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FINAL FIVE YEAR REVIEW JEB FORT STORY VA (PUBLIC DOCUMENT)  
10/25/2013  
OSAGE OF VIRGINIA

Final

**Five-Year Review**

**Joint Expeditionary Base Fort Story  
Virginia Beach, Virginia**

*Prepared for:*

**Department of the Navy  
Naval Facilities Engineering Command  
Mid-Atlantic**

*Prepared by:*



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*In Support Of:*

**Contract No. N40085-10-D-3057  
Contract Task Order 0011**

**October 25, 2013**

## Five-Year Review

### Joint Expeditionary Base Fort Story Virginia Beach, Virginia

October 25, 2013

This report documents the first Five-Year Review, which includes the 80<sup>th</sup> Division Reserve Site and the Lighterage Amphibious Resupply Cargo Maintenance Area at Joint Expeditionary Base Fort Story as required by the Comprehensive Environmental Response, Compensation, and Liability Act §121 and the National Contingency Plan Part 300.430 (f)(4)(ii) of the Code of Federal Regulations.

Approved by:



*F.E. Hughlett*  
Acting

31 Oct 13

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F.E. Hughlett  
Captain, United States Navy  
Commander  
JEB Little Creek-Fort Story

Date

# Executive Summary

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The lead agency, the United States Navy (Navy), conducted this Five-Year Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Review at Joint Expeditionary Base (JEB) Fort Story in Virginia Beach, Virginia. The Five-Year Review requirement extends to all remedial actions that result in any hazardous substances, pollutants, or contaminants remaining at the site under CERCLA §121. The purpose of the Five-Year Review is to evaluate the implementation and performance of the selected remedy at each site. The evaluation will assess whether each remedy remains protective of human health and the environment and will present recommendations based upon the findings. This Five-Year Review was prepared in accordance with 2011 Navy Five-Year Review Policy, the United States Environmental Protection Agency (USEPA) Comprehensive Five-Year Review Guidance (USEPA, 2001), the supplemental guidance Clarifying the Use of Protectiveness Determinations for CERCLA Five-Year Reviews (USEPA, 2012a), and the Supplement for Assessing Protectiveness at Sites for Vapor Intrusion (USEPA, 2012b) and received regulatory oversight by the Virginia Department of Environmental Quality (VDEQ). Because the sites that were covered under this Five-Year Review are non-National Priorities List (NPL) Federal facilities sites, the USEPA did not have a statutorily defined role in the Five-Year Review process. This Five-Year Review discusses the Remedial Actions (RAs) and remedies that have been implemented at the 80th Division Reserve Site (DRS) and Lighterage Amphibious Resupply Cargo (LARC) 60 Maintenance Area.

The remedy for the 80<sup>th</sup> DRS and the LARC 60 Maintenance Area at Fort Story included Land Use Controls (LUCs) with long-term monitoring (LTM) of groundwater for natural attenuation. A Five-Year Review was triggered for both sites because hazardous constituents remain on-site above levels that allow for unlimited use and unrestricted exposure (UU/UE). The first facility Decision Document (DD) for the LARC 60 Maintenance Area was signed on October 31<sup>st</sup>, 2008 and is the start date for this Five-Year Review period.

This Five-Year Review has determined that the remedy at the 80th DRS is currently protective of human health and the environment because exposure pathways that could result in unacceptable risk in the short term are being controlled through LUCs and annual inspections. However, the LUC boundaries that are represented in the Navy Geographical Information System (GIS) database should be amended to correspond with the LUC boundaries that are included in the LUC Remedial Design (RD), ensuring the long-term protectiveness of the site. After the LUC boundaries have been adjusted, a Remedial Action Completion Report (RACR) should be completed to document that the remedy is operational and functioning and remedial action is complete. Long-term protectiveness of the remedy can be verified through continued LTM which may be used to evaluate the potential for off-site contaminant migration and the effectiveness of natural attenuation.

This Five-Year Review has determined that the remedy at the LARC 60 Maintenance Area is currently protective of human health and the environment because exposure pathways that could result in unacceptable risk in the short term are being controlled through LUCs and annual inspections. However, the LTM Plan should be amended to reflect changes in

groundwater sampling frequency, providing for monitoring until site until conditions allow for UU/UE and ensuring the long-term protectiveness of the remedy. After the LTM Plan has been amended, a RACR should be completed to document that the remedy is operational and functioning and remedial action is complete.

## Five-Year Review Summary Form

### Site Identification

Site Name: Joint Expeditionary Base Fort Story

USEPA ID: VA6210020875

Region: 3

State: Virginia

City/County: Virginia Beach

### Activity Status

NPL Status: Not NPL

Remediation Station: Ongoing

Multiple Sites: Yes

Construction Complete Date: Not Applicable (N/A)

Have the sites been put into Reuse? The Lighterage Amphibious Resupply Cargo (LARC) 60 Maintenance Area and 80<sup>th</sup> Division Reserve Site (DRS) currently contain several buildings whose tenants support the Installation's mission. The 80<sup>th</sup> DRS is utilized as a small arms testing and evaluation range.

### Review Status

Lead Agency: United States Navy

Author Name: Osage of Virginia

Author Title: Navy Contractor

Author Affiliation: Osage of Virginia, Inc.

Review Period: through October 2013

Review Number: First Five-Year Review

Date of Site Inspection: 5/23/2013

Type of Review: Statutory

Trigger Action(s): Signature of the Decision Document for LARC 60 Maintenance Area

Trigger Action Date: 10/31/2008

Due Date: 10/31/2013

## Five-Year Review Summary Form (continued)

### 1. 80<sup>th</sup> DRS

#### Issues

A LUC Remedial Design (RD) and Long Term Monitoring Plan have been completed, however a Remedial Action Completion Report (RACR) has not been finalized to document that the remedy is in place.

During the site visit it was determined that monitoring well MW-11 was mis-labeled as MW-10.

The Georeadiness Explorer platform in Navy Installation Restoration Information Solution (NIRIS) was utilized to verify the LUC boundaries at the 80th DRS. The LUC boundaries that were illustrated did not identically represent the area included in the LUC RD.

#### Recommendations and Follow-up Actions

Document that the remedy is operational and functional and remedial action is complete in a RACR.

Monitoring well MW-11 should be re-labeled appropriately.

The LUC shapefile should be adjusted to correctly represent the LUC boundaries that are included in the LUC RD.

#### Protectiveness Statement

The remedy at the 80th DRS is currently protective of human health and the environment because exposure pathways that could result in unacceptable risk in the short term are being controlled through LUCs and annual inspections. However, the LUC boundaries that are represented in the Navy GIS database should be amended to correspond with the LUC boundaries that are included in the LUC RD, ensuring the long-term protectiveness of the site. After the LUC boundaries have been adjusted, a RACR should be completed to document that the remedy is operational and functioning and remedial action is complete. Long-term protectiveness of the remedy can be verified through continued LTM which may be used to evaluate the potential for off-site contaminant migration and the effectiveness of natural attenuation.

### 2. LARC 60 Maintenance Area

#### Issues

A LUC Remedial Design (RD) and Long Term Monitoring Plan have been completed, however a

Remedial Action Completion Report (RACR) has not been finalized to document that the remedy is in place.

LTM plan currently provides for only two semiannual groundwater sampling events followed by another two annual sampling events; three of these events have been completed. The LTM plan should be amended to provide for a sampling regimen that will ensure the long-term protectiveness of the site (e.g. one groundwater sampling event conducted every five years until MCLs are not exceeded and a 6-month sampling event confirms no MCL exceedances).

**Recommendations and Follow-up Actions**

Amend the LTM plan to include an extended sampling regimen. Document implementation of the LUC RD and groundwater long term monitoring (LTM) plan with a RACR.

**Protectiveness Statement**

The remedy at the LARC 60 Maintenance Area is currently protective of human health and the environment because exposure pathways that could result in unacceptable risk in the short term are being controlled through LUCs and annual inspections. However, the LTM Plan should be amended to reflect changes in groundwater sampling frequency, providing for monitoring until site until conditions allow for UU/UE and ensuring the long-term protectiveness of the remedy. After the LTM Plan has been amended, a RACR should be completed to document that the remedy is operational and functioning and remedial action is complete.

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A	Site Inspection Checklists
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D	Interview Records – 80 <sup>th</sup> DRS
E	Johnson and Ettinger Model Inputs
F	Interview Records – LARC 60 Maintenance Area

# Acronyms and Abbreviations

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ARAR	applicable or relevant and appropriate requirement
AST	above-ground storage tank
BARC	Barge Amphibious Resupply Cargo
BTEX	benzene, toluene, ethylbenzene, xylenes
Cis-1,2-DCE	cis-1,2-Dichloroethene
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
COC	chemicals of concern
COPC	chemicals of potential concern
DD	Decision Document
DRS	Division Reserve Site
ERA	Ecological Risk Assessment
ERC	Environmental Restoration Company
FS	Feasibility Study
GIS	Geographical Information System
GRX	Georeadiness Explorer
HHRA	Human Health Risk Assessment
IT	International Technological
JEB	Joint Expeditionary Base
LARC	Lighterage Amphibious Resupply Cargo
LOTS	Logistics-Over-The-Shore
LTM	long-term monitoring
LUC	Land Use Controls
MCL	Maximum Contaminant Levels
MEK	methyl ethyl ketone
MIBK	methyl isobutyl ketone
mg/kg	Milligram Per Kilogram
NAB	Naval Amphibious Base
NAVFAC	Naval Facilities Engineering Command
NCP	National Contingency Plan

NIRIS	Navy Installation Restoration Information Solution
NPL	National Priorities List
O&M	operations and maintenance
OSWER	Office of Solid Waste and Emergency Response
OWS	oil water separator
PAH	polycyclic aromatic hydrocarbon
PAL	Project Action Limit
PA/SI	Preliminary Assessment/Site Investigation
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
RA	Remedial Action
RACR	Remedial Action Completion Report
RAO	Remedial Action Objective
RBC	Risk-Based Concentrations
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
RSL	Regional Screening Level
SCR	Site Characterization Report
SLERA	Screening Level Ecological Risk Assessment
SVOC	Semi-Volatile Organic Compound
TCE	trichloroethene
TPH	total petroleum hydrocarbons
µg/l	micrograms per liter
USACE	United States Army Corps of Engineers
USAEHA	United States Army Environmental Hygiene Agency
USEPA	United States Environmental Protection Agency
UST	under-ground storage tank
UU/UE	unrestricted use and unlimited exposure
VC	vinyl chloride
VDEQ	Virginia Department of Environmental Quality
VISL	Vapor Intrusion Screening Level
VOC	Volatile Organic Compound

## SECTION 1

# Introduction

---

This report presents the findings of the first Five-Year Review at JEB Fort Story (Fort Story). This review was conducted by the lead agency, the Navy, under regulatory oversight of the Virginia Department of Environmental Quality (VDEQ). The purpose of the Five-Year Review process is to assess whether the remedy at a site is protective of human health and the environment. Additionally, the report will provide recommendations to address any issues that were identified during the review process. This is the first Five-Year Review for the 80<sup>th</sup> Division Reserve Site (DRS) and Lighterage Amphibious Resupply Cargo (LARC) 60 Maintenance Area at Fort Story. A map illustrating each site's location within Fort Story is available in **Figure 1**. A Five-Year Review is required for each of these sites because hazardous substances, pollutants, or contaminants remain on-site above levels that allow for unrestricted use and unlimited exposure (UU/UE).

The Navy prepared this Five-Year Review Report pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

*If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The United States Environmental Protection Agency (USEPA) interpreted this requirement further in the NCP as stated in 40 Code of Federal Regulations (CFR) Part 300.430 (f)(4)(ii):

*If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

## 1.1 Facility Background

Fort Story is located at Cape Henry, at the mouth of the Chesapeake Bay, in Virginia Beach, Virginia. In 1914, the Virginia General Assembly gave this land to the United States Government and Fort Story was formed. Prior to World War II, this military installation primarily functioned as a Harbor Defense Command. After World War II, Fort Story's mission changed toward amphibious operations and training, including Logistics-Over-The-Shore (LOTS) operations. On October 1<sup>st</sup>, 2009, the first Joint Base was formed in Hampton Roads, JEB Little Creek-Fort Story, which was comprised of the former Naval Amphibious Base (NAB) Little Creek and Army Post Fort Story.

## 1.2 Sites

There are two CERCLA non-National Priorities List (NPL) sites located within Fort Story; both have remedy selecting Decision Documents (DDs) in place. The sites are the 80<sup>th</sup> DRS and the LARC 60 Maintenance Area.

## 1.3 Report Organization

The Five-Year Review for Fort Story consists of an Executive Summary and five sections:

**Executive Summary** – provides an overview of the Five-Year Review process conducted at Fort Story and findings including the protectiveness statements for each site.

**Section 1** – Introduction and purpose of the Five-Year Review and background of Fort Story

**Section 2** – Description of the Five-Year Review process

**Sections 3 and 4** – Descriptions of each site addressed in this Five-Year Review including the site history and background; chronology of events; site characterization; description of remedial actions (remedy implementation, remedy operation and maintenance [O&M]); technical assessment; issues, recommendations, and follow-up actions; and statement of protectiveness. Figures of each site and tables identifying cleanup levels are provided within each section, as applicable.

**Section 5** – References

## SECTION 2

# Five-Year Review Process

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This section discusses the various components of the Five-Year Review process that were conducted to fulfill the objectives identified in **Section 1**. The Five-Year Review process at Fort Story commenced on January 22<sup>nd</sup>, 2013, when the records review was initiated.

## 2.1 Document Review

Various site-specific documents and data were reviewed for each site in order to gather the following information:

- Potential risks to human health and the environment
- Remedial Action Objectives (RAOs)
- Selected remedy
- Applicable or relevant and appropriate requirements (ARARs)
- Land use control (LUC) boundaries

A list of the reports that were reviewed for each site is presented in **Table 1**.

## 2.2 Data Review

Historical data was reviewed to support a protectiveness determination for each site. A detailed description of the data interpretation for the 80<sup>th</sup> DRS and LARC 60 Maintenance Area is provided in **Sections 3.5.3** and **4.5.3**, respectively.

## 2.3 Site Inspections

On May 23<sup>rd</sup>, 2013, the lead agency, the Navy, and VDEQ conducted inspections of the 80<sup>th</sup> DRS and the LARC 60 Maintenance Area. The inspections were performed to visually confirm site conditions and document information about each site's status with respect to remedy implementation. Site inspection checklists for each site are presented in **Appendix A**.

## 2.4 Community Involvement

A notice that a Five-Year Review was being conducted was placed in the Virginian-Pilot on June 2<sup>nd</sup>, 2013; it is available in **Appendix B**. The notice included a web link to the JEB Fort Story Administrative record:

[http://www.navfac.navy.mil/products\\_and\\_services/ev/products\\_and\\_services/env\\_restoration/administrative\\_records.html?p\\_instln\\_id=FORT\\_STORY\\_JEB](http://www.navfac.navy.mil/products_and_services/ev/products_and_services/env_restoration/administrative_records.html?p_instln_id=FORT_STORY_JEB)

Another public announcement will be made upon completion of this report; included will be the findings and recommendations of this Five-Year Review.

## 2.5 Interviews

Interviews were conducted with the following individuals:

- JEB Little Creek-Fort Story Base Master Planning – Planner
- JEB Little Creek-Fort Story Public Affairs - Officer
- JEB Little Creek-Fort Story Base Environmental - Lead Environmental Protection Specialist
- Small Arms Testing and Evaluation Compound (SATEC) - Environmental Protection Specialist (80<sup>th</sup> DRS)
- Building 804 occupant (LARC 60 Maintenance Area)
- Building 1081 occupant (LARC 60 Maintenance Area)
- Building 1082 occupant (LARC 60 Maintenance Area)
- Building 1088 occupant (LARC 60 Maintenance Area)

The purpose of the interviews was to identify any concerns regarding either of the sites mentioned in this report that may affect the protectiveness of the remedy.

SECTION 3

# 80<sup>th</sup> Division Reserve Site

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A discussion of the 80<sup>th</sup> DRS, including the site’s historical use, investigation history, long term monitoring data, and an assessment of the various elements of the Five-Year Review is presented in this section.

## 3.1 Site Chronology

A chronology of events for the 80<sup>th</sup> DRS is presented below.

Date	Event
1994	Montgomery Watson Final Site Assessment Report
1994	Environmental Restoration Company Site Characterization Report
1995	International Technological (IT) Corporation Removal Action
2008	Malcolm Pirnie Remedial Investigation (RI)
2009	Decision Document Finalized
2010	Long Term Monitoring (LTM) Plan Finalized
2012	LUC Remedial Design (RD)
2012	Annual LUC Inspection

## 3.2 Site History and Background

The 80<sup>th</sup> DRS was utilized in the maintenance of various amphibious vehicles. LARC vehicles were washed on a 50-foot by 70-foot concrete pad located at the site. The wash pad was bordered by sand to the north where LARCs were staged. There was also a 1,000-gallon used oil under-ground storage tank (UST), a 250-gallon antifreeze above-ground storage tank (AST) and a drum storage area located just to the west of the wash pad. Run-off from the wash pad and spillage from the drum pad, UST and AST were identified as potential sources for the volatile organic compound (VOC), total petroleum hydrocarbons (TPH), and metals contamination that was identified in site soils (ERS, 1994). IT Corporation conducted a removal action of contaminated soil from the tank and LARC staging areas in 1995.

### 3.2.1 Physical Characteristics

The 80<sup>th</sup> DRS is located within Fort Story, to the north of DaNang Road and to the east of Hospital Road. A site location map is provided in **Figure 1**. Currently, approximately half of the site is covered by a paved storage and parking area; the remainder of the site consists of a mostly level sandy surface with pine trees and small native shrubs.

Runoff from the former wash pad area is captured by three catch basins located along the northern side of the pad; the water is then routed into an oil water separator (OWS). Precipitation on other paved portions of the site flows toward the ground surface where it is lost through infiltration.

The shallow lithology at the 80<sup>th</sup> DRS consists primarily of medium grained sandy deposits (Montgomery Watson, 1994). During the 1994 Site Characterization Report (SCR) investigation, a rising head bailer test was attempted but was unsuccessful because a change in head could not be achieved. Hydraulic conductivity values at the site were estimated to be comparable to that of proximal sites with similar lithology; these values ranged from  $1.21 \times 10^{-2}$  cm/sec to  $1.24 \times 10^{-2}$  cm/sec. Groundwater at the site generally flows in a north/northwesterly direction toward the Chesapeake Bay (Malcolm Pirnie, 2008c). No surface water bodies are present at the site.

### 3.2.2 Land and Resource Use

The historic land use at the site is described in **Section 3.2**.

The Installation is currently identified as having industrial usage and the facility is expected to maintain this designation. The northeastern portion of the site currently lies within a tactical range. This area is restricted by a fence from the northwestern part of the site that contains a small former picnic area. The southern section of the site consists of mostly vacant paved storage and parking areas. At the time of this review, there were no occupied buildings located over the dissolved VOC plume; only a few storage sheds were present. The nearest residential area is located approximately one and a half miles to the east of the 80<sup>th</sup> DRS.

Groundwater at the site is not currently utilized as a drinking water source. Water is provided to the Installation via the City of Virginia Beach municipal water supply.

### 3.2.3 History of Contamination

A summary of findings from the various investigation efforts is provided below:

- VOCs, semi-volatile organic compounds (SVOCs), Pesticides, PCBs, and metals were detected in soil
  - Soil with TPH concentrations above 100 parts per million (ppm) was identified at shallow depths near the wash pad (LARC staging area).
  - The areas with the highest polycyclic aromatic hydrocarbon (PAH) concentrations were located near the former UST/AST and drum storage areas.
  - Aldrin was the only pesticide that was present in levels above the USEPA risk-based concentrations (RBCs) for residential soils; industrial soil RBCs were not exceeded for this contaminant.

- Aroclor-1260 was the only polychlorinated biphenyl (PCB) detected in soil; in all instances it was present at concentrations below USEPA RBCs for residential soils.
- Arsenic, iron, and vanadium concentrations exceeded USEPA RBCs for residential soils; there were no exceedances of the USEPA RBCs for industrial soils.
- VOCs, SVOCs, and metals were detected in groundwater
  - Trichloroethene (TCE) and tetrachloroethene (PCE) were present in levels exceeding USEPA National Primary Drinking Water Regulations Maximum Contaminant Levels (MCLs). Since 2003, VOC MCL exceedances have only been observed in monitoring wells MW-5, MW-8, and MW-9.
  - Cis-1,2-Dichloroethene (cis-1,2-DCE) has been detected in groundwater; however these concentrations have been below the USEPA MCL (USEPA, 2013a).
  - Bis(2-ethylhexyl)phthalate was detected in groundwater at concentrations greater than USEPA RBCs but less than the USEPA MCL (USEPA, 2013a) .
  - Total iron and total and dissolved manganese were present in concentrations above the USEPA RBCs.

### 3.2.4 Initial Response

In 1994, Montgomery Watson performed a Site Assessment to evaluate the potential for soil contamination at the site. Elevated TPH levels were detected in soil. An SCR, in the same year, identified PCE and TCE in groundwater. In 1995, IT Corporation conducted a removal action at the site. Approximately 3,400 tons of TPH-contaminated soil was removed. Nearly 30 tons of PCE-contaminated soil was excavated for disposal as Resource Conservation and Recovery Act (RCRA) hazardous waste (IT Corp, 1995).

### 3.2.5 Basis for Taking Action

Remedial action is required at the 80<sup>th</sup> DRS to protect human health from exposure to VOCs in groundwater.

The Human Health Risk Assessment (HHRA) performed during the 2008 RI identified the following chemicals of potential concern (COPCs):

Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, aldrin, arsenic, iron, and vanadium were identified as COPCs in soils. Cis-1,2-DCE, PCE, TCE, bis(2-ethylhexyl)phthalate, total antimony, total and dissolved arsenic, total and dissolved iron, total and dissolved manganese, and total and dissolved vanadium were identified as COPCs in groundwater.

The following potential receptors and exposure pathways were identified in the HHRA:

- Fort Story site workers exposure (adults only) to contaminated surface soils during site maintenance
- Construction worker exposure (adults only) to contaminated surface/subsurface soils

- Construction worker exposure (adults only) to contaminated groundwater
- Commercial/industrial worker exposure to vapors in structures from groundwater via volatilization

The HHRA determined that risk levels identified with the aforementioned exposure pathways were within an acceptable range (Malcolm Pirnie, 2008c).

The Screening Level Ecological Risk Assessment (SLERA) performed during the 2008 RI concluded that COPC concentrations in soil do not pose a risk to upper trophic receptors and that remediation decisions should not be based upon any existing adverse effects to ecological receptors (Malcolm Pirnie, 2008c).

Because there was no unacceptable risk associated with soils at the site, there were no retained chemicals of concern (COCs) for soil and therefore site soils did not require remedial action to be protective of human health and the environment for unlimited use and unrestricted exposure.

Due to USEPA MCL exceedances, a DD was prepared requiring LTM and LUCs to monitor contamination at the site and restrict groundwater use.

## 3.3 Remedial Actions

### 3.3.1 Remedy Selection

The final Decision Document (DD) presenting the selected remedy for the 80<sup>th</sup> DRS was signed in July, 2009 (Malcolm Pirnie, 2009).

The RAOs include:

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

The Selected Remedy included the following:

- LTM to monitor natural attenuation and migration of VOCs (PCE, TCE, and daughter products cis-1,2-DCE and vinyl chloride [VC]) in groundwater
- LUC implementation for groundwater to eliminate the potential for exposure to contaminants. The objective of the LUCs is to prohibit groundwater withdrawal and use with the exception of environmental monitoring.

The LUC objectives were to:

- Prohibit the withdrawal of groundwater except for environmental monitoring and testing

- Maintain the integrity of any current or future monitoring system

Although, not specifically listed as a land use control in the current LUC RD, the current Decision Document does prohibit future residential use of the site.

The cleanup levels in groundwater for the site are based upon the USEPA MCLs:

VOC	USEPA MCL (µg/l)
PCE	5
TCE	5
cis-1,2-DCE	70
VC	2

### 3.3.2 Remedy Implementation

A LUC RD was finalized for the 80<sup>th</sup> DRS in March, 2012 (Weston, 2012). LUCs boundaries are currently in the Navy Geographical Information System (GIS) database, and annual site inspections are conducted to help prevent exposure to VOCs in groundwater. A map illustrating the LUC boundaries included in the LUC RD is available in **Figure 2**.

The LTM plan for the 80<sup>th</sup> DRS was finalized in July, 2010 and is described below in **Section 3.3.3**. LTM sampling was last performed in November 2010. The November 2010 results showed exceedances of the USEPA MCL for PCE in monitoring wells MW-5 and MW-9.

At the time of this Five-Year Review, documentation of remedy implementation in a RACR has not yet been completed.

### 3.3.3 Remedy O&M

The LUCs are inspected annually in accordance with the LUC RD. The last inspection was conducted in August 2012. At the time of the inspection, there were no issues noted that would compromise the protectiveness of the remedies in place. Additionally, no groundwater withdrawal wells, except those utilized for environmental monitoring were observed. No unauthorized intrusive activities were witnessed and the land use at the site had remained the same. It was generally noted that the monitoring wells throughout the site either had locks that were malfunctioning or missing. The locks for each monitoring well at the 80<sup>th</sup> DRS were subsequently replaced. Documents from the last LUC inspection for the 80<sup>th</sup> DRS are presented in **Appendix C**.

The 80<sup>th</sup> DRS LTM plan indicates that groundwater sampling is required once every five years as part of the five-year review status of the site; four VOCs (PCE, TCE, cis-1,2-DCE, and VC) are monitored. If groundwater sampling indicates that VOC concentrations are below USEPA MCLs, a confirmation sampling event must be conducted within three to six months. Groundwater sampling at the site may be discontinued if no USEPA MCL exceedances are confirmed in the second effort (Weston, 2010). The last groundwater sampling event at the 80<sup>th</sup> DRS was conducted in November 2010; there were USEPA MCL exceedances for PCE in monitoring wells MW-5 and MW-9 (Weston, 2011).

## 3.4 Progress Since Last Five-Year Review

This is the first Five-Year Review that has been performed at the 80<sup>th</sup> DRS.

## 3.5 Five-Year Review Process

The various components of the Five-Year Review process are discussed below.

### 3.5.1 Community Involvement

A notice announcing the commencement of the Five-Year Review process and inviting public inquiry was placed in the Virginian-Pilot on June 2<sup>nd</sup>, 2013. A copy of the public notice is available in **Appendix B**.

This report will be made available to the public at the Naval Facilities Engineering Command (NAVFAC) portal website:

[http://www.navfac.navy.mil/products\\_and\\_services/ev/products\\_and\\_services/env\\_restoration/administrative\\_records.html?p\\_instln\\_id=FORT\\_STORY\\_JEB](http://www.navfac.navy.mil/products_and_services/ev/products_and_services/env_restoration/administrative_records.html?p_instln_id=FORT_STORY_JEB)

### 3.5.2 Document Review

Relevant documents were reviewed to assess the protectiveness of the remedy at the 80<sup>th</sup> DRS. A complete list of the documents that were utilized for this report is available in **Table 1**.

### 3.5.3 Data Review

Groundwater monitoring has been conducted at the 80<sup>th</sup> DRS since 2003. Four sampling events were conducted over a seven year period; groundwater sampling events were conducted in January 2003, June 2004, July 2010, and November 2010. During this timeframe, USEPA MCL exceedances for PCE have occurred in monitoring wells MW-5, MW-8, and MW-9. There was also a USEPA MCL exceedance for TCE in monitoring well MW-9 during the June 2004 sampling event. USEPA MCL exceedances are provided in **Table 2**. A map showing the location of each exceedance is provided as **Figure 3**. During the most recent sampling event, there were exceedances of the USEPA MCL for PCE in monitoring wells MW-5 and MW-9; however, there were not any significant VOC concentration increases in monitoring well MW-6, which is located down-gradient of monitoring wells MW-5 and MW-9, demonstrating that contaminant migration remains within the site boundaries.

### 3.5.4 Site Inspection

On May 23<sup>rd</sup> 2013, the Navy and VDEQ conducted a site inspection. The purpose of the inspection was to gather information to support the Five-Year Review process of assessing the protectiveness of the remedy at the 80<sup>th</sup> DRS. A site inspection checklist is provided in **Appendix A**. During the inspection, it was discovered that monitoring well MW-11 was mislabeled as MW-10. Prior to the inspection, monitoring well MW-10 had been abandoned. No other items of note were identified as a result of the site inspection.

### 3.5.5 Interviews

Interviews were conducted with the following people:

- JEB Little Creek-Fort Story Base Master Planning – Planner

- JEB Little Creek-Fort Story Public Affairs - Officer
- JEB Little Creek-Fort Story Base Environmental - Lead Environmental Protection Specialist
- Small Arms Testing and Evaluation Compound (SATEC) - Environmental Protection Specialist (80<sup>th</sup> DRS)

The purpose of the interviews was to aid in assessing the effectiveness of the remedy at the 80<sup>th</sup> DRS. The interview records are available in **Appendix D**. No significant problems that would compromise the effectiveness of the remedy were identified during the interviews.

## 3.6 Technical Assessment

### Question A – Is the remedy functioning as intended by the decision documents?

The review of various documents, ARARs, LTM and site inspection results indicate that the remedy is functioning as intended by the DDs. Groundwater cleanup levels have not been achieved and continued LTM is required. The results from various sampling events indicate that the dissolved VOC concentrations at the site appear to be stable and offsite migration has not occurred. LUCs are in-place to restrict groundwater uptake and use to environmental monitoring. In accordance with the LUC RD, an annual inspection of the LUCs is conducted and the results are provided in a report to VDEQ. During the LUC RD inspection, in August 2012, there were no indications that the institutional controls were violated. Similarly, during the last inspection, which was performed in support of this Five-Year Review, there were no indications that the institutional controls were violated.

### Question B – Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes. The project action limits (PALs) for groundwater at the 80<sup>th</sup> DRS are based upon the USEPA MCLs for PCE (5 micrograms per liter [ $\mu\text{g}/\text{l}$ ]), TCE (5  $\mu\text{g}/\text{l}$ ), cis-1,2-DCE (70  $\mu\text{g}/\text{l}$ ), and VC (2  $\mu\text{g}/\text{l}$ ). At the time of this Five-Year Review, these values had not changed from the program goals. There were no changes in site conditions that were noted during the site inspection that would result in increased exposure or new routes of exposure to receptors. No change in land use was noted during the site inspection; there is no anticipated change in land use for the near future. No new exposure pathways or receptors were identified.

There have been revisions to the toxicity factors for TCE, PCE, and cis-1,2-DCE (USEPA, 2013b) since the Final RI report that included the HHRA and SLERA was completed in 2008. These revisions, however, will not change the results of the risk assessment.

Although there are currently no occupied buildings at the site, the vapor intrusion pathway under a future scenario was evaluated as part of this five year review through a comparison of site groundwater data to EPA Vapor Intrusion Screening Levels (VISLs)(USEPA, 2013c) and to MCLs for those chemicals whose groundwater-to-indoor air residential VISL is less than the MCL. Because there is a residential land use restriction and industrial VISLs for the COCs are higher than the MCL, the MCL is considered an appropriate metric for the VI pathway. The metric that will be utilized will be the higher of the VISL and the MCL. There are no groundwater exceedences of concern for the VI pathway. Consequently, assessment of the VI

pathway does not require any changes to the RAOs or the remedy to ensure protection of human health. The VI pathway will be considered as part of future five year reviews to ensure long-term protection of human health until groundwater concentrations are acceptable for unlimited use and unrestricted exposure.

The remediation goals are the MCLs, which have not changed for the COCs. No new exposure pathways have been identified that would compromise the protectiveness of the LUCs.

Question C - Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that could call into question the protectiveness of the remedy.

### 3.7 Issues, Recommendations, and Follow-up Actions

The following issues have been identified for the 80<sup>th</sup> DRS during this Five-Year Review:

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
No documentation that the remedy is in place	Document implementation of LTM and LUCs in a RACR	Navy	VDEQ	October 2014	N	N
MW-11 mislabeled as MW-10	Paint over stick-up well casing and re-label well MW-11	Navy	VDEQ	November 2013	N	N
LUC boundaries misrepresented in NIRIS	Correct boundaries and verify the plume extent is covered	Navy	VDEQ	November 2013	N	Y

A LUC RD is used to guide implementation of the selected remedy. The remedial action is the implementation of the DD and the RD. The LUC RD and LTM plan have been completed for the site however a Remedial Action Completion Report (RACR) has not been completed. A RACR should be completed to document that the remedial action has been completed and the RD (LUC RD and LTM plan) for the site is operating and functional.

During the site visit it was determined that monitoring well MW-11 was mis-labeled as MW-10. The monitoring well should be re-labeled appropriately.

The Georeadiness Explorer (GRX) platform in Navy Installation Restoration Information Solution (NIRIS) was utilized to verify the LUC boundaries at the 80<sup>th</sup> DRS. The LUC boundaries that were illustrated did not identically represent the area included in the LUC RD.

The LUC shapefile should be adjusted to correctly represent the LUC boundaries that are included in the LUC RD.

### **3.8 Statements of Protectiveness**

The remedy at the 80<sup>th</sup> DRS is currently protective of human health and the environment because exposure pathways that could result in unacceptable risk in the short term are being controlled through LUCs and annual inspections. However, the LUC boundaries that are represented in the Navy GIS database should be amended to correspond with the LUC boundaries that are included in the LUC RD, ensuring the long-term protectiveness of the site. After the LUC boundaries have been adjusted, a RACR should be completed to document that the remedy is operational and functioning and remedial action is complete. Long-term protectiveness of the remedy can be verified through continued LTM, which may be used to evaluate the potential for off-site contaminant migration and the effectiveness of natural attenuation.

### **3.9 Next Review**

The next Five-Year Review for the 80<sup>th</sup> DRS is required in October 2018.

SECTION 4

# LARC 60 Maintenance Area

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A discussion of the LARC 60 Maintenance Area, including the site’s historical use, investigation history, long term monitoring data, and an assessment of the various elements of the Five-Year Review is presented in this section.

## 4.1 Site Chronology

A chronology of events for the LARC 60 Maintenance Area is presented below:

<b>Date</b>	<b>Event</b>
1992	James Montgomery Preliminary Assessment/Site Investigation (PA/SI)
1994	ERC Initial Abatement
1994	IT Corporation Bioremediation
1995	UST Investigation
1995	Earth Technology Soil Sampling Event
1996	Malcolm Pirnie HHRA/Ecological Risk Assessment
2002	Malcolm Pirnie Groundwater Pilot Scale Study (Injection Event)
2002	Malcolm Pirnie RI
2004	Malcolm Pirnie Feasibility Study (FS)
2007	Malcolm Pirnie RI Addendum
2008	Final Decision Document
2008	Final LTM Plan
2011	Final LUC RD
2012	Annual LUC Inspection

## 4.2 Site History and Background

The LARC 60 Maintenance Area was the maintenance and wash rack area for the LARC 60 vehicles located within Fort Story. The LARC vehicles were utilized to ferry supplies from ship

to shore. In the 1950s, the area was utilized as the motor pool and maintenance area for the LARC 60's predecessor, the Barge Amphibious Resupply Cargo (BARC). The Fort Story LARC 60 site lies in a sand flat between the coastal dune complex to the north and central sand ridge to the south. A 10,000-gallon UST, formerly located at the LARC 60 motor pool, was used to store used oil and degreasing solvents. The site is primarily covered by pavement, including a concrete wash rack pad which was constructed in 1982. In 1994, IT Corporation conducted a bioremediation of contaminated soil at the site.

#### **4.2.1 Physical Characteristics, Geology, and Hydrogeology**

The LARC 60 Maintenance Area is centrally located within Fort Story, to the south of Atlantic Avenue. The site is bounded to the west by Lingayan Gulf Road and to the east by Okinawa Road. A site location map is available in **Figure 1**. The great majority of the site consists of a paved roads and parking areas; the remainder of the site consists of a mostly level sandy surface with pine trees and small native shrubs.

A network of catch basins located throughout the LARC 60 site captures storm and wash water runoff. This water is diverted to an OWS near Building 1088 and eventually enters an outfall that discharges into the Chesapeake Bay.

The shallow lithology at the LARC 60 Maintenance Area is dominated by fine to medium grained, poorly graded sandy deposits. Hydraulic conductivity was assessed during the PA/SI; values ranged from 42 to 390 gal/day/ft<sup>2</sup>, with an average value of 157 gal/day/ft<sup>2</sup> or 7.42X10<sup>-3</sup> cm/sec (Montgomery Watson, 1992). Groundwater at the site flows in a northerly direction towards the shore of the Chesapeake Bay.

#### **4.2.2 Land and Resource Use**

The historic land use at the site is described in **Section 4.2**.

The Installation is currently identified as industrial usage and the facility is expected to maintain this designation.

Several buildings that support the Installation mission are located within the site's boundaries. Building 1088 is currently used for maintenance of heavy and tactical equipment. Buildings 1081 and 1082 are currently being renovated but will be used for training of Navy personnel. The buildings will contain office, classroom, and training spaces, conference rooms, gear lockers, and shower facilities. Building 804 is currently being utilized to dispatch various vehicles as required. The southern portion of the site includes a vast paved area that is occasionally utilized for tactical and aggressive driving training. The nearest residential area is located approximately one mile to the east of the LARC 60 Maintenance Area.

The groundwater at the site is not currently utilized as a drinking water source. Water is provided to the Installation via the City of Virginia Beach municipal water supply. Groundwater at the site generally flows in a northerly direction toward the Chesapeake Bay. No surface water bodies are present at the site.

#### **4.2.3 History of Contamination**

A summary of findings from the various investigation efforts is provided below:

- VOCs, SVOCs, Pesticides, PCBs, and metals were detected in soil

- TPH contaminated soil ranging in concentration from 36,353 milligrams per kilogram (mg/kg) to 62,823 mg/kg was present at the bottom of the UST basin during the UST removal (Malcolm Pirnie, 2008a). TPH was also detected in soils from borings surrounding the OWS.
- Acetone, PCE, and toluene were detected in soil samples collected from the former UST area. Acetone, methylene chloride, methyl ethyl ketone (MEK), and toluene were detected in soil collected near the former OWS area. Methylene chloride, MEK, styrene, PCE, toluene, and TCE were detected in soil from the sandbox area. Of these contaminants, only PCE and methylene chloride were present in concentrations above the USEPA RBCs for residential soils; however none of these contaminants exceeded the USEPA RBCs for industrial soils (Malcolm Pirnie, 2008a).
- Several metals, including arsenic, were present in soils at the LARC 60 maintenance area; none of these contaminants exceeded the USEPA RBCs for industrial soils (Malcolm Pirnie, 2008a).
- VOCs, SVOCs, and metals were detected in groundwater
  - TPH, benzene, toluene, ethylbenzene, and xylenes (BTEX) were detected in groundwater down-gradient of the former UST. Dissolved TPH was present in concentrations exceeding the Virginia groundwater standard for petroleum hydrocarbons; dissolved toluene levels exceeded the USEPA tap water RBCs.
  - PCE, TCE, cis-1,2-DCE, and VC have been detected in groundwater at the LARC 60 Maintenance Area. The areas with the highest dissolved chlorinated VOC concentrations were located near the former UST. VOC USEPA MCL exceedances have only been observed in monitoring wells MW-117, 6MW-3S, 6MW-7, and 6MW-9. PCE, TCE, cis-1,2-DCE, and VC were present in concentrations exceeding the USEPA tap water RBCs and USEPA MCLs.
  - Bis[2-ethylhexyl]phthalate, naphthalene and 2-methylnaphthalene have been detected in groundwater at the site; only naphthalene and 2-methylnaphthalene have been detected at concentrations exceeding the USEPA tap water RBCs; bis[2-ethylhexyl]phthalate exceeded the USEPA MCL.
  - Several metals, both total and dissolved have been detected at the LARC 60 Maintenance Area. Total and dissolved arsenic, iron, and manganese exceeded the USEPA RBCs for tap water in samples from MW-117. Antimony, arsenic, and manganese exceeded USEPA RBCs from groundwater near the OWS area. Only arsenic (both total and dissolved) has been detected in concentrations exceeding the USEPA MCL.

#### 4.2.4 Initial Response

In 1987, the United States Army Environmental Hygiene Agency (USAEHA) conducted a Health Risk Assessment at the LARC 60 Maintenance Area to determine if a health threat existed for workers at the site. Grease, oil, lead, and chromium were identified in soil to the

north of the wash rack, however the USAEHA concluded that there was not a significant health hazard to workers at the site (Montgomery Watson, 1992).

The LARC 60 Maintenance Area was included in a PA/SI conducted by James Montgomery, Inc. in 1991 and 1992. Two areas of environmental concern were identified: the wash rack and the former UST area.

In 1992, Environmental Restoration Company (ERC) removed the 10,000-gallon AST near Building 1081. Petroleum-contaminated soil was reportedly removed from and then placed back into the excavation (Malcolm Pirnie, 2008a).

IT Corporation conducted an in-situ bioremediation in 1994. The project targeted source areas to prevent further groundwater contamination. Pits were excavated throughout the site and a biological inoculant solution was mixed into each pit to treat TPH-contaminated soil. 5,800 gallons of sludge and 2,800 gallons of oil, grease, and oily water were removed for off-site disposal (IT Corp, 1994). Although the United States Army Corps of Engineers (USACE) treatment goal of 50 parts per million (ppm) was not reached, sampling results indicated that the effort had successfully reduced VOCs. Similarly, no PAHs were detected, demonstrating that the bioremediation had addressed the hazardous component of the source. Subsequent remedial efforts at the site focused on groundwater.

#### **4.2.5 Basis for Taking Action**

Remedial action is required at the LARC 60 Maintenance Area to protect human health and the welfare of the environment from exposure to VOCs, SVOCs, and metals in groundwater. VOCs, SVOCs, or metals in groundwater at the site have exceeded USEPA MCLs or USEPA RBCs for tap water.

The HHRA performed in 1996 identified and retained the following COCs:

Arsenic was the only COC that was identified in surface and subsurface soils. Cis-1,2-DCE, methyl isobutyl ketone (MIBK) toluene, VC, 2-methylnaphthalene, antimony, arsenic, iron, and manganese were identified as COCs in groundwater. Iron and manganese were identified as COCs in surface water.

The following potential receptors and exposure pathways were identified in the HHRA:

- Residential exposure of adults and children to contaminated water through ingestion of drinking water and/or dermal contact with and inhalation of volatilized chemicals while bathing or showering
- Residential exposure of adults and children to contaminated soil through ingestion of chemicals

The HHRA determined that there was potential risk present under a residential future scenario. It concluded that the majority (approximately 97 percent) of the non-carcinogenic risk derived from the total exposure hazard index for ingestion of soils and ingestion of, dermal contact with, and inhalation of chemicals in groundwater was associated with ingestion of arsenic and manganese in groundwater. Similarly, it established that the greatest component (98 percent of the total risk) of the estimated cancer risk from exposure to chemicals in surface soils and groundwater was resultant from arsenic in groundwater. Lastly, the HHRA determined that

exposure to contaminated groundwater from arsenic, PCE, and TCE was the only adult exposure scenario exceeding the USEPA remediation goal (Malcolm Pirnie, 1996b).

The Ecological Risk Assessment (ERA) performed in 1996 identified several COCs; however, it determined that the potential effects arising from the contamination would have minimal ecological significance (Malcolm Pirnie, 1996a).

## 4.3 Remedial Actions

### 4.3.1 Remedy Selection

The final DD presenting the selected remedy for the LARC 60 Maintenance Area was signed in October, 2008.

The RAOs include:

- To ensure protection of human health and the environment in case of future use of groundwater as a drinking water source

The Selected Remedy included the following:

- LTM to monitor natural attenuation and migration of VOCs (PCE, TCE, and daughter products cis-1,2-DCE and VC), SVOCs, and metals (both total and dissolved) in groundwater
- LUC implementation for groundwater to eliminate exposure to contaminants. The objective of the LUCs is to prohibit groundwater withdrawal and use with the exception of environmental monitoring

The cleanup levels in groundwater for the site are based upon the USEPA MCLs; some of the USEPA MCLs for VOCs are presented below:

VOC	USEPA MCL (µg/l)
PCE	5
TCE	5
cis-1,2-DCE	70
VC	2

### 4.3.2 Remedy Implementation

A LUC RD was finalized for the LARC 60 Maintenance Area in September, 2011 (Navy, 2011). The LUC boundaries are currently available in the NAVY GIS Database under the GRX platform; LUCs are maintained through annual site inspections. A map illustrating the LUC boundaries is presented in **Figure 4**.

The LTM Plan for the LARC 60 Maintenance Area was finalized in December, 2008 (Malcolm Pirnie, 2008b). An MCL exceedance of VC in monitoring well 6MW-3S, during the August 2009 sampling event, prompted the requirement for continued LTM at the site. The most recent groundwater sampling event was conducted in October, 2011. At the time of the 2011 event,

PCE concentrations in the sample from monitoring well 6MW-7 exceeded the USEPA MCLs; there were no other exceedances of the PALs.

### **4.3.3 Remedy O&M**

The LUCs are inspected annually in accordance with the LUC RD. The last inspection was conducted in August 2012. At the time of the inspection, there were no issues noted that would compromise the protectiveness of the remedies in place. Additionally, no groundwater withdrawal wells, except those utilized for environmental monitoring were observed. No unauthorized intrusive activities were witnessed and the land use at the site had remained the same. It was generally noted that the monitoring wells throughout the site were in need of repair and either had locks that were malfunctioning or missing. All required repairs have been completed and the locks have been replaced since the time of the inspection. Documents from the last LUC inspection for the LARC 60 Maintenance Area are presented in **Appendix C**.

LTM at the LARC 60 Maintenance Area consists of groundwater sampling of seven monitoring wells (6MW-3S, 6MW-5S, 6MW-7, 6MW-9, 6MW-11, MW-117, MW-118) for VOCs, SVOCs, and Metals (both total and dissolved).

The LTM plan provides for two semiannual and two annual groundwater sampling events at the site. Three of these actions have been completed (February and August 2009, and October 2011). The third sampling event was not conducted due to a PCE PAL exceedance in monitoring well 6MW-7 during the October 2011 event. It was anticipated that more time was necessary for the continued natural attenuation of VOCs at the site and therefore any required additional groundwater sampling events would be postponed until after the Five-Year Review for the site.

## **4.4 Progress Since Last Five-Year Review**

This is the first Five-Year Review that has been performed at the LARC 60 Maintenance Area.

## **4.5 Five-Year Review Process**

The various components of the Five-Year Review process are discussed below.

### **4.5.1 Community Involvement**

A notice announcing the commencement of the Five-Year Review process and inviting public inquiry was placed in the *Virginian-Pilot* on June 2nd, 2013. A copy of the public notice is available in **Appendix B**.

This report will be made available to the public at the NAVFAC portal website:

[http://www.navfac.navy.mil/products\\_and\\_services/ev/products\\_and\\_services/env\\_restoration/administrative\\_records.html?p\\_instln\\_id=FORT\\_STORY\\_JEB](http://www.navfac.navy.mil/products_and_services/ev/products_and_services/env_restoration/administrative_records.html?p_instln_id=FORT_STORY_JEB)

### **4.5.2 Document Review**

Several relevant documents, including monitoring data and ARARs within the DD, were reviewed during this Five-Year Review. A complete list of the documents that were utilized for this report is available in **Table 1**.

### 4.5.3 Data Review

The selected remedy at the LARC 60 Maintenance Area addresses exceedances of USEPA MCLs or RBCs in groundwater. Groundwater sampling was first conducted at the LARC 60 Maintenance Area in 1995 during a UST investigation. Several groundwater sampling events followed, between 2000 and 2007, as characterization of the site continued; groundwater sampling events were also conducted in February and August 2009, and most recently in October 2011. During this timeframe, USEPA MCL exceedances for PCE have occurred in monitoring wells 6MW-3S, 6MW-7, and MW-117; there have also been USEPA MCL exceedances for TCE, cis-1,2-DCE, and VC recorded in monitoring wells 6MW-3S and MW-117. There was one SVOC exceedance in monitoring well 6MW-3S. Total metals results exceeded PALs in groundwater from wells MW-117, MW-118, and 6MW-7. Lastly, dissolved metals goals were exceeded in monitoring well MW-117. **Table 3** lists each documented PAL exceedance. A map showing the location of each exceedance has been provided in **Figure 5**.

Concentrations have generally declined over time. At the time of the October, 2011 sampling event, PCE concentrations in monitoring well 6MW-7 (8.5 µg/l) exceeded the PAL/USEPA MCL for PCE (5 µg/l). The PCE concentration in this well was higher in 2003 (11 µg/l). Significant increases in contaminant concentrations have not been observed in the corresponding wells down-gradient of each exceedance location, indicating that contaminants are currently within site boundaries.

No concerns were identified due to potential vapor intrusion (VI) during the 1996 HHRA (Malcolm Pirnie, 1996b) or the 2002 RI (Malcolm Pirnie, 2002). During this Five-Year Review, environmental data, site characteristics, and other relevant information were reviewed to assess the potential for VI and develop a protectiveness determination for this pathway.

The Johnson and Ettinger Model was used to estimate incremental cancer risk and non-cancer hazard from vapor intrusion to indoor air using available groundwater data and conservative default model inputs; site-specific inputs were utilized when available. Results from the Johnson and Ettinger Model for each COC are available in **Table 4**. The model inputs for each COC are provided in **Appendix E**. The model yielded results that were all within an acceptable risk management range. It should be noted that groundwater at the site is shallow, generally five to ten feet below ground surface; however, there have been occasional readings of five feet or less. For this reason, the limitations of the Johnson and Ettinger Model were acknowledged and the Office of Solid Waste and Emergency Response (OSWER) Vapor Intrusion Screening Level (VISL) Calculator was also utilized to evaluate potential VI based on target groundwater concentrations for each COC in a residential and commercial exposure scenario. The OSWER VISL uses the most recent toxicity values and chemical property information from the Regional Screening Level (RSL) tables to provide recommended screening level concentrations for groundwater and other media.

A target risk for carcinogens of 1.00E-04 and a target hazard quotient of 1 for non-carcinogens was utilized to generate screening levels for groundwater under a commercial scenario. A target risk for carcinogens of 1.00E-06 and a target hazard quotient of 1 for non-carcinogens was utilized to generate screening levels for groundwater in a residential scenario. Results from the OSWER VISL for each COC are presented in **Table 5**. Groundwater screening concentrations for COCs in both scenarios were compared to groundwater data from the three most recent sampling events (February 2009, August 2009, and October 2011). Groundwater concentrations

are below either the VISLs or the PAL/USEPA MCL for the most conservative residential scenario. VC was not present in groundwater at levels above the method detection limit (0.3 µg/l) during the 2011 groundwater sampling effort. TCE was detected in monitoring well 6MW-3S at a concentration of 2.2 µg/l during the 2011 event, below the USEPA MCL of 5 µg/l. Consequently, VI is not considered a pathway of concern at the LARC 60 Maintenance Area.

The LARC 60 Maintenance Area is currently in an industrial/commercial use. Each building within the site boundaries was inspected and interviews were conducted with the tenants. A description of each building is available in **Section 4.5.4**. Interview summary forms have been provided in **Appendix F**.

#### **4.5.4 Site Inspection**

On May 23<sup>rd</sup> 2013, the Navy and VDEQ conducted a site inspection. The purpose of the inspection was to gather information to support the Five-Year Review process of assessing the protectiveness of the remedy at the LARC 60 Maintenance Area. A site inspection checklist is provided in **Appendix A**. During the inspection, no items of note were identified that would compromise the protectiveness of the remedy at the site. The Navy returned to the site to conduct further inspection of the various buildings (Buildings 1088, 1082, 1081, and 804) that are located within the LARC 60 Maintenance Area site boundaries on June 13<sup>th</sup> 2013. At the time, Building 1081 was vacant and undergoing renovations; Building 804 was occupied by a Marine unit whose purpose was to dispatch vehicles as required. Attempts were made to gain entry to Buildings 1082 and 1088 on this date; however they were unoccupied and locked. On June 27<sup>th</sup> 2013, the Navy secured access to Buildings 1082 and 1088. A brief description of each building is provided below:

##### **Building 1081**

- Used to support applied instruction to Navy Seals after basic training has been completed
- Primarily an equipment storage locker area with a few office/administrative spaces and bathroom/shower facilities
- The storage areas have ceilings approximately 25-feet high and contain large bay doors for access
- Some office/administrative spaces are present that have drop-tile ceilings approximately 8-feet high
- Flooring across the entirety of the building consists of concrete slab and appears to be in good condition; carpet or tile is present in the office or bathroom areas, respectively
- According to the tenant, the building will be periodically occupied with less than 20 people who will move between Buildings 1081 and 1082, as required

##### **Building 1082**

- Used to teach applied instruction to Navy Seals after basic training has been completed

- Primarily a training area with some equipment/storage lockers, office and classroom/conference spaces and bathroom/shower facilities
- The storage and training areas have ceilings approximately 25-feet high; large bay doors are present for access
- Classroom/conference spaces have drop-tile ceilings approximately 8-feet high
- Flooring across the entirety of the building consists of concrete slab and appears to be in good condition; carpet or tile is present in the classroom or bathroom areas, respectively
- According to the tenant, the building will be typically occupied with less than 20 people who will move between Buildings 1081 and 1082, as required; on occasion, more people may be present

### **Building 1088**

- Used to perform maintenance on heavy equipment and tactical vehicles
- Primarily a maintenance shop with a few office spaces and a bathroom/shower facility
- The maintenance areas have ceilings approximately 30-feet high; very large bay doors are present for access of industrial equipment on the north and south sides of the building
- Office spaces have drop-tile ceilings approximately 8-feet high
- Flooring across the entirety of the building consists of concrete slab of sufficient thickness to support very heavy equipment and appears to be in good condition; carpet or tile is present in the office or bathroom areas, respectively
- Building will be periodically occupied with approximately 5 people

### **Building 804**

- Used to perform minor maintenance on vehicles and dispatch them as required
- The northern portion of the building consists of office spaces and a bathroom facility; the southern portions contains a maintenance shop
- The maintenance areas have ceilings approximately 15 feet high; large bay doors are present for access on the east side of the building
- Office spaces have drop-tile ceilings approximately 8 feet high
- Flooring across the entirety of the building consists of concrete slab and appears to be in good condition; carpet or tile is present in the office or bathroom areas, respectively
- Building will be typically occupied with approximately 12 people

No information was revealed during the site inspection that indicated that the remedy would not be protective of human health and the environment.

#### 4.5.5 Interviews

Interviews were conducted with the following people:

- JEB Little Creek-Fort Story Base Master Planning – Planner
- JEB Little Creek-Fort Story Public Affairs - Officer
- JEB Little Creek-Fort Story Base Environmental - Lead Environmental Protection Specialist
- Building 804 occupant (LARC 60 Maintenance Area)
- Building 1081 occupant (LARC 60 Maintenance Area)
- Building 1082 occupant (LARC 60 Maintenance Area)
- Building 1088 occupant (LARC 60 Maintenance Area)

The purpose of the interviews was to aid in assessing the effectiveness of the remedy at the LARC 60 Maintenance Area. The interview records are available in **Appendix F**. No significant problems that would compromise the effectiveness of the remedy were identified during the interviews.

### 4.6 Technical Assessment

#### Question A – Is the remedy functioning as intended by the decision documents?

The major components of the RD, the LUC RD and LTM Plan, have been finalized. LUC boundaries are currently included in the Navy GIS database and the Navy conducts annual site inspections to ensure that ICs are not violated and there is no exposure to contaminants at the site. Documentation of the remedy in place at the LARC 60 Maintenance Area should be completed in a RACR.

Available data were used to assess if potential health concerns may exist due to vapor intrusion. As discussed in **Section 4.5.3**, the Johnson and Ettinger Model was used in conjunction with the most recent groundwater data yielding results that were in the acceptable risk management range. Groundwater screening level concentrations generated via the OSWER VISL did not indicate that VI is a pathway of concern at the LARC 60 Maintenance Area.

Multiple lines of evidence support a determination that a vapor intrusion pathway is unlikely to present a risk to human health at the LARC 60 Maintenance Area:

- Estimated modeled cancer risk is within the acceptable risk management range of 10E-4 to 10E-6
- Groundwater COC concentrations from multiple sampling events are below either the VISL or USEPA MCL for the most conservative residential scenario
- LTM at the LARC 60 Maintenance Area has identified isolated USEPA MCL exceedances; most recently, in 2011, there was an exceedance of PCE (8.5 µg/L) in monitoring well 6MW-7. Given the very low concentrations of VOCs in groundwater

(PCE at 8.5 µg/L as compared to an MCL drinking water standard of 5 µg/L and VC at 2.9 µg/L as compared to an MCL drinking water standard of 2 µg/L) providing very low vapor source strength for potential VI, the uncertainty relating to the lack of soil gas data or subslab soil gas data for assessing VI is recognized and considered an acceptable uncertainty that does not prevent a defensible assessment of the VI pathway.

- Characteristics of on-site buildings are expected to have high air exchange rates with high ceilings and large bay doors. Subsurface to indoor air attenuation factors are expected to be much greater than default conservative attenuation factors with thick concrete foundations suited for industrial use

The review of various documents, ARARs, LTM and site inspection results indicate that the remedy is functioning as intended by the DDs; however in order for the remedy at the LARC 60 Maintenance Area to be protective in the long-term, continued LTM is required. The results from various sampling events indicate that the dissolved VOC concentrations at the site appear to be stable or decreasing and offsite migration has not occurred. LUCs are in-place, providing protection in the short term, and restricting groundwater uptake and use to environmental monitoring. During the site inspection, there were no indications that the institutional controls have been violated.

Question B - Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes. The PALs for groundwater at the LARC 60 Maintenance Area are based upon the USEPA MCLs for VOCs, SVOCs, and metals. At the time of this Five-Year Review, these values had not changed from the values that were used to develop the DD.

There have been revisions to the toxicity factors for TCE, PCE, and cis-1,2-DCE (USEPA, 2013b) since the 2002 Final RI report that included the HHRA and ERA. These revisions, however, will not change the results of the risk assessment. The remediation goals are the MCLs, which have not changed for the COCs. No new exposure pathways have been identified that would compromise the protectiveness of the LUCs.

Question C - Has any other information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that would call into question the protectiveness of the remedy.

## **4.7 Issues, Recommendations, and Follow-up Actions**

The following issues have been identified for the LARC 60 Maintenance Area during this Five-Year Review:

Issue	Recommendations/ Follow-Up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
No documentation that the remedy is in place	Document implementation of LTM and LUCs in a RACR	Navy	VDEQ	October 2014	N	N
LTM Plan needs to be amended to reflect change in sampling frequency and to ensure LTM until clean up goals are achieved and site restrictions are removed to allow for UU/UE	Modify the LTM Plan to address issues	Navy	VDEQ	September 2014	N	Y

An RD is used to guide implementation of the selected remedy. The remedial action is the implementation of the DD and the RD. The LUC RD and LTM plan have been completed for the site however a RACR has not been completed.

The current LTM plan provides for only two semiannual groundwater sampling events followed by another two annual sampling events (see section 3.5 of the LTM plan). Three of these four groundwater sampling events have already been completed. The LTM plan should be amended to provide for a sampling regimen that will ensure the long-term protectiveness of the site (e.g. one groundwater sampling event conducted every five years until MCLs are not exceeded and a 6-month sampling event to confirm no MCL exceedances). After the LTM plan has been amended, a RACR should be completed to document implementation of the remedial design (LUC RD and LTM plan) for the site.

## 4.8 Statements of Protectiveness

The remedy at the LARC 60 Maintenance Area is currently protective of human health and the environment because exposure pathways that could result in unacceptable risk in the short term are being controlled through LUCs and annual inspections. However, the LTM Plan should be amended to reflect changes in groundwater sampling frequency, providing for monitoring until site until conditions allow for UU/UE and ensuring the long-term protectiveness of the remedy. After the LTM Plan has been amended, a RACR should be completed to document that the remedy is operational and functioning and remedial action is complete.

## 4.9 Next Review

The next Five-Year Review for the 80<sup>th</sup> DRS is required in October 2018.

## SECTION 5

# References

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Table 1 - Five-Year Review Summary  
 Joint Expeditionary Base Fort Story  
 Virginia Beach, Virginia

Site Name	Documents Reviewed	Actions Since Last Five-Year Review	RAOs	Remedy	Protectiveness	Recommendations	Next Review
80th Division Reserve Site	1994 - Draft Site Assessment Report 1994 - Site Characterization Report 1995 - Final Removal Action Report 2002 - Final Remedial Investigation Work Plan 2005 - Quality Control Summary/Analytical Results Report 2008 - Final Remedial Investigation Report 2009 - Final Decision Document 2010 - Final Long Term Monitoring Plan 2010 - Long Term Monitoring Report 2012 - Final Remedial Design for Land Use Controls 2012 - Annual LUC Inspection Report	N/A - this is the first Five-Year Review	Address VOCs in groundwater	LTM - groundwater LUCs - groundwater	The remedy at the 80th DRS is currently protective of human health and the environment because exposure pathways that could result in unacceptable risk in the short term are being controlled through LUCs and annual inspections. However, the LUC boundaries that are represented in the Navy GIS database should be amended to correspond with the LUC boundaries that are included in the LUC RD, ensuring the long term protectiveness of the site. After the LUC boundaries have been adjusted, a RACR should be completed to document that the remedy is operational and functioning and remedial action is complete. Long-term protectiveness of the remedy can be verified through continued LTM which may be used to evaluate the potential for off-site contaminant migration and the effectiveness of natural attenuation.	Update LUC boundaries, Document remedy implementation in RACR	2018
LARC 60 Maintenance Area	1991 - Final Analytical Results Document 1992 - Preliminary Assessment/Site Investigation Report 1994 - Initial Abatement Measures Report 1994 - Remedial Action Report 1996 - Draft Ecological Risk Assessment Report 1996 - Draft Human Health Risk Assessment Report 2002 - Final Remedial Investigation Report 2004 - Draft Feasibility Study Report 2007 - Final Remedial Investigation Addendum 2008 - Final Decision Document 2008 - Final LTM Plan 2009 - LTM Report 2011 - Long Term Monitoring Report 2011 - Final Remedial Design for Land Use Controls 2012 - LTM Report 2012 - Annual LUC Inspection Report	N/A - this is the first Five-Year Review	Address VOCs, SVOCs, and metals in groundwater	LTM - groundwater LUCs - groundwater	The remedy at the LARC 60 Maintenance Area is currently protective of human health and the environment because exposure pathways that could result in unacceptable risk in the short term are being controlled through LUCs and annual inspections.. However, the LTM Plan should be amended to reflect changes in groundwater sampling frequency, providing for monitoring until site until conditions allow for UU/UE and ensuring the long term protectiveness of the remedy. After the LTM Plan has been amended, a RACR should be completed to document that the remedy is operational and functioning and remedial action is complete.	Re-label MW-11, Update LTM Plan, Document remedy implementation in RACR	2018

Table 2 - Project Action Limit Exceedances  
 80th Division Reserve Site, Joint Expeditionary Base Fort Story  
 Virginia Beach, Virginia

Analyte	PAL/MCL	Monitoring Well Identification and Groundwater Sampling Results											
		MW-1				MW-5				MW-6			
		Jan-03	Jun-04	Jul-10	Nov-10	Jan-03	Jun-04	Jul-10	Nov-10	Jan-03	Jun-04	Jul-10	Nov-10
PCE	5 µg/l	5 U	5 U	0.5 U	0.57	0.3 J	2.1 J	0.67	6.0	5 U	1.2 J	0.23 J	0.18 J

Analyte	PAL	Monitoring Well Identification and Groundwater Sampling Results											
		MW-7				MW-8				MW-9			
		Jan-03	Jun-04	Jul-10	Nov-10	Jan-03	Jun-04	Jul-10	Nov-10	Jan-03	Jun-04	Jul-10	Nov-10
PCE	5 µg/l	4.0 J	5 U	0.38 J	0.66	6.0 J	5 U	0.32 J	0.15 J	0.8 J	6.3	2.2	6.0
TCE	5 µg/l	3.0 J	5 U	0.5 U	0.15 J	0.8 J	5 U	0.5 U	0.5 U	5 U	7.5	2.2	2.0

all results are in micrograms per liter (µg/l)

PAL - project action limit

MCL - United States Environmental Protection Agency Maximum Contaminant Levels

PCE - tetrachloroethene

TCE - trichloroethene

grey shading indicates a detection

values shaded in red exceed the PAL/MCL

U - the analyte was analyzed for but not detected

J - result is < the reporting limit but ≥ the method detection limit; result is an approximation

Table 3 - Project Action Limit Exceedances  
 Volatile Organic Compounds  
 LARC 60 Maintenance Area, Joint Expeditionary Base Fort story  
 Virginia Beach, Virginia

Analyte	PAL/MCL	Volatile Organic Compounds Results (µg/L)																										
		6MW-3S					6MW-11					MW-117					6MW-5S											
		1995	2000	2003	2004	2007	Feb-09	Aug-09	2011	2004	2007	Feb-09	Aug-09	2011	1995	2000	2003	2004	2007	Feb-09	Aug-09	2011	2003	2004	2007	Feb-09	Aug-09	2011
cis-1,2-Dichloroethene	70 µg/l	5 U	2 J	1 J	100	0.88	0.28 J	1.6	1.6	0.5 U	0.5 U	0.5 U	0.5 U	0.3 U	20	1,900	22	24	2	0.23 J	0.68	0.62 J	5 U	1.1	0.5 U	0.53	0.18 J	0.41 J
Tetrachloroethene	5 µg/l	5 U	5 U	0.4 J	62	0.33 J	0.5 U	0.5 U	0.2 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U	8.5	50 U	2 J	0.67 J	0.5 U	1.6	0.7	0.4 J	5 U	0.84	0.5 U	0.5 U	0.5 U	0.17 J
Trichloroethene	5 µg/l	5 U	1.3 J	1 J	140	1.9	0.45 J	0.49 J	2.2	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U	18	50 U	1 J	0.5 U	0.55	0.25	0.2 U	5 U	1.7	0.5 U	0.29 J	0.21 J	0.6 J	
Vinyl Chloride	2 µg/l	10 U	3.1 J	1 J	9.7	0.5 U	0.5 U	2.9	0.3 U	0.5 U	0.5 U	0.5 U	0.3 U	10 U	8.6 J	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.3 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.3 U	

Analyte	PAL/MCL	Sample ID and Results (µg/L)																		
		6MW-7					MW-118					6MW-9								
		2003	2004	2007	Feb-09	Aug-09	2011	1995	2000	2003	2004	Feb-09	Aug-09	2011	2003	2004	2007	Feb-09	Aug-09	2011
cis-1,2-Dichloroethene	70 µg/l	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.3 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	0.3 U	5 U	0.5 U	0.5 U	0.11 J	0.5 U	0.3 U
Tetrachloroethene	5 µg/l	11	0.49 J	1.3	2.3	1.5	8.5	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	0.2 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
Trichloroethene	5 µg/l	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	0.2 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.2 U
Vinyl Chloride	2 µg/l	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.3 U	10 U	10 U	5 U	0.5 U	0.5 U	0.5 U	0.3 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.3 U

Analyte	PAL/MCL	Semivolatile Organic Compounds Results (µg/L)																				
		6MW-3S			6MW-11			MW-117			6MW-5S			6MW-7			MW-118			6MW-9		
		Feb-09	Aug-09	2011	Feb-09	Aug-09	2011	Feb-09	Aug-09	2011	Feb-09	Aug-09	2011	Feb-09	Aug-09	2011	Feb-09	Aug-09	2011	Feb-09	Aug-09	2011
bis(2-Ethylhexyl)phthalate	6 µg/l	6.4	6.1	1.9 U	5.0 U	5.0 U	2.0 U	5.0 U	5.0 U	2.0 U	5.0 U	5.0 U	2.0 U	5.3 U	5.0 U	2.1 U	5.0 U	5.0 U	2.0 U	5.0 U	5.0 U	2.0 U

Analyte	PAL/MCL	Total Metals Results (µg/L)																																		
		6MW-3S					6MW-11					MW-117					6MW-5S					6MW-7					MW-118					6MW-9				
		1995	2000	Feb-09	Aug-09	2011	Feb-09	Aug-09	2011	1995	2000	Feb-09	Aug-09	2011	1995	2000	Feb-09	Aug-09	2011	Feb-09	Aug-09	2011	1995	2000	Feb-09	Aug-09	2011	1995	2000	Feb-09	Aug-09	2011	1995	2000	Feb-09	Aug-09
Arsenic	10 µg/l	14	3.0 U	3.4 B	6.7 B	1.2 Q	3.4 B	2.4 U	2.3 Q	91	21	16.7	15	6.8 Q	4.7 B	2.4 U	2.2 Q	2.2 U	2.4 U	0.74 JQ	10.0 U	3.0 U	2.2 U	2.4 U	2.1 Q	3 B	3.5 B	2.6 Q								

Analyte	PAL/MCL	Dissolved Metals Results (µg/L)																																		
		6MW-3S					6MW-11					MW-117					6MW-5S					6MW-7					MW-118					6MW-9				
		1995	2000	Feb-09	Aug-09	2011	Feb-09	Aug-09	2011	1995	2000	Feb-09	Aug-09	2011	1995	2000	Feb-09	Aug-09	2011	Feb-09	Aug-09	2011	1995	2000	Feb-09	Aug-09	2011	1995	2000	Feb-09	Aug-09	2011	1995	2000	Feb-09	Aug-09
Arsenic	10 µg/l	10.0 U	3.0 U	4.4 B	9.6 B	1 Q	3.4 B	5.6 B	1.9 Q	40	14	16.1	18.2	0.49 JQ	4.9 B	4 B	2.8 Q	2.2 U	2.4 U	0.5 UQ	10.0 U	3.0 U	3.1 B	2.5 B	2.6 Q	3.4 B	6.4 B	0.91 JQ								

all results are in micrograms per liter (µg/l)  
 PAL - project action limit  
 MCL - United States Environmental Protection Agency Maximum Contaminant Levels  
 U - undetected at the limit of detection  
 B - detected in associated method blank  
 Q - one or more quality control criteria failed  
 J - estimated; the analyte was positively identified; the quantitation is an estimation  
 grey shading indicates a detection  
 values shaded in red exceed the PAL/MCL

Table 4 - Johnson and Ettinger Model Vapor Intrusion Results  
 LARC 60 Maintenance Area, Joint Expeditionary Base Fort story  
 Virginia Beach, Virginia

CAS	COC	2011 LTM results	Incremental risk from vapor intrusion to indoor air, carcinogen	Hazard quotient from vapor intrusion to indoor air, non-carcinogen
127184	Tetrachloroethene	8.5 µg/l	1.20E-07	2.69E-02
79016	Trichloroethylene	2.2 µg/l	4.76E-07	1.35E-01
75014	Vinyl chloride	0.3 U	NR	NR
156592	Cis-1,2-Dichloroethylene	1.6 µg/l	NA	NA

NA - there are currently no inhalation assessments for Cis-1,2-Dichloroethylene developed for the Integrated Risk Information System

U - the analyte was not present in concentrations above the method detection limit

NR - no results were available because the analyte was not present in concentrations above the method detection limit

If the HQ for a chemical  $\leq$  than one (1E+00), it is believed that there is no appreciable risk that non-cancer health effects will occur

If the HQ > 1E+00, there is some possibility that non-cancer effects may occur

Table 5 - OSWER Vapor Intrusion Screening Level Calculator Results  
LARC 60 Maintenance Area, Joint Expeditionary Base Fort story  
Virginia Beach, Virginia

CAS	COC	2011 LTM results	Target Groundwater Concentration @ TCR=1E-06 or THQ=1 (Residential)	Is Target Groundwater Concentration < MCL?	Target Groundwater Concentration @ TCR=1E-04 or THQ=1 (Commercial)	Is Target Groundwater Concentration < MCL?
127184	Tetrachloroethene	8.5 µg/l	13 µg/l	No (5 µg/l)	240 µg/l	No (5 µg/l)
79016	Trichloroethylene	2.2 µg/l	1.1 µg/l	Yes (5 µg/l)	22 µg/l	No (5 µg/l)
75014	Vinyl chloride	0.3 U	0.14 µg/l	Yes (2 µg/l)	250 µg/l	No (2 µg/l)
156592	Cis-1,2-Dichloroethylene	1.6 µg/l	NA	No (70 µg/l)	NA	No (70 µg/l)

CAS	COC	Aug 2009 LTM results	Target Groundwater Concentration @ TCR=1E-06 or THQ=1 (Residential)	Is Target Groundwater Concentration < MCL?	Target Groundwater Concentration @ TCR=1E-04 or THQ=1 (Commercial)	Is Target Groundwater Concentration < MCL?
127184	Tetrachloroethene	1.5 µg/l	13 µg/l	No (5 µg/l)	240 µg/l	No (5 µg/l)
79016	Trichloroethylene	0.49 µg/l	1.1 µg/l	Yes (5 µg/l)	22 µg/l	No (5 µg/l)
75014	Vinyl chloride	2.9 µg/l	0.14 µg/l	Yes (2 µg/l)	250 µg/l	No (2 µg/l)
156592	Cis-1,2-Dichloroethylene	1.6 µg/l	NA	No (70 µg/l)	NA	No (70 µg/l)

CAS	COC	Feb 2009 LTM results	Target Groundwater Concentration @ TCR=1E-06 or THQ=1 (Residential)	Is Target Groundwater Concentration < MCL?	Target Groundwater Concentration @ TCR=1E-04 or THQ=1 (Commercial)	Is Target Groundwater Concentration < MCL?
127184	Tetrachloroethene	2.3 µg/l	13 µg/l	No (5 µg/l)	240 µg/l	No (5 µg/l)
79016	Trichloroethylene	0.55 µg/l	1.1 µg/l	Yes (5 µg/l)	22 µg/l	No (5 µg/l)
75014	Vinyl chloride	0.5 U	0.14 µg/l	Yes (2 µg/l)	250 µg/l	No (2 µg/l)
156592	Cis-1,2-Dichloroethylene	0.53 µg/l	NA	No (70 µg/l)	NA	No (70 µg/l)

NA - there is inadequate information to assess the carcinogenic potential; there is no inhalation unit risk factor or reference concentration for the chemical

U - the analyte was not present in concentrations above the method detection limit

TCR - target risk for carcinogens

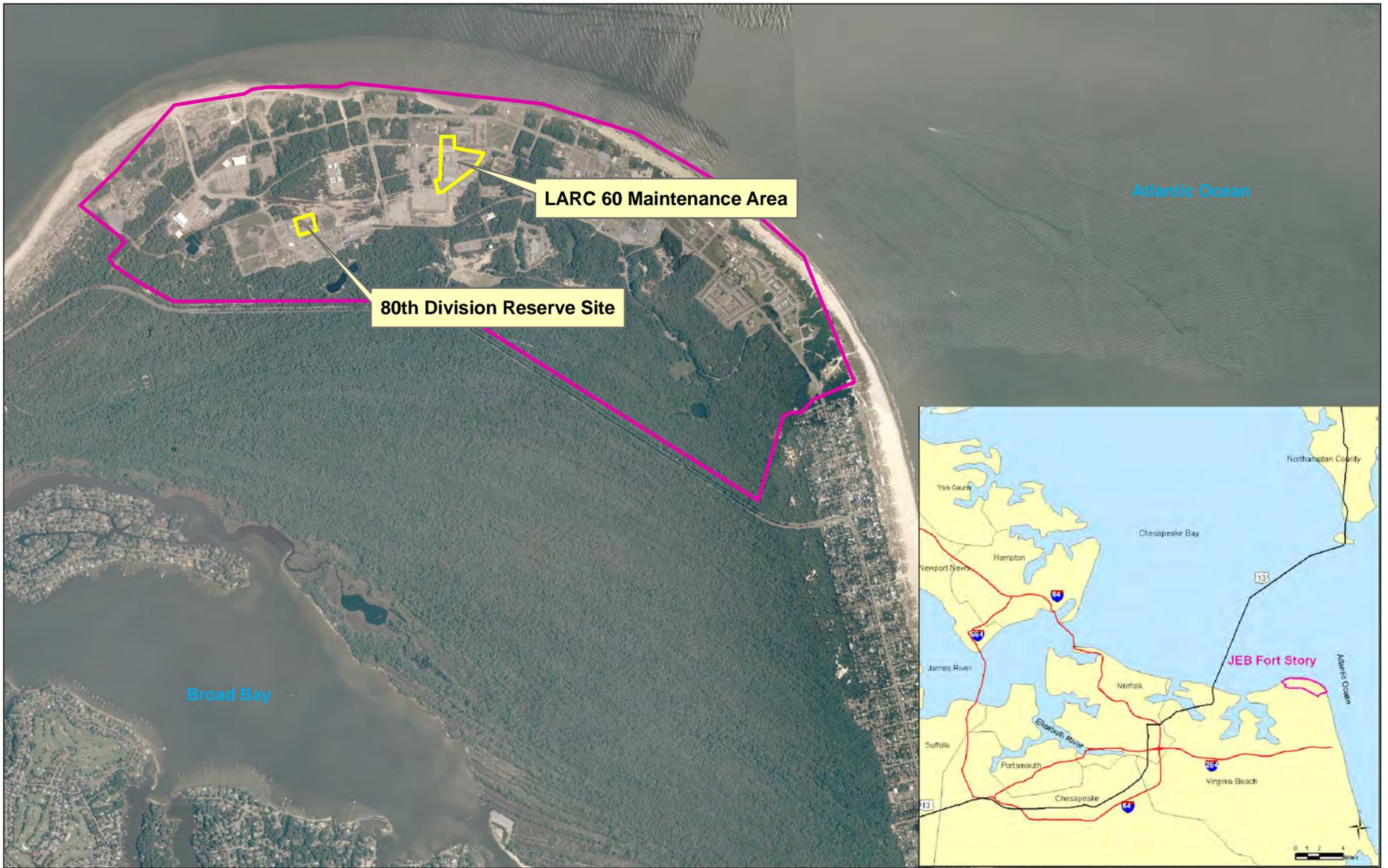
THQ - target hazard quotient for non-carcinogens

LTM - long term monitoring

CAS - Chemical Abstracts Service number

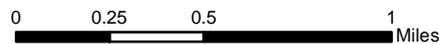
COC - constituent of concern





Legend

- Land Use Control Boundary
- JEB Fort Story Base Boundary



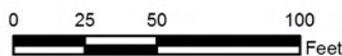
**Figure 1**  
 CERCLA Five-Year Review Site Location Map  
 Joint Expeditionary Base (JEB) Fort Story  
 Virginia Beach, Virginia





Legend

-  Monitoring Well
-  Former UST / AST
-  Former Drum Storage Area
-  Land Use Control Boundary



**Figure 2 - Land Use Control Boundaries**  
 80th Division Reserve Site  
 Joint Expeditionary Base (JEB) Fort Story  
 Virginia Beach, Virginia

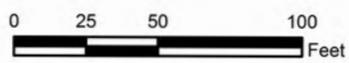
Analyte	PAL/MCL	MW-5	MW-8	MW-9	
		Nov-10	Jan-03	Jun-04	Nov-10
PCE	5 µg/L	6.0	6.0 J	6.3	6.0
TCE	5 µg/L	0.68	0.8 J	7.5	2

all results in micrograms per liter (µg/L)  
 PAL - project action limit  
 MCL - United States Environmental Protection Agency Maximum Contaminant Levels  
 PCE - tetrachloroethene  
 TCE - trichloroethene  
**Values shaded in red exceed the PAL/MCL**  
 U - the analyte was analyzed for but not detected  
 J - result is < the reporting limit but ≥ the method detection limit; result is an approximation



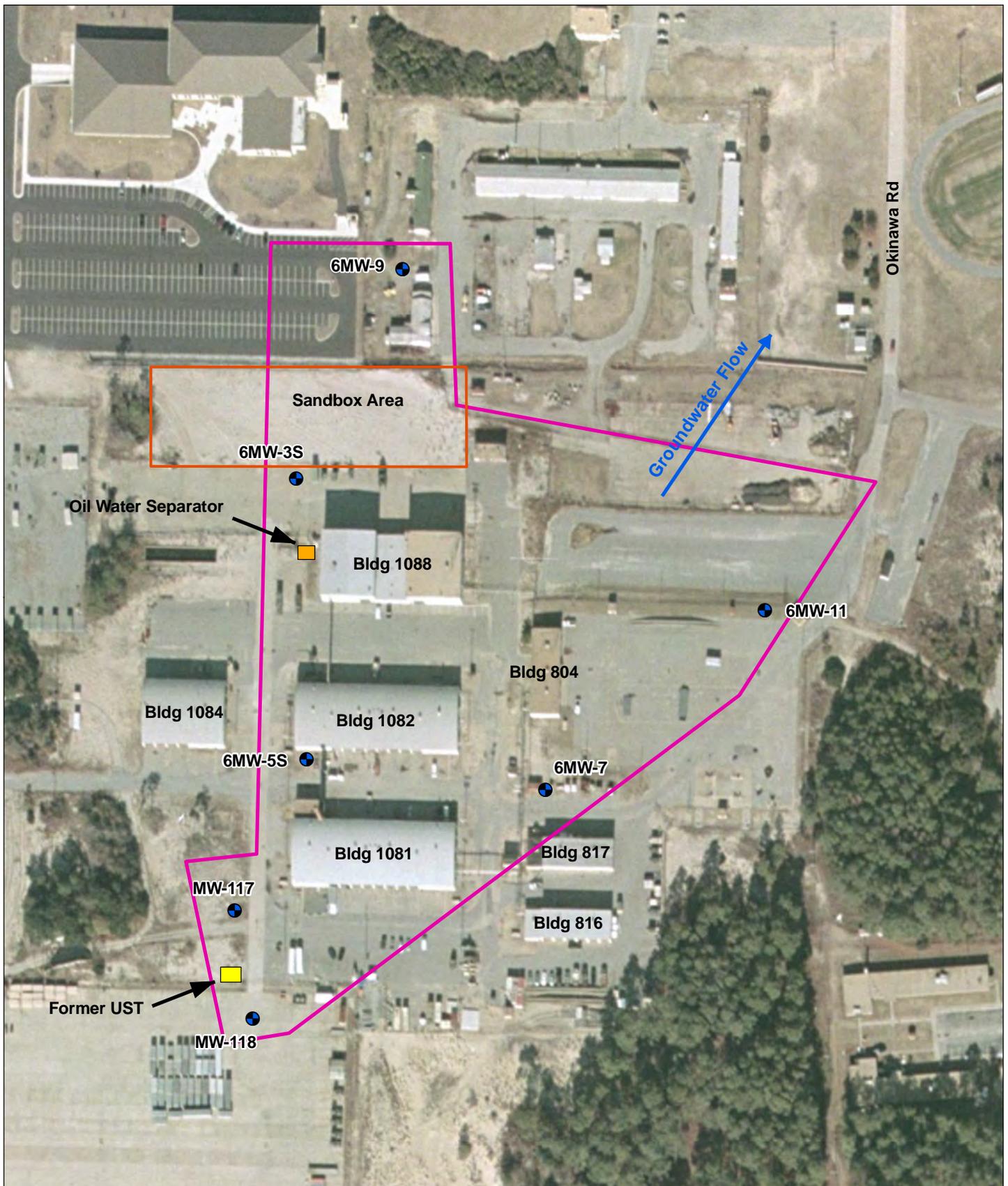
Legend

- Monitoring Well with Exceedances
- Monitoring Well
- Former UST / AST
- Former Drum Storage Area
- Land Use Control Boundary



**Figure 3 - Site Project Action Limit Exceedances**  
 80th Division Reserve Site  
 Joint Expeditionary Base (JEB) Fort Story  
 Virginia Beach, Virginia





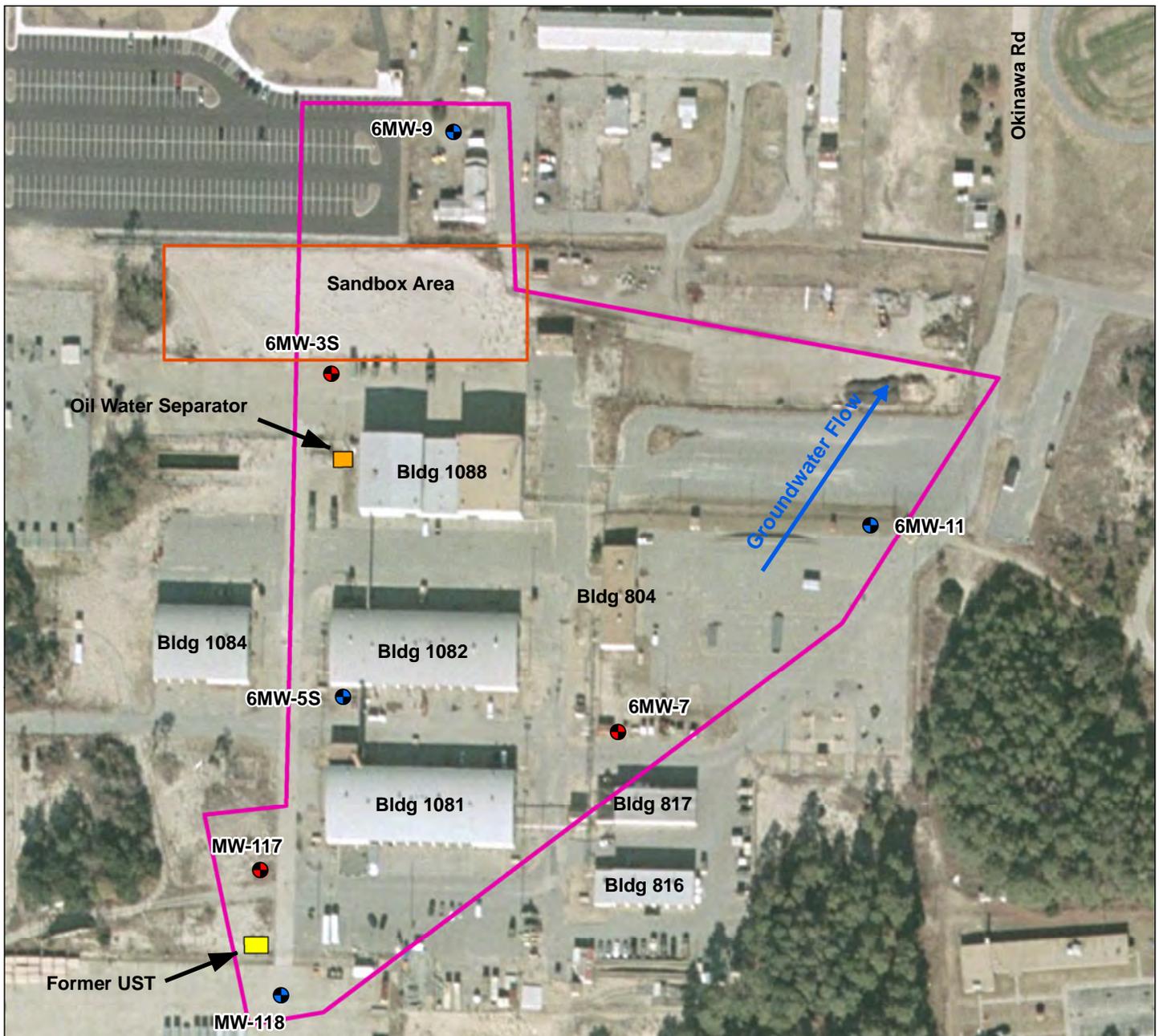
Legend

-  Monitoring Well
-  Sandbox Area
-  Oil Water Separator
-  Former UST
-  Land Use Control Boundary (LARC 60)



**Figure 4 - Land Use Control Boundaries**  
 LARC 60 Maintenance Area  
 Joint Expeditionary Base (JEB) Fort Story  
 Virginia Beach, VA





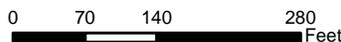
Analyte	PAL/MCL	6MW-3S				6MW-7			MW-117			
		2000	2004	Feb-09	Aug-09	2003	Feb-09	2011	1995	2000	Feb-09	Aug-09
cis-1,2-Dichloroethene	70 µg/L	2 J	100	0.28 J	1.6	5 U	0.5 U	0.3 U	20	1900	0.23 J	0.68
Tetrachloroethene	5 µg/L	5 U	62	0.5 U	0.5 U	11	2.3	8.5	8.5	50 U	1.6	0.7
Trichloroethene	5 µg/L	1.3 J	140	0.45 J	0.49 J	5 U	0.5 U	0.2 U	18	50 U	0.55	0.25
Vinyl Chloride	2 µg/L	3.1 J	9.7	0.5 U	2.9	5 U	0.5 U	0.3 U	10 U	8.5 J	0.5 U	0.5 U
bis(2-Ethylhexyl)phthalate	6 µg/L	N/A	ND	6.4	6.1	ND	5.3 U	2.1 U	ND	ND	5.0 U	5.0 U
Arsenic (Total)	10 µg/L	3.0 U	ND	3.4 B	6.7 B	ND	2.2 U	0.74 JQ	91	21	16.7	15
Arsenic (Dissolved)	10 µg/L	3.0 U	ND	4.4 B	9.6 B	ND	2.2 U	0.5 UQ	40	14	16.1	18.2

all results in micrograms per liter (µg/L)  
 PAL - project action limit  
 MCL - United States Environmental Protection Agency Maximum Contaminant Levels  
 U - undetected at the limit of detection  
 J - estimated; the analyte was positively identified; the quantitation is an estimation

B - detected in associated method blank  
 Q - one or more quality control criteria failed  
 grey shading indicates a detection  
 values shaded in red exceed the PAL/MCL

Legend

- Monitoring Well with Exceedances
- Monitoring Well
- Sandbox Area
- Oil Water Separator
- Former UST
- Land Use Control Boundary (LARC 60)



**Figure 5 - Site Project Action Limit Exceedances**  
 LARC 60 Maintenance Area  
 Joint Expeditionary Base (JEB) Fort Story  
 Virginia Beach, VA





<b>I. Site Information</b>																									
<b>Site Name:</b> 80 <sup>th</sup> Division Reserve Site	<b>Date of Inspection:</b> 5/23/2013																								
<b>Location and Region:</b> JEBFS Mid-Atlantic	<b>USEPA ID:</b> VA6210020875																								
<b>Agency, office, or company leading the Five-Year Review:</b> Navy in partnership with VDEQ	<b>Weather/temperature:</b> 74 ° F, cloudy, occasional rain																								
<p><b>Remedy Includes:</b> (Check all that apply)</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Landfill cover/containment</li> <li><input type="checkbox"/> Access Controls</li> <li><input checked="" type="checkbox"/> Institutional Controls</li> <li><input type="checkbox"/> Groundwater pump and treatment</li> <li><input type="checkbox"/> Surface water collection and treatment</li> <li><input checked="" type="checkbox"/> Monitored natural attenuation</li> <li><input type="checkbox"/> Groundwater containment</li> <li><input type="checkbox"/> Vertical barrier walls</li> <li><input type="checkbox"/> Other _____</li> </ul>																									
<b>Attachments:</b> site map with Land Use Controls boundaries provided as Figure 2																									
<p>Local regulatory authorities and response agencies (i.e. State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply</p> <p>Agency: <u>VDEQ</u></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Contact: <u>Wade Smith</u></td> <td style="width: 30%;">Remedial Project Manager</td> <td style="width: 15%;">5/23/2013</td> <td style="width: 25%;">(804) 698-4125</td> </tr> <tr> <td style="text-align: center;">Name</td> <td style="text-align: center;">Title</td> <td style="text-align: center;">Date</td> <td style="text-align: center;">Phone number</td> </tr> <tr> <td colspan="2">Problems, suggestions: See Section XI</td> <td colspan="2">Report attached: Not applicable</td> </tr> </table> <p>Agency: <u>Navy</u></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Contact: <u>Bryan Peed</u></td> <td style="width: 30%;">Remedial Project Manager</td> <td style="width: 15%;">5/23/2013</td> <td style="width: 25%;">(757) 341-0480</td> </tr> <tr> <td style="text-align: center;">Name</td> <td style="text-align: center;">Title</td> <td style="text-align: center;">Date</td> <td style="text-align: center;">Phone number</td> </tr> <tr> <td colspan="2">Problems, suggestions: See Section XI</td> <td colspan="2">Report attached: Not applicable</td> </tr> </table>		Contact: <u>Wade Smith</u>	Remedial Project Manager	5/23/2013	(804) 698-4125	Name	Title	Date	Phone number	Problems, suggestions: See Section XI		Report attached: Not applicable		Contact: <u>Bryan Peed</u>	Remedial Project Manager	5/23/2013	(757) 341-0480	Name	Title	Date	Phone number	Problems, suggestions: See Section XI		Report attached: Not applicable	
Contact: <u>Wade Smith</u>	Remedial Project Manager	5/23/2013	(804) 698-4125																						
Name	Title	Date	Phone number																						
Problems, suggestions: See Section XI		Report attached: Not applicable																							
Contact: <u>Bryan Peed</u>	Remedial Project Manager	5/23/2013	(757) 341-0480																						
Name	Title	Date	Phone number																						
Problems, suggestions: See Section XI		Report attached: Not applicable																							
<b>II. Interviews – see Appendix C</b>																									

### III. On-Site Documents (Check all that apply)

#### 1. O&M Documents

O&M Manual	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
As-built drawings	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Maintenance logs	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>

Remarks: LTM reports and Annual LUC inspections provided to VDEQ

#### 2. Site Specific Health and Safety Plan

Readily Available <input checked="" type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input type="checkbox"/>	
Contingency/emergency response plan	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>

Remarks: SSHSP included in contractor's LTM event per Navy contract requirements

#### 3. O&M and OSHA Training Records

Readily Available <input checked="" type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input type="checkbox"/>
---	-------------------------------------	------------------------------

Remarks: per Navy contract requirements

#### 4. Permits and Service Agreements

Air discharge permit	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Effluent discharge	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Waste disposal, POTW	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Other permits	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>

Remarks: investigation derived waste is characterized and disposed as required

#### 5. Gas Generation Records

Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
--	-------------------------------------	---

Remarks:

#### 6. Settlement Monument Records

Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
--	-------------------------------------	---

Remarks:

#### 7. Groundwater Monitoring Records

Readily Available <input checked="" type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input type="checkbox"/>
---	-------------------------------------	------------------------------

Remarks: available on request

#### 8. Leachate Extraction Records

Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
--	-------------------------------------	---

Remarks:



Type of monitoring (e.g. self-reporting, drive by): Inspection checklist and site walk  
Frequency: Annual  
Responsible Party/agency: Navy

Contact: <u>Bryan Peed</u>	<u>Remedial Project Manager</u>	<u>5/23/2013</u>	<u>(757) 341-0480</u>
Name	Title	Date	Phone number

Reporting is up to date

Yes  No  N/A

Reports are verified by the lead agency

Yes  No  N/A

Specific requirements in deed or decision documents have been met

Yes  No  N/A

Violations have been reported

Yes  No  N/A

Other problems or suggestions:

**2. Adequacy**

ICs are adequate

ICs are inadequate

Remarks:

**D. General**

**1. Vandalism/trespassing**

Location shown on site map

No vandalism evident

**2. Land use changes on site**

Remarks: the SATEC group has taken over picnic/volley ball area near MW-6 and MW-9.

**3. Land use changes off site**

Remarks: none observed

**VI. General Site Conditions**

**1. Roads damaged**

Location shown on site map

Roads adequate

Remarks:

**B. Other Site Conditions**

1. Remarks:		
<b>VII. Landfill Covers – Not applicable</b>		
<b>VIII. Vertical Barrier Walls – Not applicable</b>		
<b>IX. Groundwater/Surface Water Remedies</b>		
<b>A. Groundwater Extraction Wells/Pumps/Pipelines</b>	Applicable <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
<b>B. Surface water Collection Structures, Pumps, and Pipelines</b>	Applicable <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
<b>C. Treatment Systems</b>	Applicable <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
<b>1. Treatment Train (Check Components that apply)</b> <input type="checkbox"/> Metals removal <input type="checkbox"/> Air stripping <input type="checkbox"/> Oil/water separation <input type="checkbox"/> Carbon adsorbers <input type="checkbox"/> Bioremediation Remarks:		
<b>2. Electrical Enclosures and Panels (properly rated and functional)</b>		N/A <input checked="" type="checkbox"/>
<b>3. Tanks, Vaults, Storage Vessels</b>		N/A <input checked="" type="checkbox"/>
<b>4. Discharge Structure and Appurtenances</b>		N/A <input checked="" type="checkbox"/>
<b>5. Treatment Building(s)</b>		N/A <input checked="" type="checkbox"/>
<b>6. Monitoring Wells (pump and treatment remedy)</b> <span style="float: right;">N/A <input checked="" type="checkbox"/></span> <input type="checkbox"/> Properly secured/locked <input type="checkbox"/> Functioning <input type="checkbox"/> Routinely sampled <input type="checkbox"/> Good condition <input type="checkbox"/> All required wells located <input type="checkbox"/> Needs maintenance Remarks:		
<b>D. Monitoring Data</b>		

<b>1. Monitoring Data</b>	
<input checked="" type="checkbox"/> Is routinely submitted on time	
<input checked="" type="checkbox"/> Is of acceptable quality	
<b>2. Monitoring data suggests:</b>	Groundwater plume is effectively contained <input checked="" type="checkbox"/>
<b>E. Monitored Natural Attenuation</b>	Applicable <input checked="" type="checkbox"/> N/A <input type="checkbox"/>
<b>1. Monitoring Wells</b> (natural attenuation remedy)	N/A <input type="checkbox"/>
<input checked="" type="checkbox"/> Properly secured/locked	
<input checked="" type="checkbox"/> Functioning	
<input type="checkbox"/> Routinely sampled	
<input checked="" type="checkbox"/> Good condition	
<input checked="" type="checkbox"/> All required wells located	
<input checked="" type="checkbox"/> Needs maintenance	
Remarks: See notes in Section XI	
<b>X. Other Remedies</b>	N/A <input checked="" type="checkbox"/>
<b>XI. Overall Observations</b>	
<b>A. Implementation of the Remedy</b>	
<p>Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e. to contain contaminant plume, minimize infiltration and gas emission, etc.).</p> <p><u>The remedy at the 80<sup>th</sup> DRS includes LUCs with monitoring to protect 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. No violations of the LUCs were noted during the inspection.</u></p>	
<b>B. Adequacy of O&amp;M</b>	
<p>Describe issues and observations related to the implementation and scope of O&amp;M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.</p> <p><u>Monitoring well MW-11 was mislabeled as MW-10. MW-10 has been abandoned. Items are currently being stored by the Small Arms Testing Evaluation Compound that may impede access to monitoring wells for future LTM events. The tenant should be notified prior to any groundwater sampling event to ensure access to each well is secured. Another groundwater sampling event is required prior to the next five-year review.</u></p>	

**C. Early Indicators of Potential Remedy Problems**

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.

There were no early indicators of potential remedy problems at the time of the inspection.

**D. Opportunities for Optimization**

Describe possible opportunities for optimization in monitoring tasks or operation of the remedy.

No optimization opportunities were identified.

<b>I. Site Information</b>																	
<b>Site Name:</b> Joint Expeditionary Base Fort Story	<b>Date of Inspection:</b> 5/23/2013																
<b>Location and Region:</b> JEBCFS Mid-Atlantic	<b>USEPA ID:</b> VA6210020875																
<b>Agency, office, or company leading the Five-Year Review:</b> Navy in partnership with VDEQ	<b>Weather/temperature:</b> 74 ° F, cloudy, occasional rain																
<p><b>Remedy Includes:</b> (Check all that apply)</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Landfill cover/containment</li> <li><input type="checkbox"/> Access Controls</li> <li><input checked="" type="checkbox"/> Institutional Controls</li> <li><input type="checkbox"/> Groundwater pump and treatment</li> <li><input type="checkbox"/> Surface water collection and treatment</li> <li><input type="checkbox"/> Monitored natural attenuation</li> <li><input type="checkbox"/> Groundwater containment</li> <li><input type="checkbox"/> Vertical barrier walls</li> <li><input type="checkbox"/> Other _____</li> </ul>																	
<b>Attachments:</b> site map with Land Use Controls boundaries provided as Figure 4																	
<p>Local regulatory authorities and response agencies (i.e. State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply</p> <p>Agency: <u>VDEQ</u></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Contact: <u>Wade Smith</u></td> <td style="width: 30%;">Remedial Project Manager</td> <td style="width: 15%;">5/23/2013</td> <td style="width: 25%;">(804) 698-4125</td> </tr> <tr> <td style="text-align: center;">Name</td> <td style="text-align: center;">Title</td> <td style="text-align: center;">Date</td> <td style="text-align: center;">Phone number</td> </tr> </table> <p>Problems, suggestions: See Section XI      Report attached: Not applicable</p> <p>Agency: <u>Navy</u></p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Contact: <u>Bryan Peed</u></td> <td style="width: 30%;">Remedial Project Manager</td> <td style="width: 15%;">5/23/2013</td> <td style="width: 25%;">(757) 341-0480</td> </tr> <tr> <td style="text-align: center;">Name</td> <td style="text-align: center;">Title</td> <td style="text-align: center;">Date</td> <td style="text-align: center;">Phone number</td> </tr> </table> <p>Problems, suggestions: See Section XI      Report attached: Not applicable</p>		Contact: <u>Wade Smith</u>	Remedial Project Manager	5/23/2013	(804) 698-4125	Name	Title	Date	Phone number	Contact: <u>Bryan Peed</u>	Remedial Project Manager	5/23/2013	(757) 341-0480	Name	Title	Date	Phone number
Contact: <u>Wade Smith</u>	Remedial Project Manager	5/23/2013	(804) 698-4125														
Name	Title	Date	Phone number														
Contact: <u>Bryan Peed</u>	Remedial Project Manager	5/23/2013	(757) 341-0480														
Name	Title	Date	Phone number														
<b>II. Interviews – Not Applicable, see Appendix E</b>																	

### III. On-Site Documents (Check all that apply)

**1. O&M Documents**

O&M Manual	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
As-built drawings	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Maintenance logs	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>

Remarks: LTM reports and Annual LUC inspections provided to VDEQ

**2. Site Specific Health and Safety Plan**    Readily Available     Up to date     N/A

Contingency/emergency response plan    Readily Available     Up to date     N/A

Remarks: SSHSP included in contractor's LTM event per Navy contract requirements

**3. O&M and OSHA Training Records**    Readily Available     Up to date     N/A

Remarks: per Navy contract requirements

**4. Permits and Service Agreements**

Air discharge permit	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Effluent discharge	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Waste disposal, POTW	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Other permits	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>

Remarks:

**5. Gas Generation Records**    Readily Available     Up to date     N/A

Remarks:

**6. Settlement Monument Records**    Readily Available     Up to date     N/A

Remarks:

**7. Groundwater Monitoring Records**    Readily Available     Up to date     N/A

Remarks:

**8. Leachate Extraction Records**    Readily Available     Up to date     N/A

Remarks:

<b>9. Discharge Compliance Records</b>	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Remarks:			
<b>10. Daily Access/Security Logs</b>	Readily Available <input type="checkbox"/>	Up to date <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Remarks:			
<b>IV. O&amp;M Cost</b>			
<b>1. O&amp;M Organization</b>			
<input type="checkbox"/> State in-house <input type="checkbox"/> PRP in-house <input checked="" type="checkbox"/> Federal Facility in-house <input type="checkbox"/> Contractor for State <input type="checkbox"/> Contractor for PRP <input checked="" type="checkbox"/> Contractor for Federal facility			
Remarks: LTM is performed by a contractor and LUC inspections are performed in-house in partnership with VDEQ.			
<b>2. O&amp;M Cost Records</b>			
O&M costs are not recognized since there is no remediation system. LTM is performed by a contractor and LUC inspections are performed in-house in partnership with VDEQ.			
<b>3. Unanticipated or Unusually High O&amp;M Costs During Review Period</b>			N/A <input checked="" type="checkbox"/>
<b>V. Access and Institutional controls</b>			
<b>A. Fencing</b>			
<b>1. Fencing damaged</b>			N/A <input checked="" type="checkbox"/>
<b>B. Other Access Restrictions</b>			
<b>1. Signs and other security measures</b>			N/A <input checked="" type="checkbox"/>
<b>C. Institutional Controls</b>			
<b>1. Implementation and enforcement</b>			
Conditions imply ICs not properly implemented			
Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	N/A <input type="checkbox"/>	
Conditions imply ICs not being fully enforced			
Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	N/A <input type="checkbox"/>	

Type of monitoring (e.g. self-reporting, drive by): Inspection checklist and site walk  
Frequency: Annual  
Responsible Party/agency: Navy

Contact: <u>Bryan Peed</u>	<u>Remedial Project Manager</u>	<u>5/23/2013</u>	<u>(757) 341-0480</u>
Name	Title	Date	Phone number

Reporting is up to date

Yes  No  N/A

Reports are verified by the lead agency

Yes  No  N/A

Specific requirements in deed or decision documents have been met

Yes  No  N/A

Violations have been reported

Yes  No  N/A

Other problems or suggestions:

**2. Adequacy**

ICs are adequate

ICs are inadequate

Remarks:

**D. General**

**1. Vandalism/trespassing**

Location shown on site map

No vandalism evident

**2. Land use changes on site**

Remarks:

**3. Land use changes off site**

Remarks:

**VI. General Site Conditions**

**1. Roads damaged**

Location shown on site map

Roads adequate

Remarks:

**B. Other Site Conditions**

1. Remarks:	
<b>VII. Landfill Covers – Not applicable</b>	
<b>VIII. Vertical Barrier Walls – Not applicable</b>	
<b>IX. Groundwater/Surface Water Remedies</b>	
<b>A. Groundwater Extraction Wells/Pumps/Pipelines</b>	Applicable <input type="checkbox"/> N/A <input checked="" type="checkbox"/>
<b>B. Surface water Collection Structures, Pumps, and Pipelines</b>	Applicable <input type="checkbox"/> N/A <input checked="" type="checkbox"/>
<b>C. Treatment Systems</b>	Applicable <input type="checkbox"/> N/A <input checked="" type="checkbox"/>
<b>1. Treatment Train</b> (Check Components that apply) <ul style="list-style-type: none"> <li><input type="checkbox"/> Metals removal</li> <li><input type="checkbox"/> Air stripping</li> <li><input type="checkbox"/> Oil/water separation</li> <li><input type="checkbox"/> Carbon adsorbers</li> <li><input type="checkbox"/> Bioremediation</li> </ul> Remarks:	
<b>2. Electrical Enclosures and Panels</b> (properly rated and functional)	N/A <input checked="" type="checkbox"/>
<b>3. Tanks, Vaults, Storage Vessels</b>	N/A <input checked="" type="checkbox"/>
<b>4. Discharge Structure and Appurtenances</b>	N/A <input checked="" type="checkbox"/>
<b>5. Treatment Building(s)</b>	N/A <input checked="" type="checkbox"/>
<b>6. Monitoring Wells</b> (pump and treatment remedy) <ul style="list-style-type: none"> <li>Properly secured/locked</li> <li>Functioning</li> <li>Routinely sampled</li> <li>Good condition</li> <li>All required wells located</li> <li>Needs maintenance</li> </ul> Remarks:	N/A <input checked="" type="checkbox"/>
<b>D. Monitoring Data</b>	
<b>1. Monitoring Data</b> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Is routinely submitted on time</li> <li><input checked="" type="checkbox"/> Is of acceptable quality</li> </ul>	

<p><b>2. Monitoring data suggests:</b></p> <p><b>E. Monitored Natural Attenuation</b></p>	<p>Groundwater plume is effectively contained <input checked="" type="checkbox"/></p> <p>Applicable <input checked="" type="checkbox"/> N/A <input type="checkbox"/></p>
<p><b>1. Monitoring Wells</b> (natural attenuation remedy)</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Properly secured/locked</li> <li><input checked="" type="checkbox"/> Functioning</li> <li><input type="checkbox"/> Routinely sampled</li> <li><input checked="" type="checkbox"/> Good condition</li> <li><input checked="" type="checkbox"/> All required wells located</li> <li><input type="checkbox"/> Needs maintenance</li> </ul> <p>Remarks: See notes in Section XI</p>	<p>N/A <input type="checkbox"/></p>
<p><b>X. Other Remedies</b> N/A <input checked="" type="checkbox"/></p>	
<p><b>XI. Overall Observations</b></p>	
<p><b>A. Implementation of the Remedy</b></p>	
<p>Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e. to contain contaminant plume, minimize infiltration and gas emission, etc.).</p> <p><u>The remedy at the LARC 60 Maintenance Area includes LUCs with monitoring to ensure protection of human health and the environment in case of future use of groundwater as a drinking water source. No violations of the LUCs were noted during the inspection.</u></p>	
<p><b>B. Adequacy of O&amp;M</b></p>	
<p>Describe issues and observations related to the implementation and scope of O&amp;M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.</p> <p><u>No issues were noted during the site visit that would compromise the current or long-term protectiveness of the remedy at the LARC 60 Maintenance Area.</u></p>	
<p><b>C. Early Indicators of Potential Remedy Problems</b></p> <p>Describe issues and observations such as unexpected changes in the cost or scope of O&amp;M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.</p> <p><u>There were no early indicators of potential remedy problems at the time of the inspection.</u></p>	

**D. Opportunities for Optimization**

Describe possible opportunities for optimization in monitoring tasks or operation of the remedy.

No optimization opportunities were identified.



THE VIRGINIAN-PILOT  
NORFOLK, VIRGINIA  
AFFIDAVIT OF PUBLICATION

The Virginian-Pilot

OSAGE OF VIRGINIA, INC.  
ATTN: DAVID COHN  
2618 COLLEY AVE  
NORFOLK VA 23517

REFERENCE: AA417762  
23606695 Five-Yr Review Fort

State of Virginia  
City of Norfolk

This day, Shirell Belcher appeared before me and, after being duly sworn, made oath that: 1) she is affidavit clerk of the Virginian-Pilot, a newspaper published by The Virginian-Pilot Media Companies, LLC, in the cities of Norfolk, Portsmouth, Chesapeake, Suffolk, and Virginia Beach, Commonwealth of Virginia and in the state of North Carolina 2.) That the advertisement hereto annexed has been published in said newspaper on the dates stated



PUBLISHED ON: 06/02

TOTAL COST: 744.00  
FILED ON: 06/07/13

AD SPACE: 96 LINE

Legal Affiant

Subscribed and sworn to before me in my city and state on the day and year aforesaid this 11 of June in the year of 2013. (NRN:7145124)

Notary:

My commission expires October 31, 2015.

Public Notices



**PUBLIC NOTICE**  
**Five-Year Review**  
**Joint Expeditionary Base**  
**Fort Story**  
**Virginia Beach, Virginia**

The Department of the Navy is beginning the first Five-Year Review of existing Decision Documents and ongoing remedial (environmental cleanup) actions at Joint Expeditionary Base (JEB) Fort Story, located in Virginia Beach, Virginia. A Decision Document is a public document explaining the selected remedial action for implementation at a site. In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, and the National Contingency Plan [40 Code of Federal Regulations Part 300.430(f)(4)(ii)], remedial actions that result in any hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure must be reviewed every five years. The Five-Year Review period for JEB Fort Story began when the first Decision Document for the Base was signed on October 31, 2008. The purpose of the Five-Year Review is to ensure these environmental cleanup actions continue to adequately protect human health and the environment. The Navy will submit draft findings of the Five-Year Review to the Virginia Department of Environmental Quality in June 2013. The final Five-Year Review report will be made available to the public in October 2013.

**Decision Documents and remedial actions to be reviewed:**

**80th Division Reserve Site:** The Decision Document, signed in July 2009, selected land use controls and long-term monitoring of groundwater as the remedy for the site.

**Lighterage Amphibious Resupply Cargo (LARC) 60 Site:** The Decision Document, signed in October 2008, selected land use controls and long-term monitoring of groundwater as the remedy for the site.

The remedy for each site was selected based on findings contained in documents that are part of the Administrative Record for JEB Fort Story, which can be accessed at the following location:  
[https://portal.navy.mil/portal/page/portal/navfac/navfac\\_vw\\_pp/navfac\\_hq\\_pp/navfac\\_env\\_pp/env\\_restorations/installations/lant/midlant/lebcfs/eb\\_east/records](https://portal.navy.mil/portal/page/portal/navfac/navfac_vw_pp/navfac_hq_pp/navfac_env_pp/env_restorations/installations/lant/midlant/lebcfs/eb_east/records)

The Administrative Record provides background information on all of the sites included in the Five Year Review, as well as remedial investigations conducted at each site. If you have questions regarding the effectiveness of the selected remedies, please contact the JEB Little Creek-Fort Story Public Affairs Office:  
**Public Affairs Office**  
**Joint Expeditionary Base Little**  
**Creek-Fort Story**  
2600 Tarawa Ct., Suite 100  
Virginia Beach, Virginia 23459-3297  
Phone: (757) 462 8425

VP June 2, 2013 23606695



# **Annual Inspection Report (JEBFS)**

## **(Draft) Fiscal Year 2012 Site and Land Use Control Annual Inspection Report for the Lighterage Amphibious Resupply Cargo (LARC) 60 Maintenance Area and the 80<sup>th</sup> Division Reserve Sites Located at Joint Expeditionary Base (JEB) Fort Story, Virginia Beach, Virginia**

**Date: May 6, 2013**

### **Introduction**

This report presents findings from the fiscal year (FY) 2012 annual site and land use control (LUC) inspections for the Environmental Restoration Program at Joint Expeditionary Base (JEB) Fort Story, Virginia Beach, Virginia. In accordance with the site-specific LUC Remedial Designs (RDs) for the LARC 60 and 80<sup>th</sup> Division Reserve sites, inspections are conducted on an annual basis for both sites to ensure that LUCs are maintained. During these inspections, the overall condition of the sites and ongoing activities were also observed. This report is developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986, and, to the extent practicable, the National Oil and Hazardous Substances Contingency Plan.

### **Facility Background**

JEB Fort Story is located in Virginia Beach, Virginia adjacent to First Landing State Park and Shore Drive (U.S. 60). JEB Fort Story consists of approximately 1,450 acres and is situated on Cape Henry which roughly divides the waters of the Chesapeake Bay and the Atlantic Ocean. JEB Fort Story is the only available facility that has the necessary natural terrain features and beaches, sand, surf, and variable tide conditions (bay and ocean) and hinterlands, all of which are normally experienced by amphibious operations. Therefore, JEB 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, and the training and testing of new equipment, doctrines and techniques.

### **LARC 60**

The LARC 60 site, which is the maintenance and wash rack area for LARC 60 vehicles, is located in the sand flat area that lies between the coastal dune complex to the north and the central sand ridge to the south. The LARC 60 site includes Buildings 1081, 1082, 1083 and 1088. During the 1950s, the wash rack area was first used as the barge amphibious resupply cargo (BARC) motor pool and maintenance facility. In 1964, the BARC vehicle was phased out and the LARC 60 vehicle was prototyped.

A former 10,000-gallon UST was located at the north gate of the LARC 60 vehicle motor pool approximately 600 feet south of the wash rack area. This UST, installed in 1983, was used for storing used oil and degreasers. Although James M. Montgomery, Inc.'s (JMM) April 1990 field visits to this area identified soil-stained zones around the UST, there are no reports of tanks

## **Annual Inspection Report (JEBFS)**

failing or leaking documented. These soil-stained areas may have been caused by overfilling or spillage during use. In 1987, the U.S. Army Environmental Hygiene Agency sampled the UST and found it contained oil, water, 1,1,1-trichloroethane and chromium. In September 1992, the Environmental Restoration Company (ERC) removed the waste oil UST and excavated petroleum-stained soils an additional three feet from the sides and bottom of the excavation. The specific volume of soils removed is not known.

A 2007 RI Addendum summarized groundwater monitoring data and presented revised risk assessment conclusions. The revised human health risk assessment concluded that the only risk identified was for the future scenario of residential development. Therefore, there is no human health risk identified for the LARC 60 site. The RI addendum also confirmed that there was no ecological risk as stated in the Final RI. Contaminants of potential concern (VOCs and PAHs) have been identified in the groundwater at levels above United States Environmental Protection Agency (USEPA) maximum contaminant levels (MCLs); therefore, the selected remedy specified in the 2008 DD is LUCs with monitoring for groundwater. The following LUC objective for the LARC 60 site was established as part of the selected remedy:

- Prohibit future use of site groundwater as a drinking water source.

### **80<sup>th</sup> Division Reserve Site (DRS)**

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.

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

A removal action of contaminated soil was performed in the LARC staging area and the tank area. Approximately 3,500 tons of TPH-contaminated soils and 30 tons of PCE-contaminated soil were excavated from the site and transported off-site for thermal desorption. The areas were backfilled with clean fill.

LUCs with Monitoring are necessary at the former 80th DRS because two VOCs, trichloroethene (TCE) and tetrachloroethene (PCE), have exceeded MCLs; however, based on the limited contamination detected at the site, the trends indicate that the VOC concentrations in groundwater are decreasing due to numerous fate mechanisms, and the results of the baseline risk assessment that did not identify receptors and potentially exposed populations.

- Prohibit the withdrawal of groundwater except for environmental monitoring and testing
- Maintain the integrity of any current or future monitoring system

# Annual Inspection Report (JEBFS)

## LUC Inspections

In accordance with the current respective LUC RDs for the LARC 60 and 80<sup>th</sup> Division Reserve sites, inspections are conducted on an annual basis to ensure that LUCs and remedy systems are maintained. FY 2012 inspections were conducted by Navy personnel in the month of August, 2012, utilizing the inspection checklists provided in **Attachment A**. The results of the inspections are summarized as follows.

### LARC 60

#### *Groundwater Withdrawal*

There are no groundwater withdrawal wells, except those for environmental monitoring and remedial action, located within the LUC boundary. Additionally, no direct exposure pathways to groundwater were observed at the site.

#### *Land Use*

No change in land use was observed. In addition, no unauthorized intrusive activities, debris disposal, or IDW storage were observed. A survey plat of the site has been completed and registered with the City of Virginia Beach. The LUC boundary has also been established in NIRIS to annotate the boundary spatially and outline the applicable LUC requirements.

#### *Remedial Action System Maintenance*

**The following maintenance requirements/repairs were conducted as a result of the FY 2012 site inspection:**

- **Monitoring Well (6MW-3S)** – The bolts securing the well cover would not tighten due to stripped threads in the flange. The flange was replaced and the well lid is now secure.
- **Monitoring Well (6MW-7)** - Because of the location (sandy area) and the construction of the well (flush mount); the monitoring well would routinely get covered by wind blown sand, which makes it hard to locate during monitoring events. The well has now been reconstructed above the ground surface with protective bollards.
- **Monitoring Well (6MW-5S)** – The down hole pvc-pipe portion of the well was constructed too high above the ground surface, which did not allow the well lid to fit securely on top of the well. The pvc pipe was cut at an elevation that would allow the cover to fit flush and secure.
- **Monitoring Well (MW-117)** – Although the well itself did have a lid, the above-ground protective enclosure did not have a lid. A lid was fabricated for the enclosure and the well is now secure.
- **Monitoring Well (MW-118)** - The bolts securing the well cover would not tighten due to the threads being stripped in the flange. The flange was replaced and the well lid is now secure.
- **General Note on all Site Monitoring Wells** – The monitoring wells across the site either had locks that did not function or were missing altogether. With this round of maintenance, all monitoring wells were equipped with new locks.

#### *Corrective Action Recommendations*

The following corrective actions are recommended for LARC 60:

- To date, all repairs have been completed and there are no recommendations at this time.

# Annual Inspection Report (JEBFS)

## 80<sup>th</sup> Division Reserve Site

### *Groundwater Withdrawal*

There are no groundwater withdrawal wells, except those for environmental monitoring and remedial action, located within the LUC boundary. Additionally, no direct exposure pathways to groundwater were observed at the site.

### *Land Use*

No change in land use was observed. In addition, no unauthorized intrusive activities, debris disposal, or IDW storage were observed. A survey plat of the site has been completed and registered with the City of Virginia Beach. The LUC boundary has also been established in NIRIS to annotate the boundary spatially and outline the applicable LUC requirements.

### *Remedial Action System Maintenance*

**The following maintenance requirements/repairs were conducted as a result of the FY 2012 site inspection:**

- **General Note on all Site Monitoring Wells** – The monitoring wells across the site either had locks that did not function or were missing altogether. With this round of maintenance, all monitoring wells were equipped with new locks.

### *Corrective Action Recommendations*

- To date, all repairs have been completed and there are no recommendations at this time.

**IR Inspection Checklist**

80<sup>th</sup> Division Reserve Site

Joint Expeditionary Base Little Creek - Fort Story, Virginia Beach, Virginia

Site Description:

The 80th Division Reserve Site (DRS) is located on Fort Story 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. 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 (UST), 250-gallon antifreeze aboveground storage tank (AST), and a former drum storage area were located west of the wash pad. Several of the downgradient monitoring wells are located within a fenced area associated with the Small Arms Testing and Evaluation Compound.

Inspection Questionnaire:

**General**

1. Is the area free of any indication of recent and/or current intrusive activities within the site boundary, as depicted on the figure, or in the immediate vicinity of the site? If no, mark location of intrusive activities on figure, note extent and purpose of activity.
2. Is the area free of stressed vegetation or free of other identifiable concerns with regards to this site? If no, annotate these concerns in the comments section below, mark location of concern on map, and notify activity coordinator.
3. Is the area free of storage of any investigative derived waste (IDW) on site? If no, mark location of IDW on figure, note its condition in the comment section below, and notify activity coordinator. Indicate if IDW is properly labeled, per example below.

Investigative Derived Waste

80<sup>th</sup> Division Reserve Site

Date

Media

Do not handle, analysis pending

Navy Contact Name/Phone #

Yes	No
✓	
✓	
✓	

**Site Specific**

4. Are site monitoring wells, as depicted on the figure, in good condition and appear to be locked? (i.e. damaged protective posts and/or well head/casing) If no, describe condition of the deficient monitoring well(s), mark location of deficient monitoring well. *In general, locks were either missing or not functioning.*
5. Is the area free of any signs of disturbance (i.e. digging, settlement, cracking, holes, erosion)? If no, describe condition of the disturbance, mark location on the map, and note extent.
6. Any evidence of use of the site for residential, child care, elementary or secondary school, or playground facilities?
7. Any evidence of withdrawal of groundwater for any purpose except environmental monitoring and testing?
8. Have the LUCs for this site been annotated in the Navy GIS database and real estate summary maps?
9. Have previously proposed corrective actions (if any) been completed? *NIA, since this is the first inspections*

Yes	No
	✓
✓	
	✓
	✓
✓	

NIA  
 ✓

Recommendations:

(Enter suggested improvements to this form)

*Replace all locks*

*Bryan K. Peed* *Bryan K. Peed*

Inspection performed by: (Print and sign)

*Aug 3, 2012*

Date

**IR Inspection Checklist**

LARC 60 Maintenance Area Site

Joint Expeditionary Base Little Creek - Fort Story, Virginia Beach, Virginia

Site Description:

The LARC 60 Maintenance Area Site, which is the maintenance and wash rack area for the LARC 60 vehicles, is located in the sand flat area that lies between the coastal dune complex to the north and the central sand ridge to the south. The LARC 60 site includes Buildings 1081, 1082, 1083 and 1088.

Inspection Questionnaire:

General

1. Is the area free of any unidentified wells or evidence of groundwater withdraw within the site boundary, as depicted on the figure, or in the immediate vicinity of the site? If no, mark location of well or withdraw site on figure, note extent and purpose of activity.

Yes	No
<input checked="" type="checkbox"/>	<input type="checkbox"/>

Site Specific

2. Are site monitoring wells, as depicted on the figure, in good condition and do they appear to be locked? If no, describe condition of the deficient monitoring well(s) (i.e. damaged protective posts and/or well head/casing) and mark location of deficient monitoring well.

Yes	No
<input type="checkbox"/>	<input checked="" type="checkbox"/>

General - Locks are either missing or not working properly  
All Wells

GMW-35 - Threads in flange  
GMW-118 stripped

3. Have previously proposed corrective actions (if any) been completed?

Completion Date N/A  
Proposed Completion Date N/A

GMW-117 Above-ground enclosure does not have a lid.

GMW-7 - Flush mount well covered by sand-

GMW-55 - PVC portion of the well sticks up to high, well lid does not fit flush

Yes	No	N/A
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Recommendations:

(Enter suggested improvements to this form)

GMW-55 Cut PVC to allow for lid to close.

GMW-7 Reconstruct well to above ground surface with ballards

GMW-35, 118 Replace well flange

GMW-117 Construct lid to replace missing one.

Bryan K. Peed Bryan K. Peed

Aug 3, 2012  
Date

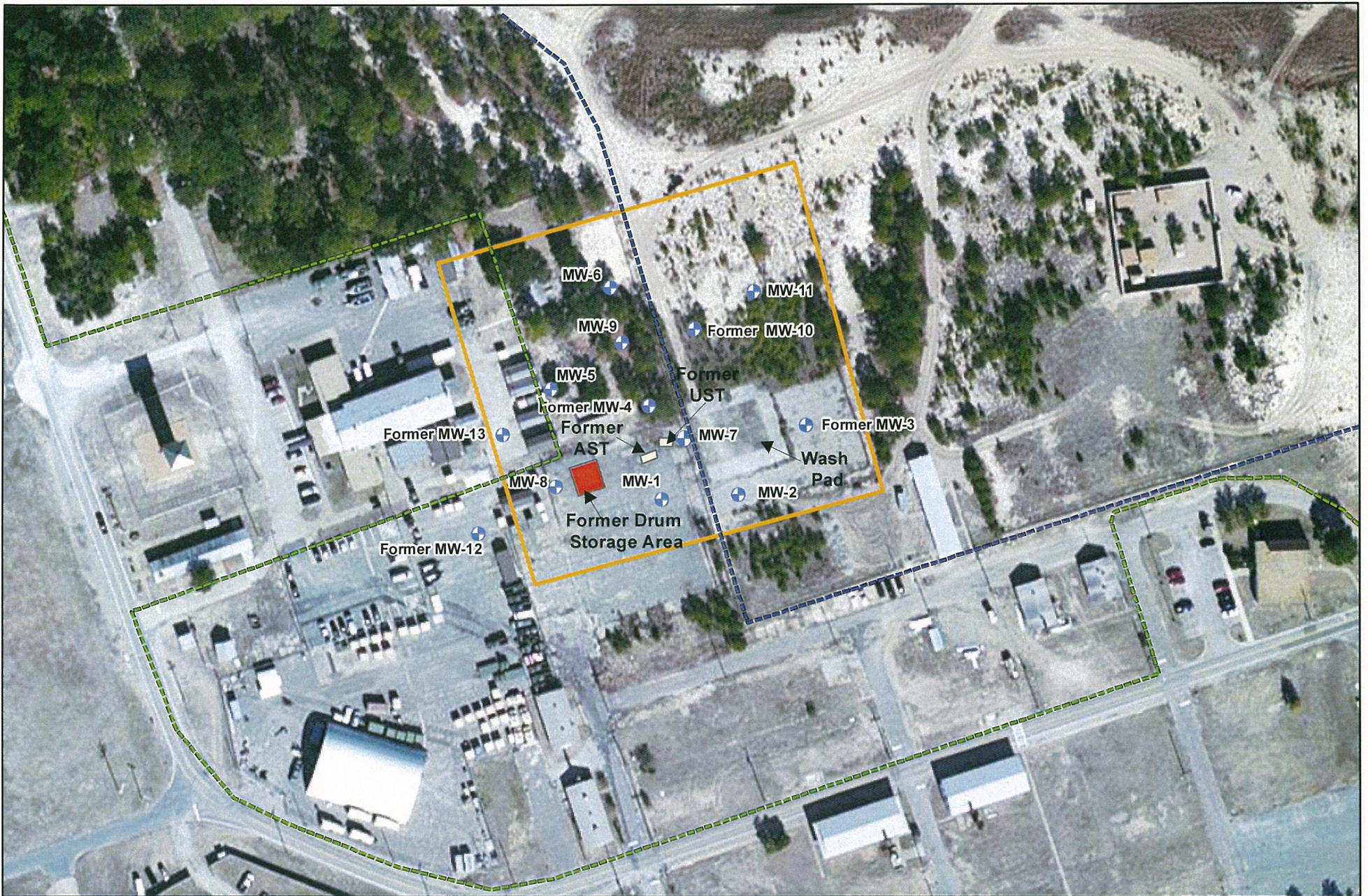
Inspector Contact Information:

Name (Print) Bryan Peed

Name (Signature) Bryan K. Peed

Phone # 757 341-0480

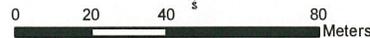
Email address bryan.peed@navy.mil



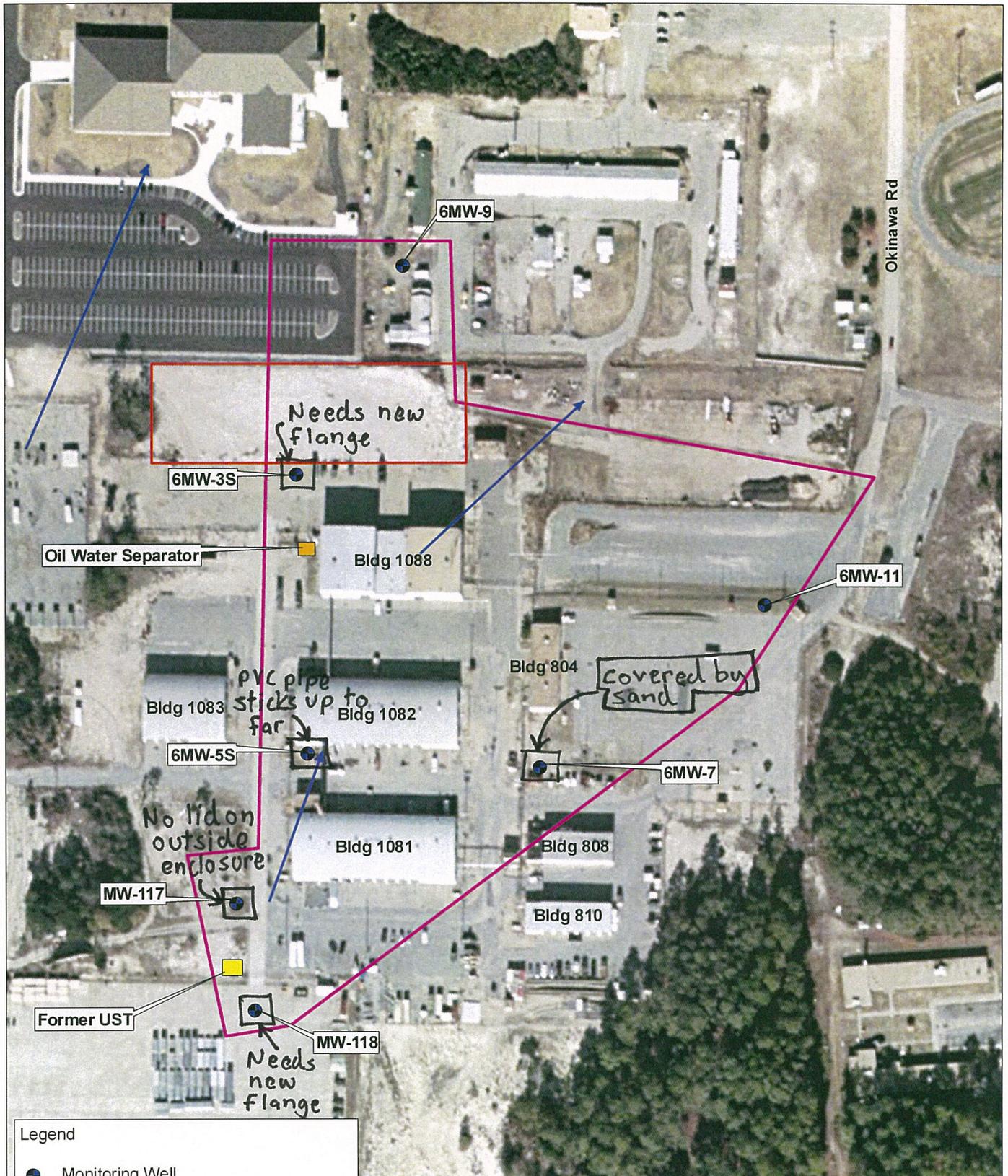
**Legend**

-  Approximate Monitoring Well Location
-  Land Use Control Boundary
-  Existing Fence
-  Proposed Fence

*Wells in general  
need new locks*



**Figure 3**  
80th DRS Site Map  
Fort Story  
Virginia Beach, VA



- Legend
- Monitoring Well
  - ➔ Groundwater Flow Direction
  - ▭ Sandbox Area
  - Oil Water Separator
  - Former UST
  - ▭ Land Use Control Boundary (LARC 60)

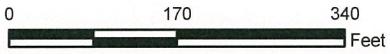


Figure 1  
Land Use Control Boundary  
LARC 60

Joint Expeditionary Base Fort Story, Virginia



wells in general need new locks



## Interview Record

<b>Site Name:</b> 80th Division Reserve Site	<b>EPA ID:</b> VA6210020875
<b>Subject:</b> Five-Year Review	<b>Time:</b> 0900
	<b>Date:</b> 5/29/2013
<b>Type:</b> In person	<b>Location:</b> Public Works Dept.

### Contact Made By:

<b>Name:</b> David Cohn	<b>Title:</b> Project Manager	<b>Organization:</b> Osage of Virginia, Inc.
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### Individual Contacted:

<b>Title:</b> Planner	<b>Organization:</b> JEBCFS Base Master Planning	<b>Telephone:</b> 757-462-5371
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### Summary Of Conversation

1. What is your overall impression of this project?  
There have been not been any updates of recent activity for this project.
  
2. What effects have site operations had on the surrounding community?  
Site operations have not had any effects on the surrounding community at this point.
  
3. Are you aware of any community concerns regarding the site or its operation and administration?  
I am not aware of any community concerns regarding the site or its operation.

- 4.** Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities?

I am not aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities.

- 5.** Have there been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?

There have not been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by our office regarding the site.

- 6.** Have there been any complaints, violations, or other incidents related to the site requiring a response by your office?

There have not been any complaints, violations, or other incidents related to the site requiring a response by our office.

- 7.** Do you feel well informed about the site's activities and progress?

No, there have been no recent updates regarding the site from Base Environmental.

- 8.** Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

I do not have any comments, suggestions, or recommendations regarding the site's management or operation.

**Other Items of Note:**

None

## Interview Record

**Site Name:** 80th Division Reserve Site

**EPA ID:** VA6210020875

**Subject:** Five-Year Review

**Time:** 1310

**Date:** 6/27/2013

**Type:** In-person

**Location:** Public Affairs Office

### Contact Made By:

**Name:** David Cohn

**Title:** Project Manager

**Organization:** Osage of Virginia, Inc.

### Individual Contacted:

**Title:** Public Affairs Officer

**Organization:** JEBLCFS Public Affairs

**Telephone:** 757-462-8425

### Summary Of Conversation

1. What is your overall impression of the Environmental Restoration Program?  
My overall impression is that the Environmental Restoration Program is outstanding based upon feedback received from public partners.
2. What effects have site operations had on the surrounding community?  
I am not aware that site operations have had any negative effects on the surrounding community.
3. Are you aware of any community concerns regarding the site or its operation and administration?  
I am not aware of any community concerns regarding the site or its operation and administration.

- 4.** Have there been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?

The Public Affairs Office recently put out a Public Notice announcing the commencement of the Five-Year Review at Fort Story. No other communications or activities have occurred.

- 5.** Have there been inquiries related to the site requiring a response by your office?

There have been no inquiries related to the site requiring a response by our office.

- 6.** Do you feel well informed about the site's activities and progress?

Yes, I feel well informed about the site's activities and progress.

- 7.** Has the Environmental Program had any negative effects on the Public Affairs Office operations?

The Environmental Program has had no negative effect on operations. LUCs have not had any negative impact on Base Personnel.

- 8.** Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

If possible, I would like to get more people involved in public meetings.

**Other Comments:** None.

## Interview Record

<b>Site Name:</b> 80 <sup>th</sup> Division Reserve Site	<b>EPA ID:</b> VA6210020875
<b>Subject:</b> Five-Year Review	<b>Time:</b> 1340
	<b>Date:</b> 6/27/2013
<b>Type:</b> In-person	<b>Location:</b> Building 3165

### Contact Made By:

<b>Name:</b> David Cohn	<b>Title:</b> Project Manager	<b>Organization:</b> Osage of Virginia, Inc.
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### Individual Contacted:

<b>Title:</b> Lead Environmental Protection Specialist	<b>Organization:</b> JEBCFS Base Environmental
<b>Telephone:</b> 757-462-5361	

### Summary Of Conversation

1. What is your overall impression of the Environmental Restoration Program?  
The Environmental Restoration Program has been effective in what they are trying to accomplish; however, it can be a difficult process.
  
2. What effects have site operations had on the surrounding community?  
I am not aware that site operations have had any effect on the surrounding community.
  
3. Are you aware of any community concerns regarding the site or its operation and administration?  
I am not aware of any community concerns regarding the site or its operation and administration.

- 4.** Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities?

I am not aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities.

- 5.** Have there been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?

To my knowledge there have not been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by our office regarding the site.

- 6.** Have there been any impacts related to the site requiring a response by your office?

There have not been any impacts related to the site requiring a response by our office.

- 7.** Do you feel well informed about the site's activities and progress?

Yes, I feel well informed about the site's activities and progress.

- 8.** Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

I do not have any comments, suggestions, or recommendations regarding the site's management or operation other than investigation derived waste should be removed as quickly as possible.

**Other Comments:** None.



- 4.** Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities?

I am not aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities.

- 5.** Have there been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?

There have not been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by our office regarding the site.

- 6.** Have there been any complaints, violations, or other incidents related to the site requiring a response by your office?

There have not been any complaints, violations, or other incidents related to the site requiring a response by our office.

- 7.** Do you feel well informed about the site's activities and progress?

Yes, I feel well informed about the site's activities and progress.

- 8.** Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

I do not have any comments, suggestions, or recommendations regarding the site's management or operation.

**Other Comments:**

SATEC – small arms testing and evaluation compound is completely fenced with limited access.



DATA ENTRY SHEET

NJ-GW-ADV-JAN2013  
USEPA Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES

**ENTER**  
Chemical CAS No.  
(numbers only, no dashes)

127184

**ENTER**  
Initial groundwater conc.,  $C_w$   
( $\mu\text{g/L}$ )

8.50E+00

**NOTE: SEE SPECIAL INSTRUCTIONS FOR METHYLENE CHLORIDE, TRICHLOROETHENE, AND VINYL CHLORIDE ON RESULTS PAGE**

Chemical

Tetrachloroethylene

MORE  
↓

**ENTER**  
Average soil/groundwater temperature,  $T_s$   
( $^{\circ}\text{C}$ )

14

**ENTER**  
Depth below grade to bottom of enclosed space floor,  $L_f$   
(cm)

15

**ENTER**  
Depth below grade to water table,  $L_{WT}$   
(cm)

153

**ENTER**  
Thickness of soil stratum A,  $h_A$   
(cm)

153

**ENTER**  
Thickness of soil stratum B, (Enter value or 0)  $h_B$   
(cm)

0

**ENTER**  
Thickness of soil stratum C, (Enter value or 0)  $h_C$   
(cm)

0

**ENTER**  
Soil stratum directly above water table, (Enter A, B, or C)

A

**ENTER**  
SCS soil type directly above water table

S

**ENTER**  
Soil stratum A SCS soil type (used to estimate soil vapor permeability)

S

OR

**ENTER**  
User-defined stratum A soil vapor permeability,  $k_v$   
( $\text{cm}^2$ )

MORE  
↓

**ENTER**  
Stratum A SCS soil type  
Lookup Soil Parameters

S

**ENTER**  
Stratum A soil dry bulk density,  $\rho_b^A$   
( $\text{g/cm}^3$ )

1.66

**ENTER**  
Stratum A soil total porosity,  $n^A$   
(unitless)

0.375

**ENTER**  
Stratum A soil water-filled porosity,  $\theta_w^A$   
( $\text{cm}^3/\text{cm}^3$ )

0.054

**ENTER**  
Stratum B SCS soil type  
Lookup Soil Parameters

S

**ENTER**  
Stratum B soil dry bulk density,  $\rho_b^B$   
( $\text{g/cm}^3$ )

1.66

**ENTER**  
Stratum B soil total porosity,  $n^B$   
(unitless)

0.375

**ENTER**  
Stratum B soil water-filled porosity,  $\theta_w^B$   
( $\text{cm}^3/\text{cm}^3$ )

0.054

**ENTER**  
Stratum C SCS soil type  
Lookup Soil Parameters

C

**ENTER**  
Stratum C soil dry bulk density,  $\rho_b^C$   
( $\text{g/cm}^3$ )

1.66

**ENTER**  
Stratum C soil total porosity,  $n^C$   
(unitless)

0.375

**ENTER**  
Stratum C soil water-filled porosity,  $\theta_w^C$   
( $\text{cm}^3/\text{cm}^3$ )

0.054

MORE  
↓

**ENTER**  
Enclosed space floor thickness,  $L_{crack}$   
(cm)

10

**ENTER**  
Soil-bldg. pressure differential,  $\Delta P$   
( $\text{g/cm-s}^2$ )

40

**ENTER**  
Enclosed space floor length,  $L_B$   
(cm)

3679

**ENTER**  
Enclosed space floor width,  $W_B$   
(cm)

1269

**ENTER**  
Enclosed space height,  $H_B$   
(cm)

366

**ENTER**  
Floor-wall seam crack width,  $w$   
(cm)

0.1

**ENTER**  
Indoor air exchange rate,  $ER$   
(1/h)

0.25

**ENTER**  
Average vapor flow rate into bldg. OR Leave blank to calculate  $Q_{soil}$   
(L/m)

5

MORE  
↓

**ENTER**  
Averaging time for carcinogens,  $AT_C$   
(yrs)

70

**ENTER**  
Averaging time for noncarcinogens,  $AT_{NC}$   
(yrs)

30

**ENTER**  
Exposure duration,  $ED$   
(yrs)

30

**ENTER**  
Exposure frequency,  $EF$   
(days/yr)

350

**ENTER**  
Target risk for carcinogens,  $TR$   
(unitless)

Used to calculate risk-based groundwater concentration.

1.0E-06

**ENTER**  
Target hazard quotient for noncarcinogens,  $THQ$   
(unitless)

1

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, $D_a$ ( $\text{cm}^2/\text{s}$ )	Diffusivity in water, $D_w$ ( $\text{cm}^2/\text{s}$ )	Henry's law constant at reference temperature, H ( $\text{atm}\cdot\text{m}^3/\text{mol}$ )	Henry's law constant reference temperature, $T_R$ ( $^\circ\text{C}$ )	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ ( $\text{cal}/\text{mol}$ )	Normal boiling point, $T_B$ ( $^\circ\text{K}$ )	Critical temperature, $T_C$ ( $^\circ\text{K}$ )	Organic carbon partition coefficient, $K_{oc}$ ( $\text{cm}^3/\text{g}$ )	Pure component water solubility, S ( $\text{mg}/\text{L}$ )	Unit risk factor, URF ( $\mu\text{g}/\text{m}^3$ ) <sup>-1</sup>	Reference conc., RfC ( $\text{mg}/\text{m}^3$ )
5.05E-02	9.46E-06	1.77E-02	25	8,288	394.45	620.25	9.49E+01	2.06E+02	2.6E-07	4.0E-02

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, $\tau$ (sec)	Source-building separation, $L_T$ (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ ( $\text{cm}^3/\text{cm}^3$ )	Stratum B soil air-filled porosity, $\theta_a^B$ ( $\text{cm}^3/\text{cm}^3$ )	Stratum C soil air-filled porosity, $\theta_a^C$ ( $\text{cm}^3/\text{cm}^3$ )	Stratum A effective total fluid saturation, $S_{te}$ ( $\text{cm}^3/\text{cm}^3$ )	Stratum A soil intrinsic permeability, $k_i$ ( $\text{cm}^2$ )	Stratum A soil relative air permeability, $k_{rg}$ ( $\text{cm}^2$ )	Stratum A soil effective vapor permeability, $k_v$ ( $\text{cm}^2$ )	Thickness of capillary zone, $L_{cz}$ (cm)	Total porosity in capillary zone, $n_{cz}$ ( $\text{cm}^3/\text{cm}^3$ )	Air-filled porosity in capillary zone, $\theta_{a,cz}$ ( $\text{cm}^3/\text{cm}^3$ )	Water-filled porosity in capillary zone, $\theta_{w,cz}$ ( $\text{cm}^3/\text{cm}^3$ )	Floor-wall seam perimeter, $X_{crack}$ (cm)
9.46E+08	138	0.321	0.321	0.321	0.003	9.99E-08	0.998	9.98E-08	17.05	0.375	0.122	0.253	9,896

Bldg. ventilation rate, $Q_{building}$ ( $\text{cm}^3/\text{s}$ )	Area of enclosed space below grade, $A_B$ ( $\text{cm}^2$ )	Crack-to-total area ratio, $\eta$ (unitless)	Crack depth below grade, $Z_{crack}$ (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, $H_{TS}$ (atm- $\text{m}^3/\text{mol}$ )	Henry's law constant at ave. groundwater temperature, $H'_{TS}$ (unitless)	Vapor viscosity at ave. soil temperature, $\mu_{TS}$ (g/cm-s)	Stratum A effective diffusion coefficient, $D_A^{eff}$ ( $\text{cm}^2/\text{s}$ )	Stratum B effective diffusion coefficient, $D_B^{eff}$ ( $\text{cm}^2/\text{s}$ )	Stratum C effective diffusion coefficient, $D_C^{eff}$ ( $\text{cm}^2/\text{s}$ )	Capillary zone effective diffusion coefficient, $D_{cz}^{eff}$ ( $\text{cm}^2/\text{s}$ )	Total overall effective diffusion coefficient, $D_T^{eff}$ ( $\text{cm}^2/\text{s}$ )	Diffusion path length, $L_d$ (cm)
1.19E+05	4.82E+06	2.05E-04	15	9,513	9.57E-03	4.06E-01	1.77E-04	8.16E-03	0.00E+00	0.00E+00	3.25E-04	2.05E-03	138

Convection path length, $L_p$ (cm)	Source vapor conc., $C_{source}$ ( $\mu\text{g}/\text{m}^3$ )	Crack radius, $r_{crack}$ (cm)	Average vapor flow rate into bldg., $Q_{soil}$ ( $\text{cm}^3/\text{s}$ )	Crack effective diffusion coefficient, $D^{crack}$ ( $\text{cm}^2/\text{s}$ )	Area of crack, $A_{crack}$ ( $\text{cm}^2$ )	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, $\alpha$ (unitless)	Infinite source bldg. conc., $C_{building}$ ( $\mu\text{g}/\text{m}^3$ )	Unit risk factor, URF ( $\mu\text{g}/\text{m}^3$ ) <sup>-1</sup>	Reference conc., RfC ( $\text{mg}/\text{m}^3$ )
15	3.45E+03	0.10	8.33E+01	8.16E-03	9.90E+02	6.72E+44	3.25E-04	1.12E+00	2.6E-07	4.0E-02

END

DATA ENTRY SHEET

NJ-GW-ADV-JAN2013  
USEPA Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES

**ENTER**  
Chemical CAS No.  
(numbers only, no dashes)

79016

**ENTER**  
Initial groundwater conc.,  $C_w$   
( $\mu\text{g/L}$ )

2.20E+00

**NOTE: SEE SPECIAL INSTRUCTIONS FOR METHYLENE CHLORIDE, TRICHLOROETHENE, AND VINYL CHLORIDE ON RESULTS PAGE**

Chemical

Trichloroethylene

MORE  
↓

<b>ENTER</b> Average soil/groundwater temperature, $T_s$ ( $^{\circ}\text{C}$ )	<b>ENTER</b> Depth below grade to bottom of enclosed space floor, $L_f$ (cm)	<b>ENTER</b> Depth below grade to water table, $L_{WT}$ (cm)	<b>ENTER</b> Totals must add up to value of $L_{WT}$ (cell G28)			<b>ENTER</b> Soil stratum directly above water table, (Enter A, B, or C)	<b>ENTER</b> SCS soil type directly above water table	<b>ENTER</b> Soil stratum A SCS soil type (used to estimate soil vapor permeability)	<b>ENTER</b> User-defined stratum A soil vapor permeability, $k_v$ ( $\text{cm}^2$ )
$h_A$ (cm)	$h_B$ (cm)	$h_C$ (cm)	Thickness of soil stratum A, $h_A$ (cm)	Thickness of soil stratum B, (Enter value or 0) $h_B$ (cm)	Thickness of soil stratum C, (Enter value or 0) $h_C$ (cm)		OR		
14	15	153	153	0	0	A	S	S	

MORE  
↓

<b>ENTER</b> Stratum A SCS soil type Lookup Soil Parameters	<b>ENTER</b> Stratum A soil dry bulk density, $\rho_b^A$ ( $\text{g/cm}^3$ )	<b>ENTER</b> Stratum A soil total porosity, $n^A$ (unitless)	<b>ENTER</b> Stratum A soil water-filled porosity, $\theta_w^A$ ( $\text{cm}^3/\text{cm}^3$ )	<b>ENTER</b> Stratum B SCS soil type Lookup Soil Parameters	<b>ENTER</b> Stratum B soil dry bulk density, $\rho_b^B$ ( $\text{g/cm}^3$ )	<b>ENTER</b> Stratum B soil total porosity, $n^B$ (unitless)	<b>ENTER</b> Stratum B soil water-filled porosity, $\theta_w^B$ ( $\text{cm}^3/\text{cm}^3$ )	<b>ENTER</b> Stratum C SCS soil type Lookup Soil Parameters	<b>ENTER</b> Stratum C soil dry bulk density, $\rho_b^C$ ( $\text{g/cm}^3$ )	<b>ENTER</b> Stratum C soil total porosity, $n^C$ (unitless)	<b>ENTER</b> Stratum C soil water-filled porosity, $\theta_w^C$ ( $\text{cm}^3/\text{cm}^3$ )
S	1.66	0.375	0.054	S	1.66	0.375	0.054	C	1.66	0.375	0.054

MORE  
↓

<b>ENTER</b> Enclosed space floor thickness, $L_{crack}$ (cm)	<b>ENTER</b> Soil-bldg. pressure differential, $\Delta P$ ( $\text{g/cm-s}^2$ )	<b>ENTER</b> Enclosed space floor length, $L_B$ (cm)	<b>ENTER</b> Enclosed space floor width, $W_B$ (cm)	<b>ENTER</b> Enclosed space height, $H_B$ (cm)	<b>ENTER</b> Floor-wall seam crack width, $w$ (cm)	<b>ENTER</b> Indoor air exchange rate, $ER$ (1/h)	<b>ENTER</b> Average vapor flow rate into bldg. OR Leave blank to calculate $Q_{soil}$ (L/m)
10	40	3679	1269	366	0.1	0.25	5

MORE  
↓

<b>ENTER</b> Averaging time for carcinogens, $AT_C$ (yrs)	<b>ENTER</b> Averaging time for noncarcinogens, $AT_{NC}$ (yrs)	<b>ENTER</b> Exposure duration, $ED$ (yrs)	<b>ENTER</b> Exposure frequency, $EF$ (days/yr)	<b>ENTER</b> Target risk for carcinogens, $TR$ (unitless)	<b>ENTER</b> Target hazard quotient for noncarcinogens, $THQ$ (unitless)
70	30	30	350	1.0E-06	1

END

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

Diffusivity in air, $D_a$ ( $\text{cm}^2/\text{s}$ )	Diffusivity in water, $D_w$ ( $\text{cm}^2/\text{s}$ )	Henry's law constant at reference temperature, H ( $\text{atm}\cdot\text{m}^3/\text{mol}$ )	Henry's law constant reference temperature, $T_R$ ( $^\circ\text{C}$ )	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ ( $\text{cal}/\text{mol}$ )	Normal boiling point, $T_B$ ( $^\circ\text{K}$ )	Critical temperature, $T_C$ ( $^\circ\text{K}$ )	Organic carbon partition coefficient, $K_{oc}$ ( $\text{cm}^3/\text{g}$ )	Pure component water solubility, S ( $\text{mg}/\text{L}$ )	Unit risk factor, URF ( $\mu\text{g}/\text{m}^3$ ) <sup>-1</sup>	Reference conc., RfC ( $\text{mg}/\text{m}^3$ )
6.87E-02	1.02E-05	9.85E-03	25	7,505	360.35	573.35	6.07E+01	1.28E+03	4.1E-06	2.0E-03

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, $\tau$ (sec)	Source-building separation, $L_T$ (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ ( $\text{cm}^3/\text{cm}^3$ )	Stratum B soil air-filled porosity, $\theta_a^B$ ( $\text{cm}^3/\text{cm}^3$ )	Stratum C soil air-filled porosity, $\theta_a^C$ ( $\text{cm}^3/\text{cm}^3$ )	Stratum A effective total fluid saturation, $S_{te}$ ( $\text{cm}^3/\text{cm}^3$ )	Stratum A soil intrinsic permeability, $k_i$ ( $\text{cm}^2$ )	Stratum A soil relative air permeability, $k_{rg}$ ( $\text{cm}^2$ )	Stratum A soil effective vapor permeability, $k_v$ ( $\text{cm}^2$ )	Thickness of capillary zone, $L_{cz}$ (cm)	Total porosity in capillary zone, $n_{cz}$ ( $\text{cm}^3/\text{cm}^3$ )	Air-filled porosity in capillary zone, $\theta_{a,cz}$ ( $\text{cm}^3/\text{cm}^3$ )	Water-filled porosity in capillary zone, $\theta_{w,cz}$ ( $\text{cm}^3/\text{cm}^3$ )	Floor-wall seam perimeter, $X_{crack}$ (cm)
9.46E+08	138	0.321	0.321	0.321	0.003	9.99E-08	0.998	9.98E-08	17.05	0.375	0.122	0.253	9,896

Bldg. ventilation rate, $Q_{building}$ ( $\text{cm}^3/\text{s}$ )	Area of enclosed space below grade, $A_B$ ( $\text{cm}^2$ )	Crack-to-total area ratio, $\eta$ (unitless)	Crack depth below grade, $Z_{crack}$ (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, $H_{TS}$ (atm- $\text{m}^3/\text{mol}$ )	Henry's law constant at ave. groundwater temperature, $H'_{TS}$ (unitless)	Vapor viscosity at ave. soil temperature, $\mu_{TS}$ (g/cm-s)	Stratum A effective diffusion coefficient, $D_A^{eff}$ ( $\text{cm}^2/\text{s}$ )	Stratum B effective diffusion coefficient, $D_B^{eff}$ ( $\text{cm}^2/\text{s}$ )	Stratum C effective diffusion coefficient, $D_C^{eff}$ ( $\text{cm}^2/\text{s}$ )	Capillary zone effective diffusion coefficient, $D_{cz}^{eff}$ ( $\text{cm}^2/\text{s}$ )	Total overall effective diffusion coefficient, $D_T^{eff}$ ( $\text{cm}^2/\text{s}$ )	Diffusion path length, $L_d$ (cm)
1.19E+05	4.82E+06	2.05E-04	15	8,320	5.75E-03	2.44E-01	1.77E-04	1.11E-02	0.00E+00	0.00E+00	4.43E-04	2.79E-03	138

Convection path length, $L_p$ (cm)	Source vapor conc., $C_{source}$ ( $\mu\text{g}/\text{m}^3$ )	Crack radius, $r_{crack}$ (cm)	Average vapor flow rate into bldg., $Q_{soil}$ ( $\text{cm}^3/\text{s}$ )	Crack effective diffusion coefficient, $D^{crack}$ ( $\text{cm}^2/\text{s}$ )	Area of crack, $A_{crack}$ ( $\text{cm}^2$ )	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, $\alpha$ (unitless)	Infinite source bldg. conc., $C_{building}$ ( $\mu\text{g}/\text{m}^3$ )	Unit risk factor, URF ( $\mu\text{g}/\text{m}^3$ ) <sup>-1</sup>	Reference conc., RfC ( $\text{mg}/\text{m}^3$ )
15	5.37E+02	0.10	8.33E+01	1.11E-02	9.90E+02	8.87E+32	3.79E-04	2.03E-01	4.1E-06	2.0E-03

END

DATA ENTRY SHEET

NJ-GW-ADV-JAN2013  
USEPA Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES

**ENTER**  
Chemical CAS No.  
(numbers only, no dashes)

156592

**ENTER**  
Initial groundwater conc.,  $C_w$   
( $\mu\text{g/L}$ )

1.60E+00

**NOTE: SEE SPECIAL INSTRUCTIONS FOR METHYLENE CHLORIDE, TRICHLOROETHENE, AND VINYL CHLORIDE ON RESULTS PAGE**

Chemical

cis-1,2-Dichloroethylene

MORE  
↓

<b>ENTER</b> Average soil/groundwater temperature, $T_s$ ( $^{\circ}\text{C}$ )	<b>ENTER</b> Depth below grade to bottom of enclosed space floor, $L_f$ (cm)	<b>ENTER</b> Depth below grade to water table, $L_{WT}$ (cm)	<b>ENTER</b> Totals must add up to value of $L_{WT}$ (cell G28)			<b>ENTER</b> Soil stratum directly above water table, (Enter A, B, or C)	<b>ENTER</b> SCS soil type directly above water table	<b>ENTER</b> Soil stratum A SCS soil type (used to estimate soil vapor permeability)	<b>ENTER</b> User-defined stratum A soil vapor permeability, $k_v$ ( $\text{cm}^2$ )
$T_s$	$L_f$	$L_{WT}$	Thickness of soil stratum A, $h_A$ (cm)	Thickness of soil stratum B, (Enter value or 0) $h_B$ (cm)	Thickness of soil stratum C, (Enter value or 0) $h_C$ (cm)				
14	15	153	153	0	0	A	S	S	

MORE  
↓

<b>ENTER</b> Stratum A SCS soil type Lookup Soil Parameters	<b>ENTER</b> Stratum A soil dry bulk density, $\rho_b^A$ ( $\text{g/cm}^3$ )	<b>ENTER</b> Stratum A soil total porosity, $n^A$ (unitless)	<b>ENTER</b> Stratum A soil water-filled porosity, $\theta_w^A$ ( $\text{cm}^3/\text{cm}^3$ )	<b>ENTER</b> Stratum B SCS soil type Lookup Soil Parameters	<b>ENTER</b> Stratum B soil dry bulk density, $\rho_b^B$ ( $\text{g/cm}^3$ )	<b>ENTER</b> Stratum B soil total porosity, $n^B$ (unitless)	<b>ENTER</b> Stratum B soil water-filled porosity, $\theta_w^B$ ( $\text{cm}^3/\text{cm}^3$ )	<b>ENTER</b> Stratum C SCS soil type Lookup Soil Parameters	<b>ENTER</b> Stratum C soil dry bulk density, $\rho_b^C$ ( $\text{g/cm}^3$ )	<b>ENTER</b> Stratum C soil total porosity, $n^C$ (unitless)	<b>ENTER</b> Stratum C soil water-filled porosity, $\theta_w^C$ ( $\text{cm}^3/\text{cm}^3$ )
S	1.66	0.375	0.054	S	1.66	0.375	0.054	C	1.66	0.375	0.054

MORE  
↓

<b>ENTER</b> Enclosed space floor thickness, $L_{crack}$ (cm)	<b>ENTER</b> Soil-bldg. pressure differential, $\Delta P$ ( $\text{g/cm-s}^2$ )	<b>ENTER</b> Enclosed space floor length, $L_B$ (cm)	<b>ENTER</b> Enclosed space floor width, $W_B$ (cm)	<b>ENTER</b> Enclosed space height, $H_B$ (cm)	<b>ENTER</b> Floor-wall seam crack width, $w$ (cm)	<b>ENTER</b> Indoor air exchange rate, $ER$ (1/h)	<b>ENTER</b> Average vapor flow rate into bldg. OR Leave blank to calculate $Q_{soil}$ (L/m)
10	40	3679	1269	366	0.1	0.25	5

MORE  
↓

<b>ENTER</b> Averaging time for carcinogens, $AT_C$ (yrs)	<b>ENTER</b> Averaging time for noncarcinogens, $AT_{NC}$ (yrs)	<b>ENTER</b> Exposure duration, $ED$ (yrs)	<b>ENTER</b> Exposure frequency, $EF$ (days/yr)	<b>ENTER</b> Target risk for carcinogens, $TR$ (unitless)	<b>ENTER</b> Target hazard quotient for noncarcinogens, $THQ$ (unitless)
70	30	30	350	1.0E-06	1

END

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

Diffusivity in air, $D_a$ ( $\text{cm}^2/\text{s}$ )	Diffusivity in water, $D_w$ ( $\text{cm}^2/\text{s}$ )	Henry's law constant at reference temperature, H ( $\text{atm}\cdot\text{m}^3/\text{mol}$ )	Henry's law constant reference temperature, $T_R$ ( $^\circ\text{C}$ )	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ ( $\text{cal}/\text{mol}$ )	Normal boiling point, $T_B$ ( $^\circ\text{K}$ )	Critical temperature, $T_C$ ( $^\circ\text{K}$ )	Organic carbon partition coefficient, $K_{oc}$ ( $\text{cm}^3/\text{g}$ )	Pure component water solubility, S ( $\text{mg}/\text{L}$ )	Unit risk factor, URF ( $\mu\text{g}/\text{m}^3$ ) <sup>-1</sup>	Reference conc., RfC ( $\text{mg}/\text{m}^3$ )
8.84E-02	1.13E-05	4.08E-03	25	7,192	328.15	544.20	3.96E+01	6.41E+03	0.0E+00	0.0E+00

END

INTERMEDIATE CALCULATIONS SHEET

Exposure duration, $\tau$ (sec)	Source-building separation, $L_T$ (cm)	Stratum A soil air-filled porosity, $\theta_a^A$ (cm <sup>3</sup> /cm <sup>3</sup> )	Stratum B soil air-filled porosity, $\theta_a^B$ (cm <sup>3</sup> /cm <sup>3</sup> )	Stratum C soil air-filled porosity, $\theta_a^C$ (cm <sup>3</sup> /cm <sup>3</sup> )	Stratum A effective total fluid saturation, $S_{te}$ (cm <sup>3</sup> /cm <sup>3</sup> )	Stratum A soil intrinsic permeability, $k_i$ (cm <sup>2</sup> )	Stratum A soil relative air permeability, $k_{rg}$ (cm <sup>2</sup> )	Stratum A soil effective vapor permeability, $k_v$ (cm <sup>2</sup> )	Thickness of capillary zone, $L_{cz}$ (cm)	Total porosity in capillary zone, $n_{cz}$ (cm <sup>3</sup> /cm <sup>3</sup> )	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm <sup>3</sup> /cm <sup>3</sup> )	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm <sup>3</sup> /cm <sup>3</sup> )	Floor-wall seam perimeter, $X_{crack}$ (cm)
9.46E+08	138	0.321	0.321	0.321	0.003	9.99E-08	0.998	9.98E-08	17.05	0.375	0.122	0.253	9,896

Bldg. ventilation rate, $Q_{building}$ (cm <sup>3</sup> /s)	Area of enclosed space below grade, $A_B$ (cm <sup>2</sup> )	Crack-to-total area ratio, $\eta$ (unitless)	Crack depth below grade, $Z_{crack}$ (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, $H_{TS}$ (atm-m <sup>3</sup> /mol)	Henry's law constant at ave. groundwater temperature, $H'_{TS}$ (unitless)	Vapor viscosity at ave. soil temperature, $\mu_{TS}$ (g/cm-s)	Stratum A effective diffusion coefficient, $D_A^{eff}$ (cm <sup>2</sup> /s)	Stratum B effective diffusion coefficient, $D_B^{eff}$ (cm <sup>2</sup> /s)	Stratum C effective diffusion coefficient, $D_C^{eff}$ (cm <sup>2</sup> /s)	Capillary zone effective diffusion coefficient, $D_{cz}^{eff}$ (cm <sup>2</sup> /s)	Total overall effective diffusion coefficient, $D_T^{eff}$ (cm <sup>2</sup> /s)	Diffusion path length, $L_d$ (cm)
1.19E+05	4.82E+06	2.05E-04	15	7,617	2.49E-03	1.06E-01	1.77E-04	1.43E-02	0.00E+00	0.00E+00	5.74E-04	3.62E-03	138

Convection path length, $L_p$ (cm)	Source vapor conc., $C_{source}$ (μg/m <sup>3</sup> )	Crack radius, $r_{crack}$ (cm)	Average vapor flow rate into bldg., $Q_{soil}$ (cm <sup>3</sup> /s)	Crack effective diffusion coefficient, $D^{crack}$ (cm <sup>2</sup> /s)	Area of crack, $A_{crack}$ (cm <sup>2</sup> )	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, $\alpha$ (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m <sup>3</sup> )	Unit risk factor, URF (μg/m <sup>3</sup> ) <sup>-1</sup>	Reference conc., RfC (mg/m <sup>3</sup> )
15	1.69E+02	0.10	8.33E+01	1.43E-02	9.90E+02	3.88E+25	4.23E-04	7.16E-02	NA	NA

END



## Interview Record

**Site Name:** LARC 60 Maintenance Area **EPA ID:** VA6210020875  
**Subject:** Five-Year Review **Time:** 0900 **Date:** 5/29/2013  
**Type:** **Location:**

### Contact Made By:

**Name:** David Cohn **Title:** Project Manager **Organization:** Osage of Virginia, Inc.

### Individual Contacted:

**Title:** Planner **Organization:** JEBCFS Base Master Planning **Telephone:** 757-462-5371

### Summary Of Conversation

1. What is your overall impression of this project?  
There have been not been any updates of recent activity for this project.
2. What effects have site operations had on the surrounding community?  
Site operations have not had any effects on the surrounding community at this point.
3. Are you aware of any community concerns regarding the site or its operation and administration?  
I am not aware of any community concerns regarding the site or its operation.

- 4.** Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities?

I am not aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities.

- 5.** Have there been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?

There have not been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by our office regarding the site.

- 6.** Have there been any complaints, violations, or other incidents related to the site requiring a response by your office?

There have not been any complaints, violations, or other incidents related to the site requiring a response by our office.

- 7.** Do you feel well informed about the site's activities and progress?

No, there have been no recent updates regarding the site from Base Environmental.

- 8.** Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

I do not have any comments, suggestions, or recommendations regarding the site's management or operation. There is a MILCON (P-162 Marine Corps Cooperative Group) planned near BLDG 750 to the north of the site. The MILCON will cover approximately 9 acres.

**Other Items of Note:**

None

## Interview Record

<b>Site Name:</b> LARC 60 Maintenance Area	<b>EPA ID:</b> VA6210020875	
<b>Subject:</b> Five-Year Review	<b>Time:</b> 1300	<b>Date:</b> 6/27/2013
<b>Type:</b> In-person	<b>Location:</b> Public Affairs Office	

### Contact Made By:

<b>Name:</b> David Cohn	<b>Title:</b> Project Manager	<b>Organization:</b> Osage of Virginia, Inc.
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### Individual Contacted:

<b>Title:</b> Public Affairs Officer	<b>Organization:</b> JEBLCFS Public Affairs	<b>Telephone:</b> 757-462-8425
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### Summary Of Conversation

1. What is your overall impression of the Environmental Restoration Program?  
My overall impression is that the Environmental Restoration Program is outstanding based upon feedback received from public partners.
  
2. What effects have site operations had on the surrounding community?  
I am not aware that site operations have had any negative effects on the surrounding community.
  
3. Are you aware of any community concerns regarding the site or its operation and administration?  
I am not aware of any community concerns regarding the site or its operation and administration.

- 4.** Have there been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?

The Public Affairs Office recently put out a Public Notice announcing the commencement of the Five-Year Review at Fort Story. No other communications or activities have occurred.

- 5.** Have there been inquiries related to the site requiring a response by your office?

There have been no inquiries related to the site requiring a response by our office.

- 6.** Do you feel well informed about the site's activities and progress?

Yes, I feel well informed about the site's activities and progress.

- 7.** Has the Environmental Program had any negative effects on the Public Affairs Office operations?

The Environmental Program has had no negative effect on operations. LUCs have not had any negative impact on Base Personnel.

- 8.** Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

If possible, I would like to get more people involved in public meetings.

**Other Comments:** None.

## Interview Record

**Site Name:** LARC 60 Maintenance Area

**EPA ID:** VA6210020875

**Subject:** Five-Year Review

**Time:** 1340

**Date:** 6/27/2013

**Type:** In-person

**Location:** Building 3165

### Contact Made By:

**Name:** David Cohn

**Title:** Project Manager

**Organization:** Osage of Virginia, Inc.

### Individual Contacted:

**Title:** Lead Environmental Protection Specialist

**Organization:** JEBCFS Base Environmental

**Telephone:** 757-462-5361

### Summary Of Conversation

1. What is your overall impression of the Environmental Restoration Program?  
The Environmental Restoration Program has been effective in what they are trying to accomplish; however, it can be a difficult process.
2. What effects have site operations had on the surrounding community?  
I am not aware that site operations have had any effect on the surrounding community.
3. Are you aware of any community concerns regarding the site or its operation and administration?  
I am not aware of any community concerns regarding the site or its operation and administration.

- 4.** Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities?

I am not aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities.

- 5.** Have there been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?

To my knowledge there have not been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by our office regarding the site.

- 6.** Have there been any impacts related to the site requiring a response by your office?

There have not been any impacts related to the site requiring a response by our office.

- 7.** Do you feel well informed about the site's activities and progress?

Yes, I feel well informed about the site's activities and progress.

- 8.** Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

I do not have any comments, suggestions, or recommendations regarding the site's management or operation other than investigation derived waste should be removed as quickly as possible.

**Other Comments:** None.

## Interview Record

<b>Site Name:</b> LARC 60 Maintenance Area	<b>EPA ID:</b> VA6210020875
<b>Subject:</b> Five-Year Review	<b>Time:</b> 0845
	<b>Date:</b> 6/13/2013
<b>Type:</b> In person	<b>Location:</b> Bldg. 804 Fort Story

### Contact Made By:

<b>Name:</b> David Cohn	<b>Title:</b> Project Manager	<b>Organization:</b> Osage of Virginia, Inc.
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### Individual Contacted:

<b>Title:</b> Corporal E-4/Building 804 Occupant	<b>Organization:</b> USMC	<b>Telephone:</b> 757-422-7303
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### Summary Of Conversation

1. What is your overall impression of this project?  
I have no knowledge of the site.
  
2. What effects have site operations had on the surrounding community?  
Site operations have not had any effects on the surrounding community at this point.
  
3. Are you aware of any community concerns regarding the site or its operation and administration?  
I am not aware of any community concerns regarding the site or its operation.
  
4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities?  
I am not aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities. Recently a water line broke.

- 5.** Have there been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?

There have not been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by our office regarding the site.

- 6.** Have there been any complaints, violations, or other incidents related to the site requiring a response by your office?

There have not been any complaints, violations, or other incidents related to the site requiring a response by our office.

- 7.** Do you feel well informed about the site's activities and progress?

No, I have no information about the site.

- 8.** Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

I do not have any comments, suggestions, or recommendations regarding the site's management or operation.

**Other Comments:** Building 804 is utilized to dispatch vehicles as required. The interviewee did not have any knowledge of the LARC 60 Maintenance Area.

## Interview Record

<b>Site Name:</b> LARC 60 Maintenance Area	<b>EPA ID:</b> VA6210020875
<b>Subject:</b> Five-Year Review	<b>Time:</b> 1210
	<b>Date:</b> 6/27/2013
<b>Type:</b> In person	<b>Location:</b> Bldg. 1082 Fort Story

### Contact Made By:

<b>Name:</b> David Cohn	<b>Title:</b> Project Manager	<b>Organization:</b> Osage of Virginia, Inc.
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### Individual Contacted:

**Title:** Advanced Training Command Facility Manager/Buildings 1081&1082 Occupant  
**Organization:** Navy

### Summary Of Conversation

1. What is your overall impression of this project?  
I am concerned that the environmental site may affect future construction in the area.
  
2. What effects have site operations had on the surrounding community?  
I am not aware that site operations have had any effects on the surrounding community at this point.
  
3. Are you aware of any community concerns regarding the site or its operation and administration?  
I am not aware of any community concerns regarding the site or its operation.

- 4.** Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities?

I am not aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities.

- 5.** Have there been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?

There have not been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by our office regarding the site.

- 6.** Have there been any complaints, violations, or other incidents related to the site requiring a response by your office?

There have not been any complaints, violations, or other incidents related to the site requiring a response by our office.

- 7.** Do you feel well informed about the site's activities and progress?

No, I have no information about the site.

- 8.** Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

I do not have any comments, suggestions, or recommendations regarding the site's management or operation.

**Other Comments:** Buildings 1081 and 1082 will be used for training purposes for Navy personnel. The buildings will contain office, classroom, and training spaces, conference rooms, gear lockers, and shower facilities.

## Interview Record

**Site Name:** LARC 60 Maintenance Area

**EPA ID:** VA6210020875

**Subject:** Five-Year Review

**Time:** 1100

**Date:** 6/27/2013

**Type:** In-person

**Location:** Bldg. 1088 Fort Story

### Contact Made By:

**Name:** David Cohn

**Title:** Project Manager

**Organization:** Osage of Virginia, Inc.

### Individual Contacted:

**Title:** Senior Mechanic/Building 1088 Occupant

**Organization:** Army

**Telephone:** 757-422-7161

### Summary Of Conversation

1. What is your overall impression of this project?

I have no overall impression of the project; site operations have not affected operations here.

2. What effects have site operations had on the surrounding community?

I am not aware that site operations have had any effects on the surrounding community at this point. We coordinate when monitoring activities are required at the site.

3. Are you aware of any community concerns regarding the site or its operation and administration?

I am not aware of any community concerns regarding the site or its operation.

- 4.** Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities?

I am not aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from the local authorities.

- 5.** Have there been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?

There have not been any routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by our office regarding the site.

- 6.** Have there been any complaints, violations, or other incidents related to the site requiring a response by your office?

There have not been any complaints, violations, or other incidents related to the site requiring a response by our office.

- 7.** Do you feel well informed about the site's activities and progress?

Yes, I feel well informed about the site's activities and progress.

- 8.** Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

I do not have any comments, suggestions, or recommendations regarding the site's management or operation.

**Other Comments:** Building 1088 has been utilized for maintenance of heavy and tactical equipment for more than 10 years. The oil water separator located outside the northwest corner of the building is still operational.