2 3/10B, saturated, med dense, shell hash present	
65	60'-64'	48"/48"	16		clayey SILT (ML), GLEY2 3/10gy, saturated, med-dense, shell hash	
70	64'-68'	48"/48"	17		SAA	
	68'-72'	48"/48"	18		silty CLAY (CL), dry-moist, dense, shell hash	PID=0.0 ppm
75	72'-76'	48"/48"	19		SAA	PID=0.0 ppm
80	76'-80'	48"/48"	20		SILT (ML), GLEY2 6/5pb, v. dry, v. dense	PID=0.0 ppm

Well Screened from 40'-60' bgs

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW13	SHEET 1 OF 1

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 4.53 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on 850X ATV Rig

WATER LEVELS : 2.30 ft (TOC) START : 3/06/09 END : 3/06/09 LOGGER : Patrick Murphy

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	0'-4'	24"/48"	1		CLAY (CL), 2.5Y5/2 grayish brown, saturated, soft CLAY w/ organics	PID=0.0 ppm
5						
	4'-8'	24"/48"	2		SAA	PID=0.0 ppm
10						
	8'-12'	20"/48"	3		CLAY (CL), 10YR2/1 black, saturated, soft CLAY	PID=0.0 ppm
15						
	12'-16'	36"/48"	4		SAA	PID=0.0 ppm
20	16'-20'	48"/48"	5		SAA w/ peat (PT)	PID=0.0 ppm
	20'-24'	6"/48"	6		silty CLAY (ML), 10YR2/1 black, saturated, soft CLAY w/ silts and peat	PID=0.0 ppm
25						
	24'-28'	36"/48"	7		silty SAND (SM), GLEY2 3/1 v. dark bluish gray, saturated, f/g loose SAND w/ silts, trace clay, and shell hash	PID=360ppm
30						
	28'-32'	24"/48"	8		SAA	PID=325ppm

Well Screened from 10'-30' bgs

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW13A	SHEET 1 OF 2

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 4.85 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on 850X ATV Rig

WATER LEVELS : 2.47 ft (TOC) START : 3/03/09 END : 3/05/09 LOGGER : Patrick Murphy

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
5	0'-4'	24"/48"	1		CLAY (CL), 2.5Y5/2 grayish brown, saturated, soft CLAY w/ organics	PID=0.0 ppm
10	4'-8'	24"/48"	2		SAA	PID=0.0 ppm
	8'-12'	20"/48"	3		CLAY (CL), 10YR2/1 black, saturated, soft CLAY	PID=0.0 ppm
15	12'-16'	36"/48"	4		SAA	PID=0.0 ppm
20	16'-20'	48"/48"	5		SAA w/ peat (PT)	PID=0.0 ppm
25	20'-24'	6"/48"	6		silty CLAY (ML), 10YR2/1 black, saturated, soft CLAY w/ silts and peat	PID=0.0 ppm
30	24'-28'	36"/48"	7		silty SAND (SM), GLEY2 3/1 v. dark bluish gray, saturated, f/g loose SAND w/ silts, trace clay, and shell hash	PID=360ppm
	28'-32'	24"/48"	8		SAA	PID=325ppm
35	32'-36'	40"/48"	9		SAA	PID=1246ppm
40	36'-40'	48"/48"	10		silty SAND (SM), GLEY2 3/1 v dark bluish gray, wet-saturated, loose f/g SAND w/ silts and trace shell hash	PID=240ppm
45	40'-44'	48"/48"	11		SAA	PID=1.5ppm
50	44'-48'	48"/48"	12		SAA	PID=0.8ppm
55	48'-52'	48"/48"	13		SAA	PID=1.5ppm

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW13A	SHEET 2 OF 2

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 4.85 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on 850X ATV Rig

WATER LEVELS : 2.47 ft (TOC) START : 3/03/09 END : 3/05/09 LOGGER : Patrick Murphy

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	52'-56'	48"/48"	14		silty SAND (SM), GLEY2 3/1 v. dark bluish gray, wet medium dense SAND w/ silts, trace clay and shell hash	PID=1.2ppm
60	56'-60'	48"/48"	15		SAA except moist-wet and dense	PID=2.5ppm
	60'-64'	48"/48"	16		SAA	PID=6.0ppm
65						
	64'-68'	48"/48"	17		silty SAND (SM), GLEY2 3/1 v dark bluish gray, moist v. dense f/g SAND w/ silts and some clay	PID=1.0ppm
70						
	68'-72'	48"/48"	18		silty CLAY (ML), GLEY2 3/1 v dark greenish gray, dry-moist, v stiff CLAY w/ silts	PID=1.0ppm
75						
	72'-76'	48"/48"	19		SAA	PID=0.5ppm

Well Screened from 40'-60' bgs

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW16	SHEET 1 OF 1

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 7.23 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : Portable Tripod w/ 140 lbs hammer and chop 'n' wash method

WATER LEVELS : 5.83 ft (TOC) START : 6/16/09 END : 6/17/09 LOGGER : Patrick Murphy

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	0'-2'	12"/24"	1		clayey SAND (SC), 10YR5/6 yellowish brown, dry-moist, medium grained loose SAND w/ clay organics present	PID=0.0 ppm
5	2'-6'	36"/48"	2		silty CLAY (CL), 10YR7/1 light gray mottled w/ light brown, moist, soft CLAY w/ organics, trace silts/fines	PID=0.0 ppm
10	6'-10'	20"/48"	3		silty CLAY (CL), GLEY1 5/1 greenish gray, moist, medium stiff-stiff CLAY w/ organics,	PID=0.0 ppm
15	10'-14'	30"/48"	4		silty SAND (SM), 2.5Y5/6 light olive brown, saturated v. loose f/g SAND w/ silts	PID=0.0 ppm
	14'-16'	10"/24"	5		SAA except SAND is medium dense	PID=0.0 ppm
20*	16'-20'	48"/48"	6*		SAA*	PID=0.0 ppm

Well Screened from 10'-30' bgs.

*: Note: Samples were not taken from below 20' bgs due to the hole collapsing in, resulting in unrepresentative samples (fluff).

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW18	SHEET 1 OF 1

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 32.35 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on 850X ATV Rig

WATER LEVELS : 31.50 ft (TOC) START : 6/22/09 END : 6/22/09 LOGGER : Patrick Murphy

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
5	0'-4'	48"/48"	1		SAND(SW), 7.5YR4/6 strong brown, dry, well graded medium dense, medium coarse SAND	PID=0.6 ppm
	4'-8'	48"/48"	2		sandy CLAY (SC), 10YR5/8 yellowish brown, dry, medium stiff CLAY w/ sand organics	PID=0.3 ppm
10	8'-10'	12"/24"	3		sandy CLAY (SC), 10YR5/8 yellowish brown mottled w/ 10YR7/1 light gray, dry, medium stiff CLAY w/ f/g sand	PID=0.4 ppm
15	10'-14'	44"/48"	4		clayey SAND (SC), 10YR5/8 yellowish brown mottled w/ 10YR7/1 light gray, dry-moist, f/g loose SAND w/ clay	PID=0.1 ppm
	14'-18'	48"/48"	5		sandy CLAY (SC), 10YR5/8 yellowish brown mottled w/ 10YR7/1 light gray, dry-moist, soft CLAY w/ f/g sand	PID=0.3 ppm
20	18'-20'	24"/24"	6		clayey SAND (SC), 10YR6/3 pale brown, dry-moist, f/g loose-medium dense SAND w/ clays and silts	PID=0.0 ppm
25	20'-24'	48"/48"	7		SAA	PID=0.0 ppm
	24'-28'	48"/48"	8		sandy CLAY (SC), 2.5Y5/2 grayish brown, moist, medium stiff CLAY w/ f/g sand, silts, and shell hash	PID=0.0 ppm
30	28'-30'	24"/24"	9		silty sandy CLAY (SC), 2.5Y4/3 olive brown, wet, soft CLAY w/ f/g sand and silts	PID=0.0 ppm
35	30'-34'	48"/48"	10		silty SAND (SM), 2.5Y5/4 light olive brown, saturated f/g loose SAND w/ silts and shell hash	PID=0.0 ppm
	34'-38'	48"/48"	11		silty SAND (SM), 2.5Y5/4 light olive brown, saturated, f/g loose SAND w/ silts and shell hash	PID=0.0 ppm
40	38'-40'	24"/24"	12		SAA	PID=0.1 ppm
45	40'-44'	48"/48"	13		SAA	PID=0.0 ppm
	44'-48'	48"/48"	14		SAA except very loose	PID=0.0 ppm
50	48'-50'	24"/24"	15		SAA, mottled w/ 2.5Y5/1 gray	PID=0.1 ppm
55	50'-54'	48"/48"	16		silty SAND (SM), 2.5Y5/4 light olive brown, saturated f/g loose SAND w/ silts and shell hash	PID=0.0 ppm
	54'-58'	48"/48"	17		SAA	PID=0.1 ppm
60	58'-60'	24"/24"	18		SAA	PID=0.0 ppm

Well Screen from 40'-60' bgs

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW11	SHEET 1 OF 1

CH2MHILL

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 32.16 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 28.46 ft (TOC) START : 2/18/09 END : 2/19/09 LOGGER : C. Lippincott

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	0'-4'	48"/48"	1		silty clayey SAND (SC), yellowish tan, moist, loose	No PID due to rain
5						
	4'-8'	48"/48"	2		sandy silty CLAY (CL), yellowish tan, moist, med. stiff to stiff, med. plastic	
10						
	8'-12'	48"/48"	3		SAA becoming greenish gray at 10' bgs, v. stiff, dry	
15						
	12'-16'	48"/48"	4		SAA (CL), some thin (1-2") sandy silt seems, also some reddish brown oxidized zones, softer near seems	
20	16'-20'	48"/48"	5		**16'-18':** SAA becoming softer and wet, low plastic **18'-20':** sandy clayey SILT (ML), bluish grey, moist, soft to stiff, low to no plasticity	
	20'-24'	48"/48"	6		silty CLAY (CL), bluish gray, moist-wet, stiff, med. plasticity, 6" silty fine sand seem at 20' bgs.	
25						
	24'-28'	48"/48"	7		**24'-27':** SAA interbedded silty CLAY (CL), bluish grey, moist, stiff to v. stiff, thin oxidized reddish brown seem (2" thick) at 25.5' bgs.	
30					**27'-28':** clayey silty SAND (SC), bluish gray with thin reddish brown oxidized seems, dry to moist. stiff to v. stiff, shell hash	
	28'-32'	48"/48"	8		clayey silty SAND (SC), bluish gray, wet, loose to med. stiff, few clayey siltier seems, shell hash	
35	32'-36'	48"/48"	9		**32'-34.5':** SAA, wet, shell hash **34.5'-36':** silty SAND (SP), greenish gray, moist-wet, f/g, loose to med dense SAND, very compact,	
40	36'-40'	48"/48"	10		SAA more shell hash, wet	

Well Screened from 28'-38' bgs

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW12	SHEET 1 OF 1

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 32.16 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 2.30 ft (TOC) START : 2/20/09 END : 2/20/09 LOGGER : C. Lippencott

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	0'-4'	0"/48"	1		No recovery due to loose soil sliding out of sleeve	
5						
	4'-8'	36"/48"	2		clayey silty SAND (SC), yellowish orange to ligh brown moist-wet, soft SAND w/ organics	PID=0.0 ppm
10						
	8'-12'	48"/48"	3		silty SAND (SC), light brown to yellowish orange, moist-wet, soft SAND w/ organics	PID=0.2 ppm
15						
	12'-16'	48"/48"	4		SAA except very wet w/ some shell hash	PID=0.0 ppm
20	16'-20'	48"/48"	5		SAA	PID= unavailable due to malfunction
	20'-24'	48"/48"	6		**20'-21'**: SAA **21'-24'**: silty CLAY (SM), blusih greenish gray, moist-wet, loose-med dense, little shell hash	
25						
	24'-28'	48"/48"	7		**24'-25'**: SAA **25'-28'**: sandy clayey SILT (ML), bluish greenish gray, moist, soft-stiff w/ little shells	
30						

Well Screened from 5'-25' bgs

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW12A	SHEET 1 OF 2

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 5.50 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 2.64 ft (TOC) START : 2/23/09 END : 2/23/09 LOGGER : M. Ost

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	0'-4'	0"/48"	1		No recovery due to loose soil sliding out of sleeve	
5						
	4'-8'	36"/48"	2		clayey silty SAND (SC), yellowish orange to ligh brown moist-wet, soft SAND w/ organics	PID=0.0 ppm
10						
	8'-12'	48"/48"	3		silty SAND (SC), light brown to yellowish orange, moist-wet, soft SAND w/ organics	PID=0.2 ppm
15						
	12'-16'	48"/48"	4		SAA except very wet w/ some shell hash	PID=0.0 ppm
20	16'-20'	48"/48"	5		SAA	PID= unavailable due to malfunction
	20'-24'	48"/48"	6		**20'-21'**: SAA **21'-24'**: silty CLAY (SM), blusih greenish gray, moist-wet, loose-med dense, little shell hash	
25						
	24'-28'	48"/48"	7		**24'-25'**: SAA **25'-28'**: sandy clayey SILT (ML), bluish greenish gray, moist, soft-stiff w/ little shells	
30						
	28'-32'	24"/48"	8		clayey SILT (ML), GLEY1 3/10gy, saturated, med-dense, some shell hash	
35						
	32'-36'	48"/48"	9		SAA	
40	36'-40'	48"/48"	10		sandy SILT (SM), GLEY1 3/10gy, saturated, loose SAND w/ some shell hash and dark mottling	
	40'-44'	48"/48"	11		SAA except silty SAND (SM)	
45						
	44'-48'	48"/48"	12		SAA	
50						
	48'-52'	48"/48"	13		**48'-50'**: SAA **50'-52-:** clayey SILT (ML), saturated, med dense shell hash	
55						

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW12A	SHEET 2 OF 2

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 5.50 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on Truck Rig

WATER LEVELS : 2.64 ft (TOC) START : 2/23/09 END : 2/23/09 LOGGER : M. Ost

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	52'-56'	48"/48"	14		SILT (ML), GLEY1 3/10gy, saturated, loose, shell hash strong in first two feet w/ no shells in last two ft.	
60	56'-60'	48"/48"	15		**56'-59':** clayey SILTY (ML), GLEY2 3/10B, saturated v. loose w/ no shell hash **59'-60':** silty CLAY (CL), GLEY2 3/10B, saturated, med dense, shell hash present	
65	60'-64'	48"/48"	16		clayey SILT (ML), GLEY2 3/10gy, saturated, med-dense, shell hash	
70	64'-68'	48"/48"	17		SAA	
75	68'-72'	48"/48"	18		silty CLAY (CL), dry-moist, dense, shell hash	PID=0.0 ppm
	72'-76'	48"/48"	19		SAA	PID=0.0 ppm
80	76'-80'	48"/48"	20		SILT (ML), GLEY2 6/5pb, v. dry, v. dense	PID=0.0 ppm

Well Screened from 40'-60' bgs

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW13	SHEET 1 OF 1

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 4.53 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on 850X ATV Rig

WATER LEVELS : 2.30 ft (TOC) START : 3/06/09 END : 3/06/09 LOGGER : Patrick Murphy

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	0'-4'	24"/48"	1		CLAY (CL), 2.5Y5/2 grayish brown, saturated, soft CLAY w/ organics	PID=0.0 ppm
5						
	4'-8'	24"/48"	2		SAA	PID=0.0 ppm
10						
	8'-12'	20"/48"	3		CLAY (CL), 10YR2/1 black, saturated, soft CLAY	PID=0.0 ppm
15						
	12'-16'	36"/48"	4		SAA	PID=0.0 ppm
20	16'-20'	48"/48"	5		SAA w/ peat (PT)	PID=0.0 ppm
	20'-24'	6"/48"	6		silty CLAY (ML), 10YR2/1 black, saturated, soft CLAY w/ silts and peat	PID=0.0 ppm
25						
	24'-28'	36"/48"	7		silty SAND (SM), GLEY2 3/1 v. dark bluish gray, saturated, f/g loose SAND w/ silts, trace clay, and shell hash	PID=360ppm
30						
	28'-32'	24"/48"	8		SAA	PID=325ppm

Well Screened from 10'-30' bgs

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW13A	SHEET 1 OF 2

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 4.85 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on 850X ATV Rig

WATER LEVELS : 2.47 ft (TOC) START : 3/03/09 END : 3/05/09 LOGGER : Patrick Murphy

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	0'-4'	24"/48"	1		CLAY (CL), 2.5Y5/2 grayish brown, saturated, soft CLAY w/ organics	PID=0.0 ppm
5						
	4'-8'	24"/48"	2		SAA	PID=0.0 ppm
10						
	8'-12'	20"/48"	3		CLAY (CL), 10YR2/1 black, saturated, soft CLAY	PID=0.0 ppm
15						
	12'-16'	36"/48"	4		SAA	PID=0.0 ppm
20	16'-20'	48"/48"	5		SAA w/ peat (PT)	PID=0.0 ppm
	20'-24'	6"/48"	6		silty CLAY (ML), 10YR2/1 black, saturated, soft CLAY w/ silts and peat	PID=0.0 ppm
25						
	24'-28'	36"/48"	7		silty SAND (SM), GLEY2 3/1 v. dark bluish gray, saturated, f/g loose SAND w/ silts, trace clay, and shell hash	PID=360ppm
30						
	28'-32'	24"/48"	8		SAA	PID=325ppm
35						
	32'-36'	40"/48"	9		SAA	PID=1246ppm
40	36'-40'	48"/48"	10		silty SAND (SM), GLEY2 3/1 v dark bluish gray, wet-saturated, loose f/g SAND w/ silts and trace shell hash	PID=240ppm
	40'-44'	48"/48"	11		SAA	PID=1.5ppm
45						
	44'-48'	48"/48"	12		SAA	PID=0.8ppm
50						
	48'-52'	48"/48"	13		SAA	PID=1.5ppm
55						

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW13A	SHEET 2 OF 2

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 4.85 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on 850X ATV Rig

WATER LEVELS : 2.47 ft (TOC) START : 3/03/09 END : 3/05/09 LOGGER : Patrick Murphy

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	52'-56'	48"/48"	14		silty SAND (SM), GLEY2 3/1 v. dark bluish gray, wet medium dense SAND w/ silts, trace clay and shell hash	PID=1.2ppm
60	56'-60'	48"/48"	15		SAA except moist-wet and dense	PID=2.5ppm
	60'-64'	48"/48"	16		SAA	PID=6.0ppm
65						
	64'-68'	48"/48"	17		silty SAND (SM), GLEY2 3/1 v dark bluish gray, moist v. dense f/g SAND w/ silts and some clay	PID=1.0ppm
70						
	68'-72'	48"/48"	18		silty CLAY (ML), GLEY2 3/1 v dark greenish gray, dry-moist, v stiff CLAY w/ silts	PID=1.0ppm
75						
	72'-76'	48"/48"	19		SAA	PID=0.5ppm

Well Screened from 40'-60' bgs

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW16	SHEET 1 OF 1

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 7.23 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : Portable Tripod w/ 140 lbs hammer and chop 'n' wash method

WATER LEVELS : 5.83 ft (TOC) START : 6/16/09 END : 6/17/09 LOGGER : Patrick Murphy

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	0'-2'	12"/24"	1		clayey SAND (SC), 10YR5/6 yellowish brown, dry-moist, medium grained loose SAND w/ clay organics present	PID=0.0 ppm
5	2'-6'	36"/48"	2		silty CLAY (CL), 10YR7/1 light gray mottled w/ light brown, moist, soft CLAY w/ organics, trace silts/fines	PID=0.0 ppm
10	6'-10'	20"/48"	3		silty CLAY (CL), GLEY1 5/1 greenish gray, moist, medium stiff-stiff CLAY w/ organics,	PID=0.0 ppm
15	10'-14'	30"/48"	4		silty SAND (SM), 2.5Y5/6 light olive brown, saturated v. loose f/g SAND w/ silts	PID=0.0 ppm
	14'-16'	10"/24"	5		SAA except SAND is medium dense	PID=0.0 ppm
20*	16'-20'	48"/48"	6*		SAA*	PID=0.0 ppm

Well Screened from 10'-30' bgs.

*: Note: Samples were not taken from below 20' bgs due to the hole collapsing in, resulting in unrepresentative samples (fluff).

PROJECT NUMBER	BORING NUMBER	
358315.FI.FS	YS06-GW18	SHEET 1 OF 1

SOIL BORING LOG

PROJECT :CTO-166 Sites 1, 3, 6, and 7 LOCATION : Yorktown NWS

ELEVATION : 32.35 ft msl (TOC) DRILLING CONTRACTOR : Parratt Wolff

DRILLING METHOD AND EQUIPMENT USED : 4 1/4 inch ID Hollow Stem Auger on 850X ATV Rig

WATER LEVELS : 31.50 ft (TOC) START : 6/22/09 END : 6/22/09 LOGGER : Patrick Murphy

DEPTH BELOW SURFACE (FT)	INTERVAL (FT)	RECOVERY (IN)	#/TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	CORE DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
	0'-4'	48"/48"	1		SAND(SW), 7.5YR4/6 strong brown, dry, well graded medium dense, medium coarse SAND	PID=0.6 ppm
5						
	4'-8'	48"/48"	2		sandy CLAY (SC), 10YR5/8 yellowish brown, dry, medium stiff CLAY w/ sand organics	PID=0.3 ppm
10	8'-10'	12"/24"	3		sandy CLAY (SC), 10YR5/8 yellowish brown mottled w/ 10YR7/1 light gray, dry, medium stiff CLAY w/ f/g sand	PID=0.4 ppm
	10'-14'	44"/48"	4		clayey SAND (SC), 10YR5/8 yellowish brown mottled w/ 10YR7/1 light gray, dry-moist, f/g loose SAND w/ clay	PID=0.1 ppm
15						
	14'-18'	48"/48"	5		sandy CLAY (SC), 10YR5/8 yellowish brown mottled w/ 10YR7/1 light gray, dry-moist, soft CLAY w/ f/g sand	PID=0.3 ppm
20	18'-20'	24"/24"	6		clayey SAND (SC), 10YR6/3 pale brown, dry-moist, f/g loose-medium dense SAND w/ clays and silts	PID=0.0 ppm
	20'-24'	48"/48"	7		SAA	PID=0.0 ppm
25						
	24'-28'	48"/48"	8		sandy CLAY (SC), 2.5Y5/2 grayish brown, moist, medium stiff CLAY w/ f/g sand, silts, and shell hash	PID=0.0 ppm
30	28'-30'	24"/24"	9		silty sandy CLAY (SC), 2.5Y4/3 olive brown, wet, soft CLAY w/ f/g sand and silts	PID=0.0 ppm
	30'-34'	48"/48"	10		silty SAND (SM), 2.5Y5/4 light olive brown, saturated f/g loose SAND w/ silts and shell hash	PID=0.0 ppm
35						
	34'-38'	48"/48"	11		silty SAND (SM), 2.5Y5/4 light olive brown, saturated, f/g loose SAND w/ silts and shell hash	PID=0.0 ppm
40	38'-40'	24"/24"	12		SAA	PID=0.1 ppm
	40'-44'	48"/48"	13		SAA	PID=0.0 ppm
45						
	44'-48'	48"/48"	14		SAA except very loose	PID=0.0 ppm
50	48'-50'	24"/24"	15		SAA, mottled w/ 2.5Y5/1 gray	PID=0.1 ppm
	50'-54'	48"/48"	16		silty SAND (SM), 2.5Y5/4 light olive brown, saturated f/g loose SAND w/ silts and shell hash	PID=0.0 ppm
55						
	54'-58'	48"/48"	17		SAA	PID=0.1 ppm
60	58'-60'	24"/24"	18		SAA	PID=0.0 ppm

Well Screen from 40'-60' bgs

Appendix B
Well Survey Results

Well Survey Results for Site 6

Site 6

Monitoring Well	Northing (Y)	Easting (X)	Concrete Surface (ft msl)	Ground Surface (ft msl)	Elevation Top of Casing (ft msl)
6GW11	3626945.81	12042063.24	28.64		32.16
6GW12	3626007.36	12042245.00	3.33		5.50
6GW12A	3626004.05	12042241.90	3.44		5.69
6GW13	3626124.70	12042087.99	2.10		4.53
6GW13A	3626127.90	12042085.05	1.94		4.85
6GW14	3626226.12	12041779.27		0.6	3.91
6GW15	3626189.40	12041820.59		0.9	4.17
6GW16	3626045.88	12041682.36	5.26		7.23
6GW17	3626264.97	12041621.92		0.8	3.95
6GW18	3626372.84	12040875.67	29.06		32.35

Shots taken on wells were marked with black marker on the top of the PVC

Appendix C
Waste Profiles

Analytics Corporation
10329 Stony Run Lane
Ashland, VA 23005
Phone: (804)365-3000
Fax: (804)365-3002

July 22, 2009

CARMELA TOMBES
AIR WATER & SOIL
2109-A NORTH HAMILTON STREET
RICHMOND, VA 23230

Purchase Order:

Client ID: 09070236
Workorder: 9197009

Dear CARMELA TOMBES:

Enclosed are the analytical results for sample(s) received by the laboratory on on Thursday, July 16, 2009. Results reported herein conform to the most current NELAC standards, where applicable, unless otherwise narrated in the body of the report.

Unless otherwise specified all analyses of solid materials are based on dry weight.

The signature at the end of this report certify that the results are based on the referenced methods and unless otherwise noted meet the requirements of NELAC.

Reported results relate only to the items tested, as received by the laboratory

On-site analysis (analysis ASAP) is recommended for the following tests: pH, temperature, dissolved oxygen, residual chlorine and sulfite. Whenperformed off-site, these tests do not meet NELAC standards.

Abbreviations:ug/L = micrograms per Liter, mg/L = milligrams per Liter, ug/g = micrograms per gram, mg/kg = milligrams per kilogramug/wp = micrograms per wipe, ug/ml = micrograms per millimeter, uS = microsiemens per centimeter at 25 degrees Celciusppb = parts per billion, DF = Dilution Factor

If you have any questions concerning this report, please feel free to call Client Services at 1-800-888-8061.

Sincerely,

Dawn A Casto

Dawn Casto

Enclosures

CERTIFICATE OF ANALYSIS

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Analytics Corporation
10329 Stony Run Lane
Ashland, VA 23005
Phone: (804)365-3000
Fax: (804)365-3002

SAMPLE SUMMARY

Workorder: 9197009 09070236

Lab ID	Sample ID	Matrix	Date Collected	Date Received
9197009001	09070236-001	Aqueous Liquid	7/14/2009 14:35	7/16/2009 08:00
9197009002	09070236-002	Soil/Solids/Sediment	7/14/2009 14:40	7/16/2009 08:00
9197009003	09070236-003	Aqueous Liquid	7/14/2009 15:20	7/16/2009 08:00
9197009004	09070236-004	Soil/Solids/Sediment	7/14/2009 15:30	7/16/2009 08:00

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Analytics Corporation
10329 Stony Run Lane
Ashland, VA 23005
Phone: (804)365-3000
Fax: (804)365-3002

ANALYTICAL RESULTS

Workorder: 9197009 09070236

Lab ID: **9197009001** Date Received: 7/16/2009 08:00 Matrix: Aqueous Liquid
Sample ID: **09070236-001** Date Collected: 7/14/2009 14:35 Samp Type: NA

Parameters	Results	Units	Report Limit	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: SW-846 9014			Preparation Method: SW-846 Chapter 7.3 Analytical Method: SW-846 9014						
Reactive Cyanide	<200	mg/L	200	1	7/20/2009 15:09	DOI	7/21/2009 12:04	DOI	
Analysis Desc: SW-846 9034			Preparation Method: SW-846 Chapter 7.3 Analytical Method: SW-846 9034						
Reactive Sulfide	<200	mg/L	200	1	7/20/2009 15:09	DOI	7/22/2009 14:54	DOI	

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Analytics Corporation
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Ashland, VA 23005
Phone: (804)365-3000
Fax: (804)365-3002

ANALYTICAL RESULTS

Workorder: 9197009 09070236

Lab ID: **9197009002** Date Received: 7/16/2009 08:00 Matrix: Soil/Solids/Sediment

Sample ID: **09070236-002** Date Collected: 7/14/2009 14:40 Samp Type: NA

Parameters	Results	Units	Report Limit	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: SW-846 9030B			Preparation Method: SW-846 Chapter 7.3 Analytical Method: SW-846 9030B						
Reactive Sulfide	<200	mg/Kg	200	1	7/20/2009 15:07	DOI	7/22/2009 14:54	DOI	
Analysis Desc: SW-846 9014			Preparation Method: SW-846 Chapter 7.3 Analytical Method: SW-846 9014						
Reactive Cyanide	<200	mg/Kg	200	1	7/20/2009 15:07	DOI	7/21/2009 12:04	DOI	
Physical Properties									
Analysis Desc: SW-846 3550 sec 7.2			Analytical Method: SW-846 3550 sec 7.2						
Percent Moisture	50.4	%		1			7/21/2009 13:19	NT	

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Ashland, VA 23005
Phone: (804)365-3000
Fax: (804)365-3002

ANALYTICAL RESULTS

Workorder: 9197009 09070236

Lab ID: **9197009003** Date Received: 7/16/2009 08:00 Matrix: Aqueous Liquid
Sample ID: **09070236-003** Date Collected: 7/14/2009 15:20 Samp Type: NA

Parameters	Results	Units	Report Limit	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: SW-846 9014			Preparation Method: SW-846 Chapter 7.3 Analytical Method: SW-846 9014						
Reactive Cyanide	<200	mg/L	200	1	7/20/2009 15:09	DOI	7/21/2009 12:04	DOI	
Analysis Desc: SW-846 9034			Preparation Method: SW-846 Chapter 7.3 Analytical Method: SW-846 9034						
Reactive Sulfide	<200	mg/L	200	1	7/20/2009 15:09	DOI	7/22/2009 14:54	DOI	

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Analytics Corporation
10329 Stony Run Lane
Ashland, VA 23005
Phone: (804)365-3000
Fax: (804)365-3002

ANALYTICAL RESULTS

Workorder: 9197009 09070236

Lab ID: **9197009004** Date Received: 7/16/2009 08:00 Matrix: Soil/Solids/Sediment

Sample ID: **09070236-004** Date Collected: 7/14/2009 15:30 Samp Type: NA

Parameters	Results	Units	Report Limit	DF	Prepared	By	Analyzed	By	Qual
Analysis Desc: SW-846 9030B			Preparation Method: SW-846 Chapter 7.3 Analytical Method: SW-846 9030B						
Reactive Sulfide	<200	mg/Kg	200	1	7/20/2009 15:07	DOI	7/22/2009 14:54	DOI	
Analysis Desc: SW-846 9014			Preparation Method: SW-846 Chapter 7.3 Analytical Method: SW-846 9014						
Reactive Cyanide	<200	mg/Kg	200	1	7/20/2009 15:07	DOI	7/21/2009 12:04	DOI	
Physical Properties									
Analysis Desc: SW-846 3550 sec 7.2			Analytical Method: SW-846 3550 sec 7.2						
Percent Moisture	20.7	%		1			7/21/2009 13:19	NT	

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Certificate of Analysis

Final Report

Laboratory Order ID 09070236

Client Name: Potomac Environmental, Inc.
2105 Lake Ave.
Richmond, VA 23230

Date Received: July 15, 2009
Date Issued: July 29, 2009

Submitted To: Weegie Thompson
Project Number: PN: 358315.FI.FS
Client Site I.D.: Yorktown NWS CTO-166 Site 6/7
Purchase Order NA

Sample I.D.: YS06-IDW01-0709
Laboratory Sample I.D.: 09070236-001
Date/Time Sampled: 07/14/09 14:35

Parameter	Method	Sample Results	Rep Limi	Analysis Date/Time	Analyst
TCLP Extraction Fluid	SW1311	0 NA	--	07/16/09 16:00	NBA
TCLP Arsenic	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:38	MWL
TCLP Barium	SW6010C	< 0.5 mg/L	0.500	07/23/09 16:38	MWL
TCLP Cadmium	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:38	MWL
TCLP Chromium	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:38	MWL
TCLP Lead	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:38	MWL
TCLP Mercury	SW7470A	< 0.008 mg/L	0.008	07/22/09 13:52	NBA
TCLP Selenium	SW6010C	< 0.25 mg/L	0.250	07/23/09 16:38	MWL
TCLP Silver	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:38	MWL
TCLP Benzene	SW8260B	< 0.1 mg/L	0.10	07/21/09 19:48	MKD
TCLP Carbon Tetrachloride	SW8260B	< 0.1 mg/L	0.10	07/21/09 19:48	MKD
TCLP Chlorobenzene	SW8260B	< 0.1 mg/L	0.10	07/21/09 19:48	MKD
TCLP Chloroform	SW8260B	< 0.1 mg/L	0.10	07/21/09 19:48	MKD
TCLP 1,4-Dichlorobenzene	SW8260B	< 0.1 mg/L	0.10	07/21/09 19:48	MKD
TCLP 1,2-Dichloroethane	SW8260B	< 0.1 mg/L	0.10	07/21/09 19:48	MKD
TCLP 1,1-Dichloroethylene	SW8260B	< 0.1 mg/L	0.10	07/21/09 19:48	MKD
TCLP Methyl ethyl ketone	SW8260B	< 0.1 mg/L	0.10	07/21/09 19:48	MKD
TCLP Tetrachloroethylene	SW8260B	< 0.1 mg/L	0.10	07/21/09 19:48	MKD
TCLP Trichloroethylene	SW8260B	< 0.1 mg/L	0.10	07/21/09 19:48	MKD
TCLP Vinyl chloride	SW8260B	< 0.1 mg/L	0.10	07/21/09 19:48	MKD
TCLP 2,4,5-TP (Silvex)	SW8151A	< 0.002 mg/L	0.002	07/22/09 16:01	RPF
TCLP 2,4-D	SW8151A	< 0.01 mg/L	0.010	07/22/09 16:01	RPF
TCLP Chlordane	SW8081A	< 0.003 mg/L	0.003	07/28/09 17:32	RPF
TCLP Endrin	SW8081A	< 0.002 mg/L	0.002	07/28/09 17:32	RPF
TCLP Heptachlor	SW8081A	< 0.001 mg/L	0.001	07/28/09 17:32	RPF
TCLP Heptachlor Epoxide	SW8081A	< 0.001 mg/L	0.001	07/28/09 17:32	RPF
TCLP Lindane	SW8081A	< 0.004 mg/L	0.004	07/28/09 17:32	RPF
TCLP Methoxychlor	SW8081A	< 0.1 mg/L	0.100	07/28/09 17:32	RPF

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Certificate of Analysis

Final Report

Laboratory Order ID 09070236

Client Name: Potomac Environmental, Inc.
2105 Lake Ave.
Richmond, VA 23230

Date Received: July 15, 2009
Date Issued: July 29, 2009

Submitted To: Weegie Thompson

Project Number: PN: 358315.FI.FS

Client Site I.D.: Yorktown NWS CTO-166 Site 6/7

Purchase Order NA

Sample I.D.: YS06-IDW01-0709

Laboratory Sample I.D.: 09070236-001

Date/Time Sampled: 07/14/09 14:35

Parameter	Method	Sample Results	Rep Limi	Analysis Date/Time	Analyst
TCLP Toxaphene	SW8081A	< 0.005 mg/L	0.005	07/28/09 17:32	RPF
TCLP 2,4,5-Trichlorophenol	SW8270D	< 0.1 mg/L	0.100	07/28/09 12:05	JHV
TCLP 2,4,6-Trichlorophenol	SW8270D	< 0.1 mg/L	0.100	07/28/09 12:05	JHV
TCLP 2,4-Dinitrotoluene	SW8270D	< 0.1 mg/L	0.10	07/28/09 12:05	JHV
TCLP Cresols	SW8270D	< 0.1 mg/L	0.10	07/28/09 12:05	JHV
TCLP Hexachlorobenzene	SW8270D	< 0.1 mg/L	0.10	07/28/09 12:05	JHV
TCLP Hexachlorobutadiene	SW8270D	< 0.2 mg/L	0.20	07/28/09 12:05	JHV
TCLP Hexachloroethane	SW8270D	< 0.5 mg/L	0.50	07/28/09 12:05	JHV
TCLP Nitrobenzene	SW8270D	< 0.1 mg/L	0.10	07/28/09 12:05	JHV
TCLP o-Cresol	SW8270D	< 0.1 mg/L	0.10	07/28/09 12:05	JHV
TCLP p-Cresol	SW8270D	< 0.1 mg/L	0.10	07/28/09 12:05	JHV
TCLP Pentachlorophenol	SW8270D	< 0.1 mg/L	0.10	07/28/09 12:05	JHV
TCLP Pyridine	SW8270D	< 0.5 mg/L	0.50	07/28/09 12:05	JHV
Corrosivity	SW7.2	Non-corrosive	--	07/16/09 13:06	WBP
Ignitability	SW1010	42 °C	15	07/22/09 14:29	WBP
Reactive Cyanide	SW7.3/SW9010B	See Attached	--		
Reactive Sulfide	SW7.3/SW9030B	See Attached	--		

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Certificate of Analysis

Final Report

Laboratory Order ID 09070236

Client Name: Potomac Environmental, Inc.
2105 Lake Ave.
Richmond, VA 23230

Date Received: July 15, 2009
Date Issued: July 29, 2009

Submitted To: Weegie Thompson

Project Number: PN: 358315.FI.FS

Client Site I.D.: Yorktown NWS CTO-166 Site 6/7

Purchase Order NA

Sample I.D.: YS06-IDW02-0709

Laboratory Sample I.D.: 09070236-002

Date/Time Sampled: 07/14/09 14:40

Parameter	Method	Sample Results	Rep Limi	Analysis Date/Time	Analyst
TCLP Extraction Fluid	SW1311	#1	--	07/16/09 16:00	NBA
TCLP Arsenic	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:41	MWL
TCLP Barium	SW6010C	< 0.5 mg/L	0.500	07/23/09 16:41	MWL
TCLP Cadmium	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:41	MWL
TCLP Chromium	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:41	MWL
TCLP Lead	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:41	MWL
TCLP Mercury	SW7470A	< 0.008 mg/L	0.008	07/22/09 13:54	NBA
TCLP Selenium	SW6010C	< 0.25 mg/L	0.250	07/23/09 16:41	MWL
TCLP Silver	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:41	MWL
TCLP Benzene	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:30	MKD
TCLP Carbon Tetrachloride	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:30	MKD
TCLP Chlorobenzene	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:30	MKD
TCLP Chloroform	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:30	MKD
TCLP 1,4-Dichlorobenzene	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:30	MKD
TCLP 1,2-Dichloroethane	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:30	MKD
TCLP 1,1-Dichloroethylene	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:30	MKD
TCLP Methyl ethyl ketone	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:30	MKD
TCLP Tetrachloroethylene	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:30	MKD
TCLP Trichloroethylene	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:30	MKD
TCLP Vinyl chloride	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:30	MKD
TCLP 2,4,5-TP (Silvex)	SW8151A	< 0.002 mg/L	0.002	07/22/09 17:29	RPF
TCLP 2,4-D	SW8151A	< 0.01 mg/L	0.010	07/22/09 17:29	RPF
TCLP Chlordane	SW8081A	< 0.003 mg/L	0.003	07/28/09 18:29	RPF
TCLP Endrin	SW8081A	< 0.002 mg/L	0.002	07/28/09 18:29	RPF
TCLP Heptachlor	SW8081A	< 0.001 mg/L	0.001	07/28/09 18:29	RPF
TCLP Heptachlor Epoxide	SW8081A	< 0.001 mg/L	0.001	07/28/09 18:29	RPF
TCLP Lindane	SW8081A	< 0.004 mg/L	0.004	07/28/09 18:29	RPF
TCLP Methoxychlor	SW8081A	< 0.1 mg/L	0.100	07/28/09 18:29	RPF

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Certificate of Analysis

Final Report

Laboratory Order ID 09070236

Client Name: Potomac Environmental, Inc.
2105 Lake Ave.
Richmond, VA 23230

Date Received: July 15, 2009
Date Issued: July 29, 2009

Submitted To: Weegie Thompson

Project Number: PN: 358315.FI.FS

Client Site I.D.: Yorktown NWS CTO-166 Site 6/7

Purchase Order NA

Sample I.D.: YS06-IDW02-0709

Laboratory Sample I.D.: 09070236-002

Date/Time Sampled: 07/14/09 14:40

Parameter	Method	Sample Results	Rep Limi	Analysis Date/Time	Analyst
TCLP Toxaphene	SW8081A	< 0.005 mg/L	0.005	07/28/09 18:29	RPF
TCLP 2,4,5-Trichlorophenol	SW8270D	< 100 ug/L	100	07/28/09 12:39	JHV
TCLP 2,4,6-Trichlorophenol	SW8270D	< 100 ug/L	100	07/28/09 12:39	JHV
TCLP 2,4-Dinitrotoluene	SW8270D	< 100 ug/L	100	07/28/09 12:39	JHV
TCLP Cresols	SW8270D	< 100 ug/L	100	07/28/09 12:39	JHV
TCLP Hexachlorobenzene	SW8270D	< 100 ug/L	100	07/28/09 12:39	JHV
TCLP Hexachlorobutadiene	SW8270D	< 200 ug/L	200	07/28/09 12:39	JHV
TCLP Hexachloroethane	SW8270D	< 500 ug/L	500	07/28/09 12:39	JHV
TCLP Nitrobenzene	SW8270D	< 100 ug/L	100	07/28/09 12:39	JHV
TCLP o-Cresol	SW8270D	< 100 ug/L	100	07/28/09 12:39	JHV
TCLP p-Cresol	SW8270D	< 100 ug/L	100	07/28/09 12:39	JHV
TCLP Pentachlorophenol	SW8270D	< 100 ug/L	100	07/28/09 12:39	JHV
TCLP Pyridine	SW8270D	< 500 ug/L	500	07/28/09 12:39	JHV
Corrosivity	SW7.2	Non-corrosive	--	07/16/09 13:06	WBP
Ignitability	SW1010	> 60 °C	15	07/24/09 11:47	LMT
Reactive Cyanide	SW7.3/SW9010B	See Attached	--		
Reactive Sulfide	SW7.3/SW9030B	See Attached	--		

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Certificate of Analysis

Final Report

Laboratory Order ID 09070236

Client Name: Potomac Environmental, Inc.
2105 Lake Ave.
Richmond, VA 23230

Date Received: July 15, 2009
Date Issued: July 29, 2009

Submitted To: Weegie Thompson
Client Site I.D.: Yorktown NWS CTO-166 Site 6/7

Project Number: PN: 358315.FI.FS
Purchase Order NA

Sample I.D.: YS06-IDW03-0709
Date/Time Sampled: 07/14/09 15:20

Laboratory Sample I.D.: 09070236-003

Parameter	Method	Sample Results	Rep Limi	Analysis Date/Time	Analyst
TCLP Extraction Fluid	SW1311	0 NA	--	07/16/09 16:00	NBA
TCLP Arsenic	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:44	MWL
TCLP Barium	SW6010C	< 0.5 mg/L	0.500	07/23/09 16:44	MWL
TCLP Cadmium	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:44	MWL
TCLP Chromium	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:44	MWL
TCLP Lead	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:44	MWL
TCLP Mercury	SW7470A	< 0.008 mg/L	0.008	07/22/09 13:56	NBA
TCLP Selenium	SW6010C	< 0.25 mg/L	0.250	07/23/09 16:44	MWL
TCLP Silver	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:44	MWL
TCLP Benzene	SW8260B	< 0.1 mg/L	0.10	07/21/09 20:11	MKD
TCLP Carbon Tetrachloride	SW8260B	< 0.1 mg/L	0.10	07/21/09 20:11	MKD
TCLP Chlorobenzene	SW8260B	< 0.1 mg/L	0.10	07/21/09 20:11	MKD
TCLP Chloroform	SW8260B	< 0.1 mg/L	0.10	07/21/09 20:11	MKD
TCLP 1,4-Dichlorobenzene	SW8260B	< 0.1 mg/L	0.10	07/21/09 20:11	MKD
TCLP 1,2-Dichloroethane	SW8260B	< 0.1 mg/L	0.10	07/21/09 20:11	MKD
TCLP 1,1-Dichloroethylene	SW8260B	< 0.1 mg/L	0.10	07/21/09 20:11	MKD
TCLP Methyl ethyl ketone	SW8260B	< 0.1 mg/L	0.10	07/21/09 20:11	MKD
TCLP Tetrachloroethylene	SW8260B	< 0.1 mg/L	0.10	07/21/09 20:11	MKD
TCLP Trichloroethylene	SW8260B	< 0.1 mg/L	0.10	07/21/09 20:11	MKD
TCLP Vinyl chloride	SW8260B	< 0.1 mg/L	0.10	07/21/09 20:11	MKD
TCLP 2,4,5-TP (Silvex)	SW8151A	< 0.002 mg/L	0.002	07/22/09 16:16	RPF
TCLP 2,4-D	SW8151A	< 0.01 mg/L	0.010	07/22/09 16:16	RPF
TCLP Chlordane	SW8081A	< 0.003 mg/L	0.003	07/28/09 18:14	RPF
TCLP Endrin	SW8081A	< 0.002 mg/L	0.002	07/28/09 18:14	RPF
TCLP Heptachlor	SW8081A	< 0.001 mg/L	0.001	07/28/09 18:14	RPF
TCLP Heptachlor Epoxide	SW8081A	< 0.001 mg/L	0.001	07/28/09 18:14	RPF
TCLP Lindane	SW8081A	< 0.004 mg/L	0.004	07/28/09 18:14	RPF
TCLP Methoxychlor	SW8081A	< 0.1 mg/L	0.100	07/28/09 18:14	RPF

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Final Report

Laboratory Order ID 09070236

Client Name: Potomac Environmental, Inc.
2105 Lake Ave.
Richmond, VA 23230

Date Received: July 15, 2009
Date Issued: July 29, 2009

Submitted To: Weegie Thompson

Project Number: PN: 358315.FI.FS

Client Site I.D.: Yorktown NWS CTO-166 Site 6/7

Purchase Order NA

Sample I.D.: YS06-IDW03-0709

Laboratory Sample I.D.: 09070236-003

Date/Time Sampled: 07/14/09 15:20

Parameter	Method	Sample Results	Rep Limi	Analysis Date/Time	Analyst
TCLP Toxaphene	SW8081A	< 0.005 mg/L	0.005	07/28/09 18:14	RPF
TCLP 2,4,5-Trichlorophenol	SW8270D	< 0.1 mg/L	0.100	07/28/09 13:13	JHV
TCLP 2,4,6-Trichlorophenol	SW8270D	< 0.1 mg/L	0.100	07/28/09 13:13	JHV
TCLP 2,4-Dinitrotoluene	SW8270D	< 0.1 mg/L	0.10	07/28/09 13:13	JHV
TCLP Cresols	SW8270D	< 0.1 mg/L	0.10	07/28/09 13:13	JHV
TCLP Hexachlorobenzene	SW8270D	< 0.1 mg/L	0.10	07/28/09 13:13	JHV
TCLP Hexachlorobutadiene	SW8270D	< 0.2 mg/L	0.20	07/28/09 13:13	JHV
TCLP Hexachloroethane	SW8270D	< 0.5 mg/L	0.50	07/28/09 13:13	JHV
TCLP Nitrobenzene	SW8270D	< 0.1 mg/L	0.10	07/28/09 13:13	JHV
TCLP o-Cresol	SW8270D	< 0.1 mg/L	0.10	07/28/09 13:13	JHV
TCLP p-Cresol	SW8270D	< 0.1 mg/L	0.10	07/28/09 13:13	JHV
TCLP Pentachlorophenol	SW8270D	< 0.1 mg/L	0.10	07/28/09 13:13	JHV
TCLP Pyridine	SW8270D	< 0.5 mg/L	0.50	07/28/09 13:13	JHV
Corrosivity	SW7.2	Non-corrosive	--	07/16/09 13:06	WBP
Ignitability	SW1010	50 °C	15	07/22/09 14:42	WBP
Reactive Cyanide	SW7.3/SW9010B	See Attached	--		
Reactive Sulfide	SW7.3/SW9030B	See Attached	--		

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Final Report

Laboratory Order ID 09070236

Client Name: Potomac Environmental, Inc.
2105 Lake Ave.
Richmond, VA 23230

Date Received: July 15, 2009
Date Issued: July 29, 2009

Submitted To: Weegie Thompson

Project Number: PN: 358315.FI.FS

Client Site I.D.: Yorktown NWS CTO-166 Site 6/7

Purchase Order NA

Sample I.D.: YS06-IDW04-0709

Laboratory Sample I.D.: 09070236-004

Date/Time Sampled: 07/14/09 15:30

Parameter	Method	Sample Results	Rep Limi	Analysis Date/Time	Analyst
TCLP Extraction Fluid	SW1311	#1	--	07/16/09 16:00	NBA
TCLP Arsenic	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:47	MWL
TCLP Barium	SW6010C	< 0.5 mg/L	0.500	07/23/09 16:47	MWL
TCLP Cadmium	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:47	MWL
TCLP Chromium	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:47	MWL
TCLP Lead	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:47	MWL
TCLP Mercury	SW7470A	< 0.008 mg/L	0.008	07/22/09 13:58	NBA
TCLP Selenium	SW6010C	< 0.25 mg/L	0.250	07/23/09 16:47	MWL
TCLP Silver	SW6010C	< 0.1 mg/L	0.100	07/23/09 16:47	MWL
TCLP Benzene	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:53	MKD
TCLP Carbon Tetrachloride	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:53	MKD
TCLP Chlorobenzene	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:53	MKD
TCLP Chloroform	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:53	MKD
TCLP 1,4-Dichlorobenzene	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:53	MKD
TCLP 1,2-Dichloroethane	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:53	MKD
TCLP 1,1-Dichloroethylene	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:53	MKD
TCLP Methyl ethyl ketone	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:53	MKD
TCLP Tetrachloroethylene	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:53	MKD
TCLP Trichloroethylene	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:53	MKD
TCLP Vinyl chloride	SW8260B	< 0.1 mg/L	0.10	07/23/09 11:53	MKD
TCLP 2,4,5-TP (Silvex)	SW8151A	< 0.002 mg/L	0.002	07/22/09 17:44	RPF
TCLP 2,4-D	SW8151A	< 0.01 mg/L	0.010	07/22/09 17:44	RPF
TCLP Chlordane	SW8081A	< 0.003 mg/L	0.003	07/28/09 18:43	RPF
TCLP Endrin	SW8081A	< 0.002 mg/L	0.002	07/28/09 18:43	RPF
TCLP Heptachlor	SW8081A	< 0.001 mg/L	0.001	07/28/09 18:43	RPF
TCLP Heptachlor Epoxide	SW8081A	< 0.001 mg/L	0.001	07/28/09 18:43	RPF
TCLP Lindane	SW8081A	< 0.004 mg/L	0.004	07/28/09 18:43	RPF
TCLP Methoxychlor	SW8081A	< 0.1 mg/L	0.100	07/28/09 18:43	RPF

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Certificate of Analysis

Final Report

Laboratory Order ID 09070236

Client Name: Potomac Environmental, Inc.
2105 Lake Ave.
Richmond, VA 23230

Date Received: July 15, 2009
Date Issued: July 29, 2009

Submitted To: Weegie Thompson

Project Number: PN: 358315.FI.FS

Client Site I.D.: Yorktown NWS CTO-166 Site 6/7

Purchase Order NA

Sample I.D.: YS06-IDW04-0709

Laboratory Sample I.D.: 09070236-004

Date/Time Sampled: 07/14/09 15:30

Parameter	Method	Sample Results	Rep Limi	Analysis Date/Time	Analyst
TCLP Toxaphene	SW8081A	< 0.005 mg/L	0.005	07/28/09 18:43	RPF
TCLP 2,4,5-Trichlorophenol	SW8270D	< 100 ug/L	100	07/28/09 14:58	JHV
TCLP 2,4,6-Trichlorophenol	SW8270D	< 100 ug/L	100	07/28/09 14:58	JHV
TCLP 2,4-Dinitrotoluene	SW8270D	< 100 ug/L	100	07/28/09 14:58	JHV
TCLP Cresols	SW8270D	< 100 ug/L	100	07/28/09 14:58	JHV
TCLP Hexachlorobenzene	SW8270D	< 100 ug/L	100	07/28/09 14:58	JHV
TCLP Hexachlorobutadiene	SW8270D	< 200 ug/L	200	07/28/09 14:58	JHV
TCLP Hexachloroethane	SW8270D	< 500 ug/L	500	07/28/09 14:58	JHV
TCLP Nitrobenzene	SW8270D	< 100 ug/L	100	07/28/09 14:58	JHV
TCLP o-Cresol	SW8270D	< 100 ug/L	100	07/28/09 14:58	JHV
TCLP p-Cresol	SW8270D	< 100 ug/L	100	07/28/09 14:58	JHV
TCLP Pentachlorophenol	SW8270D	< 100 ug/L	100	07/28/09 14:58	JHV
TCLP Pyridine	SW8270D	< 500 ug/L	500	07/28/09 14:58	JHV
Corrosivity	SW7.2	Non-corrosive	--	07/16/09 13:06	WBP
Ignitability	SW1010	> 60 °C	15	07/24/09 14:05	LMT
Reactive Cyanide	SW7.3/SW9010B	See Attached	--		
Reactive Sulfide	SW7.3/SW9030B	See Attached	--		

CTO-166

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CHAIN OF CUSTODY

PAGE 1 OF 1

CLIENT NAME: Potomac Environmental / CH2M HILL	PROJECT NAME: CTO-166 Site 6/7
CLIENT CONTACT: Weegie Thomson / Pat Murphy	SITE NAME: Yorktown NWS
CLIENT ADDRESS: 2105 Lake Ave. Richmond, VA 23230	PROJECT NUMBER: PN: 358315.FI.FS
CLIENT PHONE NUMBER: 804-288-5043 / 757-671-6245	P.O. NUMBER:
CLIENT FAX NUMBER: EMAIL:	REGULATORY AUTHORITY:

Is sample for compliance reporting? YES NO | Is sample from a chlorinated supply? YES (NO) | PWS I.D. #:

SAMPLER NAME (PRINT): Pat Murphy | SAMPLER SIGNATURE: [signature] | Turn Around Time: PER CONTRACT Day(s)

Have ammonia and TKN samples been verified to be dechlorinated at the time of sampling?: YES NO

CLIENT SAMPLE I.D.	Composite Start Date	Composite Start Time	Grab Date or Composite Stop Date	Grab Time or Composite Stop Time	Number of Containers	Grab	Composite	Field Filtered (Dissolved Metals)	MATRIX: Ground Water / Surface Water	Waste Water / Storm Water	Drinking Water	Soil	Solids	Other	ANALYSIS / (PRESERVATIVE): Full TCLP							COMMENTS: Quote I.D.: PLEASE NOTE PRESERVATIVE(S) or PUMP RATE (L/min)
1) YS06-IDW01-0709	7-14	1435			10		X		X						10							
2) YS06-IDW02-0709	|	1440			2		X					X			2							
3) YS06-IDW03-0709	|	1530			10		X		X						10							
4) YS06-IDW04-0709	|	1530			2		X					X			2							
5)																						
6)																						
7)																						
8)																						On ice
9)																						
10)																						

RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME
[signature]	7/14/09 1700	A McJunney	7-15-09 11:25
RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME
RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME

QC Data Package: Level I ☐ Level II ☐ Level III ☐ Level IV ☐

LAB USE ONLY — COOLER TEMP 3.6 °C

09070236

PEI
Yorktown NWS

09070236
DUE: 10 Days
Recd: 07/15/09

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Certificate of Analysis

Final Report

Laboratory Order ID 09070236

Client Name:	Potomac Environmental, Inc. 2105 Lake Ave. Richmond, VA 23230	Date Received: Date Issued:	July 15, 2009 July 29, 2009
Submitted To:	Weegie Thompson	Project Number:	PN: 358315.FI.FS
Client Site I.D.:	Yorktown NWS CTO-166 Site 6/7	Purchase Order	NA

Ted Soyars

Laboratory Manager

End Notes:

The test results listed in this report relate only to the samples submitted to the laboratory and as received by the Laboratory.

Unless otherwise noted, the test results for solid materials are calculated on a dry weight basis. Analyses for pH, dissolved oxygen, temperature, residual chlorine and sulfite that are performed in the laboratory do not meet NELAC requirements due to extremely short holding times. These analyses should be performed in the field.

The signature on the final report certifies that these results conform to all applicable NELAC standards unless otherwise specified. For a complete list of the Laboratory's NELAC certified parameters please contact customer service.

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CH 166

CHAIN OF CUSTODY

PAGE 1 OF 1

CLIENT NAME: Blue Environmental Consultants	PROJECT NAME: CH 166 Site [illegible]
CLIENT CONTACT: [illegible] / Pat Murphy	SITE NAME: [illegible]
CLIENT ADDRESS: 2105 Lakeside Ave Richmond VA 23230	PROJECT NUMBER: [illegible]
CLIENT PHONE NUMBER: 804-288-[illegible] / 757-[illegible]	P.O. NUMBER:
CLIENT FAX NUMBER: / EMAIL:	REGULATORY AUTHORITY:
Is sample for compliance reporting? YES NO / Is sample from a chlorinated supply? YES (NO)	PWS I.D. #:
SAMPLER NAME (PRINT): Pat Murphy / SAMPLER SIGNATURE: [signature]	Turn Around Time: [illegible] Day(s)

Have ammonia and TKN samples been verified to be dechlorinated at the time of sampling?: YES NO

CLIENT SAMPLE I.D.	Composite Start Date	Composite Start Time	Grab Date or Composite Stop Date	Grab Time or Composite Stop Time	Number of Containers	Grab	Composite	Field Filtered (Dissolved Metals)	MATRIX: Ground Water / Surface Water	Waste Water / Storm Water	Drinking Water	Soil	Solids	Other	ANALYSIS / (PRESERVATIVE): Full TCL [illegible]	RIC (WT)						COMMENTS: Quote I.D.: PLEASE NOTE PRESERVATIVE(S) or PUMP RATE (L/min)
1) [illegible]		1135			10		X		X						10	✓						
2) [illegible]		1140			2		X					X			2	✓						
3) [illegible]		1520			12		X		X						12	✓						
4) [illegible]		1510			2		X					X			2	✓						
5)																						
6)																						
7)																						
8)																						
9)																						
10)																						

RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME
[signature]	[illegible]	A McJiney	7-15-09 11:25
RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME
RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME

QC Data Package: Level I ☐ Level II ☐ Level III ☐ Level IV ☐

LAB USE ONLY — COOLER TEMP 3.6°C

09070236

PEI
Yorktown NWS

09070236
DUE: 10 Days
Recd: 07/15/09

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PEI
Yorktown NWS
09070236

09070236
DUE: 10 Days
Recd: 07/15/09

Sample Conditions Che

Opened by: (print) A McGinley **Lab ID No.:**

(sign) A McGinley **Date Cooler Opened:** 7-15-09

		YES	NO	N/A
1.	How were samples received? Fed Ex ☑ UPS ☐ Courier ☐ Walk In ☐			
2.	Were custody seals used?	☑	☐	☐
3.	If yes, are custody seals unbroken and intact at the date and time of arrival?	☑	☐	☐
4.	Are the custody papers filled out completely and correctly?	☑	☐	☐
5.	Do all bottle labels agree with custody papers?	☑	☐	☐
6.	Are the samples received on ice?	☑	☐	☐
7.	Is the temperature blank or representative sample within acceptable limits? (4 degrees Celsius +/-2)	☑	☐	☐
8.	Are all samples within holding time for requested tests?	☑	☐	☐
9	Is a sufficient amount of sample provided to perform the tests indicated?	☑	☐	☐
10	Are all samples in proper containers for the analyses requested?	☑	☐	☐
11	Are all samples appropriately preserved for the analyses requested?	☑	☐	☐
12	Are all volatile organic containers free of headspace?	☑	☐	☐

COMMENTS

10 Day TAT per Waejie Thompson 7/15/09 GAN

ANALYTICS

Analytics Corporation
Administrative SOP for Sample Receiving and Log-in

Account Name: AWS Workorder Number: 9197009

Sample Container Receipt Form

Page ___ of ___

Client Sample ID	090702-36							
	001	002	003	004				
Analytics Sample ID	1	2	3	4				
Type of Container	250P	40z6	250P	40z6				
Number of Containers	1							
Temperature on Arrival	7.1							
pH on Arrival	6	—	6	—		—		
Chlorine on Arrival (ppm)								
VOA Sample Condition -								
General Condition	OK							
Preservation (as marked)	Cool							
Notes and comments								

P=Plastic; G=Glass, Am=Amber, VOA=VOA vial

Sample Custodian [signature] Date 7-16-09

JAMES ALTIERI

AIR WATER & SOIL LABORATORIES, INC.

Analytics

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RICHMOND, VIRGINIA 23230
(804) 358-8295 PHONE
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CHAIN OF CUSTODY

PAGE ____ OF ____

CLIENT NAME: AWS	PROJECT NAME:
CLIENT CONTACT:	SITE NAME:
CLIENT ADDRESS:	PROJECT NUMBER: 09070236
CLIENT PHONE NUMBER:	P.O. NUMBER:
CLIENT FAX NUMBER: / EMAIL:	REGULATORY AUTHORITY:
Is sample for compliance reporting? YES NO / Is sample from a chlorinated supply? YES NO	PWS I.D. #:
SAMPLER NAME (PRINT): / SAMPLER SIGNATURE:	Turn Around Time: STD Day(s)

Have ammonia and TKN samples been verified to be dechlorinated at the time of sampling?: YES NO

CLIENT SAMPLE I.D.	Composite Start Date	Composite Start Time	Grab Date or Composite Stop Date	Grab Time or Composite Stop Time	Number of Containers	Grab	Composite	Field Filtered (Dissolved Metals)	MATRIX: Ground Water / Surface Water	Waste Water / Storm Water	Drinking Water	Soil	Solids	Other ____	ANALYSIS / (PRESERVATIVE): Reactivity						COMMENTS: Quote I.D.: PLEASE NOTE PRESERVATIVE(S) or PUMP RATE (L/min)
1) 09070236-001			7/14/09	1435	1				X						X						
2) -002			↓	1440	1							X			X						
3) -003				1520	1				X						X						
4) -004			↓	1530	1							X			X						
5)																					
6)																					
7)																					
8)																					
9)																					
10)																					5

RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME	QC Data Package	LAB USE ONLY	COOLER TEMP
[signature]	7/15/09	[signature]	7-15-09 1620	Level I ☐		11 °C
RELINQUISHED:	DATE / TIME	RECEIVED: JAMES ACHEAN	DATE / TIME	Level II ☐		
RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME	Level III ☐		
				Level IV ☐		

HAZARDOUS WASTE ACCUMULATION AREA (HWAA) CHECKLIST

INSPECTOR:	DATE:	TIME:	AREA:
Pat Murphy	8/3/09	1030	Site 6 BLDG 109
CUSTODIAN:	PHONE No.:		CODE/UNIT:
Pat Murphy	757-567-1553		

All "NO" answers require the violation to be noted and corrected. Comment may include violation description, action, date action completed, and other pertinent details.

HWAA Compliance Questions	*Circle Answer*	*Comment*
1. Are good housekeeping standards employed?	(Yes) No	
2. Is the area free of any spills or container overfills (waste product on the container lid)?	(Yes) No	
3. Is a fire extinguisher located and available within 50 feet?	(Yes) No	
4. Is spill control equipment (examples: absorbents) available at the Site?	(Yes) No	
5. Are HW inspections conducted and properly documented every 7 days?	(Yes) No	
6. Are HW inspection records kept for 3 years or from the beginning, whichever shorter?	(Yes) No	
7. Has the HW manager received annual training? Date of last training 8/3/09	(Yes) No	
8. Are "HAZARDOUS WASTE ACCUMULATION AREA" sign and emergency contact information posted at the site?	(Yes) No	
9. Is "NO SMOKING" sign posted if ignitable or reactive wastes are stored?	(Yes) No	
If there is no hazardous waste currently stored at the site, answer N/A for the remainder of checklist.		
10. Are HW containers in good condition (non-leaking or non-corroded) and compatible with the waste stored in them?	(Yes) No N/A	
11. For hazardous waste containing volatile organics, are individual HW containers either (circle applicable items) a. less than 26 gallons? b. 26 or greater but less than 119 gallons; and DOT approved? c. Are air emissions documentation allowing non-DOT containers maintained with the inspection records?	Yes No (N/A)	
12. Are incompatible wastes separated by a wall, berm, or overpack to prevent mixing?	Yes No (N/A)	
13. Are HW containers kept sealed except when waste is being added or removed?	(Yes) No N/A	
14. HW labels a. on the containers? b. clearly visible and facing out for inspection? c. include the words, "HAZARDOUS WASTE?" d. include specific contents of the waste(s)? e. include the accumulation date? List date of oldest drum: 6/19/09	 (Yes) No N/A (Yes) No N/A (Yes) No N/A (Yes) No N/A (Yes) No N/A	Note: Aqueous IDW Accumulation started on 6/19/09. IDW Samples were ~~pulled~~ collected on 7/14/09. IDW was pending analysis until 8/3/09 when results were obtained.
15. Are old HW labels & markings removed?	(Yes) No N/A	
16. Are all HWs removed within 45 days?	(Yes) No N/A	
17. Are adequate aisle spaces maintained for incident response?	(Yes) No N/A	

HAZARDOUS WASTE ACCUMULATION AREA (HWAA) CHECKLIST

INSPECTOR: Pat Murphy	DATE: 8/10/09	TIME: 0950	AREA: Site 6 BLDG 109
CUSTODIAN: Pat Murphy	PHONE No.: 757-567-1553		CODE/UNIT:

All "NO" answers require the violation to be noted and corrected. Comment may include violation description, action, date action completed, and other pertinent details.

HWAA Compliance Questions	*Circle Answer*	*Comment*
1. Are good housekeeping standards employed?	(Yes) No	
2. Is the area free of any spills or container overfills (waste product on the container lid)?	(Yes) No	
3. Is a fire extinguisher located and available within 50 feet?	(Yes) No	
4. Is spill control equipment (examples: absorbents) available at the Site?	(Yes) No	
5. Are HW inspections conducted and properly documented every 7 days?	(Yes) No	
6. Are HW inspection records kept for 3 years or from the beginning, whichever shorter?	(Yes) No	
7. Has the HW manager received annual training? Date of last training 8/3/09	(Yes) No	
8. Are "HAZARDOUS WASTE ACCUMULATION AREA" sign and emergency contact information posted at the site?	(Yes) No	
9. Is "NO SMOKING" sign posted if ignitable or reactive wastes are stored?	(Yes) No	
If there is no hazardous waste currently stored at the site, answer N/A for the remainder of checklist.		
10. Are HW containers in good condition (non-leaking or non-corroded) and compatible with the waste stored in them?	(Yes) No N/A	
11. For hazardous waste containing volatile organics, are individual HW containers either (circle applicable items) a. less than 26 gallons? b. 26 or greater but less than 119 gallons; and DOT approved? c. Are air emissions documentation allowing non-DOT containers maintained with the inspection records?	Yes No (N/A)	
12. Are incompatible wastes separated by a wall, berm, or overpack to prevent mixing?	Yes No (N/A)	
13. Are HW containers kept sealed except when waste is being added or removed?	(Yes) No N/A	
14. HW labels a. on the containers? b. clearly visible and facing out for inspection? c. include the words, "HAZARDOUS WASTE?" d. include specific contents of the waste(s)? e. include the accumulation date? List date of oldest drum:_____	 (Yes) No N/A (Yes) No N/A (Yes) No N/A (Yes) No N/A (Yes) No N/A	Note: Aqueous IDW Accumulation started on 6/19/09. IDW Samples were collected on 7/14/09. IDW was pending analysis until 8/3/09 when results were obtained.
15. Are old HW labels & markings removed?	(Yes) No N/A	
16. Are all HWs removed within 45 days?	(Yes) No N/A	
17. Are adequate aisle spaces maintained for incident response?	(Yes) No N/A	

HAZARDOUS WASTE ACCUMULATION AREA (HWAA) CHECKLIST

INSPECTOR:	DATE:	TIME:	AREA:
Pat Murphy	8/17/09	0900	Site 6 BLDG 109
CUSTODIAN:	PHONE No.:		CODE/UNIT:
Pat Murphy	757-567-1553		

All "NO" answers require the violation to be noted and corrected. Comment may include violation description, action, date action completed, and other pertinent details.

HWAA Compliance Questions	*Circle Answer*	*Comment*
1. Are good housekeeping standards employed?	(Yes) No	
2. Is the area free of any spills or container overfills (waste product on the container lid)?	(Yes) No	
3. Is a fire extinguisher located and available within 50 feet?	(Yes) No	
4. Is spill control equipment (examples: absorbents) available at the Site?	(Yes) No	
5. Are HW inspections conducted and properly documented every 7 days?	(Yes) No	
6. Are HW inspection records kept for 3 years or from the beginning, whichever shorter?	(Yes) No	
7. Has the HW manager received annual training? Date of last training 8/3/09	(Yes) No	
8. Are "HAZARDOUS WASTE ACCUMULATION AREA" sign and emergency contact information posted at the site?	(Yes) No	
9. Is "NO SMOKING" sign posted if ignitable or reactive wastes are stored?	(Yes) No	
If there is no hazardous waste currently stored at the site, answer N/A for the remainder of checklist.		
10. Are HW containers in good condition (non-leaking or non-corroded) and compatible with the waste stored in them?	(Yes) No N/A	
11. For hazardous waste containing volatile organics, are individual HW containers either (circle applicable items) a. less than 26 gallons? b. 26 or greater but less than 119 gallons; and DOT approved? c. Are air emissions documentation allowing non-DOT containers maintained with the inspection records?	Yes No (N/A)	
12. Are incompatible wastes separated by a wall, berm, or overpack to prevent mixing?	Yes No (N/A)	
13. Are HW containers kept sealed except when waste is being added or removed?	(Yes) No N/A	
14. HW labels a. on the containers? b. clearly visible and facing out for inspection? c. include the words, "HAZARDOUS WASTE?" d. include specific contents of the waste(s)? e. include the accumulation date? List date of oldest drum:	 (Yes) No N/A (Yes) No N/A (Yes) No N/A (Yes) No N/A (Yes) No N/A	Note: Aqueous IDW Accumulation Started on 6/19/09. IDW Samples were collected on 7/14/09. IDW was pending analysis until 8/3/09 when results were obtained
15. Are old HW labels & markings removed?	(Yes) No N/A	
16. Are all HWs removed within 45 days?	(Yes) No N/A	
17. Are adequate aisle spaces maintained for incident response?	(Yes) No N/A	

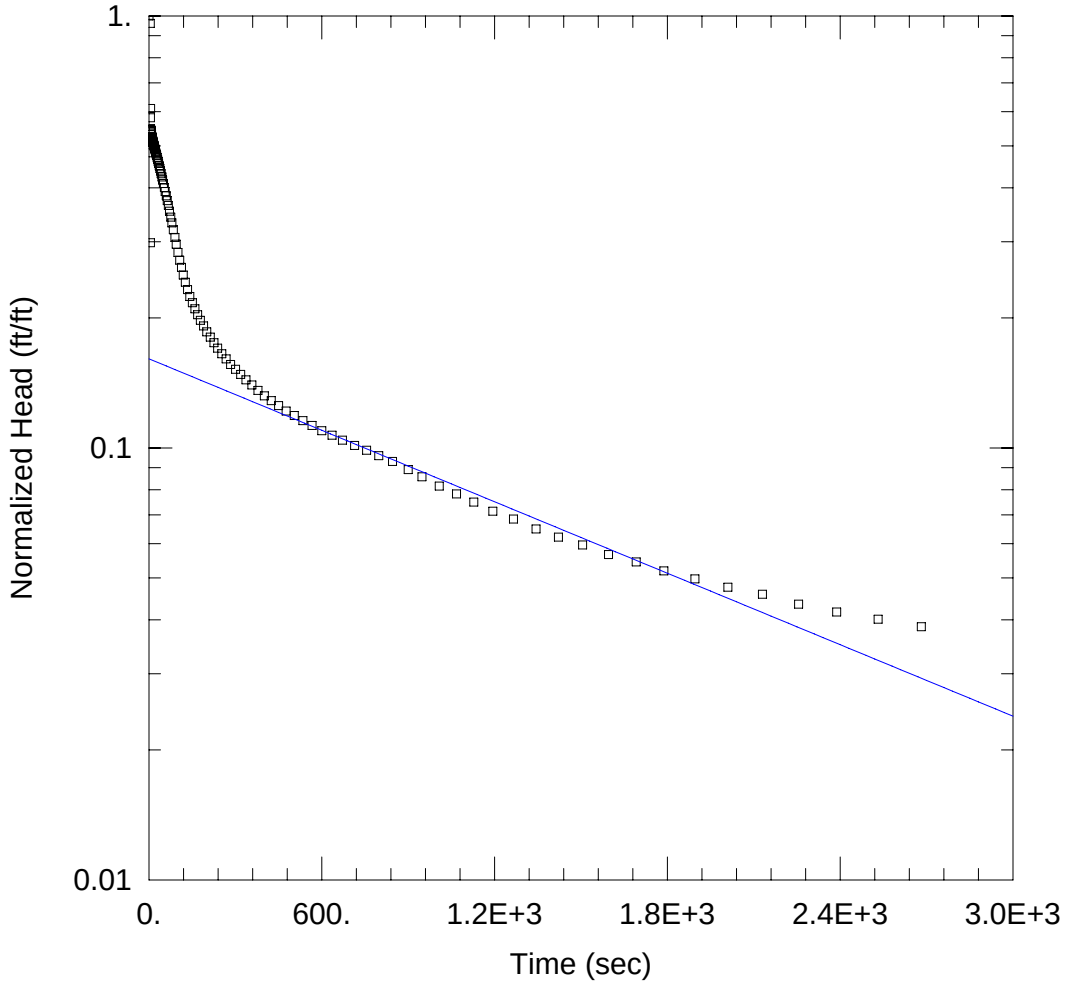
Appendix D
Slug Test Plots

Well Survey Results for Site 6

Site 6

Monitoring Well	Northing (Y)	Easting (X)	Concrete Surface (ft msl)	Ground Surface (ft msl)	Elevation Top of Casing (ft msl)
6GW11	3626945.81	12042063.24	28.64		32.16
6GW12	3626007.36	12042245.00	3.33		5.50
6GW12A	3626004.05	12042241.90	3.44		5.69
6GW13	3626124.70	12042087.99	2.10		4.53
6GW13A	3626127.90	12042085.05	1.94		4.85
6GW14	3626226.12	12041779.27		0.6	3.91
6GW15	3626189.40	12041820.59		0.9	4.17
6GW16	3626045.88	12041682.36	5.26		7.23
6GW17	3626264.97	12041621.92		0.8	3.95
6GW18	3626372.84	12040875.67	29.06		32.35

Shots taken on wells were marked with black marker on the top of the PVC



6GW06 RISING HEAD TEST 1

Data Set: C:\...\6GW06R1.aqt
Date: 09/16/09 Time: 10:47:08

PROJECT INFORMATION

Client: Navy CLEAN
Location: Yorktown
Test Date: 9/3/09

AQUIFER DATA

Saturated Thickness: 11. ft Anisotropy Ratio (Kz/Kr): 1.

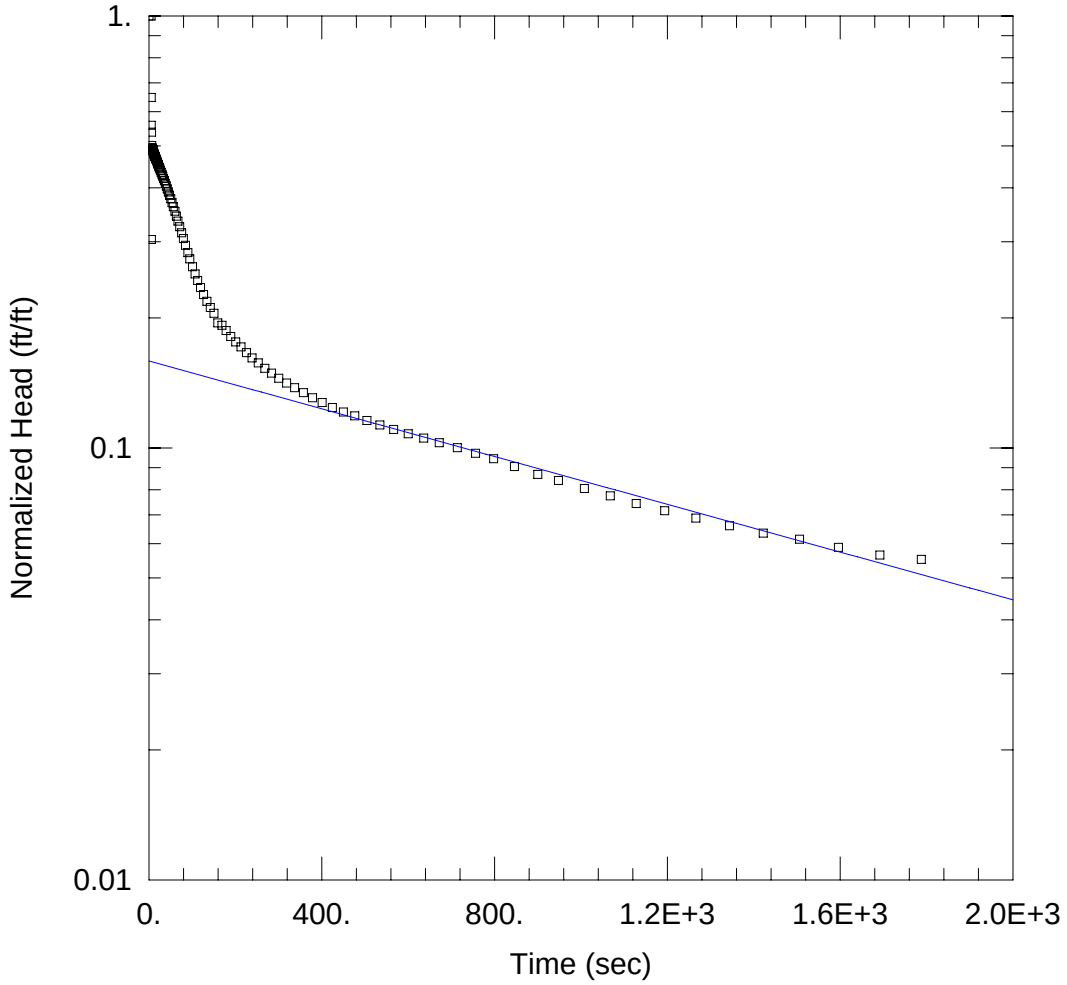
WELL DATA (6GW06)

Initial Displacement: 5.084 ft
Total Well Penetration Depth: 11. ft
Casing Radius: 0.086 ft
Static Water Column Height: 10.96 ft
Screen Length: 10. ft
Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.05336 ft/day
y0 = 0.8174 ft



6GW06 RISING HEAD TEST 2

Data Set: C:\...\6GW06R2.aqt
Date: 09/16/09 Time: 10:47:51

PROJECT INFORMATION

Client: Navy CLEAN
Location: Yorktown
Test Date: 9/3/09

AQUIFER DATA

Saturated Thickness: 11. ft
Anisotropy Ratio (Kz/Kr): 1.

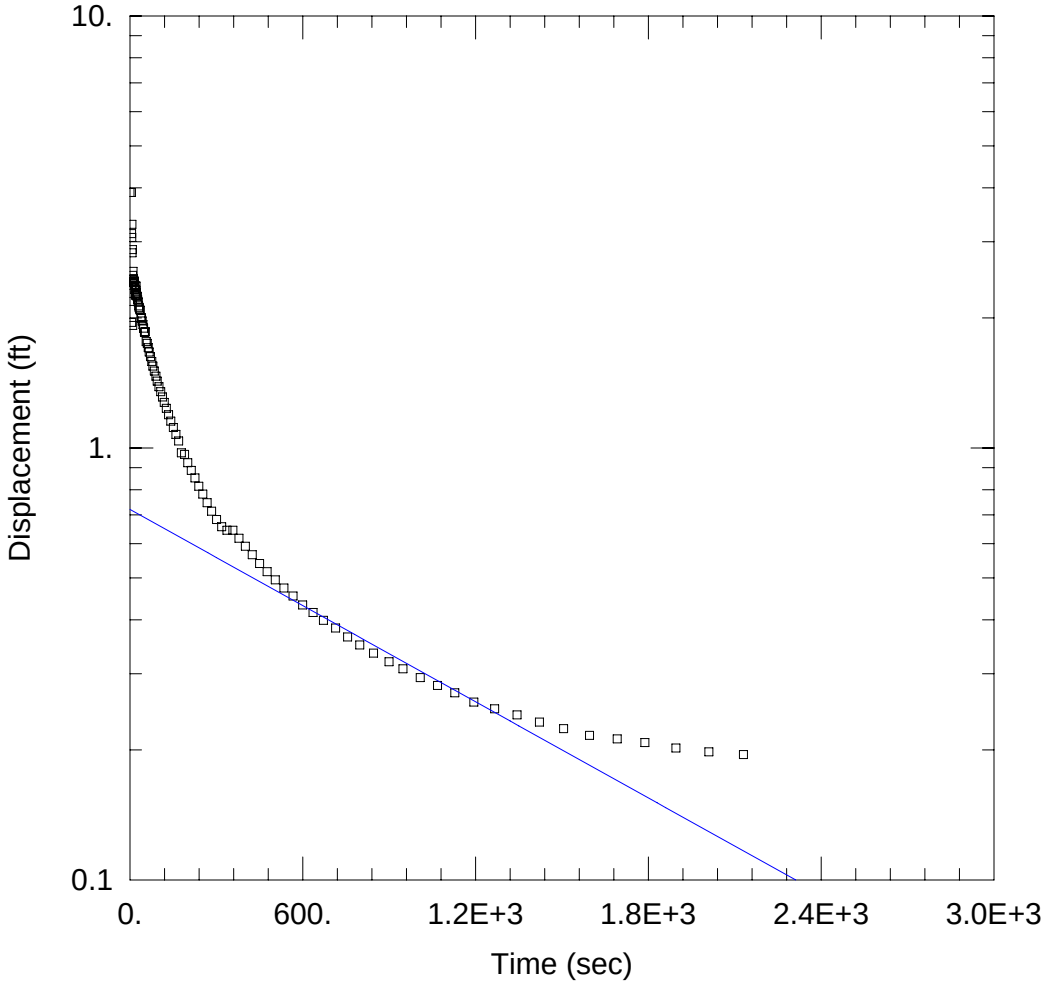
WELL DATA (6GW06)

Initial Displacement: 5.435 ft
Static Water Column Height: 10.96 ft
Total Well Penetration Depth: 11. ft
Screen Length: 10. ft
Casing Radius: 0.086 ft
Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0535 ft/day
y0 = 0.8637 ft



6GW06 FALLING HEAD TEST 1

Data Set: C:\...\6GW06F1.aqt
Date: 09/16/09 Time: 09:42:43

PROJECT INFORMATION

Client: Navy CLEAN
Location: Yorktown
Test Date: 9/3/09

AQUIFER DATA

Saturated Thickness: 20. ft Anisotropy Ratio (Kz/Kr): 1.

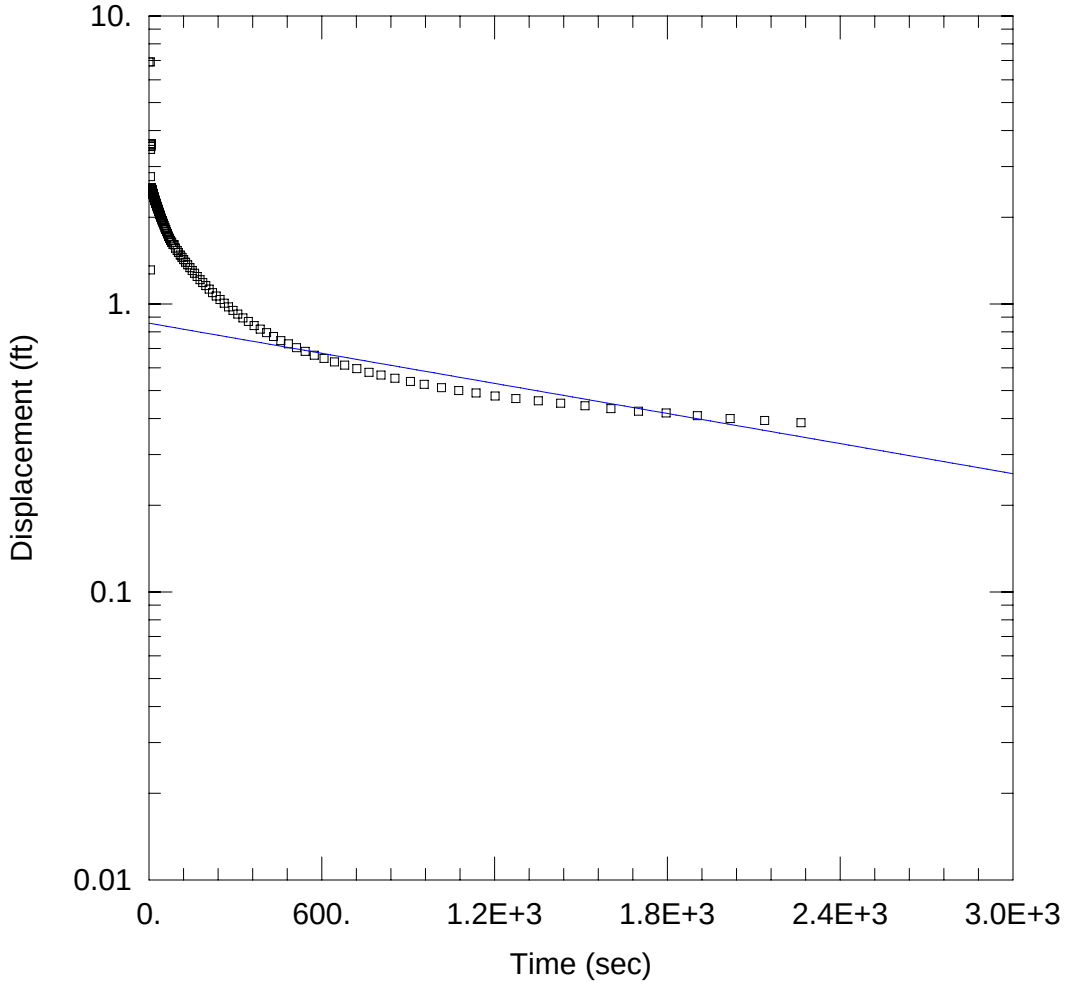
WELL DATA (6GW06)

Initial Displacement: 3.903 ft Static Water Column Height: 10.96 ft
Total Well Penetration Depth: 11. ft Screen Length: 10. ft
Casing Radius: 0.0861 ft Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.06225 ft/day y0 = 0.7205 ft



6GW06 FALLING HEAD TEST 2

Data Set: C:\...\6GW06F2.aqt
Date: 09/16/09 Time: 09:44:03

PROJECT INFORMATION

Client: Navy CLEAN
Location: Yorktown
Test Date: 9/3/09

AQUIFER DATA

Saturated Thickness: 11. ft Anisotropy Ratio (Kz/Kr): 1.

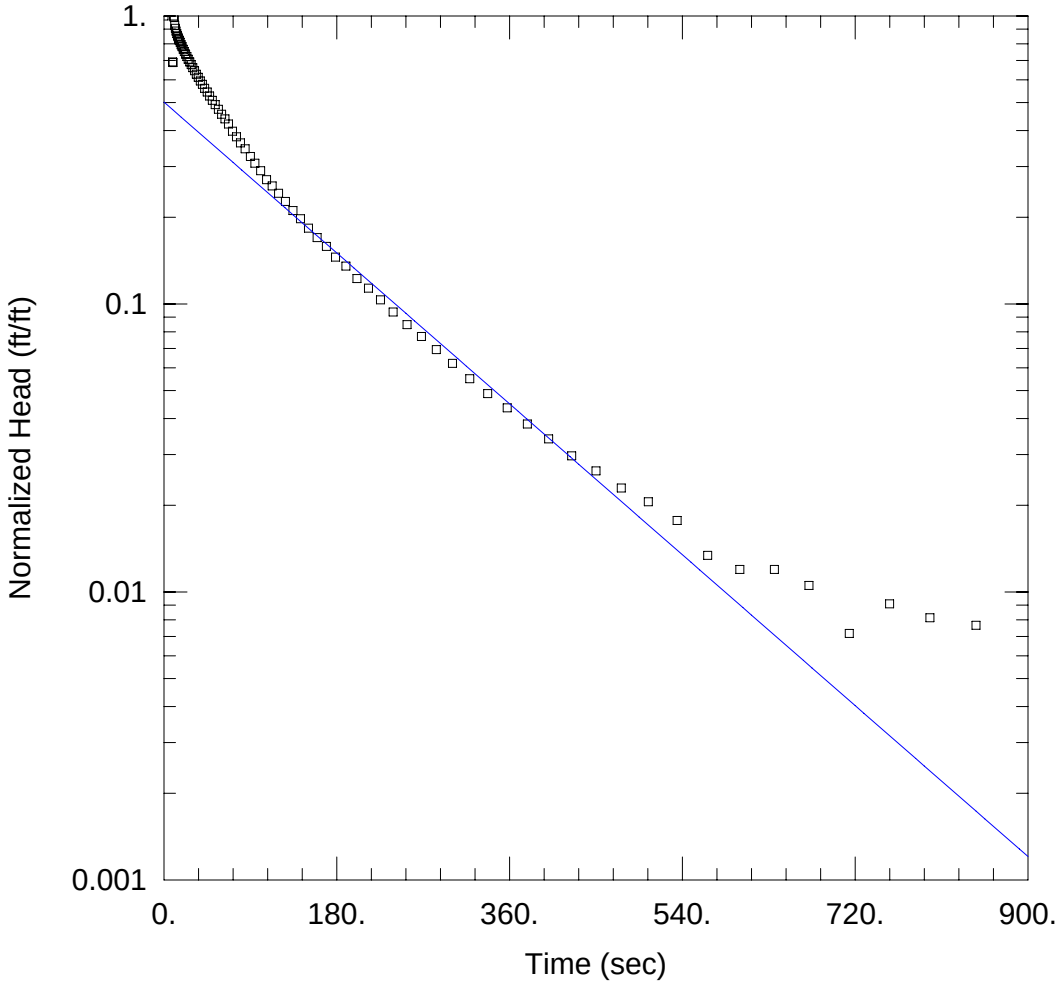
WELL DATA (6GW06)

Initial Displacement: 6.919 ft Static Water Column Height: 10.96 ft
Total Well Penetration Depth: 11. ft Screen Length: 10. ft
Casing Radius: 0.0861 ft Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.03379 ft/day y0 = 0.857 ft



6GW13 RISING HEAD TEST 1

Data Set: C:\...\6GW13R1.aqt
Date: 09/14/09 Time: 09:47:00

PROJECT INFORMATION

Client: Navy CLEAN
Location: Yorktown
Test Date: 9/3/09

AQUIFER DATA

Saturated Thickness: 32. ft Anisotropy Ratio (Kz/Kr): 1.

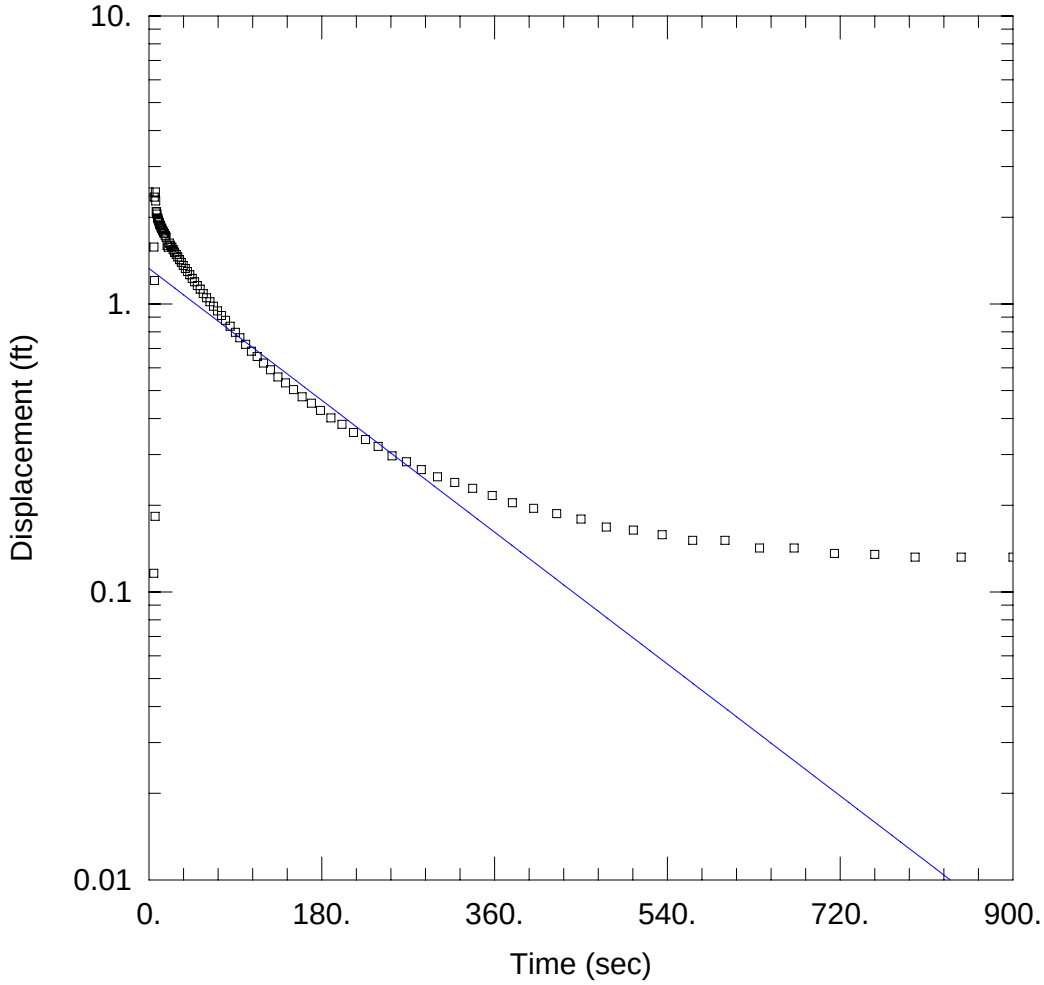
WELL DATA (6GW13)

Initial Displacement: 2.09 ft Static Water Column Height: 31.04 ft
Total Well Penetration Depth: 32. ft Screen Length: 20. ft
Casing Radius: 0.0861 ft Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.3691 ft/day y0 = 1.049 ft



6GW13 RISING HEAD TEST 2

Data Set: C:\...\6GW13R2.aqt
Date: 09/14/09 Time: 09:46:29

PROJECT INFORMATION

Client: Navy CLEAN
Location: Yorktown
Test Date: 9/3/09

AQUIFER DATA

Saturated Thickness: 32. ft Anisotropy Ratio (Kz/Kr): 1.

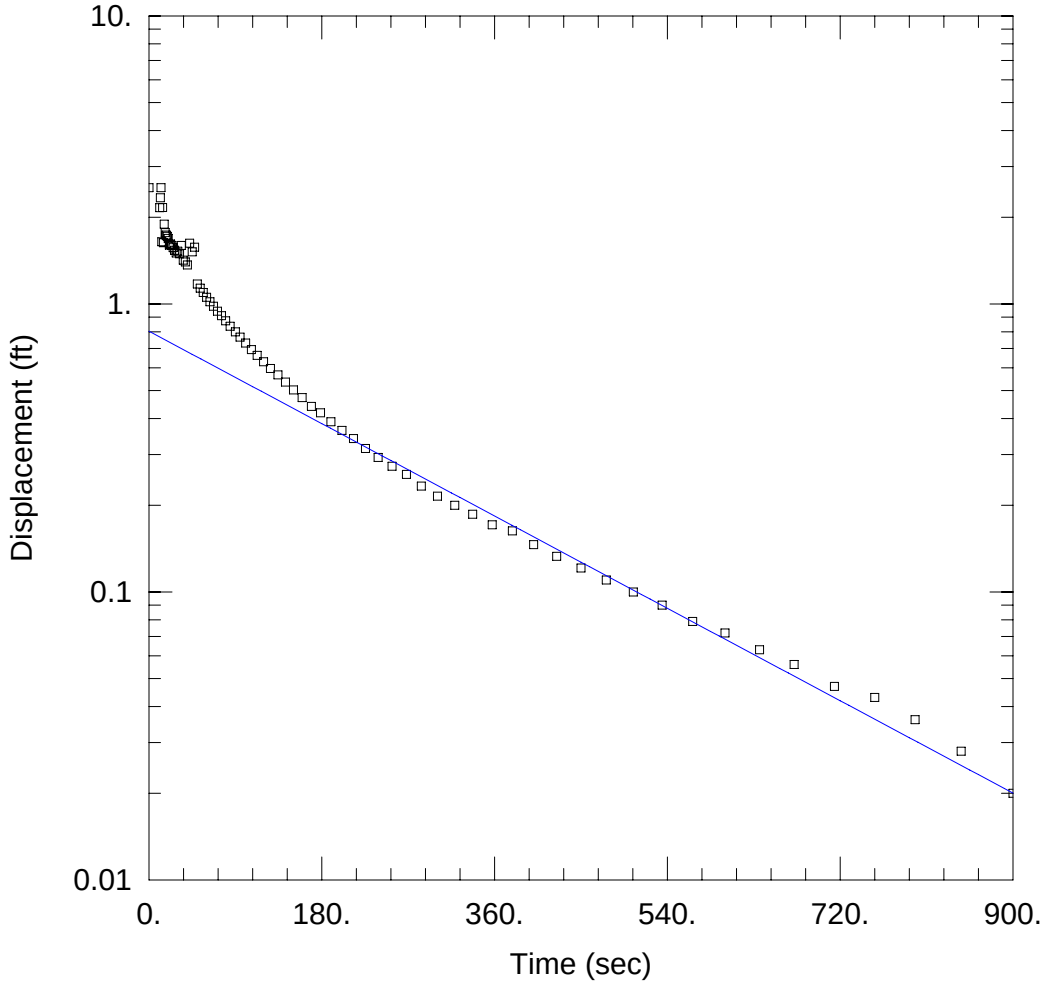
WELL DATA (6GW13)

Initial Displacement: 2.446 ft Static Water Column Height: 31.04 ft
Total Well Penetration Depth: 32. ft Screen Length: 20. ft
Casing Radius: 0.0681 ft Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.2018 ft/day y0 = 1.328 ft



6GW13 FALLING HEAD TEST 1

Data Set: C:\...\6GW13F1.aqt
Date: 09/14/09 Time: 09:46:17

PROJECT INFORMATION

Client: Navy CLEAN
Location: Yorktown
Test Date: 9/3/09

AQUIFER DATA

Saturated Thickness: 32. ft Anisotropy Ratio (Kz/Kr): 1.

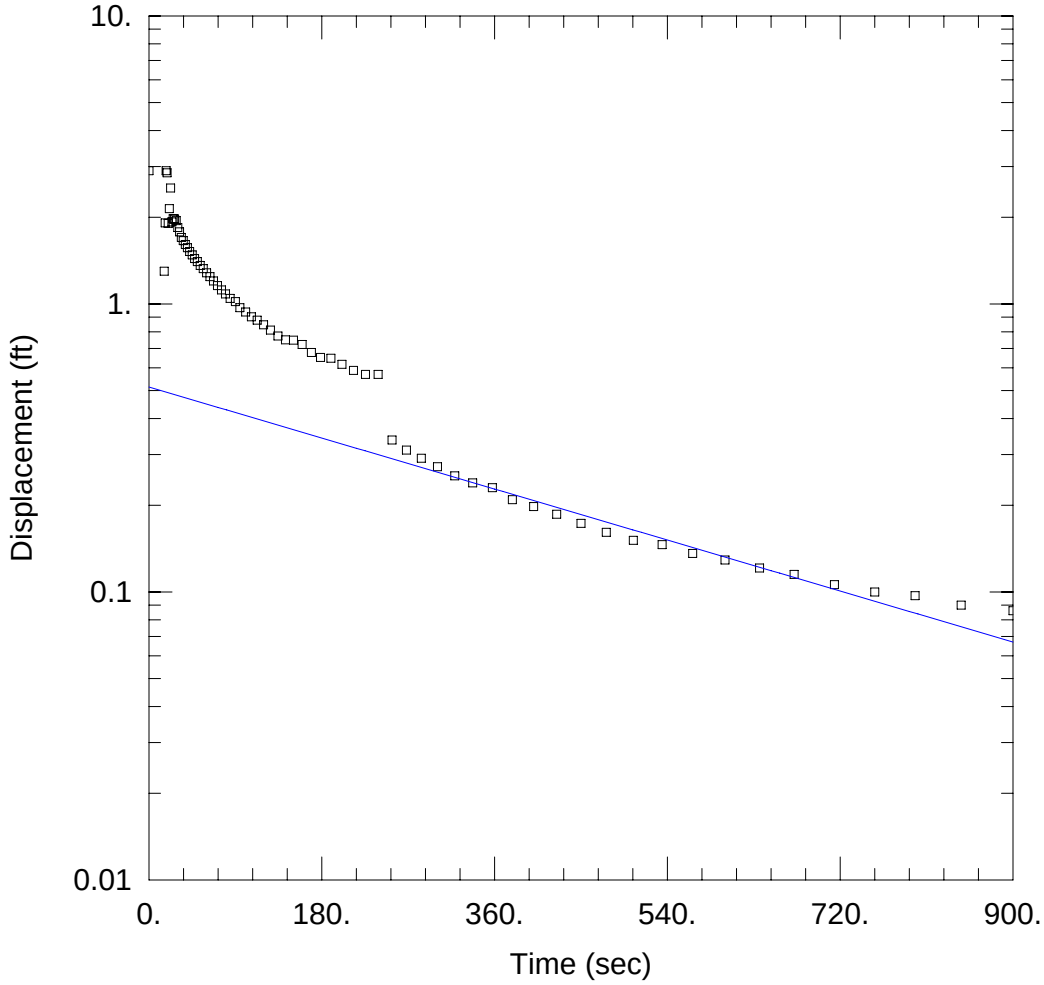
WELL DATA (6GW13)

Initial Displacement: 2.533 ft Static Water Column Height: 31.04 ft
Total Well Penetration Depth: 32. ft Screen Length: 20. ft
Casing Radius: 0.086 ft Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.2254 ft/day y0 = 0.8038 ft



6GW13 FALLING HEAD TEST 2

Data Set: C:\...\6GW13F2.aqt
Date: 09/14/09 Time: 09:46:04

PROJECT INFORMATION

Client: Navy CLEAN
Location: Yorktown
Test Date: 9/3/09

AQUIFER DATA

Saturated Thickness: 32. ft Anisotropy Ratio (Kz/Kr): 1.

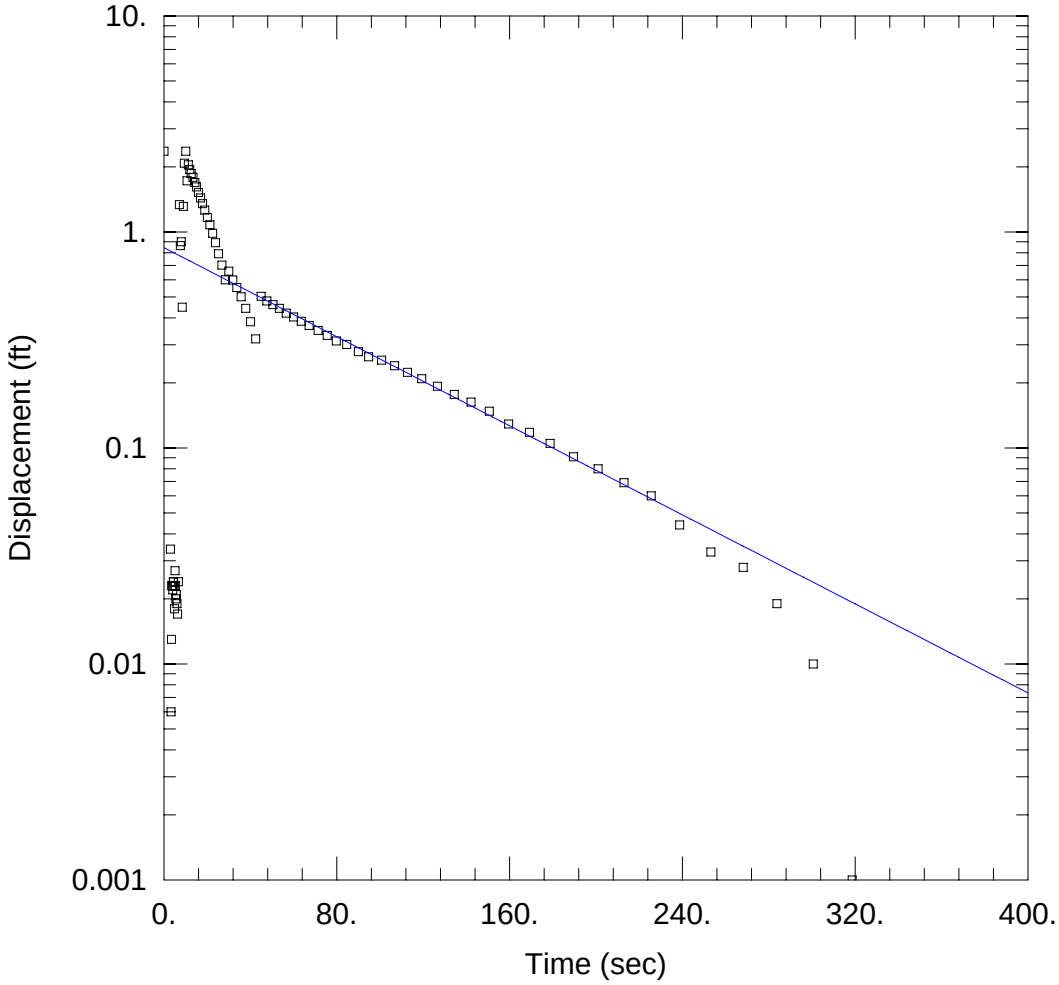
WELL DATA (6GW13)

Initial Displacement: 2.899 ft Static Water Column Height: 31.04 ft
Total Well Penetration Depth: 32. ft Screen Length: 20. ft
Casing Radius: 0.086 ft Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.1245 ft/day y0 = 0.5145 ft



6GW15 RISING HEAD TEST 1

Data Set: C:\...\6GW15R1.aqt
Date: 09/14/09 Time: 09:51:56

PROJECT INFORMATION

Client: Navy CLEAN
Location: Yorktown
Test Date: 9/3/09

AQUIFER DATA

Saturated Thickness: 61. ft Anisotropy Ratio (Kz/Kr): 1.

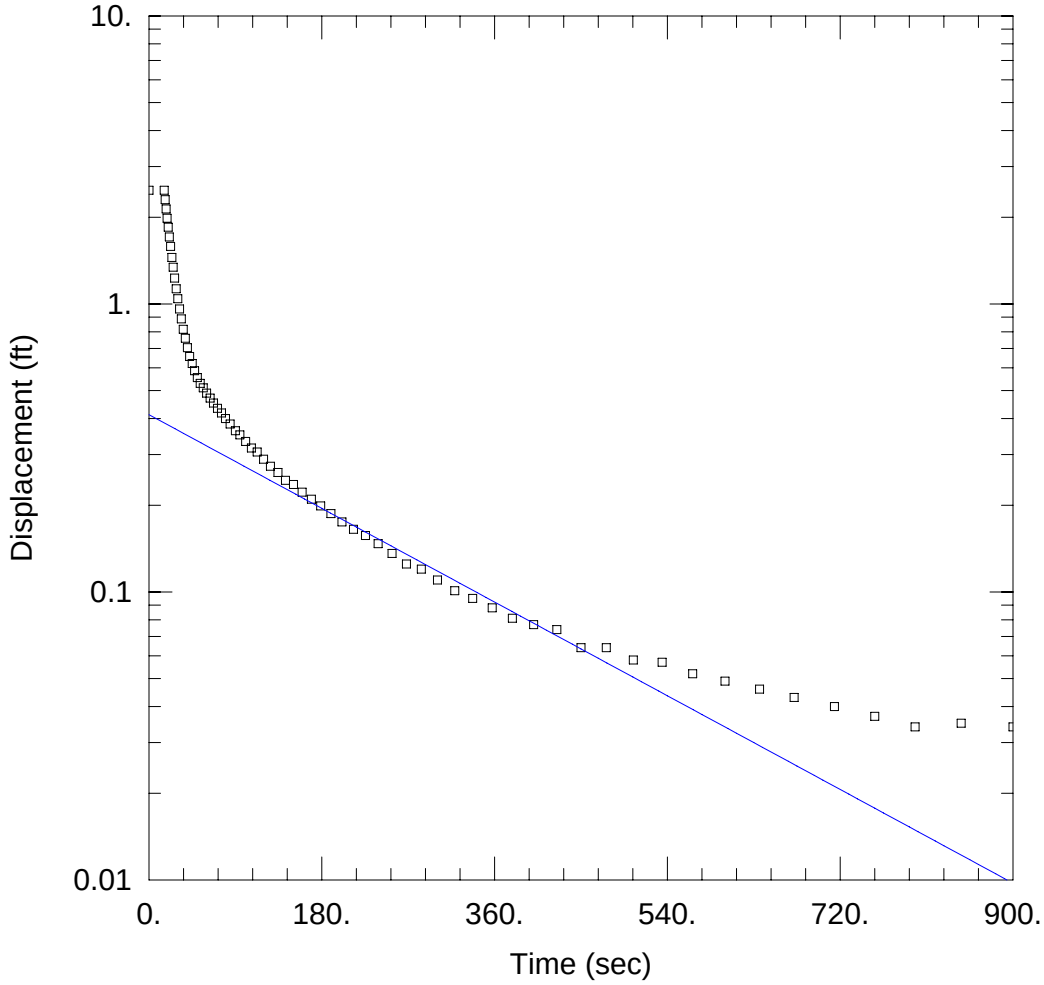
WELL DATA (6GW15)

Initial Displacement: 2.366 ft Static Water Column Height: 60.26 ft
Total Well Penetration Depth: 61. ft Screen Length: 20. ft
Casing Radius: 0.0861 ft Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.7283 ft/day y0 = 0.8454 ft



6GW15 RISING HEAD TEST 2

Data Set: C:\...\6GW15R2.aqt
Date: 09/14/09 Time: 09:52:13

PROJECT INFORMATION

Client: Navy CLEAN
Location: Yorktown
Test Date: 9-3-09

AQUIFER DATA

Saturated Thickness: 61. ft Anisotropy Ratio (Kz/Kr): 1.

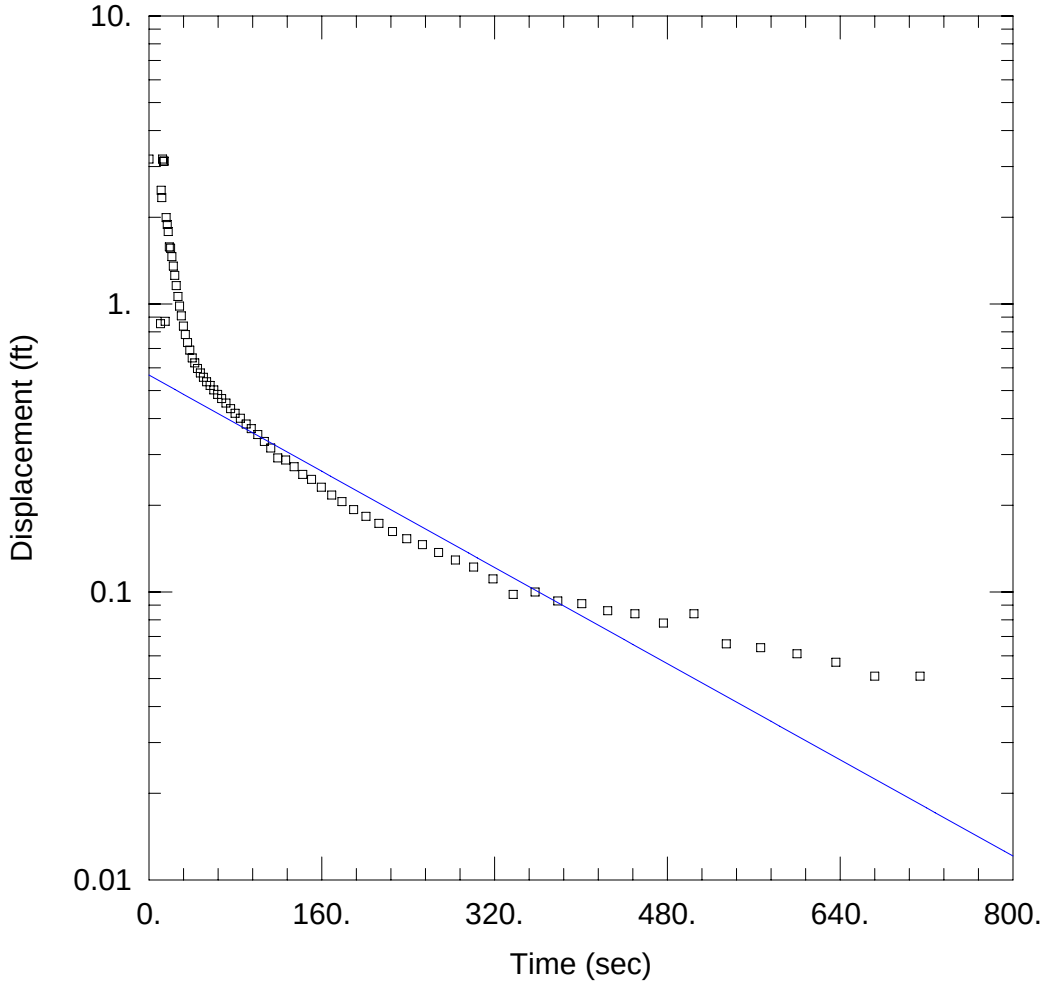
WELL DATA (6GW15)

Initial Displacement: 2.481 ft
Total Well Penetration Depth: 61. ft
Casing Radius: 0.0861 ft
Static Water Column Height: 60.26 ft
Screen Length: 20. ft
Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.2554 ft/day
y0 = 0.4126 ft



6GW15 FALLING HEAD TEST 1

Data Set: C:\...\6GW15F1.aqt
Date: 09/14/09 Time: 09:51:32

PROJECT INFORMATION

Client: Navy CLEAN
Location: Yorktown
Test Date: 9/3/09

AQUIFER DATA

Saturated Thickness: 61. ft Anisotropy Ratio (Kz/Kr): 1.

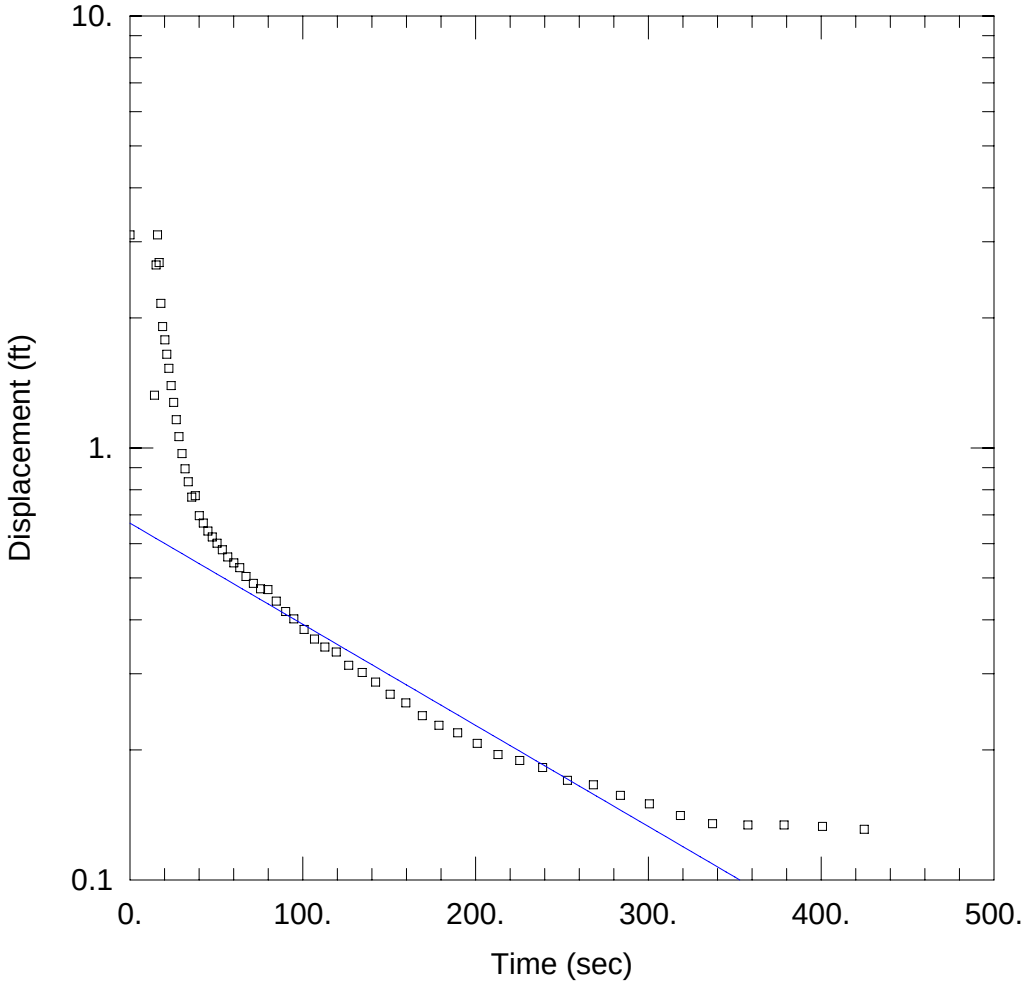
WELL DATA (6GW15)

Initial Displacement: 3.184 ft Static Water Column Height: 60.26 ft
Total Well Penetration Depth: 61. ft Screen Length: 20. ft
Casing Radius: 0.0861 ft Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.295 ft/day y0 = 0.5661 ft



6GW15 FALLING HEAD TEST 2

Data Set: C:\...\6GW15F2.aqt
Date: 09/14/09 Time: 09:51:45

PROJECT INFORMATION

Client: Navy CLEAN
Location: Yorktown
Test Date: 9/3/09

AQUIFER DATA

Saturated Thickness: 61. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (6GW15)

Initial Displacement: 3.114 ft Static Water Column Height: 60.26 ft
Total Well Penetration Depth: 61. ft Screen Length: 20. ft
Casing Radius: 0.0861 ft Wellbore Radius: 0.333 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.3307 ft/day y0 = 0.6696 ft

Appendix E
Laboratory Reports

Laboratory SOPs are proprietary and confidential.
They are provided upon request at the discretion of the Project Manager.

Appendix F
Human Health Risk Assessment Tables

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

Site 6, NWS Yorktown

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Groundwater	Groundwater	Yorktown-Eastover Aquifer - Tap Water	Resident	Adult	Dermal Absorption	On-site	Quant	Although unlikely, groundwater will be evaluated for use as a future potable water supply.
						Ingestion	On-site	Quant	Although unlikely, groundwater will be evaluated for use as a future potable water supply.
					Child	Dermal Absorption	On-site	Quant	Although unlikely, groundwater will be evaluated for use as a future potable water supply.
						Ingestion	On-site	Quant	Although unlikely, groundwater will be evaluated for use as a future potable water supply.
					Child/Adult	Dermal Absorption	On-site	Quant	Although unlikely, groundwater will be evaluated for use as a future potable water supply. Child/Adult evaluated for cancer risk only.
						Ingestion	On-site	Quant	Although unlikely, groundwater will be evaluated for use as a future potable water supply. Child/Adult evaluated for cancer risk only.
				Industrial Worker	Adult	Dermal Absorption	On-site	None	Industrial workers not expected to take a significant number of showers/baths at workplace.
						Ingestion	On-site	Quant	Although unlikely, groundwater will be evaluated for use as a future potable water supply.
			Yorktown-Eastover Aquifer - Excavation Pit	Construction Worker	Adult	Dermal Absorption	On-site	Quant	Construction worker may contact groundwater in an excavation during construction/excavation activities.
						Ingestion	On-site	None	Ingestion of groundwater during construction activities expected to be minimal.
		Air	Yorktown-Eastover Aquifer-Water Vapors at Showerhead	Resident	Adult	Inhalation	On-site	Quant	Although unlikely, groundwater will be evaluated for use as future potable water supply.
					Child	Inhalation	On-site	Quant	Although unlikely, groundwater will be evaluated for use as future potable water supply.
					Child/Adult	Inhalation	On-site	Quant	Although unlikely, groundwater will be evaluated for use as a future potable water supply. Child/Adult evaluated for cancer risk only.
				Industrial Worker	Adult	Inhalation	On-site	None	Industrial workers not expected to take a significant number of showers/baths at workplace.
			Yorktown-Eastover Aquifer-Volatilization from Water in Excavation Pit	Construction Worker	Adult	Inhalation	On-site	None	Construction worker may inhale vapors from groundwater in an open excavation during construction/excavation activities.
			Yorktown-Eastover Aquifer-Vapor Intrusion to Indoor Air	Resident	Adult	Inhalation	On-site	Quant	Future resident could inhale vapors migrating from groundwater in indoor air if future resident constructed on site.
					Child	Inhalation	On-site	Quant	Future resident could inhale vapors migrating from groundwater into indoor air if future resident constructed on site.
					Child/Adult	Inhalation	On-site	Quant	Future resident could inhale vapors migrating from groundwater into indoor air if future resident constructed on site. Child/Adult evaluated for cancer risk only.
				Industrial Worker	Adult	Inhalation	On-site	Quant	Future industrial workers could inhale vapors migrating from groundwater into indoor air if future industrial building constructed on site.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

Site 6, NWS Yorktown

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Surface Water	Surface Water	Felgates Creek	Trespasser/Visitor	Adult	Dermal Absorption	On-site	Quant	Trespassers/visitors could contact surface water in Felgates Creek downgradient of Site 6.
						Ingestion	On-site	Quant	Trespassers/visitors could contact surface water in Felgates Creek downgradient of Site 6.
					Adolescent	Dermal Absorption	On-site	Quant	Trespassers/visitors could contact surface water in Felgates Creek downgradient of Site 6.
						Ingestion	On-site	Quant	Trespassers/visitors could contact surface water in Felgates Creek downgradient of Site 6.
	Sediment	Sediment	Felgates Creek	Trespasser/Visitor	Adult	Dermal Absorption	On-site	Quant	Trespassers/visitors could contact sediment in Felgates Creek downgradient of Site 6.
						Ingestion	On-site	Quant	Trespassers/visitors could contact sediment in Felgates Creek downgradient of Site 6.
					Adolescent	Dermal Absorption	On-site	Quant	Trespassers/visitors could contact sediment in Felgates Creek downgradient of Site 6.
						Ingestion	On-site	Quant	Trespassers/visitors could contact sediment in Felgates Creek downgradient of Site 6.
Future	Surface Water	Surface Water	Felgates Creek	Construction Worker	Adult	Dermal Absorption	On-site	Quant	Construction workers could contact surface water in Felgates Creek downgradient of Site 6.
						Ingestion	On-site	Quant	Construction workers could contact surface water in FelgatesCreek downgradient of Site 6.
	Sediment	Sediment	Felgates Creek	Construction Worker	Adult	Dermal Absorption	On-site	Quant	Construction workers could contact sediment in Felgates Creek downgradient of Site 6.
						Ingestion	On-site	Quant	Construction workers could contact sediment in Felgates Creek downgradient of Site 6.

Quant: will be quantitatively evaluated.

Qual: will be qualitatively evaluated.

None: Not considered to be a complete pathway, therefore, not evaluated.

Table 2.1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Tap Water	71-55-6	1,1,1-Trichloroethane	2.9E-01 J	3.9E-01 J	UG/L	YS06-GW06-0309	2/25	0.5 - 8300	3.9E-01	ND	9.1E+02 N	2.0E+02	MCL	NO	BSL
	75-34-3	**1,1-Dichloroethane**	**8.2E-01**	**5.5E+00**	**UG/L**	**YS06-GW06-0309**	**4/25**	**0.5 - 8300**	**5.5E+00**	**ND**	**2.4E+00 C**	**N/A**		**YES**	**ASL**
	75-35-4	1,1-Dichloroethene	1.0E-01 J	9.2E+00	UG/L	YS06-GW08-0309	8/25	0.5 - 8300	9.2E+00	ND	3.4E+01 N	7.0E+00	MCL	NO	BSL
	120-82-1	1,2,4-Trichlorobenzene	1.5E-01 J	1.5E-01 J	UG/L	YS06-GW02-0309	1/25	0.5 - 8300	1.5E-01	ND	4.1E-01 C**	7.0E+01	MCL	NO	BSL
	107-06-2	**1,2-Dichloroethane**	**2.5E-01 J**	**2.5E-01 J**	**UG/L**	**YS06-GW08-0309**	**1/25**	**0.5 - 8300**	**2.5E-01**	**ND**	**1.5E-01 C**	**5.0E+00**	**MCL**	**YES**	**ASL**
	540-59-0	**1,2-Dichloroethene (total)**	**1.1E-01 J**	**7.7E+03 J**	**UG/L**	**YS06-GW13-0409**	**14/25**	**0.5 - 8300**	**7.7E+03**	**ND**	**3.3E+01 N**	**N/A**		**YES**	**ASL**
	78-93-3	2-Butanone	1.3E+00 L	8.6E+01 L	UG/L	YS06-GW15-0309	2/4	2.5 - 2.5	8.6E+01	ND	7.1E+02 N	N/A		NO	BSL
	591-78-6	2-Hexanone	1.4E+00 J	1.4E+00 J	UG/L	YS06-GW17-0709	1/25	2.5 - 42000	1.4E+00	ND	4.7E+00 N	N/A		NO	BSL
	71-43-2	**Benzene**	**1.6E+00 J**	**1.6E+00 J**	**UG/L**	**YS06-GW04-0309**	**1/25**	**0.5 - 8300**	**1.6E+00**	**ND**	**4.1E-01 C**	**5.0E+00**	**MCL**	**YES**	**ASL**
	75-15-0	Carbon disulfide	1.2E-01 J	6.3E-01	UG/L	YS06-GW12A-0409	6/25	0.5 - 8300	6.3E-01	ND	1.0E+02 N	N/A		NO	BSL
	75-00-3	Chloroethane	1.6E-01 J	1.6E-01 J	UG/L	YS06-GW01-0309	1/25	0.5 - 8300	1.6E-01	ND	2.1E+03 N	N/A		NO	BSL
	74-87-3	Chloromethane	2.1E-01 J	2.1E-01 J	UG/L	YS06-GW17-0709	1/25	0.5 - 8300	2.1E-01	ND	1.9E+01 N	N/A		NO	BSL
	156-59-2	**cis-1,2-Dichloroethene**	**1.1E-01 J**	**7.8E+03 J**	**UG/L**	**YS06-GW13-0409**	**14/25**	**0.5 - 8300**	**7.8E+03**	**ND**	**3.7E+01 N**	**7.0E+01**	**MCL**	**YES**	**ASL**
	100-41-4	Ethylbenzene	3.0E-01 J	3.0E-01 J	UG/L	YS06-GW09B-0409	1/25	0.5 - 8300	3.0E-01	ND	1.5E+00 C	7.0E+02	MCL	NO	BSL
	98-82-8	Isopropylbenzene	2.6E-01 J	2.6E-01 J	UG/L	YS06-GW04-0309	1/25	0.5 - 8300	2.6E-01	ND	6.8E+01 N	N/A		NO	BSL
	79-20-9	Methyl acetate	1.3E+00	1.3E+00	UG/L	YS06-GW17-0709	1/25	0.5 - 8300	1.3E+00	N/A	3.7E+03 N	N/A		NO	BSL
	108-87-2	Methylcyclohexane	3.8E-01 J	3.8E-01 J	UG/L	YS06-GW04-0309	1/25	0.5 - 8300	3.8E-01	ND	N/A	N/A		NO	NTX
	75-09-2	Methylene chloride	2.3E-01 J	2.3E-01 J	UG/L	YS06-GW08-0309	1/25	0.5 - 8300	2.3E-01	ND	4.8E+00 C	5.0E+00	MCL	NO	BSL
	1634-04-4	Methyl-tert-butyl ether (MTBE)	1.1E-01 J	1.1E-01 J	UG/L	YS06-GW17-0709	1/25	0.5 - 8300	1.1E-01	N/A	1.2E+01 C	N/A		NO	BSL
	95-47-6	o-Xylene	1.4E-01 J	1.4E-01 J	UG/L	YS06-GW04-0309	1/25	0.5 - 8300	1.4E-01	ND	1.2E+02 N	N/A		NO	BSL
	127-18-4	**Tetrachloroethene**	**3.0E+03 J**	**3.0E+03 J**	**UG/L**	**YS06-GW13-0409**	**1/25**	**0.5 - 8300**	**3.0E+03**	**ND**	**1.1E-01 C**	**5.0E+00**	**MCL**	**YES**	**ASL**
	156-60-5	**trans-1,2-Dichloroethene**	**1.3E+00 J**	**2.8E+01 J**	**UG/L**	**YS06-GW08-0309**	**5/25**	**0.5 - 8300**	**2.8E+01**	**ND**	**1.1E+01 N**	**1.0E+02**	**MCL**	**YES**	**ASL**
	79-01-6	**Trichloroethene**	**1.1E-01 J**	**2.8E+05**	**UG/L**	**YS06-GW13-0409**	**14/25**	**0.5 - 8300**	**2.8E+05**	**ND**	**2.0E+00 C**	**5.0E+00**	**MCL**	**YES**	**ASL**
	75-01-4	**Vinyl chloride**	**7.3E-01 J**	**7.3E+01 L**	**UG/L**	**YS06-GW13A-0409**	**6/25**	**0.5 - 8300**	**7.3E+01**	**ND**	**1.6E-02 C**	**2.0E+00**	**MCL**	**YES**	**ASL**
	1330-20-7	Xylene, total	1.4E-01 J	1.4E-01 J	UG/L	YS06-GW04-0309	1/25	0.5 - 8300	1.4E-01	ND	2.0E+01 N	1.0E+04	MCL	NO	BSL
	121-14-2	**2,4-Dinitrotoluene**	**4.0E+00 NJ**	**5.1E+01 K**	**UG/L**	**YS06-GW09-0309**	**5/25**	**0.38 - 1.2**	**5.1E+01**	**ND**	**2.2E-01 C**	**N/A**		**YES**	**ASL**
	98-95-3	**Nitrobenzene**	**2.8E-01 J**	**1.4E+00 K**	**UG/L**	**YS06-GW17-0709**	**3/25**	**0.38 - 1.2**	**1.4E+00**	**N/A**	**1.2E-01 C**	**N/A**		**YES**	**ASL**
	99-35-4	1,3,5-Trinitrobenzene	3.8E-01 J	8.9E+00	UG/L	YS06-GW10-0309	3/25	0.38 - 1.2	8.9E+00	ND	1.1E+02 N	N/A		NO	BSL
	99-65-0	**1,3-Dinitrobenzene**	**3.7E-01 J**	**1.8E+01 K**	**UG/L**	**YS06-GW09-0309**	**3/25**	**0.38 - 1.2**	**1.8E+01**	**ND**	**3.7E-01 N**	**N/A**		**YES**	**ASL**
	118-96-7	2,4,6-Trinitrotoluene	7.0E-02 J	1.3E+00	UG/L	YS06-GW10-0309	6/25	0.38 - 1.2	1.3E+00	ND	1.0E+00 C**	N/A		YES	ASL
	35572-78-2	**2-Amino-4,6-dinitrotoluene**	**1.8E-01 J**	**7.4E+03**	**UG/L**	**YS06-GW04-0309**	**7/25**	**0.38 - 1000**	**7.4E+03**	**ND**	**1.8E+00 N**	**N/A**		**YES**	**ASL**
	88-72-2	2-Nitrotoluene	5.2E-02 J	5.2E-02 J	UG/L	YS06-GW11-0309	1/25	0.38 - 1.2	5.2E-02	ND	3.1E-01 C	N/A		NO	BSL
	618-87-1	**3,5-Dinitroaniline**	**1.0E-01 J**	**7.8E-01 J**	**UG/L**	**YS06-GW09-0309**	**4/25**	**0.38 - 1.2**	**7.8E-01**	**N/A**	**3.7E-01 N**	**N/A**		**YES**	**ASL**
	99-08-1	**3-Nitrotoluene**	**2.7E+00**	**2.7E+00**	**UG/L**	**YS06-GW17-0709**	**1/25**	**0.38 - 1.2**	**2.7E+00**	**ND**	**3.7E-01 N**	**N/A**		**YES**	**ASL**
	19406-51-0	4-Amino-2,6-dinitrotoluene	1.7E-01 J	3.8E-01 J	UG/L	YS06-GW17-0709	2/25	0.38 - 1.2	3.8E-01	ND	7.3E+00 N	N/A		NO	BSL
	99-99-0	**4-Nitrotoluene**	**5.9E+00 K**	**5.9E+00 K**	**UG/L**	**YS06-GW16-0609**	**1/25**	**0.38 - 1.2**	**5.9E+00**	**N/A**	**4.2E+00 C***	**N/A**		**YES**	**ASL**
	2691-41-0	HMX	3.8E-01 J	8.3E+00	UG/L	YS06-GW05BP-0309	4/25	0.38 - 1.2	8.3E+00	N/A	1.8E+02 N	N/A		NO	BSL
	78-11-5	PETN	2.0E+00 J	2.0E+00 J	UG/L	YS06-GW13A-0409	1/25	2.8 - 6	2.0E+00	N/A	N/A	N/A		NO	NTX

Table 2.1

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	121-82-4	**RDX**	**8.1E-02 J**	**7.0E+01 K**	**UG/L**	**YS06-GW09-0309**	**9/25**	**0.38 - 1.2**	**7.0E+01**	**N/A**	**6.1E-01 C**	**N/A**		**YES**	**ASL**
	7429-90-5	Aluminum, Dissolved	1.3E+02 J	1.3E+03	UG/L	YS06-GW09B-0409	3/25	200 - 200	1.3E+03	1.5E+02 J	3.7E+03 N	50-200	SMCL	NO	BSL
	7440-36-0	**Antimony, Dissolved**	**9.8E+01**	**9.8E+01**	**UG/L**	**YS06-GW01A-0309**	**1/25**	**10 - 10**	**9.8E+01**	**1.9E+01 J**	**1.5E+00 N**	**6.0E+00**	**MCL**	**YES**	**ASL**
	7440-38-2	**Arsenic, Dissolved**	**2.3E+00 L**	**2.1E+01**	**UG/L**	**YS06-GW04-0309**	**23/25**	**10 - 10**	**2.1E+01**	**ND**	**4.5E-02 C**	**1.0E+01**	**MCL**	**YES**	**ASL**
	7440-39-3	Barium, Dissolved	2.0E+01 J	3.9E+02 L	UG/L	YS06-GW01A-0309	24/25	200 - 200	3.9E+02	3.1E+01 J	7.3E+02 N	2.0E+03	MCL	NO	BSL
	7440-41-7	**Beryllium, Dissolved**	**9.1E+00 L**	**9.1E+00 L**	**UG/L**	**YS06-GW01A-0309**	**1/25**	**5 - 5**	**9.1E+00**	**ND**	**7.3E+00 N**	**4.0E+00**	**MCL**	**YES**	**ASL**
	7440-43-9	**Cadmium, Dissolved**	**9.5E-01 J**	**8.5E+00**	**UG/L**	**YS06-GW01A-0309**	**3/25**	**5 - 5**	**8.5E+00**	**ND**	**1.8E+00 N**	**5.0E+00**	**MCL**	**YES**	**ASL**
	7440-70-2	Calcium, Dissolved	4.7E+04	2.2E+05	UG/L	YS06-GW09-0309	25/25	5000 - 5000	2.2E+05	7.0E+04	N/A	N/A		NO	NUT
	7440-47-3	**Chromium, Dissolved**	**6.6E-01 J**	**1.8E+01**	**UG/L**	**YS06-GW01A-0309**	**6/25**	**10 - 10**	**1.8E+01**	**ND**	**4.3E-02 C**	**1.0E+02**	**MCL**	**YES**	**ASL**
	7440-48-4	**Cobalt, Dissolved**	**8.9E-01 J**	**8.9E+01**	**UG/L**	**YS06-GW01A-0309**	**7/25**	**5 - 5**	**8.9E+01**	**ND**	**1.1E+00 N**	**N/A**		**YES**	**ASL**
	7440-50-8	Copper, Dissolved	4.6E+00 J	4.9E+01	UG/L	YS06-GW01A-0309	2/25	5 - 5	4.9E+01	4.0E+00 J	1.5E+02 N	1.3E+03	AL	NO	BSL
	7439-89-6	**Iron, Dissolved**	**1.1E+02**	**2.0E+04**	**UG/L**	**YS06-GW01-0309**	**19/25**	**100 - 100**	**2.0E+04**	**5.8E+00 J**	**2.6E+03 N**	**3.0E+02**	**SMCL**	**YES**	**ASL**
	7439-92-1	Lead, Dissolved	3.4E+00 L	5.5E+00 L	UG/L	YS06-GW01A-0309	2/25	3 - 3	5.5E+00	ND	N/A	1.5E+01	MCL	NO	NTX
	7439-95-4	Magnesium, Dissolved	1.2E+03 J	3.9E+05	UG/L	YS06-GW04-0309	25/25	5000 - 5000	3.9E+05	3.4E+03 J	N/A	N/A		NO	NUT
	7439-96-5	**Manganese, Dissolved**	**3.0E+00 J**	**5.5E+02**	**UG/L**	**YS06-GW01-0309**	**25/25**	**10 - 10**	**5.5E+02**	**1.2E+01 J**	**8.8E+01 N**	**5.0E+01**	**SMCL**	**YES**	**ASL**
	7439-97-6	Mercury, Dissolved	1.4E-01 J	1.8E-01 L	UG/L	YS06-GW06B-0309	2/25	0.2 - 0.2	1.8E-01	ND	1.1E+00 N	2.0E+00	MCL	NO	BSL
	7440-02-0	**Nickel, Dissolved**	**6.7E-01**	**7.5E+01**	**UG/L**	**YS06-GW01A-0309**	**9/25**	**40 - 40**	**7.5E+01**	**ND**	**7.3E+01 N**	**N/A**		**YES**	**ASL**
	7440-09-7	Potassium, Dissolved	6.1E+02 J	1.5E+05 J	UG/L	YS06-GW04-0309	25/25	5000 - 5000	1.5E+05	5.7E+03	N/A	N/A		NO	NUT
	7782-49-2	**Selenium, Dissolved**	**3.0E+00 L**	**2.8E+01**	**UG/L**	**YS06-GW04-0309**	**8/20**	**5 - 5**	**2.8E+01**	**3.9E+00 K**	**1.8E+01 N**	**5.0E+01**	**MCL**	**YES**	**ASL**
	7440-22-4	Silver, Dissolved	1.6E+01 L	1.6E+01 L	UG/L	YS06-GW01A-0309	1/25	5 - 5	1.6E+01	ND	1.8E+01 N	N/A		NO	BSL
	7440-23-5	Sodium, Dissolved	4.5E+03 J	3.1E+06 J	UG/L	YS06-GW04-0309	25/25	5000 - 50000	3.1E+06	8.6E+03	N/A	N/A		NO	NUT
	7440-28-0	Thallium, Dissolved	4.1E+00 L	2.2E+01 L	UG/L	YS06-GW01A-0309	2/25	10 - 10	2.2E+01	ND	N/A	2.0E+00	MCL	NO	NTX
	7440-62-2	**Vanadium, Dissolved**	**4.8E-01 J**	**9.1E+01 L**	**UG/L**	**YS06-GW01A-0309**	**6/25**	**20 - 20**	**9.1E+01**	**6.3E+00 J**	**1.8E+01 N**	**N/A**		**YES**	**ASL**
	7440-66-6	**Zinc, Dissolved**	**1.2E+00 J**	**5.3E+03**	**UG/L**	**YS06-GW04-0309**	**13/25**	**20 - 20**	**5.3E+03**	**5.9E+00 J**	**1.1E+03 N**	**5.0E+03**	**SMCL**	**YES**	**ASL**

[1] Following USEPA Region III guidance (*Guidance on the Selection of Analytical Metal Results from Monitoring Well Samples for Use in Quantitative Assessment* of Risk, USEPA, 1992), dissolved inorganic groundwater data used for tap water because an order of magnitude difference noted between dissolved and total results.

[2] Maximum concentration is used for screening.

[3] Background values are the maximum detected concentration from Yorktown Eastover aquifer Background dataset

[4] Oak Ridge National Laboratory (ORNL). Dec., 2009. Regional Screening Levels for Chemical Contaminants at Superfund Sites.
Tap Water RSLs (based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens). [Online]. Available: http://epa-prgs.ornl.gov/chemicals/index.shtml
RSL value for 1,3-dinitrobenzene used as a surrogate for 3,5-dinitroaniline.
RSL value for Manganese (water) used as surrogate for manganese.
RSL value for Mercury (inorganic salts) used as surrogate for mercury.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

COPC = Chemical of Potential Concern
J = Estimated Value
K = Biased High
L = Biased Low
UG/L = micrograms per liter
ND = not detected
N/A = not available, not applicable
MCL = Maximum Contaminant Level, Primary Drinking Water Standards
SMCL = Maximum Contaminant Level, Secondary Drinking Water Standards
AL = Action Level, Safe Drinking Water Act
C = Carcinogenic
C* = N screening level < 100x C screening level, therefore
N screening value/10 used as screening level
C** = N screening level < 10x C screening level, therefore
N screening value/10 used as screening level
N = Noncarcinogenic

Table 2.2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Water in Excavation Pit	71-55-6	1,1,1-Trichloroethane	2.9E-01 J	3.9E-01 J	UG/L	YS06-GW06-0309	2/25	0.5 - 8300	3.9E-01	ND	9.1E+02 N	2.0E+02	MCL	NO	BSL
	75-34-3	**1,1-Dichloroethane**	**8.2E-01**	**5.5E+00**	**UG/L**	**YS06-GW06-0309**	**4/25**	**0.5 - 8300**	**5.5E+00**	**ND**	**2.4E+00 C**	**N/A**		**YES**	**ASL**
	75-35-4	1,1-Dichloroethene	1.0E-01 J	9.2E+00	UG/L	YS06-GW08-0309	8/25	0.5 - 8300	9.2E+00	ND	3.4E+01 N	7.0E+00	MCL	NO	BSL
	120-82-1	1,2,4-Trichlorobenzene	1.5E-01 J	1.5E-01 J	UG/L	YS06-GW02-0309	1/25	0.5 - 8300	1.5E-01	ND	4.1E-01 C**	7.0E+01	MCL	NO	BSL
	107-06-2	**1,2-Dichloroethane**	**2.5E-01 J**	**2.5E-01 J**	**UG/L**	**YS06-GW08-0309**	**1/25**	**0.5 - 8300**	**2.5E-01**	**ND**	**1.5E-01 C**	**5.0E+00**	**MCL**	**YES**	**ASL**
	540-59-0	**1,2-Dichloroethene (total)**	**1.1E-01 J**	**7.7E+03 J**	**UG/L**	**YS06-GW13-0409**	**14/25**	**0.5 - 8300**	**7.7E+03**	**ND**	**3.3E+01 N**	**N/A**		**YES**	**ASL**
	78-93-3	2-Butanone	1.3E+00 L	8.6E+01 L	UG/L	YS06-GW15-0309	2/4	2.5 - 2.5	8.6E+01	ND	7.1E+02 N	N/A		NO	BSL
	591-78-6	2-Hexanone	1.4E+00 J	1.4E+00 J	UG/L	YS06-GW17-0709	1/25	2.5 - 42000	1.4E+00	ND	4.7E+00 N	N/A		NO	BSL
	71-43-2	**Benzene**	**1.6E+00 J**	**1.6E+00 J**	**UG/L**	**YS06-GW04-0309**	**1/25**	**0.5 - 8300**	**1.6E+00**	**ND**	**4.1E-01 C**	**5.0E+00**	**MCL**	**YES**	**ASL**
	75-15-0	Carbon disulfide	1.2E-01 J	6.3E-01	UG/L	YS06-GW12A-0409	6/25	0.5 - 8300	6.3E-01	ND	1.0E+02 N	N/A		NO	BSL
	75-00-3	Chloroethane	1.6E-01 J	1.6E-01 J	UG/L	YS06-GW01-0309	1/25	0.5 - 8300	1.6E-01	ND	2.1E+03 N	N/A		NO	BSL
	74-87-3	Chloromethane	2.1E-01 J	2.1E-01 J	UG/L	YS06-GW17-0709	1/25	0.5 - 8300	2.1E-01	ND	1.9E+01 N	N/A		NO	BSL
	156-59-2	**cis-1,2-Dichloroethene**	**1.1E-01 J**	**7.8E+03 J**	**UG/L**	**YS06-GW13-0409**	**14/25**	**0.5 - 8300**	**7.8E+03**	**ND**	**3.7E+01 N**	**7.0E+01**	**MCL**	**YES**	**ASL**
	100-41-4	Ethylbenzene	3.0E-01 J	3.0E-01 J	UG/L	YS06-GW09B-0409	1/25	0.5 - 8300	3.0E-01	ND	1.5E+00 C	7.0E+02	MCL	NO	BSL
	98-82-8	Isopropylbenzene	2.6E-01 J	2.6E-01 J	UG/L	YS06-GW04-0309	1/25	0.5 - 8300	2.6E-01	ND	6.8E+01 N	N/A		NO	BSL
	79-20-9	Methyl acetate	1.3E+00	1.3E+00	UG/L	YS06-GW17-0709	1/25	0.5 - 8300	1.3E+00	N/A	3.7E+03 N	N/A		NO	BSL
	108-87-2	Methylcyclohexane	3.8E-01 J	3.8E-01 J	UG/L	YS06-GW04-0309	1/25	0.5 - 8300	3.8E-01	ND	N/A	N/A		NO	NTX
	75-09-2	Methylene chloride	2.3E-01 J	2.3E-01 J	UG/L	YS06-GW08-0309	1/25	0.5 - 8300	2.3E-01	ND	4.8E+00 C	5.0E+00	MCL	NO	BSL
	1634-04-4	Methyl-tert-butyl ether (MTBE)	1.1E-01 J	1.1E-01 J	UG/L	YS06-GW17-0709	1/25	0.5 - 8300	1.1E-01	N/A	1.2E+01 C	N/A		NO	BSL
	95-47-6	o-Xylene	1.4E-01 J	1.4E-01 J	UG/L	YS06-GW04-0309	1/25	0.5 - 8300	1.4E-01	ND	1.2E+02 N	N/A		NO	BSL
	127-18-4	**Tetrachloroethene**	**3.0E+03 J**	**3.0E+03 J**	**UG/L**	**YS06-GW13-0409**	**1/25**	**0.5 - 8300**	**3.0E+03**	**ND**	**1.1E-01 C**	**5.0E+00**	**MCL**	**YES**	**ASL**
	156-60-5	**trans-1,2-Dichloroethene**	**1.3E+00 J**	**2.8E+01 J**	**UG/L**	**YS06-GW08-0309**	**5/25**	**0.5 - 8300**	**2.8E+01**	**ND**	**1.1E+01 N**	**1.0E+02**	**MCL**	**YES**	**ASL**
	79-01-6	**Trichloroethene**	**1.1E-01 J**	**2.8E+05**	**UG/L**	**YS06-GW13-0409**	**14/25**	**0.5 - 8300**	**2.8E+05**	**ND**	**2.0E+00 C**	**5.0E+00**	**MCL**	**YES**	**ASL**
	75-01-4	**Vinyl chloride**	**7.3E-01 J**	**7.3E+01 L**	**UG/L**	**YS06-GW13A-0409**	**6/25**	**0.5 - 8300**	**7.3E+01**	**ND**	**1.6E-02 C**	**2.0E+00**	**MCL**	**YES**	**ASL**
	1330-20-7	Xylene, total	1.4E-01 J	1.4E-01 J	UG/L	YS06-GW04-0309	1/25	0.5 - 8300	1.4E-01	ND	2.0E+01 N	1.0E+04	MCL	NO	BSL
	121-14-2	**2,4-Dinitrotoluene**	**4.0E+00 NJ**	**5.1E+01 K**	**UG/L**	**YS06-GW09-0309**	**5/25**	**0.38 - 1.2**	**5.1E+01**	**ND**	**2.2E-01 C**	**N/A**		**YES**	**ASL**
	98-95-3	**Nitrobenzene**	**2.8E-01 J**	**1.4E+00 K**	**UG/L**	**YS06-GW17-0709**	**3/25**	**0.38 - 1.2**	**1.4E+00**	**N/A**	**1.2E-01 C**	**N/A**		**YES**	**ASL**
	99-35-4	1,3,5-Trinitrobenzene	3.8E-01 J	8.9E+00	UG/L	YS06-GW10-0309	3/25	0.38 - 1.2	8.9E+00	ND	1.1E+02 N	N/A		NO	BSL
	99-65-0	**1,3-Dinitrobenzene**	**3.7E-01 J**	**1.8E+01 K**	**UG/L**	**YS06-GW09-0309**	**3/25**	**0.38 - 1.2**	**1.8E+01**	**ND**	**3.7E-01 N**	**N/A**		**YES**	**ASL**
	118-96-7	2,4,6-Trinitrotoluene	7.0E-02 J	1.3E+00	UG/L	YS06-GW10-0309	6/25	0.38 - 1.2	1.3E+00	ND	1.8E+00 C**	N/A		NO	BSL
	35572-78-2	**2-Amino-4,6-dinitrotoluene**	**1.8E-01 J**	**7.4E+03**	**UG/L**	**YS06-GW04-0309**	**7/25**	**0.38 - 1000**	**7.4E+03**	**ND**	**7.3E+00 N**	**N/A**		**YES**	**ASL**
	88-72-2	2-Nitrotoluene	5.2E-02 J	5.2E-02 J	UG/L	YS06-GW11-0309	1/25	0.38 - 1.2	5.2E-02	ND	3.1E-01 C	N/A		NO	BSL
	618-87-1	**3,5-Dinitroaniline**	**1.0E-01 J**	**7.8E-01 J**	**UG/L**	**YS06-GW09-0309**	**4/25**	**0.38 - 1.2**	**7.8E-01**	**N/A**	**3.7E-01 N**	**N/A**		**YES**	**ASL**
	99-08-1	**3-Nitrotoluene**	**2.7E+00**	**2.7E+00**	**UG/L**	**YS06-GW17-0709**	**1/25**	**0.38 - 1.2**	**2.7E+00**	**ND**	**3.7E-01 N**	**N/A**		**YES**	**ASL**
	19406-51-0	4-Amino-2,6-dinitrotoluene	1.7E-01 J	3.8E-01 J	UG/L	YS06-GW17-0709	2/25	0.38 - 1.2	3.8E-01	ND	7.3E+00 N	N/A		NO	BSL
	99-99-0	**4-Nitrotoluene**	**5.9E+00 K**	**5.9E+00 K**	**UG/L**	**YS06-GW16-0609**	**1/25**	**0.38 - 1.2**	**5.9E+00**	**N/A**	**4.2E+00 C***	**N/A**		**YES**	**ASL**
	2691-41-0	HMX	3.8E-01 J	8.3E+00	UG/L	YS06-GW05BP-0309	4/25	0.38 - 1.2	8.3E+00	N/A	1.8E+02 N	N/A		NO	BSL
	78-11-5	PETN	2.0E+00 J	2.0E+00 J	UG/L	YS06-GW13A-0409	1/25	2.8 - 6	2.0E+00	N/A	N/A	N/A		NO	NTX

Table 2.2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
	121-82-4	**RDX**	**8.1E-02 J**	**7.0E+01 K**	**UG/L**	**YS06-GW09-0309**	**9/25**	**0.38 - 1.2**	**7.0E+01**	**N/A**	**6.1E-01 C**	**N/A**		**YES**	**ASL**
	7429-90-5	**Aluminum**	**5.4E+01 J**	**6.8E+04**	**UG/L**	**YS06-GW09B-0409**	**22/25**	**200 - 200**	**6.8E+04**	**1.2E+03**	**3.7E+03 N**	**50-200**	**SMCL**	**YES**	**ASL**
	7440-36-0	**Antimony**	**1.9E+00 J**	**6.9E+00 J**	**UG/L**	**YS06-GW01-0309**	**8/25**	**10 - 10**	**6.9E+00**	**ND**	**1.5E+00 N**	**6.0E+00**	**MCL**	**YES**	**ASL**
	7440-38-2	**Arsenic**	**2.3E+00 J**	**3.7E+01**	**UG/L**	**YS06-GW09B-0409**	**10/25**	**10 - 10**	**3.7E+01**	**3.5E+00 J**	**4.5E-02 C**	**1.0E+01**	**MCL**	**YES**	**ASL**
	7440-39-3	Barium	2.4E+01 J	2.2E+02	UG/L	YS06-GW04-0309	25/25	200 - 200	2.2E+02	4.4E+01 J	7.3E+02 N	2.0E+03	MCL	NO	BSL
	7440-41-7	Beryllium	4.7E+00 J	4.7E+00 J	UG/L	YS06-GW09B-0409	1/25	5 - 5	4.7E+00	ND	7.3E+00 N	**4.0E+00**	**MCL**	NO	BSL
	7440-43-9	**Cadmium**	**2.5E+00 L**	**2.5E+00 L**	**UG/L**	**YS06-GW04-0309**	**1/25**	**5 - 5**	**2.5E+00**	**ND**	**1.8E+00 N**	**5.0E+00**	**MCL**	**YES**	**ASL**
	7440-70-2	Calcium	6.2E+04	2.5E+05	UG/L	YS06-GW09B-0409	25/25	5000 - 5000	2.5E+05	6.7E+04	N/A	N/A		NO	NUT
	7440-47-3	**Chromium**	**1.2E+00 J**	**3.5E+02**	**UG/L**	**YS06-GW09B-0409**	**11/25**	**10 - 10**	**3.5E+02**	**4.7E+00 L**	**4.3E-02 C**	**1.0E+02**	**MCL**	**YES**	**ASL**
	7440-48-4	**Cobalt**	**1.1E+00 J**	**3.0E+01**	**UG/L**	**YS06-GW09B-0409**	**7/25**	**5 - 5**	**3.0E+01**	**ND**	**1.1E+00 N**	**N/A**		**YES**	**ASL**
	7440-50-8	Copper	8.8E-01 J	5.4E+01	UG/L	YS06-GW09B-0409	8/25	5 - 5	5.4E+01	4.5E+00 J	1.5E+02 N	1.3E+03	AL	NO	BSL
	7439-89-6	**Iron**	**3.0E+02**	**1.4E+05**	**UG/L**	**YS06-GW09B-0409**	**25/25**	**100 - 100**	**1.4E+05**	**2.4E+03**	**2.6E+03 N**	**3.0E+02**	**SMCL**	**YES**	**ASL**
	7439-92-1	Lead[6]	2.1E+00 J	8.0E+01	UG/L	YS06-GW17-0709	12/25	3 - 3	8.0E+01	ND	N/A	1.5E+01	MCL	NO	NTX
	7439-95-4	Magnesium	1.0E+03 J	3.9E+05	UG/L	YS06-GW04-0309	25/25	5000 - 5000	3.9E+05	3.4E+03 J	N/A	N/A		NO	NUT
	7439-96-5	**Manganese**	**1.3E+01**	**5.8E+02**	**UG/L**	**YS06-GW01-0309**	**25/25**	**10 - 10**	**5.8E+02**	**1.8E+01**	**8.8E+01 N**	**5.0E+01**	**SMCL**	**YES**	**ASL**
	7440-02-0	**Nickel**	**8.2E-01 J**	**1.3E+02**	**UG/L**	**YS06-GW13-0409**	**17/25**	**40 - 40**	**1.3E+02**	**ND**	**7.3E+01 N**	**N/A**		**YES**	**ASL**
	7440-09-7	Potassium	1.2E+03 J	1.5E+05 J	UG/L	YS06-GW04-0309	25/25	5000 - 5000	1.5E+05	5.5E+03	N/A	N/A		NO	NUT
	7782-49-2	Selenium	3.4E+00 J	3.4E+00 J	UG/L	YS06-GW12-0409	1/25	5 - 5	3.4E+00	2.9E+00 J	1.8E+01 N	**5.0E+01**	**MCL**	NO	BSL
	7440-23-5	Sodium	4.9E+03 J	3.1E+06	UG/L	YS06-GW04-0309	25/25	5000 - 50000	3.1E+06	8.3E+03	N/A	N/A		NO	NUT
	7440-62-2	**Vanadium**	**7.0E-01 J**	**2.0E+02**	**UG/L**	**YS06-GW09B-0409**	**18/25**	**20 - 20**	**2.0E+02**	**7.5E+00 J**	**1.8E+01 N**	**N/A**		**YES**	**ASL**
	7440-66-6	**Zinc**	**5.5E+00 J**	**3.9E+04**	**UG/L**	**YS06-GW17-0709**	**17/25**	**20 - 100**	**3.9E+04**	**1.5E+01 J**	**1.1E+03 N**	**5.0E+03**	**MCL**	**YES**	**ASL**

[1] Total inorganic groundwater data used for water in excavation pit because construction worker would be exposed directly to the water in the excavation pit.

[2] Maximum concentration is used for screening.

[3] Background values are the maximum detected concentration from Yorktown Eastover aquifer Background dataset

[4] Oak Ridge National Laboratory (ORNL). Dec. 2009. Regional Screening Levels for Chemical Contaminants at Superfund Sites.
Tap Water RSLs (based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens). [Online]. Available: http://epa-prgs.ornl.gov/chemicals/index.shtml
RSL value for Manganese (water) used as surrogate for manganese.
RSL value for Mercury (inorganic salts) used as surrogate for mercury.

[5] Rationale Codes

Selection Reason:	Above Screening Levels (ASL)
Deletion Reason:	No Toxicity Information (NTX)
	Essential Nutrient (NUT)
	Below Screening Level (BSL)

[6] Although the maximum deteced lead concentraiton exceeds the action level for lead, lead was not identified as a COPC for groundwater in an excavation pit, as the construction worker receptor would be exposed to this water through dermal contact and inhalation, and the action level for lead is based on ingestion of the lead in water, which is much more conserative than dermal contact with lead.

COPC = Chemical of Potential Concern
J = Estimated Value
K = Biased High
L = Biased Low
UG/L = micrograms per liter
ND = not detected
N/A = not available, not applicable
MCL = Maximum Contaminant Level, Primary Drinking Water Standards
SMCL = Maximum Contaminant Level, Secondary Drinking Water Standards
AL = Action Level, Safe Drinking Water Act
C = Carcinogenic
C* = N screening level < 100x C screening level, therefore
N screening value/10 used as screening level
C** = N screening level < 10x C screening level, therefore
N screening value/10 used as screening level
N = Noncarcinogenic

Table 2.3

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Water Vapors at Showerhead and in Excavation Pit	71-55-6	1,1,1-Trichloroethane	2.9E-01 J	3.9E-01 J	UG/L	YS06-GW06-0309	2/25	0.5 - 8300	3.9E-01	ND	9.1E+02 N	2.0E+02	MCL	NO	BSL
	75-34-3	**1,1-Dichloroethane**	**8.2E-01**	**5.5E+00**	**UG/L**	**YS06-GW06-0309**	**4/25**	**0.5 - 8300**	**5.5E+00**	**ND**	**2.4E+00 C**	**N/A**		**YES**	**ASL**
	75-35-4	1,1-Dichloroethene	1.0E-01 J	9.2E+00	UG/L	YS06-GW08-0309	8/25	0.5 - 8300	9.2E+00	ND	3.4E+01 N	7.0E+00	MCL	NO	BSL
	120-82-1	1,2,4-Trichlorobenzene	1.5E-01 J	1.5E-01 J	UG/L	YS06-GW02-0309	1/25	0.5 - 8300	1.5E-01	ND	2.1E+00 C**	7.0E+01	MCL	NO	BSL
	107-06-2	**1,2-Dichloroethane**	**2.5E-01 J**	**2.5E-01 J**	**UG/L**	**YS06-GW08-0309**	**1/25**	**0.5 - 8300**	**2.5E-01**	**ND**	**1.5E-01 C**	**5.0E+00**	**MCL**	**YES**	**ASL**
	540-59-0	**1,2-Dichloroethene (total)**	**1.1E-01 J**	**7.7E+03 J**	**UG/L**	**YS06-GW13-0409**	**14/25**	**0.5 - 8300**	**7.7E+03**	**ND**	**3.3E+01 N**	**N/A**		**YES**	**ASL**
	78-93-3	2-Butanone	1.3E+00 L	8.6E+01 L	UG/L	YS06-GW15-0309	2/4	2.5 - 2.5	8.6E+01	ND	7.1E+02 N	N/A		NO	BSL
	591-78-6	2-Hexanone	1.4E+00 J	1.4E+00 J	UG/L	YS06-GW17-0709	1/25	2.5 - 42000	1.4E+00	ND	4.7E+00 N	N/A		NO	BSL
	71-43-2	**Benzene**	**1.6E+00 J**	**1.6E+00 J**	**UG/L**	**YS06-GW04-0309**	**1/25**	**0.5 - 8300**	**1.6E+00**	**ND**	**4.1E-01 C**	**5.0E+00**	**MCL**	**YES**	**ASL**
	75-15-0	Carbon disulfide	1.2E-01 J	6.3E-01	UG/L	YS06-GW12A-0409	6/25	0.5 - 8300	6.3E-01	ND	1.0E+02 N	N/A		NO	BSL
	75-00-3	Chloroethane	1.6E-01 J	1.6E-01 J	UG/L	YS06-GW01-0309	1/25	0.5 - 8300	1.6E-01	ND	2.1E+03 N	N/A		NO	BSL
	74-87-3	Chloromethane	2.1E-01 J	2.1E-01 J	UG/L	YS06-GW17-0709	1/25	0.5 - 8300	2.1E-01	ND	1.9E+01 N	N/A		NO	BSL
	156-59-2	**cis-1,2-Dichloroethene**	**1.1E-01 J**	**7.8E+03 J**	**UG/L**	**YS06-GW13-0409**	**14/25**	**0.5 - 8300**	**7.8E+03**	**ND**	**3.7E+01 N**	**7.0E+01**	**MCL**	**YES**	**ASL**
	100-41-4	Ethylbenzene	3.0E-01 J	3.0E-01 J	UG/L	YS06-GW09B-0409	1/25	0.5 - 8300	3.0E-01	ND	1.5E+00 C	7.0E+02	MCL	NO	BSL
	98-82-8	Isopropylbenzene	2.6E-01 J	2.6E-01 J	UG/L	YS06-GW04-0309	1/25	0.5 - 8300	2.6E-01	ND	6.8E+01 N	N/A		NO	BSL
	79-20-9	Methyl acetate	1.3E+00	1.3E+00	UG/L	YS06-GW17-0709	1/25	0.5 - 8300	1.3E+00	N/A	3.7E+03 N	N/A		NO	BSL
	108-87-2	Methylcyclohexane	3.8E-01 J	3.8E-01 J	UG/L	YS06-GW04-0309	1/25	0.5 - 8300	3.8E-01	ND	N/A	N/A		NO	NTX
	75-09-2	Methylene chloride	2.3E-01 J	2.3E-01 J	UG/L	YS06-GW08-0309	1/25	0.5 - 8300	2.3E-01	ND	4.8E+00 C	5.0E+00	MCL	NO	BSL
	1634-04-4	Methyl-tert-butyl ether (MTBE)	1.1E-01 J	1.1E-01 J	UG/L	YS06-GW17-0709	1/25	0.5 - 8300	1.1E-01	N/A	1.2E+01 C	N/A		NO	BSL
	95-47-6	o-Xylene	1.4E-01 J	1.4E-01 J	UG/L	YS06-GW04-0309	1/25	0.5 - 8300	1.4E-01	ND	1.2E+02 N	N/A		NO	BSL
	127-18-4	**Tetrachloroethene**	**3.0E+03 J**	**3.0E+03 J**	**UG/L**	**YS06-GW13-0409**	**1/25**	**0.5 - 8300**	**3.0E+03**	**ND**	**1.1E-01 C**	**5.0E+00**	**MCL**	**YES**	**ASL**
	156-60-5	**trans-1,2-Dichloroethene**	**1.3E+00 J**	**2.8E+01 J**	**UG/L**	**YS06-GW08-0309**	**5/25**	**0.5 - 8300**	**2.8E+01**	**ND**	**1.1E+01 N**	**1.0E+02**	**MCL**	**YES**	**ASL**
	79-01-6	**Trichloroethene**	**1.1E-01 J**	**2.8E+05**	**UG/L**	**YS06-GW13-0409**	**14/25**	**0.5 - 8300**	**2.8E+05**	**ND**	**2.0E+00 C**	**5.0E+00**	**MCL**	**YES**	**ASL**
	75-01-4	**Vinyl chloride**	**7.3E-01 J**	**7.3E+01 L**	**UG/L**	**YS06-GW13A-0409**	**6/25**	**0.5 - 8300**	**7.3E+01**	**ND**	**1.6E-02 C**	**2.0E+00**	**MCL**	**YES**	**ASL**
	1330-20-7	Xylene, total	1.4E-01 J	1.4E-01 J	UG/L	YS06-GW04-0309	1/25	0.5 - 8300	1.4E-01	ND	2.0E+01 N	1.0E+04	MCL	NO	BSL
	98-95-3	**Nitrobenzene**	**2.8E-01 J**	**1.4E+00 K**	**UG/L**	**YS06-GW17-0709**	**3/25**	**0.38 - 1.2**	**1.4E+00**	**N/A**	**1.2E-01 C**	**N/A**		**YES**	**ASL**

[1] Minumum and maximum detected concentration.

[2] Maximum concentration is used for screening.

[3] Background values are the maximum detected concentration from Yorktown Eastover aquifer Background dataset

[4] Oak Ridge National Laboratory (ORNL). Dec 2009. Regional Screening Levels for Chemical Contaminants at Superfund Sites.
Tap Water RSLs (based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens). [Online]. Available: http://epa-prgs.ornl.gov/chemicals/index.shtml
RSL value for Methyl Isobutyl Ketone (4-methyl-2-pentanone) used as surrogate for 2-Hexanone.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

COPC = Chemical of Potential Concern
J = Estimated Value
K = Biased High
L = Biased Low
N = Noncarcinogenic
UG/L = micrograms per liter
ND = not detected
N/A = not available, not applicable
MCL = Maximum Contaminant Level, Primary Drinking Water Standards
C = Carcinogenic
C* = N screening level < 100x C screening level, therefore
N screening value/10 used as screening level
C** = N screening level < 10x C screening level, therefore
N screening value/10 used as screening level
N = Noncarcinogenic

Table 2.4

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Groundwater	71-55-6	1,1,1-Trichloroethane	2.9E-01 J	3.9E-01 J	UG/L	YS06-GW06-0309	2/18	0.5 - 2.1	3.9E-01	ND	1.1E+03 N	2.0E+02	MCL	NO	BSL
	75-34-3	1,1-Dichloroethane	8.2E-01	5.5E+00	UG/L	YS06-GW06-0309	4/18	0.5 - 2.1	5.5E+00	ND	9.4E+00 C	N/A		NO	BSL
	75-35-4	1,1-Dichloroethene	1.0E-01 J	7.4E+00	UG/L	YS06-GW12-0409	5/18	0.5 - 2.1	7.4E+00	ND	2.6E+01 N	N/A	MCL	NO	BSL
	120-82-1	1,2,4-Trichlorobenzene	1.5E-01 J	1.5E-01 J	UG/L	YS06-GW02-0309	1/18	0.5 - 2.1	1.5E-01	ND	7.0E+01 N	7.0E+01	MCL	NO	BSL
	540-59-0	**1,2-Dichloroethene (total)**	**1.1E-01 J**	**6.1E+01**	**UG/L**	**YS06-GW12-0409**	**8/18**	**0.5 - 2.1**	**6.1E+01**	**ND**	**5.2E+01 N**	**N/A**		**YES**	**ASL**
	75-15-0	Carbon disulfide	2.5E-01 J	6.3E-01	UG/L	YS06-GW12A-0409	2/18	0.5 - 2.1	6.3E-01	ND	1.7E+02 N	N/A		NO	BSL
	75-00-3	Chloroethane	1.6E-01 J	1.6E-01 J	UG/L	YS06-GW01-0309	1/18	0.5 - 2.1	1.6E-01	ND	3.0E+03 N	N/A		NO	BSL
	156-59-2	cis-1,2-Dichloroethene	1.1E-01 J	6.0E+01	UG/L	YS06-GW12-0409	8/18	0.5 - 2.1	6.0E+01	ND	7.0E+01 N	7.0E+01	MCL	NO	BSL
	100-41-4	Ethylbenzene	3.0E-01 J	3.0E-01 J	UG/L	YS06-GW09B-0409	1/18	0.5 - 2.1	3.0E-01	ND	7.0E+02 M	7.0E+02	MCL	NO	BSL
	156-60-5	trans-1,2-Dichloroethene	1.3E+00 J	3.6E+00	UG/L	YS06-GW01P-0309	2/18	0.5 - 2.1	3.6E+00	ND	1.0E+02 N	1.0E+02	MCL	NO	BSL
	79-01-6	**Trichloroethene**	**1.1E-01 J**	**7.6E+01 J**	**UG/L**	**YS06-GW12-0409**	**9/18**	**0.5 - 2.1**	**7.6E+01**	**ND**	**5.0E+00 M**	**5.0E+00**	**MCL**	**YES**	**ASL**
	75-01-4	**Vinyl chloride**	**7.3E-01 J**	**4.1E+00**	**UG/L**	**YS06-GW01-0309**	**2/18**	**0.5 - 2.1**	**4.1E+00**	**ND**	**2.0E+00 M**	**2.0E+00**	**MCL**	**YES**	**ASL**
	98-95-3	Nitrobenzene	2.8E-01 J	1.0E+00	UG/L	-GW12-0409 : YS06-GW12P-	2/18	0.38 - 1.2	1.0E+00	ND	1.3E+02 C	N/A		NO	BSL

[1] Minimum/Maximum detected concentrations.
[2] Maximum concentration is used for screening.
[3] Background values not available.
[4] Generic vapor intrusion screening values (USEPA, 2002); see Table 2.1 Supplement A
[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)
Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered
J = Estimated Value
K = Biased High
L = Biased Low
N = Noncarcinogenic
C = Carcinogenic
N = Noncarcinogenic
UG/L = micrograms per liter
ND = not detected
N/A = not available, not applicable

Table 2.4 Supplement A
Calculation of Target Groundwater Concentrations for Vapor Intrusion Screening
Site 6, NWS, Yorktown, Yorktown, Virginia

CAS Number	Constituent	Unit Risk Factor (URF) $(ug/m^3)^{-1}$	Reference Concentration (RfC) mg/m^3	Target Indoor Air Concentration[2], carcinogen (C_{Cancer}) ug/m^3	Target Indoor Air Concentration[2], non-carcinogen ($C_{non-Cancer}$) ug/m^3	Target Indoor Air Concentration ($C_{target,ia}$) ug/m^3	System-Temp Henry's Law Constant (H'TS)[3] Dimensionless	Risk-Based Target Groundwater Concentration (C_{gw}) ug/L	MCL ug/L	Final Target Groundwater Concentration[4] (C_{gw}) ug/L
71-55-6	1,1,1-Trichloroethane	N/A	5.0E+00	NA	5.2E+02	5.2E+02	4.9E-01	1.1E+03	2.0E+02	1.07E+03
75-34-3	1,1-Dichloroethane	1.6E-06	N/A	1.5E+00	NA	1.5E+00	1.6E-01	9.4E+00	N/A	9.36E+00
75-35-4	1,1-Dichloroethene	N/A	2.0E-01	NA	2.1E+01	2.1E+01	8.0E-01	2.6E+01	N/A	2.63E+01
120-82-1	1,2,4-Trichlorobenzene	N/A	2.0E-03	NA	2.1E-01	2.1E-01	2.8E-02	7.4E+00	7.0E+01	7.00E+01
540-59-0	1,2-Dichloroethene (total)	N/A	6.0E-02	NA	6.3E+00	6.3E+00	1.2E-01	5.2E+01	N/A	5.22E+01
75-15-0	Carbon disulfide	N/A	7.0E-01	NA	7.3E+01	7.3E+01	4.3E-01	1.7E+02	N/A	1.69E+02
75-00-3	Chloroethane	N/A	1.0E+01	NA	1.0E+03	1.0E+03	3.5E-01	3.0E+03	N/A	2.99E+03
156-59-2	cis-1,2-Dichloroethene	N/A	6.0E-02	NA	6.3E+00	6.3E+00	1.2E-01	5.4E+01	7.0E+01	7.00E+01
100-41-4	Ethylbenzene	2.5E-06	1.0E+00	9.7E-01	1.0E+02	9.7E-01	1.9E-01	5.2E+00	7.0E+02	7.00E+02
156-60-5	trans-1,2-Dichloroethene	N/A	6.0E-02	NA	6.3E+00	6.3E+00	1.2E-01	5.2E+01	1.0E+02	1.00E+02
79-01-6	Trichloroethene	2.0E-06	N/A	1.2E+00	NA	1.2E+00	2.6E-01	4.8E+00	5.0E+00	5.00E+00
75-01-4	Vinyl chloride	4.4E-06	1.0E-01	1.6E-01	1.0E+01	1.6E-01	9.1E-01	1.8E-01	2.0E+00	2.00E+00
98-95-3	Nitrobenzene	4.0E-05	9.0E-03	6.1E-02	9.4E-01	6.1E-02	4.7E-04	1.3E+02	N/A	1.28E+02

Notes:
[1] The vapor intrusion screening levels [i.e., target groundwater concentration from Table 2c, Subsurface Vapor Intrusion Guidance (EPA, 2002)] were updated using the methodology presented in Appendix D of Subsurface Vapor Intrusion Guidance (EPA, 2002).
[2] Values are Regional Screening Levels (RSL) for residential air (based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens). [Oak Ridge National Laboratory (ORNL), Dec. 2009].
[3] H'TS = Henry's Law Constant (dimensionless) at system (i.e., groundwater) temperature. Calculated using equation 3 from USEPA, 2004.
Average groundwater temperature (15.25°C) based on data from wells GW01-03, GW05-07, GW09-12, GW16, and GW18
[4] If the calculated groundwater target concentration is less than the Maximum Contaminant Level (MCL) for the compound, the target concentration is set at the MCL (EPA, 2002).
RfC and RSL values for trans-1,2-dichloroethene used as surrogate for 1,2-dichloroethene (total).
MCL = maximum contaminant level (EPA, 2009).
N/A = Not available.

Variables	Units	Value
$C_{target,ia}$ = Target indoor air conc., minimum	ug/m^3	Solved by Eq. 1
C_{gw} = Target groundwater conc.	ug/L	Solved by Eq. 2
TCR = Target Cancer Risk	unitless	1.00E-06
THQ = Target Hazard Quotient	unitless	1
URF = Unit Risk Factor	$(ug/m^3)^{-1}$	Chemical-specific
RfC = Reference Concentration	mg/m^3	Chemical-specific
H = Dimensionless Henry's Law Constant	unitless	Chemical-specific
alpha (α) = Attenuation Factor	unitless	0.001

Equation 1: $C_{target,ia}$ = Minimum(C_{cancer}, $C_{non-cancer}$)
Equation 2: Cgw = $C_{target,ia} \times 10^{-3}\ m^3/L * 1/H'TS * 1/\alpha$

Table 2.5

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier		Maximum [1] Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Water at GW09	540-59-0	1,2-Dichloroethene (total)	1.1E-01	J	1.1E-01	J	UG/L	YS06-GW09-0309	1/1	0.5 - 0.5	1.1E-01	ND	3.3E+01 N	N/A		NO	BSL
	156-59-2	cis-1,2-Dichloroethene	1.1E-01	J	1.1E-01	J	UG/L	YS06-GW09-0309	1/1	0.5 - 0.5	1.1E-01	ND	3.7E+01 N	7.0E+01	MCL	NO	BSL
	79-01-6	Trichloroethene	8.7E-01		8.7E-01		UG/L	YS06-GW09-0309	1/1	0.5 - 0.5	8.7E-01	ND	2.0E+00 C	5.0E+00	MCL	NO	BSL
	121-14-2	**2,4-Dinitrotoluene**	**5.1E+01**	**K**	**5.1E+01**	**K**	**UG/L**	**YS06-GW09-0309**	**1/1**	**0.98 - 0.98**	**5.1E+01**	**ND**	**2.2E-01 C**	**N/A**		**YES**	**ASL**
	99-65-0	**1,3-Dinitrobenzene**	**1.8E+01**	**K**	**1.8E+01**	**K**	**UG/L**	**YS06-GW09-0309**	**1/1**	**0.98 - 0.98**	**1.8E+01**	**ND**	**3.7E-01 N**	**N/A**		**YES**	**ASL**
	35572-78-2	2-Amino-4,6-dinitrotoluene	5.0E+00	K	5.0E+00	K	UG/L	YS06-GW09-0309	1/1	0.98 - 0.98	5.0E+00	ND	7.3E+00 N	N/A		NO	BSL
	618-87-1	**3,5-Dinitroaniline**	**7.8E-01**	**J**	**7.8E-01**	**J**	**UG/L**	**YS06-GW09-0309**	**1/1**	**0.98 - 0.98**	**7.8E-01**	**N/A**	**3.7E-01 N**	**N/A**		**YES**	**ASL**
	2691-41-0	HMX	4.1E+00	K	4.1E+00	K	UG/L	YS06-GW09-0309	1/1	0.98 - 0.98	4.1E+00	N/A	1.8E+02 N	N/A		NO	BSL
	121-82-4	**RDX**	**7.0E+01**	**K**	**7.0E+01**	**K**	**UG/L**	**YS06-GW09-0309**	**1/1**	**0.98 - 0.98**	**7.0E+01**	**N/A**	**6.1E-01 C**	**N/A**		**YES**	**ASL**
	7429-90-5	Aluminum	5.4E+01	J	5.4E+01	J	UG/L	YS06-GW09-0309	1/1	200 - 200	5.4E+01	1.2E+03	3.7E+03 N	50-200	SMCL	NO	BSL
	7440-38-2	**Arsenic**	**3.1E+00**	**J**	**3.1E+00**	**J**	**UG/L**	**YS06-GW09-0309**	**1/1**	**10 - 10**	**3.1E+00**	**3.5E+00 J**	**4.5E-02 C**	**1.0E+01**	**MCL**	**YES**	**ASL**
	7440-39-3	Barium	5.9E+01	J	5.9E+01	J	UG/L	YS06-GW09-0309	1/1	200 - 200	5.9E+01	4.4E+01 J	7.3E+02 N	2.0E+03	MCL	NO	BSL
	7440-70-2	Calcium	2.3E+05		2.3E+05		UG/L	YS06-GW09-0309	1/1	5000 - 5000	2.3E+05	6.7E+04	N/A	N/A		NO	NUT
	7439-89-6	Iron	5.6E+02		5.6E+02		UG/L	YS06-GW09-0309	1/1	100 - 100	5.6E+02	2.4E+03	2.6E+03 N	3.0E+02	SMCL	NO	BSL
	7439-92-1	Lead	3.3E+00		3.3E+00		UG/L	YS06-GW09-0309	1/1	3 - 3	3.3E+00	ND	N/A	15	MCL	NO	NTX
	7439-95-4	Magnesium	1.3E+04		1.3E+04		UG/L	YS06-GW09-0309	1/1	5000 - 5000	1.3E+04	3.4E+03 J	N/A	N/A		NO	NUT
	7439-96-5	**Manganese**	**1.3E+02**		**1.3E+02**		**UG/L**	**YS06-GW09-0309**	**1/1**	**10 - 10**	**1.3E+02**	**1.8E+01**	**8.8E+01 N**	**5.0E+01**	**SMCL**	**YES**	**ASL**
	7440-09-7	Potassium	3.8E+03	J	3.8E+03	J	UG/L	YS06-GW09-0309	1/1	5000 - 5000	3.8E+03	5.5E+03	N/A	N/A		NO	NUT
	7440-23-5	Sodium	2.6E+05		2.6E+05		UG/L	YS06-GW09-0309	1/1	5000 - 5000	2.6E+05	8.3E+03	N/A	N/A		NO	NUT
	7440-70-2	Calcium, Dissolved	2.2E+05		2.2E+05		UG/L	YS06-GW09-0309	1/1	5000 - 5000	2.2E+05	7.0E+04	N/A	N/A		NO	NUT
	7439-89-6	Iron, Dissolved	2.5E+02		2.5E+02		UG/L	YS06-GW09-0309	1/1	100 - 100	2.5E+02	5.8E+00 J	2.6E+03 N	3.0E+02	SMCL	NO	BSL
	7439-95-4	Magnesium, Dissolved	1.3E+04		1.3E+04		UG/L	YS06-GW09-0309	1/1	5000 - 5000	1.3E+04	3.4E+03 J	N/A	N/A		NO	NUT
	7439-96-5	**Manganese, Dissolved**	**1.2E+02**		**1.2E+02**		**UG/L**	**YS06-GW09-0309**	**1/1**	**10 - 10**	**1.2E+02**	**1.2E+01 J**	**8.8E+01 N**	**5.0E+01**	**SMCL**	**YES**	**ASL**
	7440-09-7	Potassium, Dissolved	4.0E+03	J	4.0E+03	J	UG/L	YS06-GW09-0309	1/1	5000 - 5000	4.0E+03	5.7E+03	N/A	N/A		NO	NUT
	7440-23-5	Sodium, Dissolved	2.6E+05		2.6E+05		UG/L	YS06-GW09-0309	1/1	5000 - 5000	2.6E+05	8.6E+03	N/A	N/A		NO	NUT

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values are the maximum detected concentration from Yorktown Eastover aquifer Background dataset

[4] Oak Ridge National Laboratory (ORNL). Dec. 2009. Regional Screening Levels for Chemical Contaminants at Superfund Sites.
Tap Water RSLs (based on 10^{-6} for carcinogens and HQ of 0.1 for noncarcinogens). [Online]. Available: http://epa-prgs.ornl.gov/chemicals/index.shtml
RSL value for 1,3-dinitrobenzene used as a surrogate for 3,5-dinitroaniline.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

J = Estimated Value
K = Biased High
L = Biased Low
C = Carcinogenic
N = Noncarcinogenic
UG/L = micrograms per liter
ND = not detected
N/A = not available, not applicable
MCL = Maximum Contaminant Level, Primary Drinking Water Standards
SMCL = Maximum Contaminant Level, Secondary Drinking Water Standards
AL = Action Level, Safe Drinking Water Act

Table 2.6

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier		Maximum [1] Concentration Qualifier		Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Surface Water	75-15-0	Carbon disulfide	1.1E-01	J	4.8E-01	J	UG/L	YS06-SW74P-0809	7/11	0.5 - 0.5	4.8E-01	N/A	1.0E+03	N			NO	BSL
	88-72-2	2-Nitrotoluene	3.6E-01	J	3.6E-01	J	UG/L	YS06-SW78-0809	1/11	0.37 - 0.38	3.6E-01	N/A	3.1E+00	C			NO	BSL
	2691-41-0	HMX	3.2E-01	J	3.6E-01	J	UG/L	YS06-SW72-0809	2/11	0.37 - 0.38	3.6E-01	N/A	1.8E+03	N			NO	BSL
	7429-90-5	Aluminum	4.4E+02	K	2.3E+03	K	UG/L	YS06-SW76-0809	11/11	200 - 200	2.3E+03	N/A	3.7E+04	N			NO	BSL
	7440-38-2	**Arsenic**	**2.9E+00**	**J**	**5.0E+00**	**J**	**UG/L**	**YS06-SW73-0809**	**7/11**	**10 - 10**	**5.0E+00**	**N/A**	**4.5E-01**	**C**			**YES**	**ASL**
	7440-39-3	Barium	2.7E+01	J	3.0E+01	J	UG/L	YS06-SW76-0809	11/11	200 - 200	3.0E+01	N/A	7.3E+03	N			NO	BSL
	7440-70-2	Calcium	1.9E+05		2.2E+05		UG/L	YS06-SW70-0809	11/11	5000 - 5000	2.2E+05	N/A	N/A				NO	NUT
	7440-47-3	**Chromium**	**9.2E-01**	**L**	**3.8E+00**	**J**	**UG/L**	**YS06-SW76-0809**	**3/11**	**10 - 10**	**3.8E+00**	**N/A**	**4.3E-02**	**C**			**YES**	**ASL**
	7440-48-4	Cobalt	7.7E-01	J	9.6E-01	J	UG/L	YS06-SW73-0809	3/11	5 - 5	9.6E-01	N/A	1.1E+01	N			NO	BSL
	7440-50-8	Copper	1.0E+00	J	2.1E+00	J	UG/L	YS06-SW73-0809	10/11	5 - 5	2.1E+00	N/A	1.5E+03	N	1.3E+03	AWQC	NO	BSL
	7439-89-6	Iron	7.2E+02	J	3.0E+03	J	UG/L	YS06-SW76-0809	11/11	100 - 100	3.0E+03	N/A	2.6E+04	N			NO	BSL
	7439-95-4	Magnesium	5.4E+05		6.8E+05		UG/L	YS06-SW70-0809	11/11	5000 - 5000	6.8E+05	N/A	N/A				NO	NUT
	7439-96-5	Manganese	5.9E+01		2.0E+02		UG/L	YS06-SW78-0809	11/11	10 - 10	2.0E+02	N/A	8.8E+02	N			NO	BSL
	7440-02-0	Nickel	1.9E+00	J	1.9E+00	J	UG/L	YS06-SW76-0809	1/11	40 - 40	1.9E+00	N/A	7.3E+02	N			NO	BSL
	7440-09-7	Potassium	2.7E+05		3.5E+05		UG/L	YS06-SW70-0809	11/11	5000 - 5000	3.5E+05	N/A	N/A				NO	NUT
	7782-49-2	Selenium	4.1E+00	K	4.1E+00	K	UG/L	YS06-SW71-0809	1/11	5 - 5	4.1E+00		1.8E+02	N			NO	BSL
	7440-22-4	Silver	3.8E-01	L	1.1E+00	L	UG/L	YS06-SW70-0809 : YS06-SW73-0809	8/11	5 - 5	1.1E+00	N/A	1.8E+02	N			NO	BSL
	7440-23-5	Sodium	4.1E+06	J	5.3E+06	J	UG/L	YS06-SW70-0809	11/11	100000 - 100000	5.3E+06	N/A	N/A				NO	NUT
	7440-62-2	Vanadium	3.2E+00	J	8.3E+00	J	UG/L	YS06-SW76-0809	11/11	20 - 20	8.3E+00	N/A	1.8E+02	N			NO	BSL
	7440-66-6	Zinc	1.1E+01	J	2.2E+01		UG/L	YS06-SW73-0809	4/11	20 - 20	2.2E+01	N/A	1.1E+04	N	7.4E+03	AWQC	NO	BSL

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values not available.

[4] Oak Ridge National Laboratory (ORNL). Dec. 2009. Regional Screening Levels for Chemical Contaminants at Superfund Sites. [Online]. Available: http://epa-prgs.ornl.gov/chemicals/index.shtml. Ten times adjusted (nc RSLs adjusted by dividing by 10) tap water RSLs RSL value for Manganese (water) used as surrogate for manganese.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

K = Biased High

L = Biased Low

C = Carcinogenic

N = Noncarcinogenic

AWQC = National Ambient Water Quality Criteria

Table 2.7

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	CAS Number	Chemical	Minimum [1] Concentration Qualifier	Maximum [1] Concentration Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration [2] Used for Screening	Background [3] Value	Screening [4] Toxicity Value	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for [5] Contaminant Deletion or Selection
Sediment	75-15-0	Carbon disulfide	1.1E-02 J	2.1E-02 J	MG/KG	YS06-SD76-0809 : YS06-SD77-0809	3/11	0.0076 - 0.026	2.1E-02	N/A	8.2E+02 NS			NO	BSL
	156-60-5	trans-1,2-Dichloroethene	7.4E-03 J	7.4E-03 J	MG/KG	YS06-SD77-0809	1/11	0.0076 - 0.026	7.4E-03	N/A	1.5E+02 N			NO	BSL
	606-20-2	2,6-Dinitrotoluene	2.0E-01 J	2.0E-01 J	MG/KG	YS06-SD77-0809	1/11	0.5 - 0.5	2.0E-01	N/A	6.1E+01 N			NO	BSL
	98-95-3	Nitrobenzene	1.2E-01 J	1.2E-01 J	MG/KG	YS06-SD77-0809	1/11	0.5 - 0.5	1.2E-01	N/A	4.8E+01 C*			NO	BSL
	88-72-2	2-Nitrotoluene	2.7E-01 J	2.7E-01 J	MG/KG	YS06-SD77-0809	1/11	0.5 - 0.5	2.7E-01	N/A	2.9E+01 C*			NO	BSL
	479-45-8	Tetryl	1.5E-01 J	1.5E-01 J	MG/KG	YS06-SD77-0809	1/11	0.5 - 0.5	1.5E-01	N/A	2.4E+02 N			NO	BSL
	7429-90-5	Aluminum	5.9E+03	2.4E+04	MG/KG	YS06-SD74P-0809	11/11	29 - 59.3	2.4E+04	N/A	7.7E+04 N			NO	BSL
	7440-38-2	**Arsenic**	**2.8E+00**	**1.1E+01**	**MG/KG**	**YS06-SD75-0809**	**11/11**	**1.4 - 3**	**1.1E+01**	**N/A**	**3.9E+00 C***			**YES**	**ASL**
	7440-39-3	Barium	1.2E+01 J	4.7E+01 J	MG/KG	YS06-SD75-0809	11/11	29 - 59.3	4.7E+01	N/A	1.5E+04 N			NO	BSL
	7440-70-2	Calcium	1.3E+03	3.3E+04	MG/KG	YS06-SD70-0809	11/11	724 - 1480	3.3E+04	N/A	N/A			NO	NUT
	7440-47-3	**Chromium**	**1.4E+01**	**4.8E+01**	**MG/KG**	**YS06-SD74P-0809**	**11/11**	**1.4 - 3**	**4.8E+01**	**N/A**	**2.9E+00 C**			**YES**	**ASL**
	7440-48-4	Cobalt	2.3E+00	8.4E+00	MG/KG	YS06-SD74P-0809 : YS06-SD75-0809	11/11	0.72 - 1.5	8.4E+00	N/A	2.3E+01 N			NO	BSL
	7440-50-8	Copper	5.8E+00	2.7E+01	MG/KG	YS06-SD75-0809	11/11	0.72 - 1.5	2.7E+01	N/A	3.1E+03 N			NO	BSL
	7439-89-6	Iron	1.2E+04	4.0E+04	MG/KG	YS06-SD75-0809	11/11	14.5 - 29.7	4.0E+04	N/A	5.5E+04 N			NO	BSL
	7439-92-1	Lead	8.6E+00	3.6E+01	MG/KG	YS06-SD77-0809	11/11	0.43 - 0.89	3.6E+01	N/A	4.0E+02 NL			NO	BSL
	7439-95-4	Magnesium	2.2E+03	7.3E+03	MG/KG	YS06-SD75-0809	11/11	724 - 1480	7.3E+03	N/A	N/A			NO	NUT
	7439-96-5	Manganese	7.5E+01	3.2E+02	MG/KG	YS06-SD77-0809	11/11	1.4 - 3	3.2E+02	N/A	1.8E+03 N			NO	BSL
	7439-97-6	Mercury	2.8E-02 J	1.1E-01	MG/KG	YS06-SD75-0809 : YS06-SD77-0809	9/11	0.045 - 0.099	1.1E-01	N/A	2.3E+01 N			NO	BSL
	7440-02-0	Nickel	5.3E+00 J	2.3E+01	MG/KG	YS06-SD75-0809	11/11	5.8 - 11.9	2.3E+01	N/A	1.5E+03 N			NO	BSL
	7440-09-7	Potassium	1.9E+03	4.9E+03	MG/KG	YS06-SD74P-0809	11/11	724 - 1480	4.9E+03	N/A	N/A			NO	NUT
	7782-49-2	Selenium	5.8E-01 L	1.2E+00 L	MG/KG	YS06-SD73-0809 : YS06-SD77-0809	7/11	0.72 - 1.5	1.2E+00	N/A	3.9E+02 N			NO	BSL
	7440-23-5	Sodium	2.7E+03	1.2E+04	MG/KG	YS06-SD73-0809	11/11	724 - 1480	1.2E+04	N/A	N/A			NO	NUT
	7440-62-2	Vanadium	1.7E+01	6.7E+01	MG/KG	YS06-SD75-0809	11/11	2.9 - 5.9	6.7E+01	N/A	3.9E+02 N			NO	BSL
	7440-66-6	Zinc	2.9E+01 J	1.4E+02	MG/KG	YS06-SD75-0809	11/11	2.9 - 5.9	1.4E+02	N/A	2.3E+04 N			NO	BSL

[1] Minimum/Maximum detected concentrations.

[2] Maximum concentration is used for screening.

[3] Background values not available.

[4] Oak Ridge National Laboratory (ORNL). Dec. 2009. Regional Screening Levels for Chemical Contaminants at Superfund Sites. [Online].
Available: http://epa-prgs.ornl.gov/chemicals/index.shtml. Ten times the adjusted (nc RSLs adjusted by dividing by 10) residential soil RSLs.
The soil value of 400 mg/kg for lead is from the Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities, USEPA, July 14, 1994.
RSL value for Manganese (water) used as surrogate for manganese.
RSL value for Mercury (inorganic salts) used as surrogate for mercury.

[5] Rationale Codes

Selection Reason: Above Screening Levels (ASL)

Deletion Reason: No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/ To Be Considered

J = Estimated Value

K = Biased High

L = Biased Low

C = Carcinogenic

C* = N screening level < 100x C screening level, therefore N screening value/10 used as screening level

N = Noncarcinogenic

Table 3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Site 6
NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)		Maximum Concentration (Qualifier)		Exposure Point Concentration			
								Value	Units	Statistic	Rationale
Yorktown - Eastover Aquifer Tap Water	1,1-Dichloroethane	UG/L	9.0E-01	1.1E+00	NP	1.4E+00	J	1.1E+00	UG/L	95% KM-t	4
	1,2-Dichloroethane	UG/L	9.4E+02	1.0E+04	NP	2.5E-01	J	2.5E-01	UG/L	Max	4, 5
	Benzene	UG/L	9.4E+02	5.0E+03	NP	1.6E+00	J	1.6E+00	UG/L	Max	4, 5
	cis-1,2-Dichloroethene	UG/L	1.6E+03	5.7E+03	NP	7.8E+03	J	5.7E+03	UG/L	95% KM	1, 3
	Tetrachloroethene	UG/L	3.5E+02	3.7E+03	NP	3.0E+03	J	3.0E+03	UG/L	Max	4, 5
	trans-1,2-Dichloroethene	UG/L	5.5E+00	1.3E+01	NP	2.8E+01	J	1.3E+01	UG/L	95% KM-t	1, 3
	Trichloroethene	UG/L	3.4E+04	1.7E+05	NP	2.8E+05		1.7E+05	UG/L	95% KM	1, 3
	Vinyl chloride	UG/L	1.1E+01	3.0E+01	NP	7.3E+01	L	3.0E+01	UG/L	95% KM-BCA	1, 3
	2,4-Dinitrotoluene	UG/L	7.6E+00	3.7E+01	NP	3.6E+01	K	3.6E+01	UG/L	Max	4, 5
	Nitrobenzene	UG/L	5.5E-01	6.8E-01	NP	1.0E+00		6.8E-01	UG/L	95% Mod-t	4
	1,3-Dinitrobenzene	UG/L	9.2E-01	5.0E-01	NP	3.7E-01	J	3.7E-01	UG/L	Max	4, 5
	2-Amino-4,6-dinitrotoluene	UG/L	8.3E+02	1.2E+04	NP	7.4E+03		7.4E+03	UG/L	Max	4, 5
	RDX	UG/L	3.4E+00	3.6E+01	NP	2.3E+01		2.3E+01	UG/L	Max	4, 5
	Antimony, Dissolved	UG/L	1.3E+01	1.2E+02	NP	9.8E+01		9.8E+01	UG/L	Max	4, 5
	Arsenic, Dissolved	UG/L	9.0E+00	1.9E+01	NP	2.1E+01		1.9E+01	UG/L	95% Cheb-m	4
	Beryllium, Dissolved	UG/L	1.3E+00	1.1E+01	NP	9.1E+00	L	9.1E+00	UG/L	Max	4, 5
	Cadmium, Dissolved	UG/L	1.3E+00	8.5E+00	NP	8.5E+00		8.5E+00	UG/L	95% KM-BCA	4
	Chromium, Dissolved	UG/L	3.8E+00	7.6E+00	NP	1.8E+01		7.6E+00	UG/L	95% KM-t	1, 2
	Cobalt, Dissolved	UG/L	1.1E+01	1.2E+02	NP	8.9E+01		8.9E+01	UG/L	Max	1, 5
	Iron, Dissolved	UG/L	1.2E+03	4.2E+03	NP	6.4E+03		4.2E+03	UG/L	95% KM	1, 3
	Manganese, Dissolved	UG/L	9.9E+01	1.9E+02	G	3.5E+02		1.9E+02	UG/L	App. G	1, 3
	Nickel, Dissolved	UG/L	2.6E+01	4.4E+01	NP	7.5E+01		4.4E+01	UG/L	95% KM-t	1, 2
	Selenium, Dissolved	UG/L	8.2E+00	1.3E+01	NP	2.8E+01		1.3E+01	UG/L	95% KM-BCA	1, 3
	Vanadium, Dissolved	UG/L	1.1E+01	1.4E+02	NP	9.1E+01	L	9.1E+01	UG/L	Max	4
	Zinc, Dissolved	UG/L	1.1E+03	2.3E+03	NP	5.3E+03		2.3E+03	UG/L	95% KM-BCA	1, 3

Values were calculated using the results from the wells from the center of the plume. These included YS06-GW001A, YS06-GW004, YS06-GW005B, YS06-GW008. YS06-GW012, YS06-GW013, YS06-GW014, and YS06-GW015
ProUCL, Version 4.00.04 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. February 2009. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

Options: Maximum Detected Value (M); 95% Kaplan-Meier (t) UCL (95% KM-t); 95% Chebyshev (mean, std) UCL (95% Cheb-m); 95% Student's-T test UCL (95% Stud-t); 95% Kaplan-Meier Chebyshev UCL (95% KM); 95% Modified-t UCL (95% Mod-t); 95% Chebyshev MVUE (95% Cheb) 95% KM BCA UCL (95% KM-BCA); 95% Approximate Gamma (App. G)

UCL Rationale:
(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Test indicates data are gamma distributed.
(4) Distribution tests are inconclusive
(5) Max value used because 95% UCL greater than max.

N = Normal
T = Log-Transformed
NP = Non-Parametric
G = Gamma
ug/L = micrograms per liter
J = Estimated Value

Table 3.2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Site 6
NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)		Maximum Concentration (Qualifier)		Exposure Point Concentration			
								Value	Units	Statistic	Rationale
Yorktown - Eastover Aquifer Water in Excavation Pit	1,1-Dichloroethane	UG/L	9.0E-01	1.1E+00	NP	1.4E+00	J	1.1E+00	UG/L	95% KM-t	4
	1,2-Dichloroethane	UG/L	9.4E+02	1.0E+04	NP	2.5E-01	J	2.5E-01	UG/L	Max	4, 5
	Benzene	UG/L	9.4E+02	5.0E+03	NP	1.6E+00	J	1.6E+00	UG/L	Max	4, 5
	cis-1,2-Dichloroethene	UG/L	1.6E+03	5.7E+03	NP	7.8E+03	J	5.7E+03	UG/L	95% KM	1, 3
	Tetrachloroethene	UG/L	3.5E+02	3.7E+03	NP	3.0E+03	J	3.0E+03	UG/L	Max	4, 5
	trans-1,2-Dichloroethene	UG/L	5.5E+00	1.3E+01	NP	2.8E+01	J	1.3E+01	UG/L	95% KM-t	1, 3
	Trichloroethene	UG/L	3.4E+04	1.7E+05	NP	2.8E+05		1.7E+05	UG/L	95% KM	1, 3
	Vinyl chloride	UG/L	1.1E+01	3.0E+01	NP	7.3E+01	L	3.0E+01	UG/L	95% KM-BCA	1, 3
	2,4-Dinitrotoluene	UG/L	7.6E+00	3.7E+01	NP	3.6E+01	K	3.6E+01	UG/L	Max	4, 5
	Nitrobenzene	UG/L	5.5E-01	6.8E-01	NP	1.0E+00		6.8E-01	UG/L	95% Mod-t	4
	1,3-Dinitrobenzene	UG/L	9.2E-01	5.0E-01	NP	3.7E-01	J	3.7E-01	UG/L	Max	4, 5
	2-Amino-4,6-dinitrotoluene	UG/L	8.3E+02	1.2E+04	NP	7.4E+03		7.4E+03	UG/L	Max	4, 5
	RDX	UG/L	3.4E+00	3.6E+01	NP	2.3E+01		2.3E+01	UG/L	Max	4, 5
	Aluminum	UG/L	7.5E+02	1.1E+03	NP	1.8E+03		1.1E+03	UG/L	95% KM-BCA	1, 3
	Antimony	UG/L	3.6E+00	4.5E+00	NP	2.0E+00	J	2.0E+00	UG/L	Max	4, 5
	Arsenic	UG/L	6.1E+00	6.4E+00	NP	7.1E+00	J	6.4E+00	UG/L	95% KM-t	4
	Cadmium	UG/L	6.0E-01	1.6E+00	NP	2.5E+00	L	1.6E+00	UG/L	95% Cheb-m	4
	Chromium	UG/L	2.9E+01	3.0E+01	NP	3.2E+01		3.0E+01	UG/L	95% KM-t	4
	Cobalt	UG/L	1.7E+00	2.0E+00	NP	2.6E+00	J	2.0E+00	UG/L	95% KM-t	1, 2
	Iron	UG/L	4.7E+03	1.1E+04	G	1.9E+04		1.1E+04	UG/L	App. G	1, 3
	Manganese	UG/L	1.1E+02	2.0E+02	G	3.8E+02		2.0E+02	UG/L	App. G	1, 3
	Nickel	UG/L	2.2E+01	5.0E+01	NP	1.3E+02		5.0E+01	UG/L	95% KM-BCA	1, 3
	Vanadium	UG/L	3.5E+00	1.1E+01	NP	1.6E+01	J	1.1E+01	UG/L	95% KM	1, 3
	Zinc	UG/L	1.6E+03	3.3E+03	NP	8.3E+03		3.3E+03	UG/L	95% KM-BCA	1, 3

Values were calculated using the results from the wells from the center of the plume. These included YS06-GW001A, YS06-GW004, YS06-GW005B, YS06-GW008. YS06-GW012, YS06-GW013, YS06-GW014, and YS06-GW015
ProUCL, Version 4.00.04 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. February 2009. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

Options: Maximum Detected Value (M); 95% Kaplan-Meier (t) UCL (95% KM-t); 95% Chebyshev (mean, std) UCL (95% Cheb-m); 95% Kaplan-Meier Chebyshev UCL (95% KM); 95% Modified-t UCL (95% Mod-t); 95% Chebyshev MVUE (95% Cheb) 95% KM BCA UCL (95% KM-BCA); 95% Approximate Gamma (App. G)

UCL Rationale:
(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Test indicates data are gamma distributed.
(4) Distribution tests are inconclusive
(5) Max value used because 95% UCL greater than max.

N = Normal
T = Log-Transformed
NP = Non-Parametric
G = Gamma
ug/L = micrograms per liter
J = Estimated Value

Table 3.3
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Site 6
NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)		Maximum Concentration (Qualifier)		Exposure Point Concentration			
								Value	Units	Statistic	Rationale
Yorktown - Eastover Aquifer Water Vapors at Showerhead and in Excavation Pit	1,1-Dichloroethane	UG/L	9.0E-01	1.1E+00	NP	1.4E+00	J	1.1E+00	UG/L	95% KM-t	4
	1,2-Dichloroethane	UG/L	9.4E+02	1.0E+04	NP	2.5E-01	J	2.5E-01	UG/L	Max	4, 5
	Benzene	UG/L	9.4E+02	5.0E+03	NP	1.6E+00	J	1.6E+00	UG/L	Max	4, 5
	cis-1,2-Dichloroethene	UG/L	1.6E+03	5.7E+03	NP	7.8E+03	J	5.7E+03	UG/L	95% KM	1, 3
	Tetrachloroethene	UG/L	3.5E+02	3.7E+03	NP	3.0E+03	J	3.0E+03	UG/L	Max	4, 5
	trans-1,2-Dichloroethene	UG/L	5.5E+00	1.3E+01	NP	2.8E+01	J	1.3E+01	UG/L	95% KM-t	1, 3
	Trichloroethene	UG/L	3.4E+04	1.7E+05	NP	2.8E+05		1.7E+05	UG/L	95% KM	1, 3
	Vinyl chloride	UG/L	1.1E+01	3.0E+01	NP	7.3E+01	L	3.0E+01	UG/L	95% KM-BCA	1, 3
	Nitrobenzene	UG/L	5.5E-01	6.8E-01	NP	1.0E+00		6.8E-01	UG/L	95% Mod-t	4

Values were calculated using the results from the wells from the center of the plume. These included YS06-GW001A, YS06-GW004, YS06-GW005B, YS06-GW008. YS06-GW012, YS06-GW013, YS06-GW014, and YS06-GW015
ProUCL, Version 4.00.04 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. February 2009. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

Options: Maximum Detected Value (M); 95% Kaplan-Meier (t) UCL (95% KM-t); 95% Chebyshev (mean, std) UCL (95% Cheb-m); 95% Student's-T test UCL (95% Stud-t); 95% Kaplan-Meier Chebyshev UCL (95% KM); 95% Modified-t UCL (95% Mod-t); 95% Chebyshev MVUE (95% Cheb) 95% KM BCA UCL (95% KM-BCA); 95% Approximate Gamma (App. G)

UCL Rationale:
(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Test indicates data are gamma distributed.
(4) Distribution tests are inconclusive
(5) Max value used because 95% UCL greater than max.

N = Normal
T = Log-Transformed
NP = Non-Parametric
G = Gamma
ug/L = micrograms per liter
J = Estimated Value

Table 3.4

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater to Indoor Air

Exposure Point	Chemical of Potential Concern	Maximum Detected Concentration (Groundwater)	Units	Exposure Medium	Exposure Medium Concentration (C_{ia})	Units	Reference for Exposure Medium Calculation
Groundwater to Indoor Air	1,2-Dichloroethene	6.1E+01	ug/L	Groundwater to Indoor Air	7.3E-03	mg/m^3	EPA, 2002 & 2004
	Trichloroethene	7.6E+01	ug/L	Groundwater to Indoor Air	1.9E-02	mg/m^3	EPA, 2002 & 2004
	Vinyl chloride	4.1E+00	ug/L	Groundwater to Indoor Air	3.7E-03	mg/m^3	EPA, 2002 & 2004

$C_{ia} = C_{gw} \times H'_{TS} \times \alpha \div 10^{-3}\ m^3/L * 10^{-3}\ mg/\mu g$

C_{ia} = Indoor air concentration (mg/m^3)

C_{gw} = groundwater concentration (µg/L)

H'_{TS} - System Temperature Henry's Law Constant (unitless); see Table 2.4 Supplement A.

α = attenuation factor (default, 0.001; USEPA 2002)

USEPA. 2002. OSWER Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). November.

USEPA. 2004. User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings. Office of Emergency and Remedial Response. February.

Table 3.5

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)		Exposure Point Concentration			
							Value	Units	Statistic	Rationale
Tap Water at GW09	2,4-Dinitrotoluene	UG/L	5.1E+01	N/A	5.1E+01	K	5.1E+01	UG/L	Max	5
	1,3-Dinitrobenzene	UG/L	1.8E+01	N/A	1.8E+01	K	1.8E+01	UG/L	Max	5
	3,5-Dinitroaniline	UG/L	7.8E-01	N/A	7.8E-01	J	7.8E-01	UG/L	Max	5
	RDX	UG/L	7.0E+01	N/A	7.0E+01	K	7.0E+01	UG/L	Max	5
	Manganese, Dissolved	UG/L	1.2E+02	N/A	1.2E+02		1.2E+02	UG/L	Max	5

ProUCL, Version 4.00.04 used to determine distribution of data and calculated EPC, following recommendations in users guide (USEPA. February 2009. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

Statistics: Maximum Detected Value (Max)

(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Test indicates data are gamma distributed.
(4) Distribution tests are inconclusive
(5) Maximum detected concentration used because sample size is less than 5.

N = Normal
N/A = not available/not applicable
T = Log-Transformed
NP = Non-Parametric
ug/L = micrograms per liter
J = Estimated Value

Table 3.6

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)		Exposure Point Concentration			
							Value	Units	Statistic	Rationale
Water In Excavation Pit at GW09	2,4-Dinitrotoluene	UG/L	5.1E+01	N/A	5.1E+01	K	5.1E+01	UG/L	Max	5
	1,3-Dinitrobenzene	UG/L	1.8E+01	N/A	1.8E+01	K	1.8E+01	UG/L	Max	5
	3,5-Dinitroaniline	UG/L	7.8E-01	N/A	7.8E-01	J	7.8E-01	UG/L	Max	5
	RDX	UG/L	7.0E+01	N/A	7.0E+01	K	7.0E+01	UG/L	Max	5
	Arsenic	UG/L	3.1E+00	N/A	3.1E+00	J	3.1E+00	UG/L	Max	5
	Manganese	UG/L	1.3E+02	N/A	1.3E+02		1.3E+02	UG/L	Max	5

ProUCL, Version 4.00.04 used to determine distribution of data and calculated EPC, following recommendations in users guide (USEPA. February 2009. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

Statistics: Maximum Detected Value (Max)

(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Test indicates data are gamma distributed.
(4) Distribution tests are inconclusive
(5) Maximum detected concentration used because sample size is less than 5.

N = Normal
N/A = not available/not applicable
T = Log-Transformed
NP = Non-Parametric
ug/L = micrograms per liter
J = Estimated Value

Table 3.7

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)		Maximum Concentration (Qualifier)		Exposure Point Concentration			
								Value	Units	Statistic	Rationale
Felgates Creek											
	Arsenic	UG/L	3.5E+00	4.0E+00	NP	5.0E+00	J	4.0E+00	UG/L	95% KM-BCA	4
	Chromium	UG/L	1.4E+00	2.1E+00	NP	3.8E+00	J	2.1E+00	UG/L	95% KM-t	1, 2

ProUCL, Version 4.00.04 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. February 2009. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

J = Estimated Value
UG/L= micrograms per liter

Options: 95% KM BCA UCL (95% KM-BCA); 95% Kaplan-Meier (t) UCL (95% KM-t)

UCL Rationale:
(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Test indicates data are gamma distributed.
(4) Distribution tests are inconclusive

Table 3.8

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)		Maximum Concentration (Qualifier)	Exposure Point Concentration			
							Value	Units	Statistic	Rationale
Felgates Creek										
	Arsenic	MG/KG	7.2E+00	8.7E+00	N	1.1E+01	8.7E+00	MG/KG	95% Stud-t	2
	Chromium	MG/KG	3.3E+01	4.0E+01	N	4.8E+01	4.0E+01	MG/KG	95% Stud-t	1, 2, 3

ProUCL, Version 4.00.04 used to determine distribution of data and calculate 95% UCL, following recommendations in users guide (USEPA. February 2009. ProUCL, Version 4.0. Prepared by Lockheed Martin Environmental Services).

N = Normal
MG/KG = milligrams per kilogram

Options: 95% Student's-T test UCL (95% Stud-t);

UCL Rationale:
(1) Shapiro-Wilk W Test/Lilliefors test indicates data are log-normally distributed.
(2) Shapiro-Wilk W Test/Lilliefors indicates data are normally distributed.
(3) Test indicates data are gamma distributed.
(4) Distribution tests are inconclusive

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.RME	µg/l	See Table 3.1.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-W	Ingestion Rate of Water	2	liters/day	EPA, 1997	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
		Child	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.RME	µg/l	See Table 3.1.RME	CDI (mg/kg-day) =
				IR-W	Ingestion Rate of Water	1	liters/day	EPA, 1997	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
		Child/Adult	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.RME	µg/l	See Table 3.1.RME	CDI (mg/kg-day) =
				IR-W-A	Ingestion Rate of Water, Adult	2	liters/day	EPA, 1997	CW x IR-W-Adj x EF x CF2 x 1/AT
				IR-W-C	Ingestion Rate of Water, Child	1	liters/day	EPA, 1997	
				IR-W-Adj	Ingestion Rate of Water, Age-adjusted	1.09	liter-year/kg-day	calculated	IR-W-Adj (liter-year/kd-day) =
				EF	Exposure Frequency	350	days/year	EPA, 1991	(ED-C x IR-W-C / BW-C) +
				ED-A	Exposure Duration, Adult	24	years	EPA, 1991	(ED-A x IR-W-A / BW-A)
				ED-C	Exposure Duration, Child	6	years	EPA, 1991	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW-A	Body Weight , Adult	70	kg	EPA, 1991	
				BW-C	Body Weight, Child	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inestion	Industrial Worker	Adult	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.RME	µg/l	See Table 3.1.RME	CDI (mg/kg-day) =
				IR-W	Ingestion Rate of Water	1	liters/day	EPA, 1991	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	250	days/year	EPA, 1991	
				ED	Exposure Duration	25	years	EPA, 1991	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	EPA, 1989	
Dermal	Resident	Adult	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.RME	µg/l	See Table 3.1.RME	CDI (mg/kg-day) =
				DAevent	Dermally Absorbed Dose per Event	calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
				FA	Fraction absorbed water	chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	0.58	hr/event	EPA, 2004	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Contact	18,000	cm^2	EPA, 2004	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	350	days/year	EPA, 2004	
				ED	Exposure Duration	24	years	EPA, 2004	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	70	kg	EPA, 1991	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Resident	Child	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.RME	µg/l	See Table 3.1.RME	CDI (mg/kg-day) =
				DAevent	Dermally Absorbed Dose per Event	calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
				FA	Fraction absorbed water	chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	1.0	hr/event	EPA, 2004	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Contact	6,600	cm^2	EPA, 2004	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	350	days/year	EPA, 2004	
				ED	Exposure Duration	6	years	EPA, 2004	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	15	kg	EPA, 1991	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	
		Child/Adult	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.RME	µg/l	See Table 3.1.RME	CDI (mg/kg-day) = DA-Adj x EF x 1/AT
				DAevent-A	Dermally Absorbed Dose per Event, Adult	calculated	mg/cm^2-event	calculated	
				DAevent-C	Dermally Absorbed Dose per Event, Child	calculated	mg/cm^2-event	calculated	DA-Adj = (Daevent-A x SA-A x ED-A x 1/BW-A)
				DA-Adj	Dermally Absorbed Dose, Age-adjusted	calculated	mg-year/event-kg	calculated	+ (Daevent-C x SA-C x ED-C x 1/BW-C)
				FA	Fraction absorbed water	chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}-A	Event Time, Adult	0.58	hr/event	EPA, 2004	t_{event}<t*: DAevent (mg/cm^2-event) =
				t_{event}-C	Event Time, Child	1.0	hr/event	EPA, 2004	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				SA-A	Skin Surface Area, Adult	18,000	cm^2	EPA, 2004	x CF2 x CF3
				SA-C	Skin Surface Area, Child	6,600	cm^2	EPA, 2004	
				EV	Event Frequency	1	events/day	EPA, 2004	t_{event}>t*: DAevent (mg/cm^2-event) =
				EF	Exposure Frequency	350	days/year	EPA, 2004	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				ED-A	Exposure Duration, Adult	24	years	EPA, 2004	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				ED-C	Exposure Duration, Child	6	years	EPA, 2004	
				BW-A	Body Weight, Adult	70	kg	EPA, 1991	
				BW-C	Body Weight, Child	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Construction Worker	Adult	Yorktown-Eastover Aquifer - Excavation Pit	CW	Chemical Concentration in Water	See Table 3.3.RME	µg/l	See Table 3.3.RME	CDI (mg/kg-day) =
				DAevent	Dermally Absorbed Dose per Event	calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
				FA	Fraction absorbed water	chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	8	hr/day	(1)	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Contact	5,700	cm^2	EPA, 2004, (2)	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	125	days/year	VDEQ, 2010	
				ED	Exposure Duration	1	years	EPA, 1991	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	70	kg	EPA, 1991	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	365	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	

(1) Professional judgment based on construction activities that would occur 8 hrs per day for the RME.

(2) Skin surface area in contact with groundwater assumed to be hands, forearms, lower legs, and feet.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

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EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

EPA, 2004 . Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment (Final). EPA/540/R/99/005. July 2004.

VDEQ, 2010: Viriginia Department of Envirommental Quality, Voluntary Remediaion Program Risk Assessment Guidance.

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Resident	Adult	Yorktown-Eastover Aquifer - Water Vapors at Showerhead	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	Chronic Daily Intake (CDI) (mg/m3) =
				CAa	Chemical Concentration in Air from Show	Calculated	mg/m^3	Calculated	CAa x ETa x EDa x EF x CF1 x 1/AT
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				EDa	Exposure Duration	24	years	EPA, 1991	Use Foster & Chrostowski Shower model to
				ETa	Exposure Time	0.58	hr/day	EPA, 2004	calculate Ca-a and Ca-c
				CF1	Conversion Factor 1	1/24	day/hour	- -	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
			Indoor Air	CW	Chemical Concentration in Water	See Table 3.1	µg/l	See Table 3.1	Chronic Daily Intake (CDI) (mg/m3) =
				CA	Chemical Concentration in Air	See Table 3.4	mg/m^3	See Table 3.4	CA x ET x EF x ED x CF1 x 1/AT
				ET	Exposure Time	24	hr/day	EPA, 1991	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	CA calculated using Johnson and Ettinger model
				CF1	Conversion Factor 1	1/24	day/hour	- -	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
		Child	Yorktown-Eastover Aquifer - Water Vapors at Showerhead	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	Chronic Daily Intake (CDI) (mg/m3) =
				CAc	Chemical Concentration in Air from Show	Calculated	mg/m^3	Calculated	CA_c x ET_c x ED_c x EF x CF1 x 1/AT
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				EDc	Exposure Duration	6	years	EPA, 1991	Use Foster & Chrostowski Shower model to
				ETc	Exposure Time	1	hr/day	EPA, 2004	calculate Ca-a and Ca-c
				CF1	Conversion Factor 1	1/24	day/hour	- -	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
			Indoor Air	CW	Chemical Concentration in Water	See Table 3.1	µg/l	See Table 3.1	Chronic Daily Intake (CDI) (mg/m3) =
				CA	Chemical Concentration in Air	See Table 3.4	mg/m^3	See Table 3.4	CA x ET x EF x ED x CF1 x 1/AT
				ET	Exposure Time	24	hr/day	EPA, 1991	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	CA calculated using Johnson and Ettinger model
				CF1	Conversion Factor 1	1/24	day/hour	- -	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
		Child/Adult	Yorktown-Eastover Aquifer - Water Vapors at Showerhead	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	Chronic Daily Intake (CDI) (mg/m3) =
				Ca-a	Air Concentration for shower, Adult	Calculated	mg/m^3	Calculated	(CAc x ETc x EDc + CAa x ETa x EDa) x EF x CF1 x 1/AT
				Ca-c	Air Concentration for shower, child	Calculated	mg/m^3	Calculated	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				EDa	Exposure Duration, Adult	24	years	EPA, 1991	Use Foster & Chrostowski Shower model to
				EDc	Exposure Duration, Child	6	years	EPA, 1991	calculate Ca-a and Ca-c
				ETa	Exposure Time	0.58	hr/day	EPA, 2004	
				ETc	Exposure Time	1	hr/day	EPA, 2004	
				CF1	Conversion Factor 1	1/24	day/hour	- -	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
			Indoor Air	CW	Chemical Concentration in Water	See Table 3.1	µg/l	See Table 3.1	Chronic Daily Intake (CDI) (mg/m3) =
				CA	Chemical Concentration in Air	See Table 3.4	mg/m^3	See Table 3.4	CA x ET x EF x ED x CF1 x 1/AT
				ET	Exposure Time	24	hr/day	EPA, 1991	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration, Resident	30	years	EPA, 1991	CA calculated using Johnson and Ettinger model
				CF1	Conversion Factor 1	1/24	day/hour	- -	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
	Industrial Worker	Adult	Indoor Air	CW	Chemical Concentration in Water	See Table 3.1	µg/l	See Table 3.1	Chronic Daily Intake (CDI) (mg/m3) =
				CA	Chemical Concentration in Air	See Table 3.4	mg/m^3	See Table 3.4	CA x ET x EF x ED x CF1 x 1/AT
				ET	Exposure Time	8	hr/day	(1)	
				EF	Exposure Frequency	250	days/year	EPA, 1991	CA calculated using Johnson and Ettinger model
				ED	Exposure Duration	25	years	EPA, 1991	
				CF1	Conversion Factor 1	1/24	day/hour	- -	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	EPA, 1989	

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Construction Worker	Adult	Yorktown-Eastover Aquifer - Water Vapors at Excavation Pit	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	Chronic Daily Intake (CDI) (mg/m3) =
				CA	Chemical Concentration in Air	calculated	mg/m^3		CA x ET x EF x ED x CF1 x 1/AT
				ET	Exposure Time	8	hr/day	(1)	
				EF	Exposure Frequency	125	days/year	VDEQ, 2010	
				ED	Exposure Duration	1	years	EPA, 1991	CA calculated using Virginia Voluntary Remediation
				CF1	Conversion Factor 1	1/24	day/hour	- -	Program Method
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	EPA, 1989	

Notes:

(1) Professional judgment based on construction activities that would occur 8 hrs per day for the RME.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 2004 . Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment (Final). EPA/540/R/99/005. July 2004.

VDEQ, 2010: Viriginia Department of Envirommental Quality, Voluntary Remediaion Program Risk Assessment Guidance.

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Trespasser/Visitor	Adult	Felgates Creek	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-W	Ingestion Rate of Water	0.05	liters/day	EPA, 1989	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	52	days/year	Prof Judgment (1)	
				ED	Exposure Duration	24	years	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
		Adolescent	Felgates Creek	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	CDI (mg/kg-day) =
				IR-W	Ingestion Rate of Water	0.05	liters/day	EPA, 1989	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	52	days/year	Prof Judgment (1)	
				ED	Exposure Duration	9	years	(2)	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	51	kg	EPA, 1997, (3)	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	
	Construction Worker	Adult	Felgates Creek	CW	Chemical Concentration in Water	See Table 3.1.RME	µg/l	See Table 3.1.RME	CDI (mg/kg-day) =
				IR-W	Ingestion Rate of Water	0.05	liters/day	EPA, 1989	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	10	days/year	Prof Judgment (4)	
				ED	Exposure Duration	1	years	EPA, 1991	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	EPA, 1989	

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Trespasser/Visitor	Adult	Felgates Creek	CW	Chemical Concentration in Water	See Table 3.1.RME	µg/l	See Table 3.1.RME	CDI (mg/kg-day) =
				DAevent	Dermally Absorbed Dose per Event	calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
				FA	Fraction absorbed water	chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	1	hr/event	Prof Judgment (1)	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Contact	5,700	cm^2	EPA,2004, (5)	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	52	days/year	Prof Judgment (1)	
				ED	Exposure Duration	24	years	EPA, 2004	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	70	kg	EPA, 1991	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	
		Adolescent	Felgates Creek	CW	Chemical Concentration in Water	See Table 3.1.RME	µg/l	See Table 3.1.RME	CDI (mg/kg-day) =
				DAevent	Dermally Absorbed Dose per Event	calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
				FA	Fraction absorbed water	chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	1	hr/event	Prof Judgment (1)	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Contact	4,046	cm^2	EPA, 2004 (5)	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	52	days/year	Prof Judgment (1)	
				ED	Exposure Duration	9	years	EPA, 2004	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	51	kg	EPA, 1997, (3)	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Current/Future
Medium: Surface Water
Exposure Medium: Surface Water

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
	Construction Worker	Adult	Felgates Creek	CW	Chemical Concentration in Water	See Table 3.1.RME	µg/l	See Table 3.1.RME	CDI (mg/kg-day) =
				DAevent	Dermally Absorbed Dose per Event	calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
				FA	Fraction absorbed water	chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	8	hr/day	(4)	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Contact	5,700	cm^2	EPA, 2004, (5)	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	10	days/year	Prof Judgment (4)	
				ED	Exposure Duration	1	years	EPA, 1991	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	70	kg	EPA, 1991	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	365	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	

(1) Professional judgment assuming 1 day per week for 52 weeks per year, and 1 hour per day (or event).

(2) Professional judgement assuming adolescents from 9 to 18 years of age.

(3) Body weight is average of the mean values for boys and girls for the ages 9 through 18.

(4) Professional judgment assuming construction worker in contact with surface water 10 days (2 weeks) per construction activity and 8 hours per day.

(5) The skin surface area includes hands, forearms, lower legs, and feet.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

EPA, 2004 . Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment (Final). EPA/540/R/99/005. July 2004.

TABLE 4.4.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Trespasser/Visitor	Adult	Sediment	CSed	Chemical Concentration in Sediment	See Table 3.2.RME	mg/kg	See Table 3.2.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-Sed	Ingestion Rate of Sediment	50	mg/day	EPA, 1991 (1)	CSed x IR-Sed x EF x ED x CF1 x 1/BW x 1/AT
				EF	Exposure Frequency	52	days/year	Prof Judgment (2)	
				ED	Exposure Duration	24	years	EPA, 1991	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
		Adolescent	Sediment	CSed	Chemical Concentration in Sediment	See Table 3.2.RME	mg/kg	See Table 3.2.RME	CDI (mg/kg-day) =
				IR-Sed	Ingestion Rate of Sediment	50	mg/day	EPA, 1991 (1)	CSed x IR-Sed x EF x ED x CF3 x 1/BW x 1/AT
				EF	Exposure Frequency	52	days/year	Prof Judgment (2)	
				ED	Exposure Duration	9	years	(3)	
				CF3	Conversion Factor 3	0.000001	kg/mg	- -	
				BW	Body Weight	51	kg	EPA, 1997, (4)	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	
	Construction Worker	Adult	Sediment	CSed	Chemical Concentration in Sediment	See Table 3.2.RME	mg/kg	See Table 3.2.RME	CDI (mg/kg-day) =
				IR-Sed	Ingestion Rate of Sediment	240	mg/day	EPA, 1991 (1)	CSed x IR-Sed x EF x ED x CF3 x 1/BW x 1/AT
				EF	Exposure Frequency	10	days/year	Prof Judgment (5)	
				ED	Exposure Duration	1	years	EPA, 1991	
				CF3	Conversion Factor 3	0.000001	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	EPA, 1989	

TABLE 4.4.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Trespasser/Visitor	Adult	Sediment	CSed	Chemical Concentration in Sediment	See Table 3.2.RME	mg/kg	See Table 3.2.RME	CDI (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	5,700	cm^2	EPA, 2004, (6)	CSed x SA x SSAF x DABS x CF1 x EF x
				SSAF	Soil to Skin Adherence Factor	0.3	mg/cm^2-day	EPA, 2004, (7)	ED x 1/BW x 1/AT
				DABS	Dermal Absorption Factor Solids	Chemical specific	--	EPA, 2004	
				CF1	Conversion Factor 1	0.000001	kg/mg	- -	
				EF	Exposure Frequency	52	days/year	(2)	
				ED	Exposure Duration	24	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
		Adolescent	Sediment	CSed	Chemical Concentration in Sediment	See Table 3.2.RME	mg/kg	See Table 3.2.RME	CDI (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	4,046	cm^2	EPA, 2004, (6)	CSed x SA x SSAF x DABS x CF3 x EF x
				SSAF	Soil to Skin Adherence Factor	0.2	mg/cm^2-day	EPA, 2004, (8)	ED x 1/BW x 1/AT
				DABS	Dermal Absorption Factor Solids	chem specific	--	EPA, 2004	
				CF3	Conversion Factor 3	0.000001	kg/mg	- -	
				EF	Exposure Frequency	52	days/year	(2)	
				ED	Exposure Duration	9	years	(3)	
				BW	Body Weight	51	kg	EPA, 1997, (4)	
				AT-C	Averaging Time (Cancer)	25550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3285	days	EPA, 1989	

TABLE 4.4.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Current/Future
Medium: Sediment
Exposure Medium: Sediment

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
	Construction Worker	Adult	Sediment	CSed	Chemical Concentration in Sediment	See Table 3.2.RME	mg/kg	See Table 3.2.RME	CDI (mg/kg-day) =
				SA	Skin Surface Area Available for Contact	5,700	cm^2	EPA, 2004, (6)	CSed x SA x SSAF x DABS x CF3 x EF x
				SSAF	Soil to Skin Adherence Factor	0.3	mg/cm^2-day	EPA, 2004, (7)	ED x 1/BW x 1/AT
				DABS	Dermal Absorption Factor Solids	chem specific	--	EPA, 2004	
				CF3	Conversion Factor 3	0.000001	kg/mg	- -	
				EF	Exposure Frequency	10	days/year	Prof Judgment (5)	
				ED	Exposure Duration	1	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	EPA, 1989	

(1) Professional Judgement assuming 1/2 the default value for the residential and construction worker soil scenarios.
(2) Professional Judgment assuming 1 day per week for 52 weeks per year
(3) Professional Judgement assuming adolescents from 9 to 18 years of age.
(4) Body weight is average of the mean values for boys and girls for the ages 9 through 18.
(5) Professional judgment assuming construction worker in contact with sediment 10 days (2 weeks) per construction activity.
(6) The skin surface area includes hands, forearms, lower legs, and feet.
(7) RME SSAF is geometric mean soil adherence factor for reed gatherers.
(8) RME SSAF is geometric mean soil adherence factor for children playing in wet soil.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.
EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.
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EPA, 2004 . Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment (Final). EPA/540/R/99/005. July 2004.

TABLE 4.1.CTE

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.CTE	µg/l	See Table 3.1.CTE	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-W	Ingestion Rate of Water	1.4	liters/day	EPA, 1993	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				ED	Exposure Duration	9	years	EPA, 1993	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	
		Child	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.CTE	µg/l	See Table 3.1.CTE	CDI (mg/kg-day) =
				IR-W	Ingestion Rate of Water	1	liters/day	EPA, 1997	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				ED	Exposure Duration	6	years	EPA, 1991	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
		Child/Adult	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.CTE	µg/l	See Table 3.1.CTE	CDI (mg/kg-day) =
				IR-W-A	Ingestion Rate of Water, Adult	1.4	liters/day	EPA, 1993	CW x IR-W-Adj x EF x CF2 x 1/AT
				IR-W-C	Ingestion Rate of Water, Child	1	liters/day	EPA, 1997	
				IR-W-Adj	Ingestion Rate of Water, Age-adjusted	0.58	liter-year/kg-day	calculated	IR-W-Adj (liter-year/kd-day) =
				EF	Exposure Frequency	234	days/year	EPA, 1993	(ED-C x IR-W-C / BW-C) +
				ED-A	Exposure Duration, Adult	9	years	EPA, 1993	(ED-A x IR-W-A / BW-A)
				ED-C	Exposure Duration, Child	6	years	EPA, 1991	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW-A	Body Weight , Adult	70	kg	EPA, 1991	
				BW-C	Body Weight, Child	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	

TABLE 4.1.CTE

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inestion	Industrial Worker	Adult	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.CTE	µg/l	See Table 3.1.CTE	CDI (mg/kg-day) =
				IR-W	Ingestion Rate of Water	1	liters/day	EPA, 1991	CW x IR-W x EF x ED x CF2 x 1/BW x 1/AT
				EF	Exposure Frequency	219	days/year	EPA, 2004	
				ED	Exposure Duration	9	years	EPA, 2004	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	
Dermal	Resident	Adult	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.CTE	µg/l	See Table 3.1.CTE	CDI (mg/kg-day) =
				DAevent	Dermally Absorbed Dose per Event	Calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
				FA	Fraction absorbed water	Chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	Chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	Chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	Chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	Chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	0.25	hr/event	EPA, 2004	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Contact	18,000	cm^2	EPA, 2004	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				ED	Exposure Duration	9	years	EPA, 2004	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	70	kg	EPA, 1991	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	

TABLE 4.1.CTE

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Resident	Child	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.CTE	µg/l	See Table 3.1.CTE	CDI (mg/kg-day) =
				DAevent	Dermally Absorbed Dose per Event	Calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
				FA	Fraction absorbed water	Chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	Chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	Chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	Chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	Chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	0.33	hr/event	EPA, 2004	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Contact	6,600	cm^2	EPA, 2004	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				ED	Exposure Duration	6	years	EPA, 2001	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	15	kg	EPA, 1991	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	
		Child/Adult	Yorktown-Eastover Aquifer - Tap Water	CW	Chemical Concentration in Water	See Table 3.1.CTE	µg/l	See Table 3.1.CTE	CDI (mg/kg-day) = DA-Adj x EF x 1/AT
				DAevent-A	Dermally Absorbed Dose per Event, Adult	Calculated	mg/cm^2-event	calculated	
				DAevent-C	Dermally Absorbed Dose per Event, Child	Calculated	mg/cm^2-event	calculated	DA-Adj = (Daevent-A x SA-A x ED-A x 1/BW-A)
				DA-Adj	Dermally Absorbed Dose, Age-adjusted	Calculated	mg-year/event-kg	calculated	+ (Daevent-C x SA-C x ED-C x 1/BW-C)
				FA	Fraction absorbed water	Chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	Chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	Chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	Chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	Chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}-A	Event Time, Adult	0.25	hr/event	EPA, 2004	t_{event}<t*: DAevent (mg/cm^2-event) =
				t_{event}-C	Event Time, Child	0.33	hr/event	EPA, 2004	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				SA-A	Skin Surface Area, Adult	18,000	cm^2	EPA, 2004	x CF2 x CF3
				SA-C	Skin Surface Area, Child	6,600	cm^2	EPA, 2004	
				EV	Event Frequency	1	events/day	EPA, 2004	t_{event}>t*: DAevent (mg/cm^2-event) =
				EF	Exposure Frequency	234	days/year	EPA, 1993	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				ED-A	Exposure Duration, Adult	9	years	EPA, 2001	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				ED-C	Exposure Duration, Child	6	years	EPA, 2001	
				BW-A	Body Weight, Adult	70	kg	EPA, 1991	
				BW-C	Body Weight, Child	15	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	

TABLE 4.1.CTE

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Construction Worker	Adult	Yorktown-Eastover Aquifer - Excavation Pit	CW	Chemical Concentration in Water	See Table 3.2.CTE	µg/l	See Table 3.2.CTE	CDI (mg/kg-day) =
				DAevent	Dermally Absorbed Dose per Event	Calculated	mg/cm^2-event	calculated	DAevent x SA x EV x EF x ED x 1/BW x 1/AT
				FA	Fraction absorbed water	Chemical specific	dimensionless	EPA, 2004	
				K_p	Permeability Coefficient	Chemical specific	cm/hr	EPA, 2004	Inorganics: DAevent (mg/cm^2-event) =
				τ	Lag Time	Chemical specific	hr/event	EPA, 2004	Kp x CW x t_{event} x CF2 x CF3
				t*	Time to Reach Steady-state	Chemical specific	hours	EPA, 2004	
				B	Ratio of Permeability of Stratum Corneum to Epidermis	Chemical specific	dimensionless	EPA, 2004	Organics :
				t_{event}	Event Time	4	hr/day	(1)	t_{event}<t*: DAevent (mg/cm^2-event) =
				SA	Skin Surface Area Available for Contact	5,700	cm^2	EPA, 2004, (2)	2 x FA x Kp x CW x (sqrt((6 x τ x t_{event})/π))
				EV	Event Frequency	1	events/day	EPA, 2004	x CF2 x CF3
				EF	Exposure Frequency	125	days/year	VDEQ, 2010	
				ED	Exposure Duration	1	years	EPA, 1991	t_{event}>t*: DAevent (mg/cm^2-event) =
				BW	Body Weight	70	kg	EPA, 1991	FA x Kp x CW x (t_{event}/(1+B) + 2 x τ x
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	((1 + 3B + $3B^2$)/$(1+B)^2$)) x CF2 x CF3
				AT-N	Averaging Time (Non-Cancer)	365	days	EPA, 1989	
				CF2	Conversion Factor 2	0.001	mg/µg	- -	
				CF3	Conversion Factor 3	0.001	l/cm^3	- -	

(1) Professional judgment assuming 1/2 RME value for CT.

(2) Skin surface area in contact with groundwater assumed to be hands, forearms, lower legs, and feet.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

EPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

EPA, 2004 . Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment (Final). EPA/540/R/99/005. July 2004.

VDEQ, 2010: Viriginia Department of Enviromental Quality, Voluntary Remediaion Program Risk Assessment Guidance.

TABLE 4.2.CTE
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Resident	Adult	Yorktown-Eastover Aquifer - Water Vapors at Showerhead	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	Chronic Daily Intake (CDI) (mg/m3) =
				CAa	Chemical Concentration in Air from Show	Calculated	mg/m^3	Calculated	CAa x ETa x EDa x EF x CF1 x 1/AT
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				EDa	Exposure Duration	9	years	EPA, 1993	Use Foster & Chrostowski Shower model to
				ETa	Exposure Time	0.25	hr/day	EPA, 2004	calculate Ca-a and Ca-c
				CF1	Conversion Factor 1	1/24	day/hour	- -	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3,285	days	EPA, 1989	
			Yorktown-Eastover Aquifer - Vapor Intrusion to Indoor Air	CW	Chemical Concentration in Water	See Table 3.3.CTE	µg/l	See Table 3.3.CTE	Chronic Daily Intake (CDI) (mg/m3) =
				CA	Chemical Concentration in Air	See Table 3.4.CTE	mg/m^3	See Table 3.4.CTE	CA x ET x ED x EF x CF1 x 1/AT
				ET	Exposure Time	24	hr/day	EPA, 1991	
				EF	Exposure Frequency	234	days/year	EPA, 1993	CA calculated using Johnson and Ettinger model
				ED	Exposure Duration	9	years	EPA, 1993	
				CF1	Conversion Factor 1	1/24	day/hour	- -	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	EPA, 1989	
		Child	Yorktown-Eastover Aquifer - Water Vapors at Showerhead	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	Chronic Daily Intake (CDI) (mg/m3) =
				CAc	Chemical Concentration in Air from Show	Calculated	mg/m^3	Calculated	CA_c x ET_c x ED_c x EF x CF1 x 1/AT
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				EDc	Exposure Duration	6	years	EPA, 1991	Use Foster & Chrostowski Shower model to
				ETc	Exposure Time	0.33	hr/day	EPA, 2004	calculate Ca-a and Ca-c
				CF1	Conversion Factor 1	1/24	day/hour	- -	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	
			Yorktown-Eastover Aquifer - Vapor Intrusion to Indoor Air	CW	Chemical Concentration in Water	See Table 3.3.CTE	µg/l	See Table 3.3.CTE	Chronic Daily Intake (CDI) (mg/m3) =
				CA	Chemical Concentration in Air	See Table 3.4.CTE	mg/m3	See Table 3.4.CTE	CA x ET x ED x EF x CF1 x 1/AT
				ET	Exposure Time	24	hr/day	EPA, 1991	
				EF	Exposure Frequency	234	days/year	EPA, 1993	CA calculated using Johnson and Ettinger model
				ED	Exposure Duration	6	years	EPA, 1991	
				CF1	Conversion Factor 1	1/24	day/hour	- -	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	EPA, 1989	

TABLE 4.2.CTE
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
		Child/Adult	Yorktown-Eastover Aquifer - Water Vapors at Showerhead	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	Chronic Daily Intake (CDI) (mg/m3) =
				Ca-a	Air Concentration for shower, Adult	Calculated	mg/m^3	Calculated	(CAc x ETc x EDc + CAa x ETa x EDa) x EF x CF1 x 1/AT
				Ca-c	Air Concentration for shower, child	Calculated	mg/m^3	Calculated	
				EF	Exposure Frequency	234	days/year	EPA, 1993	
				EDa	Exposure Duration, Adult	9	years	EPA, 1993	Use Foster & Chrostowski Shower model to
				EDc	Exposure Duration, Child	6	years	EPA, 1991	calculate Ca-a and Ca-c
				ETa	Exposure Time	0.25	hr/day	EPA, 2004	
				ETc	Exposure Time	0.33	hr/day	EPA, 2004	
				CF1	Conversion Factor 1	1/24	day/hour	- -	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
			Yorktown-Eastover Aquifer - Vapor Intrusion to Indoor Air	CW	Chemical Concentration in Water	See Table 3.1	µg/l	See Table 3.1	Chronic Daily Intake (CDI) (mg/m3) =
				CA	Chemical Concentration in Air	See Table 3.2	mg/m^3	See Table 3.2	CA x ET x ED x EF x CF1 x 1/AT
				ET	Exposure Time	24	hr/day	EPA, 1991	
				EF	Exposure Frequency	234	days/year	EPA, 1993	CA calculated using Johnson and Ettinger model
				ED	Exposure Duration, Resident	15	years	EPA, 1993	
				CF1	Conversion Factor 1	1/24	day/hour	- -	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	

TABLE 4.2.CTE

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Industrial Worker	Adult	Yorktown-Eastover Aquifer - Vapor Intrusion to Indoor Air	CW	Chemical Concentration in Water	See Table 3.1.RME	µg/l	See Table 3.1.RME	Chronic Daily Intake (CDI) (mg/kg-day) =
				CA	Chemical Concentration in Air	See Table 3.2.RME	mg/m^3	See Table 3.2.RME	CA x IN x ET x EF x ED x 1/BW x 1/AT
				IN	Inhalation Rate	0.83	m^3/hr	EPA, 1997	
				ET	Exposure Time	8	hr/day	(2)	
				EF	Exposure Frequency	219	days/year	EPA, 2004	CA calculated using Johnson and Ettinger model
				ED	Exposure Duration	9	years	EPA, 2004	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9,125	days	EPA, 1989	
	Construction Worker	Adult	Yorktown-Eastover Aquifer - Water Vapors at Excavation Pit	CW	Chemical Concentration in Water	See Table 3.2.RME	µg/l	See Table 3.2.RME	Chronic Daily Intake (CDI) (mg/m3) =
				CA	Chemical Concentration in Air	calculated	mg/m^3		CA x ET x EF x ED x CF1 x 1/AT
				ET	Exposure Time	4	hr/day	(1)	
				EF	Exposure Frequency	125	days/year	VDEQ, 2010	
				ED	Exposure Duration	1	years	EPA, 1991	CA calculated using Virginia Voluntary Remediation
				CF1	Conversion Factor 1	1/24	day/hour	- -	Program Method
				AT-C	Averaging Time (Cancer)	25,550	days	EPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	EPA, 1989	

Notes:

(1) Professional judgment assuming 1/2 RME value for CT.

(2) Assumed contact with groundwater during construction project would be 125 days/year.

(3) Assumed that worker would be present 8 hrs per day.

Sources:

EPA, 1989: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

EPA, 1991: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER Directive 9285.6-03.

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EPA, 1997: Exposure Factors Handbook. EPA/600/P-95/002Fa.

EPA, 2004 . Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment (Final). EPA/540/R/99/005. July 2004.

VDEQ, 2010: Viriginia Department of Envirommental Quality, Voluntary Remediaion Program Risk Assessment Guidance.

TABLE 5.1
NON-CANCER TOXICITY DATA -- ORAL/DERMAL
Site 6
NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3) (MM/DD/YY)
1,1-Dichloroethane	Chronic	2.0E-01	mg/kg-day	Generally > 50%	2.0E-01	mg/kg-day	Kidney	3000	PPRTV	9/27/2006
	Subchronic	2.0E+00	mg/kg-day	Generally > 50%	2.0E+00	mg/kg-day	Kidney	300	PPRTV	9/27/2006
1,2-Dichloroethane	Chronic	2.0E-02	mg/kg-day	Generally > 50%	2.0E-02	mg/kg-day	Kidney	3000/1	PPRTV	5/6/2009
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloroethene	Chronic	9.0E-03	mg/kg/day	Generally > 50%	9.0E-03	mg/kg/day	Liver	1000	HEAST	7/1/1997
	Subchronic	9.0E-03	mg/kg/day	Generally > 50%	9.0E-03	mg/kg/day	Liver	1000	HEAST	7/1/1997
Benzene	Chronic	4.0E-03	mg/kg-day	Generally > 50%	4.0E-03	mg/kg-day	Blood, Immune	300/1	IRIS	1/6/2010
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethene	Chronic	1.0E-02	mg/kg/day	Generally > 50%	1.0E-02	mg/kg/day	Blood	3000	PPRTV	3/1/2006
	Subchronic	1.0E-01	mg/kg/day	Generally > 50%	1.0E-01	mg/kg/day	Blood	300	PPRTV	5/6/2009
Tetrachloroethene	Chronic	1.0E-02	mg/kg/day	Generally > 50%	1.0E-02	mg/kg/day	Liver, Body Weight	1000/1	IRIS	1/6/2010
	Subchronic	1.0E-01	mg/kg/day	Generally > 50%	1.0E-01	mg/kg/day	Liver	100	HEAST	7/1/1997
trans-1,2-Dichloroethene	Chronic	2.0E-02	mg/kg/day	Generally > 50%	2.0E-02	mg/kg/day	Blood	1000/1	IRIS	1/6/2010
	Subchronic	2.0E-01	mg/kg/day	Generally > 50%	2.0E-01	mg/kg/day	Blood	100	HEAST	07/01/97
Trichloroethene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl chloride	Chronic	3.0E-03	mg/kg-day	Generally > 50%	3.0E-03	mg/kg-day	Liver	30/1	IRIS	1/6/2010
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dinitrotoluene	Chronic	2.0E-03	mg/kg-day	Generally > 50%	2.0E-03	mg/kg-day	CNS, Blood, Biliary Tract	100	IRIS	1/6/2010
	Subchronic	2.0E-03	mg/kg-day	generally > 50%	2.0E-03	mg/kg-day	CNS, Blood, Biliary Tract	100	HEAST	07/01/97
Nitrobenzene	Chronic	2.0E-03	mg/kg-day	generally > 50%	2.0E-03	mg/kg-day	Blood	1000/1	IRIS	1/6/2010
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,3-Dinitrobenzene	Chronic	1.0E-04	mg/kg-day	Generally > 50%	1.0E-04	mg/kg-day	Spleen	3000/1	IRIS	1/6/2010
	Subchronic	1.0E-03	mg/kg-day	generally > 50%	1.0E-03	mg/kg-day	Spleen	100	HEAST	07/01/97
2-Amino-4,6-dinitrotoluene	Chronic	2.0E-03	mg/kg-day	generally > 50%	2.0E-03	mg/kg-day	CNS, Blood, Biliary Tract	100	IRIS	1/6/2010
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3,5-Dinitroaniline	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RDX	Chronic	3.0E-03	mg/kg-day	generally > 50%	3.0E-03	mg/kg-day	Prostrate	100/1	IRIS	01/06/10
	Subchronic	3.0E-03	mg/kg-day	generally > 50%	3.0E-03	mg/kg-day	Prostrate	100/1	HEAST	07/01/97
Aluminum	Chronic	1.0E+00	mg/kg-day	NA	1.0E+00	mg/kg-day	Neurological, Developmental	100	PPRTV	10/23/2006
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Site 6

NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3) (MM/DD/YY)
Antimony	Chronic	4.0E-04	mg/kg-day	15%	6.0E-05	mg/kg-day	Longevity, Blood	1000/1	IRIS	1/6/2010
	Subchronic	4.0E-04	mg/kg-day	15%	6.0E-05	mg/kg-day	Whole Body, Blood	1000	PPRTV	7/29/2008
Arsenic	Chronic	3.0E-04	mg/kg-day	95%	3.0E-04	mg/kg-day	Skin, Vascular	3/1	IRIS	10/22/2009
	Subchronic	3.0E-04	mg/kg-day	95%	3.0E-04	mg/kg-day	Skin, Vascular	3	HEAST	7/1/1997
Beryllium	Chronic	2.0E-03	mg/kg-day	0.07%	1.4E-06	mg/kg-day	Intestine	300	IRIS	1/6/2010
	Subchronic	5.0E-03	mg/kg-day	0.07%	3.5E-06	mg/kg-day	Lifetime	100	HEAST	7/1/1997
Cadmium (water)	Chronic	5.0E-04	mg/kg-day	5%	2.5E-05	mg/kg-day	Blood	10/1	IRIS	1/6/2010
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (hexavalent)	Chronic	3.0E-03	mg/kg-day	2.5%	7.5E-05	mg/kg-day	Not identified	300/3	IRIS	1/6/2010
	Subchronic	2.0E-02	mg/kg-day	2.5%	5.0E-04	mg/kg-day	Not identified	100	HEAST	7/1/1997
Cobalt	Chronic	3.0E-04	mg/kg-day	N/A	3.0E-04	mg/kg/day	Thyroid	1000	PPRTV	8/25/2008
	Subchronic	3.0E-03	mg/kg-day	N/A	3.0E-03	mg/kg/day	Thyroid	300	PPRTV	8/25/2008
Iron	Chronic	7.0E-01	mg/kg-day	N/A	7.0E-01	mg/kg-day	Gastrointestinal	1.5	PPRTV	9/11/2006
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	2.4E-02	mg/kg-day	4%	9.6E-04	mg/kg-day	CNS	1/1	IRIS	1/6/2010
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel	Chronic	2.0E-02	mg/kg-day	4%	8.0E-04	mg/kg-day	Decreased Body Weight, Decreased Organ Weights	300/1	IRIS	1/6/2010
	Subchronic	2.0E-02	mg/kg-day	4%	8.0E-04	mg/kg-day	Whole body	300	HEAST	7/1/1997
Selenium	Chronic	5.0E-03	mg/kg-day	30 - 80%	5.0E-03	mg/kg-day	Whole Body	3/1	IRIS	1/6/2010
	Subchronic	5.0E-03	mg/kg-day	30 - 80%	5.0E-03	mg/kg-day	Whole Body	3	HEAST	7/1/1997
Vanadium	Chronic	5.0E-03	mg/kg-day	2.6%	1.3E-04	mg/kg-day	Hair, Blood	100	IRIS	1/6/2010
	Subchronic	7.0E-03	mg/kg-day	2.6%	1.8E-04	mg/kg-day	Lifetime	100	HEAST	7/1/1997
Zinc	Chronic	3.0E-01	mg/kg-day	Variable	3.0E-01	mg/kg-day	Blood	3/1	IRIS	1/6/2010
	Subchronic	3.0E-01	mg/kg-day	Variable	3.0E-01	mg/kg-day	Blood	3	HEAST	7/1/1997

(1) Source: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evolution Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). Final. Section 4.2 and Exhibit 4-1. USEPA recommends that the oral RfD should not be adjusted to estimate the absorbed dose for compounds when the absorption efficiency is greater than 50%. Constituents that do not have oral absorption efficiencies reported on this table were assumed to have an oral absorption efficiency of 100%.

(2) Adjusted Dermal RfD = RfD (oral) x Absorption Efficiency or ABS_{GI}

(2) For IRIS values, the date IRIS was searched.
For HEAST values, the date of HEAST.
For PPRTV values, the date of the PPRTV document.

Definitions: HEAST= Health Effects Assessment Summary Tables
IRIS = Integrated Risk Information System
N/A = Not Applicable or Not Available.
PPRTV = Provisional Peer-Reviewed Toxicity Values
CNS = Central Nervous System
N/A = Not Applicable or Not Available

TABLE 5.2
NON-CANCER TOXICITY DATA -- INHALATION
Site 6
NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted Inhalation RfD (1)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (2) (MM/DD/YY)
1,1-Dichloroethane	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloroethane	Chronic	2.4E+00	mg/m^3	6.9E-01	mg/kg-day	Kidney	300	ATSDR MRL (RSL)	6/16/2009
	Subchronic	N/A	mg/m^2	N/A	mg/kg-day	N/A	N/A	N/A	N/A
1,2-Dichloroethene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	Chronic	3.0E-02	mg/m3	8.6E-03	mg/kg-day	Blood, Immune	300/1	IRIS	1/6/2010
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	Chronic	2.7E-01	mg/m3	7.7E-02	mg/kg-day	Kidney, Liver	N/A	ASTDR	9/97
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,2-Dichloroethene	Chronic	6.0E-02	mg/m3	1.7E-02	mg/kg-day	Kidney	3000	PPRTV	10/02
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl chloride	Chronic	1.0E-01	mg/m^3	2.9E-02	mg/kg-day	Liver	30/1	IRIS	1/6/2010
	Subchronic	N/A	mg/m^3	N/A	mg/kg-day	N/A	N/A	N/A	N/A
2,4-Dinitrotoluene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nitrobenzene	Chronic	9.0E-03	mg/m^3	2.6E-03	mg/kg-day	Lungs, Nose	30/1	IRIS	1/6/2010
	Subchronic	1.8E-02	mg/m3	5.0E-03	mg/kg-day	Blood, Adrenal Glands, Kidney, Liver	1000	HEAST	07/01/97
1,3-Dinitrobenzene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Amino-4,6-dinitrotoluene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3,5-Dinitroaniline	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RDX	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aluminum	Chronic	5.0E-03	mg/m^3	1.4E-03	mg/kg-day	Neurological	300	PPRTV	10/23/2006
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Antimony	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	Chronic	1.5E-05	mg/m^3	4.3E-06	mg/kg-day	Developmental, Cardiovascular, Nervous System	3/1	Cal EPA	1/6/2010
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 5.2
NON-CANCER TOXICITY DATA -- INHALATION
Site 6
NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted Inhalation RfD (1)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (2) (MM/DD/YY)
Beryllium	Chronic	2.0E-05	mg/m^3	5.7E-06	mg/kg-day	Lungs	10/1	IRIS	1/6/2010
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	Chronic	1.0E-05	mg/m3	2.9E-06	mg/kg-day	Kidney	N/A	ASTDR	9/08
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (hexavalent)	Chronic	1.0E-04	mg/m^3	2.9E-05	mg/kg-day	Respiratory System	300/1	IRIS	1/6/2010
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cobalt	Chronic	6.0E-06	mg/m^3	1.7E-06	mg/kg-day	Respiratory System	100	PPRTV	8/25/2008
	Subchronic	2.0E-05	mg/m^3	5.7E-06	mg/kg-day	Respiratory System	100	PPRTV	8/25/2008
Iron	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	Chronic	5.0E-05	mg/m3	1.4E-05	mg/kg-day	CNS	1000/1	IRIS	1/6/2010
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel	Chronic	9.0E-05	mg/m3	2.6E-05	mg/kg-day	Respiratory System	N/A	ATSDR	08/01/05
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	Chronic	2.0E-02	mg/m3	5.7E-03	mg/kg-day	Respiratory System	30/1	Cal EPA	1/6/2010
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Subchronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A = Not Applicable

(1) Inhalation RfD = RfC x 20 m3/day x 1/70 kg

(2) For IRIS values, the date IRIS was searched.

For Cal EPA values, the date Cal EPA database was searched.

For PPRTV values, the date of the PPRTV document.

For ATSDR values, the date of the ATSDR toxicity profile.

For HEAST values, the date of HEAST.

Definitions: Cal EPA = California EPA

IRIS = Integrated Risk Information System

N/A = Not Applicable or Not Available.

ATSDR = Agency for Toxic Substances and Disease Registry

CNS = Central Nervous System

HEAST= Health Effects Assessment Summary Tables

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

Site 6

NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor (1)	Units	EPA Carcinogen Group	Source	Date (2) (MM/DD/YY)
1,1-Dichloroethane	5.7E-03	Generally > 50%	5.7E-03	$(mg/kg\text{-}day)^{-1}$	N/A	CalEPA	1/6/2010
1,2-Dichloroethane	9.1E-02	Generally > 50%	9.1E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/6/2010
1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	5.5E-02	Generally > 50%	5.5E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	1/6/2010
cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	5.4E-01	Generally > 50%	5.4E-01	$(mg/kg\text{-}day)^{-1}$	B2	CalEPA	1/6/2010
trans-1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	5.9E-03	Generally > 50%	5.9E-03	$(mg/kg\text{-}day)^{-1}$	2A	CalEPA	1/6/2010
Vinyl Chloride	7.2E-01	Generally > 50%	7.2E-01	$(mg/kg\text{-}day)^{-1}$	A	IRIS	1/6/2010
2,4-Dinitrotoluene	3.1E-01	Generally > 50%	3.1E-01	$(mg/kg\text{-}day)^{-1}$	2B	CalEPA	1/6/2010
Nitrobenzene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3,5-Dinitroaniline	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RDX	1.1E-01	Generally > 50%	1.1E-01	$(mg/kg\text{-}day)^{-1}$	C	IRIS	1/6/2010
Aluminum	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Antimony	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	1.5E+00	95%	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	1/6/2010
Beryllium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium	5.0E-01	2.5%	1.3E-02	N/A	D	New Jersey	1/4/2010
Cobalt	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A-Not available

IRIS = Integrated Risk Information System

CalEPA = California EPA

New Jersey = New Jersey EPA

(1) Refer to RAGS, Part E. July 2004.

(2) For IRIS values, the date IRIS was searched.
For CalEPA values, the date Cal EPA database was searched.

EPA Carcinogen Group:

A - Human carcinogen

A2 - Suspected human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

IARC Classification

2B - The agent is possibly carcinogenic to humans

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

Site 6

NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Unit Risk	Units	Adjustment (1)	Inhalation Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guidance Description	Source	Date (2) (MM/DD/YY)
1,1-Dichloroethane	1.6E-06	$(ug/m3)^{-1}$	3500	5.6E-03	$(mg/kg\text{-}day)^{-1}$	C	CalEPA	1/6/2010
1,2-Dichloroethane	2.6E-05	$(ug/m3)^{-1}$	3500	9.1E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	1/6/2010
1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	7.8E-06	$(ug/m3)^{-1}$	3500	2.7E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	1/6/2010
cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	5.9E-06	$(ug/m3)^{-1}$	3500	2.1E-02	$(mg/kg\text{-}day)^{-1}$	2A	CalEPA	1/6/2010
trans-1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	01/06/10
Trichloroethene	2.0E-06	$(ug/m3)^{-1}$	3500	7.0E-03	$(mg/kg\text{-}day)^{-1}$	2A	CalEPA	1/6/2010
Vinyl chloride	4.4E-06	$(ug/m3)^{-1}$	3500	1.5E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	1/6/2010
2,4-Dinitrotoluene	8.9E-05	$(ug/m3)^{-1}$	3500	3.1E-01	$(mg/kg\text{-}day)^{-1}$	2B	CalEPA	1/6/2010
Nitrobenzene	4.0E-05	$(ug/m3)^{-1}$	3500	1.4E-01	$(mg/kg\text{-}day)^{-1}$	likely carcinogen to humans	IRIS	1/6/2010
1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3,5-Dinitroaniline	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RDX	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aluminum	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Antimony	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	4.3E-03	$(ug/m3)^{-1}$	3500	1.5E+01	$(mg/kg\text{-}day)^{-1}$	A	IRIS	1/6/2010
Beryllium	2.4E-03	$(ug/m3)^{-1}$	3500	8.4E+00	$(mg/kg\text{-}day)^{-1}$	B1	IRIS	1/6/2010
Cadmium	1.8E-03	$(ug/m3)^{-1}$	3500	6.3E+00	$(mg/kg\text{-}day)^{-1}$	B1	IRIS	1/6/2010
Chromium (hexavalent)	8.4E-02	$(ug/m3)^{-1}$	3500	2.9E+02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	1/4/2010
Cobalt	9.0E-03	$(ug/m3)^{-1}$	3500	3.2E+01	$(mg/kg\text{-}day)^{-1}$	B1	PPRTV	8/25/2008
Iron	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel	2.6E-04	$(ug/m3)^{-1}$	3500	9.1E-01	$(mg/kg\text{-}day)^{-1}$	A	CalEPA	1/6/2010
Selenium	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

IRIS = Integrated Risk Information System
PPRTV = Provisional Peer-Reviewed Toxicity Value
CalEPA = California EPA
N/A = Not Available

(1) Adjustment Factor applied to Unit Risk to calculate Inhalation Slope Factor = 70kg x 1/20m3/day x 1000ug/mg

(2) For IRIS values, the date IRIS was searched.
For PPRTV values, the date of the PPRTV document.
For Cal EPA values, the date Cal EPA database was searched.

EPA Group:
A - Human carcinogen
A2 - Suspected human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

IARC Classification
2B - The agent is possibly carcinogenic to humans

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water	Ingestion	1,1-Dichloroethane	1.1E+00	µg/L	N/A		N/A		N/A	3.0E-05	mg/kg/day	2.0E-01	mg/kg/day	1.5E-04
				1,2-Dichloroethane	2.5E-01	µg/L	N/A		N/A		N/A	6.8E-06	mg/kg/day	2.0E-02	mg/kg/day	3.4E-04
				Benzene	1.6E+00	µg/L	N/A		N/A		N/A	4.4E-05	mg/kg/day	4.0E-03	mg/kg/day	1.1E-02
				cis-1,2-Dichloroethene	5.7E+03	µg/L	N/A		N/A		N/A	1.6E-01	mg/kg/day	1.0E-02	mg/kg/day	1.6E+01
				Tetrachloroethene	3.0E+03	µg/L	N/A		N/A		N/A	8.2E-02	mg/kg/day	1.0E-02	mg/kg/day	8.2E+00
				trans-1,2-Dichloroethene	1.3E+01	µg/L	N/A		N/A		N/A	3.5E-04	mg/kg/day	2.0E-02	mg/kg/day	1.8E-02
				Trichloroethene	1.7E+05	µg/L	N/A		N/A		N/A	4.7E+00	mg/kg/day	N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	N/A		N/A		N/A	8.1E-04	mg/kg/day	3.0E-03	mg/kg/day	2.7E-01
				2,4-Dinitrotoluene	3.6E+01	µg/L	N/A		N/A		N/A	9.9E-04	mg/kg/day	2.0E-03	mg/kg/day	4.9E-01
				Nitrobenzene	6.8E-01	µg/L	N/A		N/A		N/A	1.9E-05	mg/kg/day	2.0E-03	mg/kg/day	9.4E-03
				1,3-Dinitrobenzene	3.7E-01	µg/L	N/A		N/A		N/A	1.0E-05	mg/kg/day	1.0E-04	mg/kg/day	1.0E-01
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	N/A		N/A		N/A	2.0E-01	mg/kg/day	2.0E-03	mg/kg/day	1.0E+02
				RDX	2.3E+01	µg/L	N/A		N/A		N/A	6.3E-04	mg/kg/day	3.0E-03	mg/kg/day	2.1E-01
				Antimony, Dissolved	9.8E+01	µg/L	N/A		N/A		N/A	2.7E-03	mg/kg/day	4.0E-04	mg/kg/day	6.7E+00
				Arsenic, Dissolved	1.9E+01	µg/L	N/A		N/A		N/A	5.2E-04	mg/kg/day	3.0E-04	mg/kg/day	1.7E+00
				Beryllium, Dissolved	9.1E+00	µg/L	N/A		N/A		N/A	2.5E-04	mg/kg/day	2.0E-03	mg/kg/day	1.2E-01
				Cadmium, Dissolved	8.5E+00	µg/L	N/A		N/A		N/A	2.3E-04	mg/kg/day	5.0E-04	mg/kg/day	4.7E-01
				Chromium, Dissolved	7.6E+00	µg/L	N/A		N/A		N/A	2.1E-04	mg/kg/day	3.0E-03	mg/kg/day	6.9E-02
				Cobalt, Dissolved	8.9E+01	µg/L	N/A		N/A		N/A	2.4E-03	mg/kg/day	3.0E-04	mg/kg/day	8.1E+00
				Iron, Dissolved	4.2E+03	µg/L	N/A		N/A		N/A	1.1E-01	mg/kg/day	7.0E-01	mg/kg/day	1.6E-01
				Manganese, Dissolved	1.9E+02	µg/L	N/A		N/A		N/A	5.3E-03	mg/kg/day	2.4E-02	mg/kg/day	2.2E-01
				Nickel, Dissolved	4.4E+01	µg/L	N/A		N/A		N/A	1.2E-03	mg/kg/day	2.0E-02	mg/kg/day	6.1E-02
				Selenium, Dissolved	1.3E+01	µg/L	N/A		N/A		N/A	3.6E-04	mg/kg/day	5.0E-03	mg/kg/day	7.1E-02
				Vanadium, Dissolved	9.1E+01	µg/L	N/A		N/A		N/A	2.5E-03	mg/kg/day	5.0E-03	mg/kg/day	5.0E-01
				Zinc, Dissolved	2.3E+03	µg/L	N/A		N/A		N/A	6.2E-02	mg/kg/day	3.0E-01	mg/kg/day	2.1E-01
			Exp. Route Total								N/A					1.4E+02
			Dermal	1,1-Dichloroethane	1.1E+00	µg/L	N/A		N/A		N/A	2.4E-06	mg/kg/day	2.0E-01	mg/kg/day	1.2E-05
				1,2-Dichloroethane	2.5E-01	µg/L	N/A		N/A		N/A	3.4E-07	mg/kg/day	2.0E-02	mg/kg/day	1.7E-05
				Benzene	1.6E+00	µg/L	N/A		N/A		N/A	6.7E-06	mg/kg/day	4.0E-03	mg/kg/day	1.7E-03
				cis-1,2-Dichloroethene	5.7E+03	µg/L	N/A		N/A		N/A	1.4E-02	mg/kg/day	1.0E-02	mg/kg/day	1.4E+00
				Tetrachloroethene	3.0E+03	µg/L	N/A		N/A		N/A	5.0E-02	mg/kg/day	1.0E-02	mg/kg/day	5.0E+00
				trans-1,2-Dichloroethene	1.3E+01	µg/L	N/A		N/A		N/A	3.2E-05	mg/kg/day	2.0E-02	mg/kg/day	1.6E-03
				Trichloroethene	1.7E+05	µg/L	N/A		N/A		N/A	7.9E-01	mg/kg/day	N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	N/A		N/A		N/A	4.3E-05	mg/kg/day	3.0E-03	mg/kg/day	1.4E-02
				2,4-Dinitrotoluene	3.6E+01	µg/L	N/A		N/A		N/A	6.1E-05	mg/kg/day	2.0E-03	mg/kg/day	3.0E-02
				Nitrobenzene	6.8E-01	µg/L	N/A		N/A		N/A	1.4E-06	mg/kg/day	2.0E-03	mg/kg/day	6.9E-04
				1,3-Dinitrobenzene	3.7E-01	µg/L	N/A		N/A		N/A	3.8E-07	mg/kg/day	1.0E-04	mg/kg/day	3.8E-03
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	N/A		N/A		N/A	1.1E-02	mg/kg/day	2.0E-03	mg/kg/day	5.4E+00
				RDX	2.3E+01	µg/L	N/A		N/A		N/A	5.7E-06	mg/kg/day	3.0E-03	mg/kg/day	1.9E-03
				Antimony, Dissolved	9.8E+01	µg/L	N/A		N/A		N/A	1.4E-05	mg/kg/day	6.0E-05	mg/kg/day	2.3E-01
				Arsenic, Dissolved	1.9E+01	µg/L	N/A		N/A		N/A	2.7E-06	mg/kg/day	3.0E-04	mg/kg/day	9.0E-03
				Beryllium, Dissolved	9.1E+00	µg/L	N/A		N/A		N/A	1.3E-06	mg/kg/day	1.4E-06	mg/kg/day	9.3E-01
				Cadmium, Dissolved	8.5E+00	µg/L	N/A		N/A		N/A	1.2E-06	mg/kg/day	2.5E-05	mg/kg/day	4.9E-02
				Chromium, Dissolved	7.6E+00	µg/L	N/A		N/A		N/A	2.2E-06	mg/kg/day	7.5E-05	mg/kg/day	2.9E-02

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater (continued)	Groundwater	Yorktown-Eastover Aquifer Tap Water	Dermal	Cobalt, Dissolved	8.9E+01	µg/L	N/A		N/A		N/A	5.1E-06	mg/kg/day	3.0E-04	mg/kg/day	1.7E-02
				Iron, Dissolved	4.2E+03	µg/L	N/A		N/A		N/A	6.0E-04	mg/kg/day	7.0E-01	mg/kg/day	8.5E-04
				Manganese, Dissolved	1.9E+02	µg/L	N/A		N/A		N/A	2.8E-05	mg/kg/day	9.6E-04	mg/kg/day	2.9E-02
				Nickel, Dissolved	4.4E+01	µg/L	N/A		N/A		N/A	1.3E-06	mg/kg/day	8.0E-04	mg/kg/day	1.6E-03
				Selenium, Dissolved	1.3E+01	µg/L	N/A		N/A		N/A	1.9E-06	mg/kg/day	5.0E-03	mg/kg/day	3.7E-04
				Vanadium, Dissolved	9.1E+01	µg/L	N/A		N/A		N/A	1.3E-05	mg/kg/day	1.3E-04	mg/kg/day	1.0E-01
				Zinc, Dissolved	2.3E+03	µg/L	N/A		N/A		N/A	1.9E-04	mg/kg/day	3.0E-01	mg/kg/day	6.4E-04
			Exp. Route Total								N/A					1.3E+01
		Exposure Point Total									N/A					1.6E+02
	Exposure Medium Total										N/A					1.6E+02
	Air	Yorktown -Eastover Aquifer Water Vapors at Showerhead	Inhalation	1,1-Dichloroethane	2.5E-03	mg/m^3	N/A		N/A		N/A	5.9E-05	mg/m^3	N/A		N/A
				1,2-Dichloroethane	5.0E-04	mg/m^3	N/A		N/A		N/A	1.2E-05	mg/m^3	2.4E+00	mg/m^3	4.8E-06
				Benzene	4.1E-03	mg/m^3	N/A		N/A		N/A	9.5E-05	mg/m^3	3.0E-02	mg/m^3	3.2E-03
				cis-1,2-Dichloroethene	1.3E+01	mg/m^3	N/A		N/A		N/A	3.0E-01	mg/m^3	N/A		N/A
				Tetrachloroethene	5.6E+00	mg/m^3	N/A		N/A		N/A	1.3E-01	mg/m^3	2.7E-01	mg/m^3	4.8E-01
				trans-1,2-Dichloroethene	3.1E-02	mg/m^3	N/A		N/A		N/A	7.2E-04	mg/m^3	6.0E-02	mg/m^3	1.2E-02
				Trichloroethene	3.5E+02	mg/m^3	N/A		N/A		N/A	8.1E+00	mg/m^3	N/A		N/A
				Vinyl chloride	8.7E-02	mg/m^3	N/A		N/A		N/A	2.0E-03	mg/m^3	1.0E-01	mg/m^3	2.0E-02
				Nitrobenzene	1.4E-04	mg/m^3	N/A		N/A		N/A	3.2E-06	mg/m^3	9.0E-03	mg/m^3	3.5E-04
			Exp. Route Total								N/A					5.1E-01
		Exposure Point Total									N/A					5.1E-01
		Indoor Air	Inhalation	1,2-Dichloroethene	7.3E-03	mg/m^3	N/A		N/A		N/A	2.4E-03	mg/m^3	N/A		N/A
				Trichloroethene	1.9E-02	mg/m^3	N/A		N/A		N/A	6.4E-03	mg/m^3	N/A		N/A
				Vinyl chloride	3.7E-03	mg/m^3	N/A		N/A		N/A	1.2E-03	mg/m^3	1.0E-01	mg/m^3	1.2E-02
			Exp. Route Total								N/A					1.2E-02
		Exposure Point Total									N/A					1.2E-02
	Exposure Medium Total										N/A					5.3E-01
Groundwater Total											N/A					1.6E+02

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Table 7.1.RME Supplement A

Inhalation exposure while showering calculated on Table 7.1.RME Supplement B

Table 7.1.RME Supplement A
Calculation of DA_{event}
Residential Adult Groundwater
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
1,1-Dichloroethane	1.1E+00	6.7E-03	2.6E-02	3.8E-01	9.2E-01	1.0E+00	0.58	9.7E-09	2
1,2-Dichloroethane	2.5E-01	4.2E-03	1.6E-02	3.8E-01	9.2E-01	1.0E+00	0.58	1.4E-09	2
Benzene	1.6E+00	1.5E-02	5.1E-02	2.9E-01	7.0E-01	1.0E+00	0.58	2.7E-08	2
cis-1,2-Dichloroethene[1]	5.7E+03	7.7E-03	2.9E-02	3.7E-01	8.9E-01	1.0E+00	0.58	5.6E-05	2
Tetrachloroethene	3.0E+03	3.3E-02	1.7E-01	9.1E-01	2.2E+00	1.0E+00	0.58	2.0E-04	2
trans-1,2-Dichloroethene	1.3E+01	7.7E-03	2.9E-02	3.7E-01	8.9E-01	1.0E+00	0.58	1.3E-07	2
Trichloroethene	1.7E+05	1.2E-02	5.1E-02	5.8E-01	1.4E+00	1.0E+00	0.58	3.2E-03	2
Vinyl chloride	3.0E+01	5.6E-03	1.7E-02	2.4E-01	5.7E-01	1.0E+00	0.58	1.7E-07	3
2,4-Dinitrotoluene	3.6E+01	3.1E-03	1.6E-02	1.1E+00	2.7E+00	1.0E+00	0.58	2.5E-07	2
Nitrobenzene[2]	6.8E-01	5.4E-03	2.3E-02	5.1E-01	1.2E+00	1.0E+00	0.58	5.6E-09	2
1,3-Dinitrobenzene[2]	3.7E-01	2.1E-03	1.0E-02	9.2E-01	2.2E+00	1.0E+00	0.58	1.5E-09	2
2-Amino-4,6-dinitrotoluene[2]	7.4E+03	2.4E-03	1.3E-02	1.3E+00	3.2E+00	1.0E+00	0.58	4.3E-05	2
RDX[2]	2.3E+01	3.5E-04	2.0E-03	1.8E+00	4.4E+00	1.0E+00	0.58	2.3E-08	2
Antimony, Dissolved	9.8E+01	1.0E-03	NA	NA	NA	NA	0.58	5.7E-08	1
Arsenic, Dissolved	1.9E+01	1.0E-03	NA	NA	NA	NA	0.58	1.1E-08	1
Beryllium, Dissolved	9.1E+00	1.0E-03	NA	NA	NA	NA	0.58	5.3E-09	1
Cadmium, Dissolved	8.5E+00	1.0E-03	NA	NA	NA	NA	0.58	4.9E-09	1
Chromium, Dissolved	7.6E+00	2.0E-03	NA	NA	NA	NA	0.58	8.8E-09	1
Cobalt, Dissolved	8.9E+01	4.0E-04	NA	NA	NA	NA	0.58	2.1E-08	1
Iron, Dissolved	4.2E+03	1.0E-03	NA	NA	NA	NA	0.58	2.4E-06	1
Manganese, Dissolved	1.9E+02	1.0E-03	NA	NA	NA	NA	0.58	1.1E-07	1
Nickel, Dissolved	4.4E+01	2.0E-04	NA	NA	NA	NA	0.58	5.2E-09	1
Selenium, Dissolved	1.3E+01	1.0E-03	NA	NA	NA	NA	0.58	7.6E-09	1
Vanadium, Dissolved	9.1E+01	1.0E-03	NA	NA	NA	NA	0.58	5.3E-08	1
Zinc, Dissolved	2.3E+03	6.0E-04	NA	NA	NA	NA	0.58	7.8E-07	1

[1] trans-1,2-Dichloroethane used as a surrogate.

Inorganics: DA_{event} (mg/cm^2-event) =

K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =

If t_{event}<t*, then DA_{event} =

2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =

FA x K_p x CW x (t_{event}/(1+B) + 2 x τ_{event} x ((1 + 3xB + 3xB^2)/(1+B)^2) x 0.001 mg/µg x 0.001 l/cm^3 (eq 3)

Notes:

Permeability constants and other input parameter values from EPA 2004,*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this documen

B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).

t* - Time to reach steady-state

[1] trans-1,2-Dichloroethane used as a surrogate.

[2]Lag time and B calculated on Table 7.1b.RME Supplement. Permeability constants from RAIS databases (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem).

N/A - not applicable.

Table 7.1b.RME Supplement
Calculation of DAevent
Site 6
NWS Yorktown, Yorktown, Virginia

Chemical	MW	Kp (cm/hr)	B[1]	Dsc/lsc[1]	lsc (cm)	Dsc (cm^2/hr)	τ[1] (hr)	c[1]	b[1]	t*[1] (hr)
Nitrobenzene	123.11	5.4E-03	2.3E-02	3.2E-04	1.0E-03	3.2E-07	5.1E-01	3.5E-01	3.2E-01	1.2E+00
1,3-Dinitrobenzene	168.11	2.1E-03	1.0E-02	1.8E-04	1.0E-03	1.8E-07	9.2E-01	3.4E-01	3.1E-01	2.2E+00
2-Amino-4,6-dinitrotoluene	197.15	2.4E-03	1.3E-02	1.2E-04	1.0E-03	1.2E-07	1.3E+00	3.4E-01	3.1E-01	3.2E+00
RDX	222.12	3.5E-04	2.0E-03	9.0E-05	1.0E-03	9.0E-08	1.8E+00	3.3E-01	3.0E-01	4.4E+00

1. Equations from *Dermal Exposure Assessment: Principles and Applications*. EPA/600/8-91/011B. January 1992.
Kp values from RAIS database (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem).

Table 7.1.RME Supplement B

Inhalation Exposure Concentrations from Foster and Chrostowski Shower Model

Adult Resident

Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Exposure Point Concentration Cwo (µg/L)	Molecular weight (MW) (g/mole)	Henry's Law Constant (H) (atm-m^3/mole)	Kg (VOC) (cm/hr)	Kl (VOC) (cm/hr)	KL (cm/hr)	Kal (cm/hr)	Cwd (µg/L)	S (µg/m^3 -min)	Ca (mg/m^3)
1,1-Dichloroethane	1.1E+00	9.9E+01	5.6E-03	1.3E+03	1.3E+01	1.3E+01	1.7E+01	1.5E-01	1.2E-01	2.5E-03
1,2-Dichloroethane	2.5E-01	9.9E+01	1.2E-03	1.3E+03	1.3E+01	1.1E+01	1.5E+01	2.9E-02	2.4E-02	5.0E-04
Benzene	1.6E+00	7.8E+01	5.6E-03	1.4E+03	1.5E+01	1.4E+01	1.9E+01	2.4E-01	2.0E-01	4.1E-03
cis-1,2-Dichloroethene	5.7E+03	9.7E+01	4.1E-03	1.3E+03	1.3E+01	1.3E+01	1.7E+01	7.6E+02	6.3E+02	1.3E+01
Tetrachloroethene	3.0E+03	1.7E+02	1.8E-02	9.9E+02	1.0E+01	1.0E+01	1.4E+01	3.2E+02	2.7E+02	5.6E+00
trans-1,2-Dichloroethene	1.3E+01	9.7E+01	1.7E-01	1.3E+03	1.3E+01	1.3E+01	1.8E+01	1.8E+00	1.5E+00	3.1E-02
Trichloroethene	1.7E+05	1.3E+02	1.0E-02	1.1E+03	1.2E+01	1.1E+01	1.5E+01	2.0E+04	1.7E+04	3.5E+02
Vinyl chloride	3.0E+01	6.3E+01	2.8E-02	1.6E+03	1.7E+01	1.7E+01	2.2E+01	5.0E+00	4.2E+00	8.7E-02
Nitrobenzene	6.8E-01	1.2E+02	2.4E-05	1.1E+03	1.2E+01	1.0E+00	1.4E+00	8.0E-03	6.7E-03	1.4E-04

Variables	Units	Exposure Assumptions
Kg(VOC) = gas-film mass transfer coefficient	cm/hr	Solved by Eq 1
Kl(VOC) = liquid-film mass transfer coefficient	cm/hr	Solved by Eq 2
KL = overall mass transfer coefficient	cm/hr	Solved by Eq 3
Kal = adjusted overall mass transfer coeff.	cm/hr	Solved by Eq 4
Tl = Calibration temp. of water	K (20C +273)	293
Ts = Shower water temperature	k (45C)	318
Us = water viscosity at Ts	centipoise	0.596
Ul = water viscosity at Tl	cp	1.002
Cwd = conc. leaving droplets after time sdt	µg/l	Solved by Eq 5
sdt = shower droplet drop time	sec	0.5
d = shower droplet diameter	mm	1
FR = shower water flow rate	l/min	10
SV = shower room air volume	m^3	12
S = indoor VOC generation rate	µg/m^3-min	Solved by Eq 6
Ds = duration of shower	min	34.8
Dt = total duration in shower room	min	60
R = air exchange rate	min^{-1}	0.0083
Ca = indoor air concentration of VOCs	µg/m^3	Solved by Eq 7

Equation 1:	Kg(VOC) =	$3000 * (18 / MW)^{0.5}$
Equation 2:	Kl(VOC) =	$20 * (44 / MW)^{0.5}$
Equation 3:	KL =	$((1 / Kl(VOC)) + (0.024 / (Kg (VOC) * H)))^{-1}$
Equation 4:	Kal =	$(KL * (((Tl * Us) / (Ts * Ul))^{-0.5}))$
Equation 5:	Cwd =	(Cwo * (1-EXP((-1 * Kal * sdt)/(60 * d))))
Equation 6:	S =	(Cwd * FR / SV)
Equation 7:	Ca =	If t>Ds [(S / R) * (Ds + (EXP(-R * Dt) / R) -(EXP(R *(Ds - Dt)) / R)] / Dt * 1/1000

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water	Ingestion	1,1-Dichloroethane	1.1E+00	µg/L	N/A		N/A		N/A	7.1E-05	mg/kg/day	2.0E-01	mg/kg/day	3.5E-04
				1,2-Dichloroethane	2.5E-01	µg/L	N/A		N/A		N/A	1.6E-05	mg/kg/day	2.0E-02	mg/kg/day	8.0E-04
				Benzene	1.6E+00	µg/L	N/A		N/A		N/A	1.0E-04	mg/kg/day	4.0E-03	mg/kg/day	2.6E-02
				cis-1,2-Dichloroethene	5.7E+03	µg/L	N/A		N/A		N/A	3.6E-01	mg/kg/day	1.0E-02	mg/kg/day	3.6E+01
				Tetrachloroethene	3.0E+03	µg/L	N/A		N/A		N/A	1.9E-01	mg/kg/day	1.0E-02	mg/kg/day	1.9E+01
				trans-1,2-Dichloroethene	1.3E+01	µg/L	N/A		N/A		N/A	8.3E-04	mg/kg/day	2.0E-02	mg/kg/day	4.1E-02
				Trichloroethene	1.7E+05	µg/L	N/A		N/A		N/A	1.1E+01	mg/kg/day	N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	N/A		N/A		N/A	1.9E-03	mg/kg/day	3.0E-03	mg/kg/day	6.3E-01
				2,4-Dinitrotoluene	3.6E+01	µg/L	N/A		N/A		N/A	2.3E-03	mg/kg/day	2.0E-03	mg/kg/day	1.2E+00
				Nitrobenzene	6.8E-01	µg/L	N/A		N/A		N/A	4.4E-05	mg/kg/day	2.0E-03	mg/kg/day	2.2E-02
				1,3-Dinitrobenzene	3.7E-01	µg/L	N/A		N/A		N/A	2.4E-05	mg/kg/day	1.0E-04	mg/kg/day	2.4E-01
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	N/A		N/A		N/A	4.7E-01	mg/kg/day	2.0E-03	mg/kg/day	2.4E+02
				RDX	2.3E+01	µg/L	N/A		N/A		N/A	1.5E-03	mg/kg/day	3.0E-03	mg/kg/day	4.9E-01
				Antimony, Dissolved	9.8E+01	µg/L	N/A		N/A		N/A	6.2E-03	mg/kg/day	4.0E-04	mg/kg/day	1.6E+01
				Arsenic, Dissolved	1.9E+01	µg/L	N/A		N/A		N/A	1.2E-03	mg/kg/day	3.0E-04	mg/kg/day	4.0E+00
				Beryllium, Dissolved	9.1E+00	µg/L	N/A		N/A		N/A	5.8E-04	mg/kg/day	2.0E-03	mg/kg/day	2.9E-01
				Cadmium, Dissolved	8.5E+00	µg/L	N/A		N/A		N/A	5.4E-04	mg/kg/day	5.0E-04	mg/kg/day	1.1E+00
				Chromium, Dissolved	7.6E+00	µg/L	N/A		N/A		N/A	4.9E-04	mg/kg/day	3.0E-03	mg/kg/day	1.6E-01
				Cobalt, Dissolved	8.9E+01	µg/L	N/A		N/A		N/A	5.7E-03	mg/kg/day	3.0E-04	mg/kg/day	1.9E+01
				Iron, Dissolved	4.2E+03	µg/L	N/A		N/A		N/A	2.7E-01	mg/kg/day	7.0E-01	mg/kg/day	3.8E-01
				Manganese, Dissolved	1.9E+02	µg/L	N/A		N/A		N/A	1.2E-02	mg/kg/day	2.4E-02	mg/kg/day	5.1E-01
				Nickel, Dissolved	4.4E+01	µg/L	N/A		N/A		N/A	2.8E-03	mg/kg/day	2.0E-02	mg/kg/day	1.4E-01
				Selenium, Dissolved	1.3E+01	µg/L	N/A		N/A		N/A	8.3E-04	mg/kg/day	5.0E-03	mg/kg/day	1.7E-01
				Vanadium, Dissolved	9.1E+01	µg/L	N/A		N/A		N/A	5.8E-03	mg/kg/day	5.0E-03	mg/kg/day	1.2E+00
				Zinc, Dissolved	2.3E+03	µg/L	N/A		N/A		N/A	1.4E-01	mg/kg/day	3.0E-01	mg/kg/day	4.8E-01
			Exp. Route Total								N/A					3.4E+02
			Dermal	1,1-Dichloroethane	1.1E+00	µg/L	N/A		N/A		N/A	5.5E-06	mg/kg/day	2.0E-01	mg/kg/day	2.8E-05
				1,2-Dichloroethane	2.5E-01	µg/L	N/A		N/A		N/A	7.8E-07	mg/kg/day	2.0E-02	mg/kg/day	3.9E-05
				Benzene	1.6E+00	µg/L	N/A		N/A		N/A	1.6E-05	mg/kg/day	4.0E-03	mg/kg/day	3.9E-03
				cis-1,2-Dichloroethene	5.7E+03	µg/L	N/A		N/A		N/A	3.2E-02	mg/kg/day	1.0E-02	mg/kg/day	3.2E+00
				Tetrachloroethene	3.0E+03	µg/L	N/A		N/A		N/A	1.1E-01	mg/kg/day	1.0E-02	mg/kg/day	1.1E+01
				trans-1,2-Dichloroethene	1.3E+01	µg/L	N/A		N/A		N/A	7.3E-05	mg/kg/day	2.0E-02	mg/kg/day	3.7E-03
				Trichloroethene	1.7E+05	µg/L	N/A		N/A		N/A	1.8E+00	mg/kg/day	N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	N/A		N/A		N/A	1.0E-04	mg/kg/day	3.0E-03	mg/kg/day	3.4E-02
				2,4-Dinitrotoluene	3.6E+01	µg/L	N/A		N/A		N/A	1.4E-04	mg/kg/day	2.0E-03	mg/kg/day	6.8E-02
				Nitrobenzene	6.8E-01	µg/L	N/A		N/A		N/A	3.1E-06	mg/kg/day	2.0E-03	mg/kg/day	1.5E-03
				1,3-Dinitrobenzene	3.7E-01	µg/L	N/A		N/A		N/A	8.5E-07	mg/kg/day	1.0E-04	mg/kg/day	8.5E-03
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	N/A		N/A		N/A	2.4E-02	mg/kg/day	2.0E-03	mg/kg/day	1.2E+01
				RDX	2.3E+01	µg/L	N/A		N/A		N/A	1.3E-05	mg/kg/day	3.0E-03	mg/kg/day	4.2E-03
				Antimony, Dissolved	9.8E+01	µg/L	N/A		N/A		N/A	4.1E-05	mg/kg/day	6.0E-05	mg/kg/day	6.9E-01
				Arsenic, Dissolved	1.9E+01	µg/L	N/A		N/A		N/A	8.0E-06	mg/kg/day	3.0E-04	mg/kg/day	2.7E-02
				Beryllium, Dissolved	9.1E+00	µg/L	N/A		N/A		N/A	3.8E-06	mg/kg/day	1.4E-06	mg/kg/day	2.7E+00
				Cadmium, Dissolved	8.5E+00	µg/L	N/A		N/A		N/A	3.6E-06	mg/kg/day	2.5E-05	mg/kg/day	1.4E-01
				Chromium, Dissolved	7.6E+00	µg/L	N/A		N/A		N/A	6.4E-06	mg/kg/day	7.5E-05	mg/kg/day	8.5E-02

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater (continued)	Groundwater	Yorktown-Eastover Aquifer Tap Water	Dermal	Cobalt, Dissolved	8.9E+01	µg/L	N/A		N/A		N/A	1.5E-05	mg/kg/day	3.0E-04	mg/kg/day	5.0E-02
				Iron, Dissolved	4.2E+03	µg/L	N/A		N/A		N/A	1.8E-03	mg/kg/day	7.0E-01	mg/kg/day	2.5E-03
				Manganese, Dissolved	1.9E+02	µg/L	N/A		N/A		N/A	8.1E-05	mg/kg/day	9.6E-04	mg/kg/day	8.5E-02
				Nickel, Dissolved	4.4E+01	µg/L	N/A		N/A		N/A	3.8E-06	mg/kg/day	8.0E-04	mg/kg/day	4.7E-03
				Selenium, Dissolved	1.3E+01	µg/L	N/A		N/A		N/A	5.5E-06	mg/kg/day	5.0E-03	mg/kg/day	1.1E-03
				Vanadium, Dissolved	9.1E+01	µg/L	N/A		N/A		N/A	3.8E-05	mg/kg/day	1.3E-04	mg/kg/day	2.9E-01
				Zinc, Dissolved	2.3E+03	µg/L	N/A		N/A		N/A	5.7E-04	mg/kg/day	3.0E-01	mg/kg/day	1.9E-03
			Exp. Route Total								N/A					3.1E+01
		Exposure Point Total									N/A					3.7E+02
	Exposure Medium Total										N/A					3.7E+02
	Air	Columbia and Yorktown -Eastover Aquifer Water Vapors at Showerhead	Inhalation	1,1-Dichloroethane	3.7E-03	mg/m^3	N/A		N/A		N/A	1.5E-04	mg/m^3	N/A		N/A
				1,2-Dichloroethane	7.3E-04	mg/m^3	N/A		N/A		N/A	2.9E-05	mg/m^3	2.4E+00	mg/m^3	1.2E-05
				Benzene	6.0E-03	mg/m^3	N/A		N/A		N/A	2.4E-04	mg/m^3	3.0E-02	mg/m^3	7.9E-03
				cis-1,2-Dichloroethene	1.9E+01	mg/m^3	N/A		N/A		N/A	7.6E-01	mg/m^3	N/A		N/A
				Tetrachloroethene	8.1E+00	mg/m^3	N/A		N/A		N/A	3.2E-01	mg/m^3	2.7E-01	mg/m^3	1.2E+00
				trans-1,2-Dichloroethene	4.6E-02	mg/m^3	N/A		N/A		N/A	1.8E-03	mg/m^3	6.0E-02	mg/m^3	3.0E-02
				Trichloroethene	5.1E+02	mg/m^3	N/A		N/A		N/A	2.0E+01	mg/m^3	N/A		N/A
				Vinyl chloride	1.3E-01	mg/m^3	N/A		N/A		N/A	5.1E-03	mg/m^3	1.0E-01	mg/m^3	5.1E-02
				Nitrobenzene	2.0E-04	mg/m^3	N/A		N/A		N/A	8.0E-06	mg/m^3	9.0E-03	mg/m^3	8.9E-04
			Exp. Route Total								N/A					1.3E+00
		Exposure Point Total									N/A					1.3E+00
		Indoor Air	Inhalation	1,2-Dichloroethene	7.3E-03	mg/m^3	N/A		N/A		N/A	7.0E-03	mg/m^3	N/A		N/A
				Trichloroethene	1.9E-02	mg/m^3	N/A		N/A		N/A	1.9E-02	mg/m^3	N/A		N/A
				Vinyl chloride	3.7E-03	mg/m^3	N/A		N/A		N/A	3.6E-03	mg/m^3	1.0E-01	mg/m^3	3.6E-02
			Exp. Route Total								N/A					3.6E-02
		Exposure Point Total									N/A					3.6E-02
	Exposure Medium Total										N/A					1.3E+00
Groundwater Total											N/A					3.7E+02

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Table 7.2.RME Supplement A

Inhalation exposure while showering calculated on Table 7.2.RME Supplement B

Table 7.2.RME Supplement A
Calculation of DA_{event}
Residential Child Groundwater
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
1,1-Dichloroethane	1.1E+00	6.7E-03	2.6E-02	3.8E-01	9.2E-01	1.0E+00	1	1.3E-08	3
1,2-Dichloroethane	2.5E-01	4.2E-03	1.6E-02	3.8E-01	9.2E-01	1.0E+00	1	1.8E-09	3
Benzene	1.6E+00	1.5E-02	5.1E-02	2.9E-01	7.0E-01	1.0E+00	1	3.7E-08	3
cis-1,2-Dichloroethene[1]	5.7E+03	7.7E-03	2.9E-02	3.7E-01	8.9E-01	1.0E+00	1	7.6E-05	3
Tetrachloroethene	3.0E+03	3.3E-02	1.7E-01	9.1E-01	2.2E+00	1.0E+00	1	2.6E-04	2
trans-1,2-Dichloroethene	1.3E+01	7.7E-03	2.9E-02	3.7E-01	8.9E-01	1.0E+00	1	1.7E-07	3
Trichloroethene	1.7E+05	1.2E-02	5.1E-02	5.8E-01	1.4E+00	1.0E+00	1	4.2E-03	2
Vinyl chloride	3.0E+01	5.6E-03	1.7E-02	2.4E-01	5.7E-01	1.0E+00	1	2.4E-07	3
2,4-Dinitrotoluene	3.6E+01	3.1E-03	1.6E-02	1.1E+00	2.7E+00	1.0E+00	1	3.2E-07	2
Nitrobenzene[2]	6.8E-01	5.4E-03	2.3E-02	5.1E-01	1.2E+00	1.0E+00	1	7.3E-09	2
1,3-Dinitrobenzene[2]	3.7E-01	2.1E-03	1.0E-02	9.2E-01	2.2E+00	1.0E+00	1	2.0E-09	2
2-Amino-4,6-dinitrotoluene[2]	7.4E+03	2.4E-03	1.3E-02	1.3E+00	3.2E+00	1.0E+00	1	5.7E-05	2
RDX[2]	2.3E+01	3.5E-04	2.0E-03	1.8E+00	4.4E+00	1.0E+00	1	3.0E-08	2
Antimony, Dissolved	9.8E+01	1.0E-03	NA	NA	NA	NA	1	9.8E-08	1
Arsenic, Dissolved	1.9E+01	1.0E-03	NA	NA	NA	NA	1	1.9E-08	1
Beryllium, Dissolved	9.1E+00	1.0E-03	NA	NA	NA	NA	1	9.1E-09	1
Cadmium, Dissolved	8.5E+00	1.0E-03	NA	NA	NA	NA	1	8.5E-09	1
Chromium, Dissolved	7.6E+00	2.0E-03	NA	NA	NA	NA	1	1.5E-08	1
Cobalt, Dissolved	8.9E+01	4.0E-04	NA	NA	NA	NA	1	3.6E-08	1
Iron, Dissolved	4.2E+03	1.0E-03	NA	NA	NA	NA	1	4.2E-06	1
Manganese, Dissolved	1.9E+02	1.0E-03	NA	NA	NA	NA	1	1.9E-07	1
Nickel, Dissolved	4.4E+01	2.0E-04	NA	NA	NA	NA	1	8.9E-09	1
Selenium, Dissolved	1.3E+01	1.0E-03	NA	NA	NA	NA	1	1.3E-08	1
Vanadium, Dissolved	9.1E+01	1.0E-03	NA	NA	NA	NA	1	9.1E-08	1
Zinc, Dissolved	2.3E+03	6.0E-04	NA	NA	NA	NA	1	1.4E-06	1

[1] trans-1,2-Dichloroethane used as a surrogate.

Inorganics: DA_{event} (mg/cm^2-event) =

K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =

If t_{event}<t*, then DA_{event} =

2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =

FA x K_p x CW x (t_{event}/(1+B) + 2 x τ_{event} x ((1 + 3xB + 3xB^2)/(1+B)^2) x 0.001 mg/µg x 0.001 l/cm^3 (eq 3)

Notes:

Permeability constants and other input parameter values from EPA 2004,*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this documen

B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).

t* - Time to reach steady-state

[1] trans-1,2-Dichloroethane used as a surrogate.

[2]Lag time and B calculated on Table 7.1b.RME Supplement. Permeability constants from RAIS databases (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem).

N/A - not applicable.

Table 7.2.RME Supplement B

Inhalation Exposure Concentrations from Foster and Chrostowski Shower Model

Child Resident

Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Exposure Point Concentration Cwo (µg/L)	Molecular weight (MW) (g/mole)	Henry's Law Constant (H) (atm-m^3/mole)	Kg (VOC) (cm/hr)	Kl (VOC) (cm/hr)	KL (cm/hr)	Kal (cm/hr)	Cwd (µg/L)	S (µg/m^3 -min)	Ca (mg/m^3)
1,1-Dichloroethane	1.1E+00	9.9E+01	5.6E-03	1.3E+03	1.3E+01	1.3E+01	1.7E+01	1.5E-01	1.2E-01	3.7E-03
1,2-Dichloroethane	2.5E-01	9.9E+01	1.2E-03	1.3E+03	1.3E+01	1.1E+01	1.5E+01	2.9E-02	2.4E-02	7.3E-04
Benzene	1.6E+00	7.8E+01	5.6E-03	1.4E+03	1.5E+01	1.4E+01	1.9E+01	2.4E-01	2.0E-01	6.0E-03
cis-1,2-Dichloroethene	5.7E+03	9.7E+01	4.1E-03	1.3E+03	1.3E+01	1.3E+01	1.7E+01	7.6E+02	6.3E+02	1.9E+01
Tetrachloroethene	3.0E+03	1.7E+02	1.8E-02	9.9E+02	1.0E+01	1.0E+01	1.4E+01	3.2E+02	2.7E+02	8.1E+00
trans-1,2-Dichloroethene	1.3E+01	9.7E+01	1.7E-01	1.3E+03	1.3E+01	1.3E+01	1.8E+01	1.8E+00	1.5E+00	4.6E-02
Trichloroethene	1.7E+05	1.3E+02	1.0E-02	1.1E+03	1.2E+01	1.1E+01	1.5E+01	2.0E+04	1.7E+04	5.1E+02
Vinyl chloride	3.0E+01	6.3E+01	2.8E-02	1.6E+03	1.7E+01	1.7E+01	2.2E+01	5.0E+00	4.2E+00	1.3E-01
Nitrobenzene	6.8E-01	1.2E+02	2.4E-05	1.1E+03	1.2E+01	1.0E+00	1.4E+00	8.0E-03	6.7E-03	2.0E-04

Variables	Units	Exposure Assumptions
Kg(VOC) = gas-film mass transfer coefficient	cm/hr	Solved by Eq 1
Kl(VOC) = liquid-film mass transfer coefficient	cm/hr	Solved by Eq 2
KL = overall mass transfer coefficient	cm/hr	Solved by Eq 3
Kal = adjusted overall mass transfer coeff.	cm/hr	Solved by Eq 4
Tl = Calibration temp. of water	K (20C +273)	293
Ts = Shower water temperature	k (45C)	318
Us = water viscosity at Ts	centipoise	0.596
Ul = water viscosity at Tl	cp	1.002
Cwd = conc. leaving droplets after time sdt	µg/l	Solved by Eq 5
sdt = shower droplet drop time	sec	0.5
d = shower droplet diameter	mm	1
FR = shower water flow rate	l/min	10
SV = shower room air volume	m^3	12
S = indoor VOC generation rate	µg/m^3-min	Solved by Eq 6
Ds = duration of shower	min	60
Dt = total duration in shower room	min	80
R = air exchange rate	min^{-1}	0.0083
Ca = indoor air concentration of VOCs	µg/m^3	Solved by Eq 7

Equation 1:	Kg(VOC) =	$3000 * (18 / MW)^{0.5}$
Equation 2:	Kl(VOC) =	$20 * (44 / MW)^{0.5}$
Equation 3:	KL =	$((1 / Kl(VOC)) + (0.024 / (Kg (VOC) * H)))^{-1}$
Equation 4:	Kal =	$(KL * (((Tl * Us) / (Ts * Ul))^{-0.5}))$
Equation 5:	Cwd =	(Cwo * (1-EXP((-1 * Kal * sdt)/(60 * d))))
Equation 6:	S =	(Cwd * FR / SV)
Equation 7:	Ca =	If t>Ds [(S / R) * (Ds + (EXP(-R * Dt) / R) -(EXP(R *(Ds - Dt)) / R)] / Dt * 1/1000

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water	Ingestion	1,1-Dichloroethane	1.1E+00	µg/L	1.6E-05	mg/kg/day	5.7E-03	(mg/kg-day)$^{-1}$	9.4E-08	N/A		N/A		N/A
				1,2-Dichloroethane	2.5E-01	µg/L	3.7E-06	mg/kg/day	9.1E-02	(mg/kg-day)$^{-1}$	3.4E-07	N/A		N/A		N/A
				Benzene	1.6E+00	µg/L	2.4E-05	mg/kg/day	5.5E-02	(mg/kg-day)$^{-1}$	1.3E-06	N/A		N/A		N/A
				cis-1,2-Dichloroethene	5.7E+03	µg/L	8.5E-02	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Tetrachloroethene	3.0E+03	µg/L	4.5E-02	mg/kg/day	5.4E-01	(mg/kg-day)$^{-1}$	2.4E-02	N/A		N/A		N/A
				trans-1,2-Dichloroethene	1.3E+01	µg/L	1.9E-04	mg/kg/day	N/A	(mg/kg-day)$^{-1}$	N/A	N/A		N/A		N/A
				Trichloroethene	1.7E+05	µg/L	2.6E+00	mg/kg/day	5.9E-03	(mg/kg-day)$^{-1}$	1.5E-02	N/A		N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	4.4E-04	mg/kg/day	7.2E-01	(mg/kg-day)$^{-1}$	3.2E-04	N/A		N/A		N/A
				2,4-Dinitrotoluene	3.6E+01	µg/L	5.4E-04	mg/kg/day	3.1E-01	(mg/kg-day)$^{-1}$	1.7E-04	N/A		N/A		N/A
				Nitrobenzene	6.8E-01	µg/L	1.0E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				1,3-Dinitrobenzene	3.7E-01	µg/L	5.5E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	1.1E-01	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				RDX	2.3E+01	µg/L	3.4E-04	mg/kg/day	1.1E-01	(mg/kg-day)$^{-1}$	3.8E-05	N/A		N/A		N/A
				Antimony, Dissolved	9.8E+01	µg/L	1.5E-03	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Arsenic, Dissolved	1.9E+01	µg/L	2.8E-04	mg/kg/day	1.5E+00	(mg/kg-day)$^{-1}$	4.2E-04	N/A		N/A		N/A
				Beryllium, Dissolved	9.1E+00	µg/L	1.4E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Cadmium, Dissolved	8.5E+00	µg/L	1.3E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Chromium, Dissolved	7.6E+00	µg/L	1.1E-04	mg/kg/day	5.0E-01	(mg/kg-day)$^{-1}$	5.7E-05	N/A		N/A		N/A
				Cobalt, Dissolved	8.9E+01	µg/L	1.3E-03	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Iron, Dissolved	4.2E+03	µg/L	6.2E-02	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Manganese, Dissolved	1.9E+02	µg/L	2.9E-03	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Nickel, Dissolved	4.4E+01	µg/L	6.6E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Selenium, Dissolved	1.3E+01	µg/L	1.9E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Vanadium, Dissolved	9.1E+01	µg/L	1.4E-03	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Zinc, Dissolved	2.3E+03	µg/L	3.4E-02	mg/kg/day	N/A		N/A	N/A		N/A		N/A
			Exp. Route Total								4.0E-02					N/A
			Dermal	1,1-Dichloroethane	1.1E+00	µg/L	1.3E-06	mg/kg/day	5.7E-03	(mg/kg-day)$^{-1}$	7.4E-09	N/A		N/A		N/A
				1,2-Dichloroethane	2.5E-01	µg/L	1.8E-07	mg/kg/day	9.1E-02	(mg/kg-day)$^{-1}$	1.7E-08	N/A		N/A		N/A
				Benzene	1.6E+00	µg/L	3.6E-06	mg/kg/day	5.5E-02	(mg/kg-day)$^{-1}$	2.0E-07	N/A		N/A		N/A
				cis-1,2-Dichloroethene	5.7E+03	µg/L	7.5E-03	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Tetrachloroethene	3.0E+03	µg/L	2.7E-02	mg/kg/day	5.4E-01	(mg/kg-day)$^{-1}$	1.4E-02	N/A		N/A		N/A
				trans-1,2-Dichloroethene	1.3E+01	µg/L	1.7E-05	mg/kg/day	N/A	(mg/kg-day)$^{-1}$	N/A	N/A		N/A		N/A
				Trichloroethene	1.7E+05	µg/L	4.2E-01	mg/kg/day	5.9E-03	(mg/kg-day)$^{-1}$	2.5E-03	N/A		N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	2.4E-05	mg/kg/day	7.2E-01	(mg/kg-day)$^{-1}$	1.7E-05	N/A		N/A		N/A
				2,4-Dinitrotoluene	3.6E+01	µg/L	3.3E-05	mg/kg/day	3.1E-01	(mg/kg-day)$^{-1}$	1.0E-05	N/A		N/A		N/A
				Nitrobenzene	6.8E-01	µg/L	7.4E-07	mg/kg/day	N/A	(mg/kg-day)$^{-1}$	N/A	N/A		N/A		N/A
				1,3-Dinitrobenzene	3.7E-01	µg/L	2.0E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	5.7E-03	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				RDX	2.3E+01	µg/L	3.0E-06	mg/kg/day	1.1E-01	(mg/kg-day)$^{-1}$	3.3E-07	N/A		N/A		N/A
				Antimony, Dissolved	9.8E+01	µg/L	8.3E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Arsenic, Dissolved	1.9E+01	µg/L	1.6E-06	mg/kg/day	1.5E+00	(mg/kg-day)$^{-1}$	2.4E-06	N/A		N/A		N/A
				Beryllium, Dissolved	9.1E+00	µg/L	7.8E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Cadmium, Dissolved	8.5E+00	µg/L	7.2E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Chromium, Dissolved	7.6E+00	µg/L	1.3E-06	mg/kg/day	1.3E-02	(mg/kg-day)$^{-1}$	1.6E-08	N/A		N/A		N/A

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater (continued)	Groundwater	Yorktown-Eastover Aquifer Tap Water	Dermal	Cobalt, Dissolved	8.9E+01	µg/L	3.0E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Iron, Dissolved	4.2E+03	µg/L	3.6E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Manganese, Dissolved	1.9E+02	µg/L	1.6E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Nickel, Dissolved	4.4E+01	µg/L	7.6E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Selenium, Dissolved	1.3E+01	µg/L	1.1E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Vanadium, Dissolved	9.1E+01	µg/L	7.7E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Zinc, Dissolved	2.3E+03	µg/L	1.2E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
			Exp. Route Total								1.7E-02					N/A
		Exposure Point Total									5.7E-02					N/A
	Exposure Medium Total										5.7E-02					N/A
	Air	Columbia and Yorktown -Eastover Aquifer Water Vapors at Showerhead	Inhalation	1,1-Dichloroethane	6.7E-02	mg/m^3 x hr/day x yr	3.8E-02	ug/m^3	1.6E-06	(µg/m^3)$^{-1}$	6.1E-08	N/A		N/A		N/A
				1,2-Dichloroethane	1.3E-02	mg/m3 x hr/day x yr	7.5E-03	ug/m^3	2.6E-05	(µg/m^3)$^{-1}$	2.0E-07	N/A		N/A		N/A
				Benzene	1.1E-01	mg/m3 x hr/day x yr	6.2E-02	ug/m^3	7.8E-06	(µg/m^3)$^{-1}$	4.8E-07	N/A		N/A		N/A
				cis-1,2-Dichloroethene	3.4E+02	mg/m3 x hr/day x yr	1.9E+02	ug/m^3	N/A		N/A	N/A		N/A		N/A
				Tetrachloroethene	1.5E+02	mg/m3 x hr/day x yr	8.4E+01	ug/m^3	5.9E-06	(µg/m^3)$^{-1}$	4.9E-04	N/A		N/A		N/A
				trans-1,2-Dichloroethene	8.2E-01	mg/m3 x hr/day x yr	4.7E-01	ug/m^3	N/A		N/A	N/A		N/A		N/A
				Trichloroethene	9.2E+03	mg/m3 x hr/day x yr	5.3E+03	ug/m^3	2.0E-06	(µg/m^3)$^{-1}$	1.0E-02	N/A		N/A		N/A
				Vinyl chloride	2.3E+00	mg/m3 x hr/day x yr	1.3E+00	ug/m^3	4.4E-06	(µg/m^3)$^{-1}$	5.7E-06	N/A		N/A		N/A
				Nitrobenzene	3.6E-03	mg/m3 x hr/day x yr	2.1E-03	ug/m^3	4.0E-05	(µg/m^3)$^{-1}$	8.3E-08	N/A		N/A		N/A
			Exp. Route Total								1.1E-02					N/A
		Exposure Point Total									1.1E-02					N/A
		Indoor Air	Inhalation	1,2-Dichloroethene	7.3E-03	mg/m^3	3.0E+00	ug/m^3	N/A		N/A	N/A		N/A		N/A
				Trichloroethene	1.9E-02	mg/m^3	8.0E+00	ug/m^3	2.0E-06	(µg/m^3)$^{-1}$	1.6E-05	N/A		N/A		N/A
				Vinyl chloride	3.7E-03	mg/m^3	1.5E+00	ug/m^3	4.4E-06	(µg/m^3)$^{-1}$	6.8E-06	N/A		N/A		N/A
			Exp. Route Total								2.3E-05					N/A
		Exposure Point Total									2.3E-05					N/A
	Exposure Medium Total										1.1E-02					N/A
Groundwater Total											6.8E-02					N/A

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Tables 7.1.RME and 7.2.RME Supplement A.

Inhalation exposure while showering calculated on Tables 7.1.RME and 7.2.RME Supplement B

TABLE 7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water	Ingestion	1,1-Dichloroethane	1.1E+00	µg/L	3.9E-06	mg/kg/day	5.7E-03	$(mg/kg\text{-}day)^{-1}$	2.2E-08	1.1E-05	mg/kg/day	2.0E-01	mg/kg/day	5.4E-05
				1,2-Dichloroethane	2.5E-01	µg/L	8.7E-07	mg/kg/day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	8.0E-08	2.4E-06	mg/kg/day	2.0E-02	mg/kg/day	1.2E-04
				Benzene	1.6E+00	µg/L	5.6E-06	mg/kg/day	5.5E-02	$(mg/kg\text{-}day)^{-1}$	3.1E-07	1.6E-05	mg/kg/day	4.0E-03	mg/kg/day	3.9E-03
				cis-1,2-Dichloroethene	5.7E+03	µg/L	2.0E-02	mg/kg/day	N/A		N/A	5.5E-02	mg/kg/day	1.0E-02	mg/kg/day	5.5E+00
				Tetrachloroethene	3.0E+03	µg/L	1.0E-02	mg/kg/day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	5.7E-03	2.9E-02	mg/kg/day	1.0E-02	mg/kg/day	2.9E+00
				trans-1,2-Dichloroethene	1.3E+01	µg/L	4.5E-05	mg/kg/day	N/A		N/A	1.3E-04	mg/kg/day	1.0E-02	mg/kg/day	1.3E-02
				Trichloroethene	1.7E+05	µg/L	6.0E-01	mg/kg/day	5.9E-03	$(mg/kg\text{-}day)^{-1}$	3.5E-03	1.7E+00	mg/kg/day	N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	1.0E-04	mg/kg/day	7.2E-01	$(mg/kg\text{-}day)^{-1}$	7.4E-05	2.9E-04	mg/kg/day	3.0E-03	mg/kg/day	9.6E-02
				2,4-Dinitrotoluene	3.6E+01	µg/L	1.3E-04	mg/kg/day	3.1E-01	$(mg/kg\text{-}day)^{-1}$	3.9E-05	3.5E-04	mg/kg/day	2.0E-03	mg/kg/day	1.8E-01
				Nitrobenzene	6.8E-01	µg/L	2.4E-06	mg/kg/day	N/A	$(mg/kg\text{-}day)^{-1}$	N/A	6.7E-06	mg/kg/day	2.0E-03	mg/kg/day	3.3E-03
				1,3-Dinitrobenzene	3.7E-01	µg/L	1.3E-06	mg/kg/day	N/A		N/A	3.6E-06	mg/kg/day	1.0E-04	mg/kg/day	3.6E-02
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	2.6E-02	mg/kg/day	N/A		N/A	7.2E-02	mg/kg/day	2.0E-03	mg/kg/day	3.6E+01
				RDX	2.3E+01	µg/L	8.0E-05	mg/kg/day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	8.8E-06	2.3E-04	mg/kg/day	3.0E-03	mg/kg/day	7.5E-02
				Antimony, Dissolved	9.8E+01	µg/L	3.4E-04	mg/kg/day	N/A		N/A	9.5E-04	mg/kg/day	4.0E-04	mg/kg/day	2.4E+00
				Arsenic, Dissolved	1.9E+01	µg/L	6.6E-05	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	9.9E-05	1.8E-04	mg/kg/day	3.0E-04	mg/kg/day	6.2E-01
				Beryllium, Dissolved	9.1E+00	µg/L	3.2E-05	mg/kg/day	N/A		N/A	8.9E-05	mg/kg/day	2.0E-03	mg/kg/day	4.5E-02
				Cadmium, Dissolved	8.5E+00	µg/L	3.0E-05	mg/kg/day	N/A		N/A	8.3E-05	mg/kg/day	5.0E-04	mg/kg/day	1.7E-01
				Chromium, Dissolved	7.6E+00	µg/L	2.7E-05	mg/kg/day	5.0E-01	$(mg/kg\text{-}day)^{-1}$	1.3E-05	7.4E-05	mg/kg/day	3.0E-03	mg/kg/day	2.5E-02
				Cobalt, Dissolved	8.9E+01	µg/L	3.1E-04	mg/kg/day	N/A		N/A	8.7E-04	mg/kg/day	3.0E-04	mg/kg/day	2.9E+00
				Iron, Dissolved	4.2E+03	µg/L	1.5E-02	mg/kg/day	N/A		N/A	4.1E-02	mg/kg/day	7.0E-01	mg/kg/day	5.8E-02
				Manganese, Dissolved	1.9E+02	µg/L	6.7E-04	mg/kg/day	N/A		N/A	1.9E-03	mg/kg/day	2.4E-02	mg/kg/day	7.8E-02
				Nickel, Dissolved	4.4E+01	µg/L	1.6E-04	mg/kg/day	N/A		N/A	4.4E-04	mg/kg/day	2.0E-02	mg/kg/day	2.2E-02
				Selenium, Dissolved	1.3E+01	µg/L	4.6E-05	mg/kg/day	N/A		N/A	1.3E-04	mg/kg/day	5.0E-03	mg/kg/day	2.6E-02
				Vanadium, Dissolved	9.1E+01	µg/L	3.2E-04	mg/kg/day	N/A		N/A	8.9E-04	mg/kg/day	5.0E-03	mg/kg/day	1.8E-01
				Zinc, Dissolved	2.3E+03	µg/L	7.9E-03	mg/kg/day	N/A		N/A	2.2E-02	mg/kg/day	3.0E-01	mg/kg/day	7.3E-02
			Exp. Route Total								9.4E-03					5.2E+01
		Exposure Point Total									9.4E-03					5.2E+01
	Exposure Medium Total										9.4E-03					5.2E+01
	Air	Indoor Air	Inhalation	1,2-Dichloroethene	7.3E-03	mg/m^3	6.0E-04	mg/m^3	N/A		N/A	1.7E-03	mg/m^3	N/A		N/A
				Trichloroethene	1.9E-02	mg/m^3	1.6E-03	mg/m^3	2.0E-06	$(\mu g/m^3)^{-1}$	3.2E-06	4.4E-03	mg/m^3	N/A		N/A
				Vinyl chloride	3.7E-03	mg/m^3	3.0E-04	mg/m^3	4.4E-06	$(\mu g/m^3)^{-1}$	1.3E-06	8.5E-04	mg/m^3	1.0E-01	mg/m^3	8.5E-03
			Exp. Route Total								4.5E-06					8.5E-03
		Exposure Point Total									4.5E-06					8.5E-03
	Exposure Medium Total										4.5E-06					8.5E-03
Groundwater Total											9.4E-03					5.2E+01

N/A - Not available.

TABLE 7.5.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units		Units	
Groundwater	Groundwater	Yorktown - Eastover Aquifer Water in Excavation Pit	Dermal	1,1-Dichloroethane	1.1E+00	µg/L	2.5E-08	mg/kg/day	5.7E-03	$(mg/kg\text{-}day)^{-1}$	1.5E-10	1.8E-06	mg/kg/day	2.0E+00	mg/kg/day	8.9E-07
				1,2-Dichloroethane	2.5E-01	µg/L	3.6E-09	mg/kg/day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	3.3E-10	2.5E-07	mg/kg/day	2.0E-02	mg/kg/day	1.3E-05
				Benzene	1.6E+00	µg/L	7.8E-08	mg/kg/day	5.5E-02	$(mg/kg\text{-}day)^{-1}$	4.3E-09	5.5E-06	mg/kg/day	4.0E-03	mg/kg/day	1.4E-03
				cis-1,2-Dichloroethene	5.7E+03	µg/L	1.5E-04	mg/kg/day	N/A		N/A	1.0E-02	mg/kg/day	1.0E-01	mg/kg/day	1.0E-01
				Tetrachloroethene	3.0E+03	µg/L	3.6E-04	mg/kg/day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	1.9E-04	2.5E-02	mg/kg/day	1.0E-01	mg/kg/day	2.5E-01
				trans-1,2-Dichloroethene	1.3E+01	µg/L	3.4E-07	mg/kg/day	N/A		N/A	2.4E-05	mg/kg/day	2.0E-01	mg/kg/day	1.2E-04
				Trichloroethene	1.7E+05	µg/L	7.0E-03	mg/kg/day	5.9E-03	$(mg/kg\text{-}day)^{-1}$	4.1E-05	4.9E-01	mg/kg/day	N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	5.5E-07	mg/kg/day	7.2E-01	$(mg/kg\text{-}day)^{-1}$	4.0E-07	3.9E-05	mg/kg/day	3.0E-03	mg/kg/day	1.3E-02
				2,4-Dinitrotoluene	3.6E+01	µg/L	4.5E-07	mg/kg/day	3.1E-01	$(mg/kg\text{-}day)^{-1}$	1.4E-07	3.1E-05	mg/kg/day	2.0E-03	mg/kg/day	1.6E-02
				Nitrobenzene	6.8E-01	µg/L	1.3E-08	mg/kg/day	N/A		N/A	9.2E-07	mg/kg/day	3.0E-03	mg/kg/day	3.1E-04
				1,3-Dinitrobenzene	3.7E-01	µg/L	3.0E-09	mg/kg/day	N/A		N/A	2.1E-07	mg/kg/day	1.0E-03	mg/kg/day	2.1E-04
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	7.5E-05	mg/kg/day	N/A		N/A	5.3E-03	mg/kg/day	2.0E-03	mg/kg/day	2.6E+00
				RDX	2.3E+01	µg/L	3.7E-08	mg/kg/day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	4.1E-09	2.6E-06	mg/kg/day	3.0E-03	mg/kg/day	8.7E-04
				Aluminum	1.1E+03	µg/L	3.6E-06	mg/kg/day	N/A		N/A	2.5E-04	mg/kg/day	1.0E+00	mg/kg/day	2.5E-04
				Antimony	2.0E+00	µg/L	6.4E-09	mg/kg/day	N/A		N/A	4.5E-07	mg/kg/day	6.0E-05	mg/kg/day	7.4E-03
				Arsenic	6.4E+00	µg/L	2.0E-08	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	3.1E-08	1.4E-06	mg/kg/day	3.0E-04	mg/kg/day	4.8E-03
				Cadmium	1.6E+00	µg/L	5.0E-09	mg/kg/day	N/A		N/A	3.5E-07	mg/kg/day	2.5E-05	mg/kg/day	1.4E-02
				Chromium	3.0E+01	µg/L	1.9E-07	mg/kg/day	1.3E-02	$(mg/kg\text{-}day)^{-1}$	2.4E-09	1.3E-05	mg/kg/day	5.0E-04	mg/kg/day	2.7E-02
				Cobalt	2.0E+00	µg/L	2.6E-09	mg/kg/day	N/A		N/A	1.8E-07	mg/kg/day	3.0E-03	mg/kg/day	6.1E-05
				Iron	1.1E+04	µg/L	3.4E-05	mg/kg/day	N/A		N/A	2.4E-03	mg/kg/day	7.0E-01	mg/kg/day	3.4E-03
				Manganese	2.0E+02	µg/L	6.4E-07	mg/kg/day	N/A		N/A	4.5E-05	mg/kg/day	9.6E-04	mg/kg/day	4.7E-02
				Nickel	5.0E+01	µg/L	3.2E-08	mg/kg/day	N/A		N/A	2.2E-06	mg/kg/day	8.0E-04	mg/kg/day	2.8E-03
				Vanadium	1.1E+01	µg/L	3.4E-08	mg/kg/day	N/A		N/A	2.4E-06	mg/kg/day	1.8E-04	mg/kg/day	1.3E-02
				Zinc	3.3E+03	µg/L	6.2E-06	mg/kg/day	N/A		N/A	4.4E-04	mg/kg/day	3.0E-01	mg/kg/day	1.5E-03
			Exp. Route Total								2.4E-04					3.1E+00
		Exposure Point Total									2.4E-04					3.1E+00
	Exposure Medium Total										2.4E-04					3.1E+00
	Air	Yorktown -Eastover Aquifer Water Vapors in Excavation Pit	Inhalation	1,1-Dichloroethane	1.1E+00	µg/L	8.3E-05	mg/m^3	1.6E-06	$(\mu g/m^3)^{-1}$	1.3E-10	5.8E-06	mg/m^3	N/A		N/A
				1,2-Dichloroethane	2.5E-01	µg/L	4.8E-03	mg/m^3	2.6E-05	$(\mu g/m^3)^{-1}$	1.3E-07	1.3E-06	mg/m^3	2.4E+00	mg/m^3	5.2E-07
				Benzene	1.6E+00	µg/L	1.8E-05	mg/m^3	7.8E-06	$(\mu g/m^3)^{-1}$	1.4E-10	9.5E-06	mg/m^3	3.0E-02	mg/m^3	3.2E-04
				cis-1,2-Dichloroethene	5.7E+03	µg/L	1.4E-04	mg/m^3	N/A		N/A	3.0E-02	mg/m^3	N/A		N/A
				Tetrachloroethene	3.0E+03	µg/L	4.3E-01	mg/m^3	5.9E-06	$(\mu g/m^3)^{-1}$	2.5E-06	1.2E-02	mg/m^3	2.7E-01	mg/m^3	4.6E-02
				trans-1,2-Dichloroethene	1.3E+01	µg/L	7.9E-04	mg/m^3	N/A	$(\mu g/m^3)^{-1}$	N/A	6.9E-05	mg/m^3	6.0E-02	mg/m^3	1.2E-03
				Trichloroethene	1.7E+05	µg/L	1.2E+01	mg/m^3	2.0E-06	$(\mu g/m^3)^{-1}$	2.3E-05	7.9E-01	mg/m^3	N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	1.8E-01	mg/m^3	4.4E-06	$(\mu g/m^3)^{-1}$	7.7E-07	2.0E-04	mg/m^3	1.0E-01	mg/m^3	2.0E-03
				Nitrobenzene	6.8E-01	µg/L	9.9E-04	mg/m^3	4.0E-05	$(\mu g/m^3)^{-1}$	4.0E-08	9.7E-07	mg/m^3	1.8E-02	mg/m^3	5.5E-05
			Exp. Route Total								2.7E-05					4.9E-02
		Exposure Point Total									2.7E-05					4.9E-02
	Exposure Medium Total										2.7E-05					4.9E-02
Groundwater Total											2.6E-04					3.2E+00

TABLE 7.5.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units		Units	
Surface Water	Surface Water	Felgates Creek	Ingestion	Arsenic	4.0E+00	mg/kg	1.1E-09	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.7E-09	7.7E-08	mg/kg/day	4.0E-04	mg/kg/day	1.9E-04
				Chromium	2.1E+00	mg/kg	5.8E-10	mg/kg/day	5.0E-01	$(mg/kg\text{-}day)^{-1}$	2.9E-10	4.1E-08	mg/kg/day	2.0E-02	mg/kg/day	2.0E-06
			Exp. Route Total								1.9E-09					2.0E-04
			Dermal Absorption	Arsenic	4.0E+00	mg/kg	1.1E-09	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.7E-09	7.0E-08	mg/kg/day	6.0E-05	mg/kg/day	1.2E-03
				Chromium	2.1E+00	mg/kg	4.1E-08	mg/kg/day	1.3E-02	$(mg/kg\text{-}day)^{-1}$	5.1E-10	7.4E-08	mg/kg/day	5.0E-04	mg/kg/day	1.5E-04
			Exp. Route Total								2.2E-09					1.3E-03
		Exposure Point Total									4.1E-09					1.5E-03
	Exposure Medium Total										4.1E-09					1.5E-03
Surface Water Total											4.1E-09					1.5E-03
Sediment	Sediment		Ingestion	Arsenic	8.7E+00	mg/kg	1.2E-08	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.8E-08	1.1E-05	mg/kg/day	3.0E-04	mg/kg/day	3.7E-02
				Chromium	4.0E+01	mg/kg	5.3E-08	mg/kg/day	5.0E-01	$(mg/kg\text{-}day)^{-1}$	2.7E-08	5.0E-05	mg/kg/day	2.0E-02	mg/kg/day	2.5E-03
			Exp. Route Total								4.4E-08					3.9E-02
			Dermal Absorption	Arsenic	8.7E+00	mg/kg	2.5E-09	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	3.7E-09	1.7E-07	mg/kg/day	3.0E-04	mg/kg/day	5.8E-04
				Chromium	4.0E+01	mg/kg	3.8E-09	mg/kg/day	1.3E-02	$(mg/kg\text{-}day)^{-1}$	4.8E-11	2.7E-07	mg/kg/day	5.0E-04	mg/kg/day	5.3E-04
			Exp. Route Total								3.8E-09					1.1E-03
		Exposure Point Total									4.8E-08					4.0E-02
	Exposure Medium Total										4.8E-08					4.0E-02
Sediment Total											4.8E-08					4.0E-02
							Total of Receptor Risks Across All Media				2.6E-04	Total of Receptor Hazards Across All Media				3.2E+00

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Tables 7.5.RME Supplement A

Air concentration above excavation calculated on Table 7.5.RME Supplement B

DA_{event} for dermal exposure to surface water calculated on Table 7.5.RME Supplement C

Table 7.5.RME Supplement A
Calculation of DA_{event}
Construction Worker Groundwater
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
1,1-Dichloroethane	1.1E+00	6.7E-03	2.6E-02	3.8E-01	9.2E-01	1.0E+00	8	6.4E-08	3
1,2-Dichloroethane	2.5E-01	4.2E-03	1.6E-02	3.8E-01	9.2E-01	1.0E+00	8	9.1E-09	3
Benzene	1.6E+00	1.5E-02	5.1E-02	2.9E-01	7.0E-01	1.0E+00	8	2.0E-07	3
cis-1,2-Dichloroethene[1]	5.7E+03	7.7E-03	2.9E-02	3.7E-01	8.9E-01	1.0E+00	8	3.7E-04	3
Tetrachloroethene	3.0E+03	3.3E-02	1.7E-01	9.1E-01	2.2E+00	1.0E+00	8	9.0E-04	3
trans-1,2-Dichloroethene	1.3E+01	7.7E-03	2.9E-02	3.7E-01	8.9E-01	1.0E+00	8	8.5E-07	3
Trichloroethene	1.7E+05	1.2E-02	5.1E-02	5.8E-01	1.4E+00	1.0E+00	8	1.8E-02	3
Vinyl chloride	3.0E+01	5.6E-03	1.7E-02	2.4E-01	5.7E-01	1.0E+00	8	1.4E-06	3
2,4-Dinitrotoluene	3.6E+01	3.1E-03	1.6E-02	1.1E+00	2.7E+00	1.0E+00	8	1.1E-06	3
Nitrobenzene[2]	6.8E-01	5.4E-03	2.3E-02	5.1E-01	1.2E+00	1.0E+00	8	3.3E-08	3
1,3-Dinitrobenzene[2]	3.7E-01	2.1E-03	1.0E-02	9.2E-01	2.2E+00	1.0E+00	8	7.4E-09	3
2-Amino-4,6-dinitrotoluene[2]	7.4E+03	2.4E-03	1.3E-02	1.3E+00	3.2E+00	1.0E+00	8	1.9E-04	3
RDX[2]	2.3E+01	3.5E-04	2.0E-03	1.8E+00	4.4E+00	1.0E+00	8	9.4E-08	3
Aluminum	1.1E+03	1.0E-03	NA	NA	NA	NA	8	9.1E-06	1
Antimony	2.0E+00	1.0E-03	NA	NA	NA	NA	8	1.6E-08	1
Arsenic	6.4E+00	1.0E-03	NA	NA	NA	NA	8	5.1E-08	1
Cadmium	1.6E+00	1.0E-03	NA	NA	NA	NA	8	1.3E-08	1
Chromium	3.0E+01	2.0E-03	NA	NA	NA	NA	8	4.8E-07	1
Cobalt	2.0E+00	4.0E-04	NA	NA	NA	NA	8	6.5E-09	1
Iron	1.1E+04	1.0E-03	NA	NA	NA	NA	8	8.5E-05	1
Manganese	2.0E+02	1.0E-03	NA	NA	NA	NA	8	1.6E-06	1
Nickel	5.0E+01	2.0E-04	NA	NA	NA	NA	8	8.0E-08	1
Vanadium	1.1E+01	1.0E-03	NA	NA	NA	NA	8	8.4E-08	1
Zinc	3.3E+03	6.0E-04	NA	NA	NA	NA	8	1.6E-05	1

[1] trans-1,2-Dichloroethane used as a surrogate.

Inorganics: DA_{event} (mg/cm^2-event) =

K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =

If t_{event}<t*, then DA_{event} =

2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =

FA x K_p x CW x (t_{event}/(1+B) + 2 x τ_{event} x ((1 + 3xB + 3xB^2)/(1+B)^2) x 0.001 mg/µg x 0.001 l/cm^3 (eq 3)

Notes:

Permeability constants and other input parameter values from EPA 2004,*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this doc

B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).

t* - Time to reach steady-state

[1] trans-1,2-Dichloroethane used as a surrogate.

[2]Lag time and B calculated on Table 7.1b.RME Supplement. Permeability constants from RAIS databases (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=

N/A - not applicable.

Table 7.5.RME Supplement B
Calculation of Inhalation Concentration in Excavation Trench
Construction Worker
Site 6, NWS Yorktown, Yorktown, Virginia

Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	CAS No.	Molecular Weight MWi g/mol	Henry's Law Constant Hi atm-m3/mol	Gas-Phase Mass Transfer Coefficient KiG cm/s	Liquid-Phase Mass Transfer Coefficient KiL cm/s	Overall Mass Transfer Coefficient Ki cm/s	Concentration of Contaminant in Groundwater Cgw ug/L	Volatilization Factor VF L/m3	Concentration of Contaminant in Trench Ctrench ug/m3	Concentration of Contaminant in Trench Ctrench mg/m3
1,1-Dichloroethane	75-34-3	98.96	5.6E-03	4.7E-01	1.1E-03	1.1E-03	1.1E+00	4.6E-02	5.1E-02	5.1E-05
1,2-Dichloroethane	107-06-2	98.96	9.8E-04	4.7E-01	1.1E-03	1.1E-03	2.5E-01	4.4E-02	1.1E-02	1.1E-05
Benzene	71-43-2	78.11	5.6E-03	5.1E-01	1.3E-03	1.3E-03	1.6E+00	5.2E-02	8.3E-02	8.3E-05
cis-1,2-Dichloroethene	156-59-2	96.94	4.1E-03	4.7E-01	1.1E-03	1.1E-03	5.7E+03	4.6E-02	2.6E+02	2.6E-01
Tetrachloroethene	127-18-4	165.83	1.8E-02	4.0E-01	8.8E-04	8.8E-04	3.0E+03	3.6E-02	1.1E+02	1.1E-01
trans-1,2-Dichloroethene	156-60-5	96.94	9.38E-03	4.74E-01	1.15E-03	1.14E-03	1.3E+01	4.68E-02	6.06E-01	6.06E-04
Trichloroethene	79-01-6	131.39	1.0E-02	4.3E-01	9.9E-04	9.8E-04	1.7E+05	4.0E-02	6.9E+03	6.9E+00
Vinyl Chloride (commercial, construction)	75-01-4	62.50	2.7E-02	5.5E-01	1.4E-03	1.4E-03	3.0E+01	5.9E-02	1.7E+00	1.7E-03
Nitrobenzene	98-95-3	123.11	2.40E-05	4.37E-01	1.02E-03	3.02E-04	6.8E-01	1.24E-02	8.48E-03	8.48E-06

Equations

VF = $(K_i \times A \times F \times 10^{-3} \times 10^{4} \times 3600) / (ACH \times V)$

K_i = $1 / \{(1/k_{iL}) + [(R\ T) / (H_i\ k_{iG})]\}$

k_{iL} = $(MW_{O2}/MW_i)^{0.5} \times (T/298) \times k_{L,}O_2$

k_{iG} = $(MW_{H2O}/MW_i)^{0.335} \times (T/298)^{1.005} \times k_G, H_2O$

Parameter Value

For Mass-Transfer Coefficients

Kg,H2O	0.833	cm/s
MWH2O	18	
Kg,O2	0.002	cm/s
MWO2	32	
T	**77**	F
T	298	K
R	8.20E-05	atm-m3/mol-K

For Emission Flux and Concentration in Trench

CF1	1.00E-03	L/cm3
CF2	1.00E+04	cm2/m2
CF3	3600	s/hr
F	**1**	
ACH	360	hr-1

Trench dimensions

Length	**10**	ft
	3.05	m
Width	**10**	ft
	3.05	m
Depth	**8**	ft
	2.44	m
Width/Depth	1.25	

Table 7.5.RME Supplement C
Calculation of DA_{event}
Construction Worker Surface Water
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
Arsenic	4.0E+00	1.0E-03	NA	NA	NA	NA	8	3.2E-08	1
Chromium	2.1E+00	2.0E-03	NA	NA	NA	NA	8	3.3E-08	1

Inorganics: DA_{event} (mg/cm^2-event) =
K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =
If t_{event}<t*, then DA_{event} =
2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =
FA x K_p x CW x (t_{event}/(1+B) + 2 x τ_{event} x ((1 + 3xB + $3xB^2$)/$(1+B)^2$) x 0.001 mg/µg x 0.001 l/cm^3 (eq 3)

Notes:
Permeability constants and other input parameter values from EPA 2004,*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this doc
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state
N/A - not applicable.

TABLE 7.6.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	Ingestion	2,4-Dinitrotoluene	5.1E+01	µg/L	N/A		N/A		N/A	1.4E-03	mg/kg/day	2.0E-03	mg/kg/day	7.0E-01
				1,3-Dinitrobenzene	1.8E+01	µg/L	N/A		N/A		N/A	4.9E-04	mg/kg/day	1.0E-04	mg/kg/day	4.9E+00
				3,5-Dinitroaniline	7.8E-01	µg/L	N/A		N/A		N/A	2.1E-05	mg/kg/day	N/A		N/A
				RDX	7.0E+01	µg/L	N/A		N/A		N/A	1.9E-03	mg/kg/day	3.0E-03	mg/kg/day	6.4E-01
				Manganese, Dissolved	1.2E+02	µg/L	N/A		N/A		N/A	3.3E-03	mg/kg/day	2.4E-02	mg/kg/day	1.4E-01
			Exp. Route Total								N/A					6.4E+00
			Dermal	2,4-Dinitrotoluene	5.1E+01	µg/L	N/A		N/A		N/A	8.6E-05	mg/kg/day	2.0E-03	mg/kg/day	4.3E-02
				1,3-Dinitrobenzene	1.8E+01	µg/L	N/A		N/A		N/A	1.8E-05	mg/kg/day	1.0E-04	mg/kg/day	1.8E-01
				3,5-Dinitroaniline	7.8E-01	µg/L	N/A		N/A		N/A	1.4E-06	mg/kg/day	N/A		N/A
				RDX	7.0E+01	µg/L	N/A		N/A		N/A	1.7E-05	mg/kg/day	3.0E-03	mg/kg/day	5.7E-03
				Manganese, Dissolved	1.2E+02	µg/L	N/A		N/A		N/A	1.7E-05	mg/kg/day	9.6E-04	mg/kg/day	1.8E-02
			Exp. Route Total								N/A					2.5E-01
		Exposure Point Total									N/A					6.7E+00
	Exposure Medium Total										N/A					6.7E+00
Groundwater Total											N/A					6.7E+00

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Table 7.1.RME Supplement A

Table 7.6.RME Supplement A
Calculation of DA_{event}
Residential Adult Groundwater
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
2,4-Dinitrotoluene	5.1E+01	3.1E-03	1.6E-02	1.1E+00	2.7E+00	1.0E+00	0.58	3.5E-07	2
1,3-Dinitrobenzene[2]	1.8E+01	2.1E-03	1.0E-02	9.2E-01	2.2E+00	1.0E+00	0.58	7.4E-08	2
3,5-Dinitroaniline[2]	7.8E-01	3.2E-03	1.7E-02	1.1E+00	2.7E+00	1.0E+00	0.58	5.5E-09	2
RDX[2]	7.0E+01	3.5E-04	2.0E-03	1.8E+00	4.4E+00	1.0E+00	0.58	7.0E-08	2
Manganese, Dissolved	1.2E+02	1.0E-03	NA	NA	NA	NA	0.58	6.9E-08	1

[1] trans-1,2-Dichloroethane used as a surrogate.

Inorganics: DA_{event} (mg/cm^2-event) =

K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =

If t_{event}<t*, then DA_{event} =

2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =

FA x K_p x CW x (t_{event}/(1+B) + 2 x τ_{event} x ((1 + 3xB + 3xB^2)/(1+B)^2) x 0.001 mg/µg x 0.001 l/cm^3 (eq 3)

Notes:

Permeability constants and other input parameter values from EPA 2004,*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document

B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).

t* - Time to reach steady-state

[2]Lag time and B calculated on Table 7.1b.RME Supplement. Permeability constants from RAIS databases (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem).

N/A - not applicable.

Table 7.6b.RME Supplement
Calculation of DAevent
Site 6
NWS Yorktown, Yorktown, Virginia

Chemical	MW	Kp (cm/hr)	B[1]	Dsc/lsc[1]	lsc (cm)	Dsc (cm^2/hr)	τ[1] (hr)	c[1]	b[1]	t*[1] (hr)
1,3-Dinitrobenzene	168.11	2.1E-03	1.0E-02	1.8E-04	1.0E-03	1.8E-07	9.2E-01	3.4E-01	3.1E-01	2.2E+00
3,5-Dinitroaniline	183	3.2E-03	1.7E-02	1.5E-04	1.0E-03	1.5E-07	1.1E+00	3.4E-01	3.1E-01	2.7E+00
RDX	222.12	3.5E-04	2.0E-03	9.0E-05	1.0E-03	9.0E-08	1.8E+00	3.3E-01	3.0E-01	4.4E+00

1. Equations from *Dermal Exposure Assessment: Principles and Applications* . EPA/600/8-91/011B. January 1992.
Kp values from RAIS database (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem).

TABLE 7.7.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	Ingestion	2,4-Dinitrotoluene	5.1E+01	µg/L	N/A		N/A		N/A	3.3E-03	mg/kg/day	2.0E-03	mg/kg/day	1.6E+00
				1,3-Dinitrobenzene	1.8E+01	µg/L	N/A		N/A		N/A	1.2E-03	mg/kg/day	1.0E-04	mg/kg/day	1.2E+01
				3,5-Dinitroaniline	7.8E-01	µg/L	N/A		N/A		N/A	5.0E-05	mg/kg/day	N/A		N/A
				RDX	7.0E+01	µg/L	N/A		N/A		N/A	4.5E-03	mg/kg/day	3.0E-03	mg/kg/day	1.5E+00
				Manganese, Dissolved	1.2E+02	µg/L	N/A		N/A		N/A	7.6E-03	mg/kg/day	2.4E-02	mg/kg/day	3.2E-01
			Exp. Route Total								N/A					1.5E+01
			Dermal	2,4-Dinitrotoluene	5.1E+01	µg/L	N/A		N/A		N/A	2.9E-04	mg/kg/day	2.0E-03	mg/kg/day	1.5E-01
				1,3-Dinitrobenzene	1.8E+01	µg/L	N/A		N/A		N/A	6.2E-05	mg/kg/day	1.0E-04	mg/kg/day	6.2E-01
				3,5-Dinitroaniline	7.8E-01	µg/L	N/A		N/A		N/A	5.0E-06	mg/kg/day	N/A		N/A
				RDX	7.0E+01	µg/L	N/A		N/A		N/A	5.8E-05	mg/kg/day	3.0E-03	mg/kg/day	1.9E-02
				Manganese, Dissolved	1.2E+02	µg/L	N/A		N/A		N/A	7.5E-05	mg/kg/day	9.6E-04	mg/kg/day	7.8E-02
			Exp. Route Total								N/A					8.6E-01
		Exposure Point Total									N/A					1.6E+01
	Exposure Medium Total										N/A					1.6E+01
Groundwater Total											N/A					1.6E+01

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Table 7.7.RME Supplement A

Table 7.7.RME Supplement A
Calculation of DA_{event}
Residential Child Groundwater
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
2,4-Dinitrotoluene	5.1E+01	3.1E-03	1.6E-02	1.1E+00	2.7E+00	1.0E+00	1	4.6E-07	2
1,3-Dinitrobenzene[2]	1.8E+01	2.1E-03	1.0E-02	9.2E-01	2.2E+00	1.0E+00	1	9.8E-08	2
3,5-Dinitrobenzene[2]	7.8E-01	3.2E-03	1.7E-02	1.3E+00	3.2E+00	1.0E+00	1	8.0E-09	2
RDX[2]	7.0E+01	3.5E-04	2.0E-03	1.8E+00	4.4E+00	1.0E+00	1	9.2E-08	2
Manganese, Dissolved	1.2E+02	1.0E-03	NA	NA	NA	NA	1	1.2E-07	1

[1] trans-1,2-Dichloroethane used as a surrogate.

Inorganics: DA_{event} (mg/cm^2-event) =

K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =

If t_{event}<t*, then DA_{event} =

2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =

FA x K_p x CW x (t_{event}/(1+B) + 2 x τ_{event} x ((1 + 3xB + 3xB^2)/(1+B)^2) x 0.001 mg/µg x 0.001 l/cm^3 (eq 3)

Notes:

Permeability constants and other input parameter values from EPA 2004,*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document

B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).

t* - Time to reach steady-state

[1] trans-1,2-Dichloroethane used as a surrogate.

[2]Lag time and B calculated on Table 7.1b.RME Supplement. Permeability constants from RAIS databases (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem).

N/A - not applicable.

TABLE 7.8.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	Ingestion	2,4-Dinitrotoluene	5.1E+01	µg/L	7.6E-04	mg/kg/day	3.1E-01	$(mg/kg\text{-}day)^{-1}$	2.4E-04	N/A		N/A		N/A
				1,3-Dinitrobenzene	1.8E+01	µg/L	2.7E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				3,5-Dinitroaniline	7.8E-01	µg/L	1.2E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				RDX	7.0E+01	µg/L	1.0E-03	mg/kg/day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	1.1E-04	N/A		N/A		N/A
				Manganese, Dissolved	1.2E+02	µg/L	1.8E-03	mg/kg/day	N/A		N/A	N/A		N/A		N/A
			Exp. Route Total								3.5E-04					N/A
			Dermal	2,4-Dinitrotoluene	5.1E+01	µg/L	4.6E-05	mg/kg/day	3.1E-01	$(mg/kg\text{-}day)^{-1}$	1.4E-05	N/A		N/A		N/A
				1,3-Dinitrobenzene	1.8E+01	µg/L	9.8E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				3,5-Dinitroaniline	7.8E-01	µg/L	7.6E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				RDX	7.0E+01	µg/L	9.2E-06	mg/kg/day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	1.0E-06	N/A		N/A		N/A
				Manganese, Dissolved	1.2E+02	µg/L	1.0E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
			Exp. Route Total								1.5E-05					N/A
		Exposure Point Total									3.7E-04					N/A
	Exposure Medium Total										3.7E-04					N/A
Groundwater Total											3.7E-04					N/A

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Tables 7.6.RME and 7.7.RME Supplement A.

TABLE 7.9.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	Ingestion	2,4-Dinitrotoluene	5.1E+01	µg/L	1.8E-04	mg/kg/day	3.1E-01	$(mg/kg\text{-}day)^{-1}$	5.5E-05	5.0E-04	mg/kg/day	2.0E-03	mg/kg/day	2.5E-01
				1,3-Dinitrobenzene	1.8E+01	µg/L	6.3E-05	mg/kg/day	N/A		N/A	1.8E-04	mg/kg/day	1.0E-04	mg/kg/day	1.8E+00
				3,5-Dinitroaniline	7.8E-01	µg/L	2.7E-06	mg/kg/day	N/A		N/A	7.6E-06	mg/kg/day	N/A		N/A
				RDX	7.0E+01	µg/L	2.4E-04	mg/kg/day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	2.7E-05	6.8E-04	mg/kg/day	3.0E-03	mg/kg/day	2.3E-01
				Manganese, Dissolved	1.2E+02	µg/L	4.2E-04	mg/kg/day	N/A		N/A	1.2E-03	mg/kg/day	2.4E-02	mg/kg/day	4.9E-02
			Exp. Route Total								8.2E-05					2.3E+00
		Exposure Point Total									8.2E-05					2.3E+00
	Exposure Medium Total										8.2E-05					2.3E+00
Groundwater Total											8.2E-05					2.3E+00

N/A - Not available.

TABLE 7.10.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium		Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown - Eastover Aquifer Water from GW09 in Excavation Pit	Dermal	2,4-Dinitrotoluene	5.1E+01	µg/L	6.4E-07	mg/kg/day	3.1E-01		2.0E-07	4.4E-05	mg/kg/day	2.0E-03	mg/kg/day	2.2E-02
				1,3-Dinitrobenzene	1.8E+01	µg/L	1.4E-07	mg/kg/day	N/A		N/A	1.0E-05	mg/kg/day	1.0E-03	mg/kg/day	1.0E-02
				3,5-Dinitroaniline	7.8E-01	µg/L	1.1E-08	mg/kg/day	N/A		N/A	7.4E-07	mg/kg/day	N/A		N/A
				RDX	7.0E+01	µg/L	1.1E-07	mg/kg/day	N/A		N/A	8.0E-06	mg/kg/day	3.0E-03	mg/kg/day	2.7E-03
				Manganese	1.2E+02	µg/L	3.8E-07	mg/kg/day	N/A		N/A	2.7E-05	mg/kg/day	9.6E-04	mg/kg/day	2.8E-02
			Exp. Route Total								2.0E-07					6.3E-02
		Exposure Point Total									2.0E-07					6.3E-02
	Exposure Medium Total										2.0E-07					6.3E-02
Groundwater Total											2.0E-07					6.3E-02

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Tables 7.10.RME Supplement A

Table 7.10.RME Supplement A
Calculation of DA_{event}
Construction Worker Groundwater
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
2,4-Dinitrotoluene	5.1E+01	3.1E-03	1.6E-02	1.1E+00	2.7E+00	1.0E+00	8	1.6E-06	3
1,3-Dinitrobenzene[2]	1.8E+01	2.1E-03	1.0E-02	9.2E-01	2.2E+00	1.0E+00	8	3.6E-07	3
3,5-Dinitrobenzene[2]	7.8E-01	3.2E-03	1.7E-02	1.3E+00	3.2E+00	1.0E+00	8	2.6E-08	3
RDX[2]	7.0E+01	3.5E-04	2.0E-03	1.8E+00	4.4E+00	1.0E+00	8	2.9E-07	3
Manganese	1.2E+02	1.0E-03	NA	NA	NA	NA	8	9.5E-07	1

[1] trans-1,2-Dichloroethane used as a surrogate.

Inorganics: DA_{event} (mg/cm^2-event) =

K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =

If t_{event}<t*, then DA_{event} =

2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =

FA x K_p x CW x (t_{event}/(1+B) + 2 x τ_{event} x ((1 + 3xB + 3xB^2)/(1+B)^2) x 0.001 mg/µg x 0.001 l/cm^3 (eq 3)

Notes:

Permeability constants and other input parameter values from EPA 2004,*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document

B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).

t* - Time to reach steady-state

[1] trans-1,2-Dichloroethane used as a surrogate.

[2]Lag time and B calculated on Table 7.1b.RME Supplement. Permeability constants from RAIS databases (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem).

N/A - not applicable.

TABLE 7.11.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Current/Future
Receptor Population: Trespasser/Visitor
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Water	Surface Water	Felgates Creek	Ingestion	Arsenic	4.0E+00	mg/kg	1.4E-07	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.1E-07	4.0E-07	mg/kg/day	3.0E-04	mg/kg/day	1.3E-03
				Chromium	2.1E+00	mg/kg	7.3E-08	mg/kg/day	5.0E-01	$(mg/kg\text{-}day)^{-1}$	3.6E-08	2.1E-07	mg/kg/day	3.0E-03	mg/kg/day	7.1E-05
			Exp. Route Total								2.4E-07					1.4E-03
			Dermal Absorption	Arsenic	4.0E+00	mg/kg	1.6E-08	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.4E-08	4.6E-08	mg/kg/day	3.0E-04	mg/kg/day	1.5E-04
				Chromium	2.1E+00	mg/kg	1.7E-08	mg/kg/day	1.3E-02	$(mg/kg\text{-}day)^{-1}$	2.1E-10	4.8E-08	mg/kg/day	7.5E-05	mg/kg/day	6.4E-04
			Exp. Route Total								2.4E-08					8.0E-04
		Exposure Point Total									2.7E-07					2.2E-03
	Exposure Medium Total										2.7E-07					2.2E-03
Medium Total											2.7E-07					2.2E-03
Sediment	Sediment	Felgates Creek	Ingestion	Arsenic	8.7E+00	mg/kg	3.0E-07	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.6E-07	8.9E-07	mg/kg/day	3.0E-04	mg/kg/day	3.0E-03
				Chromium	4.0E+01	mg/kg	1.4E-06	mg/kg/day	5.0E-01	$(mg/kg\text{-}day)^{-1}$	7.0E-07	4.1E-06	mg/kg/day	3.0E-03	mg/kg/day	1.4E-03
			Exp. Route Total								1.2E-06					4.3E-03
			Dermal Absorption	Arsenic	8.7E+00	mg/kg	3.1E-07	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.7E-07	9.1E-07	mg/kg/day	3.0E-04	mg/kg/day	3.0E-03
				Chromium	4.0E+01	mg/kg	4.8E-07	mg/kg/day	1.3E-02	$(mg/kg\text{-}day)^{-1}$	5.9E-09	1.4E-06	mg/kg/day	7.5E-05	mg/kg/day	1.8E-02
			Exp. Route Total								4.7E-07					2.2E-02
		Exposure Point Total									1.6E-06					2.6E-02
	Exposure Medium Total										1.6E-06					2.6E-02
Medium Total											1.6E-06					2.6E-02
									Total of Receptor Risks Across All Media		1.9E-06			Total of Receptor Hazards Across All Media		2.8E-02

Notes-

N/A = Not applicable.

1. Dermal absorption factors (DABs) used to calculated dermal absorption intake from sediment are chemical specific as shown in RAGS Part E, Exhibit 3-4. DABS of 0.03 used for arsenic, and 0.01 for chromium.

DA_{event} for dermal exposure to surface water calculated on Table 7.11.RME Supplement A

Table 7.11.RME Supplement A
Calculation of DA_{event}
Adult Trespasser - Surface Water
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
Arsenic	4.0E+00	1.0E-03	NA	NA	NA	NA	1	4.0E-09	1
Chromium	2.1E+00	2.0E-03	NA	NA	NA	NA	1	4.2E-09	1

Inorganics: DA_{event} (mg/cm^2-event) =
K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =
If t_{event}<t*, then DA_{event} =
2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =
FA x K_p x CW x (t_{event}/(1+B) + 2 x τ_{event} x ((1 + 3xB + 3xB^2)/(1+B)^2) x 0.001 mg/µg x 0.001 l/cm^3 (eq 3)

Notes:
Permeability constants and other input parameter values from EPA 2004,*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state
N/A - not applicable.

TABLE 7.12.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Current/Future
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Surface Water	Surface Water	Indian Field Creek Felgates Creek	Ingestion	Arsenic	4.0E+00	mg/kg	7.1E-08	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.1E-07	5.5E-07	mg/kg/day	3.0E-04	mg/kg/day	1.8E-03
				Chromium	2.1E+00	mg/kg	3.7E-08	mg/kg/day	5.0E-01	$(mg/kg\text{-}day)^{-1}$	1.9E-08	2.9E-07	mg/kg/day	3.0E-03	mg/kg/day	9.7E-05
			Exp. Route Total								1.3E-07					1.9E-03
			Dermal Absorption	Arsenic	4.0E+00	mg/kg	5.7E-09	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	8.6E-09	4.5E-08	mg/kg/day	3.0E-04	mg/kg/day	1.5E-04
				Chromium	2.1E+00	mg/kg	6.1E-09	mg/kg/day	1.3E-02	$(mg/kg\text{-}day)^{-1}$	7.6E-11	4.7E-08	mg/kg/day	7.5E-05	mg/kg/day	6.3E-04
			Exp. Route Total								8.7E-09					7.8E-04
		Exposure Point Total									1.3E-07					2.7E-03
	Exposure Medium Total										1.3E-07					2.7E-03
Medium Total											1.3E-07					2.7E-03
Sediment	Sediment	Felgates Creek	Ingestion	Arsenic	8.7E+00	mg/kg	1.6E-07	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	2.3E-07	1.2E-06	mg/kg/day	3.0E-04	mg/kg/day	4.1E-03
				Chromium	4.0E+01	mg/kg	7.2E-07	mg/kg/day	5.0E-01	$(mg/kg\text{-}day)^{-1}$	3.6E-07	5.6E-06	mg/kg/day	3.0E-03	mg/kg/day	1.9E-03
			Exp. Route Total								5.9E-07					5.9E-03
			Dermal Absorption	Arsenic	8.7E+00	mg/kg	7.6E-08	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.1E-07	5.9E-07	mg/kg/day	3.0E-04	mg/kg/day	2.0E-03
				Chromium	4.0E+01	mg/kg	1.2E-07	mg/kg/day	1.3E-02	$(mg/kg\text{-}day)^{-1}$	1.4E-09	9.0E-07	mg/kg/day	7.5E-05	mg/kg/day	1.2E-02
			Exp. Route Total								1.2E-07					1.4E-02
		Exposure Point Total									7.1E-07					2.0E-02
	Exposure Medium Total										7.1E-07					2.0E-02
Medium Total											7.1E-07					2.0E-02
										Total of Receptor Risks Across All Media	8.4E-07				Total of Receptor Hazards Across All Media	2.3E-02

Notes-

N/A = Not applicable.

1. Dermal absorption factors (DABs) used to calculated dermal absorption intake from sediment are chemical specific as shown in RAGS Part E, Exhibit 3-4. DABS of 0.03 used for arsenic, and 0.01 for chromium.

DA_{event} for dermal exposure to surface water calculated on Table 7.12.RME Supplement A

Table 7.12.RME Supplement A
Calculation of DA_{event}
Adolescent Trespasser - Surface Water
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
Arsenic	4.0E+00	1.0E-03	NA	NA	NA	NA	1	4.0E-09	1
Chromium	2.1E+00	2.0E-03	NA	NA	NA	NA	1	4.2E-09	1

Inorganics: DA_{event} (mg/cm^2-event) =
K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =
If t_{event}<t*, then DA_{event} =
2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =
FA x K_p x CW x (t_{event}/(1+B) + 2 x τ_{event} x ((1 + 3xB + 3xB^2)/(1+B)^2) x 0.001 mg/µg x 0.001 l/cm^3 (eq 3)

Notes:
Permeability constants and other input parameter values from EPA 2004,*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document
B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).
t* - Time to reach steady-state
N/A - not applicable.

TABLE 7.1.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water	Ingestion	1,1-Dichloroethane	1.1E+00	µg/L	N/A		N/A		N/A	1.4E-05	mg/kg/day	2.0E-01	mg/kg/day	7.1E-05
				1,2-Dichloroethane	2.5E-01	µg/L	N/A		N/A		N/A	3.2E-06	mg/kg/day	2.0E-02	mg/kg/day	1.6E-04
				Benzene	1.6E+00	µg/L	N/A		N/A		N/A	2.1E-05	mg/kg/day	4.0E-03	mg/kg/day	5.1E-03
				cis-1,2-Dichloroethene	5.7E+03	µg/L	N/A		N/A		N/A	7.3E-02	mg/kg/day	1.0E-02	mg/kg/day	7.3E+00
				Tetrachloroethene	3.0E+03	µg/L	N/A		N/A		N/A	3.8E-02	mg/kg/day	1.0E-02	mg/kg/day	3.8E+00
				trans-1,2-Dichloroethene	1.3E+01	µg/L	N/A		N/A		N/A	1.7E-04	mg/kg/day	2.0E-02	mg/kg/day	8.3E-03
				Trichloroethene	1.7E+05	µg/L	N/A		N/A		N/A	2.2E+00	mg/kg/day	N/A	mg/kg/day	N/A
				Vinyl chloride	3.0E+01	µg/L	N/A		N/A		N/A	3.8E-04	mg/kg/day	3.0E-03	mg/kg/day	1.3E-01
				2,4-Dinitrotoluene	3.6E+01	µg/L	N/A		N/A		N/A	4.6E-04	mg/kg/day	2.0E-03	mg/kg/day	2.3E-01
				Nitrobenzene	6.8E-01	µg/L	N/A		N/A		N/A	8.8E-06	mg/kg/day	2.0E-03	mg/kg/day	4.4E-03
				1,3-Dinitrobenzene	3.7E-01	µg/L	N/A		N/A		N/A	4.7E-06	mg/kg/day	1.0E-04	mg/kg/day	4.7E-02
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	N/A		N/A		N/A	9.5E-02	mg/kg/day	2.0E-03	mg/kg/day	4.7E+01
				RDX	2.3E+01	µg/L	N/A		N/A		N/A	2.9E-04	mg/kg/day	3.0E-03	mg/kg/day	9.8E-02
				Antimony, Dissolved	9.8E+01	µg/L	N/A		N/A		N/A	1.3E-03	mg/kg/day	4.0E-04	mg/kg/day	3.1E+00
				Arsenic, Dissolved	1.9E+01	µg/L	N/A		N/A		N/A	2.4E-04	mg/kg/day	3.0E-04	mg/kg/day	8.1E-01
				Beryllium, Dissolved	9.1E+00	µg/L	N/A		N/A		N/A	1.2E-04	mg/kg/day	2.0E-03	mg/kg/day	5.8E-02
				Cadmium, Dissolved	8.5E+00	µg/L	N/A		N/A		N/A	1.1E-04	mg/kg/day	5.0E-04	mg/kg/day	2.2E-01
				Chromium, Dissolved	7.6E+00	µg/L	N/A		N/A		N/A	9.7E-05	mg/kg/day	3.0E-03	mg/kg/day	3.2E-02
				Cobalt, Dissolved	8.9E+01	µg/L	N/A		N/A		N/A	1.1E-03	mg/kg/day	3.0E-04	mg/kg/day	3.8E+00
				Iron, Dissolved	4.2E+03	µg/L	N/A		N/A		N/A	5.3E-02	mg/kg/day	7.0E-01	mg/kg/day	7.6E-02
				Manganese, Dissolved	1.9E+02	µg/L	N/A		N/A		N/A	2.5E-03	mg/kg/day	2.4E-02	mg/kg/day	1.0E-01
				Nickel, Dissolved	4.4E+01	µg/L	N/A		N/A		N/A	5.7E-04	mg/kg/day	2.0E-02	mg/kg/day	2.9E-02
				Selenium, Dissolved	1.3E+01	µg/L	N/A		N/A		N/A	1.7E-04	mg/kg/day	5.0E-03	mg/kg/day	3.3E-02
				Vanadium, Dissolved	9.1E+01	µg/L	N/A		N/A		N/A	1.2E-03	mg/kg/day	5.0E-03	mg/kg/day	2.3E-01
				Zinc, Dissolved	2.3E+03	µg/L	N/A		N/A		N/A	2.9E-02	mg/kg/day	3.0E-01	mg/kg/day	9.6E-02
			Exp. Route Total								N/A					6.8E+01
			Dermal	1,1-Dichloroethane	1.1E+00	µg/L	N/A		N/A		N/A	1.0E-06	mg/kg/day	2.0E-01	mg/kg/day	5.2E-06
				1,2-Dichloroethane	2.5E-01	µg/L	N/A		N/A		N/A	1.5E-07	mg/kg/day	2.0E-02	mg/kg/day	7.4E-06
				Benzene	1.6E+00	µg/L	N/A		N/A		N/A	2.9E-06	mg/kg/day	4.0E-03	mg/kg/day	7.3E-04
				cis-1,2-Dichloroethene	5.7E+03	µg/L	N/A		N/A		N/A	6.1E-03	mg/kg/day	1.0E-02	mg/kg/day	6.1E-01
				Tetrachloroethene	3.0E+03	µg/L	N/A		N/A		N/A	2.2E-02	mg/kg/day	1.0E-02	mg/kg/day	2.2E+00
				trans-1,2-Dichloroethene	1.3E+01	µg/L	N/A		N/A		N/A	1.4E-05	mg/kg/day	2.0E-02	mg/kg/day	6.9E-04
				Trichloroethene	1.7E+05	µg/L	N/A		N/A		N/A	3.5E-01	mg/kg/day	N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	N/A		N/A		N/A	1.8E-05	mg/kg/day	3.0E-03	mg/kg/day	6.1E-03
				2,4-Dinitrotoluene	3.6E+01	µg/L	N/A		N/A		N/A	2.7E-05	mg/kg/day	2.0E-03	mg/kg/day	1.3E-02
				Nitrobenzene	6.8E-01	µg/L	N/A		N/A		N/A	6.0E-07	mg/kg/day	2.0E-03	mg/kg/day	3.0E-04
				1,3-Dinitrobenzene	3.7E-01	µg/L	N/A		N/A		N/A	1.7E-07	mg/kg/day	1.0E-04	mg/kg/day	1.7E-03
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	N/A		N/A		N/A	4.7E-03	mg/kg/day	2.0E-03	mg/kg/day	2.3E+00
				RDX	2.3E+01	µg/L	N/A		N/A		N/A	2.5E-06	mg/kg/day	3.0E-03	mg/kg/day	8.3E-04
				Antimony, Dissolved	9.8E+01	µg/L	N/A		N/A		N/A	4.0E-06	mg/kg/day	6.0E-05	mg/kg/day	6.7E-02
				Arsenic, Dissolved	1.9E+01	µg/L	N/A		N/A		N/A	7.8E-07	mg/kg/day	3.0E-04	mg/kg/day	2.6E-03
				Beryllium, Dissolved	9.1E+00	µg/L	N/A		N/A		N/A	3.8E-07	mg/kg/day	1.4E-06	mg/kg/day	2.7E-01
				Cadmium, Dissolved	8.5E+00	µg/L	N/A		N/A		N/A	3.5E-07	mg/kg/day	2.5E-05	mg/kg/day	1.4E-02
				Chromium, Dissolved	7.6E+00	µg/L	N/A		N/A		N/A	6.3E-07	mg/kg/day	7.5E-05	mg/kg/day	8.3E-03

TABLE 7.1.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater (continued)	Groundwater	Yorktown-Eastover Aquifer Tap Water	Dermal	Cobalt, Dissolved	8.9E+01	µg/L	N/A		N/A		N/A	1.5E-06	mg/kg/day	3.0E-04	mg/kg/day	4.9E-03
				Iron, Dissolved	4.2E+03	µg/L	N/A		N/A		N/A	1.7E-04	mg/kg/day	7.0E-01	mg/kg/day	2.5E-04
				Manganese, Dissolved	1.9E+02	µg/L	N/A		N/A		N/A	7.9E-06	mg/kg/day	9.6E-04	mg/kg/day	8.3E-03
				Nickel, Dissolved	4.4E+01	µg/L	N/A		N/A		N/A	3.7E-07	mg/kg/day	8.0E-04	mg/kg/day	4.6E-04
				Selenium, Dissolved	1.3E+01	µg/L	N/A		N/A		N/A	5.4E-07	mg/kg/day	5.0E-03	mg/kg/day	1.1E-04
				Vanadium, Dissolved	9.1E+01	µg/L	N/A		N/A		N/A	3.7E-06	mg/kg/day	1.3E-04	mg/kg/day	2.9E-02
				Zinc, Dissolved	2.3E+03	µg/L	N/A		N/A		N/A	5.6E-05	mg/kg/day	3.0E-01	mg/kg/day	1.9E-04
			Exp. Route Total								N/A					5.6E+00
		Exposure Point Total									N/A					7.3E+01
	Exposure Medium Total										N/A					7.3E+01
	Air	Columbia and Yorktown -Eastover Aquifer Water Vapors at Showerhead	Inhalation	1,1-Dichloroethane	1.3E-03	mg/m^3	N/A		N/A		N/A	8.4E-06	mg/m^3	N/A		N/A
				1,2-Dichloroethane	2.5E-04	mg/m^3	N/A		N/A		N/A	1.7E-06	mg/m^3	2.4E+00	mg/m^3	6.9E-07
				Benzene	2.0E-03	mg/m^3	N/A		N/A		N/A	1.4E-05	mg/m^3	3.0E-02	mg/m^3	4.5E-04
				cis-1,2-Dichloroethene	6.4E+00	mg/m^3	N/A		N/A		N/A	4.3E-02	mg/m^3	N/A		N/A
				Tetrachloroethene	2.8E+00	mg/m^3	N/A		N/A		N/A	1.8E-02	mg/m^3	2.7E-01	mg/m^3	6.8E-02
				trans-1,2-Dichloroethene	1.6E-02	mg/m^3	N/A		N/A		N/A	1.0E-04	mg/m^3	6.0E-02	mg/m^3	1.7E-03
				Trichloroethene	1.7E+02	mg/m^3	N/A		N/A		N/A	1.2E+00	mg/m^3	N/A		N/A
				Vinyl chloride	4.3E-02	mg/m^3	N/A		N/A		N/A	2.9E-04	mg/m^3	1.0E-01	mg/m^3	2.9E-03
				Nitrobenzene	6.8E-05	mg/m^3	N/A		N/A		N/A	4.6E-07	mg/m^3	9.0E-03	mg/m^3	5.1E-05
			Exp. Route Total								N/A					7.3E-02
		Exposure Point Total									N/A					7.3E-02
		Indoor Air	Inhalation	1,2-Dichloroethene	7.3E-03	mg/m^3	N/A		N/A		N/A	4.5E-03	mg/m^3	N/A		N/A
				Trichloroethene	1.9E-02	mg/m^3	N/A		N/A		N/A	1.2E-02	mg/m^3	N/A		N/A
				Vinyl chloride	3.7E-03	mg/m^3	N/A		N/A		N/A	2.3E-03	mg/m^3	1.0E-01	mg/m^3	2.3E-02
			Exp. Route Total								N/A					2.3E-02
		Exposure Point Total									N/A					2.3E-02
	Exposure Medium Total										N/A					9.7E-02
Groundwater Total											N/A					7.3E+01

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Table 7.1.CTE Supplement A

Inhalation exposure while showering calculated on Table 7.1.CTE Supplement B

Table 7.1.CTE Supplement A
Calculation of DA_{event}
Residential Adult Groundwater
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
1,1-Dichloroethane	1.1E+00	6.7E-03	2.6E-02	3.8E-01	9.2E-01	1.0E+00	0.25	6.4E-09	2
1,2-Dichloroethane	2.5E-01	4.2E-03	1.6E-02	3.8E-01	9.2E-01	1.0E+00	0.25	9.0E-10	2
Benzene	1.6E+00	1.5E-02	5.1E-02	2.9E-01	7.0E-01	1.0E+00	0.25	1.8E-08	2
cis-1,2-Dichloroethene[1]	5.7E+03	7.7E-03	2.9E-02	3.7E-01	8.9E-01	1.0E+00	0.25	3.7E-05	2
Tetrachloroethene	3.0E+03	3.3E-02	1.7E-01	9.1E-01	2.2E+00	1.0E+00	0.25	1.3E-04	2
trans-1,2-Dichloroethene	1.3E+01	7.7E-03	2.9E-02	3.7E-01	8.9E-01	1.0E+00	0.25	8.4E-08	2
Trichloroethene	1.7E+05	1.2E-02	5.1E-02	5.8E-01	1.4E+00	1.0E+00	0.25	2.1E-03	2
Vinyl chloride	3.0E+01	5.6E-03	1.7E-02	2.4E-01	5.7E-01	1.0E+00	0.25	1.1E-07	2
2,4-Dinitrotoluene	3.6E+01	3.1E-03	1.6E-02	1.1E+00	2.7E+00	1.0E+00	0.25	1.6E-07	2
Nitrobenzene[2]	6.8E-01	5.4E-03	2.3E-02	5.1E-01	1.2E+00	1.0E+00	0.25	3.7E-09	2
1,3-Dinitrobenzene[2]	3.7E-01	2.1E-03	1.0E-02	9.2E-01	2.2E+00	1.0E+00	0.25	1.0E-09	2
2-Amino-4,6-dinitrotoluene[2]	7.4E+03	2.4E-03	1.3E-02	1.3E+00	3.2E+00	1.0E+00	0.25	2.8E-05	2
RDX[2]	2.3E+01	3.5E-04	2.0E-03	1.8E+00	4.4E+00	1.0E+00	0.25	1.5E-08	2
Antimony, Dissolved	9.8E+01	1.0E-03	NA	NA	NA	NA	0.25	2.4E-08	1
Arsenic, Dissolved	1.9E+01	1.0E-03	NA	NA	NA	NA	0.25	4.7E-09	1
Beryllium, Dissolved	9.1E+00	1.0E-03	NA	NA	NA	NA	0.25	2.3E-09	1
Cadmium, Dissolved	8.5E+00	1.0E-03	NA	NA	NA	NA	0.25	2.1E-09	1
Chromium, Dissolved	7.6E+00	2.0E-03	NA	NA	NA	NA	0.25	3.8E-09	1
Cobalt, Dissolved	8.9E+01	4.0E-04	NA	NA	NA	NA	0.25	8.9E-09	1
Iron, Dissolved	4.2E+03	1.0E-03	NA	NA	NA	NA	0.25	1.0E-06	1
Manganese, Dissolved	1.9E+02	1.0E-03	NA	NA	NA	NA	0.25	4.8E-08	1
Nickel, Dissolved	4.4E+01	2.0E-04	NA	NA	NA	NA	0.25	2.2E-09	1
Selenium, Dissolved	1.3E+01	1.0E-03	NA	NA	NA	NA	0.25	3.3E-09	1
Vanadium, Dissolved	9.1E+01	1.0E-03	NA	NA	NA	NA	0.25	2.3E-08	1
Zinc, Dissolved	2.3E+03	6.0E-04	NA	NA	NA	NA	0.25	3.4E-07	1

[1] trans-1,2-Dichloroethane used as a surrogate.

Inorganics: DA_{event} (mg/cm^2-event) =

K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =

If t_{event}<t*, then DA_{event} =

2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =

FA x K_p x CW x (t_{event}/(1+B) + 2 x τ_{event} x ((1 + 3xB + 3xB^2)/(1+B)^2) x 0.001 mg/µg x 0.001 l/cm^3 (eq 3)

Notes:

Permeability constants and other input parameter values from EPA 2004,*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this documen

B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).

t* - Time to reach steady-state

[1] trans-1,2-Dichloroethane used as a surrogate.

[2]Lag time and B calculated on Table 7.1b.RME Supplement. Permeability constants from RAIS databases (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem).

N/A - not applicable.

Table 7.1.CTE Supplement B

Inhalation Exposure Concentrations from Foster and Chrostowski Shower Model

Adult Resident

Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Exposure Point Concentration Cwo (µg/L)	Molecular weight (MW) (g/mole)	Henry's Law Constant (H) (atm-m^3/mole)	Kg (VOC) (cm/hr)	Kl (VOC) (cm/hr)	KL (cm/hr)	Kal (cm/hr)	Cwd (µg/L)	S (µg/m^3 -min)	Ca (mg/m^3)
1,1-Dichloroethane	1.1E+00	9.9E+01	5.6E-03	1.3E+03	1.3E+01	1.3E+01	1.7E+01	1.5E-01	1.2E-01	1.3E-03
1,2-Dichloroethane	2.5E-01	9.9E+01	1.2E-03	1.3E+03	1.3E+01	1.1E+01	1.5E+01	2.9E-02	2.4E-02	2.5E-04
Benzene	1.6E+00	7.8E+01	5.6E-03	1.4E+03	1.5E+01	1.4E+01	1.9E+01	2.4E-01	2.0E-01	2.0E-03
cis-1,2-Dichloroethene	5.7E+03	9.7E+01	4.1E-03	1.3E+03	1.3E+01	1.3E+01	1.7E+01	7.6E+02	6.3E+02	6.4E+00
Tetrachloroethene	3.0E+03	1.7E+02	1.8E-02	9.9E+02	1.0E+01	1.0E+01	1.4E+01	3.2E+02	2.7E+02	2.8E+00
trans-1,2-Dichloroethene	1.3E+01	9.7E+01	1.7E-01	1.3E+03	1.3E+01	1.3E+01	1.8E+01	1.8E+00	1.5E+00	1.6E-02
Trichloroethene	1.7E+05	1.3E+02	1.0E-02	1.1E+03	1.2E+01	1.1E+01	1.5E+01	2.0E+04	1.7E+04	1.7E+02
Vinyl chloride	3.0E+01	6.3E+01	2.8E-02	1.6E+03	1.7E+01	1.7E+01	2.2E+01	5.0E+00	4.2E+00	4.3E-02
Nitrobenzene	6.8E-01	1.2E+02	2.4E-05	1.1E+03	1.2E+01	1.0E+00	1.4E+00	8.0E-03	6.7E-03	6.8E-05

Variables	Units	Exposure Assumptions
Kg(VOC) = gas-film mass transfer coefficient	cm/hr	Solved by Eq 1
Kl(VOC) = liquid-film mass transfer coefficient	cm/hr	Solved by Eq 2
KL = overall mass transfer coefficient	cm/hr	Solved by Eq 3
Kal = adjusted overall mass transfer coeff.	cm/hr	Solved by Eq 4
Tl = Calibration temp. of water	K (20C +273)	293
Ts = Shower water temperature	k (45C)	318
Us = water viscosity at Ts	centipoise	0.596
Ul = water viscosity at Tl	cp	1.002
Cwd = conc. leaving droplets after time sdt	µg/l	Solved by Eq 5
sdt = shower droplet drop time	sec	0.5
d = shower droplet diameter	mm	1
FR = shower water flow rate	l/min	10
SV = shower room air volume	m^3	12
S = indoor VOC generation rate	µg/m^3-min	Solved by Eq 6
Ds = duration of shower	min	15
Dt = total duration in shower room	min	30
R = air exchange rate	min^{-1}	0.0083
Ca = indoor air concentration of VOCs	µg/m^3	Solved by Eq 7

Equation 1:	Kg(VOC) =	$3000 * (18 / MW)^{0.5}$
Equation 2:	Kl(VOC) =	$20 * (44 / MW)^{0.5}$
Equation 3:	KL =	$((1 / Kl(VOC)) + (0.024 / (Kg (VOC) * H)))^{-1}$
Equation 4:	Kal =	$(KL * (((Tl * Us) / (Ts * Ul))^{-0.5}))$
Equation 5:	Cwd =	(Cwo * (1-EXP((-1 * Kal * sdt)/(60 * d))))
Equation 6:	S =	(Cwd * FR / SV)
Equation 7:	Ca =	If t>Ds [(S / R) * (Ds + (EXP(-R * Dt) / R) -(EXP(R *(Ds - Dt)) / R)] / Dt * 1/1000

TABLE 7.2.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water	Ingestion	1,1-Dichloroethane	1.1E+00	µg/L	N/A		N/A		N/A	4.7E-05	mg/kg/day	2.0E-01	mg/kg/day	2.4E-04
				1,2-Dichloroethane	2.5E-01	µg/L	N/A		N/A		N/A	1.1E-05	mg/kg/day	2.0E-02	mg/kg/day	5.3E-04
				Benzene	1.6E+00	µg/L	N/A		N/A		N/A	6.8E-05	mg/kg/day	4.0E-03	mg/kg/day	1.7E-02
				cis-1,2-Dichloroethene	5.7E+03	µg/L	N/A		N/A		N/A	2.4E-01	mg/kg/day	1.0E-02	mg/kg/day	2.4E+01
				Tetrachloroethene	3.0E+03	µg/L	N/A		N/A		N/A	1.3E-01	mg/kg/day	1.0E-02	mg/kg/day	1.3E+01
				trans-1,2-Dichloroethene	1.3E+01	µg/L	N/A		N/A		N/A	5.5E-04	mg/kg/day	2.0E-02	mg/kg/day	2.8E-02
				Trichloroethene	1.7E+05	µg/L	N/A		N/A		N/A	7.3E+00	mg/kg/day	N/A	mg/kg/day	N/A
				Vinyl chloride	3.0E+01	µg/L	N/A		N/A		N/A	1.3E-03	mg/kg/day	3.0E-03	mg/kg/day	4.2E-01
				2,4-Dinitrotoluene	3.6E+01	µg/L	N/A		N/A		N/A	1.5E-03	mg/kg/day	2.0E-03	mg/kg/day	7.7E-01
				Nitrobenzene	6.8E-01	µg/L	N/A		N/A		N/A	2.9E-05	mg/kg/day	2.0E-03	mg/kg/day	1.5E-02
				1,3-Dinitrobenzene	3.7E-01	µg/L	N/A		N/A		N/A	1.6E-05	mg/kg/day	1.0E-04	mg/kg/day	1.6E-01
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	N/A		N/A		N/A	3.2E-01	mg/kg/day	2.0E-03	mg/kg/day	1.6E+02
				RDX	2.3E+01	µg/L	N/A		N/A		N/A	9.8E-04	mg/kg/day	3.0E-03	mg/kg/day	3.3E-01
				Antimony, Dissolved	9.8E+01	µg/L	N/A		N/A		N/A	4.2E-03	mg/kg/day	4.0E-04	mg/kg/day	1.0E+01
				Arsenic, Dissolved	1.9E+01	µg/L	N/A		N/A		N/A	8.1E-04	mg/kg/day	3.0E-04	mg/kg/day	2.7E+00
				Beryllium, Dissolved	9.1E+00	µg/L	N/A		N/A		N/A	3.9E-04	mg/kg/day	2.0E-03	mg/kg/day	1.9E-01
				Cadmium, Dissolved	8.5E+00	µg/L	N/A		N/A		N/A	3.6E-04	mg/kg/day	5.0E-04	mg/kg/day	7.3E-01
				Chromium, Dissolved	7.6E+00	µg/L	N/A		N/A		N/A	3.2E-04	mg/kg/day	3.0E-03	mg/kg/day	1.1E-01
				Cobalt, Dissolved	8.9E+01	µg/L	N/A		N/A		N/A	3.8E-03	mg/kg/day	3.0E-04	mg/kg/day	1.3E+01
				Iron, Dissolved	4.2E+03	µg/L	N/A		N/A		N/A	1.8E-01	mg/kg/day	7.0E-01	mg/kg/day	2.5E-01
				Manganese, Dissolved	1.9E+02	µg/L	N/A		N/A		N/A	8.2E-03	mg/kg/day	2.4E-02	mg/kg/day	3.4E-01
				Nickel, Dissolved	4.4E+01	µg/L	N/A		N/A		N/A	1.9E-03	mg/kg/day	2.0E-02	mg/kg/day	9.5E-02
				Selenium, Dissolved	1.3E+01	µg/L	N/A		N/A		N/A	5.6E-04	mg/kg/day	5.0E-03	mg/kg/day	1.1E-01
				Vanadium, Dissolved	9.1E+01	µg/L	N/A		N/A		N/A	3.9E-03	mg/kg/day	5.0E-03	mg/kg/day	7.8E-01
				Zinc, Dissolved	2.3E+03	µg/L	N/A		N/A		N/A	9.6E-02	mg/kg/day	3.0E-01	mg/kg/day	3.2E-01
			Exp. Route Total								N/A					2.3E+02
			Dermal	1,1-Dichloroethane	1.1E+00	µg/L	N/A		N/A		N/A	2.1E-06	mg/kg/day	2.0E-01	mg/kg/day	1.0E-05
				1,2-Dichloroethane	2.5E-01	µg/L	N/A		N/A		N/A	2.9E-07	mg/kg/day	2.0E-02	mg/kg/day	1.5E-05
				Benzene	1.6E+00	µg/L	N/A		N/A		N/A	5.8E-06	mg/kg/day	4.0E-03	mg/kg/day	1.4E-03
				cis-1,2-Dichloroethene	5.7E+03	µg/L	N/A		N/A		N/A	1.2E-02	mg/kg/day	1.0E-02	mg/kg/day	1.2E+00
				Tetrachloroethene	3.0E+03	µg/L	N/A		N/A		N/A	4.3E-02	mg/kg/day	1.0E-02	mg/kg/day	4.3E+00
				trans-1,2-Dichloroethene	1.3E+01	µg/L	N/A		N/A		N/A	2.7E-05	mg/kg/day	2.0E-02	mg/kg/day	1.4E-03
				Trichloroethene	1.7E+05	µg/L	N/A		N/A		N/A	6.8E-01	mg/kg/day	N/A	mg/kg/day	N/A
				Vinyl chloride	3.0E+01	µg/L	N/A		N/A		N/A	3.6E-05	mg/kg/day	3.0E-03	mg/kg/day	1.2E-02
				2,4-Dinitrotoluene	3.6E+01	µg/L	N/A		N/A		N/A	5.3E-05	mg/kg/day	2.0E-03	mg/kg/day	2.6E-02
				Nitrobenzene	6.8E-01	µg/L	N/A		N/A		N/A	1.2E-06	mg/kg/day	2.0E-03	mg/kg/day	5.9E-04
				1,3-Dinitrobenzene	3.7E-01	µg/L	N/A		N/A		N/A	3.3E-07	mg/kg/day	1.0E-04	mg/kg/day	3.3E-03
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	N/A		N/A		N/A	9.2E-03	mg/kg/day	2.0E-03	mg/kg/day	4.6E+00
				RDX	2.3E+01	µg/L	N/A		N/A		N/A	4.9E-06	mg/kg/day	3.0E-03	mg/kg/day	1.6E-03
				Antimony, Dissolved	9.8E+01	µg/L	N/A		N/A		N/A	9.1E-06	mg/kg/day	6.0E-05	mg/kg/day	1.5E-01
				Arsenic, Dissolved	1.9E+01	µg/L	N/A		N/A		N/A	1.8E-06	mg/kg/day	3.0E-04	mg/kg/day	5.9E-03
				Beryllium, Dissolved	9.1E+00	µg/L	N/A		N/A		N/A	8.5E-07	mg/kg/day	1.4E-06	mg/kg/day	6.1E-01
				Cadmium, Dissolved	8.5E+00	µg/L	N/A		N/A		N/A	7.9E-07	mg/kg/day	2.5E-05	mg/kg/day	3.2E-02
				Chromium, Dissolved	7.6E+00	µg/L	N/A		N/A		N/A	1.4E-06	mg/kg/day	7.5E-05	mg/kg/day	1.9E-02

TABLE 7.2.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater (continued)	Groundwater	Yorktown-Eastover Aquifer Tap Water	Dermal	Cobalt, Dissolved	8.9E+01	µg/L	N/A		N/A		N/A	3.3E-06	mg/kg/day	3.0E-04	mg/kg/day	1.1E-02
				Iron, Dissolved	4.2E+03	µg/L	N/A		N/A		N/A	3.9E-04	mg/kg/day	7.0E-01	mg/kg/day	5.5E-04
				Manganese, Dissolved	1.9E+02	µg/L	N/A		N/A		N/A	1.8E-05	mg/kg/day	9.6E-04	mg/kg/day	1.9E-02
				Nickel, Dissolved	4.4E+01	µg/L	N/A		N/A		N/A	8.3E-07	mg/kg/day	8.0E-04	mg/kg/day	1.0E-03
				Selenium, Dissolved	1.3E+01	µg/L	N/A		N/A		N/A	1.2E-06	mg/kg/day	5.0E-03	mg/kg/day	2.4E-04
				Vanadium, Dissolved	9.1E+01	µg/L	N/A		N/A		N/A	8.5E-06	mg/kg/day	1.3E-04	mg/kg/day	6.5E-02
				Zinc, Dissolved	2.3E+03	µg/L	N/A		N/A		N/A	1.3E-04	mg/kg/day	3.0E-01	mg/kg/day	4.2E-04
			Exp. Route Total								N/A					1.1E+01
		Exposure Point Total									N/A					2.4E+02
	Exposure Medium Total										N/A					2.4E+02
	Air	Columbia and Yorktown -Eastover Aquifer Water Vapors at Showerhead	Inhalation	1,1-Dichloroethane	1.6E-03	mg/m^3	N/A		N/A		N/A	1.4E-05	mg/m^3	N/A		N/A
				1,2-Dichloroethane	3.2E-04	mg/m^3	N/A		N/A		N/A	2.8E-06	mg/m^3	2.4E+00	mg/m^3	1.2E-06
				Benzene	2.6E-03	mg/m^3	N/A		N/A		N/A	2.3E-05	mg/m^3	3.0E-02	mg/m^3	7.7E-04
				cis-1,2-Dichloroethene	8.3E+00	mg/m^3	N/A		N/A		N/A	7.3E-02	mg/m^3	N/A		N/A
				Tetrachloroethene	3.5E+00	mg/m^3	N/A		N/A		N/A	3.1E-02	mg/m^3	2.7E-01	mg/m^3	1.2E-01
				trans-1,2-Dichloroethene	2.0E-02	mg/m^3	N/A		N/A		N/A	1.8E-04	mg/m^3	6.0E-02	mg/m^3	2.9E-03
				Trichloroethene	2.2E+02	mg/m^3	N/A		N/A		N/A	2.0E+00	mg/m^3	N/A		N/A
				Vinyl chloride	5.5E-02	mg/m^3	N/A		N/A		N/A	4.9E-04	mg/m^3	1.0E-01	mg/m^3	4.9E-03
				Nitrobenzene	8.8E-05	mg/m^3	N/A		N/A		N/A	7.7E-07	mg/m^3	9.0E-03	mg/m^3	8.6E-05
			Exp. Route Total								N/A					1.2E-01
		Exposure Point Total									N/A					1.2E-01
		Indoor Air	Inhalation	1,2-Dichloroethene	7.3E-03	mg/m^3	N/A		N/A		N/A	7.0E-03	mg/m^3	N/A	mg/m^3	N/A
				Trichloroethene	1.9E-02	mg/m^3	N/A		N/A		N/A	1.9E-02	mg/m^3	N/A	mg/m^3	N/A
				Vinyl chloride	3.7E-03	mg/m^3	N/A		N/A		N/A	3.6E-03	mg/m^3	1.0E-01	mg/m^3	3.6E-02
			Exp. Route Total								N/A					3.6E-02
		Exposure Point Total									N/A					3.6E-02
	Exposure Medium Total										N/A					1.6E-01
Groundwater Total											N/A					2.4E+02

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Table 7.2.RME Supplement A

Inhalation exposure while showering calculated on Table 7.2.RME Supplement B

Table 7.2.CTE Supplement A
Calculation of DA_{event}
Residential Child Groundwater
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
1,1-Dichloroethane	1.1E+00	6.7E-03	2.6E-02	3.8E-01	9.2E-01	1.0E+00	0.33	7.3E-09	2
1,2-Dichloroethane	2.5E-01	4.2E-03	1.6E-02	3.8E-01	9.2E-01	1.0E+00	0.33	1.0E-09	2
Benzene	1.6E+00	1.5E-02	5.1E-02	2.9E-01	7.0E-01	1.0E+00	0.33	2.0E-08	2
cis-1,2-Dichloroethene[1]	5.7E+03	7.7E-03	2.9E-02	3.7E-01	8.9E-01	1.0E+00	0.33	4.2E-05	2
Tetrachloroethene	3.0E+03	3.3E-02	1.7E-01	9.1E-01	2.2E+00	1.0E+00	0.33	1.5E-04	2
trans-1,2-Dichloroethene	1.3E+01	7.7E-03	2.9E-02	3.7E-01	8.9E-01	1.0E+00	0.33	9.7E-08	2
Trichloroethene	1.7E+05	1.2E-02	5.1E-02	5.8E-01	1.4E+00	1.0E+00	0.33	2.4E-03	2
Vinyl chloride	3.0E+01	5.6E-03	1.7E-02	2.4E-01	5.7E-01	1.0E+00	0.33	1.3E-07	2
2,4-Dinitrotoluene	3.6E+01	3.1E-03	1.6E-02	1.1E+00	2.7E+00	1.0E+00	0.33	1.9E-07	2
Nitrobenzene[2]	6.8E-01	5.4E-03	2.3E-02	5.1E-01	1.2E+00	1.0E+00	0.33	4.2E-09	2
1,3-Dinitrobenzene[2]	3.7E-01	2.1E-03	1.0E-02	9.2E-01	2.2E+00	1.0E+00	0.33	1.2E-09	2
2-Amino-4,6-dinitrotoluene[2]	7.4E+03	2.4E-03	1.3E-02	1.3E+00	3.2E+00	1.0E+00	0.33	3.3E-05	2
RDX[2]	2.3E+01	3.5E-04	2.0E-03	1.8E+00	4.4E+00	1.0E+00	0.33	1.7E-08	2
Antimony, Dissolved	9.8E+01	1.0E-03	NA	NA	NA	NA	0.33	3.2E-08	1
Arsenic, Dissolved	1.9E+01	1.0E-03	NA	NA	NA	NA	0.33	6.2E-09	1
Beryllium, Dissolved	9.1E+00	1.0E-03	NA	NA	NA	NA	0.33	3.0E-09	1
Cadmium, Dissolved	8.5E+00	1.0E-03	NA	NA	NA	NA	0.33	2.8E-09	1
Chromium, Dissolved	7.6E+00	2.0E-03	NA	NA	NA	NA	0.33	5.0E-09	1
Cobalt, Dissolved	8.9E+01	4.0E-04	NA	NA	NA	NA	0.33	1.2E-08	1
Iron, Dissolved	4.2E+03	1.0E-03	NA	NA	NA	NA	0.33	1.4E-06	1
Manganese, Dissolved	1.9E+02	1.0E-03	NA	NA	NA	NA	0.33	6.3E-08	1
Nickel, Dissolved	4.4E+01	2.0E-04	NA	NA	NA	NA	0.33	2.9E-09	1
Selenium, Dissolved	1.3E+01	1.0E-03	NA	NA	NA	NA	0.33	4.3E-09	1
Vanadium, Dissolved	9.1E+01	1.0E-03	NA	NA	NA	NA	0.33	3.0E-08	1
Zinc, Dissolved	2.3E+03	6.0E-04	NA	NA	NA	NA	0.33	4.5E-07	1

[1] trans-1,2-Dichloroethane used as a surrogate.

Inorganics: DA_{event} (mg/cm^2-event) =

K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =

If t_{event}<t*, then DA_{event} =

2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =

FA x K_p x CW x (t_{event}/(1+B) + 2 x τ_{event} x ((1 + 3xB + 3xB^2)/(1+B)^2) x 0.001 mg/µg x 0.001 l/cm^3 (eq 3)

Notes:

Permeability constants and other input parameter values from EPA 2004,*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this documen

B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).

t* - Time to reach steady-state

[1] trans-1,2-Dichloroethane used as a surrogate.

[2]Lag time and B calculated on Table 7.1b.RME Supplement. Permeability constants from RAIS databases (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem).

N/A - not applicable.

Table 7.2.CTE Supplement B

Inhalation Exposure Concentrations from Foster and Chrostowski Shower Model

Child Resident

Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Exposure Point Concentration Cwo (µg/L)	Molecular weight (MW) (g/mole)	Henry's Law Constant (H) (atm-m^3/mole)	Kg (VOC) (cm/hr)	Kl (VOC) (cm/hr)	KL (cm/hr)	Kal (cm/hr)	Cwd (µg/L)	S (µg/m^3 -min)	Ca (mg/m^3)
1,1-Dichloroethane	1.1E+00	9.9E+01	5.6E-03	1.3E+03	1.3E+01	1.3E+01	1.7E+01	1.5E-01	1.2E-01	1.6E-03
1,2-Dichloroethane	2.5E-01	9.9E+01	1.2E-03	1.3E+03	1.3E+01	1.1E+01	1.5E+01	2.9E-02	2.4E-02	3.2E-04
Benzene	1.6E+00	7.8E+01	5.6E-03	1.4E+03	1.5E+01	1.4E+01	1.9E+01	2.4E-01	2.0E-01	2.6E-03
cis-1,2-Dichloroethene	5.7E+03	9.7E+01	4.1E-03	1.3E+03	1.3E+01	1.3E+01	1.7E+01	7.6E+02	6.3E+02	8.3E+00
Tetrachloroethene	3.0E+03	1.7E+02	1.8E-02	9.9E+02	1.0E+01	1.0E+01	1.4E+01	3.2E+02	2.7E+02	3.5E+00
trans-1,2-Dichloroethene	1.3E+01	9.7E+01	1.7E-01	1.3E+03	1.3E+01	1.3E+01	1.8E+01	1.8E+00	1.5E+00	2.0E-02
Trichloroethene	1.7E+05	1.3E+02	1.0E-02	1.1E+03	1.2E+01	1.1E+01	1.5E+01	2.0E+04	1.7E+04	2.2E+02
Vinyl chloride	3.0E+01	6.3E+01	2.8E-02	1.6E+03	1.7E+01	1.7E+01	2.2E+01	5.0E+00	4.2E+00	5.5E-02
Nitrobenzene	6.8E-01	1.2E+02	2.4E-05	1.1E+03	1.2E+01	1.0E+00	1.4E+00	8.0E-03	6.7E-03	8.8E-05

Variables	Units	Exposure Assumptions
Kg(VOC) = gas-film mass transfer coefficient	cm/hr	Solved by Eq 1
Kl(VOC) = liquid-film mass transfer coefficient	cm/hr	Solved by Eq 2
KL = overall mass transfer coefficient	cm/hr	Solved by Eq 3
Kal = adjusted overall mass transfer coeff.	cm/hr	Solved by Eq 4
Tl = Calibration temp. of water	K (20C +273)	293
Ts = Shower water temperature	k (45C)	318
Us = water viscosity at Ts	centipoise	0.596
Ul = water viscosity at Tl	cp	1.002
Cwd = conc. leaving droplets after time sdt	µg/l	Solved by Eq 5
sdt = shower droplet drop time	sec	0.5
d = shower droplet diameter	mm	1
FR = shower water flow rate	l/min	10
SV = shower room air volume	m^3	12
S = indoor VOC generation rate	µg/m^3-min	Solved by Eq 6
Ds = duration of shower	min	19.8
Dt = total duration in shower room	min	40
R = air exchange rate	min^{-1}	0.0083
Ca = indoor air concentration of VOCs	µg/m^3	Solved by Eq 7

Equation 1:	Kg(VOC) =	$3000 * (18 / MW)^{0.5}$
Equation 2:	Kl(VOC) =	$20 * (44 / MW)^{0.5}$
Equation 3:	KL =	$((1 / Kl(VOC)) + (0.024 / (Kg (VOC) * H)))^{-1}$
Equation 4:	Kal =	$(KL * (((Tl * Us) / (Ts * Ul))^{-0.5}))$
Equation 5:	Cwd =	(Cwo * (1-EXP((-1 * Kal * sdt)/(60 * d))))
Equation 6:	S =	(Cwd * FR / SV)
Equation 7:	Ca =	If t>Ds [(S / R) * (Ds + (EXP(-R * Dt) / R) -(EXP(R *(Ds - Dt)) / R)] / Dt * 1/1000

TABLE 7.3.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water	Ingestion	1,1-Dichloroethane	1.1E+00	µg/L	5.9E-06	mg/kg/day	5.7E-03	(mg/kg-day)$^{-1}$	3.3E-08	N/A		N/A		N/A
				1,2-Dichloroethane	2.5E-01	µg/L	1.3E-06	mg/kg/day	9.1E-02	(mg/kg-day)$^{-1}$	1.2E-07	N/A		N/A		N/A
				Benzene	1.6E+00	µg/L	8.5E-06	mg/kg/day	5.5E-02	(mg/kg-day)$^{-1}$	4.7E-07	N/A		N/A		N/A
				cis-1,2-Dichloroethene	5.7E+03	µg/L	3.0E-02	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Tetrachloroethene	3.0E+03	µg/L	1.6E-02	mg/kg/day	5.4E-01	(mg/kg-day)$^{-1}$	8.6E-03	N/A		N/A		N/A
				trans-1,2-Dichloroethene	1.3E+01	µg/L	6.9E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Trichloroethene	1.7E+05	µg/L	9.1E-01	mg/kg/day	5.9E-03	(mg/kg-day)$^{-1}$	5.3E-03	N/A		N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	1.6E-04	mg/kg/day	7.2E-01	(mg/kg-day)$^{-1}$	1.1E-04	N/A		N/A		N/A
				2,4-Dinitrotoluene	3.6E+01	µg/L	1.9E-04	mg/kg/day	3.1E-01	(mg/kg-day)$^{-1}$	5.9E-05	N/A		N/A		N/A
				Nitrobenzene	6.8E-01	µg/L	3.6E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				1,3-Dinitrobenzene	3.7E-01	µg/L	2.0E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	3.9E-02	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				RDX	2.3E+01	µg/L	1.2E-04	mg/kg/day	1.1E-01	(mg/kg-day)$^{-1}$	1.3E-05	N/A		N/A		N/A
				Antimony, Dissolved	9.8E+01	µg/L	5.2E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Arsenic, Dissolved	1.9E+01	µg/L	1.0E-04	mg/kg/day	1.5E+00	(mg/kg-day)$^{-1}$	1.5E-04	N/A		N/A		N/A
				Beryllium, Dissolved	9.1E+00	µg/L	4.8E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Cadmium, Dissolved	8.5E+00	µg/L	4.5E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Chromium, Dissolved	7.6E+00	µg/L	4.0E-05	mg/kg/day	5.0E-01	(mg/kg-day)$^{-1}$	2.0E-05	N/A		N/A		N/A
				Cobalt, Dissolved	8.9E+01	µg/L	4.7E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Iron, Dissolved	4.2E+03	µg/L	2.2E-02	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Manganese, Dissolved	1.9E+02	µg/L	1.0E-03	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Nickel, Dissolved	4.4E+01	µg/L	2.4E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Selenium, Dissolved	1.3E+01	µg/L	6.9E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Vanadium, Dissolved	9.1E+01	µg/L	4.8E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Zinc, Dissolved	2.3E+03	µg/L	1.2E-02	mg/kg/day	N/A		N/A	N/A		N/A		N/A
			Exp. Route Total								1.4E-02					N/A
			Dermal	1,1-Dichloroethane	1.1E+00	µg/L	3.1E-07	mg/kg/day	5.7E-03	(mg/kg-day)$^{-1}$	1.8E-09	N/A		N/A		N/A
				1,2-Dichloroethane	2.5E-01	µg/L	4.4E-08	mg/kg/day	9.1E-02	(mg/kg-day)$^{-1}$	4.0E-09	N/A		N/A		N/A
				Benzene	1.6E+00	µg/L	8.7E-07	mg/kg/day	5.5E-02	(mg/kg-day)$^{-1}$	4.8E-08	N/A		N/A		N/A
				cis-1,2-Dichloroethene	5.7E+03	µg/L	1.8E-03	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Tetrachloroethene	3.0E+03	µg/L	6.5E-03	mg/kg/day	5.4E-01	(mg/kg-day)$^{-1}$	3.5E-03	N/A		N/A		N/A
				trans-1,2-Dichloroethene	1.3E+01	µg/L	4.1E-06	mg/kg/day	N/A	(mg/kg-day)$^{-1}$	N/A	N/A		N/A		N/A
				Trichloroethene	1.7E+05	µg/L	1.0E-01	mg/kg/day	5.9E-03	(mg/kg-day)$^{-1}$	6.1E-04	N/A		N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	5.5E-06	mg/kg/day	7.2E-01	(mg/kg-day)$^{-1}$	3.9E-06	N/A		N/A		N/A
				2,4-Dinitrotoluene	3.6E+01	µg/L	7.9E-06	mg/kg/day	3.1E-01	(mg/kg-day)$^{-1}$	2.5E-06	N/A		N/A		N/A
				Nitrobenzene	6.8E-01	µg/L	1.8E-07	mg/kg/day	N/A	(mg/kg-day)$^{-1}$	N/A	N/A		N/A		N/A
				1,3-Dinitrobenzene	3.7E-01	µg/L	4.9E-08	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	1.4E-03	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				RDX	2.3E+01	µg/L	7.4E-07	mg/kg/day	1.1E-01	(mg/kg-day)$^{-1}$	8.1E-08	N/A		N/A		N/A
				Antimony, Dissolved	9.8E+01	µg/L	1.3E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Arsenic, Dissolved	1.9E+01	µg/L	2.5E-07	mg/kg/day	1.5E+00	(mg/kg-day)$^{-1}$	3.8E-07	N/A		N/A		N/A
				Beryllium, Dissolved	9.1E+00	µg/L	1.2E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Cadmium, Dissolved	8.5E+00	µg/L	1.1E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Chromium, Dissolved	7.6E+00	µg/L	2.0E-07	mg/kg/day	1.3E-02		2.5E-09	N/A		N/A		N/A

TABLE 7.3.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater (continued)	Groundwater	Aquifer Tap Water	Dermal	Cobalt, Dissolved	8.9E+01	µg/L	4.7E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Iron, Dissolved	4.2E+03	µg/L	5.5E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Manganese, Dissolved	1.9E+02	µg/L	2.6E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Nickel, Dissolved	4.4E+01	µg/L	1.2E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Selenium, Dissolved	1.3E+01	µg/L	1.7E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Vanadium, Dissolved	9.1E+01	µg/L	1.2E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				Zinc, Dissolved	2.3E+03	µg/L	1.8E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
			Exp. Route Total								4.1E-03					N/A
		Exposure Point Total									1.8E-02					N/A
	Exposure Medium Total										1.8E-02					N/A
	Air	Columbia and Yorktown -Eastover Aquifer Water Vapors at Showerhead	Inhalation	1,1-Dichloroethane	6.0E-03	mg/m^3 x hr/day x yr	3.4E-03	$\mu g/m^3$	1.6E-06	$(\mu g/m^3)^{-1}$	5.5E-09	N/A		N/A		N/A
				1,2-Dichloroethane	1.2E-03	mg/m^3 x hr/day x yr	6.8E-04	$\mu g/m^3$	2.6E-05	$(\mu g/m^3)^{-1}$	1.8E-08	N/A		N/A		N/A
				Benzene	9.8E-03	mg/m^3 x hr/day x yr	5.6E-03	$\mu g/m^3$	7.8E-06	$(\mu g/m^3)^{-1}$	4.3E-08	N/A		N/A		N/A
				cis-1,2-Dichloroethene	3.1E+01	mg/m^3 x hr/day x yr	1.8E+01	$\mu g/m^3$	N/A		N/A	N/A		N/A		N/A
				Tetrachloroethene	1.3E+01	mg/m^3 x hr/day x yr	7.6E+00	$\mu g/m^3$	5.9E-06	$(\mu g/m^3)^{-1}$	4.5E-05	N/A		N/A		N/A
				trans-1,2-Dichloroethene	7.4E-02	mg/m^3 x hr/day x yr	4.2E-02	$\mu g/m^3$	N/A		N/A	N/A		N/A		N/A
				Trichloroethene	8.3E+02	mg/m^3 x hr/day x yr	4.8E+02	$\mu g/m^3$	2.0E-06	$(\mu g/m^3)^{-1}$	9.5E-04	N/A		N/A		N/A
				Vinyl chloride	2.1E-01	mg/m^3 x hr/day x yr	1.2E-01	$\mu g/m^3$	4.4E-06	$(\mu g/m^3)^{-1}$	5.2E-07	N/A		N/A		N/A
				Nitrobenzene	3.3E-04	mg/m^3 x hr/day x yr	1.9E-04	$\mu g/m^3$	4.0E-05	$(\mu g/m^3)^{-1}$	7.5E-09	N/A		N/A		N/A
			Exp. Route Total								1.0E-03					N/A
		Exposure Point Total									1.0E-03					N/A
		Indoor Air	Inhalation	1,2-Dichloroethene	7.3E-03	mg/m^3	1.0E+00	$\mu g/m^3$	N/A		N/A	N/A		N/A		N/A
				Trichloroethene	1.9E-02	mg/m^3	2.7E+00	$\mu g/m^3$	2.0E-06	$(\mu g/m^3)^{-1}$	5.4E-06	N/A		N/A		N/A
				Vinyl chloride	3.7E-03	mg/m^3	5.1E-01	$\mu g/m^3$	4.4E-06	$(\mu g/m^3)^{-1}$	2.3E-06	N/A		N/A		N/A
			Exp. Route Total								7.6E-06					N/A
		Exposure Point Total									7.6E-06					N/A
	Exposure Medium Total										1.0E-03					N/A
Groundwater Total											1.9E-02					N/A

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Tables 7.1.RME and 7.2.CTE Supplement A.

Inhalation exposure while showering calculated on Tables 7.1.RME and 7.2.CTE Supplement B

TABLE 7.4.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water	Ingestion	1,1-Dichloroethane	1.1E+00	µg/L	1.2E-06	mg/kg/day	5.7E-03	(mg/kg-day)$^{-1}$	6.9E-09	9.5E-06	mg/kg/day	2.0E-01	mg/kg/day	4.7E-05
				1,2-Dichloroethane	2.5E-01	µg/L	2.8E-07	mg/kg/day	9.1E-02	(mg/kg-day)$^{-1}$	2.5E-08	2.1E-06	mg/kg/day	2.0E-02	mg/kg/day	1.1E-04
				Benzene	1.6E+00	µg/L	1.8E-06	mg/kg/day	5.5E-02	(mg/kg-day)$^{-1}$	9.7E-08	1.4E-05	mg/kg/day	4.0E-03	mg/kg/day	3.4E-03
				cis-1,2-Dichloroethene	5.7E+03	µg/L	6.2E-03	mg/kg/day	N/A	(mg/kg-day)$^{-1}$	N/A	4.9E-02	mg/kg/day	1.0E-02	mg/kg/day	4.9E+00
				Tetrachloroethene	3.0E+03	µg/L	3.3E-03	mg/kg/day	5.4E-01	(mg/kg-day)$^{-1}$	1.8E-03	2.6E-02	mg/kg/day	1.0E-02	mg/kg/day	2.6E+00
				trans-1,2-Dichloroethene	1.3E+01	µg/L	1.4E-05	mg/kg/day	N/A		N/A	1.1E-04	mg/kg/day	1.0E-02	mg/kg/day	1.1E-02
				Trichloroethene	1.7E+05	µg/L	1.9E-01	mg/kg/day	5.9E-03	(mg/kg-day)$^{-1}$	1.1E-03	1.5E+00	mg/kg/day	N/A	mg/kg/day	N/A
				Vinyl chloride	3.0E+01	µg/L	3.3E-05	mg/kg/day	7.2E-01	(mg/kg-day)$^{-1}$	2.3E-05	2.5E-04	mg/kg/day	3.0E-03	mg/kg/day	8.4E-02
				2,4-Dinitrotoluene	3.6E+01	µg/L	4.0E-05	mg/kg/day	3.1E-01	(mg/kg-day)$^{-1}$	1.2E-05	3.1E-04	mg/kg/day	2.0E-03	mg/kg/day	1.5E-01
				Nitrobenzene	6.8E-01	µg/L	7.5E-07	mg/kg/day	N/A		N/A	5.9E-06	mg/kg/day	2.0E-03	mg/kg/day	2.9E-03
				1,3-Dinitrobenzene	3.7E-01	µg/L	4.1E-07	mg/kg/day	N/A		N/A	3.2E-06	mg/kg/day	1.0E-04	mg/kg/day	3.2E-02
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	8.2E-03	mg/kg/day	N/A		N/A	6.3E-02	mg/kg/day	2.0E-03	mg/kg/day	3.2E+01
				RDX	2.3E+01	µg/L	2.5E-05	mg/kg/day	1.1E-01	(mg/kg-day)$^{-1}$	2.8E-06	2.0E-04	mg/kg/day	3.0E-03	mg/kg/day	6.6E-02
				Antimony, Dissolved	9.8E+01	µg/L	1.1E-04	mg/kg/day	N/A		N/A	8.4E-04	mg/kg/day	4.0E-04	mg/kg/day	2.1E+00
				Arsenic, Dissolved	1.9E+01	µg/L	2.1E-05	mg/kg/day	1.5E+00	(mg/kg-day)$^{-1}$	3.1E-05	1.6E-04	mg/kg/day	3.0E-04	mg/kg/day	5.4E-01
				Beryllium, Dissolved	9.1E+00	µg/L	1.0E-05	mg/kg/day	N/A		N/A	7.8E-05	mg/kg/day	2.0E-03	mg/kg/day	3.9E-02
				Cadmium, Dissolved	8.5E+00	µg/L	9.4E-06	mg/kg/day	N/A		N/A	7.3E-05	mg/kg/day	5.0E-04	mg/kg/day	1.5E-01
				Chromium, Dissolved	7.6E+00	µg/L	8.4E-06	mg/kg/day	5.0E-01	(mg/kg-day)$^{-1}$	4.2E-06	6.5E-05	mg/kg/day	3.0E-03	mg/kg/day	2.2E-02
				Cobalt, Dissolved	8.9E+01	µg/L	9.8E-05	mg/kg/day	N/A		N/A	7.6E-04	mg/kg/day	3.0E-04	mg/kg/day	2.5E+00
				Iron, Dissolved	4.2E+03	µg/L	4.6E-03	mg/kg/day	N/A		N/A	3.6E-02	mg/kg/day	7.0E-01	mg/kg/day	5.1E-02
				Manganese, Dissolved	1.9E+02	µg/L	2.1E-04	mg/kg/day	N/A		N/A	1.6E-03	mg/kg/day	2.4E-02	mg/kg/day	6.9E-02
				Nickel, Dissolved	4.4E+01	µg/L	4.9E-05	mg/kg/day	N/A		N/A	3.8E-04	mg/kg/day	2.0E-02	mg/kg/day	1.9E-02
				Selenium, Dissolved	1.3E+01	µg/L	1.4E-05	mg/kg/day	N/A		N/A	1.1E-04	mg/kg/day	5.0E-03	mg/kg/day	2.2E-02
				Vanadium, Dissolved	9.1E+01	µg/L	1.0E-04	mg/kg/day	N/A		N/A	7.8E-04	mg/kg/day	5.0E-03	mg/kg/day	1.6E-01
				Zinc, Dissolved	2.3E+03	µg/L	2.5E-03	mg/kg/day	N/A		N/A	1.9E-02	mg/kg/day	3.0E-01	mg/kg/day	6.4E-02
			Exp. Route Total								3.0E-03					4.5E+01
		Exposure Point Total									3.0E-03					4.5E+01
	Exposure Medium Total										3.0E-03					4.5E+01
	Air	Indoor Air	Inhalation	1,2-Dichloroethene	7.3E-03	mg/m^3	1.9E-04	mg/m^3	N/A		N/A	1.5E-03	mg/m^3	N/A		N/A
				Trichloroethene	1.9E-02	mg/m^3	5.0E-04	mg/m^3	2.0E-06	(mg/kg-day)$^{-1}$	1.0E-06	3.9E-03	mg/m^3	N/A		N/A
				Vinyl chloride	3.7E-03	mg/m^3	9.6E-05	mg/m^3	4.4E-06	(mg/kg-day)$^{-1}$	4.2E-07	7.5E-04	mg/m^3	1.0E-01	mg/m^3	7.5E-03
			Exp. Route Total								1.4E-06					7.5E-03
		Exposure Point Total									1.4E-06					7.5E-03
	Exposure Medium Total										1.4E-06					7.5E-03
Groundwater Total											3.0E-03					4.5E+01

N/A - Not available.

TABLE 7.5.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown - Eastover Aquifer Water in Excavation Pit	Dermal	1,1-Dichloroethane	1.1E+00	µg/L	1.4E-08	mg/kg/day	5.7E-03	$(mg/kg\text{-}day)^{-1}$	7.9E-11	9.7E-07	mg/kg/day	2.0E+00	mg/kg/day	4.9E-07
				1,2-Dichloroethane	2.5E-01	µg/L	2.0E-09	mg/kg/day	9.1E-02	$(mg/kg\text{-}day)^{-1}$	1.8E-10	1.4E-07	mg/kg/day	2.0E-02	mg/kg/day	6.9E-06
				Benzene	1.6E+00	µg/L	4.2E-08	mg/kg/day	5.5E-02	$(mg/kg\text{-}day)^{-1}$	2.3E-09	2.9E-06	mg/kg/day	4.0E-03	mg/kg/day	7.3E-04
				cis-1,2-Dichloroethene	5.7E+03	µg/L	8.1E-05	mg/kg/day	N/A		N/A	5.7E-03	mg/kg/day	1.0E-01	mg/kg/day	5.7E-02
				Tetrachloroethene	3.0E+03	µg/L	2.2E-04	mg/kg/day	5.4E-01	$(mg/kg\text{-}day)^{-1}$	1.2E-04	1.5E-02	mg/kg/day	1.0E-01	mg/kg/day	1.5E-01
				trans-1,2-Dichloroethene	1.3E+01	µg/L	1.9E-07	mg/kg/day	N/A		N/A	1.3E-05	mg/kg/day	2.0E-01	mg/kg/day	6.5E-05
				Trichloroethene	1.7E+05	µg/L	4.0E-03	mg/kg/day	5.9E-03	$(mg/kg\text{-}day)^{-1}$	2.4E-05	2.8E-01	mg/kg/day	N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	2.9E-07	mg/kg/day	7.2E-01	$(mg/kg\text{-}day)^{-1}$	2.1E-07	2.0E-05	mg/kg/day	3.0E-03	mg/kg/day	6.8E-03
				2,4-Dinitrotoluene	3.6E+01	µg/L	2.7E-07	mg/kg/day	3.1E-01	$(mg/kg\text{-}day)^{-1}$	8.5E-08	1.9E-05	mg/kg/day	2.0E-03	mg/kg/day	9.6E-03
				Nitrobenzene	6.8E-01	µg/L	7.3E-09	mg/kg/day	N/A		N/A	5.1E-07	mg/kg/day	3.0E-03	mg/kg/day	1.7E-04
				1,3-Dinitrobenzene	3.7E-01	µg/L	1.8E-09	mg/kg/day	N/A		N/A	1.2E-07	mg/kg/day	1.0E-03	mg/kg/day	1.2E-04
				2-Amino-4,6-dinitrotoluene	7.4E+03	µg/L	4.7E-05	mg/kg/day	N/A		N/A	3.3E-03	mg/kg/day	2.0E-03	mg/kg/day	1.7E+00
				RDX	2.3E+01	µg/L	2.4E-08	mg/kg/day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	2.6E-09	1.7E-06	mg/kg/day	3.0E-03	mg/kg/day	5.6E-04
				Aluminum	1.1E+03	µg/L	1.8E-06	mg/kg/day	N/A		N/A	1.3E-04	mg/kg/day	1.0E+00	mg/kg/day	1.3E-04
				Antimony	2.0E+00	µg/L	3.2E-09	mg/kg/day	N/A		N/A	2.2E-07	mg/kg/day	6.0E-05	mg/kg/day	3.7E-03
				Arsenic	6.4E+00	µg/L	1.0E-08	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.5E-08	7.2E-07	mg/kg/day	3.0E-04	mg/kg/day	2.4E-03
				Cadmium	1.6E+00	µg/L	2.5E-09	mg/kg/day	N/A		N/A	1.7E-07	mg/kg/day	2.5E-05	mg/kg/day	7.0E-03
				Chromium	3.0E+01	µg/L	9.6E-08	mg/kg/day	1.3E-02	$(mg/kg\text{-}day)^{-1}$	1.2E-09	6.7E-06	mg/kg/day	5.0E-04	mg/kg/day	1.3E-02
				Cobalt	2.0E+00	µg/L	1.3E-09	mg/kg/day	N/A		N/A	9.1E-08	mg/kg/day	3.0E-03	mg/kg/day	3.0E-05
				Iron	1.1E+04	µg/L	1.7E-05	mg/kg/day	N/A		N/A	1.2E-03	mg/kg/day	7.0E-01	mg/kg/day	1.7E-03
				Manganese	2.0E+02	µg/L	3.2E-07	mg/kg/day	N/A		N/A	2.3E-05	mg/kg/day	9.6E-04	mg/kg/day	2.3E-02
				Nickel	5.0E+01	µg/L	1.6E-08	mg/kg/day	N/A		N/A	1.1E-06	mg/kg/day	8.0E-04	mg/kg/day	1.4E-03
				Vanadium	1.1E+01	µg/L	1.7E-08	mg/kg/day	N/A		N/A	1.2E-06	mg/kg/day	1.8E-04	mg/kg/day	6.5E-03
				Zinc	3.3E+03	µg/L	3.1E-06	mg/kg/day	N/A		N/A	2.2E-04	mg/kg/day	3.0E-01	mg/kg/day	7.3E-04
			Exp. Route Total								1.4E-04					1.9E+00
		Exposure Point Total									1.4E-04					1.9E+00
	Exposure Medium Total										1.4E-04					1.9E+00
	Air	Yorktown -Eastover Aquifer Water Vapors in Excavation Pit	Inhalation	1,1-Dichloroethane	1.1E+00	µg/L	4.2E-05	$\mu g/m^3$	1.6E-06	$(\mu g/m^3)^{-1}$	6.7E-11	2.9E-06	mg/m^3	N/A		N/A
				1,2-Dichloroethane	2.5E-01	µg/L	2.4E-03	$\mu g/m^3$	2.6E-05	$(\mu g/m^3)^{-1}$	6.3E-08	1.7E-04	mg/m^3	2.4E+00	mg/m^3	7.0E-05
				Benzene	1.6E+00	µg/L	9.0E-06	$\mu g/m^3$	7.8E-06	$(\mu g/m^3)^{-1}$	7.0E-11	6.3E-07	mg/m^3	3.0E-02	mg/m^3	2.1E-05
				cis-1,2-Dichloroethene	5.7E+03	µg/L	6.8E-05	$\mu g/m^3$	N/A		N/A	4.7E-06	mg/m^3	N/A		N/A
				Tetrachloroethene	3.0E+03	µg/L	2.1E-01	$\mu g/m^3$	5.9E-06	$(\mu g/m^3)^{-1}$	1.3E-06	1.5E-02	mg/m^3	2.7E-01	mg/m^3	5.6E-02
				trans-1,2-Dichloroethene	1.3E+01	µg/L	3.9E-04	$\mu g/m^3$	N/A	$(\mu g/m^3)^{-1}$	N/A	2.8E-05	mg/m^3	6.0E-02	mg/m^3	4.6E-04
				Trichloroethene	1.7E+05	µg/L	5.8E+00	$\mu g/m^3$	2.0E-06	$(\mu g/m^3)^{-1}$	1.2E-05	4.1E-01	mg/m^3	N/A		N/A
				Vinyl chloride	3.0E+01	µg/L	8.8E-02	$\mu g/m^3$	4.4E-06	$(\mu g/m^3)^{-1}$	3.9E-07	6.2E-03	mg/m^3	1.0E-01	mg/m^3	6.2E-02
				Nitrobenzene	6.8E-01	µg/L	4.9E-04	$\mu g/m^3$	4.0E-05	$(\mu g/m^3)^{-1}$	2.0E-08	3.5E-05	mg/m^3	1.8E-02	mg/m^3	2.0E-03
			Exp. Route Total								1.3E-05					1.2E-01
		Exposure Point Total									1.3E-05					1.2E-01
	Exposure Medium Total										1.3E-05					1.2E-01

TABLE 7.5.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater Total											1.6E-04					2.1E+00
Surface Water	Surface Water	Felgates Creek	Ingestion	Arsenic	4.0E+00	mg/kg	5.5E-10	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	8.3E-10	3.9E-08	mg/kg/day	4.0E-04	mg/kg/day	9.7E-05
				Chromium	2.1E+00	mg/kg	2.9E-10	mg/kg/day	5.0E-01	$(mg/kg\text{-}day)^{-1}$	1.5E-10	2.0E-08	mg/kg/day	2.0E-02	mg/kg/day	1.0E-06
			Exp. Route Total								9.7E-10					9.8E-05
			Dermal Absorption	Arsenic	4.0E+00	mg/kg	2.2E-09	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	3.3E-09	3.9E-08	mg/kg/day	6.0E-05	mg/kg/day	6.5E-04
				Chromium	2.1E+00	mg/kg	2.0E-08	mg/kg/day	1.3E-02	$(mg/kg\text{-}day)^{-1}$	2.5E-10	3.6E-07	mg/kg/day	5.0E-04	mg/kg/day	7.1E-04
			Exp. Route Total								3.6E-09					1.4E-03
		Exposure Point Total									4.6E-09					1.5E-03
	Exposure Medium Total										4.6E-09					1.5E-03
Surface Water Total											4.6E-09					1.5E-03
Sediment	Sediment	Felgates Creek	Ingestion	Arsenic	8.7E+00	mg/kg	2.9E-09	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	4.4E-09	2.0E-07	mg/kg/day	3.0E-04	mg/kg/day	6.8E-04
				Chromium	4.0E+01	mg/kg	1.3E-08	mg/kg/day	5.0E-01	$(mg/kg\text{-}day)^{-1}$	6.7E-09	9.4E-07	mg/kg/day	2.0E-02	mg/kg/day	4.7E-05
			Exp. Route Total								1.1E-08					7.3E-04
			Dermal Absorption	Arsenic	8.7E+00	mg/kg	1.2E-09	mg/kg/day	1.5E+00	$(mg/kg\text{-}day)^{-1}$	1.9E-09	2.9E-08	mg/kg/day	3.0E-04	mg/kg/day	9.7E-05
				Chromium	4.0E+01	mg/kg	1.9E-09	mg/kg/day	1.3E-02	$(mg/kg\text{-}day)^{-1}$	2.4E-11	1.3E-07	mg/kg/day	5.0E-04	mg/kg/day	2.7E-04
			Exp. Route Total								1.9E-09					3.6E-04
		Exposure Point Total									1.3E-08					1.1E-03
	Exposure Medium Total										1.3E-08					1.1E-03
Sediment Total											1.3E-08					1.1E-03
Total of Receptor Risks Across All Media											1.6E-04	Total of Receptor Hazards Across All Media				2.1E+00

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Tables 7.5.CTE Supplement A

Air concentration above excavation calculated on Table 7.5.RME Supplement B

DA_{event} for dermal exposure to surface water calculated on Tables 7.5.CTE Supplement C

Table 7.5.CTE Supplement A
Calculation of DA_{event}
Construction Worker Groundwater
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
1,1-Dichloroethane	1.1E+00	6.7E-03	2.6E-02	3.8E-01	9.2E-01	1.0E+00	4	3.5E-08	3
1,2-Dichloroethane	2.5E-01	4.2E-03	1.6E-02	3.8E-01	9.2E-01	1.0E+00	4	4.9E-09	3
Benzene	1.6E+00	1.5E-02	5.1E-02	2.9E-01	7.0E-01	1.0E+00	4	1.1E-07	3
cis-1,2-Dichloroethene[1]	5.7E+03	7.7E-03	2.9E-02	3.7E-01	8.9E-01	1.0E+00	4	2.0E-04	3
Tetrachloroethene	3.0E+03	3.3E-02	1.7E-01	9.1E-01	2.2E+00	1.0E+00	4	5.6E-04	3
trans-1,2-Dichloroethene	1.3E+01	7.7E-03	2.9E-02	3.7E-01	8.9E-01	1.0E+00	4	4.6E-07	3
Trichloroethene	1.7E+05	1.2E-02	5.1E-02	5.8E-01	1.4E+00	1.0E+00	4	1.0E-02	3
Vinyl chloride	3.0E+01	5.6E-03	1.7E-02	2.4E-01	5.7E-01	1.0E+00	4	7.3E-07	3
2,4-Dinitrotoluene	3.6E+01	3.1E-03	1.6E-02	1.1E+00	2.7E+00	1.0E+00	4	6.9E-07	3
Nitrobenzene[2]	6.8E-01	5.4E-03	2.3E-02	5.1E-01	1.2E+00	1.0E+00	4	1.8E-08	3
1,3-Dinitrobenzene[2]	3.7E-01	2.1E-03	1.0E-02	9.2E-01	2.2E+00	1.0E+00	4	4.4E-09	3
2-Amino-4,6-dinitrotoluene[2]	7.4E+03	2.4E-03	1.3E-02	1.3E+00	3.2E+00	1.0E+00	4	1.2E-04	3
RDX[2]	2.3E+01	3.5E-04	2.0E-03	1.8E+00	4.4E+00	1.0E+00	4	6.0E-08	2
Aluminum	1.1E+03	1.0E-03	NA	NA	NA	NA	4	4.5E-06	1
Antimony	2.0E+00	1.0E-03	NA	NA	NA	NA	4	8.0E-09	1
Arsenic	6.4E+00	1.0E-03	NA	NA	NA	NA	4	2.6E-08	1
Cadmium	1.6E+00	1.0E-03	NA	NA	NA	NA	4	6.3E-09	1
Chromium	3.0E+01	2.0E-03	NA	NA	NA	NA	4	2.4E-07	1
Cobalt	2.0E+00	4.0E-04	NA	NA	NA	NA	4	3.3E-09	1
Iron	1.1E+04	1.0E-03	NA	NA	NA	NA	4	4.2E-05	1
Manganese	2.0E+02	1.0E-03	NA	NA	NA	NA	4	8.1E-07	1
Nickel	5.0E+01	2.0E-04	NA	NA	NA	NA	4	4.0E-08	1
Vanadium	1.1E+01	1.0E-03	NA	NA	NA	NA	4	4.2E-08	1
Zinc	3.3E+03	6.0E-04	NA	NA	NA	NA	4	7.8E-06	1

[1] trans-1,2-Dichloroethane used as a surrogate.

Inorganics: DA_{event} (mg/cm^2-event) =

K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =

If t_{event}<t*, then DA_{event} =

2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =

Table 7.5.CTE Supplement C
Calculation of DA_{event}
Construction Worker Surface Water
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
Arsenic	8.7E+00	1.0E-03	NA	NA	NA	NA	4	3.5E-08	1
Chromium	4.0E+01	2.0E-03	NA	NA	NA	NA	4	3.2E-07	1

[1] trans-1,2-Dichloroethane used as a surrogate.

Inorganics: DA_{event} (mg/cm^2-event) =

K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =

If t_{event}<t*, then DA_{event} =

2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =

TABLE 7.6.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	Ingestion	2,4-Dinitrotoluene	5.1E+01	µg/L	N/A		N/A		N/A	6.5E-04	mg/kg/day	2.0E-03	mg/kg/day	3.3E-01
				1,3-Dinitrobenzene	1.8E+01	µg/L	N/A		N/A		N/A	2.3E-04	mg/kg/day	1.0E-04	mg/kg/day	2.3E+00
				3,5-Dinitroaniline	7.8E-01	µg/L	N/A		N/A		N/A	1.0E-05	mg/kg/day	N/A		N/A
				RDX	7.0E+01	µg/L	N/A		N/A		N/A	9.0E-04	mg/kg/day	3.0E-03	mg/kg/day	3.0E-01
				Manganese, Dissolved	1.2E+02	µg/L	N/A		N/A		N/A	1.5E-03	mg/kg/day	2.4E-02	mg/kg/day	6.4E-02
			Exp. Route Total								0.0E+00					3.0E+00
			Dermal	2,4-Dinitrotoluene	5.1E+01	µg/L	N/A		N/A		N/A	3.8E-05	mg/kg/day	2.0E-03	mg/kg/day	1.9E-02
				1,3-Dinitrobenzene	1.8E+01	µg/L	N/A		N/A		N/A	8.1E-06	mg/kg/day	1.0E-04	mg/kg/day	8.1E-02
				3,5-Dinitroaniline	7.8E-01	µg/L	N/A		N/A		N/A	6.0E-07	mg/kg/day	N/A		N/A
				RDX	7.0E+01	µg/L	N/A		N/A		N/A	7.6E-06	mg/kg/day	3.0E-03	mg/kg/day	2.5E-03
				Manganese, Dissolved	1.2E+02	µg/L	N/A		N/A		N/A	4.9E-06	mg/kg/day	9.6E-04	mg/kg/day	5.1E-03
			Exp. Route Total								0.0E+00					1.1E-01
		Exposure Point Total									0.0E+00					3.1E+00
	Exposure Medium Total										0.0E+00					3.1E+00
Groundwater Total											0.0E+00					3.1E+00

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Table 7.6.CTE Supplement A

TABLE 7.7.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	Ingestion	2,4-Dinitrotoluene	5.1E+01	µg/L	N/A		N/A		N/A	2.2E-03	mg/kg/day	2.0E-03	mg/kg/day	1.1E+00
				1,3-Dinitrobenzene	1.8E+01	µg/L	N/A		N/A		N/A	7.7E-04	mg/kg/day	1.0E-04	mg/kg/day	7.7E+00
				3,5-Dinitroaniline	7.8E-01	µg/L	N/A		N/A		N/A	3.3E-05	mg/kg/day	N/A		N/A
				RDX	7.0E+01	µg/L	N/A		N/A		N/A	3.0E-03	mg/kg/day	3.0E-03	mg/kg/day	1.0E+00
				Manganese, Dissolved	1.2E+02	µg/L	N/A		N/A		N/A	5.1E-03	mg/kg/day	2.4E-02	mg/kg/day	2.1E-01
			Exp. Route Total								0.0E+00					1.0E+01
			Dermal	2,4-Dinitrotoluene	5.1E+01	µg/L	N/A		N/A		N/A	7.4E-05	mg/kg/day	2.0E-03	mg/kg/day	3.7E-02
				1,3-Dinitrobenzene	1.8E+01	µg/L	N/A		N/A		N/A	1.6E-05	mg/kg/day	1.0E-04	mg/kg/day	1.6E-01
				3,5-Dinitroaniline	7.8E-01	µg/L	N/A		N/A		N/A	1.3E-06	mg/kg/day	N/A		N/A
				RDX	7.0E+01	µg/L	N/A		N/A		N/A	1.5E-05	mg/kg/day	3.0E-03	mg/kg/day	5.0E-03
				Manganese, Dissolved	1.2E+02	µg/L	N/A		N/A		N/A	1.1E-05	mg/kg/day	9.6E-04	mg/kg/day	1.2E-02
			Exp. Route Total								0.0E+00					2.1E-01
		Exposure Point Total									0.0E+00					1.0E+01
	Exposure Medium Total										0.0E+00					1.0E+01
Groundwater Total											0.0E+00					1.0E+01

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Table 7.7.CTE Supplement A

Table 7.7.CTE Supplement A
Calculation of DA_{event}
Residential Child Groundwater
Site 6, NWS Yorktown, Yorktown, Virginia

Chemical of Potential Concern	Water Concentration (CW) (µg/L)	Permeability Coefficient (K_p) (cm/hr)	B (dimensionless)	Lag Time (τ_{event}) (hr)	t* (hr)	Fraction Absorbed Water (FA) (dimensionless)	Duration of Event (t_{event}) (hr)	DA_{event} (mg/cm^2-event)	Eq
2,4-Dinitrotoluene	5.1E+01	3.1E-03	1.6E-02	1.1E+00	2.7E+00	1.0E+00	0.33	2.6E-07	2
1,3-Dinitrobenzene[2]	1.8E+01	2.1E-03	1.0E-02	9.2E-01	2.2E+00	1.0E+00	0.33	5.6E-08	2
3,5-Dinitrobenzene[2]	7.8E-01	3.2E-03	1.7E-02	1.3E+00	3.2E+00	1.0E+00	0.33	4.6E-09	2
RDX[2]	7.0E+01	3.5E-04	2.0E-03	1.8E+00	4.4E+00	1.0E+00	0.33	5.3E-08	2
Manganese, Dissolved	1.2E+02	1.0E-03	NA	NA	NA	NA	0.33	3.9E-08	1

[1] trans-1,2-Dichloroethane used as a surrogate.

Inorganics: DA_{event} (mg/cm^2-event) =

K_p x CW x t_{event} x 0.001 mg/µg x 0.001 l/cm^3 (eq 1)

Organics: DA_{event} (mg/cm^2-event) =

If t_{event}<t*, then DA_{event} =

2 x FA x K_p x CW x (sqrt((6 x τ_{event} x t_{event})/π)) x 0.001 mg/µg x 0.001 l/cm^3 (eq 2)

If t_{event}>t*, then DA_{event} =

FA x K_p x CW x (t_{event}/(1+B) + 2 x τ_{event} x ((1 + 3xB + 3xB^2)/(1+B)^2) x 0.001 mg/µg x 0.001 l/cm^3 (eq 3)

Notes:

Permeability constants and other input parameter values from EPA 2004,*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment - Final).* EPA/540/R/99/005. The default value of 0.001 was assigned to inorganics not listed in this document

B - Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless).

t* - Time to reach steady-state

[1] trans-1,2-Dichloroethane used as a surrogate.

[2]Lag time and B calculated on Table 7.1b.RME Supplement. Permeability constants from RAIS databases (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem).

N/A - not applicable.

TABLE 7.8.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	Ingestion	2,4-Dinitrotoluene	5.1E+01	µg/L	2.7E-04	mg/kg/day	3.1E-01	$(mg/kg\text{-}day)^{-1}$	8.4E-05	N/A		N/A		N/A
				1,3-Dinitrobenzene	1.8E+01	µg/L	9.6E-05	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				3,5-Dinitroaniline	7.8E-01	µg/L	4.1E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				RDX	7.0E+01	µg/L	3.7E-04	mg/kg/day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	4.1E-05	N/A		N/A		N/A
				Manganese, Dissolved	1.2E+02	µg/L	6.3E-04	mg/kg/day	N/A		N/A	N/A		N/A		N/A
			Exp. Route Total								1.2E-04					0.0E+00
			Dermal	2,4-Dinitrotoluene	5.1E+01	µg/L	1.1E-05	mg/kg/day	3.1E-01	$(mg/kg\text{-}day)^{-1}$	3.5E-06	N/A		N/A		N/A
				1,3-Dinitrobenzene	1.8E+01	µg/L	2.4E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				3,5-Dinitroaniline	7.8E-01	µg/L	1.9E-07	mg/kg/day	N/A		N/A	N/A		N/A		N/A
				RDX	7.0E+01	µg/L	2.2E-06	mg/kg/day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	2.5E-07	N/A		N/A		N/A
				Manganese, Dissolved	1.2E+02	µg/L	1.6E-06	mg/kg/day	N/A		N/A	N/A		N/A		N/A
			Exp. Route Total								3.7E-06					0.0E+00
		Exposure Point Total									1.3E-04					0.0E+00
	Exposure Medium Total										1.3E-04					0.0E+00
Groundwater Total											1.3E-04					0.0E+00

N/A - Not available.

DA_{event} for dermal exposure to groundwater calculated on Tables 7.6.RME and 7.7.RME Supplement A.

TABLE 7.9.CTE

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

Site 6

NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	Ingestion	2,4-Dinitrotoluene	5.1E+01	µg/L	5.6E-05	mg/kg/day	3.1E-01	$(mg/kg\text{-}day)^{-1}$	1.7E-05	4.4E-04	mg/kg/day	2.0E-03	mg/kg/day	2.2E-01
				1,3-Dinitrobenzene	1.8E+01	µg/L	2.0E-05	mg/kg/day	N/A		N/A	1.5E-04	mg/kg/day	1.0E-04	mg/kg/day	1.5E+00
				3,5-Dinitroaniline	7.8E-01	µg/L	8.6E-07	mg/kg/day	N/A		N/A	6.7E-06	mg/kg/day	N/A		N/A
				RDX	7.0E+01	µg/L	7.7E-05	mg/kg/day	1.1E-01	$(mg/kg\text{-}day)^{-1}$	8.5E-06	6.0E-04	mg/kg/day	3.0E-03	mg/kg/day	2.0E-01
				Manganese, Dissolved	1.2E+02	µg/L	1.3E-04	mg/kg/day	N/A		N/A	1.0E-03	mg/kg/day	2.4E-02	mg/kg/day	4.3E-02
			Exp. Route Total								2.6E-05					2.0E+00
		Exposure Point Total									2.6E-05					2.0E+00
	Exposure Medium Total										2.6E-05					2.0E+00
Groundwater Total											2.6E-05					2.0E+00

N/A - Not available.

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	1,1-Dichloroethane	N/A	N/A	N/A	N/A	Kidney	1.5E-04	N/A	1.2E-05	1.6E-04
			1,2-Dichloroethane	N/A	N/A	N/A	N/A	Kidney	3.4E-04	N/A	1.7E-05	3.6E-04
			Benzene	N/A	N/A	N/A	N/A	Blood, Immune	1.1E-02	N/A	1.7E-03	1.3E-02
			cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Blood	1.6E+01	N/A	1.4E+00	1.7E+01
			Tetrachloroethene	N/A	N/A	N/A	N/A	Liver, Body Weight	8.2E+00	N/A	5.0E+00	1.3E+01
			trans-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Blood	1.8E-02	N/A	1.6E-03	1.9E-02
			Trichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	N/A	Liver	2.7E-01	N/A	1.4E-02	2.8E-01
			2,4-Dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	4.9E-01	N/A	3.0E-02	5.2E-01
			Nitrobenzene	N/A	N/A	N/A	N/A	Blood	9.4E-03	N/A	6.9E-04	1.0E-02
			1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	Spleen	1.0E-01	N/A	3.8E-03	1.1E-01
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	1.0E+02	N/A	5.4E+00	1.1E+02
			RDX	N/A	N/A	N/A	N/A	Prostrate	2.1E-01	N/A	1.9E-03	2.1E-01
			Antimony, Dissolved	N/A	N/A	N/A	N/A	Longevity, Blood	6.7E+00	N/A	2.3E-01	6.9E+00
			Arsenic, Dissolved	N/A	N/A	N/A	N/A	Skin, Vascular	1.7E+00	N/A	9.0E-03	1.7E+00
			Beryllium, Dissolved	N/A	N/A	N/A	N/A	Intestine	1.2E-01	N/A	9.3E-01	1.1E+00
			Cadmium, Dissolved	N/A	N/A	N/A	N/A	Blood	4.7E-01	N/A	4.9E-02	5.1E-01
			Chromium, Dissolved	N/A	N/A	N/A	N/A	Not identified	6.9E-02	N/A	2.9E-02	9.8E-02
			Cobalt, Dissolved	N/A	N/A	N/A	N/A	Thyroid	8.1E+00	N/A	1.7E-02	8.1E+00
			Iron, Dissolved	N/A	N/A	N/A	N/A	Gastrointestinal	1.6E-01	N/A	8.5E-04	1.6E-01
			Manganese, Dissolved	N/A	N/A	N/A	N/A	CNS	2.2E-01	N/A	2.9E-02	2.5E-01
			Nickel, Dissolved	N/A	N/A	N/A	N/A	ed Body Weight, Decreased Organ	6.1E-02	N/A	1.6E-03	6.3E-02
			Selenium, Dissolved	N/A	N/A	N/A	N/A	Whole Body	7.1E-02	N/A	3.7E-04	7.2E-02
			Vanadium, Dissolved	N/A	N/A	N/A	N/A	Hair, Blood	5.0E-01	N/A	1.0E-01	6.0E-01
			Zinc, Dissolved	N/A	N/A	N/A	N/A	Blood	2.1E-01	N/A	6.4E-04	2.1E-01
			Chemical Total	N/A	N/A	N/A	N/A		1.4E+02	N/A	1.3E+01	1.6E+02
		Exposure Point Total					N/A					1.6E+02
	Exposure Medium Total						N/A					1.6E+02

TABLE 9.1.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Yorktown -Eastover Water Vapors at Showerhead	1,1-Dichloroethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			1,2-Dichloroethane	N/A	N/A	N/A	N/A	Kidney	N/A	4.8E-06	N/A	4.8E-06
			Benzene	N/A	N/A	N/A	N/A	Blood, Immune	N/A	3.2E-03	N/A	3.2E-03
			cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Tetrachloroethene	N/A	N/A	N/A	N/A	Kidney, Liver	N/A	4.8E-01	N/A	4.8E-01
			trans-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Kidney	N/A	1.2E-02	N/A	1.2E-02
			Trichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	N/A	Liver	N/A	2.0E-02	N/A	2.0E-02
			Nitrobenzene	N/A	N/A	N/A	N/A	Lungs, Nose	N/A	3.5E-04	N/A	3.5E-04
							N/A					
			Chemical Total	N/A	N/A	N/A	N/A		N/A	5.1E-01	N/A	5.1E-01
		Exposure Point Total					N/A					5.1E-01
		Vapor Intrusion to Indoor Air	1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Trichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	N/A	Liver	N/A	1.2E-02	N/A	1.2E-02
			Chemical Total	N/A	N/A	N/A	N/A		N/A	1.2E-02	N/A	1.2E-02
		Exposure Point Total					N/A					1.2E-02
	Exposure Medium Total						N/A					5.3E-01
Medium Total							N/A					1.6E+02
Receptor Total							N/A				Receptor HI Total	1.6E+02

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Kidney HI Across All Media =	4.9E-01
Total Blood HI Across All Media =	1.3E+02
Total Immune HI Across All Media =	1.6E-02
Total Liver HI Across All Media =	1.4E+01
Total Body Weight HI Across All Media =	1.3E+01
Total Neurological/Central Nervous System HI Across All Media =	1.1E+02
Total Billiary Tract HI Across All Media =	1.1E+02
Total Spleen HI Across All Media =	1.1E-01
Total Prostate HI Across All Media =	2.1E-01
Total Longevity HI Across All Media =	6.9E+00
Total Skin HI Across All Media=	1.7E+00

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
								Total Vascular HI Across All Media=				1.7E+00
								Total Gastrointestinal/Intestinal HI Across All Media=				1.2E+00
								Total Decreased Organ Weight HI Across All Media =				7.2E-02
								Total Thyroid HI Across All Media=				8.1E+00
								Total Whole Body HI Across All Media=				7.2E-02
								Total Hair HI Across All Media=				6.0E-01
								Total Lungs HI Across All Media=				3.5E-04
								Total Nose HI Across All Media=				3.5E-04

TABLE 9.2.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	1,1-Dichloroethane	N/A	N/A	N/A	N/A	Kidney	3.5E-04	N/A	2.8E-05	3.8E-04
			1,2-Dichloroethane	N/A	N/A	N/A	N/A	Kidney	8.0E-04	N/A	3.9E-05	8.4E-04
			Benzene	N/A	N/A	N/A	N/A	Blood, Immune	2.6E-02	N/A	3.9E-03	2.9E-02
			cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Blood	3.6E+01	N/A	3.2E+00	3.9E+01
			Tetrachloroethene	N/A	N/A	N/A	N/A	Liver, Body Weight	1.9E+01	N/A	1.1E+01	3.0E+01
			trans-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Blood	4.1E-02	N/A	3.7E-03	4.5E-02
			Trichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	N/A	Liver	6.3E-01	N/A	3.4E-02	6.6E-01
			2,4-Dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	1.2E+00	N/A	6.8E-02	1.2E+00
			Nitrobenzene	N/A	N/A	N/A	N/A	Blood	2.2E-02	N/A	1.5E-03	2.3E-02
			1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	Spleen	2.4E-01	N/A	8.5E-03	2.5E-01
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	2.4E+02	N/A	1.2E+01	2.5E+02
			RDX	N/A	N/A	N/A	N/A	Prostrate	4.9E-01	N/A	4.2E-03	4.9E-01
			Antimony, Dissolved	N/A	N/A	N/A	N/A	Longevity, Blood	1.6E+01	N/A	6.9E-01	1.6E+01
			Arsenic, Dissolved	N/A	N/A	N/A	N/A	Skin, Vascular	4.0E+00	N/A	2.7E-02	4.0E+00
			Beryllium, Dissolved	N/A	N/A	N/A	N/A	Intestine	2.9E-01	N/A	2.7E+00	3.0E+00
			Cadmium, Dissolved	N/A	N/A	N/A	N/A	Blood	1.1E+00	N/A	1.4E-01	1.2E+00
			Chromium, Dissolved	N/A	N/A	N/A	N/A	Not identified	1.6E-01	N/A	8.5E-02	2.5E-01
			Cobalt, Dissolved	N/A	N/A	N/A	N/A	Thyroid	1.9E+01	N/A	5.0E-02	1.9E+01
			Iron, Dissolved	N/A	N/A	N/A	N/A	Gastrointestinal	3.8E-01	N/A	2.5E-03	3.8E-01
			Manganese, Dissolved	N/A	N/A	N/A	N/A	CNS	5.1E-01	N/A	8.5E-02	6.0E-01
			Nickel, Dissolved	N/A	N/A	N/A	N/A	ed Body Weight, Decreased Organ	1.4E-01	N/A	4.7E-03	1.5E-01
			Selenium, Dissolved	N/A	N/A	N/A	N/A	Whole Body	1.7E-01	N/A	1.1E-03	1.7E-01
			Vanadium, Dissolved	N/A	N/A	N/A	N/A	Hair, Blood	1.2E+00	N/A	2.9E-01	1.5E+00
			Zinc, Dissolved	N/A	N/A	N/A	N/A	Blood	4.8E-01	N/A	1.9E-03	4.8E-01
			Chemical Total	N/A	N/A	N/A	N/A		3.4E+02	N/A	3.1E+01	3.7E+02
		Exposure Point Total					N/A					3.7E+02
	Exposure Medium Total						N/A					3.7E+02

TABLE 9.2.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Yorktown -Eastover Water Vapors at Showerhead	1,1-Dichloroethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			1,2-Dichloroethane	N/A	N/A	N/A	N/A	Kidney	N/A	1.2E-05	N/A	1.2E-05
			Benzene	N/A	N/A	N/A	N/A	Blood, Immune	N/A	7.9E-03	N/A	7.9E-03
			cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Tetrachloroethene	N/A	N/A	N/A	N/A	Kidney, Liver	N/A	1.2E+00	N/A	1.2E+00
			trans-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Kidney	N/A	3.0E-02	N/A	3.0E-02
			Trichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	N/A	Liver	N/A	5.1E-02	N/A	5.1E-02
			Nitrobenzene	N/A	N/A	N/A	N/A	Lungs, Nose	N/A	8.9E-04	N/A	8.9E-04
			Chemical Total	N/A	N/A	N/A	N/A		N/A	1.3E+00	N/A	1.3E+00
		Exposure Point Total					N/A					1.3E+00
		Vapor Intrusion to Indoor Air	1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Trichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	N/A	Liver	N/A	3.6E-02	N/A	3.6E-02
			Chemical Total	N/A	N/A	N/A	N/A		N/A	3.6E-02	N/A	3.6E-02
		Exposure Point Total					N/A					3.6E-02
	Exposure Medium Total						N/A					1.3E+00
Medium Total							N/A					3.7E+02
Receptor Total							N/A				Receptor HI Total	3.7E+02

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Kidney HI Across All Media =	1.2E+00
Total Blood HI Across All Media =	3.1E+02
Total Immune HI Across All Media =	3.7E-02
Total Liver HI Across All Media =	3.2E+01
Total Body Weight HI Across All Media =	3.0E+01
Total Neurological/Central Nervous System HI Across All Media =	2.5E+02
Total Billiary Tract HI Across All Media =	2.5E+02
Total Spleen HI Across All Media =	2.5E-01
Total Prostate HI Across All Media =	4.9E-01
Total Longevity HI Across All Media =	1.6E+01
Total Skin HI Across All Media=	4.0E+00

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
											Total Vascular HI Across All Media=	4.0E+00
											Total Gastrointestinal/Intestinal HI Across All Media=	3.4E+00
											Total Decreased Organ Weight HI Across All Media =	1.7E-01
											Total Thyroid HI Across All Media=	1.9E+01
											Total Whole Body HI Across All Media=	1.7E-01
											Total Hair HI Across All Media=	1.5E+00
											Total Lungs HI Across All Media=	8.9E-04
											Total Nose HI Across All Media=	8.9E-04

TABLE 9.3.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	1,1-Dichloroethane	9.4E-08	N/A	7.4E-09	1.0E-07	Kidney	N/A	N/A	N/A	N/A
			1,2-Dichloroethane	3.4E-07	N/A	1.7E-08	3.6E-07	Kidney	N/A	N/A	N/A	N/A
			Benzene	1.3E-06	N/A	2.0E-07	1.5E-06	Blood, Immune	N/A	N/A	N/A	N/A
			cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	N/A	N/A
			Tetrachloroethene	2.4E-02	N/A	1.4E-02	3.8E-02	Liver, Body Weight	N/A	N/A	N/A	N/A
			trans-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	N/A	N/A
			Trichloroethene	1.5E-02	N/A	2.5E-03	1.7E-02	N/A	N/A	N/A	N/A	N/A
			Vinyl chloride	3.2E-04	N/A	1.7E-05	3.3E-04	Liver	N/A	N/A	N/A	N/A
			2,4-Dinitrotoluene	1.7E-04	N/A	1.0E-05	1.8E-04	CNS, Blood, Biliary Tract	N/A	N/A	N/A	N/A
			Nitrobenzene	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	N/A	N/A
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	N/A	N/A	N/A	N/A
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	N/A	N/A	N/A	N/A
			RDX	3.8E-05	N/A	3.3E-07	3.8E-05	Prostrate	N/A	N/A	N/A	N/A
			Antimony, Dissolved	N/A	N/A	N/A	0.0E+00	Longevity, Blood	N/A	N/A	N/A	N/A
			Arsenic, Dissolved	4.2E-04	N/A	2.4E-06	4.3E-04	Skin, Vascular	N/A	N/A	N/A	N/A
			Beryllium, Dissolved	N/A	N/A	N/A	0.0E+00	Intestine	N/A	N/A	N/A	N/A
			Cadmium, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	N/A	N/A
			Chromium, Dissolved	5.7E-05	N/A	1.6E-08	5.7E-05	Not identified	N/A	N/A	N/A	N/A
			Cobalt, Dissolved	N/A	N/A	N/A	0.0E+00	Thyroid	N/A	N/A	N/A	N/A
			Iron, Dissolved	N/A	N/A	N/A	0.0E+00	Gastrointestinal	N/A	N/A	N/A	N/A
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	N/A	N/A	N/A	N/A
			Nickel, Dissolved	N/A	N/A	N/A	0.0E+00	ed Body Weight, Decreased Organ	N/A	N/A	N/A	N/A
			Selenium, Dissolved	N/A	N/A	N/A	0.0E+00	Whole Body	N/A	N/A	N/A	N/A
			Vanadium, Dissolved	N/A	N/A	N/A	0.0E+00	Hair, Blood	N/A	N/A	N/A	N/A
			Zinc, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	N/A	N/A
			Chemical Total	4.0E-02	N/A	1.7E-02	5.7E-02		N/A	N/A	N/A	N/A
		Exposure Point Total					5.7E-02					N/A
	Exposure Medium Total						5.7E-02					N/A

TABLE 9.3.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Yorktown -Eastover Water Vapors at Showerhead	1,1-Dichloroethane	N/A	6.1E-08	N/A	6.1E-08	N/A	N/A	N/A	N/A	N/A
			1,2-Dichloroethane	N/A	2.0E-07	N/A	2.0E-07	Kidney	N/A	N/A	N/A	N/A
			Benzene	N/A	4.8E-07	N/A	4.8E-07	Blood, Immune	N/A	N/A	N/A	N/A
			cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	N/A
			Tetrachloroethene	N/A	4.9E-04	N/A	4.9E-04	Kidney, Liver	N/A	N/A	N/A	N/A
			trans-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Kidney	N/A	N/A	N/A	N/A
			Trichloroethene	N/A	1.0E-02	N/A	1.0E-02	N/A	N/A	N/A	N/A	N/A
			Vinyl chloride	N/A	5.7E-06	N/A	5.7E-06	Liver	N/A	N/A	N/A	N/A
			Nitrobenzene	N/A	8.3E-08	N/A	8.3E-08	Lungs, Nose	N/A	N/A	N/A	N/A
			Chemical Total	N/A	1.1E-02	N/A	1.1E-02		N/A	N/A	N/A	N/A
		Exposure Point Total					1.1E-02					N/A
		Vapor Intrusion to Indoor Air	1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	N/A
			Trichloroethene	N/A	1.6E-05	N/A	1.6E-05	N/A	N/A	N/A	N/A	N/A
			Vinyl chloride	N/A	6.8E-06	N/A	6.8E-06	Liver	N/A	N/A	N/A	N/A
			Chemical Total	N/A	2.3E-05	N/A	2.3E-05		N/A	N/A	N/A	N/A
		Exposure Point Total					2.3E-05					N/A
	Exposure Medium Total						1.1E-02					N/A
Medium Total							6.8E-02					N/A
Receptor Total							6.8E-02				Receptor HI Total	N/A

TABLE 9.4.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	1,1-Dichloroethane	2.2E-08	N/A	N/A	2.2E-08	Kidney	5.4E-05	N/A	N/A	5.4E-05
			1,2-Dichloroethane	8.0E-08	N/A	N/A	8.0E-08	Kidney	1.2E-04	N/A	N/A	1.2E-04
			Benzene	3.1E-07	N/A	N/A	3.1E-07	Blood, Immune	3.9E-03	N/A	N/A	3.9E-03
			cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	5.5E+00	N/A	N/A	5.5E+00
			Tetrachloroethene	5.7E-03	N/A	N/A	5.7E-03	Liver, Body Weight	2.9E+00	N/A	N/A	2.9E+00
			trans-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	1.3E-02	N/A	N/A	1.3E-02
			Trichloroethene	3.5E-03	N/A	N/A	3.5E-03	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	7.4E-05	N/A	N/A	7.4E-05	Liver	9.6E-02	N/A	N/A	9.6E-02
			2,4-Dinitrotoluene	3.9E-05	N/A	N/A	3.9E-05	CNS, Blood, Biliary Tract	1.8E-01	N/A	N/A	1.8E-01
			Nitrobenzene	N/A	N/A	N/A	0.0E+00	Blood	3.3E-03	N/A	N/A	3.3E-03
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	3.6E-02	N/A	N/A	3.6E-02
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	3.6E+01	N/A	N/A	3.6E+01
			RDX	8.8E-06	N/A	N/A	8.8E-06	Prostrate	7.5E-02	N/A	N/A	7.5E-02
			Antimony, Dissolved	N/A	N/A	N/A	0.0E+00	Longevity, Blood	2.4E+00	N/A	N/A	2.4E+00
			Arsenic, Dissolved	9.9E-05	N/A	N/A	9.9E-05	Skin, Vascular	6.2E-01	N/A	N/A	6.2E-01
			Beryllium, Dissolved	N/A	N/A	N/A	0.0E+00	Intestine	4.5E-02	N/A	N/A	4.5E-02
			Cadmium, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	1.7E-01	N/A	N/A	1.7E-01
			Chromium, Dissolved	1.3E-05	N/A	N/A	1.3E-05	Not identified	2.5E-02	N/A	N/A	2.5E-02
			Cobalt, Dissolved	N/A	N/A	N/A	0.0E+00	Thyroid	2.9E+00	N/A	N/A	2.9E+00
			Iron, Dissolved	N/A	N/A	N/A	0.0E+00	Gastrointestinal	5.8E-02	N/A	N/A	5.8E-02
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	7.8E-02	N/A	N/A	7.8E-02
			Nickel, Dissolved	N/A	N/A	N/A	0.0E+00	ed Body Weight, Decreased Organ	2.2E-02	N/A	N/A	2.2E-02
			Selenium, Dissolved	N/A	N/A	N/A	0.0E+00	Whole Body	2.6E-02	N/A	N/A	2.6E-02
			Vanadium, Dissolved	N/A	N/A	N/A	0.0E+00	Hair, Blood	1.8E-01	N/A	N/A	1.8E-01
			Zinc, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	7.3E-02	N/A	N/A	7.3E-02
			Chemical Total	9.4E-03	N/A	N/A	9.4E-03		5.2E+01	N/A	N/A	5.2E+01
		Exposure Point Total					9.4E-03					5.2E+01
	Exposure Medium Total						9.4E-03					5.2E+01

TABLE 9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Vapor Intrusion to Indoor Air	1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	0.0E+00
			Trichloroethene	N/A	3.2E-06	N/A	3.2E-06	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	1.3E-06	N/A	1.3E-06	Liver	N/A	8.5E-03	N/A	8.5E-03
			Chemical Total	N/A	4.5E-06	N/A	4.5E-06		N/A	8.5E-03	N/A	8.5E-03
		Exposure Point Total					4.5E-06					8.5E-03
	Exposure Medium Total						4.5E-06					8.5E-03
Medium Total							9.4E-03					5.2E+01
Receptor Total							9.4E-03				Receptor HI Total	5.2E+01

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Kidney HI Across All Media =	1.8E-04
Total Blood HI Across All Media =	4.5E+01
Total Immune HI Across All Media =	3.9E-03
Total Liver HI Across All Media =	3.0E+00
Total Body Weight HI Across All Media =	3.0E+00
Total Neurological/Central Nervous System HI Across All Media =	3.6E+01
Total Billiary Tract HI Across All Media =	3.6E+01
Total Spleen HI Across All Media =	3.6E-02
Total Prostate HI Across All Media =	7.5E-02
Total Longevity HI Across All Media =	2.4E+00
Total Skin HI Across All Media=	6.2E-01
Total Vascular HI Across All Media=	6.2E-01
Total Gastrointestinal/Intestinal HI Across All Media=	1.0E-01
Total Decreased Organ Weight HI Across All Media =	2.6E-02
Total Thyroid HI Across All Media=	2.9E+00
Total Whole Body HI Across All Media=	2.6E-02
Total Hair HI Across All Media=	1.8E-01

TABLE 9.5.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer	1,1-Dichloroethane	N/A	N/A	1.5E-10	1.5E-10	Kidney	N/A	N/A	8.9E-07	8.9E-07
		Water in Excavation Pit	1,2-Dichloroethane	N/A	N/A	3.3E-10	3.3E-10	Kidney	N/A	N/A	1.3E-05	1.3E-05
			Benzene	N/A	N/A	4.3E-09	4.3E-09	Blood, Immune	N/A	N/A	1.4E-03	1.4E-03
			cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	1.0E-01	1.0E-01
			Tetrachloroethene	N/A	N/A	1.9E-04	1.9E-04	Liver	N/A	N/A	2.5E-01	2.5E-01
			trans-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	1.2E-04	1.2E-04
			Trichloroethene	N/A	N/A	4.1E-05	4.1E-05	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	4.0E-07	4.0E-07	Liver	N/A	N/A	1.3E-02	1.3E-02
			2,4-Dinitrotoluene	N/A	N/A	1.4E-07	1.4E-07	CNS, Blood, Biliary Tract	N/A	N/A	1.6E-02	1.6E-02
			Nitrobenzene	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	3.1E-04	3.1E-04
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	N/A	N/A	2.1E-04	2.1E-04
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	N/A	N/A	2.6E+00	2.6E+00
			RDX	N/A	N/A	4.1E-09	4.1E-09	Prostrate	N/A	N/A	8.7E-04	8.7E-04
			Aluminum	N/A	N/A	N/A	0.0E+00	Neurological, Developmental	N/A	N/A	2.5E-04	2.5E-04
			Antimony	N/A	N/A	N/A	0.0E+00	Whole Body, Blood	N/A	N/A	7.4E-03	7.4E-03
			Arsenic	N/A	N/A	3.1E-08	3.1E-08	Skin, Vascular	N/A	N/A	4.8E-03	4.8E-03
			Cadmium	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	1.4E-02	1.4E-02
			Chromium	N/A	N/A	2.4E-09	2.4E-09	Not identified	N/A	N/A	2.7E-02	2.7E-02
			Cobalt	N/A	N/A	N/A	0.0E+00	Thyroid	N/A	N/A	6.1E-05	6.1E-05
			Iron	N/A	N/A	N/A	0.0E+00	Gastrointestinal	N/A	N/A	3.4E-03	3.4E-03
			Manganese	N/A	N/A	N/A	0.0E+00	CNS	N/A	N/A	4.7E-02	4.7E-02
			Nickel	N/A	N/A	N/A	0.0E+00	Whole body	N/A	N/A	2.8E-03	2.8E-03
			Vanadium	N/A	N/A	N/A	0.0E+00	Lifetime	N/A	N/A	1.3E-02	1.3E-02
			Zinc	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	1.5E-03	1.5E-03
			Chemical Total	N/A	N/A	2.4E-04	2.4E-04		N/A	N/A	3.1E+00	3.1E+00
		Exposure Point Total					2.4E-04					3.1E+00
	Exposure Medium Total						2.4E-04					3.1E+00

TABLE 9.5.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Yorktown -Eastover Water Vapors in Excavation Pit	1,1-Dichloroethane	N/A	1.3E-10	N/A	1.3E-10	N/A	N/A	N/A	N/A	0.0E+00
			1,2-Dichloroethane	N/A	1.3E-07	N/A	1.3E-07	Kidney	N/A	5.2E-07	N/A	5.2E-07
			Benzene	N/A	1.4E-10	N/A	1.4E-10	Blood, Immune	N/A	3.2E-04	N/A	3.2E-04
			cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	0.0E+00
			Tetrachloroethene	N/A	2.5E-06	N/A	2.5E-06	Kidney, Liver	N/A	4.6E-02	N/A	4.6E-02
			trans-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Kidney	N/A	1.2E-03	N/A	1.2E-03
			Trichloroethene	N/A	2.3E-05	N/A	2.3E-05	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	7.7E-07	N/A	7.7E-07	Liver	N/A	2.0E-03	N/A	2.0E-03
			Nitrobenzene	N/A	4.0E-08	N/A	4.0E-08	Blood, Adrenal Glands, Kidney, Live	N/A	5.5E-05	N/A	5.5E-05
			Chemical Total	N/A	2.7E-05	N/A	2.7E-05		N/A	4.9E-02	N/A	4.9E-02
		Exposure Point Total					2.7E-05					4.9E-02
	Exposure Medium Total						2.7E-05					4.9E-02
Medium Total							2.6E-04					3.2E+00
Surface Water	Surface Water	Felgates Creek	Arsenic	1.7E-09	N/A	1.7E-09	3.3E-09	Longevity, Blood	1.9E-04	N/A	1.2E-03	1.4E-03
			Chromium	2.9E-10	N/A	5.1E-10	8.0E-10	Not identified	2.0E-06	N/A	1.5E-04	1.5E-04
			Chemical Total	1.9E-09	0.0E+00	2.2E-09	4.1E-09		2.0E-04	0.0E+00	1.3E-03	1.5E-03
		Exposure Point Total					4.1E-09					1.5E-03
	Exposure Medium Total						4.1E-09					1.5E-03
Medium Total							4.1E-09					1.5E-03
Sediment	Sediment	Felgates Creek	Arsenic	1.8E-08	N/A	3.7E-09	2.1E-08	Longevity, Blood	3.7E-02	N/A	5.8E-04	3.7E-02
			Chromium	2.7E-08	N/A	4.8E-11	2.7E-08	Not identified	2.5E-03	N/A	5.3E-04	3.0E-03
			Chemical Total	4.4E-08	0.0E+00	3.8E-09	4.8E-08		3.9E-02	0.0E+00	1.1E-03	4.0E-02
		Exposure Point Total					4.8E-08					4.0E-02
	Exposure Medium Total						4.8E-08					4.0E-02
Medium Total							4.8E-08					4.0E-02
Receptor Total							2.6E-04				Receptor HI Total	3.2E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Kidney HI Across All Media =	4.7E-02
Total Blood HI Across All Media =	2.8E+00
Total Immune HI Across All Media =	1.7E-03
Total Liver HI Across All Media =	3.1E-01

TABLE 9.5.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
								Total Neurological/Central Nervous System HI Across All Media =				2.7E+00
								Total Billiary Tract HI Across All Media =				2.7E+00
								Total Spleen HI Across All Media =				2.1E-04
								Total Prostate HI Across All Media =				8.7E-04
								Total Skin HI Across All Media=				4.8E-03
								Total Vascular HI Across All Media=				4.8E-03
								Total Gastrointestinal/Intestinal HI Across All Media=				3.4E-03
								Total Thyroid HI Across All Media=				6.1E-05
								Total Whole Body HI Across All Media=				1.0E-02
								Total Longevity HI Across All Media=				3.8E-02
								Total Developmental HI Across All Media=				2.5E-04
								Total Lifetime HI Across All Media=				1.3E-02
								Total Adrenal Glands HI Across All Media=				5.5E-05

TABLE 9.6.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	7.0E-01	N/A	4.3E-02	7.4E-01
			1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	Spleen	4.9E+00	N/A	1.8E-01	5.1E+00
			3,5-Dinitroaniline	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			RDX	N/A	N/A	N/A	N/A	Prostrate	6.4E-01	N/A	5.7E-03	6.5E-01
			Manganese, Dissolved	N/A	N/A	N/A	N/A	CNS	1.4E-01	N/A	1.8E-02	1.5E-01
							N/A					
			Chemical Total	N/A	N/A	N/A	N/A		6.4E+00	0.0E+00	2.5E-01	6.7E+00
		Exposure Point Total					N/A					6.7E+00
	Exposure Medium Total						N/A					6.7E+00
Medium Total							N/A					6.7E+00
Receptor Total							N/A	Receptor HI Total				6.7E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	7.4E-01
Total Neurological/Central Nervous System HI Across All Media =	9.0E-01
Total Billiary Tract HI Across All Media =	7.4E-01
Total Spleen HI Across All Media =	5.1E+00
Total Prostate HI Across All Media =	6.5E-01

TABLE 9.7.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	1.6E+00	N/A	1.5E-01	1.8E+00
			1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	Spleen	1.2E+01	N/A	6.2E-01	1.2E+01
			3,5-Dinitroaniline	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			RDX	N/A	N/A	N/A	N/A	Prostrate	1.5E+00	N/A	1.9E-02	1.5E+00
			Manganese, Dissolved	N/A	N/A	N/A	N/A	CNS	3.2E-01	N/A	7.8E-02	4.0E-01
							N/A					
			Chemical Total	N/A	N/A	N/A	N/A		1.5E+01	0.0E+00	8.6E-01	1.6E+01
		Exposure Point Total					N/A					1.6E+01
	Exposure Medium Total						N/A					1.6E+01
Medium Total							N/A					1.6E+01
Receptor Total							N/A	Receptor HI Total				1.6E+01

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	1.8E+00
Total Neurological/Central Nervous System HI Across All Media =	2.2E+00
Total Billiary Tract HI Across All Media =	1.8E+00
Total Spleen HI Across All Media =	1.2E+01
Total Prostate HI Across All Media =	1.5E+00

TABLE 9.8.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	2.4E-04	N/A	1.4E-05	1.4E-05	CNS, Blood, Biliary Tract	N/A	N/A	N/A	0.0E+00
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	N/A	N/A	N/A	0.0E+00
			3,5-Dinitroaniline	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	0.0E+00
			RDX	1.1E-04	N/A	1.0E-06	1.0E-06	Prostrate	N/A	N/A	N/A	0.0E+00
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	N/A	N/A	N/A	0.0E+00
			Chemical Total	3.5E-04	0.0E+00	1.5E-05	3.7E-04		N/A	N/A	N/A	N/A
		Exposure Point Total					3.7E-04					N/A
	Exposure Medium Total						3.7E-04					N/A
Medium Total							3.7E-04					N/A
Receptor Total							3.7E-04				Receptor HI Total	N/A

HI - Hazard Index

N/A - Not applicable

CNS - Central Nervous System

TABLE 9.9.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	5.5E-05	N/A	N/A	5.5E-05	CNS, Blood, Biliary Tract	2.5E-01	N/A	N/A	2.5E-01
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	1.8E+00	N/A	N/A	1.8E+00
			3,5-Dinitroaniline	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	0.0E+00
			RDX	2.7E-05	N/A	N/A	2.7E-05	Prostrate	2.3E-01	N/A	N/A	2.3E-01
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	4.9E-02	N/A	N/A	4.9E-02
			Chemical Total	8.2E-05	0.0E+00	0.0E+00	8.2E-05		2.3E+00	0.0E+00	0.0E+00	2.3E+00
		Exposure Point Total					8.2E-05					2.3E+00
	Exposure Medium Total						8.2E-05					2.3E+00
Medium Total							8.2E-05					2.3E+00
Receptor Total							8.2E-05	Receptor HI Total				2.3E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	2.5E-01
Total Neurological/Central Nervous System HI Across All Media =	3.0E-01
Total Billiary Tract HI Across All Media =	2.5E-01
Total Spleen HI Across All Media =	1.8E+00
Total Prostate HI Across All Media =	2.3E-01

TABLE 9.10.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown - Eastover Aquifer Water from GW09 in Excavation Pit	2,4-Dinitrotoluene	N/A	N/A	2.0E-07	2.0E-07	CNS, Blood, Biliary Tract	N/A	N/A	2.2E-02	2.2E-02
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	N/A	N/A	1.0E-02	1.0E-02
			3,5-Dinitroaniline	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	0.0E+00
			RDX	N/A	N/A	N/A	0.0E+00	Prostrate	N/A	N/A	2.7E-03	2.7E-03
			Manganese	N/A	N/A	N/A	0.0E+00	CNS	N/A	N/A	2.8E-02	2.8E-02
			Chemical Total	0.0E+00	0.0E+00	2.0E-07	2.0E-07		0.0E+00	0.0E+00	6.3E-02	6.3E-02
		Exposure Point Total					2.0E-07					6.3E-02
	Exposure Medium Total						2.0E-07					6.3E-02
Medium Total							2.0E-07					6.3E-02
Receptor Total							2.0E-07	Receptor HI Total				6.3E-02

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	2.2E-02
Total Neurological/Central Nervous System HI Across All Media =	5.0E-02
Total Billiary Tract HI Across All Media =	2.2E-02
Total Spleen HI Across All Media =	1.0E-02
Total Prostate HI Across All Media =	2.7E-03

TABLE 9.11.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Current/Future
Receptor Population: Trespasser/Visitor
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Felgates Creek	Arsenic	2.1E-07	N/A	2.4E-08	2.3E-07	Longevity, Blood	1.3E-03	N/A	1.5E-04	1.5E-03
			Chromium	3.6E-08	N/A	2.1E-10	3.7E-08	Not identified	7.1E-05	N/A	6.4E-04	7.1E-04
			Chemical Total	2.4E-07	0.0E+00	2.4E-08	2.7E-07		1.4E-03	0.0E+00	8.0E-04	2.2E-03
		Exposure Point Total					2.7E-07					2.2E-03
	Exposure Medium Total						2.7E-07					2.2E-03
Medium Total							2.7E-07					2.2E-03
Sediment	Sediment	Felgates Creek	Arsenic	4.6E-07	N/A	4.7E-07	9.2E-07	Longevity, Blood	3.0E-03	N/A	3.0E-03	6.0E-03
			Chromium	7.0E-07	N/A	5.9E-09	7.0E-07	Not identified	1.4E-03	N/A	1.8E-02	2.0E-02
			Chemical Total	1.2E-06	0.0E+00	4.7E-07	1.6E-06		4.3E-03	0.0E+00	2.2E-02	2.6E-02
		Exposure Point Total					1.6E-06					2.6E-02
	Exposure Medium Total						1.6E-06					2.6E-02
Medium Total							1.6E-06					2.6E-02
Receptor Total							1.9E-06				Receptor HI Total	2.8E-02

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	7.5E-03
Total Longevity HI Across All Media=	7.5E-03

TABLE 9.12.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Current/Future
Receptor Population: Trespasser/Visitor
Receptor Age: Adolescent

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Surface Water	Surface Water	Felgates Creek	Arsenic	1.1E-07	N/A	8.6E-09	1.2E-07	Longevity, Blood	1.8E-03	N/A	1.5E-04	2.0E-03
			Chromium	1.9E-08	N/A	7.6E-11	1.9E-08	Not identified	9.7E-05	N/A	6.3E-04	7.2E-04
			Chemical Total	1.3E-07	0.0E+00	8.7E-09	1.3E-07		1.9E-03	0.0E+00	7.8E-04	2.7E-03
		Exposure Point Total					1.3E-07					2.7E-03
	Exposure Medium Total						1.3E-07					2.7E-03
Medium Total							1.3E-07					2.7E-03
Sediment	Sediment	Felgates Creek	Arsenic	2.3E-07	N/A	1.1E-07	3.5E-07	Longevity, Blood	4.1E-03	N/A	2.0E-03	6.0E-03
			Chromium	3.6E-07	N/A	1.4E-09	3.6E-07	Not identified	1.9E-03	N/A	1.2E-02	1.4E-02
			Chemical Total	5.9E-07	0.0E+00	1.2E-07	7.1E-07		5.9E-03	0.0E+00	1.4E-02	2.0E-02
		Exposure Point Total					7.1E-07					2.0E-02
	Exposure Medium Total						7.1E-07					2.0E-02
Medium Total							7.1E-07					2.0E-02
Receptor Total							8.4E-07				Receptor HI Total	2.3E-02

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	8.0E-03
Total Longevity HI Across All Media=	8.0E-03

TABLE 9.1.CTE
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	1,1-Dichloroethane	N/A	N/A	N/A	N/A	Kidney	7.1E-05	N/A	5.2E-06	7.6E-05
			1,2-Dichloroethane	N/A	N/A	N/A	N/A	Kidney	1.6E-04	N/A	7.4E-06	1.7E-04
			Benzene	N/A	N/A	N/A	N/A	Blood, Immune	5.1E-03	N/A	7.3E-04	5.9E-03
			cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Blood	7.3E+00	N/A	6.1E-01	7.9E+00
			Tetrachloroethene	N/A	N/A	N/A	N/A	Liver, Body Weight	3.8E+00	N/A	2.2E+00	6.0E+00
			trans-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Blood	8.3E-03	N/A	6.9E-04	9.0E-03
			Trichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	N/A	Liver	1.3E-01	N/A	6.1E-03	1.3E-01
			2,4-Dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	2.3E-01	N/A	1.3E-02	2.4E-01
			Nitrobenzene	N/A	N/A	N/A	N/A	Blood	4.4E-03	N/A	3.0E-04	4.7E-03
			1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	Spleen	4.7E-02	N/A	1.7E-03	4.9E-02
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	4.7E+01	N/A	2.3E+00	5.0E+01
			RDX	N/A	N/A	N/A	N/A	Prostrate	9.8E-02	N/A	8.3E-04	9.9E-02
			Antimony, Dissolved	N/A	N/A	N/A	N/A	Longevity, Blood	3.1E+00	N/A	6.7E-02	3.2E+00
			Arsenic, Dissolved	N/A	N/A	N/A	N/A	Skin, Vascular	8.1E-01	N/A	2.6E-03	8.1E-01
			Beryllium, Dissolved	N/A	N/A	N/A	N/A	Intestine	5.8E-02	N/A	2.7E-01	3.3E-01
			Cadmium, Dissolved	N/A	N/A	N/A	N/A	Blood	2.2E-01	N/A	1.4E-02	2.3E-01
			Chromium, Dissolved	N/A	N/A	N/A	N/A	Not identified	3.2E-02	N/A	8.3E-03	4.1E-02
			Cobalt, Dissolved	N/A	N/A	N/A	N/A	Thyroid	3.8E+00	N/A	4.9E-03	3.8E+00
			Iron, Dissolved	N/A	N/A	N/A	N/A	Gastrointestinal	7.6E-02	N/A	2.5E-04	7.7E-02
			Manganese, Dissolved	N/A	N/A	N/A	N/A	CNS	1.0E-01	N/A	8.3E-03	1.1E-01
			Nickel, Dissolved	N/A	N/A	N/A	N/A	ed Body Weight, Decreased Organ	2.9E-02	N/A	4.6E-04	2.9E-02
			Selenium, Dissolved	N/A	N/A	N/A	N/A	Whole Body	3.3E-02	N/A	1.1E-04	3.4E-02
			Vanadium, Dissolved	N/A	N/A	N/A	N/A	Hair, Blood	2.3E-01	N/A	2.9E-02	2.6E-01
			Zinc, Dissolved	N/A	N/A	N/A	N/A	Blood	9.6E-02	N/A	1.9E-04	9.6E-02
			Chemical Total	N/A	N/A	N/A	N/A		6.8E+01	N/A	5.6E+00	7.3E+01
		Exposure Point Total					N/A					7.3E+01
	Exposure Medium Total						N/A					7.3E+01

TABLE 9.1.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Yorktown -Eastover Water Vapors at Showerhead	1,1-Dichloroethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			1,2-Dichloroethane	N/A	N/A	N/A	N/A	Kidney	N/A	6.9E-07	N/A	6.9E-07
			Benzene	N/A	N/A	N/A	N/A	Blood, Immune	N/A	4.5E-04	N/A	4.5E-04
			cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Tetrachloroethene	N/A	N/A	N/A	N/A	Kidney, Liver	N/A	6.8E-02	N/A	6.8E-02
			trans-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Kidney	N/A	1.7E-03	N/A	1.7E-03
			Trichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	N/A	Liver	N/A	2.9E-03	N/A	2.9E-03
			Nitrobenzene	N/A	N/A	N/A	N/A	Lungs, Nose	N/A	5.1E-05	N/A	5.1E-05
			Chemical Total	N/A	N/A	N/A	N/A		N/A	7.3E-02	N/A	7.3E-02
		Exposure Point Total					N/A					7.3E-02
		Vapor Intrusion to Indoor Air	1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Trichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	N/A	Liver	N/A	2.3E-02	N/A	2.3E-02
			Chemical Total	N/A	N/A	N/A	N/A		N/A	2.3E-02	N/A	2.3E-02
		Exposure Point Total					N/A					2.3E-02
	Exposure Medium Total						N/A					9.7E-02
Medium Total							N/A					7.3E+01
Receptor Total							N/A				Receptor HI Total	7.3E+01

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Kidney HI Across All Media =	7.0E-02
Total Blood HI Across All Media =	6.2E+01
Total Immune HI Across All Media =	6.3E-03
Total Liver HI Across All Media =	6.2E+00
Total Body Weight HI Across All Media =	6.1E+00
Total Neurological/Central Nervous System HI Across All Media =	5.0E+01
Total Billiary Tract HI Across All Media =	5.0E+01
Total Spleen HI Across All Media =	4.9E-02
Total Prostate HI Across All Media =	9.9E-02
Total Longevity HI Across All Media =	3.2E+00
Total Skin HI Across All Media=	8.1E-01

TABLE 9.1.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
											Total Vascular HI Across All Media=	8.1E-01
											Total Gastrointestinal/Intestinal HI Across All Media=	4.0E-01
											Total Decreased Organ Weight HI Across All Media =	3.4E-02
											Total Thyroid HI Across All Media=	3.8E+00
											Total Whole Body HI Across All Media=	3.4E-02
											Total Hair HI Across All Media=	2.6E-01
											Total Lungs HI Across All Media=	5.1E-05
											Total Nose HI Across All Media=	5.1E-05

TABLE 9.2.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	1,1-Dichloroethane	N/A	N/A	N/A	N/A	Kidney	2.4E-04	N/A	1.0E-05	2.5E-04
			1,2-Dichloroethane	N/A	N/A	N/A	N/A	Kidney	5.3E-04	N/A	1.5E-05	5.5E-04
			Benzene	N/A	N/A	N/A	N/A	Blood, Immune	1.7E-02	N/A	1.4E-03	1.9E-02
			cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Blood	2.4E+01	N/A	1.2E+00	2.5E+01
			Tetrachloroethene	N/A	N/A	N/A	N/A	Liver, Body Weight	1.3E+01	N/A	4.3E+00	1.7E+01
			trans-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Blood	2.8E-02	N/A	1.4E-03	2.9E-02
			Trichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	N/A	Liver	4.2E-01	N/A	1.2E-02	4.3E-01
			2,4-Dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	7.7E-01	N/A	2.6E-02	8.0E-01
			Nitrobenzene	N/A	N/A	N/A	N/A	Blood	1.5E-02	N/A	5.9E-04	1.5E-02
			1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	Spleen	1.6E-01	N/A	3.3E-03	1.6E-01
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	1.6E+02	N/A	4.6E+00	1.6E+02
			RDX	N/A	N/A	N/A	N/A	Prostrate	3.3E-01	N/A	1.6E-03	3.3E-01
			Antimony, Dissolved	N/A	N/A	N/A	N/A	Longevity, Blood	1.0E+01	N/A	1.5E-01	1.1E+01
			Arsenic, Dissolved	N/A	N/A	N/A	N/A	Skin, Vascular	2.7E+00	N/A	5.9E-03	2.7E+00
			Beryllium, Dissolved	N/A	N/A	N/A	N/A	Intestine	1.9E-01	N/A	6.1E-01	8.0E-01
			Cadmium, Dissolved	N/A	N/A	N/A	N/A	Blood	7.3E-01	N/A	3.2E-02	7.6E-01
			Chromium, Dissolved	N/A	N/A	N/A	N/A	Not identified	1.1E-01	N/A	1.9E-02	1.3E-01
			Cobalt, Dissolved	N/A	N/A	N/A	N/A	Thyroid	1.3E+01	N/A	1.1E-02	1.3E+01
			Iron, Dissolved	N/A	N/A	N/A	N/A	Gastrointestinal	2.5E-01	N/A	5.5E-04	2.6E-01
			Manganese, Dissolved	N/A	N/A	N/A	N/A	CNS	3.4E-01	N/A	1.9E-02	3.6E-01
			Nickel, Dissolved	N/A	N/A	N/A	N/A	ed Body Weight, Decreased Organ	9.5E-02	N/A	1.0E-03	9.6E-02
			Selenium, Dissolved	N/A	N/A	N/A	N/A	Whole Body	1.1E-01	N/A	2.4E-04	1.1E-01
			Vanadium, Dissolved	N/A	N/A	N/A	N/A	Hair, Blood	7.8E-01	N/A	6.5E-02	8.4E-01
			Zinc, Dissolved	N/A	N/A	N/A	N/A	Blood	3.2E-01	N/A	4.2E-04	3.2E-01
			Chemical Total	N/A	N/A	N/A	N/A		2.3E+02	N/A	1.1E+01	2.4E+02
		Exposure Point Total					N/A					2.4E+02
	Exposure Medium Total						N/A					2.4E+02

TABLE 9.2.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Yorktown -Eastover Water Vapors at Showerhead	1,1-Dichloroethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			1,2-Dichloroethane	N/A	N/A	N/A	N/A	Kidney	N/A	1.2E-06	N/A	1.2E-06
			Benzene	N/A	N/A	N/A	N/A	Blood, Immune	N/A	7.7E-04	N/A	7.7E-04
			cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Tetrachloroethene	N/A	N/A	N/A	N/A	Kidney, Liver	N/A	1.2E-01	N/A	1.2E-01
			trans-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Kidney	N/A	2.9E-03	N/A	2.9E-03
			Trichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	N/A	Liver	N/A	4.9E-03	N/A	4.9E-03
			Nitrobenzene	N/A	N/A	N/A	N/A	Lungs, Nose	N/A	8.6E-05	N/A	8.6E-05
			Chemical Total	N/A	N/A	N/A	N/A		N/A	1.2E-01	N/A	1.2E-01
		Exposure Point Total					N/A					1.2E-01
		Vapor Intrusion to Indoor Air	1,2-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Trichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	N/A	Liver	N/A	3.6E-02	N/A	3.6E-02
			Chemical Total	N/A	N/A	N/A	N/A		N/A	3.6E-02	N/A	3.6E-02
		Exposure Point Total					N/A					3.6E-02
	Exposure Medium Total						N/A					1.6E-01
Medium Total							N/A					2.4E+02
Receptor Total							N/A				Receptor HI Total	2.4E+02

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Kidney HI Across All Media =	1.2E-01
Total Blood HI Across All Media =	2.0E+02
Total Immune HI Across All Media =	1.9E-02
Total Liver HI Across All Media =	1.8E+01
Total Body Weight HI Across All Media =	1.7E+01
Total Neurological/Central Nervous System HI Across All Media =	1.6E+02
Total Billiary Tract HI Across All Media =	1.6E+02
Total Spleen HI Across All Media =	1.6E-01
Total Prostate HI Across All Media =	3.3E-01
Total Longevity HI Across All Media =	1.1E+01
Total Skin HI Across All Media=	2.7E+00

TABLE 9.2.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
											Total Vascular HI Across All Media=	2.7E+00
											Total Gastrointestinal/Intestinal HI Across All Media=	1.1E+00
											Total Decreased Organ Weight HI Across All Media =	1.1E-01
											Total Thyroid HI Across All Media=	1.3E+01
											Total Whole Body HI Across All Media=	1.1E-01
											Total Hair HI Across All Media=	8.4E-01
											Total Lungs HI Across All Media=	8.6E-05
											Total Nose HI Across All Media=	8.6E-05

TABLE 9.3.CTE
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	1,1-Dichloroethane	3.3E-08	N/A	1.8E-09	3.5E-08	Kidney	N/A	N/A	N/A	N/A
			1,2-Dichloroethane	1.2E-07	N/A	4.0E-09	1.2E-07	Kidney	N/A	N/A	N/A	N/A
			Benzene	4.7E-07	N/A	4.8E-08	5.2E-07	Blood, Immune	N/A	N/A	N/A	N/A
			cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	N/A	N/A
			Tetrachloroethene	8.6E-03	N/A	3.5E-03	1.2E-02	Liver, Body Weight	N/A	N/A	N/A	N/A
			trans-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	N/A	N/A
			Trichloroethene	5.3E-03	N/A	6.1E-04	6.0E-03	N/A	N/A	N/A	N/A	N/A
			Vinyl chloride	1.1E-04	N/A	3.9E-06	1.2E-04	Liver	N/A	N/A	N/A	N/A
			2,4-Dinitrotoluene	5.9E-05	N/A	2.5E-06	6.2E-05	CNS, Blood, Biliary Tract	N/A	N/A	N/A	N/A
			Nitrobenzene	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	N/A	N/A
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	N/A	N/A	N/A	N/A
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	N/A	N/A	N/A	N/A
			RDX	1.3E-05	N/A	8.1E-08	1.4E-05	Prostrate	N/A	N/A	N/A	N/A
			Antimony, Dissolved	N/A	N/A	N/A	0.0E+00	Longevity, Blood	N/A	N/A	N/A	N/A
			Arsenic, Dissolved	1.5E-04	N/A	3.8E-07	1.5E-04	Skin, Vascular	N/A	N/A	N/A	N/A
			Beryllium, Dissolved	N/A	N/A	N/A	0.0E+00	Intestine	N/A	N/A	N/A	N/A
			Cadmium, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	N/A	N/A
			Chromium, Dissolved	2.0E-05	N/A	2.5E-09	2.0E-05	Not identified	N/A	N/A	N/A	N/A
			Cobalt, Dissolved	N/A	N/A	N/A	0.0E+00	Thyroid	N/A	N/A	N/A	N/A
			Iron, Dissolved	N/A	N/A	N/A	0.0E+00	Gastrointestinal	N/A	N/A	N/A	N/A
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	N/A	N/A	N/A	N/A
			Nickel, Dissolved	N/A	N/A	N/A	0.0E+00	ed Body Weight, Decreased Organ	N/A	N/A	N/A	N/A
			Selenium, Dissolved	N/A	N/A	N/A	0.0E+00	Whole Body	N/A	N/A	N/A	N/A
			Vanadium, Dissolved	N/A	N/A	N/A	0.0E+00	Hair, Blood	N/A	N/A	N/A	N/A
			Zinc, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	N/A	N/A
			Chemical Total	1.4E-02	N/A	4.1E-03	1.8E-02		N/A	N/A	N/A	N/A
		Exposure Point Total					1.8E-02					N/A
	Exposure Medium Total						1.8E-02					N/A

TABLE 9.3.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Yorktown -Eastover Water Vapors at Showerhead	1,1-Dichloroethane	N/A	5.5E-09	N/A	5.5E-09	N/A	N/A	N/A	N/A	N/A
			1,2-Dichloroethane	N/A	1.8E-08	N/A	1.8E-08	Kidney	N/A	N/A	N/A	N/A
			Benzene	N/A	4.3E-08	N/A	4.3E-08	Blood, Immune	N/A	N/A	N/A	N/A
			cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	N/A
			Tetrachloroethene	N/A	4.5E-05	N/A	4.5E-05	Kidney, Liver	N/A	N/A	N/A	N/A
			trans-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Kidney	N/A	N/A	N/A	N/A
			Trichloroethene	N/A	9.5E-04	N/A	9.5E-04	N/A	N/A	N/A	N/A	N/A
			Vinyl chloride	N/A	5.2E-07	N/A	5.2E-07	Liver	N/A	N/A	N/A	N/A
			Nitrobenzene	N/A	7.5E-09	N/A	7.5E-09	Lungs, Nose				
			Chemical Total	N/A	1.0E-03	N/A	1.0E-03		N/A	N/A	N/A	N/A
		Exposure Point Total					1.0E-03					N/A
		Vapor Intrusion to Indoor Air	1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	0.0E+00
			Trichloroethene	N/A	5.4E-06	N/A	5.4E-06	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	2.3E-06	N/A	2.3E-06	Liver	N/A	N/A	N/A	0.0E+00
			Chemical Total	N/A	7.6E-06	N/A	7.6E-06		N/A	N/A	N/A	N/A
		Exposure Point Total					7.6E-06					N/A
	Exposure Medium Total						1.0E-03					N/A
Medium Total							1.9E-02					N/A
Receptor Total							1.9E-02				Receptor HI Total	N/A

HI - Hazard Index

N/A - Not applicable

CNS - Central Nervous System

TABLE 9.3.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total

TABLE 9.4.CTE
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	1,1-Dichloroethane	6.9E-09	N/A	N/A	6.9E-09	Kidney	4.7E-05	N/A	N/A	4.7E-05
			1,2-Dichloroethane	2.5E-08	N/A	N/A	2.5E-08	Kidney	1.1E-04	N/A	N/A	1.1E-04
			Benzene	9.7E-08	N/A	N/A	9.7E-08	Blood, Immune	3.4E-03	N/A	N/A	3.4E-03
			cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	4.9E+00	N/A	N/A	4.9E+00
			Tetrachloroethene	1.8E-03	N/A	N/A	1.8E-03	Liver, Body Weight	2.6E+00	N/A	N/A	2.6E+00
			trans-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	1.1E-02	N/A	N/A	1.1E-02
			Trichloroethene	1.1E-03	N/A	N/A	1.1E-03	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	2.3E-05	N/A	N/A	2.3E-05	Liver	8.4E-02	N/A	N/A	8.4E-02
			2,4-Dinitrotoluene	1.2E-05	N/A	N/A	1.2E-05	CNS, Blood, Biliary Tract	1.5E-01	N/A	N/A	1.5E-01
			Nitrobenzene	N/A	N/A	N/A	0.0E+00	Blood	2.9E-03	N/A	N/A	2.9E-03
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	3.2E-02	N/A	N/A	3.2E-02
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	3.2E+01	N/A	N/A	3.2E+01
			RDX	2.8E-06	N/A	N/A	2.8E-06	Prostrate	6.6E-02	N/A	N/A	6.6E-02
			Antimony, Dissolved	N/A	N/A	N/A	0.0E+00	Longevity, Blood	2.1E+00	N/A	N/A	2.1E+00
			Arsenic, Dissolved	3.1E-05	N/A	N/A	3.1E-05	Skin, Vascular	5.4E-01	N/A	N/A	5.4E-01
			Beryllium, Dissolved	N/A	N/A	N/A	0.0E+00	Intestine	3.9E-02	N/A	N/A	3.9E-02
			Cadmium, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	1.5E-01	N/A	N/A	1.5E-01
			Chromium, Dissolved	4.2E-06	N/A	N/A	4.2E-06	Not identified	2.2E-02	N/A	N/A	2.2E-02
			Cobalt, Dissolved	N/A	N/A	N/A	0.0E+00	Thyroid	2.5E+00	N/A	N/A	2.5E+00
			Iron, Dissolved	N/A	N/A	N/A	0.0E+00	Gastrointestinal	5.1E-02	N/A	N/A	5.1E-02
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	6.9E-02	N/A	N/A	6.9E-02
			Nickel, Dissolved	N/A	N/A	N/A	0.0E+00	ed Body Weight, Decreased Organ	1.9E-02	N/A	N/A	1.9E-02
			Selenium, Dissolved	N/A	N/A	N/A	0.0E+00	Whole Body	2.2E-02	N/A	N/A	2.2E-02
			Vanadium, Dissolved	N/A	N/A	N/A	0.0E+00	Hair, Blood	1.6E-01	N/A	N/A	1.6E-01
			Zinc, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	6.4E-02	N/A	N/A	6.4E-02
			Chemical Total	3.0E-03	N/A	N/A	3.0E-03		4.5E+01	N/A	N/A	4.5E+01
		Exposure Point Total					3.0E-03					4.5E+01
	Exposure Medium Total						3.0E-03					4.5E+01

TABLE 9.4.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Vapor Intrusion to Indoor Air	1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	0.0E+00
			Trichloroethene	N/A	1.0E-06	N/A	1.0E-06	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	4.2E-07	N/A	4.2E-07	Liver	N/A	7.5E-03	N/A	7.5E-03
			Chemical Total	N/A	1.4E-06	N/A	1.4E-06		N/A	7.5E-03	N/A	7.5E-03
		Exposure Point Total					1.4E-06					7.5E-03
	Exposure Medium Total						1.4E-06					7.5E-03
Medium Total							3.0E-03					4.5E+01
Receptor Total							3.0E-03				Receptor HI Total	4.5E+01

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Kidney HI Across All Media =	1.5E-04
Total Blood HI Across All Media =	3.9E+01
Total Immune HI Across All Media =	3.4E-03
Total Liver HI Across All Media =	2.7E+00
Total Body Weight HI Across All Media =	2.6E+00
Total Neurological/Central Nervous System HI Across All Media =	3.2E+01
Total Billiary Tract HI Across All Media =	3.2E+01
Total Spleen HI Across All Media =	3.2E-02
Total Prostate HI Across All Media =	6.6E-02
Total Longevity HI Across All Media =	2.1E+00
Total Skin HI Across All Media=	5.4E-01
Total Vascular HI Across All Media=	5.4E-01
Total Gastrointestinal/Intestinal HI Across All Media=	9.0E-02
Total Decreased Organ Weight HI Across All Media =	2.2E-02
Total Thyroid HI Across All Media=	2.5E+00
Total Whole Body HI Across All Media=	2.2E-02
Total Hair HI Across All Media=	1.6E-01

TABLE 9.5.CTE
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	1,1-Dichloroethane	N/A	N/A	7.9E-11	7.9E-11	Kidney	N/A	N/A	4.9E-07	4.9E-07
			1,2-Dichloroethane	N/A	N/A	1.8E-10	1.8E-10	Kidney	N/A	N/A	6.9E-06	6.9E-06
			Benzene	N/A	N/A	2.3E-09	2.3E-09	Blood, Immune	N/A	N/A	7.3E-04	7.3E-04
			cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	5.7E-02	5.7E-02
			Tetrachloroethene	N/A	N/A	1.2E-04	1.2E-04	Liver	N/A	N/A	1.5E-01	1.5E-01
			trans-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	6.5E-05	6.5E-05
			Trichloroethene	N/A	N/A	2.4E-05	2.4E-05	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	2.1E-07	2.1E-07	Liver	N/A	N/A	6.8E-03	6.8E-03
			2,4-Dinitrotoluene	N/A	N/A	8.5E-08	8.5E-08	CNS, Blood, Biliary Tract	N/A	N/A	9.6E-03	9.6E-03
			Nitrobenzene	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	1.7E-04	1.7E-04
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	N/A	N/A	1.2E-04	1.2E-04
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	N/A	N/A	1.7E+00	1.7E+00
			RDX	N/A	N/A	2.6E-09	2.6E-09	Prostrate	N/A	N/A	5.6E-04	5.6E-04
			Aluminum	N/A	N/A	N/A	0.0E+00	Neurological, Developmental	N/A	N/A	1.3E-04	1.3E-04
			Antimony	N/A	N/A	N/A	0.0E+00	Whole Body, Blood	N/A	N/A	3.7E-03	3.7E-03
			Arsenic	N/A	N/A	1.5E-08	1.5E-08	Skin, Vascular	N/A	N/A	2.4E-03	2.4E-03
			Cadmium	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	7.0E-03	7.0E-03
			Chromium	N/A	N/A	1.2E-09	1.2E-09	Not identified	N/A	N/A	1.3E-02	1.3E-02
			Cobalt	N/A	N/A	N/A	0.0E+00	Thyroid	N/A	N/A	3.0E-05	3.0E-05
			Iron	N/A	N/A	N/A	0.0E+00	Gastrointestinal	N/A	N/A	1.7E-03	1.7E-03
			Manganese	N/A	N/A	N/A	0.0E+00	CNS	N/A	N/A	2.3E-02	2.3E-02
			Nickel	N/A	N/A	N/A	0.0E+00	Whole body	N/A	N/A	1.4E-03	1.4E-03
			Vanadium	N/A	N/A	N/A	0.0E+00	Lifetime	N/A	N/A	6.5E-03	6.5E-03
			Zinc	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	7.3E-04	7.3E-04
			Chemical Total	N/A	N/A	1.4E-04	1.4E-04		N/A	N/A	1.9E+00	1.9E+00
		Exposure Point Total					1.4E-04					1.9E+00
	Exposure Medium Total						1.4E-04					1.9E+00

TABLE 9.5.CTE
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Yorktown -Eastover Water Vapors in Excavation Pit	1,1-Dichloroethane	N/A	6.7E-11	N/A	6.7E-11	N/A	N/A	N/A	N/A	0.0E+00
			1,2-Dichloroethane	N/A	6.3E-08	N/A	6.3E-08	Kidney	N/A	7.0E-05	N/A	7.0E-05
			Benzene	N/A	7.0E-11	N/A	7.0E-11	Blood, Immune	N/A	2.1E-05	N/A	2.1E-05
			cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	0.0E+00
			Tetrachloroethene	N/A	1.3E-06	N/A	1.3E-06	Kidney, Liver	N/A	5.6E-02	N/A	5.6E-02
			trans-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Kidney	N/A	4.6E-04	N/A	4.6E-04
			Trichloroethene	N/A	1.2E-05	N/A	1.2E-05	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	3.9E-07	N/A	3.9E-07	Liver	N/A	6.2E-02	N/A	6.2E-02
			Nitrobenzene	N/A	2.0E-08	N/A	2.0E-08	Blood, Adrenal Glands, Kidney, Live	N/A	2.0E-03	N/A	2.0E-03
			Chemical Total	N/A	1.3E-05	N/A	1.3E-05		N/A	1.2E-01	N/A	1.2E-01
		Exposure Point Total					1.3E-05					1.2E-01
	Exposure Medium Total						1.3E-05					1.2E-01
Medium Total							1.6E-04					2.1E+00
Surface Water	Surface Water	Felgates Creek	Arsenic	8.3E-10	N/A	3.3E-09	4.2E-09	Longevity, Blood	9.7E-05	N/A	6.5E-04	7.4E-04
			Chromium	1.5E-10	N/A	2.5E-10	4.0E-10	Not identified	1.0E-06	N/A	7.1E-04	7.1E-04
			Chemical Total	9.7E-10	0.0E+00	3.6E-09	4.6E-09		9.8E-05	0.0E+00	1.4E-03	1.5E-03
		Exposure Point Total					4.6E-09					1.5E-03
	Exposure Medium Total						4.6E-09					1.5E-03
Medium Total							4.6E-09					1.5E-03
Sediment	Sediment	Felgates Creek	Arsenic	4.4E-09	N/A	1.9E-09	6.3E-09	Longevity, Blood	6.8E-04	N/A	9.7E-05	7.8E-04
			Chromium	6.7E-09	N/A	2.4E-11	6.7E-09	Not identified	4.7E-05	N/A	2.7E-04	3.1E-04
			Chemical Total	1.1E-08	0.0E+00	1.9E-09	1.3E-08		7.3E-04	0.0E+00	3.6E-04	1.1E-03
		Exposure Point Total					1.3E-08					1.1E-03
	Exposure Medium Total						1.3E-08					1.1E-03
Medium Total							1.3E-08					1.1E-03
Receptor Total							1.6E-04				Receptor HI Total	2.1E+00

HI - Hazard Index
N/A - Not applicable

Total Kidney HI Across All Media = 5.8E-02
Total Blood HI Across All Media = 1.7E+00

TABLE 9.5.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
CNS - Central Nervous System											Total Immune HI Across All Media =	7.5E-04
											Total Liver HI Across All Media =	2.8E-01
											Total Neurological/Central Nervous System HI Across All Media =	1.7E+00
											Total Billiary Tract HI Across All Media =	1.7E+00
											Total Spleen HI Across All Media =	1.2E-04
											Total Prostate HI Across All Media =	5.6E-04
											Total Skin HI Across All Media=	2.4E-03
											Total Vascular HI Across All Media=	2.4E-03
											Total Gastrointestinal/Intestinal HI Across All Media=	1.7E-03
											Total Thyroid HI Across All Media=	3.0E-05
											Total Whole Body HI Across All Media=	5.1E-03
											Total Longevity HI Across All Media=	1.5E-03
											Total Developmental HI Across All Media=	1.3E-04
											Total Lifetime HI Across All Media=	6.5E-03
											Total Adrenal Glands HI Across All Media=	2.0E-03

TABLE 9.6.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	3.3E-01	N/A	1.9E-02	3.5E-01
			1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	Spleen	2.3E+00	N/A	8.1E-02	2.4E+00
			3,5-Dinitroaniline	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			RDX	N/A	N/A	N/A	N/A	Prostrate	3.0E-01	N/A	2.5E-03	3.0E-01
			Manganese, Dissolved	N/A	N/A	N/A	N/A	CNS	6.4E-02	N/A	5.1E-03	6.9E-02
			Chemical Total	N/A	N/A	N/A	N/A		3.0E+00	0.0E+00	1.1E-01	3.1E+00
		Exposure Point Total					N/A					3.1E+00
	Exposure Medium Total						N/A					3.1E+00
Medium Total							N/A					3.1E+00
Receptor Total							N/A	Receptor HI Total				3.1E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	3.5E-01
Total Neurological/Central Nervous System HI Across All Media =	4.1E-01
Total Billiary Tract HI Across All Media =	3.5E-01
Total Spleen HI Across All Media =	2.4E+00
Total Prostate HI Across All Media =	3.0E-01

TABLE 9.7.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	1.1E+00	N/A	3.7E-02	1.1E+00
			1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	Spleen	7.7E+00	N/A	1.6E-01	7.9E+00
			3,5-Dinitroaniline	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0E+00
			RDX	N/A	N/A	N/A	N/A	Prostrate	1.0E+00	N/A	5.0E-03	1.0E+00
			Manganese, Dissolved	N/A	N/A	N/A	N/A	CNS	2.1E-01	N/A	1.2E-02	2.2E-01
			Chemical Total	N/A	N/A	N/A	N/A		1.0E+01	0.0E+00	2.1E-01	1.0E+01
		Exposure Point Total					N/A					1.0E+01
	Exposure Medium Total						N/A					1.0E+01
Medium Total							N/A					1.0E+01
Receptor Total							N/A	Receptor HI Total				1.0E+01

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	1.1E+00
Total Neurological/Central Nervous System HI Across All Media =	1.4E+00
Total Billiary Tract HI Across All Media =	1.1E+00
Total Spleen HI Across All Media =	7.9E+00
Total Prostate HI Across All Media =	1.0E+00

TABLE 9.8.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	8.4E-05	N/A	3.5E-06	8.7E-05	CNS, Blood, Biliary Tract	N/A	N/A	N/A	0.0E+00
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	N/A	N/A	N/A	0.0E+00
			3,5-Dinitroaniline	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	0.0E+00
			RDX	4.1E-05	N/A	2.5E-07	4.1E-05	Prostrate	N/A	N/A	N/A	0.0E+00
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	N/A	N/A	N/A	0.0E+00
			Chemical Total	1.2E-04	0.0E+00	3.7E-06	1.3E-04		0.0E+00	0.0E+00	0.0E+00	0.0E+00
		Exposure Point Total					1.3E-04					0.0E+00
	Exposure Medium Total						1.3E-04					0.0E+00
Medium Total							1.3E-04					0.0E+00
Receptor Total							1.3E-04				Receptor HI Total	0.0E+00

HI - Hazard Index

N/A - Not applicable

CNS - Central Nervous System

TABLE 9.9.CTE

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	1.7E-05	N/A	N/A	1.7E-05	CNS, Blood, Biliary Tract	2.2E-01	N/A	N/A	2.2E-01
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	1.5E+00	N/A	N/A	1.5E+00
			3,5-Dinitroaniline	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	0.0E+00
			RDX	8.5E-06	N/A	N/A	8.5E-06	Prostrate	2.0E-01	N/A	N/A	2.0E-01
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	4.3E-02	N/A	N/A	4.3E-02
			Chemical Total	2.6E-05	0.0E+00	0.0E+00	2.6E-05		2.0E+00	0.0E+00	0.0E+00	2.0E+00
		Exposure Point Total					2.6E-05					2.0E+00
	Exposure Medium Total						2.6E-05					2.0E+00
Medium Total							2.6E-05					2.0E+00
Receptor Total							2.6E-05	Receptor HI Total				2.0E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	2.2E-01
Total Neurological/Central Nervous System HI Across All Media =	2.6E-01
Total Billiary Tract HI Across All Media =	2.2E-01
Total Spleen HI Across All Media =	1.5E+00
Total Prostate HI Across All Media =	2.0E-01

TABLE 10.1.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover										
			cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	Blood	1.6E+01	N/A	1.4E+00	1.7E+01
			Tetrachloroethene	N/A	N/A	N/A	N/A	Liver, Body Weight	8.2E+00	N/A	5.0E+00	1.3E+01
			Vinyl chloride	N/A	N/A	N/A	N/A	Liver	2.7E-01	N/A	1.4E-02	2.8E-01
			2,4-Dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	4.9E-01	N/A	3.0E-02	5.2E-01
			1,3-Dinitrobenzene	N/A	N/A	N/A	N/A	Spleen	1.0E-01	N/A	3.8E-03	1.1E-01
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	N/A	CNS, Blood, Biliary Tract	1.0E+02	N/A	5.4E+00	1.1E+02
			RDX	N/A	N/A	N/A	N/A	Prostrate	2.1E-01	N/A	1.9E-03	2.1E-01
			Antimony, Dissolved	N/A	N/A	N/A	N/A	Longevity, Blood	6.7E+00	N/A	2.3E-01	6.9E+00
			Arsenic, Dissolved	N/A	N/A	N/A	N/A	Skin, Vascular	1.7E+00	N/A	9.0E-03	1.7E+00
			Beryllium, Dissolved	N/A	N/A	N/A	N/A	Intestine	1.2E-01	N/A	9.3E-01	1.1E+00
			Cadmium, Dissolved	N/A	N/A	N/A	N/A	Blood	4.7E-01	N/A	4.9E-02	5.1E-01
			Cobalt, Dissolved	N/A	N/A	N/A	N/A	Thyroid	8.1E+00	N/A	1.7E-02	8.1E+00
			Iron, Dissolved	N/A	N/A	N/A	N/A	Gastrointestinal	1.6E-01	N/A	8.5E-04	1.6E-01
			Manganese, Dissolved	N/A	N/A	N/A	N/A	CNS	2.2E-01	N/A	2.9E-02	2.5E-01
			Vanadium, Dissolved	N/A	N/A	N/A	N/A	Hair, Blood	5.0E-01	N/A	1.0E-01	6.0E-01
			Zinc, Dissolved	N/A	N/A	N/A	N/A	Blood	2.1E-01	N/A	6.4E-04	2.1E-01
			Chemical Total	N/A	N/A	N/A	N/A		1.4E+02	0.0E+00	1.3E+01	1.6E+02
		Exposure Point Total					N/A					1.6E+02
	Exposure Medium Total						N/A					1.6E+02

TABLE 10.1.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Yorktown -Eastover Water Vapors at Showerhead	Tetrachloroethene	N/A	N/A	N/A	N/A N/A	Kidney, Liver	N/A	4.8E-01	N/A	4.8E-01
			Chemical Total	N/A	N/A	N/A	N/A		0.0E+00	4.8E-01	0.0E+00	4.8E-01
		Exposure Point Total					N/A					4.8E-01
		Vapor Intrusion to Indoor Air	Vinyl chloride	N/A	N/A	N/A	N/A	Liver	N/A	1.2E-02	N/A	1.2E-02
			Chemical Total	N/A	N/A	N/A	N/A		N/A	1.2E-02	N/A	1.2E-02
		Exposure Point Total					N/A					1.2E-02
	Exposure Medium Total						N/A					4.9E-01
Medium Total							N/A					1.6E+02
Receptor Total							N/A				Receptor HI Total	1.6E+02

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Kidney HI Across All Media =	4.8E-01
Total Blood HI Across All Media =	1.3E+02
Total Liver HI Across All Media =	1.4E+01
Total Body Weight HI Across All Media =	1.3E+01
Total Neurological/Central Nervous System HI Across All Media =	1.1E+02
Total Billiary Tract HI Across All Media =	1.1E+02
Total Spleen HI Across All Media =	1.1E-01
Total Prostate HI Across All Media =	2.1E-01
Total Longevity HI Across All Media =	6.9E+00
Total Skin HI Across All Media=	1.7E+00
Total Vascular HI Across All Media=	1.7E+00
Total Gastrointestinal/Intestinal HI Across All Media=	1.2E+00
Total Thyroid HI Across All Media=	8.1E+00
Total Hair HI Across All Media=	6.0E-01

TABLE 10.2.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	3.6E+01	N/A	3.2E+00	3.9E+01
			Tetrachloroethene	N/A	N/A	N/A	0.0E+00	Liver, Body Weight	1.9E+01	N/A	1.1E+01	3.0E+01
			Vinyl chloride	N/A	N/A	N/A	0.0E+00	Liver	6.3E-01	N/A	3.4E-02	6.6E-01
			2,4-Dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	1.2E+00	N/A	6.8E-02	1.2E+00
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	2.4E-01	N/A	8.5E-03	2.5E-01
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	2.4E+02	N/A	1.2E+01	2.5E+02
			RDX	N/A	N/A	N/A	0.0E+00	Prostrate	4.9E-01	N/A	4.2E-03	4.9E-01
			Antimony, Dissolved	N/A	N/A	N/A	0.0E+00	Longevity, Blood	1.6E+01	N/A	6.9E-01	1.6E+01
			Arsenic, Dissolved	N/A	N/A	N/A	0.0E+00	Skin, Vascular	4.0E+00	N/A	2.7E-02	4.0E+00
			Beryllium, Dissolved	N/A	N/A	N/A	0.0E+00	Intestine	2.9E-01	N/A	2.7E+00	3.0E+00
			Cadmium, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	1.1E+00	N/A	1.4E-01	1.2E+00
			Chromium, Dissolved	N/A	N/A	N/A	0.0E+00	Not identified	1.6E-01	N/A	8.5E-02	2.5E-01
			Cobalt, Dissolved	N/A	N/A	N/A	0.0E+00	Thyroid	1.9E+01	N/A	5.0E-02	1.9E+01
			Iron, Dissolved	N/A	N/A	N/A	0.0E+00	Gastrointestinal	3.8E-01	N/A	2.5E-03	3.8E-01
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	5.1E-01	N/A	8.5E-02	6.0E-01
			Nickel, Dissolved	N/A	N/A	N/A	0.0E+00	ed Body Weight, Decreased Organ	1.4E-01	N/A	4.7E-03	1.5E-01
			Selenium, Dissolved	N/A	N/A	N/A	0.0E+00	Whole Body	1.7E-01	N/A	1.1E-03	1.7E-01
			Vanadium, Dissolved	N/A	N/A	N/A	0.0E+00	Hair, Blood	1.2E+00	N/A	2.9E-01	1.5E+00
			Zinc, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	4.8E-01	N/A	1.9E-03	4.8E-01
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00		3.4E+02	0.0E+00	3.1E+01	3.7E+02
		Exposure Point Total					0.0E+00					3.7E+02
	Exposure Medium Total						0.0E+00					3.7E+02

TABLE 10.2.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Yorktown -Eastover Water Vapors at Showerhead	Tetrachloroethene	N/A	N/A	N/A	0.0E+00	Kidney, Liver	N/A	1.2E+00	N/A	1.2E+00
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00		0.0E+00	1.2E+00	0.0E+00	1.2E+00
		Exposure Point Total					0.0E+00					1.2E+00
	Exposure Medium Total						0.0E+00					1.2E+00
Medium Total							0.0E+00					3.7E+02
Receptor Total							0.0E+00				Receptor HI Total	3.7E+02

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Kidney HI Across All Media =	1.2E+00
Total Blood HI Across All Media =	3.1E+02
Total Liver HI Across All Media =	3.2E+01
Total Body Weight HI Across All Media =	3.0E+01
Total Neurological/Central Nervous System HI Across All Media =	2.5E+02
Total Billiary Tract HI Across All Media =	2.5E+02
Total Spleen HI Across All Media =	2.5E-01
Total Prostate HI Across All Media =	4.9E-01
Total Longevity HI Across All Media =	1.6E+01
Total Skin HI Across All Media=	4.0E+00
Total Vascular HI Across All Media=	4.0E+00
Total Gastrointestinal/Intestinal HI Across All Media=	3.4E+00
Total Decreased Organ Weight HI Across All Media =	1.7E-01
Total Thyroid HI Across All Media=	1.9E+01
Total Whole Body HI Across All Media=	1.7E-01
Total Hair HI Across All Media=	1.5E+00

TABLE 10.3.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	Benzene	1.3E-06	N/A	2.0E-07	1.5E-06	Blood, Immune	N/A	N/A	N/A	N/A
			Tetrachloroethene	2.4E-02	N/A	1.4E-02	3.8E-02	Liver, Body Weight	N/A	N/A	N/A	N/A
			Trichloroethene	1.5E-02	N/A	2.5E-03	1.7E-02	N/A	N/A	N/A	N/A	N/A
			Vinyl chloride	3.2E-04	N/A	1.7E-05	3.3E-04	Liver	N/A	N/A	N/A	N/A
			2,4-Dinitrotoluene	1.7E-04	N/A	1.0E-05	1.8E-04	CNS, Blood, Biliary Tract	N/A	N/A	N/A	N/A
			RDX	3.8E-05	N/A	3.3E-07	3.8E-05	Prostrate	N/A	N/A	N/A	N/A
			Arsenic, Dissolved	4.2E-04	N/A	2.4E-06	4.3E-04	Skin, Vascular	N/A	N/A	N/A	N/A
			Chromium, Dissolved	5.7E-05	N/A	1.6E-08	5.7E-05	Not identified	N/A	N/A	N/A	N/A
			Chemical Total	4.0E-02	0.0E+00	1.7E-02	5.7E-02		N/A	N/A	N/A	N/A
		Exposure Point Total					5.7E-02					N/A
	Exposure Medium Total						5.7E-02					N/A
Groundwater	Air	Yorktown -Eastover Water Vapors at Showerhead	1,1-Dichloroethane	N/A	6.1E-08	N/A	6.1E-08	N/A	N/A	N/A	N/A	N/A
			1,2-Dichloroethane	N/A	2.0E-07	N/A	2.0E-07	Kidney	N/A	N/A	N/A	N/A
			Benzene	N/A	4.8E-07	N/A	4.8E-07	Blood, Immune	N/A	N/A	N/A	N/A
			Tetrachloroethene	N/A	4.9E-04	N/A	4.9E-04	Kidney, Liver	N/A	N/A	N/A	N/A
			Trichloroethene	N/A	1.0E-02	N/A	1.0E-02	N/A	N/A	N/A	N/A	N/A
			Vinyl chloride	N/A	5.7E-06	N/A	5.7E-06	Liver	N/A	N/A	N/A	N/A
			Nitrobenzene	N/A	3.0E-06	N/A	3.0E-06	Lungs, Nose	N/A	N/A	N/A	N/A
			Chemical Total	0.0E+00	1.1E-02	0.0E+00	1.1E-02		N/A	N/A	N/A	N/A
		Exposure Point Total					1.1E-02					N/A
		Vapor Intrusion to Indoor Air	Trichloroethene	N/A	1.6E-05	N/A	1.6E-05	N/A	N/A	N/A	N/A	N/A
			Vinyl chloride	N/A	6.8E-06	N/A	6.8E-06	Liver	N/A	N/A	N/A	N/A
			Chemical Total	0.0E+00	2.3E-05	0.0E+00	2.3E-05		N/A	N/A	N/A	N/A
		Exposure Point Total					2.3E-05					N/A
	Exposure Medium Total						1.1E-02					N/A
Medium Total							6.8E-02					N/A
Receptor Total							6.8E-02				Receptor HI Total	N/A

TABLE 10.4.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	5.5E+00	N/A	N/A	5.5E+00
			Tetrachloroethene	5.7E-03	N/A	N/A	5.7E-03	Liver, Body Weight	2.9E+00	N/A	N/A	2.9E+00
			Trichloroethene	3.5E-03	N/A	N/A	3.5E-03	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	7.4E-05	N/A	N/A	7.4E-05	Liver	9.6E-02	N/A	N/A	9.6E-02
			2,4-Dinitrotoluene	3.9E-05	N/A	N/A	3.9E-05	CNS, Blood, Biliary Tract	1.8E-01	N/A	N/A	1.8E-01
			Nitrobenzene	N/A	N/A	N/A	0.0E+00	Blood	1.8E-01	N/A	N/A	1.8E-01
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	3.6E+01	N/A	N/A	3.6E+01
			RDX	8.8E-06	N/A	N/A	8.8E-06	Prostrate	7.5E-02	N/A	N/A	7.5E-02
			Antimony, Dissolved	N/A	N/A	N/A	0.0E+00	Longevity, Blood	2.4E+00	N/A	N/A	2.4E+00
			Arsenic, Dissolved	9.9E-05	N/A	N/A	9.9E-05	Skin, Vascular	6.2E-01	N/A	N/A	6.2E-01
			Cadmium, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	1.7E-01	N/A	N/A	1.7E-01
			Cobalt, Dissolved	N/A	N/A	N/A	0.0E+00	Thyroid	2.9E+00	N/A	N/A	2.9E+00
			Vanadium, Dissolved	N/A	N/A	N/A	0.0E+00	Hair, Blood	1.8E-01	N/A	N/A	1.8E-01
			Chemical Total	9.4E-03	0.0E+00	0.0E+00	9.4E-03		5.1E+01	0.0E+00	0.0E+00	5.1E+01
		Exposure Point Total					9.4E-03					5.1E+01
		Vapor Intrusion to Indoor Air	1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	0.0E+00
			Trichloroethene	N/A	3.2E-06	N/A	3.2E-06	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	1.3E-06	N/A	1.3E-06	Liver	N/A	8.5E-03	N/A	8.5E-03
			Chemical Total	0.0E+00	4.5E-06	0.0E+00	4.5E-06		0.0E+00	8.5E-03	0.0E+00	8.5E-03
		Exposure Point Total					4.5E-06					8.5E-03
	Exposure Medium Total						9.4E-03					5.1E+01
Medium Total							9.4E-03					5.1E+01
Receptor Total							9.4E-03				Receptor HI Total	5.1E+01

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	4.5E+01
Total Liver HI Across All Media =	3.0E+00
Total Body Weight HI Across All Media =	2.9E+00
Total Neurological/Central Nervous System HI Across All Media =	3.6E+01
Total Billiary Tract HI Across All Media =	3.6E+01
Total Prostate HI Across All Media =	7.5E-02
Total Longevity HI Across All Media =	2.4E+00

TABLE 10.4.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
											Total Skin HI Across All Media=	6.2E-01
											Total Vascular HI Across All Media=	6.2E-01
											Total Thyroid HI Across All Media=	2.9E+00
											Total Hair HI Across All Media=	1.8E-01

TABLE 10.5.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer	cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	N/A	N/A	1.0E-01	1.0E-01
		Water in Excavation Pit	Tetrachloroethene	N/A	N/A	1.9E-04	1.9E-04	Liver	N/A	N/A	2.5E-01	2.5E-01
			Trichloroethene	N/A	N/A	4.1E-05	4.1E-05	N/A	N/A	N/A	N/A	0.0E+00
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	N/A	N/A	2.6E+00	2.6E+00
			Antimony	N/A	N/A	1.9E-04	1.9E-04	Whole Body, Blood	N/A	N/A	2.5E-01	2.5E-01
			Chemical Total	0.0E+00	0.0E+00	2.3E-04	2.3E-04		0.0E+00	0.0E+00	3.0E+00	3.0E+00
		Exposure Point Total					2.3E-04					3.0E+00
	Exposure Medium Total						2.3E-04					3.0E+00
Medium Total							2.3E-04					3.0E+00
Receptor Total							2.3E-04				Receptor HI Total	3.0E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	3.0E+00
Total Liver HI Across All Media =	2.5E-01
Total Neurological/Central Nervous System HI Across All Media =	2.6E+00
Total Billiary Tract HI Across All Media =	2.6E+00
Total Whole Body HI Across All Media =	2.5E-01

TABLE 10.6.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	7.0E-01	N/A	4.3E-02	7.4E-01
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	4.9E+00	N/A	1.8E-01	5.1E+00
			RDX	N/A	N/A	N/A	0.0E+00	Prostrate	6.4E-01	N/A	5.7E-03	6.5E-01
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	1.4E-01	N/A	1.8E-02	1.5E-01
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00		6.4E+00	0.0E+00	2.5E-01	6.7E+00
		Exposure Point Total					0.0E+00					6.7E+00
	Exposure Medium Total						0.0E+00					6.7E+00
Medium Total							0.0E+00					6.7E+00
Receptor Total							0.0E+00				Receptor HI Total	6.7E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	7.4E-01
Total Neurological/Central Nervous System HI Across All Media =	9.0E-01
Total Billiary Tract HI Across All Media =	7.4E-01
Total Spleen HI Across All Media =	5.1E+00
Total Prostate HI Across All Media =	6.5E-01

TABLE 10.7.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	1.6E+00	N/A	1.5E-01	1.8E+00
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	1.2E+01	N/A	6.2E-01	1.2E+01
			RDX	N/A	N/A	N/A	0.0E+00	Prostrate	1.5E+00	N/A	1.9E-02	1.5E+00
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	3.2E-01	N/A	7.8E-02	4.0E-01
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00		1.5E+01	0.0E+00	8.6E-01	1.6E+01
		Exposure Point Total					0.0E+00					1.6E+01
	Exposure Medium Total						0.0E+00					1.6E+01
Medium Total							0.0E+00					1.6E+01
Receptor Total							0.0E+00	Receptor HI Total				1.6E+01

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	1.8E+00
Total Neurological/Central Nervous System HI Across All Media =	2.2E+00
Total Billiary Tract HI Across All Media =	1.8E+00
Total Spleen HI Across All Media =	1.2E+01
Total Prostate HI Across All Media =	1.5E+00

TABLE 10.8.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	2.4E-04	N/A	1.4E-05	1.4E-05	CNS, Blood, Biliary Tract	N/A	N/A	N/A	0.0E+00
			RDX	1.1E-04	N/A	1.0E-06	1.0E-06	Prostrate	N/A	N/A	N/A	0.0E+00
			Chemical Total	3.5E-04	0.0E+00	1.5E-05	3.7E-04		0.0E+00	0.0E+00	0.0E+00	0.0E+00
		Exposure Point Total					3.7E-04					0.0E+00
	Exposure Medium Total						3.7E-04					0.0E+00
Medium Total							3.7E-04					0.0E+00
Receptor Total							3.7E-04				Receptor HI Total	0.0E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

TABLE 10.9.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	5.5E-05	N/A	N/A	5.5E-05	CNS, Blood, Biliary Tract	2.5E-01	N/A	N/A	2.5E-01
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	1.8E+00	N/A	N/A	1.8E+00
			RDX	2.7E-05	N/A	N/A	2.7E-05	Prostrate	2.3E-01	N/A	N/A	2.3E-01
			Chemical Total	8.2E-05	0.0E+00	0.0E+00	8.2E-05		2.2E+00	0.0E+00	0.0E+00	2.2E+00
		Exposure Point Total					8.2E-05					2.2E+00
	Exposure Medium Total						8.2E-05					2.2E+00
Medium Total							8.2E-05					2.2E+00
Receptor Total							8.2E-05				Receptor HI Total	2.2E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	2.5E-01
Total Neurological/Central Nervous System HI Across All Media =	2.5E-01
Total Billiary Tract HI Across All Media =	2.5E-01
Total Spleen HI Across All Media =	1.8E+00
Total Prostate HI Across All Media =	2.3E-01

TABLE 10.1.CTE
RISK SUMMARY
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	7.3E+00	N/A	6.1E-01	7.9E+00
			Tetrachloroethene	N/A	N/A	N/A	0.0E+00	Liver, Body Weight	3.8E+00	N/A	2.2E+00	6.0E+00
			Trichloroethene	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	0.0E+00	Liver	1.3E-01	N/A	6.1E-03	1.3E-01
			2,4-Dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	2.3E-01	N/A	1.3E-02	2.4E-01
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	4.7E+01	N/A	2.3E+00	5.0E+01
			RDX	N/A	N/A	N/A	0.0E+00	Prostrate	9.8E-02	N/A	8.3E-04	9.9E-02
			Antimony, Dissolved	N/A	N/A	N/A	0.0E+00	Longevity, Blood	3.1E+00	N/A	6.7E-02	3.2E+00
			Arsenic, Dissolved	N/A	N/A	N/A	0.0E+00	Skin, Vascular	8.1E-01	N/A	2.6E-03	8.1E-01
			Beryllium, Dissolved	N/A	N/A	N/A	0.0E+00	Intestine	5.8E-02	N/A	2.7E-01	3.3E-01
			Cadmium, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	2.2E-01	N/A	1.4E-02	2.3E-01
			Cobalt, Dissolved	N/A	N/A	N/A	0.0E+00	Thyroid	3.8E+00	N/A	4.9E-03	3.8E+00
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	1.0E-01	N/A	8.3E-03	1.1E-01
			Vanadium, Dissolved	N/A	N/A	N/A	0.0E+00	Hair, Blood	2.3E-01	N/A	2.9E-02	2.6E-01
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00		6.7E+01	0.0E+00	5.5E+00	7.3E+01
		Exposure Point Total					0.0E+00					7.3E+01
	Exposure Medium Total						0.0E+00					7.3E+01
Medium Total							0.0E+00					7.3E+01
Receptor Total							0.0E+00				Receptor HI Total	7.3E+01

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	6.2E+01
Total Liver HI Across All Media =	6.2E+00
Total Body Weight HI Across All Media =	6.0E+00
Total Neurological/Central Nervous System HI Across All Media =	5.0E+01
Total Billiary Tract HI Across All Media =	5.0E+01
Total Prostate HI Across All Media =	9.9E-02
Total Longevity HI Across All Media =	3.2E+00
Total Skin HI Across All Media=	8.1E-01
Total Vascular HI Across All Media=	8.1E-01
Total Gastrointestinal/Intestinal HI Across All Media=	3.3E-01
Total Thyroid HI Across All Media=	3.8E+00
Total Hair HI Across All Media=	2.6E-01

TABLE 10.2.CTE
RISK SUMMARY
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	2.4E+01	N/A	1.2E+00	2.5E+01
			Tetrachloroethene	N/A	N/A	N/A	0.0E+00	Liver, Body Weight	1.3E+01	N/A	4.3E+00	1.7E+01
			Trichloroethene	N/A	N/A	N/A	0.0E+00	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	N/A	N/A	N/A	0.0E+00	Liver	4.2E-01	N/A	1.2E-02	4.3E-01
			2,4-Dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	7.7E-01	N/A	2.6E-02	8.0E-01
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	1.6E-01	N/A	3.3E-03	1.6E-01
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	1.6E+02	N/A	4.6E+00	1.6E+02
			RDX	N/A	N/A	N/A	0.0E+00	Prostrate	3.3E-01	N/A	1.6E-03	3.3E-01
			Antimony, Dissolved	N/A	N/A	N/A	0.0E+00	Longevity, Blood	1.0E+01	N/A	1.5E-01	1.1E+01
			Arsenic, Dissolved	N/A	N/A	N/A	0.0E+00	Skin, Vascular	2.7E+00	N/A	5.9E-03	2.7E+00
			Beryllium, Dissolved	N/A	N/A	N/A	0.0E+00	Intestine	1.9E-01	N/A	6.1E-01	8.0E-01
			Cadmium, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	7.3E-01	N/A	3.2E-02	7.6E-01
			Chromium, Dissolved	N/A	N/A	N/A	0.0E+00	Not identified	1.1E-01	N/A	1.9E-02	1.3E-01
			Cobalt, Dissolved	N/A	N/A	N/A	0.0E+00	Thyroid	1.3E+01	N/A	1.1E-02	1.3E+01
			Iron, Dissolved	N/A	N/A	N/A	0.0E+00	Gastrointestinal	2.5E-01	N/A	5.5E-04	2.6E-01
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	3.4E-01	N/A	1.9E-02	3.6E-01
			Selenium, Dissolved	N/A	N/A	N/A	0.0E+00	Whole Body	1.1E-01	N/A	2.4E-04	1.1E-01
			Vanadium, Dissolved	N/A	N/A	N/A	0.0E+00	Hair, Blood	7.8E-01	N/A	6.5E-02	8.4E-01
			Zinc, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	3.2E-01	N/A	4.2E-04	3.2E-01
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00		2.3E+02	0.0E+00	1.1E+01	2.4E+02
		Exposure Point Total					0.0E+00					2.4E+02
	Exposure Medium Total						0.0E+00					2.4E+02

TABLE 10.2.CTE
RISK SUMMARY
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Yorktown -Eastover Water Vapors at Showerhead	Tetrachloroethene	N/A	N/A	N/A	0.0E+00	Kidney, Liver	N/A	1.2E-01	N/A	1.2E-01
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00		0.0E+00	1.2E-01	0.0E+00	1.2E-01
		Exposure Point Total					0.0E+00					1.2E-01
	Exposure Medium Total						0.0E+00					1.2E-01
Medium Total							0.0E+00					2.4E+02
Receptor Total							0.0E+00				Receptor HI Total	2.4E+02

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Kidney HI Across All Media =	1.2E-01
Total Blood HI Across All Media =	2.0E+02
Total Liver HI Across All Media =	1.8E+01
Total Body Weight HI Across All Media =	1.7E+01
Total Neurological/Central Nervous System HI Across All Media =	1.6E+02
Total Billiary Tract HI Across All Media =	1.6E+02
Total Spleen HI Across All Media =	1.6E-01
Total Prostate HI Across All Media =	3.3E-01
Total Longevity HI Across All Media =	1.1E+01
Total Skin HI Across All Media=	2.7E+00
Total Vascular HI Across All Media=	2.7E+00
Total Gastrointestinal/Intestinal HI Across All Media=	1.1E+00
Total Decreased Organ Weight HI Across All Media =	1.1E-01
Total Thyroid HI Across All Media=	1.3E+01
Total Whole Body HI Across All Media=	1.1E-01
Total Hair HI Across All Media=	8.4E-01

TABLE 10.3.CTE
RISK SUMMARY
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	Tetrachloroethene	8.6E-03	N/A	3.5E-03	1.2E-02	Liver, Body Weight	N/A	N/A	N/A	0.0E+00
			Trichloroethene	5.3E-03	N/A	6.1E-04	6.0E-03	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	1.1E-04	N/A	3.9E-06	1.2E-04	Liver	N/A	N/A	N/A	0.0E+00
			2,4-Dinitrotoluene	5.9E-05	N/A	2.5E-06	6.2E-05	CNS, Blood, Biliary Tract	N/A	N/A	N/A	0.0E+00
			RDX	8.6E-03	N/A	3.5E-03	1.2E-02	Prostrate	N/A	N/A	N/A	N/A
			Arsenic, Dissolved	5.3E-03	N/A	6.1E-04	6.0E-03	Skin, Vascular	N/A	N/A	N/A	N/A
			Chromium, Dissolved	1.1E-04	N/A	3.9E-06	1.2E-04	Not identified	N/A	N/A	N/A	N/A
			Chemical Total	2.8E-02	0.0E+00	8.2E-03	3.6E-02		0.0E+00	0.0E+00	0.0E+00	0.0E+00
		Exposure Point Total					3.6E-02					0.0E+00
	Exposure Medium Total						3.6E-02					0.0E+00
	Air	Yorktown -Eastover Water Vapors at Showerhead	Tetrachloroethene	N/A	4.5E-05	N/A	4.5E-05	Kidney, Liver	N/A	N/A	N/A	0.0E+00
			Trichloroethene	N/A	9.5E-04	N/A	9.5E-04	N/A	N/A	N/A	N/A	0.0E+00
			Chemical Total	0.0E+00	1.0E-03	0.0E+00	1.0E-03		0.0E+00	0.0E+00	0.0E+00	0.0E+00
		Exposure Point Total					1.0E-03					0.0E+00
	Exposure Medium Total						1.0E-03					0.0E+00
Medium Total							3.7E-02					0.0E+00
Receptor Total							3.7E-02				Receptor HI Total	0.0E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

TABLE 10.4.CTE
RISK SUMMARY
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	cis-1,2-Dichloroethene	N/A	N/A	N/A	0.0E+00	Blood	4.9E+00	N/A	N/A	4.9E+00
			Tetrachloroethene	1.8E-03	N/A	N/A	1.8E-03	Liver, Body Weight	2.6E+00	N/A	N/A	2.6E+00
			Trichloroethene	1.1E-03	N/A	N/A	1.1E-03	N/A	N/A	N/A	N/A	0.0E+00
			Vinyl chloride	2.3E-05	N/A	N/A	2.3E-05	Liver	8.4E-02	N/A	N/A	8.4E-02
			2,4-Dinitrotoluene	1.2E-05	N/A	N/A	1.2E-05	CNS, Blood, Biliary Tract	1.5E-01	N/A	N/A	1.5E-01
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	3.2E+01	N/A	N/A	3.2E+01
			RDX	2.8E-06	N/A	N/A	2.8E-06	Prostrate	6.6E-02	N/A	N/A	6.6E-02
			Antimony, Dissolved	N/A	N/A	N/A	0.0E+00	Longevity, Blood	2.1E+00	N/A	N/A	2.1E+00
			Arsenic, Dissolved	3.1E-05	N/A	N/A	3.1E-05	Skin, Vascular	5.4E-01	N/A	N/A	5.4E-01
			Cadmium, Dissolved	N/A	N/A	N/A	0.0E+00	Blood	1.5E-01	N/A	N/A	1.5E-01
			Chromium, Dissolved	4.2E-06	N/A	N/A	4.2E-06	Not identified	2.2E-02	N/A	N/A	2.2E-02
			Cobalt, Dissolved	N/A	N/A	N/A	0.0E+00	Thyroid	2.5E+00	N/A	N/A	2.5E+00
			Vanadium, Dissolved	N/A	N/A	N/A	0.0E+00	Hair, Blood	1.6E-01	N/A	N/A	1.6E-01
			Chemical Total	3.0E-03	0.0E+00	0.0E+00	3.0E-03		3.7E+01	0.0E+00	0.0E+00	3.7E+01
		Exposure Point Total					3.0E-03					3.7E+01
	Exposure Medium Total						3.0E-03					3.7E+01
	Air	Vapor Intrusion to Indoor Air	Trichloroethene	N/A	1.0E-06	N/A	1.0E-06	N/A	N/A	N/A	N/A	0.0E+00
			Chemical Total	0.0E+00	1.0E-06	0.0E+00	1.0E-06		0.0E+00	0.0E+00	0.0E+00	0.0E+00
		Exposure Point Total					1.0E-06					0.0E+00
	Exposure Medium Total						1.0E-06					0.0E+00
Medium Total							3.0E-03					3.7E+01
Receptor Total							3.0E-03				Receptor HI Total	3.7E+01

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	3.9E+01
Total Liver HI Across All Media =	2.7E+00
Total Body Weight HI Across All Media =	2.6E+00
Total Neurological/Central Nervous System HI Across All Media =	3.2E+01
Total Billiary Tract HI Across All Media =	3.2E+01
Total Prostate HI Across All Media =	6.6E-02
Total Skin HI Across All Media=	5.4E-01
Total Vascular HI Across All Media=	5.4E-01
Total Longevity HI Across All Media=	2.1E+00
Total Thyroid HI Across All Media=	2.5E+00
Total Hair HI Across All Media=	1.6E-01

TABLE 10.5.CTE
RISK SUMMARY
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown -Eastover Aquifer Tap Water	Tetrachloroethene	N/A	N/A	1.2E-04	1.2E-04	Liver	N/A	N/A	1.5E-01	1.5E-01
			Trichloroethene	N/A	N/A	2.4E-05	2.4E-05	N/A	N/A	N/A	N/A	0.0E+00
			2-Amino-4,6-dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	N/A	N/A	1.7E+00	1.7E+00
			Chemical Total	0.0E+00	0.0E+00	1.4E-04	1.4E-04		0.0E+00	0.0E+00	1.8E+00	1.8E+00
		Exposure Point Total					1.4E-04					1.8E+00
	Exposure Medium Total						1.4E-04					1.8E+00
Medium Total							1.4E-04					1.8E+00
Receptor Total							1.4E-04	Receptor HI Total				1.8E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	1.7E+00
Total Liver HI Across All Media =	1.5E-01
Total Neurological/Central Nervous System HI Across All Media =	1.7E+00
Total Billiary Tract HI Across All Media =	1.7E+00

TABLE 10.6.CTE
RISK SUMMARY
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	3.3E-01	N/A	1.9E-02	3.5E-01
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	2.3E+00	N/A	8.1E-02	2.4E+00
			RDX	N/A	N/A	N/A	0.0E+00	Prostrate	3.0E-01	N/A	2.5E-03	3.0E-01
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00		2.9E+00	0.0E+00	1.0E-01	3.0E+00
		Exposure Point Total					0.0E+00					3.0E+00
	Exposure Medium Total						0.0E+00					3.0E+00
Medium Total							0.0E+00					3.0E+00
Receptor Total							0.0E+00				Receptor HI Total	3.0E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	3.5E-01
Total Neurological/Central Nervous System HI Across All Media =	3.5E-01
Total Billiary Tract HI Across All Media =	3.5E-01
Total Spleen HI Across All Media =	2.4E+00
Total Prostate HI Across All Media =	3.0E-01

TABLE 10.7.CTE
RISK SUMMARY
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	N/A	N/A	N/A	0.0E+00	CNS, Blood, Biliary Tract	1.1E+00	N/A	3.7E-02	1.1E+00
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	7.7E+00	N/A	1.6E-01	7.9E+00
			RDX	N/A	N/A	N/A	0.0E+00	Prostrate	1.0E+00	N/A	5.0E-03	1.0E+00
			Manganese, Dissolved	N/A	N/A	N/A	0.0E+00	CNS	2.1E-01	N/A	1.2E-02	2.2E-01
			Chemical Total	0.0E+00	0.0E+00	0.0E+00	0.0E+00		1.0E+01	0.0E+00	2.1E-01	1.0E+01
		Exposure Point Total					0.0E+00					1.0E+01
	Exposure Medium Total						0.0E+00					1.0E+01
Medium Total							0.0E+00					1.0E+01
Receptor Total							0.0E+00	Receptor HI Total				1.0E+01

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	1.1E+00
Total Neurological/Central Nervous System HI Across All Media =	1.4E+00
Total Billiary Tract HI Across All Media =	1.1E+00
Total Spleen HI Across All Media =	7.9E+00
Total Prostate HI Across All Media =	1.0E+00

TABLE 10.8.CTE
RISK SUMMARY
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	8.4E-05	N/A	3.5E-06	3.5E-06	CNS, Blood, Biliary Tract	N/A	N/A	N/A	0.0E+00
			RDX	4.1E-05	N/A	2.5E-07	4.1E-05	Prostrate	N/A	N/A	N/A	0.0E+00
			Chemical Total	1.2E-04	0.0E+00	3.7E-06	1.3E-04		0.0E+00	0.0E+00	0.0E+00	0.0E+00
		Exposure Point Total					1.3E-04					0.0E+00
	Exposure Medium Total						1.3E-04					0.0E+00
Medium Total							1.3E-04					0.0E+00
Receptor Total							1.3E-04				Receptor HI Total	0.0E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

TABLE 10.9.CTE
RISK SUMMARY
CENTRAL TENDENCY EXPOSURE
Site 6, NWS Yorktown, Yorktown, Virginia

Scenario Timeframe: Future
Receptor Population: Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Yorktown-Eastover Aquifer Tap Water at GW09	2,4-Dinitrotoluene	1.7E-05	N/A	N/A	1.7E-05	CNS, Blood, Biliary Tract	2.2E-01	N/A	N/A	2.2E-01
			1,3-Dinitrobenzene	N/A	N/A	N/A	0.0E+00	Spleen	1.5E+00	N/A	N/A	1.5E+00
			RDX	8.5E-06	N/A	N/A	8.5E-06	Prostrate	2.0E-01	N/A	N/A	2.0E-01
			Chemical Total	2.6E-05	0.0E+00	0.0E+00	2.6E-05		2.0E+00	0.0E+00	0.0E+00	2.0E+00
		Exposure Point Total					2.6E-05					2.0E+00
	Exposure Medium Total						2.6E-05					2.0E+00
Medium Total							2.6E-05					2.0E+00
Receptor Total							2.6E-05				Receptor HI Total	2.0E+00

HI - Hazard Index
N/A - Not applicable
CNS - Central Nervous System

Total Blood HI Across All Media =	2.2E-01
Total Neurological/Central Nervous System HI Across All Media =	2.2E-01
Total Billiary Tract HI Across All Media =	2.2E-01
Total Spleen HI Across All Media =	1.5E+00
Total Prostate HI Across All Media =	2.0E-01

Table 11.1
Comparison of Non-Detected Chemicals to Regional Screening Levels
Groundwater at Site 6, Yorktown

CAS Number	Chemical	Range of Detection Limits	Concentration Used for Screening ug/L	Screening [1] Toxicity Value ug/L		Exceeds Screening Value?	Rationale for Contaminant Deletion or Selection
79-34-5	1,1,2,2-Tetrachloroethane	0.5 - 8300	8.3E+03	6.7E-02	C	YES	DLASL
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.5 - 8300	8.3E+03	5.9E+03	N	YES	DLASL
79-00-5	1,1,2-Trichloroethane	0.5 - 8300	8.3E+03	2.4E-01	C	YES	DLASL
96-12-8	1,2-Dibromo-3-chloropropane	0.5 - 8300	8.3E+03	3.2E-04	C	YES	DLASL
106-93-4	1,2-Dibromoethane	0.5 - 8300	8.3E+03	6.5E-03	C	YES	DLASL
95-50-1	1,2-Dichlorobenzene	0.5 - 8300	8.3E+03	3.7E+01	N	YES	DLASL
78-87-5	1,2-Dichloropropane	0.5 - 8300	8.3E+03	3.9E-01	C*	YES	DLASL
541-73-1	1,3-Dichlorobenzene	0.5 - 8300	8.3E+03	4.3E-01	C	YES	DLASL
106-46-7	1,4-Dichlorobenzene	0.5 - 8300	8.3E+03	4.3E-01	C	YES	DLASL
108-10-1	4-Methyl-2-pentanone	2.5 - 42000	4.2E+04	2.0E+02	N	YES	DLASL
67-64-1	Acetone	2.5 - 42000	4.2E+04	2.2E+03	N	YES	DLASL
75-27-4	Bromodichloromethane	0.5 - 8300	8.3E+03	1.2E-01	C	YES	DLASL
75-25-2	Bromoform	0.5 - 8300	8.3E+03	8.5E+00	C*	YES	DLASL
74-83-9	Bromomethane	0.5 - 8300	8.3E+03	8.7E-01	N	YES	DLASL
56-23-5	Carbon tetrachloride	0.5 - 8300	8.3E+03	2.0E-01	C	YES	DLASL
108-90-7	Chlorobenzene	0.5 - 8300	8.3E+03	9.1E+00	N	YES	DLASL
67-66-3	Chloroform	0.5 - 8300	8.3E+03	1.9E-01	C	YES	DLASL
10061-01-5	cis-1,3-Dichloropropene	0.5 - 8300	8.3E+03	4.3E-01	C*	YES	DLASL
110-82-7	Cyclohexane	0.5 - 8300	8.3E+03	1.3E+03	N	YES	DLASL
124-48-1	Dibromochloromethane	0.5 - 8300	8.3E+03	1.5E-01	C	YES	DLASL
75-71-8	Dichlorodifluoromethane (Freon-12)	0.5 - 8300	8.3E+03	4.0E+01	N	YES	DLASL
m&pXYLENE	m- and p-Xylene	1 - 17000	1.7E+04	2.0E+01	N	YES	DLASL
100-42-5	Styrene	0.5 - 8300	8.3E+03	1.6E+02	N	YES	DLASL
108-88-3	Toluene	0.5 - 8300	8.3E+03	2.3E+02	N	YES	DLASL
10061-02-6	trans-1,3-Dichloropropene	0.5 - 8300	8.3E+03	4.3E-01	C*	YES	DLASL
75-69-4	Trichlorofluoromethane(Freon-11)	0.5 - 8300	8.3E+03	1.3E+02	N	YES	DLASL
606-20-2	2,6-Dinitrotoluene	0.38 - 1.2	1.2E+00	3.7E+00	N	NO	DLBSL
86-30-6	n-Nitrosodiphenylamine	5 - 5	5.0E+00	1.4E+01	C	NO	DLBSL
55-63-0	Nitroglycerin	16 - 16	1.6E+01	3.7E-01	N	YES	DLASL
556-88-7	Nitroguanidine	84 - 84	8.4E+01	3.7E+02	N	NO	DLBSL
14797-73-0	Perchlorate	0.2 - 0.2	2.0E-01	2.6E+00	N	NO	DLBSL
479-45-8	Tetryl	0.38 - 1.2	1.2E+00	1.5E+01	N	NO	DLBSL
7439-97-6	Mercury	0.2 - 0.2	2.0E-01	1.1E+00	N	NO	DLBSL
7440-22-4	Silver	5 - 5	5.0E+00	1.8E+01	N	NO	DLBSL
7440-28-0	Thallium	10 - 10	1.0E+01	NA		NO	NTX

[1] Oak Ridge National Laboratory (ORNL). December, 2009. Regional Screening Levels for Chemical Contaminants at Superfund Sites. Tap Water RSL. [Online]. Available: http://epa-prgs.ornl.gov/chemicals/index.shtml

RSL value for 1,4-dichlorobenzene used as surrogate for 1,3-dichlorobenzene

RSL value for Methyl Isobutyl Ketone (4-methyl-2-pentanone) used as surrogate for 2-Hexanone.

RSL value for Manganese (water) used as surrogate for manganese.

RSL value for Mercury (inorganic salts) used as surrogate for mercury.

RSL value for 1,3-dichloropropene used as a surrogate for cis-1,3-dichloropropene and trans-1,3-dichloropropene.

RSL value for total xylene used as a surrogate for m- and p-xylene

Definitions:
C = Carcinogenic
C* = Carcinogenic, N screening level < 100x C screening level, C screening value used as screening level
C** = N screening level < 10x C screening level, therefore N screening value/10 used as screening level
N = Noncarcinogenic
NTX = No Toxicity Information
DLBSL = Detection limit below screening level
DLASL = Detection limit above screening level
ug/L = microgram per liter

Table 11.2
Comparison of Non-Detected Chemicals to Regional Screening Levels
Surface Water at Site 6, Yorktown

CAS Number	Chemical	Range of Detection Limits ug/L	Concentration Used for Screening ug/L	Screening [1] Toxicity Value ug/L		Exceeds Screening Value?	Rationale for Contaminant Deletion or Selection
71-55-6	1,1,1-Trichloroethane	0.5 - 0.5	5.0E-01	9.1E+03	N	NO	DLBSL
79-34-5	1,1,2,2-Tetrachloroethane	0.5 - 0.5	5.0E-01	6.7E-01	C	NO	DLBSL
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.5 - 0.5	5.0E-01	5.9E+04	N	NO	DLBSL
79-00-5	1,1,2-Trichloroethane	0.5 - 0.5	5.0E-01	2.4E+00	C	NO	DLBSL
75-34-3	1,1-Dichloroethane	0.5 - 0.5	5.0E-01	2.4E+01	C	NO	DLBSL
75-35-4	1,1-Dichloroethene	0.5 - 0.5	5.0E-01	3.4E+02	N	NO	DLBSL
120-82-1	1,2,4-Trichlorobenzene	0.5 - 0.5	5.0E-01	4.1E+00	C**	NO	DLBSL
96-12-8	1,2-Dibromo-3-chloropropane	0.5 - 0.5	5.0E-01	3.2E-03	C	YES	DLASL
106-93-4	1,2-Dibromoethane	0.5 - 0.5	5.0E-01	6.5E-02	C	YES	DLASL
95-50-1	1,2-Dichlorobenzene	0.5 - 0.5	5.0E-01	3.7E+02	N	NO	DLBSL
107-06-2	1,2-Dichloroethane	0.5 - 0.5	5.0E-01	1.5E+00	C	NO	DLBSL
540-59-0	1,2-Dichloroethene (total)	0.5 - 0.5	5.0E-01	3.3E+02	N	NO	DLBSL
78-87-5	1,2-Dichloropropane	0.5 - 0.5	5.0E-01	3.9E+00	C*	NO	DLBSL
541-73-1	1,3-Dichlorobenzene	0.5 - 0.5	5.0E-01	4.3E+00	C	NO	DLBSL
106-46-7	1,4-Dichlorobenzene	0.5 - 0.5	5.0E-01	4.3E+00	C	NO	DLBSL
78-93-3	2-Butanone	2.5 - 2.5	2.5E+00	7.1E+03	N	NO	DLBSL
591-78-6	2-Hexanone	2.5 - 2.5	2.5E+00	4.7E+01	N	NO	DLBSL
108-10-1	4-Methyl-2-pentanone	2.5 - 2.5	2.5E+00	2.0E+03	N	NO	DLBSL
67-64-1	Acetone	2.5 - 2.5	2.5E+00	2.2E+04	N	NO	DLBSL
71-43-2	Benzene	0.5 - 0.5	5.0E-01	4.1E+00	C	NO	DLBSL
75-27-4	Bromodichloromethane	0.5 - 0.5	5.0E-01	1.2E+00	C	NO	DLBSL
75-25-2	Bromoform	0.5 - 0.5	5.0E-01	8.5E+01	C*	NO	DLBSL
74-83-9	Bromomethane	0.5 - 0.5	5.0E-01	8.7E+00	N	NO	DLBSL
56-23-5	Carbon tetrachloride	0.5 - 0.5	5.0E-01	2.0E+00	C	NO	DLBSL
108-90-7	Chlorobenzene	0.5 - 0.5	5.0E-01	9.1E+01	N	NO	DLBSL
75-00-3	Chloroethane	0.5 - 0.5	5.0E-01	2.1E+04	N	NO	DLBSL
67-66-3	Chloroform	0.5 - 0.5	5.0E-01	1.9E+00	C	NO	DLBSL
74-87-3	Chloromethane	0.5 - 0.5	5.0E-01	1.9E+02	N	NO	DLBSL
156-59-2	cis-1,2-Dichloroethene	0.5 - 0.5	5.0E-01	3.7E+02	N	NO	DLBSL
10061-01-5	cis-1,3-Dichloropropene	0.5 - 0.5	5.0E-01	4.3E+00	C*	NO	DLBSL
110-82-7	Cyclohexane	0.5 - 0.5	5.0E-01	1.3E+04	N	NO	DLBSL
124-48-1	Dibromochloromethane	0.5 - 0.5	5.0E-01	1.5E+00	C	NO	DLBSL
75-71-8	Dichlorodifluoromethane (Freon-12)	0.5 - 0.5	5.0E-01	4.0E+02	N	NO	DLBSL
100-41-4	Ethylbenzene	0.5 - 0.5	5.0E-01	1.5E+01	C	NO	DLBSL
98-82-8	Isopropylbenzene	0.5 - 0.5	5.0E-01	6.8E+02	N	NO	DLBSL
m&pXYLENE	m- and p-Xylene	1 - 1	1.0E+00	2.0E+02	N	NO	DLBSL
79-20-9	Methyl acetate	0.5 - 0.5	5.0E-01	3.7E+04	N	NO	DLBSL
108-87-2	Methylcyclohexane	0.5 - 0.5	5.0E-01	NA		NO	NTX
75-09-2	Methylene chloride	0.5 - 0.5	5.0E-01	4.8E+01	C	NO	DLBSL
1634-04-4	Methyl-tert-butyl ether (MTBE)	0.5 - 0.5	5.0E-01	1.3E+02	C	NO	DLBSL
95-47-6	o-Xylene	0.5 - 0.5	5.0E-01	1.2E+03	N	NO	DLBSL
100-42-5	Styrene	0.5 - 0.5	5.0E-01	1.6E+03	N	NO	DLBSL
127-18-4	Tetrachloroethene	0.5 - 0.5	5.0E-01	1.1E+00	C	NO	DLBSL
108-88-3	Toluene	0.5 - 0.5	5.0E-01	2.3E+03	N	NO	DLBSL
156-60-5	trans-1,2-Dichloroethene	0.5 - 0.5	5.0E-01	1.1E+02	N	NO	DLBSL
10061-02-6	trans-1,3-Dichloropropene	0.5 - 0.5	5.0E-01	4.3E+00	C*	NO	DLBSL
79-01-6	Trichloroethene	0.5 - 0.5	5.0E-01	2.0E+01	C	NO	DLBSL
75-69-4	Trichlorofluoromethane(Freon-11)	0.5 - 0.5	5.0E-01	1.3E+03	N	NO	DLBSL
75-01-4	Vinyl chloride	0.5 - 0.5	5.0E-01	1.6E-01	C	YES	DLASL
1330-20-7	Xylene, total	0.5 - 0.5	5.0E-01	2.0E+02	N	NO	DLBSL
121-14-2	2,4-Dinitrotoluene	0.37 - 0.38	3.8E-01	2.2E+00	C	NO	DLBSL

Table 11.2
Comparison of Non-Detected Chemicals to Regional Screening Levels
Surface Water at Site 6, Yorktown

CAS Number	Chemical	Range of Detection Limits ug/L	Concentration Used for Screening ug/L	Screening [1] Toxicity Value ug/L		Exceeds Screening Value?	Rationale for Contaminant Deletion or Selection
606-20-2	2,6-Dinitrotoluene	0.37 - 0.38	3.8E-01	3.7E+01	N	NO	DLBSL
98-95-3	Nitrobenzene	0.37 - 0.38	3.8E-01	1.2E+00	C	NO	DLBSL
99-35-4	1,3,5-Trinitrobenzene	0.37 - 0.38	3.8E-01	1.1E+03	N	NO	DLBSL
99-65-0	1,3-Dinitrobenzene	0.37 - 0.38	3.8E-01	3.7E+00	N	NO	DLBSL
118-96-7	2,4,6-Trinitrotoluene	0.37 - 0.38	3.8E-01	1.8E+01	C**	NO	DLBSL
35572-78-2	2-Amino-4,6-dinitrotoluene	0.37 - 0.38	3.8E-01	7.3E+01	N	NO	DLBSL
618-87-1	3,5-Dinitroaniline	0.37 - 0.38	3.8E-01	3.7E+00	N	NO	DLBSL
99-08-1	3-Nitrotoluene	0.37 - 0.38	3.8E-01	3.7E+00	N	NO	DLBSL
19406-51-0	4-Amino-2,6-dinitrotoluene	0.37 - 0.38	3.8E-01	7.3E+01	N	NO	DLBSL
99-99-0	4-Nitrotoluene	0.37 - 0.38	3.8E-01	4.2E+01	C*	NO	DLBSL
78-11-5	PETN	1.8 - 1.9	1.9E+00	NA		NO	NTX
121-82-4	RDX	0.37 - 0.38	3.8E-01	6.1E+00	C	NO	DLBSL
479-45-8	Tetryl	0.37 - 0.38	3.8E-01	1.5E+02	N	NO	DLBSL
7440-36-0	Antimony	10 - 10	1.0E+01	1.5E+01	N	NO	DLBSL
7440-41-7	Beryllium	5 - 5	5.0E+00	7.3E+01	N	NO	DLBSL
7440-43-9	Cadmium	5 - 5	5.0E+00	1.8E+01	N	NO	DLBSL
7439-92-1	Lead	3 - 3	3.0E+00	N/A		NO	DLBSL
7439-97-6	Mercury	0.2 - 0.2	2.0E-01	1.1E+01	N	NO	DLBSL
7440-28-0	Thallium	10 - 10	1.0E+01	NA		NO	NTX

[1]Oak Ridge National Laboratory (ORNL). Dec., 2009. Regional Screening Levels for Chemical Contaminants at Superfund Sites. [Online].
Available: http://epa-prgs.ornl.gov/chemicals/index.shtml. Ten times adjusted (nc RSLs adjusted by dividing by 10) tap water RSLs.

RSL value for Methyl Isobutyl Ketone (4-methyl-2-pentanone) used as surrogate for 2-Hexanone.

RSL value for 1,3-dinitrobenzene used as a surrogate for 3,5-dinitroaniline.

RSL value for total xylene used as a surrogate for m- and p-xylene

RSL value for Manganese (water) used as surrogate for manganese.

RSL value for Mercury (inorganic salts) used as surrogate for mercury.

RSL value for 1,3-dichloropropene used as a surrogate for cis-1,3-dichloropropene and trans-1,3-dichloropropene.

Definitions:
C = Carcinogenic
C* = Carcinogenic, N screening level < 100x C screening level, C screening value used as screening level
C** = N screening level < 10x C screening level, therefore N screening value/10 used as screening level
N = Noncarcinogenic
NTX = No Toxicity Information
DLBSL = Detection limit below screening level
DLASL = Detection limit above screening level
ug/L = microgram per liter

Table 11.3
Comparison of Non-Detected Chemicals to Regional Screening Levels
Sediment at Site 6, Yorktown

CAS Number	Chemical	Range of Detection Limits mg/kg	Concentration Used for Screening mg/kg	Screening [1] Toxicity Value mg/kg	Exceeds Screening Value?	Rationale for Contaminant Deletion or Selection
71-55-6	1,1,1-Trichloroethane	0.0076 - 0.026	2.6E-02	6.4E+02 NS	NO	DLBSL
79-34-5	1,1,2,2-Tetrachloroethane	0.0076 - 0.026	2.6E-02	5.6E+00 C	NO	DLBSL
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	0.0076 - 0.026	2.6E-02	9.1E+02 NS	NO	DLBSL
79-00-5	1,1,2-Trichloroethane	0.0076 - 0.026	2.6E-02	1.1E+01 C	NO	DLBSL
75-34-3	1,1-Dichloroethane	0.0076 - 0.026	2.6E-02	3.3E+01 C	NO	DLBSL
75-35-4	1,1-Dichloroethene	0.0076 - 0.026	2.6E-02	2.4E+02 N	NO	DLBSL
120-82-1	1,2,4-Trichlorobenzene	0.0076 - 0.026	2.6E-02	6.2E+01 C**	NO	DLBSL
96-12-8	1,2-Dibromo-3-chloropropane	0.0076 - 0.026	2.6E-02	5.4E-02 C	NO	DLBSL
106-93-4	1,2-Dibromoethane	0.0076 - 0.026	2.6E-02	3.4E-01 C	NO	DLBSL
95-50-1	1,2-Dichlorobenzene	0.0076 - 0.026	2.6E-02	3.8E+02 NS	NO	DLBSL
107-06-2	1,2-Dichloroethane	0.0076 - 0.026	2.6E-02	4.3E+00 C	NO	DLBSL
78-87-5	1,2-Dichloropropane	0.0076 - 0.026	2.6E-02	9.0E+00 C*	NO	DLBSL
541-73-1	1,3-Dichlorobenzene	0.0076 - 0.026	2.6E-02	2.4E+01 C	NO	DLBSL
106-46-7	1,4-Dichlorobenzene	0.0076 - 0.026	2.6E-02	2.4E+01 C	NO	DLBSL
78-93-3	2-Butanone	0.019 - 0.065	6.5E-02	2.8E+04 N	NO	DLBSL
591-78-6	2-Hexanone	0.019 - 0.065	6.5E-02	2.1E+02 N	NO	DLBSL
108-10-1	4-Methyl-2-pentanone	0.019 - 0.065	6.5E-02	3.4E+03 NS	NO	DLBSL
67-64-1	Acetone	0.019 - 0.065	6.5E-02	6.1E+04 N	NO	DLBSL
71-43-2	Benzene	0.0076 - 0.026	2.6E-02	1.1E+01 C*	NO	DLBSL
75-27-4	Bromodichloromethane	0.0076 - 0.026	2.6E-02	2.7E+00 C	NO	DLBSL
75-25-2	Bromoform	0.0076 - 0.026	2.6E-02	6.2E+02 C*	NO	DLBSL
74-83-9	Bromomethane	0.0076 - 0.026	2.6E-02	7.3E+00 N	NO	DLBSL
56-23-5	Carbon tetrachloride	0.0076 - 0.026	2.6E-02	2.5E+00 C	NO	DLBSL
108-90-7	Chlorobenzene	0.0076 - 0.026	2.6E-02	2.9E+02 N	NO	DLBSL
75-00-3	Chloroethane	0.0076 - 0.026	2.6E-02	2.1E+03 NS	NO	DLBSL
67-66-3	Chloroform	0.0076 - 0.026	2.6E-02	3.0E+00 C	NO	DLBSL
74-87-3	Chloromethane	0.0076 - 0.026	2.6E-02	1.2E+02 N	NO	DLBSL
156-59-2	cis-1,2-Dichloroethene	0.0076 - 0.026	2.6E-02	7.8E+02 N	NO	DLBSL
10061-01-5	cis-1,3-Dichloropropene	0.0076 - 0.026	2.6E-02	1.7E+01 C*	NO	DLBSL
110-82-7	Cyclohexane	0.0076 - 0.026	2.6E-02	1.2E+02 NS	NO	DLBSL
124-48-1	Dibromochloromethane	0.0076 - 0.026	2.6E-02	6.8E+00 C	NO	DLBSL
75-71-8	Dichlorodifluoromethane (Freon-12)	0.0076 - 0.026	2.6E-02	1.8E+02 N	NO	DLBSL
100-41-4	Ethylbenzene	0.0076 - 0.026	2.6E-02	5.4E+01 C	NO	DLBSL
98-82-8	Isopropylbenzene	0.0076 - 0.026	2.6E-02	2.7E+02 NS	NO	DLBSL
m&pXYLENE	m- and p-Xylene	0.015 - 0.052	5.2E-02	2.6E+02 NS	NO	DLBSL
79-20-9	Methyl acetate	0.0076 - 0.026	2.6E-02	2.9E+04 NS	NO	DLBSL
108-87-2	Methylcyclohexane	0.0076 - 0.026	2.6E-02	NA	NO	NTX
75-09-2	Methylene chloride	0.0076 - 0.026	2.6E-02	1.1E+02 C	NO	DLBSL
1634-04-4	Methyl-tert-butyl ether (MTBE)	0.0076 - 0.026	2.6E-02	4.3E+02 C	NO	DLBSL
95-47-6	o-Xylene	0.0076 - 0.026	2.6E-02	4.3E+02 NS	NO	DLBSL
100-42-5	Styrene	0.0076 - 0.026	2.6E-02	8.7E+02 NS	NO	DLBSL
127-18-4	Tetrachloroethene	0.0076 - 0.026	2.6E-02	5.5E+00 C	NO	DLBSL
108-88-3	Toluene	0.0076 - 0.026	2.6E-02	8.2E+02 NS	NO	DLBSL
10061-02-6	trans-1,3-Dichloropropene	0.0076 - 0.026	2.6E-02	1.7E+01 C*	NO	DLBSL
79-01-6	Trichloroethene	0.0076 - 0.026	2.6E-02	2.8E+01 C	NO	DLBSL
75-69-4	Trichlorofluoromethane(Freon-11)	0.0076 - 0.026	2.6E-02	7.9E+02 N	NO	DLBSL
75-01-4	Vinyl chloride	0.0076 - 0.026	2.6E-02	6.0E-01 C	NO	DLBSL
1330-20-7	Xylene, total	0.0076 - 0.026	2.6E-02	2.6E+02 NS	NO	DLBSL
121-14-2	2,4-Dinitrotoluene	0.5 - 0.5	5.0E-01	1.6E+01 C*	NO	DLBSL
99-35-4	1,3,5-Trinitrobenzene	0.5 - 0.5	5.0E-01	2.2E+03 N	NO	DLBSL
99-65-0	1,3-Dinitrobenzene	0.5 - 0.5	5.0E-01	6.1E+00 N	NO	DLBSL

Table 11.3
Comparison of Non-Detected Chemicals to Regional Screening Levels
Sediment at Site 6, Yorktown

CAS Number	Chemical	Range of Detection Limits mg/kg	Concentration Used for Screening mg/kg	Screening [1] Toxicity Value mg/kg	Exceeds Screening Value?	Rationale for Contaminant Deletion or Selection
118-96-7	2,4,6-Trinitrotoluene	0.5 - 0.5	5.0E-01	3.6E+01 C**	NO	DLBSL
35572-78-2	2-Amino-4,6-dinitrotoluene	0.5 - 0.5	5.0E-01	1.5E+02 N	NO	DLBSL
618-87-1	3,5-Dinitroaniline	0.5 - 0.5	5.0E-01	6.1E+00 N	NO	DLBSL
99-08-1	3-Nitrotoluene	0.5 - 0.5	5.0E-01	6.1E+00 N	NO	DLBSL
19406-51-0	4-Amino-2,6-dinitrotoluene	0.5 - 0.5	5.0E-01	1.5E+02 N	NO	DLBSL
99-99-0	4-Nitrotoluene	0.5 - 0.5	5.0E-01	2.4E+02 C**	NO	DLBSL
2691-41-0	HMX	0.5 - 0.5	5.0E-01	3.9E+03 N	NO	DLBSL
78-11-5	PETN	2.5 - 2.5	2.5E+00	NA	NO	NTX
121-82-4	RDX	0.5 - 0.5	5.0E-01	5.5E+01 C*	NO	DLBSL
7440-36-0	Antimony	1.4 - 3	3.0E+00	3.1E+01 N	NO	DLBSL
7440-41-7	Beryllium	0.72 - 1.5	1.5E+00	1.6E+02 N	NO	DLBSL
7440-43-9	Cadmium	0.72 - 1.5	1.5E+00	7.0E+01 N	NO	DLBSL
7440-22-4	Silver	0.72 - 1.5	1.5E+00	3.9E+02 N	NO	DLBSL
7440-28-0	Thallium	1.4 - 3	3.0E+00	NA	NO	NTX

[1]Oak Ridge National Laboratory (ORNL). Dec. 2009. Regional Screening Levels for Chemical Contaminants at Superfund Sites. [Online]. Available: http://epa-prgs.ornl.gov/chemicals/index.shtml. Ten times the adjusted (nc RSLs adjusted by dividing by 10) residential soil RSLs.

RSL value for 1,4-dichlorobenzene used as surrogate for 1,3-dichlorobenzene

RSL value for Methyl Isobutyl Ketone (4-methyl-2-pentanone) used as surrogate for 2-Hexanone.

RSL value for total xylene used as a surrogate for m- and p-xylene

RSL value for Mercury (inorganic salts) used as surrogate for mercury.

RSL value for 1,3-dichloropropene used as a surrogate for cis-1,3-dichloropropene and trans-1,3-dichloropropene.

Definitions:
C = Carcinogenic
C* = Carcinogenic, N screening level < 100x C screening level, C screening value used as screening level
C** = N screening level < 10x C screening level, therefore N screening value/10 used as screening level
N = Noncarcinogenic
NTX = No Toxicity Information
DLBSL = Detection limit below screening level
DLASL = Detection limit above screening level
mg/kg = milligrams per kilogram

Appendix G
Grading and Planting Plan, Site 6

Final
Grading and Planting Plan
Site 6, Explosives-Contaminated Wastewater Impoundment
Yorktown Naval Weapons Station
Yorktown, Virginia

Prepared for:

DEPARTMENT OF THE NAVY
Contract No. N62470-02-D-3260

Naval Facilities Engineering Command
Mid-Atlantic
9742 Maryland Avenue
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Prepared by:

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June 2005
Shaw Project No. 101577

Introduction

This grading and planting plan was developed to restore the site after the removal of approximately 8,000 CY of explosives-contaminated soil.

Restoration Plan Goals

The goal of this project is the restoration of approximately 0.83 acres of marsh as part of the remediation efforts at the Yorktown Naval Weapons Station, Figures 1 and 2.

The proposed restoration will restore ecological functions lost when the area was filled with explosives-contaminated sediments, which were removed and treated by Shaw. The project area remains the outlet for storm water runoff from the adjacent watershed. This continuing connection with the watershed is an important aspect of the proposed restoration because it will provide the opportunity for water quality improvements that would not otherwise be possible.

Wetland Design Narrative

The size of the restored site will be approximately 0.83 acres but will be limited by the excavation area. The new marsh is intended to encompass a complex of two different plant communities (Table 1). These are based primarily on the depth of water ranging up to 12-inches and the tolerance of the plants for brackish water. The plantings were selected with the assistance of the NOAA Virginia Fisheries Restoration Office and the U.S. Fish and Wildlife Agency and consist of vegetation that is common to the southern part of Virginia.

Table 1

Planting Area	Botanical Name	Common Name	Comments
1	Spartina alternaflora	Smooth Cord Grass	Plant @ 2’ O.C.
2	Spartina patens	Salt Meadow Cord Grass	Plant @ 2’ O.C.
	Myrica cerifera	Wax Myrtle	
	Panicum virgatum	Switchgrass	
3	Quepcus phellos	Willow Oak	Space 10’ O.C.
	Diospyros virginiana	Persimmon	Space 10’ O.C.
	Aronia arbutifolia	Red chokecherry	Space 10’ O.C.
	Virburnum detatum	Arrowwood virburnum	Space 10’ O.C.
	Panicum virgatum	Switchgrass	Plant @ 2’ O.C.
		Annual rye	2 lb - Hand cast
4	Taxodium distichom	Bald Cypress	Space @ 10’ O.C.
	Nyssa sylvatica	Black Gum	Space @ 10’ O.C.
	Sambuscus canadiens	Elderberry	Space @ 10’ O.C.
	Clethra alnifolia	Sweet pepper bush	Space @ 10’ O.C.
		Annual rye	2 lb - Hand cast
	Specialized wetland mix for obligate facultative wetlands (Ernst Seed Co.)	ERNXX-137	1lb - Hand cast

The planting locations are shown on Figure 2. The area of these components will depend on actual field conditions, but will be in similar proportion to those shown on Figure 2.

Construction Narrative

Currently the site is backfilled with clay, which will be removed to a depth of 12 to 24-inches below the current grade. The excavated soil will be returned to the borrow site. Once the clay soil is removed, the area will be backfilled with treated soils to the grades 6 to 12-inches below the grades shown on Figure 2. The material will be placed in a single lift and compaction will be incidental to the placement. A single 6-12 inch layer of imported sandy soil will then be placed to form the planting bed. A surveyor will verify the grades of the placed soil prior to the installation of the plants.

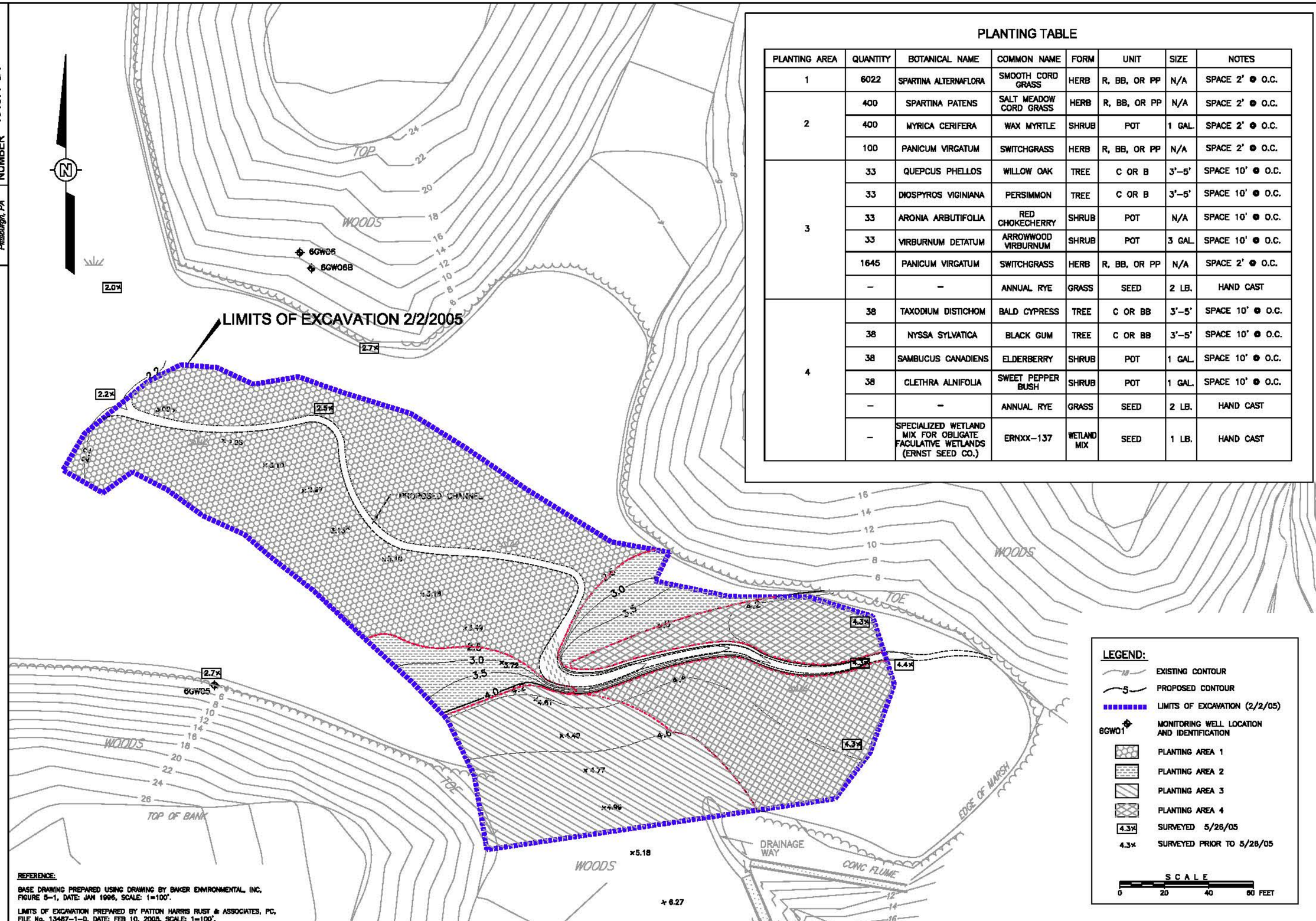
Planting will be in accordance with Table 1 and Figure 2. Spartina alternaflora, Spartina patens, and Panicum virgatum will fill the major portion of the planting area, with approximately 8,100 plants being installed on 2-foot centers. An upland area will be created along the southern and northern edges of the wetland. Planting will be in accordance with Table 1 for Area 4 and will consist of Bald Cypress, Black Gum, Elderberry, Sweet Pepper Bush, and a specialized wetland mix will be broadcast to provide some additional diversity.

Maintenance and Monitoring

The elevations selected for the marsh are designed to help minimize the invasion potential of invasive species such as Phragmites by ensuring that the majority of the basin is below mean high water. Even with these efforts the site will have to be monitored on a continuing basis to ensure *Phragmites* does not become established. However, it can be effectively controlled with herbicides and by physical removal while at early colonization densities. Quarterly monitoring will be performed during the first two growing seasons when the Spartina alternaflora, Spartina patens, and Panicum virgatum are being established.

OFFICE Pittsburgh, PA

DRAWING NUMBER 101577-D1



PLANTING TABLE

PLANTING AREA	QUANTITY	BOTANICAL NAME	COMMON NAME	FORM	UNIT	SIZE	NOTES
1	6022	SPARTINA ALTERNAFLORA	SMOOTH CORD GRASS	HERB	R, BB, OR PP	N/A	SPACE 2' @ O.C.
2	400	SPARTINA PATENS	SALT MEADOW CORD GRASS	HERB	R, BB, OR PP	N/A	SPACE 2' @ O.C.
	400	MYRICA CERIFERA	WAX MYRTLE	SHRUB	POT	1 GAL.	SPACE 2' @ O.C.
	100	PANICUM VIRGATUM	SWITCHGRASS	HERB	R, BB, OR PP	N/A	SPACE 2' @ O.C.
3	33	QUEPCUS PHELLOS	WILLOW OAK	TREE	C OR B	3'–5'	SPACE 10' @ O.C.
	33	DIOSPYROS VIGINIANA	PERSIMMON	TREE	C OR B	3'–5'	SPACE 10' @ O.C.
	33	ARONIA ARBUTIFOLIA	RED CHOKECHERRY	SHRUB	POT	N/A	SPACE 10' @ O.C.
	33	VIRBURNUM DETATUM	ARROWWOOD VIRBURNUM	SHRUB	POT	3 GAL.	SPACE 10' @ O.C.
	1645	PANICUM VIRGATUM	SWITCHGRASS	HERB	R, BB, OR PP	N/A	SPACE 2' @ O.C.
	–	–	ANNUAL RYE	GRASS	SEED	2 LB.	HAND CAST
4	38	TAXODIUM DISTICHOM	BALD CYPRESS	TREE	C OR BB	3'–5'	SPACE 10' @ O.C.
	38	NYSSA SYLVATICA	BLACK GUM	TREE	C OR BB	3'–5'	SPACE 10' @ O.C.
	38	SAMBUCUS CANADIENS	ELDERBERRY	SHRUB	POT	1 GAL.	SPACE 10' @ O.C.
	38	CLETHRA ALNIFOLIA	SWEET PEPPER BUSH	SHRUB	POT	1 GAL.	SPACE 10' @ O.C.
	–	–	ANNUAL RYE	GRASS	SEED	2 LB.	HAND CAST
	–	SPECIALIZED WETLAND MIX FOR OBLIGATE FACULATIVE WETLANDS (ERNST SEED CO.)	ERNXX–137	WETLAND MIX	SEED	1 LB.	HAND CAST

REFERENCE:

BASE DRAWING PREPARED USING DRAWING BY BAKER ENVIRONMENTAL, INC, FIGURE 5–1, DATE: JAN 1996, SCALE: 1=100'.

LIMITS OF EXCAVATION PREPARED BY PATTON HARRIS RUST & ASSOCIATES, PC, FILE No. 13457–1–D, DATE: FEB 10, 2005, SCALE: 1=100'.

REVISIONS

REV	DATE	BY	CH'K'D	APP'VD	DESCRIPTION/ISSUE

Shaw Environmental, Inc.

DESIGNED BY J.R.Folsom 2/17/05
DRAWN BY B.B.Folsom 2/17/05
CHECKED BY J.R.Folsom 2/17/05
APPROVED BY

NAVFAC Naval Facilities Engineering Command Atlantic Division

NAVAL WEAPONS STATION YORKTOWN, VIRGINIA
SITE 6 IMPOUNDMENT AREA - WETLAND RESTORATION
PLANTING PLAN

SCALE: AS SHOWN
SIZE: D
DELIVERY ORDER NO. ---
CONSTR. CONTRACT NO. N62470–02–D–3260
NAVFAC DRAWING NO. ---
SHEET I.D. –

Xref: Site 6-GRAY
Image: NAVFAC

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Plot Date/Time: 05/26/05 08:30am
Plotted by: burnsdefds.ocomnor