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JEB FORT STORY, VA
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E-MAIL TRANSMITTING REVISIONS TO 80TH DIVISION RESERVE SITE DECISION
DOCUMENT INCLUDING COMMENTS FORT STORY VA
4/14/2009
INSTALLATION RESTORATION PROGRAM FORT EUSTIS

Bateman, Joanna G Ms CIV USA IMCOM

From: Bateman, Joanna G Ms CIV USA IMCOM
Sent: Tuesday, April 14, 2009 3:52 PM
To: Wright, Bradford C CIV USA
Subject: FW: 80th DRS - DD (UNCLASSIFIED)
Attachments: FW: DD 80TH DRS FT. STORY (UNCLASSIFIED); AEC Comments.docx; Final DD - Section 2 - December 8 2009.doc; Final DD - Section 1 - December 8 2009.doc; Final DD - TOC - December 8 2008.doc; Final DD - Section 4 - December 8 2008.doc; Final DD - Section 3 - December 8 2008.doc
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was no printed*

Brad,
I've received the revisions to the 80th Division Reserve Site DD from Malcolm Pirnie. I've attached the original e-mail message from Fran which included the comments from AEC's legal office. Please review or have them review the response to AEC Comments file to make sure all comments have been addressed sufficiently. Once I get the okay from AEC, we will submit to VDEQ for review. If VDEQ agrees that all comments have been addressed, the draft final version of the DD will be made available for a 30-day public comment period. Once the comment period has ended and all comments address, the installation will sign the DD as final.

Thanks,
Joanna

-----Original Message-----

From: Glass, David [mailto:DGlass@PIRNIE.COM]
Sent: Tuesday, April 14, 2009 3:32 PM
To: Bateman, Joanna G Ms CIV USA IMCOM
Cc: Michel, Amber A Miss CTR USA IMCOM
Subject: FW: 80th DRS - DD

Joanna,

Revisions to the 80th DRS DD area attached..

Take care,

Dave

J. David Glass, PE

Project Manager/Senior Project Engineer

Malcolm Pirnie, Inc.

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Newport News, Virginia 23606

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Review of DD, 80th Division Reserve Site, Ft. Story, VA

Comment: In the description of Table 2-10 is it supposed to be the Ft. Eustis worker or Ft. Story?

Response: Fort Story workers are the at risk population. No changes made to the text.

Comment: Please add a Remedial Action Objectives section

Response: A RAO section has been added to the beginning of Section 2.4:

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.

Comment: Were other alternatives analyzed? There is no comparative analysis. A "no action alternative" is required.

Comment: There is no cost analysis.

Comment: Please list the nine criteria listed in the NCP (§300.430(f)(5)(i)) and how they were evaluated to select the remedy.

Response: These three comments were addressed by adding a Subsection to Section 2 (Section 2.8) and by modifying Section 1.5 to clearly state that the nine criteria set out in the NCP were addressed.

1.5 STATUTORY DETERMINATIONS

As part of the selection of the Selected Remedy the nine criteria required by the 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.

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.

Comment: EPA guidance document suggests language for 5 year review requirements, please consider adding: "Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment."

Response: This text is presented in Section 1.5.

Comment: The only discussion of ARARs is that the action (LUCs with monitoring) complies with all applicable state and federal statutes. A more descriptive paragraph of ARARs should be included.

Response: The following paragraph was added to Section 1.5:

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.

Comment: Per DEQ's 1/22/08 comments, it was noted that the residential risk scenario had been removed from the revised risk assessment based on Army (USAEC) guidance. Because the residential scenario was not included, land use controls (LUCs) are needed to insure that residential use does not

occur in the future. Therefore, the LUCs must also contain a prohibition on residential use of the site. (Section 1.2)

Response: (Section 1.3) The LUCs apply to potential future groundwater use at the site as a drinking water source and disallow residential use of the Site.

Comment: Please insert a range of dates to prevent immediate repeat sampling. (Section 1.4)

Response: 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.

Comment (Section 2.3): Dates of public announcement in the Virginia Pilot.

PART 1 - DECLARATION DECISION DOCUMENT

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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.

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1.4 DESCRIPTION OF SELECTED REMEDY

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

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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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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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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 January 28, 2009 and in The Wheel on January 29, 2009 with the 30-day public comment period ending on February 27, 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

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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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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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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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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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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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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

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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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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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indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene and pyrene. The remaining compounds were retained as COPCs 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 COPCs: 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 COPCs 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 COPC.

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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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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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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- 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

Part 3 – Responsiveness Summary
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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.

Deleted: To be determined

3.2 PUBLIC COMMENTS

No public comments have been received regarding the Selected Remedy or site activities.

Deleted: To be determined