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DRAFT DECISION DOCUMENT 80TH DIVISION RESERVE SITE FORT STORY VA
4/1/2009
MALCOLM PIRNIE

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80th Division Reserve Site

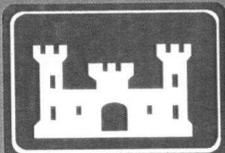
**Installation Restoration Program
Fort Story, Virginia**

**U. S. Army Garrison
Fort Eustis, Virginia**

And

**U.S. Army Corps of Engineers
Baltimore District**

April 2009



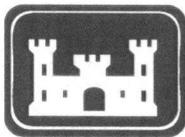
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**DECISION DOCUMENT
80TH DIVISION RESERVE SITE**

**INSTALLATION RESTORATION PROGRAM
FORT STORY, VIRGINIA**

PREPARED FOR:



**U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT
BALTIMORE, MARYLAND**

AND

**U.S. ARMY GARRISON
FORT EUSTIS, VIRGINIA**



**CONTRACT DACA31-00-D-0043
DELIVERY ORDER NO. 24**

APRIL 2009

**MALCOLM PIRNIE, INC.
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This Decision Document (DD) has been modeled after the United States Environmental Protection Agency (USEPA) Record of Decision format for CERCLA National Priorities List (NPL) sites. The EPA guidance document entitled *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*, USEPA 540-R-98-031, July 1999, has been utilized for preparation of this document.

1.1 SITE NAME AND LOCATION

This DD has been prepared for the 80th Division Reserve site (hereafter referred to as the 80th DRS) at Fort Story, Virginia. The 80th DRS is located north of DaNang Road and east of Hospital Road. The 80th DRS contains a 50-foot by 70-foot concrete pad surrounded by asphalt on the west, south, and east sides. The north side is bordered by sand that was used as the DRS staging area. Several of the downgradient site monitoring wells are located within a fenced area associated with the Small Arms Testing and Evaluation Compound.

1.2 STATEMENT OF BASIS AND PURPOSE

This DD presents the Selected Remedy (Land Use Controls [LUCs] with Monitoring) for groundwater at the 80th DRS on the U.S. Army installation designated as Fort Story, Virginia. The Selected Remedy (LUCs with Monitoring) was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The U.S. Army, as owner/operator and the "Lead Agency" (terms that are defined in the NCP) prepared this decision in consultation with the Virginia Department of Environmental Quality (VDEQ) as a "Support Agency". The Army selects the remedy in accordance with CERCLA in consultation with and concurrence by VDEQ.

1.3 ASSESSMENT OF THE SITE

The Lead Agency has determined that LUCs with Monitoring are necessary to protect public health and welfare or the environment because two volatile organic compounds (VOCs), trichloroethene (TCE) and tetrachloroethene (PCE), exceeded USEPA Maximum Contaminant Levels (MCLs). The LUCs apply to potential future groundwater use at the site as a drinking water source and disallow residential use of the Site.

1.4 DESCRIPTION OF SELECTED REMEDY

LUCs with Monitoring are necessary at the 80th DRS because TCE and PCE have exceeded USEPA MCLs. However, at present, there is limited contamination detected at the site, trends

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indicate that concentrations in groundwater are decreasing due to natural mechanisms, and the results of the baseline risk assessment indicate that there are no potentially exposed populations.

Because there is no current or planned use of groundwater as a potable water source and with the implementation of the LUCs for groundwater use, monitoring of the groundwater for VOCs is only required once every five years as part of the five-year review on the status of the site. If the VOC concentrations are below the MCLs based on the results of the monitoring event, then a confirmation sampling event will be conducted between three and six months following the initial monitoring event to confirm that all VOC concentrations are below MCLs. If confirmed, then removal of the LUCs will be warranted. If MCL exceedences remain, then the LUCs will remain in-place and the monitoring will continue every five years until VOC concentrations decrease to below the MCLs. The monitoring program will include sampling and VOC analysis of groundwater samples from six monitoring wells (MW-2 [upgradient], MW-5, MW-6, MW-7, MW-8, and MW-9). VOCs have historically only been detected in the listed wells (except for the upgradient well MW-2) with MCL exceedences only noted in two wells (MW-8 during the 2002 sampling event and MW-9 in the 2004 sampling event).

1.5 STATUTORY DETERMINATIONS

As part of the selection of the Selected Remedy the nine criteria required by the National Contingency Plan (NCP) were evaluated prior to the selection and recommendation of the selected remedial action. The assessment found that the Selected Remedy (LUCs with Monitoring) is protective of human health and the environment, complies with federal and state requirements that are applicable and appropriate to the remedial action, is cost-effective, uses permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, is effective in the short-term, satisfies the preference for treatment as a principal element of the remedy, and has been accepted by the State and the local public as a valid and reasonable remedy.

As part of the Remedial Investigation and selection of the remedy, the federal and state regulations were reviewed to identify applicable and appropriate and/or relevant requirements (ARARs). ARARs are site and project specific requirements that are legally enforceable. The ARARs developed included chemical-specific, location-specific, and action-specific requirements. The selected remedy for the Site complies with the identified ARARs and has been approved by the Lead Agency and VDEQ.

Based on the conclusions (as stated in Section 1.3 above) of the risk assessment provided in the *Final Remedial Investigation (RI) Report*, dated October 2008, prepared by Malcolm Pirnie, Inc., LUCs with Monitoring are necessary to ensure protection of human health and the environment in case of future use of site groundwater as a drinking water source. If MCL exceedences are

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noted in the subsequent sampling events at the site, a five-year review will be warranted because of the presence of hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure. If no MCL exceedences are noted and verified through confirmation sampling, a five-year review will not be required.

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AUTHORIZING SIGNATURE

Andrew W. Bowes
Colonel, U.S. Army
Garrison Commander

Date

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2.1 SITE NAME, LOCATION, AND DESCRIPTION

This DD presents the U.S. Army's selected remedy (LUCs with Monitoring) for the 80th DRS at Fort Story, Virginia. The site is known as Site 06 (FTSTY-15) – 80th DRS. The Fort Story USEPA ID Number is VA6210020875 and the RCRA USEPA ID Number is VA1213720815. The Compliance Cleanup account, Operation and Maintenance Army (OMA), is the source for investigation and cleanup funds for this site.

Fort Story is located in southeastern Virginia within the city of Virginia Beach, Virginia. Fort Story occupies an area of approximately 1,451 acres and is situated on Cape Henry which roughly divides the waters of the Chesapeake Bay to the north and the Atlantic Ocean to the east.

Fort Story currently trains Army personnel in amphibious and Logistics Over-the-Shore (LOTS) operations. Fort Story is the only available facility that has the necessary natural terrain features and beaches, sand, surf, variable tide conditions (bay and ocean) and hinterlands, all of which are normally experienced by amphibious and LOTS operations. In addition, Fort Story contains beach training areas, tactical training areas and a series of trails throughout the installation. The deep water ship anchorage, off-road driving areas and soil of sufficient bearing strength for the heavy vehicles are indispensable in amphibious training, LOTS training and the testing of new equipment, doctrines and techniques. From 1914 until the present, activities at Fort Story have included the following:

- Utilization as a coastal artillery garrison
- Headquarters of the Harbor Defense Command
- Location of a convalescent hospital during World War II
- Amphibious operations training facility

The 80th DRS area contains a 50-foot by 70-foot concrete pad surrounded by asphalt on the west, south, and east sides. The north side is bordered by sand.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

This section summarizes the site history and site investigations. No federal or state enforcement activities have been undertaken at this site.

2.2.1 Site History

The north side is bordered by sand that was used as the 80th DRS staging area. Over time, this staging area apparently became contaminated with by-products (primarily petroleum products) of the washing and maintenance operations. A 1,000 gallon used oil underground storage tank

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(UST), 250-gallon antifreeze aboveground storage tank (AST), and a former drum storage area were located west of the wash pad.

2.2.2 Previous Investigations

A summary of previous investigations conducted at the site is provided below.

PREVIOUS INVESTIGATIONS		
Investigation	Description	Results
Montgomery Watson Site Assessment Report (May 1994)	Site assessment to evaluate potential soil contamination in the former staging area.	Elevated levels of total petroleum hydrocarbons (TPH) were detected in site soils.
Environmental Restoration Company Site Characterization Report (June 1994)	Site characterization conducted to determine presence of contamination at site.	Two areas of soil contamination noted with TCE and PCE detected in monitoring well MW-4.
IT Corporation Removal Action Report (August 1995)	Removal action conducted to remediate soils.	Treated TPH- and PCE-contaminated soils off site via thermal desorption.
Malcolm Pirnie RI Report (October 2008)	Performance of an RI including the collection of soil and groundwater samples	Numerous VOCs, semivolatile organic compounds (SVOCs), and metals detected in site media. No human health or ecological risk identified for the site.

Final Site Assessment Report, Montgomery-Watson, May 1994

Montgomery Watson conducted an investigation from February to May 1994 to evaluate the presence of possible soil contamination in the former staging area of the site and around the existing concrete pad. Elevated levels of TPH – heavy oils and lead were detected in the shallow soils adjacent to the former drum storage area, tank area, and wash pad area. Based on the limited vertical extent of contaminated soil, excavation of soil and off-site treatment and disposal was feasible.

Site Characterization Report, Environmental Restoration Company (ERC), June 1994

ERC conducted a site characterization of the site in 1994. Based on the site characterization,

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two areas of soil contamination and one area of groundwater contamination were identified at the site. TPH and lead contamination was discovered in the shallow soil of the Lighterage Amphibious Resupply Cargo (LARC) staging area. These contaminants are most likely the result of bilge water discharge and sandblasting. TCE and PCE were detected in monitoring well MW-4.

Removal Action Final Report, IT Corporation, August 1995.

From April through July 1995, IT Corporation completed a removal action of contaminated soil from the LARC staging area and from the tank area. Approximately 3,500 tons of TPH-contaminated soils (from Area A) and 30 tons of PCE-contaminated soil (from Area B) were excavated from the site and transported off-site for thermal desorption. Significant quantities of contaminated soils remain in both areas. The areas were backfilled with clean fill.

Remedial Investigation Report Malcolm Pirnie, Inc., October 2008

Malcolm Pirnie completed a RI in 2008 with submission of the Final RI Report in October 2008. A summary of the nature and extent of contaminant and the risk assessment will be presented in Section 2.5 and Section 2.7, respectively.

2.3 COMMUNITY PARTICIPATION

The Malcolm Pirnie Final RI report (dated October 2008) and this DD for the 80th DRS at Fort Story, Virginia are available to the public at the Fort Eustis Environmental and Natural Resource Division office, the Fort Story Library, and the City of Virginia Beach Oceanfront Area Library.

The NCP requires public participation in the selection of a remedy for a site. The notice for public comment to this DD was placed in the Virginia Pilot on May 4, 2009 and in The Wheel on May 7, 2009 with the 30-day public comment period ending on June 6, 2009.

2.4 SCOPE AND ROLE OF RESPONSE ACTION

The Remedial Action Objectives (RAOs) include:

1. The protection of human health by controlling and eliminating current and potential exposure pathways between the impacted groundwater and populations. This includes the prevention of receptors from contact, ingestion, or other use of the impacted groundwater.

2. The long term monitoring of the natural attenuation of the organic constituents impacting the ground water (TCE and PCE) to determine when the impacts have been reduced to background concentrations.

The RAOs will be archived by the institution of LUCs with Monitoring. LUCs with Monitoring are necessary at the 80th DRS because TCE and PCE have exceeded USEPA MCLs. Because there is no current or planned use of groundwater as a potable water source and with the implementation of the LUCs for groundwater use, monitoring of the groundwater for VOCs is only required once every five years as part of the five-year review on the status of the site.

If the VOC concentrations are below the MCLs based on the results of the monitoring event, then a confirmation sampling event will be conducted between three and six months following the initial monitoring event to confirm that all VOC concentrations are below MCLs. If confirmed, then removal of the LUCs will be warranted. If MCL exceedences remain, then the LUCs will remain in-place and the monitoring will continue every five years until VOC concentrations decrease to below the MCLs.

2.5 SITE CHARACTERISTICS

The following section provides an overview of the site's physical characteristics, such as geology, and describes the nature and extent of site contamination.

2.5.1 Physical Site Characteristics

Surface Topography and Hydrology

The 80th DRS is at an elevation of approximately 10 feet above mean sea level (amsl) and is generally devoid of topographic features. The asphalt area on the south half of the site is flat. The north half of the site is located in a sandy flat area with low sand ridges. A summary of the surface hydrology across the site is presented as follows:

- Surface water flow on the wash pad flows northward to the three catch basins located on the northern edge of the wash pad.
- Flow across the other asphalted areas of the site is radial in nature with surface water flowing off of the asphalt and onto the ground surface.
- Minimal lateral flow movement downgradient of the asphalted areas exists because of the

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presence of large sandy areas that allow significant infiltration rather than surface flow.

- No drainage ditches or streams were present in the site area.

Geology and Hydrogeology

Geology and hydrogeology data were obtained through current drilling activities and from previous investigations. Five permanent monitoring wells (MW-7, MW-8, MW-9, MW-10, and MW-11) and five borings from the current investigation along with five existing permanent monitoring wells (MW-1, MW-2, MW-3, MW-5, and MW-6), two piezocone borings, and nine soil borings from the previous investigations were reviewed to evaluate the site geology. The site is underlain by sand deposits of the Kennon Formation and Columbia Group of Holocene and Pleistocene in age respectively. The upper forty feet of sediments were described with respect to lithology and sedimentary features during drilling activities (current and previous). Based on lithology, the sediments can be separated into four layers as follows:

DEPTH (feet below land surface [BLS])	UNIFIED SOIL CLASSIFICATION SYSTEM SOIL TYPE	DESCRIPTION
0 - 2	SM-SP	Medium sand to silty sand.
2 - 18	SP	Medium sand, rounded to subrounded, well sorted, with trace amounts heavy minerals, grading to coarse to very coarse sand at approximately 18 feet BLS.
18 - 40	SW	Interlayers of coarse to very coarse sand and gravel, heavy minerals, well sorted within layers, rounded to subrounded.
40 - 46	SM	Sharp contact with overlying unit. Fine sand to silty sand, some shell fragments, non-cohesive, non-plastic.

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Previous investigations reported that the water table elevations ranged from 8.5 feet National Geodetic Vertical Datum (NGVD) in the northern portion of the site to less than 8.3 feet NGVD in the southern portion. The water table was encountered approximately six feet BLS during drilling activities. Based on water elevations measured in the on-site wells, the water table occurs at 6.9 to 7.0 feet NGVD of 1929. Based on measured water levels from January 20, 2003, groundwater flows from the south to the north. Tidal influence tests were conducted at the 80th DRS through the measurement of water levels in all site wells during three events, one during high tide, one during low tide, and one during the transitional period between high and low tide. The purpose of these tests was to assess if there is any influence on the shallow water table aquifer due to the daily tides of the proximate Chesapeake Bay and Atlantic Ocean. Little variation in the water levels was noted during this tidal period. Groundwater flow direction remained constant.

Archaeological and Historical Information

In April 2003, the Secretary of the Interior determined that Fort Story was a historic district based on the installation's Cold War and World War II significance. All structures built prior to 1978 and associated archaeological deposits are components of this district.

2.5.2 Remedial Investigation Sampling Activities

The following sections outline the specific RI field activities performed at the 80th DRS at Fort Story. The initial field investigation, including monitoring well installations and sampling and soil sampling, was conducted in December 2002 and January 2003. A second groundwater sampling event, including the installation of two additional monitoring wells (MW-12 and MW-13), was conducted in June 2004 to further assess the nature and extent of groundwater contamination. Former monitoring well MW-4 is no longer active, and was not sampled during this investigation. A sampling location map is presented as **Figure 2-1**.

2.5.3 Nature and Extent of Contamination

Analytical data for the field investigations are presented in **Tables 2-1 through 2-6**.

Soil

A summary of the nature and extent of soil contamination is provided below. The soil detects above the USEPA RBCs are presented on **Figure 2-2**.

VOCs

- Acetone, methylene chloride, and toluene were detected in more than 85 percent of the surface and subsurface soil samples collected at the site. Many other VOCs including carbon disulfide, 1,4-dichlorobenzene, trans 1,2-dichloroethene (1,2-DCE), ethylbenzene,

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methyl isobutyl ketone (MIBK), PCE, trichlorofluoromethane, 1,1,2-trichloro-1,2,2-trifluoroethane, and xylenes were detected frequently (in greater than 20 percent of the samples) throughout the site. Concentrations of these compounds varied from surface to deeper depths with no apparent trends.

- The lateral extent of VOC contamination was not defined because VOCs were detected in all of the surface soil samples collected in this area. However, concentrations were several orders of magnitude lower than USEPA screening criteria.

SVOCs

- SVOCs were detected in all soil samples collected from the site. The primary SVOCs detected were polynuclear aromatic hydrocarbons (PAHs), which are constituents of petroleum hydrocarbons. Bis(2-ethylhexyl)phthalate was the only SVOC detected in two of the soil borings, while only bis(2-ethylhexyl)phthalate, fluorene, phenanthrene, and pyrene were detected one of the borings indicating minimal downgradient migration of SVOCs in soils since these 3 borings are located directly downgradient of the former UST and AST, asphalted, and drum storage areas of the site.
- Although PAHs were detected throughout the site, the areas with the highest concentrations were centered on the former UST/AST area and the former drum storage area with lower concentrations in areas generally upgradient of these areas.

Pesticides

- Endrin ketone, DDT, and endosulfan sulfate were detected in site soil samples. Aldrin was the only pesticide detected above the USEPA RBC for residential soils (38 micrograms per kilogram ($\mu\text{g}/\text{kg}$) in one sample on-site at a concentration of 73 $\mu\text{g}/\text{kg}$. Pesticides were detected in all soil samples at the site with little variation in location (upgradient, on-site, or downgradient) or with depth.
- Due to past widespread application of these pesticides, their presence at these low concentrations is expected at the site.

Polychlorinated Biphenyls (PCBs)

- Aroclor-1260 was the only PCB detected at the site and it was detected in only 2 of 30 soil samples at concentrations lower than USEPA RBCs. Due to infrequent detections, there is no pattern to its distribution at the site.

Inorganics

- Metals were detected in soil samples throughout the site as would be expected since the majority of them are naturally occurring in various concentrations. Only three metals

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(arsenic, iron, and vanadium) concentrations exceeded USEPA RBCs for residential soils, none exceeded industrial RBCs. Arsenic exceeded the RBC in 8 of 30 samples and iron exceeded the RBC in 6 of 30 samples while vanadium exceeded the RBC in 3 of 30 samples

- In general, concentrations of metals typically were similar for soil samples collected from the surface and subsurface depths.

Groundwater

A summary of the nature and extent of groundwater contamination is provided below. The groundwater detects above the USEPA RBCs and MCLs are presented on **Figure 2-3**. Monitoring wells MW-12 and MW-13 were only sampled for VOCs/SVOCs, but the collected samples contained no detections.

VOCs/SVOCs

- Several VOCs and bis(2-ethylhexyl)phthalate were detected at concentrations greater than the USEPA RBCs at the site.
- Other than toluene, which was detected in 10 wells at the site, no other organics were detected in wells that are upgradient/cross-gradient of the former AST/UST and drum storage areas.
- The highest concentrations of organics were detected in the central portions of the site near the former UST/AST (assumed source area) and drum area, with some organics detected in downgradient wells.
- The lateral distribution of PCE, TCE, and cis 1,2-DCE implies these compounds have migrated with groundwater from the former UST area downgradient to the north/northwest in that these compounds have been detected in downgradient wells MW-5, MW-6, and MW-9.
- Bis(2-ethylhexyl)phthalate was detected in only one well on-site and its apparent distribution is limited to the former UST area.

Inorganics

Although most metals were detected in total and dissolved phase throughout the site, the distribution pattern will focus on those metals that exceeded USEPA RBCs and/or MCLs. Monitoring wells MW-12 and MW-13 were not sampled for inorganic constituents.

- Total antimony concentrations are consistent across the site with detections in 8 of 10 wells across the site. The concentrations in the upgradient wells are greater than the

concentrations in the central-site and downgradient wells. This indicates that the antimony concentrations detected at the site are probably naturally occurring levels and not influenced by the past operations at the former UST/AST and drum storage areas.

- Total arsenic was detected in only 3 of 10 wells with concentrations greatest in one central-site well and in two downgradient wells. Based on the low concentrations and infrequent detection, no discernible pattern is present and it is unclear if these concentrations are solely related to natural levels or are influenced by former site activities.
- Total iron was detected in all 10 wells with concentrations greatest in one central-site well (MW-7) and in three downgradient wells (MW-9, MW-10, and MW-11). These concentrations were the only total iron detects above the USEPA RBC. Dissolved iron was also detected in all 10 wells with concentrations greatest in the same wells as the total iron concentrations. The highest concentrations of total and dissolved iron were present in downgradient wells MW-10 and MW-11 which are the least-impacted wells in relation to identified contaminants of concern for the site (VOCs and SVOCs from the former UST and drum storage areas). Based on location of the highest iron concentrations (downgradient wells), it is unclear if these concentrations are solely related to natural levels or are influenced by former site activities.
- Total and dissolved manganese were detected in all 10 wells with concentrations greatest in two downgradient wells. These concentrations were the only total or dissolved manganese detects above the USEPA RBC. The highest concentrations of total and dissolved manganese were present in two downgradient wells, which are the least-impacted wells in relation to identified contaminants of concern for the site (VOCs and SVOCs from the former UST and drum storage areas). Based on location of the highest manganese concentrations (downgradient wells), it is unclear if these concentrations are solely related to natural levels or are influenced by former site activities.
- Total vanadium concentrations are fairly consistent across the site with detections in 9 of 10 wells across the site. The concentrations (1.2 to 4.2 µg/L) in the upgradient wells (MW-1 and MW-2) are consistent with the concentrations (1.1 to 6.3 µg/L) in the central-site wells (MW-3, MW-7, and MW-8) and greater than the concentrations (0.65 to 2.3 µg/L) in the downgradient wells. This indicates that the vanadium concentrations detected at the site are probably naturally occurring levels and not influenced by the past operations at the former UST/AST and drum storage areas.

2.5.4 Fate and Transport of Contaminants

A summary of the fate and transport for the site contaminants is provided in the following sections.

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Transport Pathways

The possible transport pathways identified for the site that are considered to be minor pathways due to mitigating site conditions or contaminant properties include the following:

- Volatilization of VOCs from shallow groundwater to shallow soils. The VOCs in site groundwater are all in the low (7.5 or less) µg/L range; therefore, would not be a significant contributor of vapor when viewed with respect to COPC mass.
- Migration, enhanced by infiltrating rainwater, of SVOCs, pesticides, and metals through the vadose zone to groundwater. SVOCs, pesticides, and inorganics strongly adsorb to soil/sediments and are not readily leached to groundwater due to their low aqueous solubility.
- Migration of VOCs, pesticides, SVOCs and inorganics adsorbed to sediment/soil and transported along with windblown dust/sand. Ground cover at the site should limit the amount of transport by wind.
- Leaching of soil contaminants to surface water. Due to the low solubility of pesticides, SVOCs, and most inorganics, it is very unlikely that these compounds would be readily leached from soil.

The major transport pathways identified for the site include:

- Migration of SVOCs, pesticides, and inorganics adsorbed to soil/sediments by storm runoff into the wetlands and beach/coastal areas.
- Bulk transport, dispersion, or diffusion of VOCs from soil to groundwater.

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

This section provides a characterization of current and future site uses, and identifies the potentially exposed populations at or near the site with regard to the current situation and potential future conditions.

Current Situation

While Fort Story has numerous residential dwellings, there are no residential sites within one mile of the 80th DRS. Additionally; the land use in the immediate vicinity is best classified as industrial usage.

Soil

The majority of the site is covered with asphalt pavement; however, smaller portions of the site consist of bare sandy soil. Thus, there is a potential for a site worker to contact soil; therefore, in keeping with the conservative nature of this document, the Fort Story Site Worker will be

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retained for further evaluation. Furthermore, it will be assumed that the worker will be exposed to surface soils only in order to reflect current site conditions.

During construction, both surface and subsurface soils would be disturbed exposing the construction worker to the constituents present in the soils; therefore, a construction worker exposure scenario will be retained for further evaluation.

Groundwater

At present, there are no potable wells or irrigation wells in the immediate vicinity of the site. There are several off-post residential communities that may be utilizing groundwater as potable water; however, they are located over 1 mile west of the site and groundwater at the site flows northward towards the Chesapeake Bay. Under the current situation, because there are no nearby drinking water wells and groundwater does not appear to be impacting any surface water, exposure to contaminated groundwater from residential populations will not be evaluated.

Because there are no buildings located over the groundwater plume, vapor intrusion is not a reasonable exposure scenario at this site and will not be evaluated further for current land use.

During construction, there is the potential for exposing the construction worker to the constituents present in the groundwater; therefore, a construction worker exposure scenario will be retained for further evaluation.

Future Land Use

Based on master planning issues for Fort Story, as well as its unique location and subsequent training environments, the facility is expected to remain government property. The potential for future development of the land as commercial, residential, or recreational properties is not expected as the base will remain open and the area will continue to be identified as industrial usage; however, if development of the site occurred in the future, commercial/industrial worker exposure to groundwater would be possible via inhalation only, where indirect exposure to VOC vapors could occur through migration from groundwater into structures. This scenario has been retained to maintain a conservative approach. If land use conditions change in the future, possible exposure scenarios (e.g., residential exposure to soils and groundwater if residential development was planned) will be re-evaluated.

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2.7 SUMMARY OF SITE RISKS

Human Health Risk Assessment

Identification of Chemicals of Potential Concern (COPCs)

As shown in **Tables 2-7 through 2-9**, COPC identified during the hazard identification of the 80th DRS media because of their exceedences of USEPA screening criteria (e.g., MCLs or RBCs) include the following:

MEDIA	COPC
Soil	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene Aldrin Arsenic Iron Vanadium
Groundwater	Cis 1,2-Dichloroethene Tetrachloroethene Trichloroethene Bis(2-ethylhexyl)phthalate Total Antimony Total and Dissolved Arsenic Total and Dissolved Iron Total and Dissolved Manganese Total and Dissolved Vanadium

Exposure Assessment Summary

This section describes the complete exposure pathways by which the potential receptors may be exposed to the COPCs in the soil, surface water, and groundwater via a specific exposure route.

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Potential Receptors and Exposure Pathways Summary

The following potentially exposed populations to the contaminated media at the site have been identified:

- Fort Story Site Workers exposure (adults only) to contaminated surface soils during Site maintenance. Identified as a current and future land use population.
- Construction worker exposure (adults only) to contaminated surface/subsurface soils. Identified as a current and future land use population.
- Construction worker exposure (adults only) to contaminated groundwater. Identified as a current and future land use population.
- Commercial/industrial worker exposure to vapors in structures from groundwater via volatilization.

However, for this HHRA, as the exposure scenarios are so similar, site industrial workers and Fort Story site workers will be considered as the same receptor population. This scenario will consider exposure to surface soils at the site only. As the COPC exposure concentrations in surface soils are greater than, or equal to, the exposure concentrations of the combined surface/subsurface data set, this is a conservative assumption.

Because only industrial exposure scenarios (site and construction worker) are to be evaluated for site soils, several originally identified COPCs including indeno(1,2,3-cd)pyrene, aldrin, arsenic, iron, and vanadium will not be retained because they only exceeded the residential soil RBCs and did not exceed the industrial soil RBCs.

Exposure Pathways

The potential exposure pathways of concern at the site include:

Industrial Site Workers (Adults)

- Ingestion of chemicals in surface/subsurface soil
- Dermal contact with chemicals in surface/subsurface soil
- Inhalation of particulates from surface/subsurface soil

Construction Workers (Adults)

- Ingestion of chemicals in surface/subsurface soil
- Dermal contact with chemicals in surface/subsurface soil

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- Inhalation of particulates from surface/subsurface soil
- Ingestion of chemicals in groundwater
- Dermal contact with chemicals in groundwater
- Inhalation of volatile chemicals in groundwater

Commercial/Industrial Workers (Adults) in Structures

- Inhalation of volatile chemicals in groundwater

Risk Characterization

Potential non-cancer health effects are presented. Carcinogenic risks are similarly presented for the COPC, for each pathway of concern and for each potentially exposed population. The cumulative impact of exposure from the various pathways evaluated is estimated for each potentially exposed population.

Fort Story/Future Industrial Site Workers

Non-cancer Effects

Table 2-10 presents the chemical-specific hazard quotients for each pathway involving Fort Story and potential future industrial; site worker exposures to surface soils. In addition, the total pathway hazard, also referred to as the hazard index, which is the sum of the chemical-specific hazard quotients for each pathway, is presented in **Table 2-10**. The total exposure hazard incorporates all the appropriate exposure pathways for the Fort Eustis/Industrial site workers.

To assess the overall potential for adverse non-cancer effects posed by the chemicals of potential concern, the hazard quotients for the chemicals are summed for each of the pathways through which on-site exposure may occur.

As shown in **Table 2-10**, the four PAHs do not have identified non-cancer effects; therefore, no hazard index was calculated.

Cancer Risks

Table 2-11 presents estimated chemical-specific and total pathway cancer risks calculated for ingestion and inhalation of, and dermal contact with chemicals in surface soils. The estimated total exposure cancer risks are also noted in this table, incorporating all the appropriate exposure pathways for Fort Story/Future Industrial site workers.

The estimated cancer risk for ingestion of, dermal contact with, and inhalation of chemicals in soils is about 3.29 in one hundred thousand (3.29×10^{-5}). This value is at the mid range of the

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USEPA Superfund target risk level of 10^{-4} to 10^{-6} . Exposure to (ingestion, dermal contact, and inhalation) soil with benzo(a)pyrene accounts for approximately 70% of the risk for site workers.

Construction Workers

Non-cancer Effects

Table 2-12 presents the chemical-specific hazard quotients for each pathway involving construction workers exposures to soils (surface/subsurface combined) and groundwater. In addition, the total pathway hazard, also referred to as the hazard index, which is the sum of the chemical-specific hazard quotients for each pathway, is presented in **Table 2-12**. The total exposure hazard incorporates all the appropriate exposure pathways for the construction workers. To assess the overall potential for adverse non-cancer effects posed by the chemicals of potential concern, the hazard quotients for the chemicals are summed for each of the pathways through which on-site exposure may occur.

As shown in **Table 2-12**, the total exposure hazard index for all exposures associated with soil and groundwater is 0.275, which is less than the criterion of 1.0. Thus, adverse non-carcinogen health effects in this population are unlikely.

Cancer Risks

Table 2-13 presents estimated chemical-specific and total pathway cancer risks calculated for ingestion and inhalation of, and dermal contact with chemicals in soils (surface/subsurface combined) and groundwater. The estimated total exposure cancer risks are also noted in this table, incorporating all the appropriate exposure pathways for construction workers. The estimated cancer risk is about 1.02 in one hundred thousand (1.02×10^{-5}). This value is at the mid-range of the USEPA Superfund target risk level of 10^{-4} to 10^{-6} . The summary of risk is presented as follows:

- Approximately 15% of the risk is associated with soil exposure (Total Soil Exposure Risk = 1.49×10^{-6}) with approximately 71% of the soil exposure risk associated with exposure (ingestion, dermal, and inhalation) to benzo(a)pyrene.
- Approximately 85% of the risk is associated with groundwater exposure (Total Groundwater Exposure Risk = 8.76×10^{-6}) with approximately 93% of the groundwater exposure risk associated with inhalation of TCE vapors from groundwater.

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Commercial/Industrial Workers

Non-cancer Effects

The total exposure hazard incorporates all the appropriate exposure pathways for the commercial/industrial workers. To assess the overall potential for adverse non-cancer effects posed by the chemicals of potential concern, the hazard quotients for the chemicals are summed for the inhalation pathway only through which on-site exposure may occur.

The total exposure hazard index for inhalation of VOCs in structures associated with groundwater is 0.02, which is much less than the criterion of 1.0. Thus, adverse non-carcinogen health effects in this population are unlikely.

Cancer Risks

The estimated cancer risk is about 3.1 in one hundred thousand (3.1×10^{-5}). Approximately 90 percent of the risk is associated with TCE concentrations in groundwater. This value is at the mid-range of the USEPA Superfund target risk level of 10^{-4} to 10^{-6} . It should be noted that the 95th upper confidence limit (UCL) concentrations for these three VOCs are all less than their respective MCL.

Human Health Risk Assessment Summary

A summary of the non-carcinogenic and carcinogenic risk is provided in the following table:

Human Health Risk Assessment Summary					
Exposed Population	Exposure Pathway	Non-Cancer Effects		Cancer Effects	
		PHI	TEHI	TPR	TER
Fort Story/Future Industrial Site Workers	Ingestion of Soil	N/A	N/A	1.77×10^{-5}	3.29×10^{-5}
	Dermal Contact with Soil	N/A		1.52×10^{-5}	
	Inhalation of Soil Particulates	N/A		4.90×10^{-10}	
Commercial/Industrial Workers inside Structures	Inhalation of Vapors from GW	0.02	0.02	3.1×10^{-5}	3.1×10^{-5}
Construction Workers	Ingestion of Soil	N/A	0.275	5.70×10^{-7}	1.02×10^{-5}
	Dermal Contact with Soil	N/A		9.16×10^{-7}	

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Human Health Risk Assessment Summary					
Exposed Population	Exposure Pathway	Non-Cancer Effects		Cancer Effects	
		PHI	TEHI	TPR	TER
	Inhalation of Soil Particulates	N/A		1.59x10 ⁻⁹	
	Ingestion of Groundwater	0.00512		1.60x10 ⁻⁸	
	Dermal Contact with GW	0.104		9.45x10 ⁻⁸	
	Inhalation of Vapors from GW	0.165		8.65x10 ⁻⁶	

For Non-Carcinogens:

PHI – Pathway Hazard Index indicates non-carcinogenic risk for specific exposure pathways

TEHI – Total Exposure Hazard Index indicates non-carcinogenic risk for exposed population

Criterion of 1.0 is used to determine if adverse health effects are possible or unlikely.

N/A – Not applicable because non-cancer effects were not identified for this population.

For Carcinogens:

TPR – Total Pathway Risk indicates carcinogenic risk for specific exposure pathways

TER – Total Exposure Risk indicates carcinogenic risk for exposed population

USEPA Remediation goal of 10⁻⁴ to 10⁻⁶ used to assess carcinogenic risk.

Bolded and underlined text indicates value exceeds the non-cancer criterion of 1.0 or above the carcinogenic risk level of 10⁻⁴.

Finally, the above summary of potentially exposed populations was based on a conservative approach rather than a more reasonable estimation of risk. Additional factors that affect the conclusions drawn from the risk characterization results include the following:

- The exceedences of the industrial soil RBCs for the PAHs is limited to a small portion of the site in the interior area near the former location of the storage tanks.
- The majority of the risk associated with construction and potential future commercial/industrial worker exposure to contaminated groundwater is associated with TCE; however, the 95th UCL utilized in the risk calculations was only 2.5 µg/L which is lower than the USEPA MCL of 5 µg/L. The estimated cancer risk associated with the other groundwater COPCs combined was in the 10⁻⁷ range.
- The cancer risk established for the site workers (3.29x10⁻⁵), commercial/industrial workers (3.1x10⁻⁵) and construction workers (1.02x10⁻⁵) is within the USEPA Superfund target risk level range. As quoted in Section 300.430(e)(2)(i)(A)(2) of the NCP, “for known or suspected carcinogens, acceptable exposure levels are generally concentrations that represent an excess upper bound lifetime cancer risk to an individual of between 10⁻⁴ and 10⁻⁶”; therefore, the concentrations in soil and groundwater fall within the acceptable range based on carcinogenic risk.

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Based on the limited soil area impacted by the PAHs, the relatively low concentration of TCE (and other constituents) in groundwater, and the calculated cancer risks for site and construction workers which is within the acceptable range per NCP guidance, no additional action is warranted at the site based on the potentially exposed populations.

Ecological Risk Assessment (ERA)

Identification of COPCs

This section presents lists of chemicals detected in the soil samples that are considered COPCs. Subsurface data was considered as the existence of burrowing animals and the possibility of other turbation of soil could lead to a potentially complete pathway for biota to be exposed to the subsurface soils. Groundwater was not addressed in this assessment, as it does not have a complete exposure pathway at the site. The compounds identified as COPCs are considered to be those with the greatest potential significance to wildlife receptors.

Chemicals were retained for consideration as a COPC if they met any of the following criteria:

- 1) The detected or estimated media concentration exceeded the selected screening level.
- 2) Undetected parameters ("U"-flagged) were retained as COPCs if $\frac{1}{2}$ the method detection limit (MDL) was greater than the screening value. Consistent with laboratory protocol, the MDL was estimated as 10 percent of the PQL (practical quantification limit), which is the value in the laboratory reports and flagged with the "U".
- 3) Parameters that had no screening values were retained for consideration as final COPCs.

VOCs

A total of 10 volatile organic compounds (VOCs) were retained as COPCs. Of these compounds only PCE had USEPA Region III Biological Technical Assistance Group (BTAG) or National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Table (SQuiRT) screening values available. The remaining compounds were retained as COPCs in accordance to the above referenced protocol. These included: 1,1,2-trichloro-1,2,2-trifluoethane, 2-eexanone, carbon disulfide, acetone, 1,3-dichlorobenzene, 2-butanone (MEK), dichlorodifluoromethane, trichlorofluoromethane and methyl acetate.

SVOCs

A total of 24 semi-volatile compounds were retained as COPCs. Many of these COPCs had USEPA BTAG or NOAA SQuiRT screening values including: acenaphthene, acenaphthylene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene,

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indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene and pyrene. The remaining compounds were retained as COCPs in accordance with protocol, these COCPs were: 1,1'-biphenyl, 2,4-trinitrotoluene, 2,6-dinitrotoluene, 2-methylnaphthalene, 3,3'-dichlorobenzidine, bis(2-ethylhexyl)phthalate, carbazole, and di-n-octylphthalate

Metals

Six metals were retained as COCPs: aluminum, calcium, chromium, lead, potassium and sodium. Three of these did not have screening values but were retained according to the above-referenced protocol.

Pesticides

There were no pesticides with BTAG or SQuiRT screening values that were detected with Environmental Effects Quotient (EEQ) values equal to or greater than one. Those pesticides that were detected that have no screening values were retained as per above. The pesticides that were retained as COCPs include: alpha-BHC, beta-BHC, delta-BHC, endosulfan I, endosulfan II, endosulfan sulfate, endrin aldehyde, endrin ketone and heptachlor.

PCBs

Aroclor-1260 was detected, but was not found to be above the BTAG screening level and thus was not retained as a COCP.

Table 2-14 presents a comparison of soils data to USEPA screening criteria.

Exposure Assessment

The following summarizes the ecological setting, target receptors, and potential exposure pathways.

Ecological Setting and Species Summary

Following is a brief description of the endpoint species initially identified as potential species of concern for this assessment. The descriptions include the habitat and dietary requirements for each of these species. These receptors were identified based on the potential for exposure (i.e., potential site presence and food habitats) and susceptibility to adverse effects of the site contaminants. Also listed are the primary metabolic assumptions used for developing the exposure estimates (e.g., body weight and food consumption). A comparison of the typical home range for these species as compared to the 0.20 acre area of ecological concern for the site will be made to assess the acceptability of the initially identified species.

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- **American Robin (*Turdus migratorius*).** The American robin occurs throughout most of the continental United States during the breeding season and winters in the southern half of the United States and in Mexico and Central America. Robins forage on the ground in open areas, along habitat edges, or the edges of streams. They forage by hopping along the ground in search of ground-dwelling invertebrates and by searching for fruit and foliage-dwelling insects in shrubs and low tree branches. Foraging home ranges of 0.4 to 2.0 acres have been measured.
- **Red-tailed Hawk (*Buteo jamaciencis*).** The Red-tailed Hawk is the most widespread and familiar member of the American buteos (large soaring hawks) and represents avian predators. It is a year round resident in Virginia and they nest in the month of March in tall trees. The red-tailed hawk is usually found in grasslands or marsh- shrub habitats, but is a very adaptable bird, being equally at home in deserts and forests, and at varying heights above sea level. The Red-tailed Hawk is an opportunistic hunter. As an avian predator, the red-tailed hawk has a large home range varying from approximately 148 acres to over 6,000 acres.
- **Short-tailed Shrew (*Blarina brevicauda*).** The short-tailed shrew ranges throughout the north-central and eastern United States and into southern Canada. They occur in a wide variety of habitats, preferring those that are cool, moist and areas with abundant cover. The short-tailed shrew is primarily carnivorous, concentrating on insects, earthworms, slugs, and snails when available and represents mammalian omnivores. However, it will also eat plants, fungi, millipedes, and small mammals.

The home range for shrews varies significantly in different portions of the country and times of year. The home range can vary from 0.07 acre to over 5.4 acres. The *Wildlife Exposure Handbook* states that the shrew's home range can vary from 0.07 acres to 0.17 acres during non-breeding winter months in highly productive habitats. In lower productivity habitats, the shrew's home range in non-breeding winter months can vary between 0.25 and 0.54 acres. The year-round, average home range for shrews was reported to be approximately 1 acre. The small site size, sandy soil type, and minimal vegetative under story at the 80th DRS site would be consistent with a higher estimated year-round home range. Evaluations of area use factors (AUFs) in this risk assessment will assume approximately 0.5 acres for the shrew's year-round home range. The AUF associated with incidental soil ingestion was 1.0 assuming that a shrew could locate its borough within the impacted 0.2 acres.

- **Eastern Cottontail (*Sylvilagus floridanus*).** The eastern cottontail is the most widely distributed of the medium-sized rabbits. During the growing season, cottontails eat herbaceous plants (e.g., grasses, clover, timothy, alfalfa). During the winter in areas where herbaceous plants are not available, they consume woody vines, shrubs, and trees (e.g., birch, maple, apple). The typical home range for this species has been

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identified at 3 to 20 acres.

- **Grey Fox (*Urocyon cinereoargenteus*).** Grey foxes are present throughout the United States, except in the northwest and northern prairies. Grey foxes prey on small mammals but will also eat insects, fruits, acorns, birds, and eggs. The home range of this species varies between 141 and 8,447 acres.

For the initial analysis, all selected receptor species were assumed to feed in the contaminated areas year-round 100 percent of the time and ingest incidental amounts of contaminated soils. This is especially conservative since the site is very small at 0.2 acres and relatively unattractive to ecological receptors due to location, surrounding habitat, and large portion of the site being capped by concrete and asphalt. The robin is migratory and actually only spends 75 percent of the year in this region. Exposure from ingestion and diet was calculated for COPCs in each media and for each receptor. These exposure estimates were summed together to obtain the total exposure. An additional analysis was performed to look at actual potential area use by receptor species as described in USEPA guidelines. AUFs were derived for each species by taking the ratio of the species-specific home ranges and the impacted portion of the 80th DRS site (0.2 acres). Home ranges for individual species were based on lower-end estimates presented in the Wildlife Factors Handbook.

Exposure Pathways

Several ecologically relevant migration pathways for contaminants exist at the 80th DRS. The media of concern on this site is the soil. Types of receptors and the exposure routes are summarized below:

- root uptake from contaminated soil by plants;
- contact and absorption, incidental ingestion, and feeding on contaminated soils by invertebrates;
- incidental ingestion of contaminated soil by wildlife; and
- bioaccumulation from vegetation or animal prey at the base of the food chain by wildlife.

Based on these pathways, the following general classes of ecological receptors potentially might be exposed to contaminants at the 80th DRS.

- Uptake of COPCs by terrestrial plant and invertebrates from site soil;
- Birds that forage or nest on the site;
- Small insectivorous mammals;
- Small herbivorous mammals that feed at the site; and
- Other higher trophic level birds and mammals (e.g., carnivores) that feed within the vicinity of the 80th DRS.

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Ecological Effects Assessment

Ecological Effects Summaries

Toxicity profiles summarizing the potential adverse ecological effects of each COPC were derived from the literature, and are included as Appendix I of the Final RI Report. The profiles provide discussions of the acute and chronic toxicity of the COPCs to plants and animals. Effects on growth, reproduction, and survival of terrestrial species are given, where available. Also included are significant fate and transport characteristics of the chemicals. These summaries, in addition to established criteria, were used to identify the critical effects of COPCs.

Toxicity Reference Values

Toxicity reference values (TRVs) were derived for plants, soil/sediment invertebrates and other wildlife as described below.

Terrestrial Plants and Invertebrates - The TRVs used to evaluate the toxicity of a given COPC to terrestrial plants and soil invertebrates were derived from the available literature. Values were applied to both soil and sediment since toxicity values for sediment were unavailable. Phytotoxic values represent the lowest values from toxicity studies conducted in the field or in greenhouse and growth chamber settings. Soil TRVs based on microbial heterotroph and earthworm toxicity represent data provided by toxicity studies in the field or in laboratory settings.

Wildlife - TRVs for mammals and birds chosen as receptor species were derived based on methodology presented by Opresko et al. This general method is based on USEPA methodology for deriving human toxicity values from animal data. In this method, experimentally derived No Observed Adverse Effect Levels (NOAELs) or Lowest Observed Adverse Effect Levels (LOAELs) are used to estimate NOAELs for wildlife by adjusting the dose according to differences in body size. NOAELs for laboratory species, obtained from the literature, were converted to receptor species NOAELs as follows:

$$\text{NOAEL}_r = \text{NOAEL}_t (bw_t / bw_r)^{-1}$$

Where: NOAEL_r = receptor species NOAEL

NOAEL_t = test species NOAEL

bw_r = receptor body weight

bw_t = test species body weight

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The test species and receptor species NOAELs for the 80th DRS are provided for each of the COPC in **Table 2-15**.

Ecological Risk Characterization

Hazard Quotients (HQs)

Summaries of the HQs for avian and mammalian species are summarized in **Table 2-16** and **Table 2-17**, respectively. Based on the standard exposure assessment assumptions, aluminum was the only COPC with a hazard quotient above 1 for both avian species, while a total of nine COPCs had HQ values above 1 in mammalian species. Eight SVOC compounds including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene, had HQs ranging from 2 to 7 in shrews, foxes, and rabbits. Aluminum had HQ values ranging from 1,000 in foxes to 3,000 in rabbits. As previously stated, these HQ values were derived using the extremely conservative assumption that 100 percent of each receptor's life would be spent on the 0.2-acre 80th DRS site, which is highly unlikely to occur.

AUFs were applied to exposure equations in the form of fraction intake (FR) in each of the exposure equations. **Table 2-18** and **Table 2-19** provide revised HQ values for avian and mammalian species, respectively, following the application of species specific AUFs. No COPCs were identified for the red-tailed hawk, while aluminum remained a COPC for the American robin. For mammalian species, aluminum also remained as a COPC for the short-tailed shrew, the gray fox, and the eastern cottontail; however, only pyrene remained as a COPC among the SVOCs in the shrew with an HQ value of 3. The risk of exposure to aluminum and pyrene in site soil to ecological receptors will be discussed in more detail in the Uncertainty Analysis.

Summary of Risks

This screening level ecological risk assessment (SLERA) was completed in accordance with USEPA guidelines. The results of the SLERA and conclusions for the COPCs are summarized below.

A total of 21 VOCs were detected, 12 of these compounds had screening values. Only one compound, PCE, had an EEQ of greater than one based on BTAG criteria. Nine compounds were retained as COPCs due to lack of screening values. There were no TRVs available to assess direct contact with plants or invertebrates for these initial ten COPCs. Five TRVs were available for mammalian receptors: 2-butanone, acetone, carbon disulfide, PCE, and trichlorofluoromethane. There was no avian TRVs available for VOCs. No hazard quotients for VOCs indicate these compounds present a potential risk to ecological receptors at the 80th DRS site.

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All 24 SVOCs were initially retained as COPCs, either for exceeding the BTAG values or because they lacked TRV criteria. Seven of these SVOCs are PAHs and two are phthalates. Of the initial COPCs, 16 that had screening criteria available were retained. This included seven PAHs. No phthalates were retained. Of the initial COPCs, only fluorene had a non-BTAG TRV available. Though fluorene did not exceed the invertebrate TRV, it was retained as a COPC for exceeding the BTAG screening value.

Mammalian TRV data was available for 11 of the COPCs. Avian TRV data was only available for bis(2-Ethylhexyl)phthalate. After completing the initial exposure assessment, eight COPCs were determined to have a HQ above one for mammalian species: Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, phenanthrene and pyrene. No COPCs were found to have an HQ greater than one for avian species. AUFs were used to refine the risk characterization. Only one COPC, pyrene, was identified for shrew populations. The HQ for pyrene in shrews was 3 using a NOAEL-based TRV. Due to the minimal NOAEL-based HQ for one indicator species, pyrene is not considered to pose a risk to ecological receptors at the 80th DRS and has not been retained as a COPC in this SLERA

Six metals were initially retained as COPCs. Three of these did not have screening values. Mammalian and avian TRV data was available for three COPC metals. After completing the initial exposure assessment, aluminum was found to have an HQ equal to or greater than one for all avian and mammalian species. Aluminum toxicity in a soil matrix is related to its solubility; therefore, soil pH. For sites with soil pH above 5.5, USEPA guidelines do not recommend including aluminum as a COPC for ecological receptors. The soil conditions at the 80th DRS are consistent with elimination of aluminum as a COPC.

Uncertainties

Major areas of uncertainty are presented below along with analysis as to whether potential risk is likely to be overestimated or underestimated.

- Uncertainties associated with the exposure assessment include the use of the maximum concentration for individual COPCs as the source concentration term, the aerial extent of site soil impacted by COPCs, and routes of exposure. The use of the maximum concentration will lead to an overestimation of potential risk.
- Aerial extents of soil impacted by COPCs only extend over approximately 0.2 acres of the site. COPCs are not equally co-distributed and exposure to individual COPCs are likely to be in very localized areas within the impacted area. The assumption that all receptors will be simultaneously exposed to the maximum concentration of all COPCs is likely to lead to an overestimation of potential risk.

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- COPC concentrations in prey were assumed to be equal to the maximum reported concentrations in site soil samples. The assumption, therefore, that prey concentrations are equal to the maximum reported soil concentrations will likely overestimate risk to predator populations.
- The TRVs used in this risk assessment are based on NOAEL endpoints. The application of NOAEL TRVs ensures that concentrations of COPCs associated with HQs below unity are protective of ecological receptors; however, the approach does not account for the uncertainty of whether an adverse effect is likely to occur at HQ values above unity. A risk assessment that focuses on HQ associated with NOAEL TRVs would lead to overestimation of risk.
- The only HQ values significantly above unity are for aluminum for several species. The concentrations of aluminum in soil samples range up to 8,500 milligrams per kilogram (mg/kg). These concentrations are consistent with naturally occurring concentrations in many soils types. The USEPA recognized that due to the ubiquitous nature of aluminum, the variability of aluminum concentrations in naturally occurring soil, and the availability of conservative screening benchmarks, aluminum is often identified as a COPC for ecological risk assessments. In soil, aluminum toxicity is directly related to the soluble fraction. The USEPA states that comparisons of total aluminum concentrations to soluble-based screening values are inappropriate. Insoluble aluminum oxides are consistently less toxic than soluble forms; therefore, potential ecological risks are based on pH. The USEPA states that aluminum should only be identified as a COPC at sites where soil pH is less than 5.5. As a result, the site-specific risk from aluminum in soil at the 80th DRS site are significantly overestimated. In keeping with USEPA guidelines for ecological risk assessments for aluminum, aluminum is not considered a COPC at the 80th DRS site.

Ecological Significance

The assessment endpoints at the 80th DRS site do not include vegetation or soil invertebrates due to the small size of the impacted site, the lack of endangered species on the site, and the type of soil and vegetation on the site. The appropriate evaluation of risk posed by COPCs in soil at this site was to determine the risk posed to the overall ecosystem at Fort Story. The assessment endpoints for this SLERA; therefore, were to evaluate: 1) Uptake of COPCs into food chain, 2) survival and reproduction of upper-trophic avian species, and 3) survival and reproduction of upper-trophic mammalian species.

Based on the results of this SLERA, COPCs in soil at the 80th DRS site are not likely to accumulate in the food chain of the ecosystem surrounding the site and, therefore, do not pose a risk to upper-trophic avian or mammalian species. There is ample habitat at Fort Story

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surrounding the site to maintain a healthy, diverse ecosystem. As a result, the management goal for the 80th DRS site of protecting the ecosystem surrounding the site by evaluating uptake of COPCs from soil into the food chain can be achieved without establishing COPCs based on ecological endpoints.

Based on the combination of the low HQ value for pyrene, the elimination of aluminum as a COPC, and a conservative risk assessment approach, the conclusion of this risk characterization is that concentrations of COPCs in soils at the 80th DRS do not pose a risk to upper trophic receptors. There is no evidence that remediation decisions should be based on existing adverse effects to ecological receptors. No further ecological risk assessment is recommended for this site.

2.8 SELECTION OF THE REMEDIAL ACTION

The remedial action (LUC with Monitoring) was selected based on the lack of significant risk to the current and future likely potential receptors, and the evidence of naturally declining concentrations of TCE and PCE in the Site groundwater. Based on these findings no Feasibility Study was recommended. This recommendation was approved by the Lead Agency and VDEQ. Therefore, no Alternatives Analysis was conducted.

Though a Feasibility Study was not published, the nine criteria required by the NCP were evaluated prior to the selection and recommendation of the selected remedial action as described in Section 1.5.

The selected remedial action, LUCs with Monitoring fulfills the goals of the RAOs and has been evaluated using the nine criteria for selecting remedial actions as required by the NCP.

2.9 DOCUMENTATION OF SIGNIFICANT CHANGES

No significant changes have occurred since submission of the *Final RI Report*, dated October 2008, that included the conclusions of the baseline risk assessment that provides the basis for the LUCs with Monitoring remedy required at the 80th DRS.

Part 3 – Responsiveness Summary

DECISION DOCUMENT

DRAFT FINAL

This section details significant Public and State comments, subsequent responses, as well as resolutions regarding general concerns about the site.

3.1 VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY COMMENTS

VDEQ has reviewed and commented on the site activities and documents prepared for the site. Their comments have been incorporated into the documents, and they concur with the Selected Remedy.

3.2 PUBLIC COMMENTS

Public comment period is pending.

The following terms are presented in the DD.

AMSL	Above Mean Sea Level
AST	Aboveground Storage Tank
AUFs	Area Use Factors
BLS	Below Land Surface
BW	Body Weight
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
DCE	Dichloroethene
DD	Decision Document
DRS	Division Reserve Site
EEQ	Environmental Effects Quotient
FI	Fraction Intake
FTSTY	Fort Story
HQ	Hazard Quotient
LARC	Lightridge Amphibious Resupply Cargo
LOAEL	Lowest Observed Adverse Effect Level
LOTS	Logistics Over-the-Shore
LUCs	Land Use Controls
MCLs	Maximum Contaminant Levels
MDL	Method Detection Limit
MEK	Methyl Ethyl Ketone
MIBK	Methyl Isobutyl Ketone
Mg/kg	Milligrams per kilogram
µg/kg	Micrograms per kilogram
µg/L	Micrograms per Liter
Mg/L	Milligrams per Liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observed Adverse Effect Level
NPL	National Priorities List
PCBs	Polychlorinated biphenyls
PAHs	Polynuclear Aromatic Hydrocarbons
PCE	Tetrachloroethene
PQL	Practical Quantitation Limit
RI	Remedial Investigation
SARA	Superfund Amendments and Reauthorization Act
SLERA	Screening-Level Ecological Risk Assessment
SquiRT	Screening Quick Reference Table
SVOCs	Semivolatile Organic Compounds
TCE	Trichloroethene
TPH	Total Petroleum Hydrocarbon
TRVs	Toxicity Reference Values
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank

PART 4 – GLOSSARY
DECISION DOCUMENT

DRAFT FINAL

UCL	Upper Confidence Limit
VOCs	Volatile Organic Compounds
VDEQ	Virginia Department of Environmental Quality

**Decision Document
80th Division Reserve Site
Fort Story, Virginia**



TABLE 2-1
SOIL RESULTS - VOLATILE ORGANICS (December 2002)
80th Division Reserve Site, Fort Story, VA

Compound	Soil Results (ug/kg)									EPA RBCs ⁽¹⁾	
	Boring MW-7			Boring MW-8			Boring MW-9			Industrial Soils	Residential Soils
	0 to 6 in.	1 to 3 ft	4 to 6 ft	0 to 6 in.	1 to 3 ft	4 to 6 ft	0 to 6 in.	1 to 3 ft	4 to 6 ft		
Acetone	18 B	14 JB	19 B	15 J	14 JB	28 B	44	28	5 J	92,000,000	7,000,000
2-Butanone (MEK)	16 U	17 U	16 U	16 U	16 U	14 U	16 U	14 U	16 U	61,000,000	4,700,000
Carbon Disulfide	1 JB	0.8 JB	0.9 JB	6 U	6 U	0.9 JB	2 J	6 U	6 U	10,000,000	780,000
Chlorobenzene	0.5 J	0.5 J	0.5 J	6 U	0.5 J	0.5 J	6 U	6 U	6 U	2,000,000	160,000
1,2-Dichlorobenzene	0.3 J	7 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	9,200,000	700,000
1,3-Dichlorobenzene	0.5 J	7 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	310,000	23,000
1,4-Dichlorobenzene	0.5 J	0.4 J	0.3 J	6 U	0.4 J	0.3 J	6 U	6 U	6 U	120,000	27,000
Dichlorodifluoromethane	7 U	7 U	0.6 J	0.6 JB	6 U	6 U	6 U	6 U	6 U	20,000,000	1,600,000
1,2-Dichloroethane	7 U	7 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	31,000	7,000
Trans-1,2-dichloroethene	0.9 JB	0.7 JB	0.8 JB	6 U	0.8 JB	0.7 JB	6 U	6 U	6 U	2,000,000	160,000
Ethylbenzene	0.7 J	0.5 J	6 U	6 U	0.7 J	0.6 J	6 U	6 U	6 U	10,000,000	780,000
2-Hexanone	16 U	17 U	16 U	16 U	16 U	14 U	16 U	14 U	16 U	4,100,000	310,000
Methyl acetate	7 U	7 U	6 U	6 U	6 U	6 U	6 J	6 U	6 U	100,000,000	7,800,000
Methylene chloride	6 JB	6 JB	7 B	5 JB	8 B	7 B	4 JB	4 JB	4 JB	380,000	85,000
4-Methyl-2-pentanone	10 J	7 J	10 J	16 U	14 J	8 J	16 U	14 U	16 U	---	---
Tetrachloroethene	9 B	2 JB	5 JB	29	6 U	3 JB	6 U	6 U	6 U	5,300	1,200
Toluene	3 JB	3 JB	3 JB	2 JB	4 JB	3 JB	0.7 JB	0.7 JB	0.9 JB	8,200,000	630,000
Trichloroethene	0.8 JB	1 JB	0.7 JB	6 U	0.7 JB	0.7 JB	6 U	6 U	6 U	7,200	1,600
Trichlorofluoromethane	2 JB	2 JB	2 JB	6 U	2 JB	2 JB	6 U	6 U	6 U	31,000,000	2,300,000
1,1,2-trichloro-1,2,2-trifluoethane	2 J	1 J	2 J	2 JB	2 J	1 J	6 U	6 U	6 U	3,100,000,000	230,000,000
Xylene (total)	7 J	5 J	5 J	1 J	6 J	5 J	19 U	17 U	19 U	20,000,000	1,600,000

Notes:

(1) EPA Risk-based Concentrations for Industrial and Residential Soils (Oct 2006)
 (Non-carcinogens adjusted to a Hazard Index of 0.1)

Data Qualifiers:

- U Not detected
- J Analyte present. Reported value between detection and quantitation limits
- B Analyte present in associated method blank

550 Bolded text indicates analyte was detected.

**TABLE 2-1
SOIL RESULTS - VOLATILE ORGANICS (December 2002)
80th Division Reserve Site, Fort Story, VA**

Compound	Soil Results (ug/kg)									EPA RBCs ⁽¹⁾	
	Boring MW-10			Boring MW-11			Boring SB-1			Industrial Soils	Residential Soils
	0 to 6 in.	1 to 3 ft	4 to 6 ft	0 to 6 in.	1 to 3 ft	4 to 6 ft	0 to 6 in.	1 to 3 ft	4 to 6 ft		
Acetone	57 B	16 J	18	14 U	25	16 B	13 U	9 J	16	92,000,000	7,000,000
2-butanone (MEK)	5 J	16 U	16 U	14 U	16 U	15 U	13 U	13 U	16 U	61,000,000	4,700,000
Carbon Disulfide	1 JB	6 J	2 J	5 U	1 J	6 U	5 U	5 U	6 U	10,000,000	780,000
Chlorobenzene	9 U	7 U	7 U	5 U	6 U	6 U	5 U	5 U	6 U	2,000,000	160,000
1,2-Dichlorobenzene	9 U	7 U	7 U	5 U	6 U	6 U	5 U	5 U	6 U	9,200,000	700,000
1,3-Dichlorobenzene	9 U	7 U	7 U	5 U	6 U	6 U	5 U	5 U	6 U	310,000	23,000
1,4-Dichlorobenzene	0.4 J	7 U	7 U	5 U	6 U	6 U	5 U	5 U	6 U	120,000	27,000
Dichlorodifluoromethane	9 U	7 U	7 U	5 U	6 U	0.6 J	5 U	5 U	6 U	20,000,000	1,600,000
1,2-Dichloroethane	3 J	7 U	7 U	5 U	6 U	6 U	5 U	5 U	6 U	31,000	7,000
Trans-1,2-dichloroethene	1 JB	7 U	7 U	5 U	6 U	0.9 JB	5 U	5 U	6 U	2,000,000	160,000
Ethylbenzene	0.7 J	7 U	7 U	5 U	6 U	0.6 J	5 U	5 U	6 U	10,000,000	780,000
2-Hexanone	230	16 U	16 U	14 U	16 U	15 U	13 U	13 U	16 U	4,100,000	310,000
Methyl acetate	69	7 U	7 U	5 U	6 U	6 U	5 U	5 U	6 U	100,000,000	7,800,000
Methylene chloride	10 B	6 JB	7 B	4 JB	7 B	8 B	8 B	6 B	6 JB	380,000	85,000
4-Methyl-2-pentanone	11 J	16 U	5 J	14 U	16 U	16	13 U	13 U	16 U	---	---
Tetrachloroethene	9 U	7 U	7 U	5 U	6 U	2 JB	5 U	5 U	6 U	5,300	1,200
Toluene	4 JB	2 JB	3 JB	1 JB	2 JB	3 JB	0.8 JB	2 JB	2 JB	8,200,000	630,000
Trichloroethene	1 JB	7 U	7 U	5 U	6 U	0.5 JB	5 U	5 U	6 U	7,200	1,600
Trichlorofluoromethane	3 JB	7 U	0.8 J	5 U	6 U	2 JB	5 U	5 U	6 U	31,000,000	2,300,000
1,1,2-trichloro-1,2,2-trifluoethane	2 J	2 JB	1 JB	5 U	1 JB	2 J	5 U	5 U	6 U	3,100,000,000	230,000,000
Xylene (total)	6 J	3 J	2 J	16 U	1 J	7 J	15 U	16 U	19 U	20,000,000	1,600,000

Notes:

(1) EPA Risk-based Concentrations for Industrial and Residential Soils (Oct 2006)
(Non-carcinogens adjusted to a Hazard Index of 0.1)

550 Bolded text indicates analyte was detected.

Data Qualifiers:

- U Not detected
- J Analyte present. Reported value between detection and quantitation limits
- B Analyte present in associated method blank

**TABLE 2-1
SOIL RESULTS - VOLATILE ORGANICS (December 2002)
80th Division Reserve Site, Fort Story, VA**

Compound	Soil Results (ug/kg)												EPA RBCs ⁽¹⁾	
	Boring SB-2			Boring SB-3			Boring SB-4			Boring SB-5			Ind. Soils	Res. Soils
	0 to 6 in.	1 to 3 ft	4 to 6 ft	0 to 6 in.	1 to 3 ft	4 to 6 ft	0 to 6 in.	1 to 3 ft	4 to 6 ft	0 to 6 in.	1 to 3 ft	4 to 6 ft		
Acetone	13 U	13 J	20	13 U	13	8 J	17	15	16	14	12 J	15	92,000,000	7,000,000
2-butanone (MEK)	13 U	14 U	16 U	13 U	13 U	15 U	14 U	14 U	15 U	13 U	13 U	15 U	61,000,000	4,700,000
Carbon Disulfide	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	10,000,000	780,000
Chlorobenzene	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	2,000,000	160,000
1,2-Dichlorobenzene	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	9,200,000	700,000
1,3-Dichlorobenzene	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	310,000	23,000
1,4-Dichlorobenzene	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	120,000	27,000
Dichlorodifluoromethane	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	20,000,000	1,600,000
1,2-Dichloroethane	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	31,000	7,000
Trans-1,2-dichloroethene	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	2,000,000	160,000
Ethylbenzene	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	10,000,000	780,000
2-Hexanone	13	14 U	16 U	13 U	13 U	15 U	14 U	14 U	15 U	13 U	13 U	15 U	4,100,000	310,000
Methyl acetate	5	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	100,000,000	7,800,000
Methylene chloride	5 U	5 JB	6 JB	5 U	5 U	6 U	5 JB	5 JB	7 B	5 JB	4 JB	7 B	380,000	85,000
4-Methyl-2-pentanone	13 U	14 U	16 U	13 U	13 U	15	14 U	14 U	15 U	13 U	13 U	15 U	---	---
Tetrachloroethene	5 U	5 U	6 U	5	9	18	120	5 J	13	26	5 U	3 J	5,300	1,200
Toluene	5 U	3 JB	2 JB	5 U	1 J	6 U	2 JB	2 JB	2 JB	2 JB	2 JB	2 JB	8,200,000	630,000
Trichloroethene	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	7,200	1,600
Trichlorofluoromethane	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	5 U	5 U	6 U	31,000,000	2,300,000
1,1,2-trichloro-1,2,2-trifluoroethane	5 U	1 J	6 U	5 U	5 U	6 U	5 U	5 U	0.8 J	5 U	0.7 J	0.8 J	3,100,000,000	230,000,000
Xylene (total)	15 U	16 U	19 U	15 U	16 U	18 U	3 J	16 U	19 U	16 U	16 U	19 U	20,000,000	1,600,000

Notes:

(1) EPA Risk-based Concentrations for Industrial and Residential Soils (Oct 2006)
(Non-carcinogens adjusted to a Hazard Index of 0.1)

550 Bolded text indicates analyte was detected.

Data Qualifiers:

- U Not detected
- J Analyte present. Reported value between detection and quantitation limits
- B Analyte present in associated method blank

TABLE 2-2
SOIL RESULTS - SEMIVOLATILE ORGANICS (December 2002)
80th Division Reserve Site, Fort Story, VA

Compound	Soil Results (ug/kg)									EPA RBCs ⁽¹⁾	
	Boring MW-7			Boring MW-8			Boring MW-9			Industrial Soils	Residential Soils
	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.		
Acenaphthene	350 U	360 U	410 U	960 J	380 U	54 J	360 U	350 U	360 U	6,100,000	470,000
Acenaphthylene	350 U	54 J	410 U	2200	41 J	130 J	360 U	350 U	360 U	---	---
Anthracene	350 U	32 J	410 U	2500	46 J	160 J	360 U	350 U	360 U	31,000,000	2,300,000
Benzo(a)anthracene	350 U	140 JB	410 U	3900 B	91 JB	300 JB	360 U	350 U	360 U	3,900	220
Benzo(a)pyrene	28 JB	160 JB	410 U	3900 B	82 JB	270 JB	360 U	350 U	360 U	390	22
Benzo(b)fluoranthene	350 U	150 JB	410 U	6800 B	110 JB	340 JB	360 U	350 U	360 U	3,900	220
Benzo(g,h,i)perylene	27 J	100 J	410 U	2900	60 J	160 J	360 U	350 U	360 U	---	---
Benzo(k)fluoranthene	36 JB	190 JB	410 U	4100 B	86 JB	310 JB	360 U	350 U	360 U	39,000	2,200
1,1'-Biphenyl	350 U	360 U	410 U	470 J	380 U	62 J	360 U	350 U	360 U	5,100,000	39,000
Bis(2-ethylhexyl)phthalate	150 J	340 J	320 J	1100 U	220 J	420	40 J	110 J	880	200,000	46,000
Carbazole	350 U	360 U	410 U	480 J	380 U	380 U	360 U	350 U	360 U	140,000	32,000
Chrysene	34 JB	170 JB	410 U	4900 B	110 JB	350 JB	360 U	350 U	360 U	390,000	22,000
Dibenzo(a,h)anthracene	350 U	30 J	410 U	1200	32 J	73 J	360 U	350 U	360 U	390	22
Dibenzofuran	350 U	360 U	410 U	790 J	380 U	86 J	360 U	350 U	360 U	200,000	16,000
3,3'-Dichlorobenzidine	350 U	360 U	410 U	1100 U	380 U	380 U	360 U	350 U	360 U	6,400	1,400
2,4-Dinitrotoluene	350 U	360 U	410 U	1100 U	380 U	380 U	360 U	350 U	360 U	200,000	16,000
2,6-Dinitrotoluene	350 U	360 U	410 U	1100 U	380 U	380 U	360 U	350 U	360 U	100,000	7,800
Di-n-octyl phthalate	270 J	360 U	42 J	1100 U	380 U	380 U	360 U	350 U	360 U	---	---
Fluoranthene	28 JB	190 JB	410 U	7600 B	180 JB	600 B	360 U	350 U	360 U	4,100,000	310,000
Fluorene	350 U	36 J	410 U	1600	380 U	48 J	360 U	350 U	360 U	4,100,000	310,000
Indeno(1,2,3-cd)pyrene	29 J	94 J	410 U	3200	64 J	170 J	360 U	350 U	360 U	3,900	220
2-Methylnaphthalene	350 U	360 U	410 U	2400	42 J	190 J	360 U	350 U	360 U	410,000	31,000
N-Nitrosodiphenylamine	350 U	360 U	410 U	1100 U	380 U	380 U	360 U	350 U	360 U	580,000	130,000
Naphthalene	350 U	360 U	410 U	1200	380 U	72 J	360 U	350 U	360 U	2,000,000	160,000
Phenanthrene	350 U	96 JB	410 U	12000 B	320 JB	1200 B	360 U	350 U	360 U	---	---
Pyrene	43 JB	440 B	410 U	12000 B	320 JB	810 B	360 U	350 U	360 U	3,100,000	230,000

Notes:

(1) EPA Risk-based Concentrations for Industrial and Residential Soils (April 25, 2003)
 (Non-carcinogens adjusted to a Hazard Index of 0.1)

Data Qualifiers:

- U Not detected
- J Analyte present. Reported value between detection and quantitation limits
- D Sample diluted due to exceedance of calibration range in original sample
- B Analyte present in associated method blank

550	Bolded text indicates analyte was detected.
200	Yellow shaded box indicates analyte detected above EPA RBC for residential soils only
800	Pink shaded box indicates analyte detected above EPA RBC for both residential and industrial soils

TABLE 2-2
SOIL RESULTS - SEMIVOLATILE ORGANICS (December 2002)
80th Division Reserve Site, Fort Story, VA

Compound	Soil Results (ug/kg)									EPA RBCs ⁽¹⁾	
	Boring MW-10			Boring MW-11			Boring SB-1			Industrial Soils	Residential Soils
	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.		
Acenaphthene	370 U	360 U	390 U	360 U	340 U	390 U	49 J	85 J	410 U	6,100,000	470,000
Acenaphthylene	370 U	360 U	390 U	360 U	340 U	390 U	81 J	140 J	36 J	---	---
Anthracene	370 U	360 U	390 U	360 U	340 U	390 U	76 J	150 J	33 J	31,000,000	2,300,000
Benzo(a)anthracene	370 U	360 U	390 U	360 U	340 U	390 U	210 J	340 J	93 J	3,900	220
Benzo(a)pyrene	370 U	360 U	390 U	360 U	340 U	390 U	170 J	270 J	72 J	390	22
Benzo(b)fluoranthene	370 U	360 U	390 U	360 U	340 U	390 U	240 J	300 J	110 J	3,900	220
Benzo(g,h,i)perylene	370 U	360 U	390 U	360 U	340 U	390 U	140 J	190 J	64 J	---	---
Benzo(k)fluoranthene	370 U	360 U	390 U	360 U	340 U	390 U	210 J	360	91 J	39,000	2,200
1,1'-Biphenyl	370 U	360 U	390 U	360 U	340 U	390 U	330 U	26 J	410 U	5,100,000	39,000
Bis(2-ethylhexyl)phthalate	130 J	360 U	610	45 J	310 J	270 J	84 J	290 J	390 J	200,000	46,000
Carbazole	370 U	360 U	390 U	360 U	340 U	390 U	330 U	350 U	410 U	140,000	32,000
Chrysene	370 U	360 U	390 U	360 U	340 U	390 U	210 J	340 J	92 J	390,000	22,000
Dibenzo(a,h)anthracene	370 U	360 U	390 U	360 U	340 U	390 U	46 J	67 J	410 U	390	22
Dibenzofuran	370 U	360 U	390 U	360 U	340 U	390 U	30 J	54 J	410 U	200,000	16,000
3,3'-Dichlorobenzidine	370 U	360 U	390 U	360 U	340 U	390 U	330 U	350 U	410 U	6,400	1,400
2,4-Dinitrotoluene	370 U	360 U	390 U	360 U	340 U	390 U	330 U	350 U	410 U	200,000	16,000
2,6-Dinitrotoluene	370 U	360 U	390 U	360 U	340 U	390 U	330 U	350 U	410 U	100,000	7,800
Di-n-octyl phthalate	370 U	360 U	390 U	360 U	340 U	390 U	280 J	32 J	410 U	---	---
Fluoranthene	370 U	360 U	42 JB	360 U	340 U	390 U	370	620	150 J	4,100,000	310,000
Fluorene	370 U	360 U	390 U	360 U	340 U	390 U	94 J	170 J	28 J	4,100,000	310,000
Indeno(1,2,3-cd)pyrene	370 U	360 U	390 U	360 U	340 U	390 U	150 J	200 J	65 J	3,900	220
2-Methylnaphthalene	370 U	360 U	390 U	360 U	340 U	390 U	34 J	75 J	410 U	410,000	31,000
N-Nitrosodiphenylamine	370 U	360 U	390 U	360 U	340 U	390 U	330 U	350 U	410 U	580,000	130,000
Naphthalene	370 U	360 U	390 U	360 U	340 U	390 U	330 U	350 U	410 U	2,000,000	160,000
Phenanthrene	370 U	360 U	74 JB	360 U	340 U	390 U	390	810	150 J	---	---
Pyrene	370 U	360 U	61 JB	360 U	340 U	390 U	740 U	1200	330 J	3,100,000	230,000

Notes:

(1) EPA Risk-based Concentrations for Industrial and Residential Soils (April 25, 2003)
 (Non-carcinogens adjusted to a Hazard Index of 0.1)

Data Qualifiers:

- U Not detected
- J Analyte present. Reported value between detection and quantitation limits
- D Sample diluted due to exceedance of calibration range in original sample
- B Analyte present in associated method blank

550	Bolded text indicates analyte was detected.
200	Yellow shaded box indicates analyte detected above EPA RBC for residential soils only
800	Pink shaded box indicates analyte detected above EPA RBC for both residential and industrial soils

TABLE 2-2
SOIL RESULTS - SEMIVOLATILE ORGANICS (December 2002)
80th Division Reserve Site, Fort Story, VA

Compound	Soil Results (ug/kg)												EPA RBCs ⁽¹⁾	
	Boring SB-2			Boring SB-3			Boring SB-4			Boring SB-5			Industrial Soils	Residential Soils
	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.		
Acenaphthene	340 U	360 U	410 U	560	350 U	400 U	240 J	360 U	68 J	1100 U	350 U	410 U	6,100,000	470,000
Acenaphthylene	250 J	360 U	33 J	1700	130 J	32 J	1400	150 J	450	900 J	21 J	74 J	---	---
Anthracene	150 J	360 U	410 U	2000	120 J	400 U	1100 J	110 J	360 J	750 J	350 U	69 J	31,000,000	2,300,000
Benzo(a)anthracene	320 J	360 U	45 J	5600 D	420	83 J	4300	510	1500	3300	76 J	280 J	3,900	220
Benzo(a)pyrene	430	360 U	49 J	5500 D	330 J	58 J	4000	450	1400	3200	65 J	260 J	390	22
Benzo(b)fluoranthene	750	360 U	90 J	6500 D	660	80 J	5100	570	2000	3400	69 J	300 J	3,900	220
Benzo(g,h,i)perylene	550	26 J	58 J	3700	270 J	56 J	2500	310 J	900	1900	56 J	180 J	---	---
Benzo(k)fluoranthene	500	360 U	62 J	4100	680	79 J	3600	460	1300	3200	79 J	250 J	39,000	2,200
1,1'-Biphenyl	340 U	360 U	410 U	250 J	350 U	400 U	120 J	360 U	410 U	85 J	350 U	410 U	5,100,000	39,000
Bis(2-ethylhexyl)phthalate	91 J	130 J	180 J	200 J	160 J	260 J	1100 U	96 J	260 J	190 J	90 J	470	200,000	46,000
Carbazole	340 U	360 U	410 U	490	350 U	400 U	150 J	360 U	48 J	120 J	350 U	410 U	140,000	32,000
Chrysene	410	360 U	50 J	6000 D	450	97 J	5000	570	1800	3700	86 J	320 J	390,000	22,000
Dibenzo(a,h)anthracene	160 J	360 U	410 U	1500	110 J	400 U	910 J	110 J	350 J	690 J	350 U	64 J	390	22
Dibenzofuran	340 U	360 U	410 U	390	350 U	400 U	300 J	360 U	73 J	230 J	350 U	410 U	200,000	16,000
3,3'-Dichlorobenzidine	340 U	360 U	410 U	290 J	350 U	400 U	1100 U	360 U	41 J	1100 U	350 U	410 U	6,400	1,400
2,4-Dinitrotoluene	340 U	360 U	130 J	340 U	350 U	400 U	1100 U	360 U	410 U	1100 U	350 U	410 U	200,000	16,000
2,6-Dinitrotoluene	340 U	360 U	51 J	340 U	350 U	400 U	1100 U	360 U	410 U	1100 U	350 U	410 U	100,000	7,800
Di-n-octyl phthalate	210 J	360 U	410 U	24 J	350 U	43 J	1100 U	360 U	410 U	1100 U	350 U	410 U	---	---
Fluoranthene	530	37 J	95 J	9800 D	660	150 J	6300	750	2300	4500	120 J	420	4,100,000	310,000
Fluorene	25 J	360 U	410 U	1400	80 J	400 U	500 J	46 J	140 J	67 J	350 U	410 U	4,100,000	310,000
Indeno(1,2,3-cd)pyrene	520	25 J	55 J	3600	260 J	52 J	2600	310 J	950	2000	49 J	160 J	3,900	220
2-Methylnaphthalene	340 U	360 U	410 U	1000	51 J	400 U	510 J	360 U	94 J	490 J	350 U	49 J	410,000	31,000
N-Nitrosodiphenylamine	340 U	360 U	150 J	340 U	350 U	400 U	1100 U	360 U	410 U	1100 U	350 U	410 U	580,000	130,000
Naphthalene	340 U	360 U	410 U	340 J	350 U	400 U	190 J	360 U	31 J	120 J	350 U	410 U	2,000,000	160,000
Phenanthrene	410	29 J	70 J	9500 D	530	120 J	4500	440	1400	3700	120 J	400 J	---	---
Pyrene	920	50 J	130 J	16000 D	1000	220 J	11000	1400	4000	8200	210 J	780	3,100,000	230,000

Notes:

(1) EPA Risk-based Concentrations for Industrial and Residential Soils (April 25, 2003)
 (Non-carcinogens adjusted to a Hazard Index of 0.1)

Data Qualifiers:

- U Not detected
- J Analyte present. Reported value between detection and quantitation limits
- D Sample diluted due to exceedance of calibration range in original sample
- B Analyte present in associated method blank

550	Bolded text indicates analyte was detected.
200	Yellow shaded box indicates analyte detected above EPA RBC for residential soils only
800	Pink shaded box indicates analyte detected above EPA RBC for both residential and industrial soils

**TABLE 2-3
SOIL RESULTS - PESTICIDES AND PCBs (December 2002)
80 Division Reserve Site, Fort Story, VA**

	Soil Samples									EPA RBCs (1)		
	Boring MW-7			Boring MW-8			Boring MW-9			Industrial Soils	Residential Soils	
	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.			
Pesticides (ug/kg)												
Aldrin	0.87 U	0.9 U	1 U	0.88 U	0.98 P	0.94 U	0.9 U	0.89 U	0.91 U	170	38	
alpha-BHC	0.87 U	0.9 U	1 U	0.88 U	0.95 U	0.94 U	0.9 U	0.89 U	0.91 U	450	100	
beta-BHC	1.8 U	1.8 U	2.1 U	1.8 U	2 U	1.9 U	1.8 U	1.8 U	1.9 U	1,600	350	
delta-BHC	0.87 U	0.9 U	1 U	0.88 U	0.95 U	0.94 U	0.9 U	0.89 U	0.91 U	450	100	
gamma-BHC (Lindane)	0.87 U	0.9 U	1 U	0.88 U	0.95 U	0.94 U	0.9 U	0.89 U	0.91 U	2,200	490	
Chlordane (gamma)	0.87 U	0.9 U	1 U	0.88 U	0.95 U	0.94 U	0.9 U	0.89 U	0.91 U	8,200	1,800	
4,4'-DDD	3.5 U	3.6 U	4.1 U	3.5 U	3.8 U	4.3	2.7 JP	3.5 U	6.4 P	12,000	2,700	
4,4'-DDE	1.8 U	1.8 U	2.1 U	1.8 U	2 U	1.9 U	1.7 J	2.6	1.9 U	8,400	1,900	
4,4'-DDT	4.3 J	5.4 U	6.3 U	5.3 U	5.7 U	5.7 U	8.8 P	5.4 U	7.3	8,400	1,900	
Dieldrin	1.8 U	1.8 U	2.1 U	27 EP	2 U	16 EP	1.8 U	1.8 U	1.9 U	180	40	
Endosulfan I	1.8 U	1.8 U	2.1 U	1.8 U	2 U	1.9 U	1.8 U	1.8 U	1.9 U	610,000	47,000	
Endosulfan II	3.5 U	3.6 U	4.1 U	18 P	3.8 U	3.8 U	3.6 U	3.5 U	3.6 U	610,000	47,000	
Endosulfan sulfate	3.5 U	3.6 U	4.1 U	3.5 U	3.8 U	3.8 U	3.6 U	3.5 U	3.6 U	610,000	47,000	
Endrin	3.5 U	3.6 U	4.1 U	3.5 U	3.8 U	3.8 U	3.6 U	3.5 U	3.6 U	31,000	2,300	
Endrin aldehyde	3.5 U	3.6 U	4.1 U	3.5 U	3.8 U	3.8 U	3.6 U	3.5 U	3.6 U	31,000	2,300	
Endrin ketone	8.7 U	9 U	10 U	52	9.5 U	5.5 JP	9 U	8.9 U	9.1 U	31,000	2,300	
Heptachlor	0.87 U	0.9 U	1 U	0.88 U	0.95 U	0.94 U	0.9 U	0.89 U	0.91 U	640	140	
PCBs (ug/kg)												
Aroclor-1016	68 U	71 U	81 U	69 U	75 U	74 U	71 U	70 U	71 U	41,000	550	
Aroclor-1221	89 U	92 U	110 U	90 U	98 U	97 U	92 U	91 U	93 U	1,400	320	
Aroclor-1232	68 U	71 U	81 U	69 U	75 U	74 U	71 U	70 U	71 U	1,400	320	
Aroclor-1242	47 U	49 U	56 U	48 U	52 U	51 U	49 U	48 U	49 U	1,400	320	
Aroclor-1248	47 U	49 U	56 U	48 U	52 U	51 U	49 U	48 U	49 U	1,400	320	
Aroclor-1254	47 U	49 U	56 U	48 U	52 U	51 U	49 U	48 U	49 U	1,400	320	
Aroclor-1260	68 U	71 U	21 J	69 U	75 U	74 U	71 U	67 J	71 U	1,400	320	

Data Qualifiers:

- U Not detected
- J Analyte present. Reported value between detection and quantitation limits
- D Sample diluted due to exceedance of calibration range in original sample
- B Analyte present in associated method blank
- E Exceeded calibration range of instrument
- P Greater than 25% difference for detected levels in two GC columns

Notes:

- (1) EPA Risk-based Concentrations for Industrial and Residential Soils (April 25, 2003)
(Non-carcinogens adjusted to a Hazard Index of 0.1)

550	Bolded text indicates analyte was detected.
200	Yellow shaded box indicates analyte detected above EPA RBC for residential soils only
800	Pink shaded box indicates analyte detected above EPA RBC for both residential and industrial soils

TABLE 2-3
SOIL RESULTS - PESTICIDES AND PCBs (December 2002)
80 Division Reserve Site, Fort Story, VA

	Soil Samples									EPA RBCs (1)	
	Boring MW-10			Boring MW-11			Boring SB-1			Industrial Soils	Residential Soils
	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.		
Pesticides (ug/kg)											
Aldrin	0.93 U	0.91 U	0.98 U	0.91 U	0.86 U	0.97 U	0.84 U	11 E	1 U	170	38
alpha-BHC	0.93 U	0.91 U	0.98 U	0.91 U	0.86 U	0.98 U	0.84 U	0.87 U	1 U	450	100
beta-BHC	1.9 U	2.4 P	2 U	3.7 P	1.8 U	2 U	1.7 U	100 EP	2.1 U	1,600	350
delta-BHC	0.93 U	0.91 U	0.98 U	1.3	0.86 U	0.98 U	0.84 U	0.87 U	1 U	450	100
gamma-BHC (Lindane)	0.93 U	0.91 U	0.37 J	0.91 U	0.86 U	0.98 U	0.84 U	0.87 U	1 U	2,200	490
Chlordane (gamma)	0.93 U	0.91 U	0.98 U	0.91 U	0.86 U	0.98 U	0.84 U	0.87 U	1 U	8,200	1,800
4,4'-DDD	3.7 U	3.6 U	0.42 J	3.6 U	3.4 U	0.88 J	3.3 U	6.9 U	4.1 U	12,000	2,700
4,4'-DDE	1.9 U	1.9 U	2 U	3.1 P	1.6 J	2 U	1.7 U	3.6 U	2.1 U	8,400	1,900
4,4'-DDT	5.6 U	5.5 U	3 JP	5.5 U	1.7 J	1.3 JP	5.1 U	11 U	6.3 U	8,400	1,900
Dieldrin	1.9 U	1.9 U	2 U	1.9 U	1.8 U	2 U	1.7 U	3.6 U	2.1 U	180	40
Endosulfan I	1.9 U	1.9 U	2 U	1.9 U	1.8 U	2 U	1.7 U	3.6 U	2.1 U	610,000	47,000
Endosulfan II	3.7 U	3.6 U	3.9 U	3.6 U	3.4 U	3.9 U	3.3 U	6.9 U	4.1 U	610,000	47,000
Endosulfan sulfate	3.7 U	3.6 U	3.9 U	3.6 U	3.4 U	3.9 U	3.3 U	6.7	4.1 U	610,000	47,000
Endrin	3.7 U	3.6 U	3.9 U	3.6 U	3.4 U	3.9 U	3.3 U	3.5 U	4.1 U	31,000	2,300
Endrin aldehyde	3.7 U	3.6 U	3.9 U	0.97 J	3.4 U	3.9 U	3.3 U	3.5 U	0.88 JP	31,000	2,300
Endrin ketone	9.3 U	9.1 U	9.8 U	9.1 U	8.6 U	9.8 U	4.2 J	11	1.1 JP	31,000	2,300
Heptachlor	0.93 U	0.91 U	0.98 U	0.91 U	0.86 U	0.98 U	0.84 U	0.87 U	1 U	640	140
PCBs (ug/kg)											
Aroclor-1016	73 U	71 U	76 U	71 U	68 U	76 U	66 U	140 U	81 U	41,000	550
Aroclor-1221	96 U	93 U	100 U	93 U	89 U	100 U	86 U	180 U	110 U	1,400	320
Aroclor-1232	73 U	71 U	76 U	71 U	68 U	76 U	66 U	140 U	81 U	1,400	320
Aroclor-1242	51 U	49 U	53 U	49 U	47 U	53 U	45 U	95 U	56 U	1,400	320
Aroclor-1248	51 U	49 U	53 U	49 U	47 U	53 U	45 U	95 U	56 U	1,400	320
Aroclor-1254	51 U	49 U	53 U	49 U	47 U	53 U	45 U	95 U	56 U	1,400	320
Aroclor-1260	73 U	71 U	76 U	71 U	68 U	76 U	66 U	140 U	81 U	1,400	320

Notes:

(1) EPA Risk-based Concentrations for Industrial and Residential Soils (April 25, 2003)
 (Non-carcinogens adjusted to a Hazard Index of 0.1)

Data Qualifiers:

- U Not detected
- J Analyte present. Reported value between detection and quantitation limits
- D Sample diluted due to exceedance of calibration range in original sample
- B Analyte present in associated method blank
- E Exceeded calibration range of instrument
- P Greater than 25% difference for detected levels in two GC columns

550	Bolded text indicates analyte was detected.
200	Yellow shaded box indicates analyte detected above EPA RBC for residential soils only
800	Pink shaded box indicates analyte detected above EPA RBC for both residential and industrial soils

TABLE 2-3
SOIL RESULTS - PESTICIDES AND PCBs (December 2002)
80 Division Reserve Site, Fort Story, VA

	Soil Samples												EPA RBCs (1)	
	Boring SB-2			Boring SB-3			Boring SB-4			Boring SB-5			Ind. Soils	Res. Soils
	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.		
Pesticides (ug/kg)														
Aldrin	0.86 U	0.9 U	1 U	86 U	15 E	1 U	36	0.91 U	1 U	73 E	0.88 U	1 U	170	38
alpha-BHC	0.86 U	0.9 U	1 U	86 U	1.7 J	1 U	4.6 U	0.91 U	1 U	88 U	0.74 J	0.53 J	450	100
beta-BHC	1.8 U	1.8 U	2.1 U	180 U	3.6 U	2 U	9.3 U	1.9 U	2.1 U	180 U	1.8 U	2.1 U	1,600	350
delta-BHC	0.86 U	0.9 U	1 U	86 U	1.7 U	1 U	4.6 U	0.91 U	1 U	88 U	0.66 J	1 U	450	100
gamma-BHC (Lindane)	0.86 U	0.39 J	1 U	86 U	1.7 U	1 U	4.6 U	0.91 U	1 U	88 U	0.88 U	1 U	2,200	490
Chlordane (gamma)	0.86 U	0.9 U	1 U	86 U	1.7 U	1 U	4.6 U	0.91 U	1 U	88 U	0.88 U	1 U	8,200	1,800
4,4'-DDD	3.4 U	3.6 U	4.1 U	340 U	6.9 U	4 U	18 U	3.6 U	4.1 U	350 U	3.5 U	4.1 U	12,000	2,700
4,4'-DDE	1.8 U	1.8 U	2.1 U	180 U	3.6 U	2 U	9.3 U	1.9 U	2.1 U	180 U	1.8 U	2.1 U	8,400	1,900
4,4'-DDT	2.4 J	0.91 J	6.3 U	520 U	11 U	6 U	27 U	5.5 U	6.2 U	530 U	5.3 U	6.2 U	8,400	1,900
Dieldrin	1.8 U	1.8 U	2.1 U	180 U	3.6 U	2 U	9.3 U	1.9 U	7.1 P	180 U	1.8 U	2.1 U	180	40
Endosulfan I	1.8 U	1.8 U	2.1 U	180 U	0.9 JP	2 U	9.3 U	1.9 U	2.1 U	180 U	1.8 U	2.1 U	610,000	47,000
Endosulfan II	3.4 U	3.6 U	4.1 U	340 U	6.9 U	4 U	18 U	3.6 U	4.1 U	350 U	3.5 U	4.1 U	610,000	47,000
Endosulfan sulfate	3.4 U	3.6 U	4.1 U	69 EP	5.7	4 U	25	3.6 U	13	110 JD	0.8 J	4.1 U	610,000	47,000
Endrin	3.4 U	3.6 U	4.1 U	340 U	6.9 U	4 U	18 U	3.6 U	4.1 U	350 U	3.5 U	4.1 U	31,000	2,300
Endrin aldehyde	3.4 U	3.6 U	4.1 U	340 U	10 U	4 U	18 U	3.6 U	4.1 U	350 U	3.5 U	4.1 U	31,000	2,300
Endrin ketone	16	1.6 J	1.9 JP	110 EP	14	1.5 JP	31 JP	6.9 J	7.3 J	110	4.2 JP	7.1 J	31,000	2,300
Heptachlor	0.86 U	0.9 U	1 U	86 U	1.7 U	1 U	4.6 U	0.91 U	1 U	88 U	1 P	1 U	640	140
PCBs (ug/kg)														
Aroclor-1016	81 U	67 U	71 U	6700 U	140 U	78 U	360 U	71 U	80 U	6900 U	69 U	80 U	41,000	550
Aroclor-1221	110 U	88 U	92 U	8800 U	180 U	100 U	470 U	93 U	100 U	9000 U	90 U	100 U	1,400	320
Aroclor-1232	81 U	67 U	71 U	6700 U	140 U	78 U	360 U	71 U	80 U	6900 U	69 U	80 U	1,400	320
Aroclor-1242	56 U	46 U	49 U	4600 U	95 U	54 U	250 U	49 U	56 U	4800 U	48 U	56 U	1,400	320
Aroclor-1248	56 U	46 U	49 U	4600 U	95 U	54 U	250 U	49 U	56 U	4800 U	48 U	56 U	1,400	320
Aroclor-1254	56 U	46 U	49 U	4600 U	95 U	54 U	250 U	49 U	56 U	4800 U	48 U	56 U	1,400	320
Aroclor-1260	81 U	67 U	71 U	6700 U	140 U	78 U	360 U	71 U	80 U	6900 U	69 U	80 U	1,400	320

Notes:

(1) EPA Risk-based Concentrations for Industrial and Residential Soils (April 25, 2003)
 (Non-carcinogens adjusted to a Hazard Index of 0.1)

Data Qualifiers:

- U Not detected
- J Analyte present. Reported value between detection and quantitation limits
- D Sample diluted due to exceedance of calibration range in original sample
- B Analyte present in associated method blank
- E Exceeded calibration range of instrument
- P Greater than 25% difference for detected levels in two GC columns

550	Bolded text indicates analyte was detected.
200	Yellow shaded box indicates analyte detected above EPA RBC for residential soils only
800	Pink shaded box indicates analyte detected above EPA RBC for both residential and industrial soils

TABLE 2-4
SOIL RESULTS - METALS (December 2002)
80th Division Reserve Site, Fort Story, VA

Compound	Soil Samples (mg/kg)									EPA RBCs	
	Boring MW-7			Boring MW-8			Boring MW-9			Industrial Soils	Residential Soils
	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.		
Aluminum	1200 N*	292 N*	163 N*	6930 N*	236 N*	328 N*	889 N*	488 N*	284 N*	---	---
Antimony	0.42 B*	0.77 B*	0.57 B*	0.51 B*	0.4 U*	0.41 U*	0.56 B*	0.5 B*	0.4 U*	41	3.1
Arsenic	0.63 B*	0.25 U*	0.31 U*	1 B*	0.27 U*	0.28 U*	0.81 B*	0.43 B*	0.27 U*	1.9	0.43
Barium	5.3 *	2.2 *	1 B*	15.8 *	1.2 *	2 *	8.3 *	3.5 *	2.6 *	20,000	1,600
Beryllium	0.05 B*	0.02 B*	0.01 U*	0.11 B*	0.01 U*	0.01 U*	0.06 B*	0.03 B*	0.02 B*	200	16
Cadmium	0.04 U*	0.04 U*	0.05 U*	0.04 U*	0.04 U*	0.04 U*	0.04 U*	0.04 U*	0.04 U*	100	7.8
Calcium	247 *	96.4 B*	41.5 B*	574 *	38.6 B*	78.5 B*	3060 *	261 *	97.3 B*	---	---
Chromium	4.2 *	4.6 *	1.9 *	9.8 *	2.6 *	5 *	2.7 *	2.4 *	4.8 *	310	23
Cobalt	0.8 *	0.2 B*	0.08 B*	0.93 *	0.07 B*	0.15 B*	0.71 *	0.36 B*	0.25 B*	---	---
Copper	6.3 *	2.6 *	0.28 B*	1.3 *	0.15 U*	0.16 U*	0.15 U*	0.28 B*	0.3 B*	4,100	310
Iron	2,070 *	1,190 *	715 *	10100 *	952 *	1,250 *	2,390 *	1,330 *	1,380 *	31,000	2,300
Lead	21.2 N*	9.6 N*	1.5 N*	6.3 N*	0.65 N*	0.84 N*	8.3 N*	5.4 N*	2.1 N*	400	400
Magnesium	151 *E	45.3 B*E	30 B*E	504 *E	36.5 B*E	69.4 B*E	265 *E	86.4 B*E	54.7 B*E	---	---
Manganese	13.3 *	8.8 *	3.7 *	69.1 *	4.1 *	8.2 *	33.7 *	13.1 *	11.6 *	2,000	160
Mercury	0.035	0.017 B	0.018 U	0.034	0.017 U	0.017 U	0.02 B	0.023 B	0.018 U	31	2.3
Nickel	0.73 *	0.39 B*	0.15 B*	3.7 *	0.19 B*	0.45 B*	1.4 *	0.62 *	0.66 *	2,000	160
Potassium	169 *	61.3 B*	45.8 B*	494 *	56.5 B*	102 B*	274 *	87.9 B*	70.2 B*	---	---
Selenium	0.32 U*	0.33 U*	0.41 U*	0.69 *	0.35 U*	0.37 U*	0.35 U*	0.33 U*	0.36 U*	510	39
Silver	0.07 U*	0.07 U*	0.09 U*	0.07 U*	0.07 U*	0.08 U*	0.07 U*	0.07 U*	0.08 U*	510	39
Sodium	133 B*	65.7 B*	51.7 B*	77 B*	51.4 B*	61.1 B*	84.5 B*	62.4 B*	54.9 B*	---	---
Thallium	0.49 UN*	0.51 UN*	0.64 UN*	0.53 UN*	0.55 UN*	0.57 UN*	0.54 UN*	0.51 UN*	0.55 UN*	7.2	0.55
Vanadium	3.9 *	1.2 B*	1.2 B*	17.6 *	1.5 B*	1.9 B*	4.1 *	2.3 *	1.5 B*	100	7.8
Zinc	81.8 *E	16.5 *E	3.6 *E	10.6 *E	1.1 B*E	2.3 *E	11 *E	5.1 *E	5.4 *E	31,000	2,300

Notes:

(1) EPA Risk-based Concentrations for Industrial and Residential Soils (April 25, 2003)
 (Non-carcinogens adjusted to a Hazard Index of 0.1)

Data Qualifiers:

- U Not detected
- B Analyte present. Reported value between detection and quantitation limits
- E Estimated value, serial dilution results not within 10 percent
- N Sample spike recovery is outside of control limits
- * Sample and duplicate results are not within control limits

550	Bolded text indicates analyte was detected.
200	Yellow shaded box indicates analyte detected above EPA RBC for residential soils only
800	Pink shaded box indicates analyte detected above EPA RBC for both residential and industrial soils

TABLE 2-4
SOIL RESULTS - METALS (December 2002)
80th Division Reserve Site, Fort Story, VA

Compound	Soil Samples (mg/kg)									EPA RBCs	
	Boring MW-10			Boring MW-11			Boring SB-1			Industrial Soils	Residential Soils
	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.		
Aluminum	395 N*	1140	299 N*	739	314 N*	216 N*	424	313	135	---	---
Antimony	0.47 B	0.74 B	0.51 B*	2.1	0.71 B*	0.5 B*	0.46 B	0.39 U	0.45 U	41	3.1
Arsenic	0.51 B	1.2	0.29 U*	0.56 B	0.25 U*	0.29 U*	0.24 U	0.34 B	0.3 U	1.9	0.43
Barium	2.2 *	4.3	2.1 *	11.6	2.9 *	1.9 *	1.6	2	1 B	20,000	1,600
Beryllium	0.02 B	0.04 B	0.01 U*	0.05 B	0.02 B*	0.01 B*	0.01 B	0.02 B	0.01 U	200	16
Cadmium	0.04 U	0.04 U	0.05 U*	0.04 U	0.04 U*	0.05 U*	0.04 U	0.04 U	0.05 U	100	7.8
Calcium	70.1 B*	269	118 *	110	77.7 B*	88.9 B*	44 B	67.1 B	25 B	---	---
Chromium	1.8	4.6	6.3 *	6	5.1 *	2.2 *	1	2.2	1.6	310	23
Cobalt	0.30 B	0.54 B	0.14 B*	0.48 B	0.27 B*	0.16 B*	0.17 B	0.21 B	0.07 U	---	---
Copper	4.3	0.39 B	0.4 B*	14.4	22.2 *	0.97 *	0.14 U	0.15 U	0.17 U	4,100	310
Iron	810	1,510	867 *	1,900	1,270 *	734 *	760	1,030	335	31,000	2,300
Lead	5 N*	2.6 N*	1.4 N*	33.9 N*	33.6 N*	2.6 N*	0.84 N*	0.85 N*	0.5 N*	400	400
Magnesium	50.7 B*E	91.7 BE	45.5 B*E	84.3 BE	51.2 B*E	32.1 B*E	55.5 BE	81.2 BE	20.8 BE	---	---
Manganese	3.4	4.7	6.6 *	8	13.9 *	5.4 *	6.3	8	2.5	2,000	160
Mercury	0.021 B	0.018 U	0.02 B	0.016 U	0.018 B	0.02 B	0.016 U	0.015 U	0.02 U	31	2.3
Nickel	0.32 B	0.79	0.39 B*	0.66	0.54 *	0.23 B*	0.13 B	0.16 B	0.14 B	2,000	160
Potassium	96.7 B*	157	74.2 B*	111	58.4 B*	53.7 B*	64.9 B	94.4 B	39.7 B	---	---
Selenium	0.37 U*	0.36 U	0.38 U*	0.37 B	0.33 U*	0.38 U*	0.32 U	0.35 U	0.4 U	510	39
Silver	0.08 U*	0.08 U	0.08 U*	0.07 U	0.07 U*	0.08 U*	0.07 U	0.07 U	0.08 U	510	39
Sodium	59.6 B*	57.2 B	67 B*	127 B	95.2 B*	59.7 B*	44.5 B	49.7 B	61.7 B	---	---
Thallium	0.571 U	0.56 UN	0.58 UN*	0.54 UN	0.51 UN*	0.58 UN*	0.5 UN	0.53 UN	0.62 UN	7.2	0.55
Vanadium	2 B*	3.6	1.3 B*	2.9	1.6 B*	0.99 B*	1.4 B	1.6 B	0.76 B	100	7.8
Zinc	6.3	5.4	6.5 *E	66.3	42.7 *E	5.9 *E	1.8 B	2.6	1.6 B	31,000	2,300

Notes:

(1) EPA Risk-based Concentrations for Industrial and Residential Soils (April 25, 2003)
 (Non-carcinogens adjusted to a Hazard Index of 0.1)

Data Qualifiers:

- U Not detected
- B Analyte present. Reported value between detection and quantitation limits
- E Estimated value, serial dilution results not within 10 percent
- N Sample spike recovery is outside of control limits
- * Sample and duplicate results are not within control limits

550	Bolded text indicates analyte was detected.
200	Yellow shaded box indicates analyte detected above EPA RBC for residential soils only
800	Pink shaded box indicates analyte detected above EPA RBC for both residential and industrial soils

TABLE 2-4
SOIL RESULTS - METALS (Decemer 2002)
80th Division Reserve Site, Fort Story, VA

Compound	Soil Samples (mg/kg)												EPA RBCs	
	Boring SB-2			Boring SB-3			Boring SB-4			Boring SB-5			Ind. Soils	Res. Soils
	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.	0 to 6 in.	1 to 3 ft.	4 to 6 ft.		
Aluminum	1,970	225	142	1760	216	184	8,530	272	293	5,350	204	276	---	---
Antimony	0.35 B	0.49 B	0.45 U	0.47 B	0.44 B	0.64 B	0.38 U	0.39 U	0.45 B	0.39 U	0.43 B	0.44 U	41	3.1
Arsenic	0.35 B	0.27 U	0.3 U	0.41 B	0.41 B	0.28 U	0.92 B	0.26 U	0.3 U	0.67 B	0.25 U	0.3 U	1.9	0.43
Barium	5.1	2.2	1.3	4.6	1.4	0.98 B	14.1	2	1.7	10.7	1.3	1.4	20,000	1,600
Beryllium	0.04 B	0.02 B	0.01 U	0.04 B	0.02 B	0.01 B	0.12 B	0.03 B	0.01 U	0.08 B	0.01 U	0.01 U	200	16
Cadmium	0.04 U	0.04 U	0.05 U	0.04 U	0.04 U	0.04 U	0.04 U	0.11 B	0.05 U	0.04 U	0.04 U	0.05 U	100	7.8
Calcium	61.2 B	41.1 B	64.7 B	92.9 B	20.5 B	18.2 B	182	71.6 B	49.9 B	174	31.7 B	48.6 B	---	---
Chromium	3	1.4	1.4	3.1	2	1.4	10	1.5	2.7	6.4	2.6	1.7	310	23
Cobalt	0.35 B	0.17 B	0.07 U	0.3 B	0.22 B	0.1 B	0.73	0.22 B	0.09 B	0.59	0.09 B	0.07 U	---	---
Copper	0.38 B	0.15 U	0.17 U	0.13 U	0.14 U	0.16 U	1.0	0.15 U	0.17 U	0.41 B	0.14 U	0.17 U	4,100	310
Iron	2,650	769	395	2,640	910	619	9,060	756	696	5,970	843	730	31,000	2,300
Lead	2.7 N*	1.1 N*	0.66 N*	2.6 N*	0.86 N*	0.75 N*	6.9 N*	0.71 N*	0.72 N*	4.6 N*	0.71 N*	0.79 N*	400	400
Magnesium	114 E	40.6 BE	22.1 BE	129 E	36 BE	25.3 BE	337 E	44.2 BE	41.2 BE	266 E	34.6 BE	41.3 BE	---	---
Manganese	11	5.5	1.9	13.4	9.2	2.4	24.1	10.8	6.5	22	5	4.1	2,000	160
Mercury	0.017 U	0.016 U	0.019 U	0.015 U	0.015 U	0.02 U	0.02 B	0.018 U	0.019 U	0.032 B	0.015 U	0.02 U	31	2.3
Nickel	0.84	0.21 B	0.12 U	0.69	0.35 B	0.11 U	2.3	0.31 B	0.31 B	1.5	0.15 B	0.12 U	2,000	160
Potassium	161	63.5 B	62.7 B	173	59.8 B	56.2 B	445	50.1 B	58.6 B	361	43.1 B	55.9 B	---	---
Selenium	0.32 U	0.35 U	0.4 U	0.42 B	0.32 U	0.37 U	0.74	0.35 U	0.39 U	0.74	0.33 U	0.4 U	510	39
Silver	0.07 U	0.07 U	0.08 U	0.07 U	0.07 U	0.08 U	0.07 U	0.09 B	0.08 U	0.07 U	0.07 U	0.08 U	510	39
Sodium	51.3 B	52.2 B	77.7 B	50.3 B	48.1 B	56.7 B	68.5 B	49.9 B	58.3 B	76 B	48.6 B	51.4 B	---	---
Thallium	0.49 UN	0.54 UN	0.62 UN	0.49 UN	0.5 UN	0.57 UN	0.53 UN	0.54 UN	0.61 UN	0.53 UN	0.5 UN	0.61 UN	7.2	0.55
Vanadium	5.3	1.2 B	0.89 B	5	1.2 B	1.3 B	19.4	1.1 B	1 B	13.3	1.3 B	1.4 B	100	7.8
Zinc	4.1	5.3	15.8	3.9	1.6 B	1.5 B	8.7	3.5	2.9	6.8	1.7 B	1.3 B	31,000	2,300

Notes:

(1) EPA Risk-based Concentrations for Industrial and Residential Soils (April 25, 2003)
(Non-carcinogens adjusted to a Hazard Index of 0.1)

Data Qualifiers:

U Not detected
B Analyte present. Reported value between detection and quantitation limits
E Estimated value, serial dilution results not within 10 percent
N Sample spike recovery is outside of control limits
* Sample and duplicate results are not within control limits

550	Bolded text indicates analyte was detected.
200	Yellow shaded box indicates analyte detected above EPA RBC for residential soils only
800	Pink shaded box indicates analyte detected above EPA RBC for both residential and industrial soils

TABLE 2-5
GROUNDWATER RESULTS (January 2003)
80th Division Reserve Site, Fort Story, VA

Compound	Monitoring Well I.D. and Groundwater Results										EPA Screening Criteria	
	MW-1	MW-2	MW-3	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	Tap Water RBCs ⁽¹⁾	MCLs ⁽²⁾
VOCs (ug/L)												
cis-1,2-Dichloroethene	5 U	5 U	5 U	5 U	5 U	0.7 J	5 U	5 U	5 U	5 U	6.1	70
Tetrachloroethene	5 U	5 U	5 U	0.3 J	5 U	4 J	6	0.8 J	5 U	5 U	0.1	5
Toluene	0.5 JB	0.5 JB	1 JB	0.3 JB	0.3 JB	0.2 JB	0.4 JB	0.3 JB	0.4 JB	0.4 JB	230	1,000
1,2,4-Trichlorobenzene	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.2 JB	5 U	6.1	70
Trichloroethene	5 U	5 U	5 U	0.9 J	5 U	3 J	0.8 J	5 U	5 U	5 U	0.026	5
SVOCs (ug/L)												
Bis(2-ethylhexyl) phthalate	10 U	10 U	10 U	10 U	10 U	10 U	5 J	10 U	10 U	10 U	4.8	6
PESTICIDES/PCBs (ug/L)												
No pesticides or PCBs detected												
TOTAL METALS (ug/L)												
Aluminum	93.6 B	890	227	56.5 B	112	212	778	284	953	168	---	---
Antimony	5.1 B	6.4 B	3.1 B	2.5 B	3 B	2.3 U	4 B	2.3 U	2.8 B	4.6 B	1.5	6
Arsenic	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	3.7 U	6 B	3.7 U	4.9 B	4.8 B	0.045	10
Barium	5.2 BE	15.7 E	9.3 BE	7.8 BE	18.4 E	12.8 E	8.8 BE	30.8 E	10.8 E	13.1 E	730	2,000
Beryllium	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	7.3	4
Cadmium	0.4 U	1.1 B	0.4 U	0.4 U	0.41 B	0.4 U	0.4 U	0.71 B	0.4 U	0.4 U	1.8	5
Calcium	13,000	20,900	10,200	11,100	7,970	10,100	11,200	12,600	26,700	24,000	---	---
Chromium	1.8 B	6.6	1.9 B	1.3 B	1 B	2.1 B	2.8 B	2.2 B	4.4 B	2.2 B	11	100
Cobalt	0.59 B	0.5 U	0.5 U	0.5 U	0.5 U	0.53 B	0.5 U	0.5 U	0.5 U	0.5 U	73	---
Copper	1.5 U	1.9 B	1.5 U	1.5 U	1.5 U	1.5 U	4.2 B	1.5 U	1.5 U	1.5 U	150	1,300
Iron	650	972	292	802	884	1,390	1,020	1,120	3,240	5,130	1,100	---
Lead	1.1 U	4	1.1 U	1.1 U	1.8 B	1.1 U	1.2 B	1.1 U	1.3 B	1.1 U	---	15 ⁽³⁾
Magnesium	1,280	2,700	1,130	1,620	2,090	1,210	1,260	1,460	3,160	2,970	---	---
Manganese	19.6	17.2	36.2	20	10.6	17.2	52	26.7	122	165	73	---
Mercury	0.11 B	0.12 B	0.11 B	0.1 B	0.1 U	0.13 B	0.1 U	0.1 U	0.12 B	0.1 U	1.1 ⁽⁴⁾	2
Nickel	1 U	2.5 B	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	73	---
Potassium	1,130	2,380	1,110	1,040	1,480	2,170	1,580	2,040	4,920	2,270	---	---
Selenium	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 U	2.6 B	2.6 U	2.6 U	3.5 B	18	50
Silver	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	18	---
Sodium	4,140	4,970	3,620	4,870	11,700	3,160	7,150	7,740	4,840	4,010	---	---
Thallium	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	0.26	2
Vanadium	1.2 B	4.2 B	1.9 B	0.88 B	0.65 B	1.1 B	6.3 B	0.4 U	4.6 B	2.3 B	3.7	---
Zinc	309 *	173 *	76.6 *	134 *	86.7 *	177 *	11.7 B*	100 *	12 B*	6.8 B*	1,100	---

TABLE 2-5
GROUNDWATER RESULTS (January 2003)
80th Division Reserve Site, Fort Story, VA

Compound	Monitoring Well I.D. and Groundwater Results										EPA Screening Criteria	
	MW-1	MW-2	MW-3	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	Tap Water RBCs ⁽¹⁾	MCLs ⁽²⁾
DISSOLVED METALS (ug/L)												
Aluminum	37.9 B	86.2 B	207	39.1 B	60.7 B	73.3 B	63.6 B	98.5 B	124	85.7 B	---	---
Antimony	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	1.5	6
Arsenic	3.7 U	3.7 U	3.7 U	5.4 B	3.7 U	3.7 U	5 B	3.7 U	3.7 U	3.7 U	0.045	10
Barium	4.9 B	11.5	8.8 B	7.7 B	17.9	12.2	6.7 B	28.2	8.6 B	13	730	2,000
Beryllium	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	7.3	4
Cadmium	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.98 B	0.4 U	0.4 U	1.8	5
Calcium	13600	20800	10400	11400	8190	10400	10900	12800	27500	25200	---	---
Chromium	0.6 U	0.81 B	1.2 B	0.6 U	0.6 U	0.6 U	0.85 B	0.6 U	0.78 B	0.6 U	11	100
Cobalt	0.53 B	0.5 U	0.5 U	0.5 U	0.5 U	0.65 B	0.5 U	1.1 B	0.5 U	0.5 U	73	---
Copper	1.5 U	1.5 U	2.1 B	1.5 U	1.5 U	1.5 U	1.5 U	2.1 B	1.5 U	1.5 U	150	1,300
Iron	484	81.6 B	247	885	419	1,170	355	1,010	2,170	4,650	1,100	---
Lead	1.3 B	1.1 U	1.4 B	1.1 U	1.2 B	---	15 ⁽³⁾					
Magnesium	1,330	2,720	1,150	1,700	2,160	1,260	1,190	1,530	3,260	3,100	---	---
Manganese	18.9	13.8	37.2	21.7	9.7 B	16.9	48.5	28	123	167	73	---
Mercury	0.1 U	0.11 B	0.13 B	0.1 U	0.11 B	0.1 U	0.12 B	0.1 U	0.12 B	0.1 U	1.1 ⁽⁴⁾	2
Nickel	1 U	1 U	1.5 B	1 U	1 U	1 U	2.2 B	1.9 B	1 U	1 U	73	---
Potassium	1,340	2,630	1,250	1,200	1,670	2,410	1,730	2,320	5,520	2,670	---	---
Selenium	2.6 U	10.3	3.1 B	3.7 B	2.6 U	3.6 B	2.6 U	2.6 U	3.8 B	3 B	18	50
Silver	0.7 UN	0.7 UN	0.7 UN	0.7 UN	0.7 UN	0.7 UN	0.7 UN	0.7 UN	0.7 UN	0.7 UN	18	---
Sodium	4,010	4,860	3,560	4,740	11,900	2,930	7,400	8,570	4,860	4,100	---	---
Thallium	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	4.4 U	0.26	2
Vanadium	1.1 B	1.5 B	1.7 B	0.79 B	0.48 B	1 B	4.8 B	0.55 B	2.2 B	2 B	3.7	---
Zinc	299	27	79.7	133	88.2	158	3.6 B	97.7	4.4 B	4.9 B	1,100	---
MISCELLANEOUS (mg/L)												
Total Dissolved Solids	52	75	68	53	71	45	50	80	106	99	---	---
Total Suspended Solids	1 U	9.6	2.4	1 U	2.1	2.2	21.6	5.2	16.8	2.4	---	---

Notes:

- (1) EPA Risk-based Concentrations for Tap Water - April 25, 2003 EPA RBC Table (Non-carcinogens adjusted to a Hazard Index of 0.1)
- (2) EPA Maximum Contaminant Levels (MCLs) - Only primary drinking water standards presented. Secondary MCLs for aesthetics only and are not presented in table.
- (3) EPA Action Level of 15 ug/L presented.
- (4) EPA RBC for tap water for mercuric chloride used for mercury.

Data Qualifiers:

- Organics:*
- U Not detected
 - J Analyte present. Reported value between detection and quantitation limits
 - B Analyte present in associated method blank
- Inorganics:*
- U Not detected
 - B Analyte present. Reported value between detection and quantitation limits.
 - N Spike recovery is outside of control limits.
 - E Estimated value. Serial dilution not within 10 percent.
 - * Sample and duplicate sample not within control limits.

550 Bolded text indicates analyte was detected.
800 Shaded box indicates analyte detected above EPA screening criteria

**TABLE 2-6
GROUNDWATER RESULTS (June 2004)
80th Division Reserve Site, Fort Story, VA**

Compound	Monitoring Well I.D. and Groundwater Results														EPA Screening Criteria	
	MW-1	MW-1D	MW-2	MW-3	MW-5	MW-6	MW-6 (dup)	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	Tap Water RBCs ⁽¹⁾	MCLs ⁽²⁾
VOCs (ug/L)																
cis-1,2-Dichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	1.9 J	5 U	5 U	11	5 U	5 U	5 U	5 U	6.1	70
Tetrachloroethene	5 U	5 U	5 U	5 U	2.1 J	5 U	1.2 J	5 U	5 U	6.3	5 U	5 U	5 U	5 U	0.1	5
Trichloroethene	5 U	5 U	5 U	5 U	5 U	5 U	1.5 J	5 U	5 U	7.5	5 U	5 U	5 U	5 U	0.026	5

Notes:

- (1) EPA Risk-based Concentrations for Tap Water - October 2004 EPA RBC Table (Non-carcinogens adjusted to a Hazard Index of 0.1)
- (2) EPA Maximum Contaminant Levels (MCLs) - Only primary drinking water standards presented. Secondary MCLs for aesthetics only and are not presented in table.

Data Qualifiers:

Organics:

U Not detected

J Analyte present. Reported value between detection and quantitation limits

550
800

Bolded text indicates analyte was detected.

Shaded box indicates analyte detected above EPA screening criteria

**TABLE 2-7
Hazard Assessment for Surface Soils
80th DRS, Fort Story, Virginia**

Compound	Range of Detection	Frequency of Detection	EPA Region III Industrial Soil RBCs ⁽¹⁾	EPA Region III Residential Soil RBCs ⁽¹⁾	EPA Carcinogen Class ⁽²⁾	Potential Concern? ⁽³⁾
VOCs (ug/kg)						
Acetone	14 - 44	6/10	92,000,000	7,000,000	D	
2-Butanone (MEK)	5	1/10	61,000,000	4,700,000	D	
Carbon Disulfide	1 - 2	3/10	10,000,000	780,000	Not Assigned	
Chlorobenzene	0.5	1/10	2,000,000	160,000	D	
1,2-Dichlorobenzene	0.3	1/10	9,200,000	700,000	D	
1,3-Dichlorobenzene	0.5	1/10	310,000	23,000	D	
1,4-Dichlorobenzene	0.4 - 0.5	2/10	120,000	27,000	Not Assigned	
Dichlorodifluoromethane	0.6	1/10	20,000,000	1,600,000	Not Assigned	
1,2-Dichloroethane	3	1/10	31,000	7,000	B2	
Trans-1,2-dichloroethene	0.9 - 1	2/10	2,000,000	160,000	Not Assigned	
Ethylbenzene	0.7	2/10	10,000,000	780,000	D	
2-Hexanone	13 - 230	2/10	4,100,000	310,000	Not Assigned	
Methyl acetate	5 - 69	3/10	100,000,000	7,800,000	D	
Methylene chloride	4 - 10	9/10	380,000	85,000	B2	
4-Methyl-2-pentanone (MIBK)	10	1/10	---	---	Not Assigned	
Tetrachloroethene	5 - 120	5/10	5,300	1,200	C-B2	
Toluene	0.7 - 4	8/10	8,200,000	630,000	D	
Trichloroethene	0.8 - 1.0	2/10	7,200	1,600	B2	
Trichlorofluoromethane	2 - 3	2/10	31,000,000	2,300,000	Not Assigned	
1,1,2-trichloro-1,2,2-trifluoethane	1 - 2	4/10	3,100,000,000	230,000,000	Not Assigned	
Xylene (total)	1 - 7	3/10	20,000,000	1,600,000	D	

TABLE 2-7
Hazard Assessment for Surface Soils
80th DRS, Fort Story, Virginia

Compound	Range of Detection	Frequency of Detection	EPA Region III Industrial Soil RBCs ⁽¹⁾	EPA Region III Residential Soil RBCs ⁽¹⁾	EPA Carcinogen Class ⁽²⁾	Potential Concern? ⁽³⁾
SVOCs (ug/kg)						
Acenaphthene	49 - 960	4/10	6,100,000	470,000	Not Assigned	
Acenaphthylene ⁽⁴⁾	81 - 2,200	6/10	3,100,000	230,000	D	
Anthracene	76 - 2,500	6/10	31,000,000	2,300,000	D	
Benzo(a)anthracene	210 - 5,600	6/10	3,900	220	B2	Yes
Benzo(a)pyrene	28 - 5,500	7/10	390	22	B2	Yes
Benzo(b)fluoranthene	240 - 6,800	6/10	3,900	220	B2	Yes
Benzo(g,h,i)perylene ⁽⁴⁾	27 - 3,700	7/10	3,100,000	230,000	D	
Benzo(k)fluoranthene	36 - 4,100	7/10	39,000	2,200	B2	
1,1'-Biphenyl	85 - 470	4/10	5,100,000	39,000	D	
Bis(2-ethylhexyl)phthalate	40 - 200	8/10	200,000	46,000	B2	
Carbazole	120 - 490	4/10	140,000	32,000	----	
Chrysene	34 - 6,000	8/10	390,000	22,000	B2	
Dibenzo(a,h)anthracene	46 - 1,500	6/10	390	22	B2	Yes
Dibenzofuran	30 - 790	3/10	200,000	16,000	D	
3,3'-Dichlorobenzidine	290	1/10	6,400	1,400	B2	
Di-n-octyl phthalate	24 - 280	3/10	2,000,000	160,000	----	
Fluoranthene	370 - 9,800	7/10	4,100,000	310,000	D	
Fluorene	67 - 1,600	5/10	4,100,000	310,000	D	
Indeno(1,2,3-cd)pyrene	29 - 3,600	6/10	3,900	220	B2	Yes
2-Methylnaphthalene	34 - 2,400	5/10	410,000	31,000	D	
Naphthalene	120 - 1,200	4/10	2,000,000	160,000	Not Assigned	
Phenanthrene ⁽⁴⁾	390 - 12,000	6/10	3,100,000	230,000	D	
Pyrene	43 - 16,000	6/10	3,100,000	230,000	D	

TABLE 2-7
Hazard Assessment for Surface Soils
80th DRS, Fort Story, Virginia

Compound	Range of Detection	Frequency of Detection	EPA Region III Industrial Soil RBCs ⁽¹⁾	EPA Region III Residential Soil RBCs ⁽¹⁾	EPA Carcinogen Class ⁽²⁾	Potential Concern? ⁽³⁾
Pesticides/PCBs (ug/kg)						
Aldrin	36 - 76	2/10	170	38	B2	Yes
beta-BHC	3.7	1/10	1,600	350	C	
delta-BHC	1.3	1/10	450	100	D	
4,4'-DDD	2.7	1/10	12,000	2,700	B2	
4,4'-DDE	1.7 - 3.1	2/10	8,400	1,900	B2	
4,4'-DDT	2.4 - 8.8	3/10	8,400	1,900	B2	
Dieldrin	27	1/10	180	40	B2	
Endosulfan II ⁽⁵⁾	18	1/10	610,000	47,000	B2	
Endosulfan sulfate ⁽⁵⁾	25 - 110	3/10	610,000	47,000	B2	
Endrin aldehyde	0.97	1/10	31,000	2,300	D	
Endrin ketone	4.2 - 110	5/10	31,000	2,300	D	

**TABLE 2-7
Hazard Assessment for Surface Soils
80th DRS, Fort Story, Virginia**

Compound	Range of Detection	Frequency of Detection	EPA Region III Industrial Soil RBCs ⁽¹⁾	EPA Region III Residential Soil RBCs ⁽¹⁾	EPA Carcinogen Class ⁽²⁾	Potential Concern? ⁽³⁾
Metals (mg/kg)						
Aluminum	395 - 8,530	10/10	---	---	D	
Antimony	0.35 - 2.1	8/10	41	3.10	Not Assigned	
Arsenic	0.35 - 1.0	9/10	1.9	0.43	A	Yes
Barium	1.6 - 15.8	10/10	20,000	1,600	Not Assigned	
Beryllium	0.01 - 0.12	10/10	200	16	B2	
Calcium	44 - 3060	10/10	---	---	---	
Chromium (as Cr VI)	1 - 10	10/10	310	23	A	
Cobalt	0.17 - 0.93	10/10	2,000	160	---	
Copper	0.38 - 14.4	7/10	4,100	310	D	
Iron	760 - 10,100	10/10	31,000	2,300	---	Yes
Lead ⁽⁶⁾	0.84 - 33.9	10/10	400	400	B2	
Magnesium	50.7 - 504	10/10	---	---	---	
Manganese	3.4 - 69.1	10/10	2,000	160	D	
Mercury	0.02 - 0.035	6/10	31	2.3	D	
Nickel	0.13 - 3.7	10/10	2,000	160	B2	
Potassium	64.9 - 494	10/10	---	---	---	
Selenium	0.37 - 0.74	5/10	510	39	D	
Sodium	44.5 - 133	10/10	---	---	---	
Vanadium	2 - 19.4	10/10	100	7.8	Not Assigned	Yes
Zinc	1.8 - 81.8	10-Oct	31,000	2,300	D	

Notes:

(1) EPA Region III RBC Criteria for Industrial and Residential Soils (April 2003). Non-carcinogenic RBCs have been adjusted to a hazard quotient of 0.1.

(2) Weight of Evidence Classification:

A= Human carcinogen

B1= Probable human carcinogen, limited human data

B2= Probable human carcinogen, sufficient evidence in animals or no evidence in humans

C= Possible human carcinogen

D= Not classified as to carcinogenicity

(3) Potential Concern - Yes indicates that the chemical will be evaluated quantitatively while Qual indicates that the compound has no screening criteria available and it will be evaluated qualitatively.

(4) RBC for pyrene used as a surrogate.

(5) RBC for endosulfan used as a surrogate.

(6) USEPA Lead standard for children playing in exposed soil

TABLE 2-8
Hazard Assessment for Combined Surface/Subsurface Soils
80th DRS, Fort Story, Virginia

Compound	Range of Detection	Frequency of Detection	EPA Region III Industrial Soil RBCs ⁽¹⁾	EPA Region III Residential Soil RBCs ⁽¹⁾	EPA Carcinogen Class ⁽²⁾	Potential Concern? ⁽³⁾
VOCs (ug/kg)						
Acetone	5 - 57	26/30	92,000,000	7,000,000	D	
2-Butanone (MEK)	5	1/30	61,000,000	4,700,000	D	
Carbon Disulfide	0.8 - 6	9/30	10,000,000	780,000	Not Assigned	
Chlorobenzene	0.5	5/30	2,000,000	160,000	D	
1,2-Dichlorobenzene	0.3	1/30	9,200,000	700,000	D	
1,3-Dichlorobenzene	0.5	1/30	310,000	23,000	D	
1,4-Dichlorobenzene	0.3 - 0.5	6/30	120,000	27,000	Not Assigned	
Dichlorodifluoromethane	0.6	3/30	20,000,000	1,600,000	Not Assigned	
1,2-Dichloroethane	3	1/30	31,000	7,000	B2	
Trans-1,2-dichloroethene	0.7 - 1	7/30	2,000,000	160,000	Not Assigned	
Ethylbenzene	0.5 - 0.7	6/30	10,000,000	780,000	D	
2-Hexanone	13 - 230	2/30	4,100,000	310,000	Not Assigned	
Methyl acetate	5 - 69	3/30	100,000,000	7,800,000	D	
Methylene chloride	4 - 10	26/30	380,000	85,000	B2	
4-Methyl-2-pentanone (MIBK)	5 - 16	8/30	---	---	Not Assigned	
Tetrachloroethene	2 - 120	14/30	5,300	1,200	C-B2	
Toluene	0.7 - 5	28/30	8,200,000	630,000	D	
Trichloroethene	0.5 - 1	7/30	7,200	1,600	B2	
Trichlorofluoromethane	0.8 - 3	8/30	31,000,000	2,300,000	Not Assigned	
1,1,2-trichloro-1,2,2-trifluoroethane	0.7 - 2	15/30	3,100,000,000	230,000,000	Not Assigned	
Xylene (total)	1 - 7	11/30	20,000,000	1,600,000	D	

TABLE 2-8
Hazard Assessment for Combined Surface/Subsurface Soils
80th DRS, Fort Story, Virginia

Compound	Range of Detection	Frequency of Detection	EPA Region III Industrial Soil RBCs ⁽¹⁾	EPA Region III Residential Soil RBCs ⁽¹⁾	EPA Carcinogen Class ⁽²⁾	Potential Concern? ⁽³⁾
SVOCs (ug/kg)						
Acenaphthene	49 - 960	7/30	6,100,000	470,000	Not Assigned	
Acenaphthylene ⁽⁴⁾	21 - 2,200	18/30	3,100,000	230,000	D	
Anthracene	32 - 2,500	15/30	31,000,000	2,300,000	D	
Benzo(a)anthracene	45 - 5,600	18/30	3,900	220	B2	Yes
Benzo(a)pyrene	28 - 5,500	19/30	390	22	B2	Yes
Benzo(b)fluoranthene	69 - 6,800	18/30	3,900	220	B2	Yes
Benzo(g,h,i)perylene ⁽⁴⁾	26 - 3,700	20/30	3,100,000	230,000	D	
Benzo(k)fluoranthene	36 - 4,100	19/30	39,000	2,200	B2	
1,1'-Biphenyl	26 - 470	6/30	5,100,000	39,000	D	
Bis(2-ethylhexyl)phthalate	40 - 880	27/30	200,000	46,000	B2	
Carbazole	48 - 490	5/30	140,000	32,000	----	
Chrysene	34 - 6,000	19/30	390,000	22,000	B2	
Dibenzo(a,h)anthracene	30 - 1,500	14/30	390	22	B2	Yes
Dibenzofuran	30 - 790	6/30	200,000	16,000	D	
3,3'-Dichlorobenzidine	41 - 290	2/30	6,400	1,400	B2	
2,4-Dinitrotoluene	130	1/30	200,000	16,000	B2	
2,6-Dinitrotoluene	51	1/30	100,000	7,800	B2	
Di-n-octyl phthalate	24 - 280	6/30	2,000,000	160,000	----	
Fluoranthene	28 - 9,800	21/30	4,100,000	310,000	D	
Fluorene	28 - 1,600	12/30	4,100,000	310,000	D	
Indeno(1,2,3-cd)pyrene	25 - 3,600	19/30	3,900	220	B2	Yes
2-Methylnaphthalene	34 - 2,400	11/30	410,000	31,000	----	
N-Nitrosodiphenylamine	150	1/30	580,000	130,000	---	
Naphthalene	31 - 1,200	6/30	2,000,000	160,000	Not Assigned	
Phenanthrene ⁽⁴⁾	29 - 12,000	20/30	3,100,000	230,000	D	
Pyrene	43 - 16,000	20/30	3,100,000	230,000	D	

**TABLE 2-8
Hazard Assessment for Combined Surface/Subsurface Soils
80th DRS, Fort Story, Virginia**

Compound	Range of Detection	Frequency of Detection	EPA Region III Industrial Soil RBCs ⁽¹⁾	EPA Region III Residential Soil RBCs ⁽¹⁾	EPA Carcinogen Class ⁽²⁾	Potential Concern? ⁽³⁾
Pesticides/PCBs (ug/kg)						
Aldrin	0.98 - 73	5/30	170	38	B2	Yes
alpha-BHC	0.53 - 1.7	3/30	450	100	B2	
beta-BHC	2.4 - 100	3/30	1,600	350	C-B2	
delta-BHC	0.66	1/30	450	100	D	
gamma-BHC (Lindane)	0.37 - 0.39	2/30	2,200	490	Not Assigned	
Chlordane (gamma)	1.7	1/30	8,200	1,800	B2	
4,4'-DDD	0.42 - 6.4	5/30	12,000	2,700	B2	
4,4'-DDE	1.6 - 3.1	4/30	8,400	1,900	B2	
4,4'-DDT	0.91 - 8.8	8/30	8,400	1,900	B2	
Dieldrin	7.1 - 27	3/30	180	40	B2	
Endosulfan I ⁽⁵⁾	0.9	1/30	610,000	47,000	B2	
Endosulfan II ⁽⁵⁾	18	1/30	610,000	47,000	B2	
Endosulfan sulfate ⁽⁵⁾	0.8 - 110	7/30	610,000	47,000	B2	
Endrin aldehyde	0.88 - 0.97	2/30	31,000	2,300	B2	
Endrin ketone	1.1 - 110	17/30	31,000	2,300	B2	
Heptachlor	1	1/30	640	140	B2	
Aroclor-1260	21 - 67	2/30	1,400	320	Not Assigned	

**TABLE 2-8
Hazard Assessment for Combined Surface/Subsurface Soils
80th DRS, Fort Story, Virginia**

Compound	Range of Detection	Frequency of Detection	EPA Region III Industrial Soil RBCs ⁽¹⁾	EPA Region III Residential Soil RBCs ⁽¹⁾	EPA Carcinogen Class ⁽²⁾	Potential Concern? ⁽³⁾
Metals (mg/kg)						
Aluminum	135 - 8,530	30/30	---	---	D	
Antimony	0.35 - 2.1	20/30	41	3	Not Assigned	
Arsenic	0.35 - 1.2	13/30	1.9	0.43	A	Yes
Barium	0.98 - 15.8	30/30	20,000	1,600	Not Assigned	
Beryllium	0.01 - 0.12	21/30	200	16	B2	
Cadmium	0.11	1/30	100	8	B1	
Calcium	18.2 - 3,060	30/30	---	---	---	
Chromium (as Cr VI)	1.0 - 10	30/30	310	23	A	
Cobalt	0.07 - 0.93	27/30	---	---	---	
Copper	0.28 - 6.3	15/30	4,100	310	D	
Iron	335 - 10,100	30/30	31,000	2,300	---	Yes
Lead ⁽⁶⁾	0.5 - 33.9	30/30	400	400	B2	
Magnesium	20.8 - 504	30/30	---	---	---	
Manganese	1.9 - 69.1	30/30	2,000	160	D	
Mercury	0.017 - 0.035	11/30	31	2.3	D	
Nickel	0.13 - 3.7	26/30	2,000	160	B2	
Potassium	39.7 - 494	29/30	---	---	---	
Selenium	0.37 - 0.74	5/30	510	39	D	
Silver	0.09	1/30	510	39	D	
Sodium	44.5 - 133	30/30	---	---	---	
Vanadium	0.76 - 19.4	30/30	100	7.8	Not Assigned	Yes
Zinc	1.1 - 81.8	30/30	31,000	2,300	D	

Notes:

(1) EPA Region III RBC Criteria for Industrial and Residential Soils (April 2003). Non-carcinogenic RBCs have been adjusted to a hazard quotient of 0.1.

(2) Weight of Evidence Classification:

A= Human carcinogen

B1= Probable human carcinogen, limited human data

B2= Probable human carcinogen, sufficient evidence in animals or no evidence in humans

C= Possible human carcinogen

D= Not classified as to carcinogenicity

(3) Potential Concern - Yes indicates that the chemical will be evaluated quantitatively while Qual indicates that the compound has no screening criteria available and it will be evaluated qualitatively.

(4) RBC for pyrene used as a surrogate.

(5) RBC for endosulfan used as a surrogate.

(6) USEPA Lead standard for children playing in exposed soil

TABLE 2-9
Hazard Assessment for Groundwater
80th DRS, Fort Story, Virginia

Parameters	Range of Detection	Frequency of Detection	USEPA RBCs ⁽¹⁾	USEPA MCLs ⁽²⁾	EPA Carcinogen Class ⁽³⁾	Potential Concern? ⁽⁴⁾
VOCs (ug/l)						
cis 1, 2-DCE	0.7 - 11.0	3/22	6.1 ⁽⁵⁾	70	D	Yes
PCE	0.30 - 6.3	7/22	0.1	5	C-B2	Yes
Toluene	0.2 - 1.0	10/22	230	1000	D	
TCE	0.8 - 7.5	5/22	0.026	5	B2	Yes
1,2,4-Trichlorobenzene	0.2	1/22	6.1	70	D	
SVOCs (ug/l)						
Bis(2-ethylhexyl) phthalate	5	1/10	4.8	6	B2	Yes
Pesticides/PCBs (ug/l)						
No pesticides or PCBs detected						
Metals (ug/l), Total						
Aluminum	56.5 - 953	10/10	---	---	D	
Antimony	2.5 - 6.4	8/10	1.5	6	Not Assigned	Yes
Arsenic	4.8 - 6.0	3/10	0.045	10	A	Yes
Barium	5.2 - 30.8	10/10	730	2,000	Not Assigned	
Cadmium	0.41 - 1.1	3/10	1.8	5	B1	
Calcium	7,970 - 26,700	10/10	---	---	---	
Chromium	1.0 - 6.6	10/10	11	100	A	
Cobalt	0.53 - 0.59	2/10	73	---	---	
Copper	1.9 - 4.2	2/10	150	1,300	D	
Iron	292 - 5,130	10/10	1,100	---	---	Yes
Lead ⁽⁶⁾	1.2 - 4	4/10	---	15	B2	
Magnesium	1,130 - 3,160	10/10	---	---	---	
Manganese	10.6 - 165	10/10	73	---	D	Yes
Mercury ⁽⁷⁾	0.10 - 0.13	6/10	1.1	2	C	
Nickel	2.5	1/10	73	---	B2	
Potassium	1,040 - 4,920	10/10	---	---	---	
Selenium	2.6 - 3.5	2/10	18.0	50	D	
Sodium	3,160 - 11,700	10/10	---	---	---	
Vanadium	0.65 - 6.3	9/10	3.7	---	Not Assigned	Yes
Zinc	6.8 - 309	10/10	1,100	---	D	

TABLE 2-9
Hazard Assessment for Groundwater
80th DRS, Fort Story, Virginia

Parameters	Range of Detection	Frequency of Detection	USEPA RBCs ⁽¹⁾	USEPA MCLs ⁽²⁾	EPA Carcinogen Class ⁽³⁾	Potential Concern? ⁽⁴⁾
Metals (ug/l), Dissolved						
Aluminum	37.9 - 207	10/10	---	---	D	
Arsenic	5.0 - 5.4	2/10	0.045	10	A	Yes
Barium	4.9 - 28.2	10/10	730	2,000	Not Assigned	
Cadmium	0.98	1/10	1.8	5	B1	
Calcium	8,190 - 27,500	10/10	---	---	---	
Chromium	0.78 - 1.2	4/10	11	100	A	
Cobalt	0.53 - 1.1	3/10	73	---	---	
Copper	2.1	2/10	150	1,300	D	
Iron	81.6 - 4,650	10/10	1,100	---	---	Yes
Lead ⁽⁵⁾	1.2 - 1.3	2/10	---	15	B2	
Magnesium	1,150 - 3,260	10/10	---	---	---	
Manganese	9.7 - 167	10/10	73	---	D	Yes
Mercury ⁽⁶⁾	0.11 - 0.13	5/10	1.1	2	C	
Nickel	1.5 - 2.2	3/10	73	---	B2	
Potassium	1,200 - 5,520	10/10	---	---	---	
Selenium	3.0 - 10.3	6/10	18	50	D	
Sodium	2,930 - 11,900	10/10	---	---	---	
Vanadium	0.48 - 4.8	10/10	3.7	---	Not Assigned	Yes
Zinc	3.6 - 299	10/10	1,100	---	D	

Notes:

- (1) EPA Region III RBC Criteria for Industrial and Residential Soils (May 2002). Non-carcinogenic RBCs have been adjusted to a hazard quotient of 0.1.
- (2) EPA MCLs (July 2002)
- (3) Weight of Evidence Classification:
A= Human carcinogen
B1= Probable human carcinogen, limited human data
B2= Probable human carcinogen, sufficient evidence in animals or no
C= Possible human carcinogen
D= Not classified as to carcinogenicity

- (4) Potential Concern - **Yes** indicates that the chemical will be evaluated quantitatively while **Qual** indicates that the compound has no screening criteria available and it will be evaluated qualitatively.
- (5) Total 1,2-DCE tap water RBC value used for cis 1,2-DCE
- (6) At the tap Action Limit. Applicable only to drinking water.
- (7) EPA RBC for tap water for mercuric chloride used for mercury.

TABLE 2-10
CHRONIC HAZARD INDEX ESTIMATES (NONCANCER EFFECTS)
FORT STORY/FUTURE INDUSTRIAL SITE WORKERS
80th DRS, FORT STORY, VIRGINIA

Exposure Pathway	COPC	CDI (mg/kg-day)	RfD Adjusted For Absorption	RfD (mg/kg-day)	Hazard Quotient	Pathway Hazard Index
Ingestion of COPC in Surface Soil	Benzo(a)anthracene	4.73E-06	No	----	----	0.00E+00
	Benzo(a)pyrene	4.71E-06	No	----	----	
	Benzo(b)fluoranthene	6.11E-06	No	----	----	
	Dibenzo(a,h)anthracene	1.01E-06	No	----	----	
Dermal Contact with COPC in Surface Soil	Benzo(a)anthracene	4.05E-06	No	----	----	0.00E+00
	Benzo(a)pyrene	4.04E-06	No	----	----	
	Benzo(b)fluoranthene	5.24E-06	No	----	----	
	Dibenzo(a,h)anthracene	8.65E-07	No	----	----	
Inhalation of COPC in Site Soil Particulates	Benzo(a)anthracene	4.45E-10	No	----	----	0.00E+00
	Benzo(a)pyrene	4.43E-10	No	----	----	
	Benzo(b)fluoranthene	5.75E-10	No	----	----	
	Dibenzo(a,h)anthracene	9.49E-11	No	----	----	
Total Exposure Hazard Index						0.00E+00

Notes:

CDI = Chronic Daily Intake

RfD = Reference dose

Hazard Quotient = CDI/RfD

**TABLE 2-11
CANCER RISK ESTIMATES
FORT STORY/FUTURE INDUSTRIAL SITE WORKERS
80th DRS, FORT STORY, VIRGINIA**

Exposure Pathway	COPC	CDI (mg/kg-day)	CPS Adjusted For Absorption	CPS (mg/kg-day) ⁻¹	Chemical-Specific Risk	Total Pathway Risk
Ingestion of COPC in Surface Soil	Benzo(a)anthracene	1.69E-06	No	7.30E-01	1.23E-06	1.77E-05
	Benzo(a)pyrene	1.68E-06	No	7.30E+00	1.23E-05	
	Benzo(b)fluoranthene	2.18E-06	No	7.30E-01	1.59E-06	
	Dibenzo(a,h)anthracene	3.60E-07	No	7.30E+00	2.63E-06	
Dermal Contact with COPC in Surface Soil	Benzo(a)anthracene	1.45E-06	No	7.30E-01	1.06E-06	1.52E-05
	Benzo(a)pyrene	1.44E-06	No	7.30E+00	1.05E-05	
	Benzo(b)fluoranthene	1.87E-06	No	7.30E-01	1.37E-06	
	Dibenzo(a,h)anthracene	3.09E-07	No	7.30E+00	2.26E-06	
Inhalation of COPC in Site Soil Particulates	Benzo(a)anthracene	1.59E-10	No	---	---	4.90E-10
	Benzo(a)pyrene	1.58E-10	No	3.10E+00	4.90E-10	
	Benzo(b)fluoranthene	2.05E-10	No	---	---	
	Dibenzo(a,h)anthracene	3.39E-11	No	---	0.00E+00	
Total Exposure Risk						3.29E-05

Notes:

CDI = Chronic Daily Intake

CPS - Cancer Potency Slope

Chemical-specific Risk = CDI X CPS

**TABLE 2-12
CHRONIC HAZARD INDEX ESTIMATES (NONCANCER EFFECTS)
CONSTRUCTION WORKERS
80th DRS, FORT STORY, VIRGINIA**

Exposure Pathway	COPC	CDI (mg/kg-day)	RfD Adjusted For Absorption	RfD (mg/kg-day)	Hazard Quotient	Pathway Hazard Index
Ingestion of COPC in Combined Surface/Subsurface	Benzo(a)anthracene	4.02E-06	No	----	----	0.00E+00
	Benzo(a)pyrene	3.90E-06	No	----	----	
	Benzo(b)fluoranthene	5.18E-06	No	----	----	
	Dibenzo(a,h)anthracene	6.46E-07	No	----	----	
Dermal Contact with COPC in Combined	Benzo(a)anthracene	6.46E-06	No	----	----	0.00E+00
	Benzo(a)pyrene	6.27E-06	No	----	----	
	Benzo(b)fluoranthene	8.33E-06	No	----	----	
	Dibenzo(a,h)anthracene	1.04E-06	No	----	----	
Inhalation of COPC in Site Soil Particulates	Benzo(a)anthracene	3.70E-08	No	----	----	0.00E+00
	Benzo(a)pyrene	3.59E-08	No	----	----	
	Benzo(b)fluoranthene	4.77E-08	No	----	----	
	Dibenzo(a,h)anthracene	5.97E-09	No	----	----	
Total Soil Exposure Hazard Index						0.00E+00
Ingestion of COPC in Groundwater	cis 1,2-DCE	3.42E-07	No	9.00E-03	3.80E-05	5.12E-03
	PCE	4.31E-07	No	1.00E-02	4.31E-05	
	TCE	2.94E-07	No	3.00E-04	9.80E-04	
	Bis(2-ethylhexyl)phthalate	4.89E-07	No	2.00E-02	2.45E-05	
	Total Antimony	4.31E-07	No	4.00E-04	1.08E-03	
	Total Arsenic	5.09E-07	No	3.00E-04	1.70E-03	
	Total Iron	2.57E-04	No	3.00E-01	8.57E-04	
	Total Manganese	8.71E-06	No	1.40E-01	6.22E-05	
	Total Vanadium	3.42E-07	No	1.00E-03	3.42E-04	
Dermal Contact with COPC in Groundwater	cis 1,2-DCE	7.46E-06	No	9.00E-03	8.29E-04	1.04E-01
	PCE	9.38E-06	No	1.00E-02	9.38E-04	
	TCE	2.32E-06	No	3.00E-04	7.73E-03	
	Bis(2-ethylhexyl)phthalate	8.07E-06	Yes	2.00E-02	4.04E-04	
	Total Antimony	2.84E-07	Yes	6.00E-05	4.73E-03	
	Total Arsenic	3.36E-07	Yes	3.00E-04	1.12E-03	
	Total Iron	1.70E-04	Yes	3.00E-01	5.67E-04	
	Total Manganese	5.75E-06	Yes	5.60E-03	1.03E-03	
	Total Vanadium	2.26E-06	Yes	2.60E-05	8.69E-02	
Inhalation of COPC Vapors from Groundwater	cis 1,2-DCE	1.91E-03	No	---	---	1.65E-01
	PCE	1.85E-03	No	8.00E-02	2.31E-02	
	TCE	1.42E-03	No	1.00E-02	1.42E-01	
	Bis(2-ethylhexyl)phthalate	2.98E-06	No	---	----	
Total Groundwater Exposure Hazard Index						2.75E-01
Total Exposure Hazard Index						2.75E-01

Notes:
 CDI = Chronic Daily Intake
 RfD = Reference dose
 Hazard Quotient = CDI/RfD

**TABLE 2-13
CANCER RISK ESTIMATES
CONSTRUCTION WORKERS
80th DRS, FORT STORY, VIRGINIA**

Exposure Pathway	COPC	CDI (mg/kg-day)	CPS Adjusted For Absorption	CPS (mg/kg-day) ⁻¹	Chemical-Specific Risk	Total Pathway Risk
Ingestion of COPC in Combined Surface/Subsurface	Benzo(a)anthracene	5.74E-08	No	7.30E-01	4.19E-08	5.70E-07
	Benzo(a)pyrene	5.57E-08	No	7.30E+00	4.07E-07	
	Benzo(b)fluoranthene	7.40E-08	No	7.30E-01	5.40E-08	
	Dibenzo(a,h)anthracene	9.23E-09	No	7.30E+00	6.74E-08	
Dermal Contact with COPC in Combined	Benzo(a)anthracene	9.23E-08	No	7.30E-01	6.74E-08	9.16E-07
	Benzo(a)pyrene	8.96E-08	No	7.30E+00	6.54E-07	
	Benzo(b)fluoranthene	1.19E-07	No	7.30E-01	8.69E-08	
	Dibenzo(a,h)anthracene	1.48E-08	No	7.30E+00	1.08E-07	
Inhalation of COPC in Site Soil Particulates	Benzo(a)anthracene	5.28E-10	No	----	----	1.59E-09
	Benzo(a)pyrene	5.13E-10	No	3.10E+00	1.59E-09	
	Benzo(b)fluoranthene	6.81E-10	No	----	----	
	Dibenzo(a,h)anthracene	8.53E-11	No	----	----	
Total Soil Exposure Risk						1.49E-06
Ingestion of COPC in Groundwater	cis 1,2-DCE	4.89E-09	No	---	---	1.60E-08
	PCE	6.15E-09	No	5.40E-01	3.32E-09	
	TCE	4.19E-09	No	4.00E-01	1.68E-09	
	Bis(2-ethylhexyl)phthalate	6.99E-09	No	1.40E-02	9.79E-11	
	Total Antimony	6.15E-09	No	----	----	
	Total Arsenic	7.27E-09	No	1.50E+00	1.09E-08	
	Total Iron	3.68E-06	No	----	----	
	Total Manganese	1.24E-07	No	----	----	
	Total Vanadium	4.89E-09	No	----	----	
Dermal Contact with COPC in Groundwater	cis 1,2-DCE	1.07E-07	No	---	---	9.45E-08
	PCE	1.34E-07	No	5.40E-01	7.24E-08	
	TCE	3.32E-08	No	4.00E-01	1.33E-08	
	Bis(2-ethylhexyl)phthalate	1.15E-07	No	1.40E-02	1.61E-09	
	Total Antimony	4.06E-09	Yes	----	----	
	Total Arsenic	4.80E-09	Yes	1.50E+00	7.20E-09	
	Total Iron	2.43E-06	Yes	----	----	
	Total Manganese	8.21E-08	Yes	----	----	
	Total Vanadium	3.23E-09	Yes	----	----	
Inhalation of COPC Vapors from Groundwater	cis 1,2-DCE	2.73E-05	No	---	---	8.65E-06
	PCE	2.65E-05	No	2.00E-02	5.30E-07	
	TCE	2.03E-05	No	4.00E-01	8.12E-06	
	Bis(2-ethylhexyl)phthalate	4.26E-08	No	---	---	
Total Groundwater Exposure Risk						8.76E-06
Total Exposure Risk						1.02E-05

Notes:
 CDI = Chronic Daily Intake
 CPS - Cancer Potency Slope
 Chemical-specific Risk = CDI X CPS

**TABLE 2-14
SOIL SCREENING
80th DRS, FT. STORY, VIRGINIA**

Compound	Squirt	Soil BTAG (ug/kg)		Maximum Detected or PQL ¹	Value Used in Exposure Calcs ¹	Min Screening Level	EEQ	COPC	No Screening Value
		Flora	Fauna						
VOCs									
1,1,2-trichloro-1,2,2-trifluoroethane	--	--	--	2.0 J	2.0	0.00E+00	N/A	Y	X
1,2-Dichlorobenzene	--	1.00E+02	1.00E+02	0.3 J	0.3	1.00E+02	0.00	N	
1,2-Dichloroethane	--	--	8.70E+05	3.0 J	3.0	8.70E+05	0.00	N	
1,3-Dichlorobenzene	--	--	--	0.5 J	0.5	0.00E+00	N/A	Y	X
1,4-Dichlorobenzene		1.00E+02	1.00E+02	0.5 J	0.5	1.00E+02	0.01	N	
2-Butanone (MEK)	--	--	--	5.0 J	5.0	0.00E+00	N/A	Y	X
2-Hexanone	--	--	--	230.0	230.0	0.00E+00	N/A	Y	X
4-Methyl-2-pentanone (MIBK)	--	--	1.00E+05	14.0	14.0	1.00E+05	0.00	N	
Acetone	--	--	--	57.0 B	57.0	0.00E+00	N/A	Y	X
Carbon disulfide	--	--	--	6.0 J	6.0	0.00E+00	N/A	Y	X
Chlorobenzene	1.00E+02	--	1.00E+02	0.5 J	0.5	1.00E+02	0.01	N	
Dichlorodifluoromethane	--	--	--	0.6 J	0.6	0.00E+00	N/A	Y	X
Ethylbenzene	1.00E+06	--	--	0.7 J	0.7	1.00E+06	0.00	N	
Methyl acetate	--	--	--	69.0	69.0	0.00E+00	N/A	Y	X
Methylene chloride (Dichloromethane)	1.00E+02	3.00E+02	3.00E+02	10.0 B	10.0	1.00E+02	0.10	N	
Tetrachloroethylene	5.00E+00	3.00E+02	3.00E+02	120.0	120.0	5.00E+00	24.00	Y	
Toluene	3.00E+05	1.00E+02	1.00E+02	4.0	4.0	1.00E+02	0.04	N	
Trans-1,2-Dichloroethylene	1.00E+02	--	--	1.0 JB	1.0	1.00E+02	0.01	N	
Trichloroethylene	6.50E+01	--	3.00E+02	1.0 J	1.0	6.50E+01	0.02	N	
Trichlorofluoromethane		--	--	3.0 J	3.0	0.00E+00	N/A	Y	X
Xylenes, Total	1.00E+02	--	1.00E+02	7.0 J	7.0	1.00E+02	0.07	N	

**TABLE 2-14
SOIL SCREENING
80th DRS, FT. STORY, VIRGINIA**

Compound	Squirt	Soil BTAG (ug/kg)		Maximum Detected or PQL ¹	Value Used in Exposure Calcs ¹	Min Screening Level	EEQ	COPC	No Screening Value
		Flora	Fauna						
SVOCs									
1,1'-Biphenyl	--	--	--	470.0 J	470.0	0.00E+00	N/A	Y	X
2,4-Dinitrotoluene	--	--	--	1.10E+03 U	55.0	0.00E+00	N/A	Y	X
2,6-Dinitrotoluene	--	--	--	1.10E+03 U	55.0	0.00E+00	N/A	Y	X
2-Methylnaphthalene	--	--	--	2,400.0	2,400.0	0.00E+00	N/A	Y	X
3,3'-Dichlorobenzidine	--	--	--	2.90E+02 J	290.0	0.00E+00	N/A	Y	X
Acenaphthene	--	1.00E+02	1.00E+02	960.0 J	960.0	1.00E+02	9.60	Y	
Acenaphthylene	--	100	100	2,200.0	2,200.0	1.00E+02	22.00	Y	
Benzo(a)anthracene	1.00E+02	1.00E+02	1.00E+02	5.60E+03 D	5,600.0	1.00E+02	56.00	Y	
Benzo(a)pyrene	--	--	1.00E+02	5.50E+03 D	5,500.0	1.00E+02	55.00	Y	
Benzo(b)fluoranthene	1.00E+02	1.00E+02	1.00E+02	6.80E+03 D	6,800.0	1.00E+02	68.00	Y	
Benzo(g,h,i)perylene	--	1.00E+02	1.00E+02	3.70E+03	3,700.0	1.00E+02	37.00	Y	
Benzo(k)fluoranthene	1.00E+02	1.00E+02	1.00E+02	4.10E+03	4,100.0	1.00E+02	41.00	Y	
bis(2-Ethylhexyl)phthalate	--	--	--	3.40E+02	340.0	0.00E+00	N/A	Y	X
Carbazole	--	--	--	4.90E+02 J	490.0	0.00E+00	N/A	Y	X
Chrysene	--	1.00E+02	1.00E+02	6.00E+03 D	6,000.0	1.00E+02	60.00	Y	
Dibenzo(a,h)anthracene	1.00E+02	1.00E+02	1.00E+02	1.50E+03	1,500.0	1.00E+02	15.00	Y	
Dibenzofuran	1.00E+02	--	--	7.90E+02 J	790.0	1.00E+02	7.90	Y	
Di-n-octylphthalate	--	--	--	2.80E+02 J	280.0	0.00E+00	N/A	Y	X
Fluoranthene	--	1.00E+02	1.00E+02	9.80E+03 D	9,800.0	1.00E+02	98.00	Y	
Fluorene	--	1.00E+02	1.00E+02	1.60E+03	1,600.0	1.00E+02	16.00	Y	
Indeno(1,2,3-cd)pyrene	--	1.00E+02	1.00E+02	3.60E+03	3,600.0	1.00E+02	36.00	Y	
Naphthalene	1.00E+02	1.00E+02	1.00E+02	1.50E+02 J	150.0	1.00E+02	1.50	Y	
Phenanthrene	1.00E+02	1.00E+02	1.00E+02	1.20E+04 B	12,000.0	1.00E+02	120.00	Y	
Pyrene	1.00E+02	1.00E+02	1.00E+02	1.60E+04 D	16,000.0	1.00E+02	160.00	Y	
N-Nitrosodiphenylamine	--	--	--	1.10E+03 U	55.0	0.00E+00	N/A	Y	X

**TABLE 2-14
SOIL SCREENING
80th DRS, FT. STORY, VIRGINIA**

Compound	Squirt	Soil BTAG (ug/kg)		Maximum Detected or PQL ¹	Value Used in Exposure Calcs ¹	Min Screening Level	EEQ	COPC	No Screening Value
		Flora	Fauna						
Metals									
Aluminum	4.70E+07	1.00E+03	--	8.53E+06	8,530,000.0	1.00E+03	8,530.00	Y	
Antimony	4.80E+02	4.80E+02	--	2.10E+03 B	2,100.0	4.80E+02	4.38	Y	
Arsenic	5.20E+03	3.30E+05	--	1.00E+03	1,000.0	5.20E+03	0.19	N	
Barium	4.40E+05	4.40E+05	4.40E+05	1.58E+04	15,800.0	4.40E+05	0.04	N	
Beryllium	--	2.00E+01	--	1.20E+02 B	120.0	2.00E+01	6.00	Y	
Cadmium	--	2.50E+03	--	4.00E+01 U	2.00E+01	2.50E+03	0.00	N	
Calcium	--	--	--	3.06E+06	3,060,000.0	0.00E+00	N/A	Y	X
Chromium	3.70E+04	2.00E+01	7.50E+00	1.00E+04	10,000.0	7.50E+00	1,333.33	Y	
Cobalt	6.70E+03	1.00E+05	1.00E+05	9.30E+02	930.0	6.70E+03	0.14	N	
Copper	1.70E+04	1.50E+04		1.44E+04	14,400.0	1.50E+04	0.96	N	
Iron	1.80E+07	3.26E+06	1.20E+04	1.01E+07	10,100,000.0	1.20E+04	841.67	Y	
Lead	1.60E+04	2.00E+03	1.00E+01	3.39E+04 N	33,900.0	1.00E+01	3,390.00	Y	
Magnesium	--	4400000	4400000	5.04E+05	504,000.0	4.40E+06	0.11	N	
Manganese	3.30E+05	3.30E+05	3.30E+05	6.91E+04	69,100.0	3.30E+05	0.21	N	
Mercury	5.80E+01	5.80E+01	5.80E+01	3.50E+02 B	350.0	5.80E+01	6.03	Y	
Nickel	1.30E+04	2.00E+03	--	3.70E+03	3,700.0	2.00E+03	1.85	Y	
Potassium	--	--	--	4.94E+05	494,000.0	0.00E+00	N/A	Y	X
Selenium	2.60E+02	1.80E+03	1.80E+03	7.40E+02	740.0	2.60E+02	2.85	Y	
Silver	--	9.80E+03	--	9.00E+02 U	4.50E+02	9.80E+03	0.00	N	
Sodium	--	--	--	1.33E+05 B	133,000.0	0.00E+00	N/A	Y	X
Thallium	--	1.00E+00	--	6.40E+02 U	3.20E+02	1.00E+00	32.00	Y	
Vanadium	5.80E+04	5.00E+02	5.80E+04	1.94E+04	19,400.0	5.00E+02	38.80	Y	
Zinc	4.80E+04	1.00E+04	--	8.18E+04	81,800.0	1.00E+04	8.18	Y	

**TABLE 2-14
SOIL SCREENING
80th DRS, FT. STORY, VIRGINIA**

Compound	Squirt	Soil BTAG (ug/kg)		Maximum Detected or PQL ¹	Value Used in Exposure Calcs ¹	Min Screening Level	EEQ	COPC	No Screening Value
		Flora	Fauna						
TCL Pesticides									
4,4'-DDD	--	100	1.00E+02	2.7 P	2.7	1.00E+02	0.03	N	
4,4'-DDE	--	100	1.00E+02	3.1 P	3.1	1.00E+02	0.03	N	
4,4'-DDT	--	100	1.00E+02	8.80E+00 P	8.8	1.00E+02	0.09	N	
Aldrin	--	1.00E+02	1.00E+02	7.30E+01 E	73.0	1.00E+02	0.73	N	
alpha-BHC	--	--	--	1.70E+00 J	1.7	0.00E+00	N/A	Y	X
beta-BHC	--	--	--	1.00E+02 EP	100.0	0.00E+00	N/A	Y	X
delta-BHC	--	--	--	1.30E+00	1.3	0.00E+00	N/A	Y	X
Dieldrin	--	100	1.00E+02	27.00 EP	27.0	1.00E+02	0.27	N	
Endosulfan I	--	--	--	0.90 JP	0.9	0.00E+00	N/A	Y	X
Endosulfan II	--	--	--	18.0 P	18.0	0.00E+00	N/A	Y	X
Endosulfan sulfate	--	--	--	110.0 JD	110.0	0.00E+00	N/A	Y	X
Endrin	--	100	1.00E+02	4.1 U	4.1	1.00E+02	0.00	N	
Endrin aldehyde	--	--	--	1.0 J	1.0	0.00E+00	N/A	Y	X
Endrin ketone	--	--	--	110.0 EP	110.0	0.00E+00	N/A	Y	X
gamma-BHC (Lindane)	--	100	100	3.90E-01 J	0.4	1.00E+02	0.00	N	
gamma-Chlordane	--	--	100	1.7 U	0.85	1.00E+02	0.00	N	
Heptachlor	--	--	--	1.0 P	1.0	0.00E+00	N/A	Y	X

TABLE 2-14
SOIL SCREENING
80th DRS, FT. STORY, VIRGINIA

Compound	Squirt	Soil BTAG (ug/kg)		Maximum Detected or PQL ¹	Value Used in Exposure Calcs ¹	Min Screening Level	EEQ	COPC	No Screening Value
		Flora	Fauna						
TCL PCBs									
Aroclor-1260	5.00E+02	100	--	67.0 J	67.0	1.00E+02	0.67	N	

¹Parameters that had no screening values were retained for consideration as final COPCs. Undetected parameters ("U"-flagged) were retained as COPCs if ½ the method detection limit (MDL) was greater than the screening value. Consistent with laboratory protocol, the MDL was estimated as 10 percent of the PQL (practical quantification limit), which is value in the laboratory reports and flagged with the "U". Parameters flagged with "J", "E", or "N", although estimated to be present, are not necessarily accurate; however, they were handled as being present at the concentrations noted.

² Efroymsen, R.A., M.E. Wioll, G. W. Suter II, and A.C. Wooten. 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision.

³ Invert Tox Ref: Efroymsen, R.A., M.E. Will, and G. W. Suter II. 1997. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision.

⁴ FL=Flora; FA=Fauna; Scening against BTAG values only.

NOTES:

This table contains COPCs with published toxicity screening values and/or COPCs that were detected above PQL or at estimated concentrations that have BTAG screening values.

TABLE 2-15
TOXICITY REFERENCE VALUES (TRVs) / NOELs FOR MAMMALS AND BIRDS
80th DRS, Fort Story, Virginia

COPC	Mammal TRVs ⁽¹⁾ (mg/kg-day)				Bird TRVs ⁽²⁾ (mg/kg-day)	
	Test Species	Short-tailed Shrew	Cottontail Rabbit	Gray Fox	Test Species	Receptor Species
1,1,2-trichloro-1,2,2-trifluoroethane	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	1771 (r)	3,384	848	813	NA	NA
2-Hexanone	NA	NA	NA	NA	NA	NA
Acetone	10 (r) ^(a)	19.1	4.80	2.58	NA	NA
Carbon disulfide	42.5 (gp) ^{(b)(3)}	102	25.6	24.5	NA	NA
Dichlorodifluoromethane	NA	NA	NA	NA	NA	NA
Methyl acetate	NA	NA	NA	NA	NA	NA
Tetrachloroethylene	1.4 (m)	1.59	0.40	0.38	NA	NA
Trichlorofluoromethane	450 (r)	860	216	207	NA	NA
1,1'-Biphenyl	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA	NA	NA	NA
Acenaphthene	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA
Benzo(a)anthracene	1 (m) ^{(a)(4)}	1.14	0.28	0.27	NA	NA
Benzo(a)pyrene	1 (m) ^(a)	1.14	0.28	0.27	NA	NA
Benzo(b)fluoranthene	1 (m) ^{(a)(4)}	1.14	0.28	0.27	NA	NA
Benzo(g,h,i)perylene	1 (m) ^{(a)(4)}	1.14	0.28	0.27	NA	NA
Benzo(k)fluoranthene	1 (m) ^{(a)(4)}	1.14	0.28	0.27	NA	NA
bis(2-Ethylhexyl)phthalate	18.3 (m) ^(a)	20.8	5.21	5.00	1.1 (rd) ^(a)	1.1
Carbazole	NA	NA	NA	NA	NA	NA
Chrysene	1 (m) ^{(a)(4)}	1.14	0.28	0.27	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	NA	NA	NA	NA	NA	NA
Fluoranthene	1 (m) ^{(a)(4)}	1.14	0.28	0.27	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1 (m) ^{(a)(4)}	1.14	0.28	0.27	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA
Phenanthrene	1 (m) ^{(a)(4)}	1.14	0.28	0.27	NA	NA
Pyrene	1 (m) ^{(a)(4)}	1.14	0.28	0.27	NA	NA
Aluminum	1.93 (m) ^(a)	2.19	0.55	0.53	109.7 (rd) ^(a)	109.7
Calcium	NA	NA	NA	NA	NA	NA
Chromium	2,737 (r) ^(a)	5,230	1,311	1,257	1 (bd) ^(a)	1

TABLE 2-15
TOXICITY REFERENCE VALUES (TRVs) / NOAELs FOR MAMMALS AND BIRDS
80th DRS, Fort Story, Virginia

COPC	Mammal TRVs ⁽¹⁾ (mg/kg-day)				Bird TRVs ⁽²⁾ (mg/kg-day)	
	Test Species	Short-tailed Shrew	Cottontail Rabbit	Gray Fox	Test Species	Receptor Species
Lead	8 (r) ^(a)	15.3	3.83	3.67	3.85 (k) ^(a)	3.85
Potassium	NA	NA	NA	NA	NA	NA
Sodium	NA	NA	NA	NA	NA	NA
alpha-BHC	1.6 (r) ⁽⁵⁾	3.06	0.77	0.73	0.36 (jq) ⁽⁵⁾	0.36
beta-BHC	0.4 (r)	0.76	0.19	0.18	0.36 (jq) ⁽⁵⁾	0.36
delta-BHC	1.6 (r) ⁽⁵⁾	3.06	0.77	0.73	0.36 (jq) ⁽⁵⁾	0.36
Endosulfan I	0.15 (r) ^(a)	0.29	0.07	0.07	10 (gp) ^(a)	10
Endosulfan II	0.15 (r) ^(a)	0.29	0.07	0.07	10 (gp) ^(a)	10
Endosulfan sulfate	0.15 (r) ^(a)	0.29	0.07	0.07	10 (gp) ^(a)	10
Endrin aldehyde	0.092 (m) ^(a)	0.10	0.03	0.03	0.3 (m) ^(a)	0.3
Endrin ketone	NA	NA	NA	NA	NA	NA
Heptachlor	0.1 (mk) ^(a)	0.29	0.07	0.07	41.6 (m) ^{(d)(2)}	41.6

Notes:

- = Not Applicable

NA = Not Available

⁽¹⁾Mammal TRVs represent NOAELs for laboratory species converted to receptor species NOAELs as follows (Sample et al., 1996):

$$NOAEL_r = NOAEL_t (bw_t/bw_r)^{1/4}$$

Where: NOAEL_r = receptor NOAEL

NOAEL_t = test species NOAEL

bw_r = receptor body weight

bw_t = test species body weight

Body weights of test and receptor species (kg):

rat (r) = 0.2 muskrat = 1.2

mouse (m) = 0.025 raccoon = 5.8

guinea pig (gp) = 0.5 deer mouse = 0.02

mink (mk) = 1 red fox = 4.5

dog (d) = 10

⁽²⁾Bird TRVs are represented as follows (Sample et al., 1996): NOAEL_r = NOAEL_t (bw_t/bw_r)⁰ = NOAEL_t (1) = NOAEL_t (pe = pelican, bq = bobwhite quail, jq = Japanese quail, m = mallard, bb = blackbird, bo = barn owl, gp = gray partridge, ph = pheasant, c = chicks, k = kestrel, md = mallard duckling)

⁽³⁾Value represents an oral LD₅₀ divided by an Uncertainty Factor of 50 (5 for extrapolation from LD₅₀ to acute LOAEL (USEPA, 1986) and 10 for extrapolation from acute LOAEL to chronic NOAEL (Newell et al., 1987).

⁽⁴⁾Value is for benzo(a)pyrene.

⁽⁵⁾Mixed Isomers of BHC

References:

^(a)Sample et al., 1996.

^(b)Lewis, 1992.

^(c)Heaton, 1992.

^(d)Hudson et al., 1984.

TABLE 2-16
AVIAN HQ⁽¹⁾ SUMMARY
80th DRS, FT. STORY, VIRGINIA

Compound	Robin	Red-tailed Hawk
1,1,2-trichloro-1,2,2-trifluoethane	NA	NA
1,3-Dichlorobenzene	NA	NA
2-Butanone (MEK)	NA	NA
2-Hexanone	NA	NA
Acetone	NA	NA
Carbon disulfide	NA	NA
Dichlorodifluoromethane	NA	NA
Methyl acetate	NA	NA
Tetrachloroethylene	NA	NA
Trichlorofluoromethane	NA	NA
1,1'-Biphenyl	NA	NA
2,4-Dinitrotoluene	NA	NA
2,6-Dinitrotoluene	NA	NA
2-Methylnaphthalene	NA	NA
3,3'-Dichlorobenzidine	NA	NA
Acenaphthene	NA	NA
Acenaphthylene	NA	NA
Benzo(a)anthracene	NA	NA
Benzo(a)pyrene	NA	NA
Benzo(b)fluoranthene	NA	NA
Benzo(g,h,i)perylene	NA	NA
Benzo(k)fluoranthene	NA	NA
bis(2-Ethylhexyl)phthalate	9E-02	3E-02
Carbazole	NA	NA
Chrysene	NA	NA
Dibenzo(a,h)anthracene	NA	NA
Dibenzofuran	NA	NA
Di-n-octylphthalate	NA	NA
Fluoranthene	NA	NA
Fluorene	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA
Naphthalene	NA	NA
Phenanthrene	NA	NA
Pyrene	NA	NA
Aluminum	7E+01	9E+00
Calcium	NA	NA
Chromium	1E+00	1E+00
Lead	1E+00	1E+00
Potassium	NA	NA
Sodium	NA	NA
alpha-BHC	2E-03	5E-04
beta-BHC	4E-01	3E-02
delta-BHC	1E-03	4E-04
Endosulfan I	5E-05	1E-05
Endosulfan II	9E-04	2E-04
Endosulfan sulfate	6E-03	1E-03
Endrin aldehyde	9E-03	4E-04
Endrin ketone	NA	NA
Heptachlor	3E-05	3E-06

⁽¹⁾ Hazard Quotient (HQ) = Total Exposure / NOAEL

TABLE 2-17
MAMMALIAN HQ⁽¹⁾ SUMMARY
80th DRS, FT. STORY, VIRGINIA

Compound	Short-tailed Shrew	Gray Fox	Rabbit
1,1,2-trichloro-1,2,2-trifluoroethane	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA
2-Butanone (MEK)	9E-07	2E-06	3E-05
2-Hexanone	NA	NA	NA
Acetone	2E-03	2E-02	1E-01
Carbon disulfide	4E-05	3E-05	1E-04
Dichlorodifluoromethane	NA	NA	NA
Methyl acetate	NA	NA	NA
Tetrachloroethylene	5E-02	2E-02	3E-02
Trichlorofluoromethane	2E-06	1E-06	4E-06
1,1'-Biphenyl	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA
Acenaphthene	NA	NA	NA
Acenaphthylene	NA	NA	NA
Benzo(a)anthracene	1E+00	2E+00	2E-01
Benzo(a)pyrene	3E+00	2E+00	1E-01
Benzo(b)fluoranthene	4E+00	2E+00	2E-01
Benzo(g,h,i)perylene	9E-01	1E+00	7E-02
Benzo(k)fluoranthene	2E+00	1E+00	1E-01
bis(2-Ethylhexyl)phthalate	1E-02	5E-03	4E-04
Carbazole	NA	NA	NA
Chrysene	1E+00	2E+00	2E-01
Dibenzo(a,h)anthracene	NA	NA	NA
Dibenzofuran	NA	NA	NA
Di-n-octylphthalate	NA	NA	NA
Fluoranthene	2E+00	3E+00	5E-01
Fluorene	NA	NA	NA
Indeno(1,2,3-cd)pyrene	1E+00	1E+00	1E-01
Naphthalene	NA	NA	NA
Phenanthrene	2E+00	3E+00	1E+00
Pyrene	7E+00	4E+00	8E-01
Aluminum	2E+03	1E+03	3E+03
Calcium	NA	NA	NA
Chromium	4E-04	6E-04	5E-05
Lead	4E-01	7E-01	1E-01
Potassium	NA	NA	NA
Sodium	NA	NA	NA
alpha-BHC	3E-04	2E-04	8E-05
beta-BHC	3E-01	4E-02	2E-02
delta-BHC	3E-04	1E-04	6E-05
Endosulfan I	2E-03	1E-03	9E-04
Endosulfan II	4E-02	2E-02	2E-02
Endosulfan sulfate	2E-01	1E-01	1E-01
Endrin aldehyde	5E-02	3E-03	3E-04
Endrin ketone	NA	NA	NA
Heptachlor	7E-03	1E-03	4E-04

⁽¹⁾ Hazard Quotient (HQ) = Total Exposure / NOAEL

TABLE 2-18
AVIAN HQ⁽¹⁾ SUMMARY ASUMMING AREA USE FACTORS
80th DRS, FT. STORY, VIRGINIA

Compound	Robin	Red-tailed Hawk
1,1,2-trichloro-1,2,2-trifluoethane	NA	NA
1,3-Dichlorobenzene	NA	NA
2-Butanone (MEK)	NA	NA
2-Hexanone	NA	NA
Acetone	NA	NA
Carbon disulfide	NA	NA
Dichlorodifluoromethane	NA	NA
Methyl acetate	NA	NA
Tetrachloroethylene	NA	NA
Trichlorofluoromethane	NA	NA
1,1'-Biphenyl	NA	NA
2,4-Dinitrotoluene	NA	NA
2,6-Dinitrotoluene	NA	NA
2-Methylnaphthalene	NA	NA
3,3'-Dichlorobenzidine	NA	NA
Acenaphthene	NA	NA
Acenaphthylene	NA	NA
Benzo(a)anthracene	NA	NA
Benzo(a)pyrene	NA	NA
Benzo(b)fluoranthene	NA	NA
Benzo(g,h,i)perylene	NA	NA
Benzo(k)fluoranthene	NA	NA
bis(2-Ethylhexyl)phthalate	5E-02	3E-05
Carbazole	NA	NA
Chrysene	NA	NA
Dibenzo(a,h)anthracene	NA	NA
Dibenzofuran	NA	NA
Di-n-octylphthalate	NA	NA
Fluoranthene	NA	NA
Fluorene	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA
Naphthalene	NA	NA
Phenanthrene	NA	NA
Pyrene	NA	NA
Aluminum	4E+01	9E-03
Calcium	NA	NA
Chromium	5E-01	1E-03
Lead	5E-01	1E-03
Potassium	NA	NA
Sodium	NA	NA
alpha-BHC	9E-04	5E-07
beta-BHC	2E-01	3E-05
delta-BHC	7E-04	4E-07
Endosulfan I	2E-05	1E-08
Endosulfan II	5E-04	2E-07
Endosulfan sulfate	3E-03	1E-06
Endrin aldehyde	4E-03	4E-07
Endrin ketone	NA	NA
Heptachlor	1E-05	3E-09

Note: BOLD represents COPCs that had HQs above 1 in initial analysis.

⁽¹⁾ Hazard Quotient (HQ) = Total Exposure / NOAEL

TABLE 2-19
MAMMALIAN HQ⁽¹⁾ SUMMARY ASSUMING AREA USE FACTORS
80th DRS, FT. STORY, VIRGINIA

Compound	Short-tailed Shrew	Gray Fox	Rabbit
1,1,2-trichloro-1,2,2-trifluoroethane	NA	NA	NA
1,3-Dichlorobenzene	NA	NA	NA
2-Butanone (MEK)	4E-07	3E-09	2E-06
2-Hexanone	NA	NA	NA
Acetone	7E-04	2E-05	9E-03
Carbon disulfide	1E-05	4E-08	1E-05
Dichlorodifluoromethane	NA	NA	NA
Methyl acetate	NA	NA	NA
Tetrachloroethylene	2E-02	3E-05	2E-03
Trichlorofluoromethane	9E-07	2E-09	3E-07
1,1'-Biphenyl	NA	NA	NA
2,4-Dinitrotoluene	NA	NA	NA
2,6-Dinitrotoluene	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA
3,3'-Dichlorobenzidine	NA	NA	NA
Acenaphthene	NA	NA	NA
Acenaphthylene	NA	NA	NA
Benzo(a)anthracene	5E-01	2E-03	1E-02
Benzo(a)pyrene	1E+00	2E-03	1E-02
Benzo(b)fluoranthene	1E+00	3E-03	1E-02
Benzo(g,h,i)perylene	4E-01	1E-03	5E-03
Benzo(k)fluoranthene	8E-01	2E-03	8E-03
bis(2-Ethylhexyl)phthalate	4E-03	7E-06	2E-05
Carbazole	NA	NA	NA
Chrysene	5E-01	2E-03	1E-02
Dibenzo(a,h)anthracene	NA	NA	NA
Dibenzofuran	NA	NA	NA
Di-n-octylphthalate	NA	NA	NA
Fluoranthene	8E-01	4E-03	3E-02
Fluorene	NA	NA	NA
Indeno(1,2,3-cd)pyrene	6E-01	1E-03	7E-03
Naphthalene	NA	NA	NA
Phenanthrene	9E-01	5E-03	7E-02
Pyrene	3E+00	6E-03	5E-02
Aluminum	9E+02	2E+00	2E+02
Calcium	NA	NA	NA
Chromium	2E-04	8E-07	4E-06
Lead	2E-01	1E-03	9E-03
Potassium	NA	NA	NA
Sodium	NA	NA	NA
alpha-BHC	1E-04	2E-07	6E-06
beta-BHC	1E-01	6E-05	1E-03
delta-BHC	1E-04	2E-07	4E-06
Endosulfan I	8E-04	1E-06	7E-05
Endosulfan II	2E-02	3E-05	1E-03
Endosulfan sulfate	9E-02	2E-04	8E-03
Endrin aldehyde	2E-02	4E-06	2E-05
Endrin ketone	NA	NA	NA
Heptachlor	3E-03	2E-06	3E-05

Note: BOLD represents COPCs that had HQs above 1 in initial analysis.

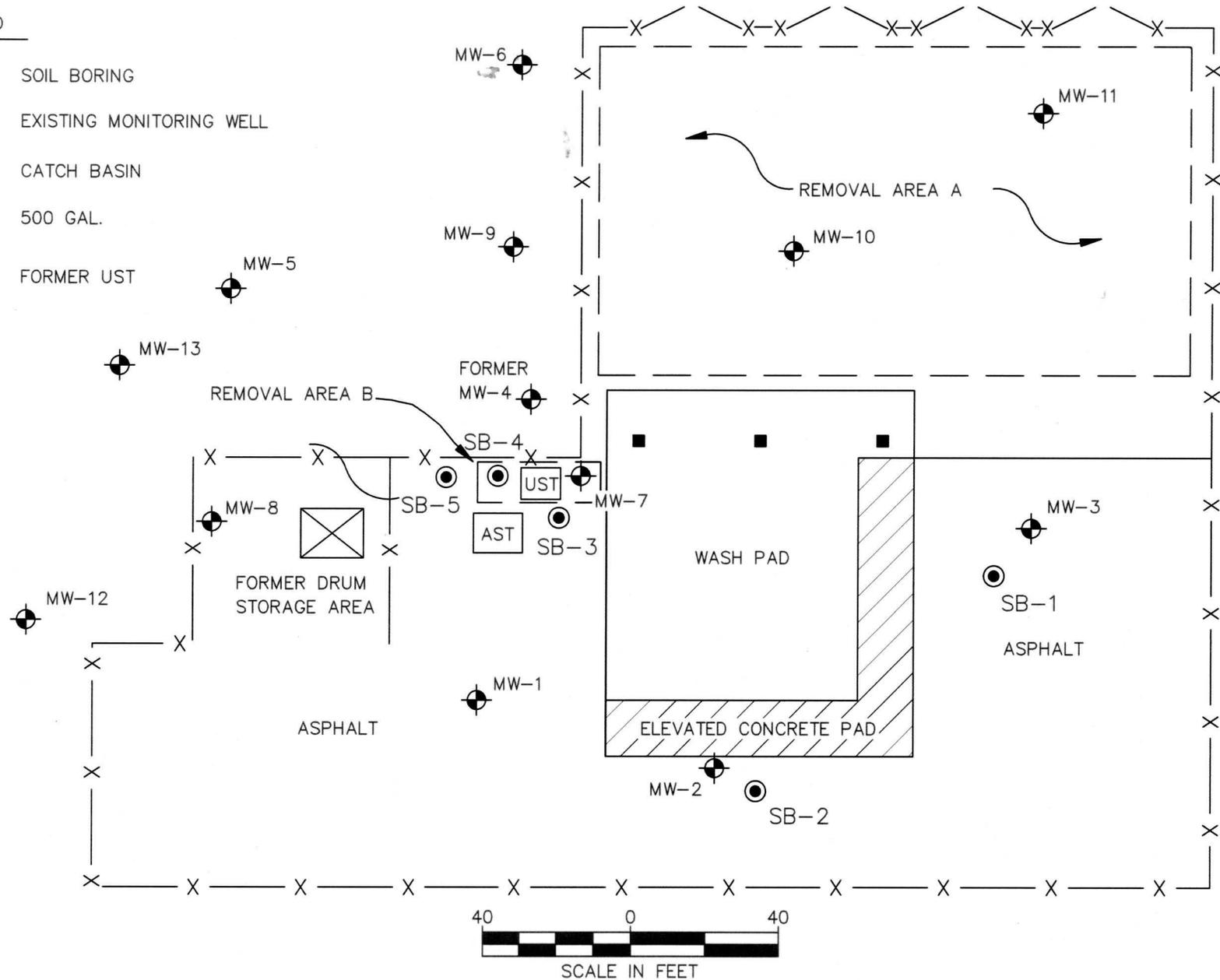
⁽¹⁾ Hazard Quotient (HQ) = Total Exposure / NOAEL

**Decision Document
80th Division Reserve Site
Fort Story, Virginia**



LEGEND

-  SOIL BORING
-  EXISTING MONITORING WELL
-  CATCH BASIN
-  500 GAL.
-  FORMER UST



IMAGES: None

LEGEND

- ⊙ SOIL BORING
- ⊕ EXISTING MONITORING WELL
- CATCH BASIN
- AST 500 GAL.
- UST FORMER UST

ORGANICS REPORTED IN ug/kg
METALS REPORTED IN mg/kg

Benzo (a) anthracene	3,900
Benzo (a) pyrene	3,900
Benzo (b) fluoranthene	6,800
Dibenzo (a,h) anthracene	1,200
Indeno (1,2,3-cd) pyrene	3,200
Arsenic	1.0
Iron	10,100
Vanadium	17.6

Benzo (a) anthracene	4,300
Benzo (a) pyrene	4,000
Benzo (b) fluoranthene	5,100
Dibenzo (a,h) anthracene	910
Indeno (1,2,3-cd) pyrene	2,600
Aluminum	8,530
Arsenic	0.92
Iron	9,060
Vanadium	19.4

Aldrin	73
Benzo (a) anthracene	3,300
Benzo (b) fluoranthene	3,400
Benzo (a) pyrene	3,200
Dibenzo (a,h) anthracene	690
Indeno (1,2,3-cd) pyrene	2,000
Arsenic	0.67
Iron	5,970
Vanadium	13.3

Arsenic	0.81
Iron	2,390

Benzo (a) pyrene	160
Arsenic	0.63

Benzo (a) anthracene	5,600
Benzo (b) fluoranthene	6,800
Benzo (a) pyrene	5,500
Dibenzo (a,h) anthracene	1,500
Indeno (1,2,3-cd) pyrene	3,600
Iron	2,640

Benzo (a) anthracene	320
Benzo (b) fluoranthene	750
Benzo (a) pyrene	430
Dibenzo (a,h) anthracene	160
Indeno (1,2,3-cd) pyrene	520
Iron	2,650

Benzo (a) anthracene	340
Benzo (b) fluoranthene	300
Benzo (a) pyrene	270
Dibenzo (a,h) anthracene	67

NOTE: MAXIMUM CONCENTRATION DETECTED FOR EACH CONTAMINANT THAT EXCEEDS THE RBC AT EACH BORING IS PRESENTED.



FORT STORY, VIRGINIA BEACH, VIRGINIA
80th DIVISION RESERVE SITE
SOIL DETECTIONS ABOVE RBCs

MALCOLM PIRNIE, INC.

MARCH 2009
FIGURE 2-2

LEGEND

- ⊙ SOIL BORING
- ⊕ EXISTING MONITORING WELL
- CATCH BASIN
- AST 500 GAL.
- UST FORMER UST

CONCENTRATIONS in ug/l

PCE	6.0
TCE	0.8
Bis(2-ethylhexyl)phthalate	5.0
Antimony	4.0
Arsenic	6.0
Vanadium	6.3
Dissolved Arsenic	5.0
Dissolved Vanadium	4.8

Antimony	3.0
PCE	1.2
TCE	1.5

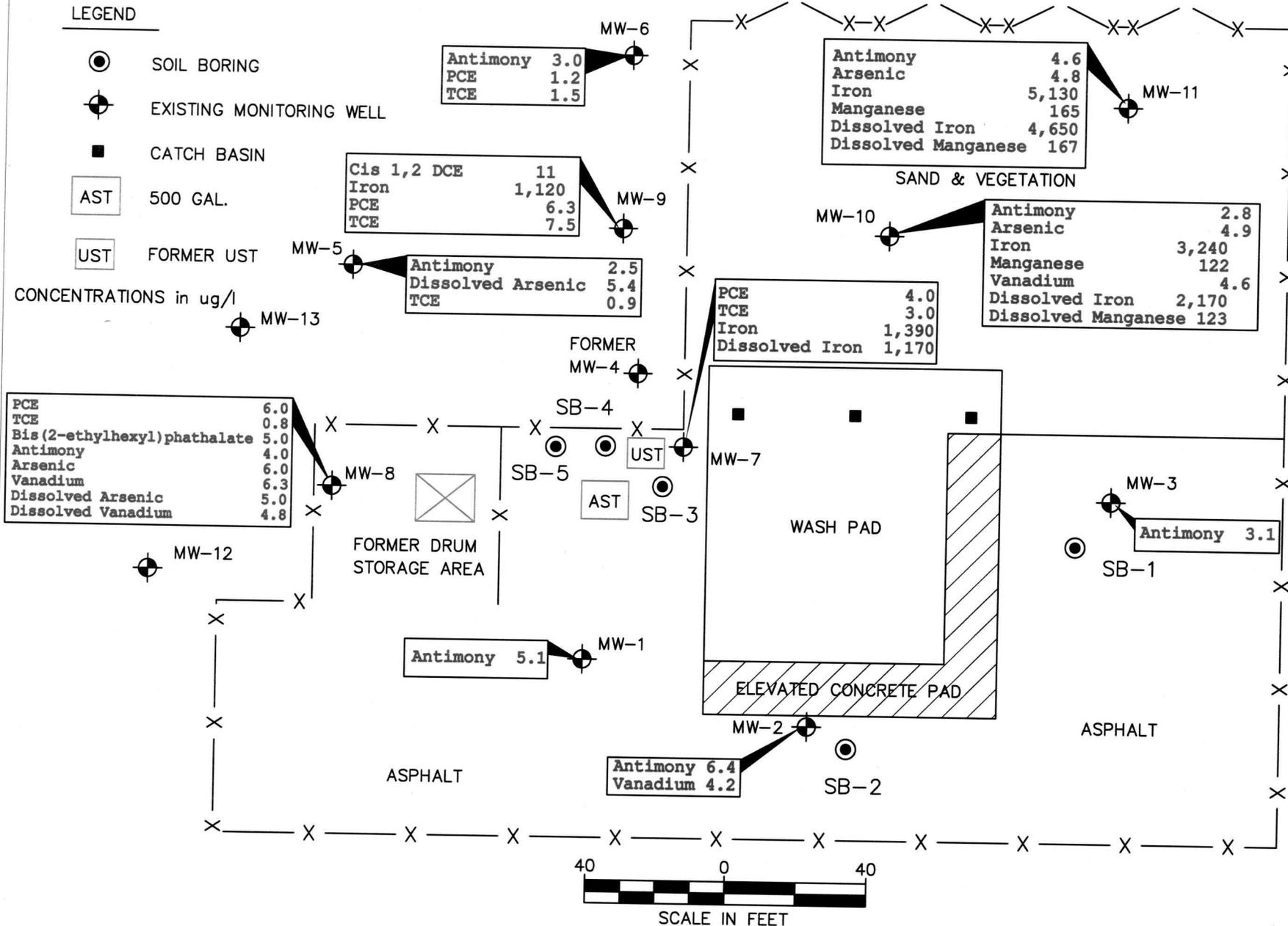
Cis 1,2 DCE	11
Iron	1,120
PCE	6.3
TCE	7.5

Antimony	2.5
Dissolved Arsenic	5.4
TCE	0.9

PCE	4.0
TCE	3.0
Iron	1,390
Dissolved Iron	1,170

Antimony	4.6
Arsenic	4.8
Iron	5,130
Manganese	165
Dissolved Iron	4,650
Dissolved Manganese	167

Antimony	2.8
Arsenic	4.9
Iron	3,240
Manganese	122
Vanadium	4.6
Dissolved Iron	2,170
Dissolved Manganese	123



FORT STORY, VIRGINIA BEACH, VIRGINIA
 80th DIVISION RESERVE SITE
 GROUNDWATER DETECTIONS ABOVE RBCs AND/OR MCLs

MALCOLM PIRNIE, INC.
 MARCH 2009
 FIGURE 2-3