EPA/ROD/R2007030001531
2007

EPA Superfund
Record of Decision:

DEFENSE GENERAL SUPPLY CENTER (DLA)
EPA ID: VA3971520751
OU 08
CHESTERFIELD COUNTY, VA
03/27/2007

Final

RECORD OF DECISION
OPERABLE UNIT 8
ACID NEUTRALIZATION PITS GROUNDWATER

DEFENSE SUPPLY CENTER RICHMOND
RICHMOND, VIRGINIA

Prepared by:

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Richmond, VA 23297-5000

23 February 2007

Revision 1

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LIST OF ACRONYMS AND ABBREVIATIONS

95UCL	95 Percent Upper Confidence Limit
ANP	Acid Neutralization Pits
ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COC	Constituent of Concern
COPC	Constituent of Potential Concern
DGSC	Defense General Supply Center
DLA	Defense Logistics Agency
DoD	U.S. Department of Defense
DPE	Dual Phase Extraction
DSCR	Defense Supply Center Richmond
EPC	Exposure-Point Concentration
FFS	Focused Feasibility Study
HI	Hazard Index
HHBRA	Human Health Baseline Risk Assessment
HQ	Hazard Quotient
ID	Identification
IRP	Installation Restoration Program
LAW	Law Engineering and Environmental Services, Inc.
LTM	Long Term Monitoring
LUC	Land Use Control
LUCIP	Land Use Control Implementation Plan
MACTEC	MACTEC Engineering and Consulting, Inc.
MCL	Maximum Contaminant Level
μg/L	microgram per liter
mg/kg-day	milligrams per kilogram per day
MNA	Monitored Natural Attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PW	Present Worth
RAO	Remedial Action Objective
RBC	Risk-based Concentration
RfD	Reference Dose
UF	Uncertainty Factor
RI	Remedial Investigation
ROD	Record of Decision
SF	Slope Factor
TCE	Trichloroethylene
TMV	Toxicity, Mobility, or Volume
USATHAMA	U. S. Army Toxic and Hazardous Materials Agency
USEPA	U. S. Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality
UF	Uncertainty Factor
VC	Vinyl Chloride
VOC	Volatile Organic Compound
WBU	Water-Bearing Unit

1.0 DECLARATION FOR THE RECORD OF DECISION

1.1 SITE NAME AND LOCATION

Operable Unit (OU) 8: Acid Neutralization Pits (ANPs) Groundwater

Defense Supply Center Richmond (DSCR) (formerly known as Defense General Supply Center [DGSC]), Chesterfield County, Virginia

U. S. Environmental Protection Agency (USEPA) Identification (ID) VA3971520751

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedy for OU 8 at DSCR, formerly referred to as DGSC, in Richmond, Chesterfield County, Virginia. This remedy was selected in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Part 300, Title 40, of the Code of Federal Regulations (CFR). The remedy selection is based on the Administrative Record for OU 8.

In accordance with CERCLA, Section 120(e)(4), and the NCP at 40 CFR Section 300.430(f)(4)(iii), Defense Logistics Agency (DLA) and USEPA Region 3 jointly selected this remedy. The Virginia Department of Environmental Quality (VDEQ) concurs on the selected remedy.

1.3 ASSESSMENT OF SITE

Actual or threatened releases of hazardous substances from OU 8 may pose a threat to public health or welfare or the environment. The response action selected in this Record of Decision (ROD) is protective of human health and the environment.

1.4 DESCRIPTION OF SELECTED REMEDY

The selected remedy will effectively and cost-efficiently meet the following remedial action objectives (RAOs) for OU 8 groundwater:

- Prevent unacceptable risk to human health and the environment from exposure to constituents of concern (COCs) in groundwater.

- Reduce groundwater COCs within the OU 8 plume to meet chemical-specific ARARs (maximum contaminant levels, MCLs).

The selected remedy includes the following components:

- Institutional controls on the installation including current and future restriction of potable groundwater use and residential land use. (The industrial land use scenario is also the basis for remedy selection at other OUs at the installation.)
- Deed restrictions to prohibit future potable groundwater use, residential development, and land use as a school or childcare-related facility, if the property changes ownership before property conditions allow for unlimited use and unrestricted exposure.
- MNA of groundwater to reduce constituent mass and concentrations.
- Groundwater monitoring for COCs, degradation by-products (daughter products), and MNA parameters in the OU 8 wells for five years after approval of the ROD. Monitoring will be conducted semi-annually for the first three years and annually thereafter.
- A contingency plan such as, but not limited to, *in situ* bioremediation (addition of chemicals or nutrients to enhance natural attenuation) if constituents could migrate off-installation at concentrations exceeding MCLs as measured by threshold levels in pre-sentinel wells located between the plume and the installation boundary.

There are no highly toxic or mobile source materials that present a significant risk to human health or the environment or that constitute principal-threat wastes requiring treatment (USEPA, 1991a). The former ANPs were the source materials for OU 8 groundwater contaminants. The ANPs were closed in 1985; the pits were cleaned, backfilled, and covered to prevent reuse. Remediation of impacted soils surrounding the ANPs was completed under OU 5.

Five-year reviews will be conducted in accordance with CERCLA, Section 121(c), and 40 CFR Section 300.430(f)(4)(ii). The five-year review is required for sites where constituents remain in place at concentrations that preclude unlimited use and unrestricted exposure. Therefore, no less frequently than every five years, the success of the selected remedy will be evaluated using the most current OU 8 information. The five-year reviews will confirm and evaluate the effectiveness of the remedial response until such time as OU 8 is declared suitable for unlimited use and unrestricted exposure, or the statutory requirement for periodic performance reviews is revoked or waived.

1.5 STATUTORY DETERMINATIONS

The selected remedy satisfies the statutory requirements of CERCLA and, to the extent practicable, the NCP. The selected remedy:

- Is protective of human health and the environment as measured by short-term protection, long-term protection, permanence, meeting RAOs within a reasonable time, and acceptance by federal and state regulatory agencies.
- Complies with federal and state ARARs.
- Is cost-effective.
- Utilizes permanent solutions and alternative treatment technologies, or resource recovery technologies, to the maximum extent practicable.
- Meets the statutory requirements of protectiveness and compliance with ARARs more cost effectively than the remedial action alternative with engineered treatment as a principal element. The remedy includes a contingency for treatment if constituents could migrate off-installation at concentrations exceeding MCLs (measured by threshold levels in pre-sentinel wells located between the plume and the installation boundary).
- Will result in hazardous substances, pollutants, or constituents remaining on-site above levels that allow for unlimited use and unrestricted exposure. Consequently, a statutory review will be conducted within five years after initiation of the response action, and at a subsequent frequency of at least once every five years, to ensure that the remedy is protective of human health and the environment. Performance of these protectiveness reviews will continue until such time as OU 8 is approved for unrestricted use, or the statutory requirement for continued remedy-performance monitoring is revoked or waived.

1.6 ROD DATA CERTIFICATION CHECKLIST

The following information is presented in the decision summary, Section 2.0:

- COCs and their respective concentrations.
- Baseline risk posed by the COCs under current and likely future exposure scenarios.
- ARARs established for the COCs and the basis for these ARARs.
- Absence of source materials constituting principal-threat wastes.
- Current and anticipated future land use assumptions and current and potential future groundwater uses evaluated in the Human Health Baseline Risk Assessment (HHBRA) and ROD.

- Potential land and groundwater uses that will be available at OU 8 as a result of the selected remedy.

- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, along with the annual discount rate and the number of years over which the remedy cost estimates are projected.

- Key factors that led to the remedy selection.

Additional information can be found in the Administrative Record file for OU 8.

1.7 AUTHORIZING SIGNATURES

Date: May 13, 2007

CHARLES R. CARRELL
Director, DES Richmond
Defense Supply Center Richmond (DSCR)

Date: 3/13/07

DENNIS LILLO
Acting Staff Director, Environmental, Safety and Occupational Health
HQ, Defense Logistics Agency (DLA)

Date: 3/27/07

JAMES J. BURKE
Director, Hazardous Site Cleanup Division
U. S. Environmental Protection Agency (USEPA)
Region 3

2.0 DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

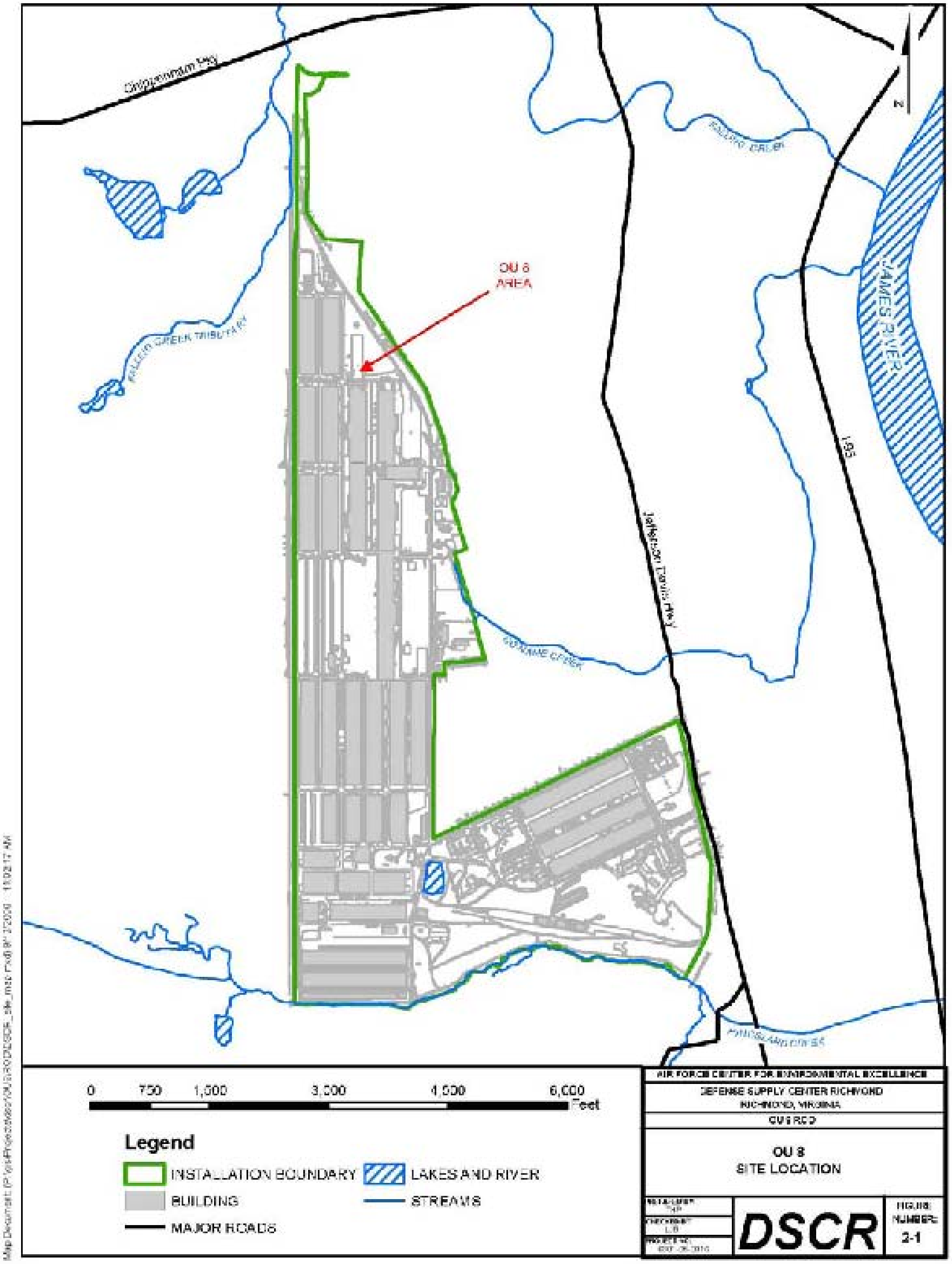
The installation (a "facility" for purposes of CERCLA) is located in Chesterfield County, Virginia, approximately 8 miles south of Richmond and approximately 16 miles north of Petersburg. The name on the National Priorities List (NPL) is DGSC, and the USEPA ID is VA3971520751. The lead federal agency for DSCR is DLA. USEPA is the lead regulatory agency, and VDEQ is designated as a support regulatory agency. The source of cleanup funds is the Defense Environmental Restoration Account.

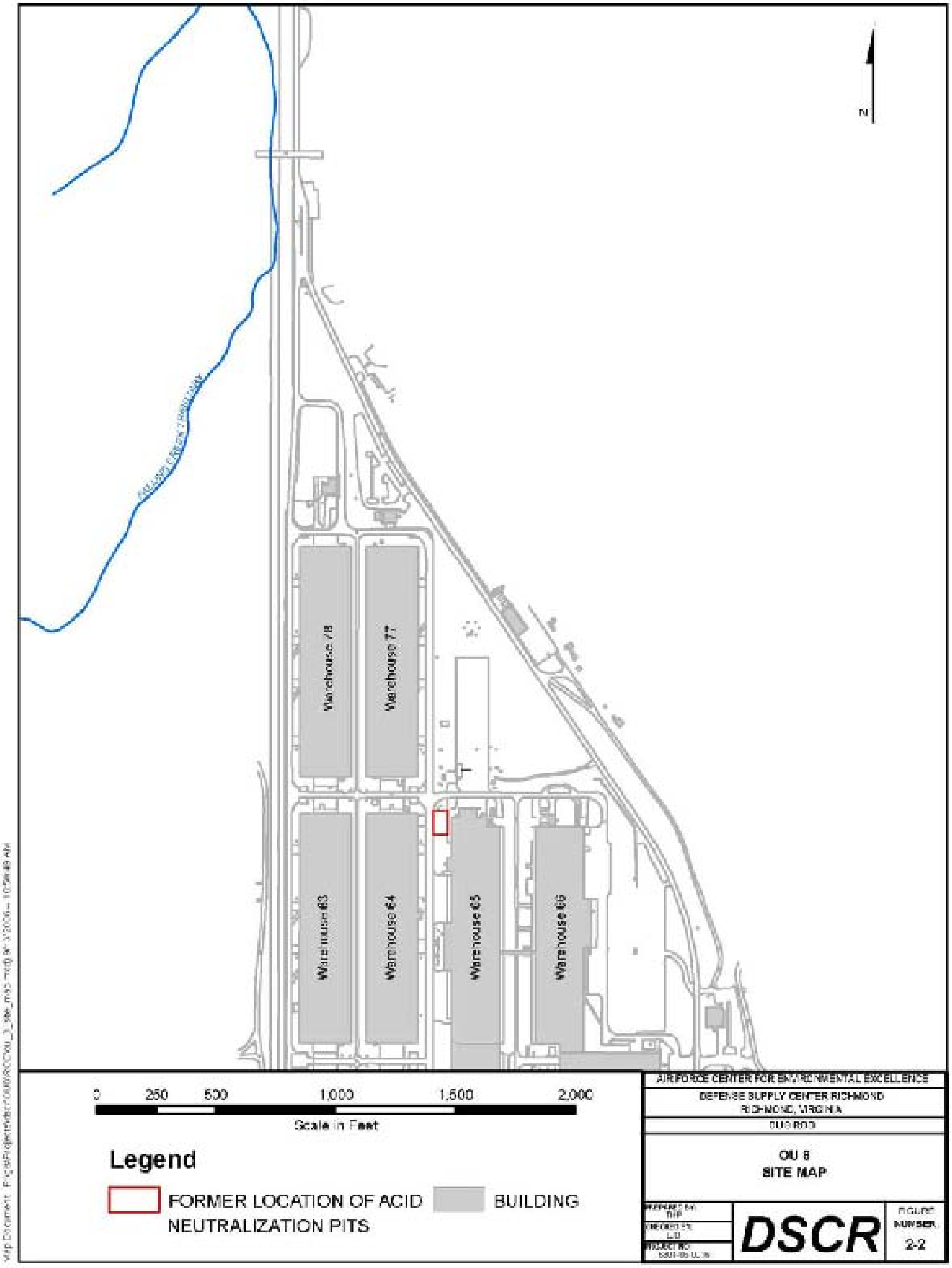
The installation is the lead U. S. Department of Defense (DoD) center for aviation weapon systems and environmental logistics support. DSCR is the aviation supply-and-demand chain manager for DLA. The installation is the primary supply source for nearly 930,000 repair parts and operating items, and it is the inventory control point for nearly 700,000 supply items in over 200 commodity classes. The work force numbers approximately 2,300. The general facility layout and OU 8 location within the installation are shown in Figure 2-1.

OU 8 consists of groundwater (in the upper water-bearing unit [WBU]) impacted by past operations at the former ANPs (OU 5) and is located in the northern part of the installation, commonly referred to as Zone 1. The ANPs were located approximately 25 feet northwest of Warehouse 65, as shown in Figure 2-2. The OU 8 impacted groundwater does not extend off the installation.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The U.S. Army purchased the property known today as DSCR on 6 June 1941. Construction began in August 1941, and the Richmond General Depot was activated in January 1942. In the first two decades of its existence, the mission was traditional logistics support to the U.S. Army with emphasis on Quartermaster items. With activation of the Military General Supply Agency and its absorption by the Defense Supply Agency in 1962, the mission was expanded to provide supply management of more than 30,000 general items to the military and certain civilian agencies worldwide.


OU 8
AREA
JAMES RIVER
I-95
0
750
1,500
3,000
4,500
6,000
Feet
Legend
INSTALLATION BOUNDARY
LAKES AND RIVER
BUILDING
STREAMS
MAJOR ROADS
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
DEFENSE SUPPLY CENTER RICHMOND
RICHMOND, VIRGINIA
OU 8
SITE LOCATION
DSCR
FIGURE
NUMBER:
2-1


N
Warehouse 78
Warehouse 77
Warehouse 63
Warehouse 64
Warehouse 65
Warehouse 66
0 250 500 1,000 1,500 2,000
Scale in Feet
Legend
FORMER LOCATION OF ACID NEUTRALIZATION PITS
BUILDING
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
DEFENSE SUPPLY CENTER RICHMOND
RICHMOND, VIRGINIA
OU 8
SITE MAP
DSCR
FIGURE NUMBER
2-2

The current installation was activated as the Richmond General Depot and was renamed (in sequence): the Richmond Armed Service Forces Depot; Richmond Quartermaster Depot; Richmond General Depot (again); Richmond Quartermaster Depot (again); and DGSC. The name DGSC was changed to DSCR on 1 January 1996. The Defense Supply Agency became DLA in 1977 (DSCR, 2005).

The ANPs were concrete settling pits that received wastewater from metal cleaning operations at Warehouse 65 from 1958 to the early 1980s. In addition, solvents may have been transported from other installation locations and disposed in the ANPs. The capacity of the primary pit and secondary pit was approximately 14,600 and 3,000 gallons, respectively. The two ANPs were located in a fenced area and both were approximately 6.5 feet deep. From 1958 to the late 1970s, wastewater from the primary pit was discharged to the storm sewer. After the addition of the secondary pit in the late 1970s, wastewater was discharged to the sanitary sewer. Solids that collected in the pit bottoms were periodically removed and disposed at the Chesterfield County landfill. The ANPs were closed in 1985. The sludge was removed, the pit bottoms were washed, and the pits were backfilled with clean soil. Concrete covers were placed over the pits to prevent reuse. The ANPs and surrounding impacted soils were designated as OU 5, and remediation of impacted soils surrounding the ANPs was completed in 1992. Impacted groundwater beneath and downgradient of the ANPs is OU 8.

2.2.1 Preliminary Environmental Investigations

In 1980, DoD placed DSCR in its Installation Restoration Program (IRP). During Phase I of the IRP, the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) conducted an Installation Assessment. The Installation Assessment Report (USATHAMA, 1981) indicated possible soil impacts at six locations and possible groundwater impacts at three. In 1982, the U.S. Army Environmental Hygiene Agency identified three additional areas of groundwater impact (the Area 50 Landfill, the former Fire Training Area and the National Guard Area).

In 1984, USEPA identified the installation as a candidate for the Superfund NPL. In 1987, the installation was officially placed on the NPL because of high levels of chlorinated volatile organic compounds (VOCs) in groundwater and the potential for off-installation migration.

2.2.2 CERCLA Activities

In 1990, DLA, DSCR, USEPA, and VDEQ signed a Federal Facilities Agreement (FFA) that established DLA as the lead federal agency responsible for evaluating and executing necessary, feasible, and reasonable remedial actions to ensure protection of human health and the environment from releases at DSCR. In accordance with CERCLA Section 121(e)(4) and 40 CFR Section 300.430(f)(4)(iii), the FFA provides that selection of the remedy is made jointly by DLA and USEPA or, if unable to reach agreement, by USEPA.

2.2.2.1 Summary of Investigations and Remedial Activities

The Remedial Investigation (RI) of the ANPs, conducted from 1986 to 1987, identified low levels of VOCs in soil (Law, 1995). A pilot test for a soil vapor extraction system (vacuum extraction of soil gas to reduce soil VOC concentrations) was conducted in 1992 as part of the Remedial Design for the OU 5 ROD. Because soil concentrations met remediation goals after the pilot test, soil remediation was deemed complete. An Explanation of Significant Difference was signed in March 1996, eliminating the SVE system from the OU 5 remedy. Groundwater constituents attributed to the ANPs were detected only in the upper WBU. No COCs were identified in the lower WBU.

A dual-phase extraction (DPE) system (which injects clean air and extracts impacted air and groundwater) was operated from June 1997 to January 2004 (MACTEC, 2006a). The DPE system was initiated as a treatability study and was continued as a voluntary interim action. In the ANP study area, VOCs in groundwater exceeded drinking water standards (MCLs). Before initiating the DPE system, the groundwater plume extended from the former ANPs almost to the installation boundary. Today, the size of the plume is smaller and concentrations have decreased. (The plume in 1997 and the reduced plume in 2006 are both shown in Figure 2-7.) These reductions were likely the result of source removal, natural attenuation (including biodegradation), and operation of the DPE system. Currently, the plume is well within the installation boundary. The past and current extent of contamination in groundwater is described in Section 2.5.2.

A Supplemental Feasibility Study (MACTEC, 2006a), including groundwater monitoring, was conducted from 2003 to 2004 to refine the conceptual site model (MACTEC, 2006b). A quarterly groundwater monitoring program was conducted from 2001 to 2005. In July 2005, the groundwater monitoring program became a semi-annual event. Data collected in 2004 were utilized to evaluate the DPE system and perform a rebound test. Analytical data indicated that concentrations had reached asymptotic conditions (i.e., were not changing over time.) Monitoring wells sampled in association with OU 8 are shown in Figure 2-3.

2.2.2.2 OU 8 Focused Feasibility Study

The final revised Focused Feasibility Study (FFS) (MACTEC, 2006c) evaluated three remedial alternatives for constituents in OU 8 groundwater. The FFS followed the applicable USEPA guidance (USEPA, 1988). A summary of the FFS is presented in Section 2.9. The HHBRA in the RI was updated to evaluate on-site industrial land use and hypothetical off-site residential exposure, and this updated HHBRA was included in Appendix C of the FFS. A summary of the HHBRA is presented in Section 2.7.

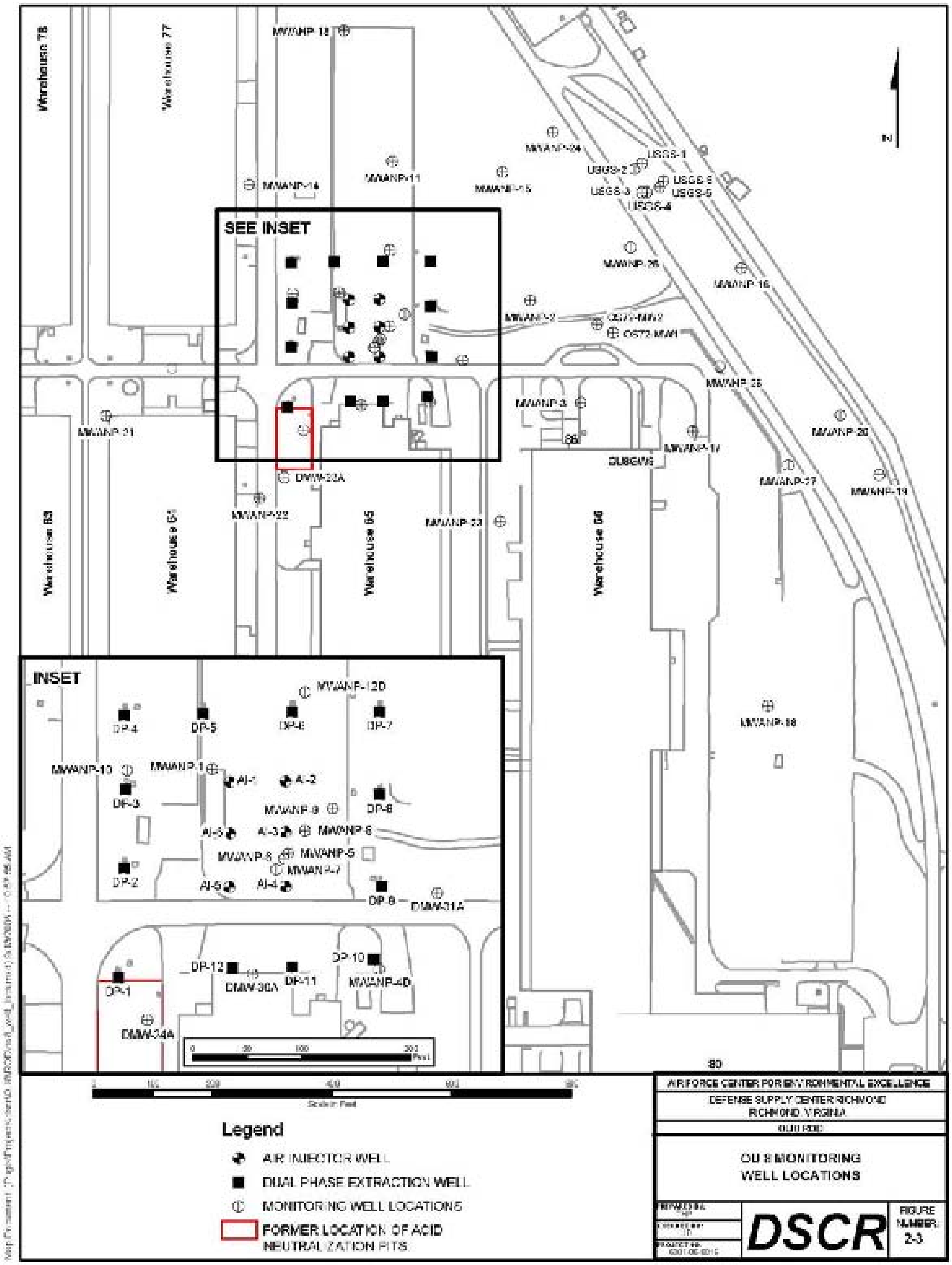
2.2.2.3 Proposed Plan

A Proposed Plan was prepared to provide information to the public regarding planned actions at OU 8 and to seek public input before making a final decision (MACTEC, 2006d). The Proposed Plan presented remedial alternatives and the preferred alternative with the rationale for selection.

2.3 COMMUNITY PARTICIPATION

The Proposed Plan summarizing the alternatives considered in the OU 8 FFS was published in May 2006 and was made available to the public in the Administrative Record located at the Chesterfield County Public Library, Central Branch, Local History Department, 9501 Lori Road, Chesterfield, VA 23832 (phone 804-748-1603). The Administrative Record can also be viewed online (www.adminrec.com).

The public comment period for the Proposed Plan ran from 1 June to 17 July 2006. A public meeting was conducted on 27 June 2006 at 7:30 pm at the Bensley Park and Community Center, 2900 Drewrys Bluff Road, Richmond, VA 23237. Notification of the public comment period and public meeting was published on 28 May 2006 in the *Richmond Times Dispatch* and the *Chester Village News*. The public notice invited the community to submit comments on the Proposed Plan to DSCR, USEPA, or VDEQ during the 45-day comment period and to attend the public meeting (conducted to provide a forum for the community to ask questions and offer comments on the OU 8 Proposed Plan). Responses to public comments are provided in the Responsiveness Summary, Section 3.0.


Warehouse 78
Warehouse 77
Warehouse 53
Warehouse 55
Warehouse 56
SEE INSET
INSET
MWANP-24
MWANP-11
MWANP-14
MWANP-16
MWANP-20
MWANP-22
MWANP-23
MWANP-17
MWANP-18
MWANP-19
MWANP-21
MWANP-12D
DP-4
DP-5
DP-6
DP-7
DP-3
DP-8
DP-2
DP-9
DP-1
DP-10
DP-11
DP-12
AI-1
AI-2
AI-3
AI-4
AI-5
AI-6
MWANP-9
MWANP-5
MWANP-6
MWANP-7
MWANP-8
DMW-31A
DMW-30A
DMW-24A
Legend
AIR INJECTOR WELL
DUAL PHASE EXTRACTION WELL
MONITORING WELL LOCATIONS
FORMER LOCATION OF ACID NEUTRALIZATION PITS
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
DEFENSE SUPPLY CENTER RICHMOND
RICHMOND, VIRGINIA
OU 8 MONITORING WELL LOCATIONS
DSCR
FIGURE NUMBER: 2-3

2.4 SCOPE AND ROLE OF RESPONSE ACTION

The environmental issues at the installation are complex. The overall environmental management plan for OU 8 is based on the following factors:

- The installation is currently an industrial facility and is expected to remain industrial.
- The installation will remain the property of the federal government for the foreseeable future. In the event of future property transfer for civilian use, land and groundwater use controls incorporated into this ROD and in effect at the time of transfer will be attached to the property deed. Therefore, the reliability of land use controls (LUCs) is high.
- Groundwater beneath the installation is not used for potable purposes, and potable groundwater use has been restricted installation-wide in the Environmental Land Use Control Implementation Plan (LUCIP) (MACTEC, 2006e). A Chesterfield County Ordinance (Chapter 12, Article IV, Section 12-51(3)) requires a hydrologic study before private well installation to evaluate groundwater quantity and quality. Residences where the property line is within 200 feet of a water utility line are required to tie into the public water supply system (Code, County of Chesterfield, Virginia, Chapter 18, Section 18-60).

The Environmental Restoration Program at DSCR is being conducted under CERCLA, as amended, and has been organized into the following 13 OUs that comprise 9 source (soil) OUs, 3 groundwater OUs, and 1 groundwater interim action OU.

OU 1	–	Open Storage Area
OU 2	–	Area 50 Source Area
OU 3	–	National Guard Source Area
OU 4	–	Fire Training Source Area
OU 5	–	ANPs Source Area
OU 6	–	Area 50/Open Storage Area/National Guard Area Groundwater
OU 7	–	Fire Training Area Groundwater
OU 8	**–**	**ANPs Area Groundwater**
OU 9	–	Interim Action for OU 6
OU 10	–	Former Building 68
OU 11	–	Transitory Shelter 202
OU 12	–	Former Building 112
OU 13	–	Polycyclic Aromatic Hydrocarbon Area

Final RODs were issued for OUs 1, 3, 4, 5, and 12. Final remedial actions were implemented at OUs 1, 3, and 5. The ROD for OU 5 called for no further action. A final ROD with an interim remedy was issued for OU 9. (Interim remedial action for OU 6 groundwater was implemented as OU 9.) A removal action was completed at OU 4. The OU 12 remedial action construction was completed in September 2006.

This ROD addresses the impacted groundwater associated with OU 8 in accordance with CERCLA and the NCP. The objectives of the ROD are to:

- Summarize the conditions warranting a response action at OU 8.
- Specify the RAOs that must be achieved to ensure protection of human health and the environment.
- Define the scope of the response actions and the performance metrics to be used to assess the effectiveness (protectiveness) of the selected remedy and whether additional response action is necessary.

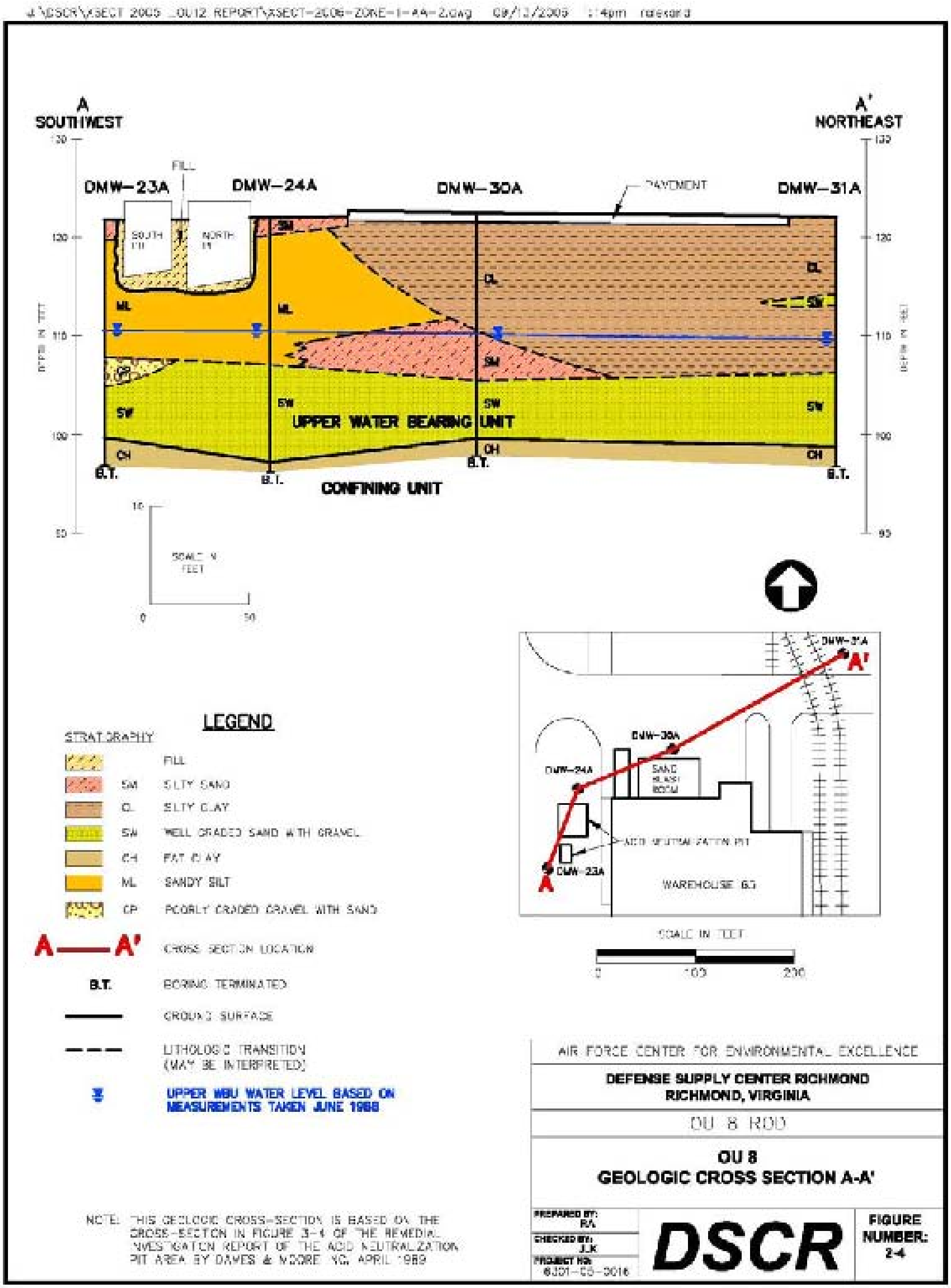
The selected remedy meets the OU-specific RAOs (outlined in Section 1.0) and is consistent with the current and future industrial use of the installation.

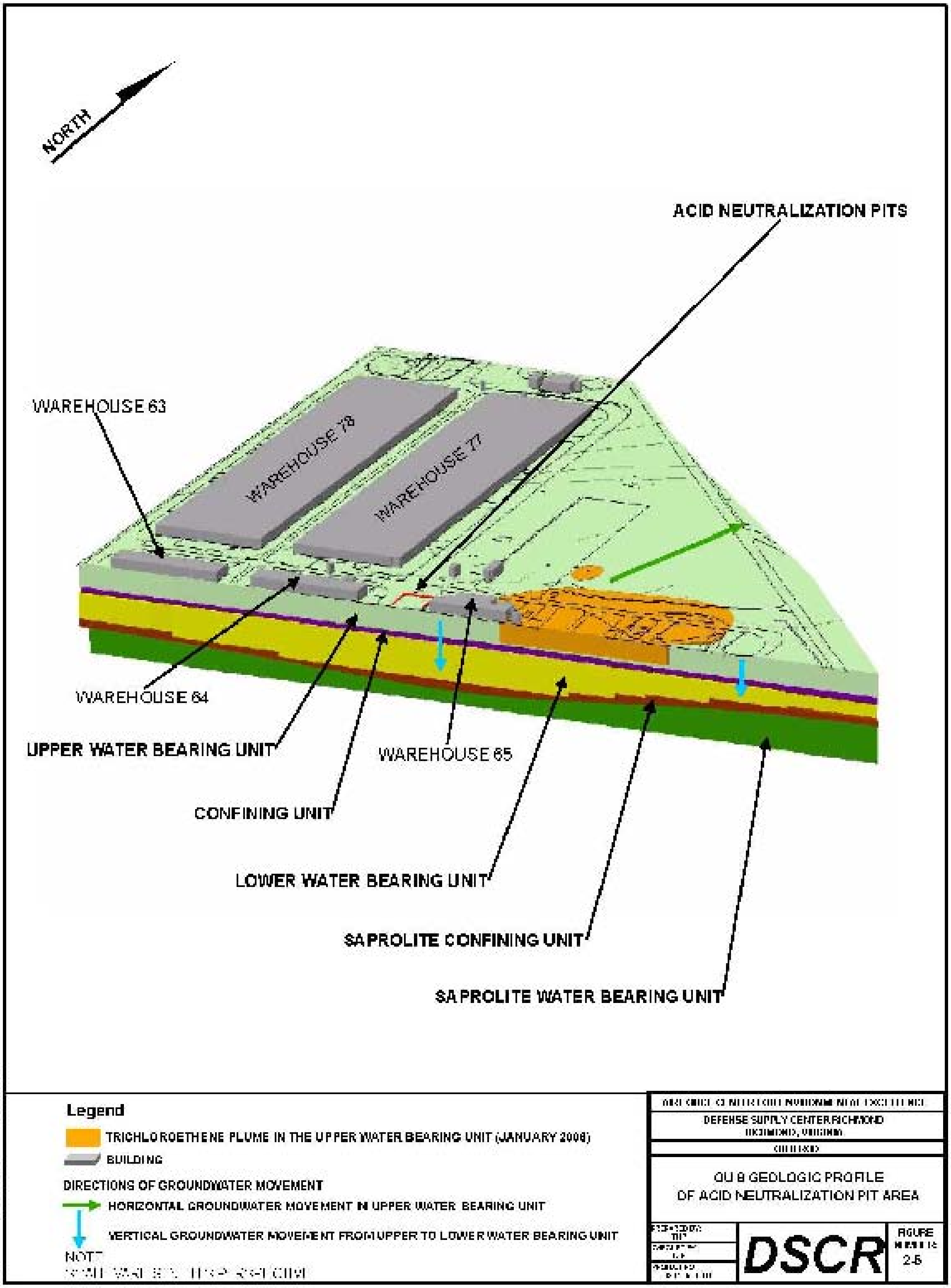
2.5 SITE CHARACTERISTICS

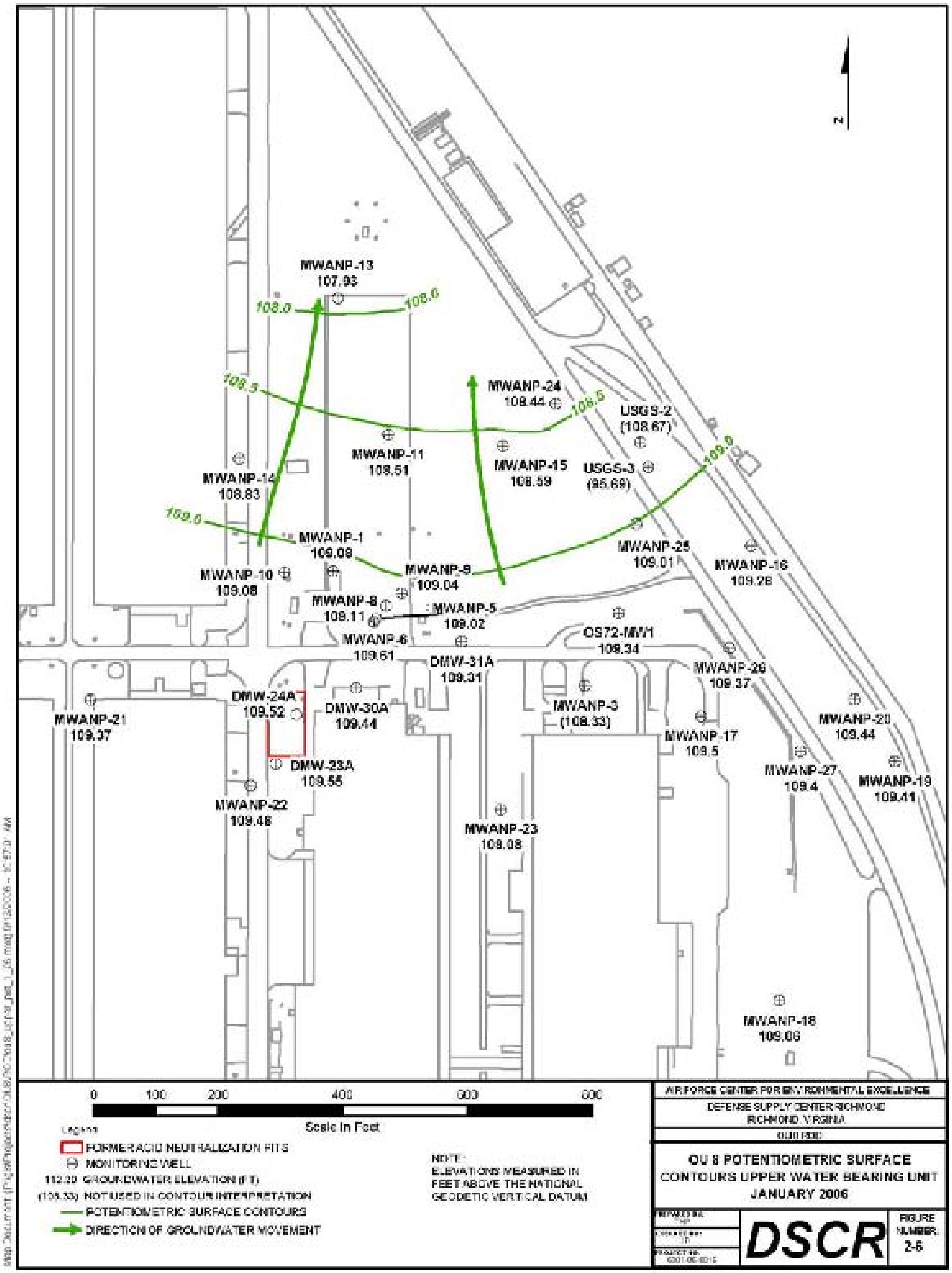
2.5.1 OU 8 Geology and Hydrogeology

For groundwater, poorly sorted (irregularly sized) sand and gravel extending to the underlying confining unit have been designated as the upper WBU. Coastal plain sediments below the confining unit constitute the lower WBU. Groundwater constituents attributed to the ANPs were detected in the upper WBU. No COCs were identified in the lower WBU. Figure 2-4 shows a southwest-northeast cross-section through the former ANPs in the upper WBU. Figure 2-5 shows the upper and lower WBUs and confining layer beneath the former ANPs in a three-dimensional view. Near the former ANPs, the thickness of these units is approximately 23 to 26 feet for the upper WBU, 5 to 10 feet for the confining unit, and 10 to 25 feet for the lower WBU. The depth to groundwater is approximately 12 feet below ground surface.

The general direction of groundwater flow in the upper WBU is east-northeast with an estimated average linear velocity of 0.26 feet per day or 93.1 feet per year (MACTEC, 2006c). The groundwater flow direction (measured in January 2006) is shown in Figure 2-6.


A SOUTHWEST
A' NORTHEAST
DMW-23A
DMW-24A
DMW-30A
DMW-31A
FILL
PAVEMENT
SOUTH PIT
NORTH PIT
UPPER WATER BEARING UNIT
CONFINING UNIT
B.T.
SCALE IN FEET
LEGEND
STRATIGRAPHY
FILL
SM SILTY SAND
CL SILTY CLAY
SW WELL GRADED SAND WITH GRAVEL
CH FAT CLAY
ML SANDY SILT
GP POORLY GRADED GRAVEL WITH SAND
A—A' CROSS SECTION LOCATION
B.T. BORING TERMINATED
GROUND SURFACE
LITHOLOGIC TRANSITION (MAY BE INTERPRETED)
UPPER WBU WATER LEVEL BASED ON MEASUREMENTS TAKEN JUNE 1988
SAND BLAST ROOM
ACID NEUTRALIZATION PIT
WAREHOUSE 63
NOTE: THIS GEOLOGIC CROSS-SECTION IS BASED ON THE CROSS-SECTION IN FIGURE 3-4 OF THE REMEDIAL INVESTIGATION REPORT OF THE ACID NEUTRALIZATION PIT AREA BY DAMES & MOORE INC, APRIL 1989
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
DEFENSE SUPPLY CENTER RICHMOND
RICHMOND, VIRGINIA
OU 8 ROD
OU 8
GEOLOGIC CROSS SECTION A-A'
DSCR
FIGURE NUMBER: 2-4


NORTH
ACID NEUTRALIZATION PITS
WAREHOUSE 63
WAREHOUSE 78
WAREHOUSE 77
WAREHOUSE 64
UPPER WATER BEARING UNIT
WAREHOUSE 65
CONFINING UNIT
LOWER WATER BEARING UNIT
SAPROLITE CONFINING UNIT
SAPROLITE WATER BEARING UNIT
Legend
TRICHLOROETHENE PLUME IN THE UPPER WATER BEARING UNIT (JANUARY 2006)
BUILDING
DIRECTIONS OF GROUNDWATER MOVEMENT
HORIZONTAL GROUNDWATER MOVEMENT IN UPPER WATER BEARING UNIT
VERTICAL GROUNDWATER MOVEMENT FROM UPPER TO LOWER WATER BEARING UNIT
DEFENSE SUPPLY CENTER RICHMOND
OU 8 GEOLOGIC PROFILE
OF ACID NEUTRALIZATION PIT AREA
DSCR
FIGURE
2-5


N
MWANP-13
107.93
108.0
108.0
108.5
MWANP-24
108.44
108.5
USGS-2
(108.67)
109.0
MWANP-11
108.51
MWANP-15
108.59
USGS-3
(95.69)
MWANP-14
108.83
109.0
MWANP-1
109.08
MWANP-25
109.01
MWANP-16
109.28
MWANP-10
109.08
MWANP-9
109.04
MWANP-8
109.11
MWANP-5
109.02
OS72-MW1
109.34
MWANP-6
109.61
DMW-31A
109.31
MWANP-26
109.37
DMW-24A
109.52
DMW-30A
109.44
MWANP-3
(108.33)
MWANP-21
109.37
MWANP-17
109.5
MWANP-20
109.44
DMW-23A
109.55
MWANP-27
109.4
MWANP-19
109.41
MWANP-22
109.46
MWANP-23
109.08
MWANP-18
109.06
0
100
200
400
Scale In Feet
Legend
FORMER ACID NEUTRALIZATION PITS
MONITORING WELL
112.20 GROUNDWATER ELEVATION (FT)
NOT USED IN CONTOUR INTERPRETATION
POTENTIOMETRIC SURFACE CONTOURS
DIRECTION OF GROUNDWATER MOVEMENT
NOTE:
ELEVATIONS MEASURED IN
FEET ABOVE THE NATIONAL
GEODETIC VERTICAL DATUM
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
DEFENSE SUPPLY CENTER RICHMOND
RICHMOND, VIRGINIA
OU 8 POTENTIOMETRIC SURFACE
CONTOURS UPPER WATER BEARING UNIT
JANUARY 2006
DSCR
FIGURE
NUMBER:
2-6

2.5.2 Nature and Extent

As outlined in the HHBRA and summarized in Section 2.7, two COCs were identified in the upper WBU. Trichloroethylene (TCE) and vinyl chloride (VC) cumulatively resulted a 10^{-5} risk level (6×10^{-5} for a child and adult combined if groundwater was used as a drinking water source for a future, hypothetical resident located at the installation property boundary).

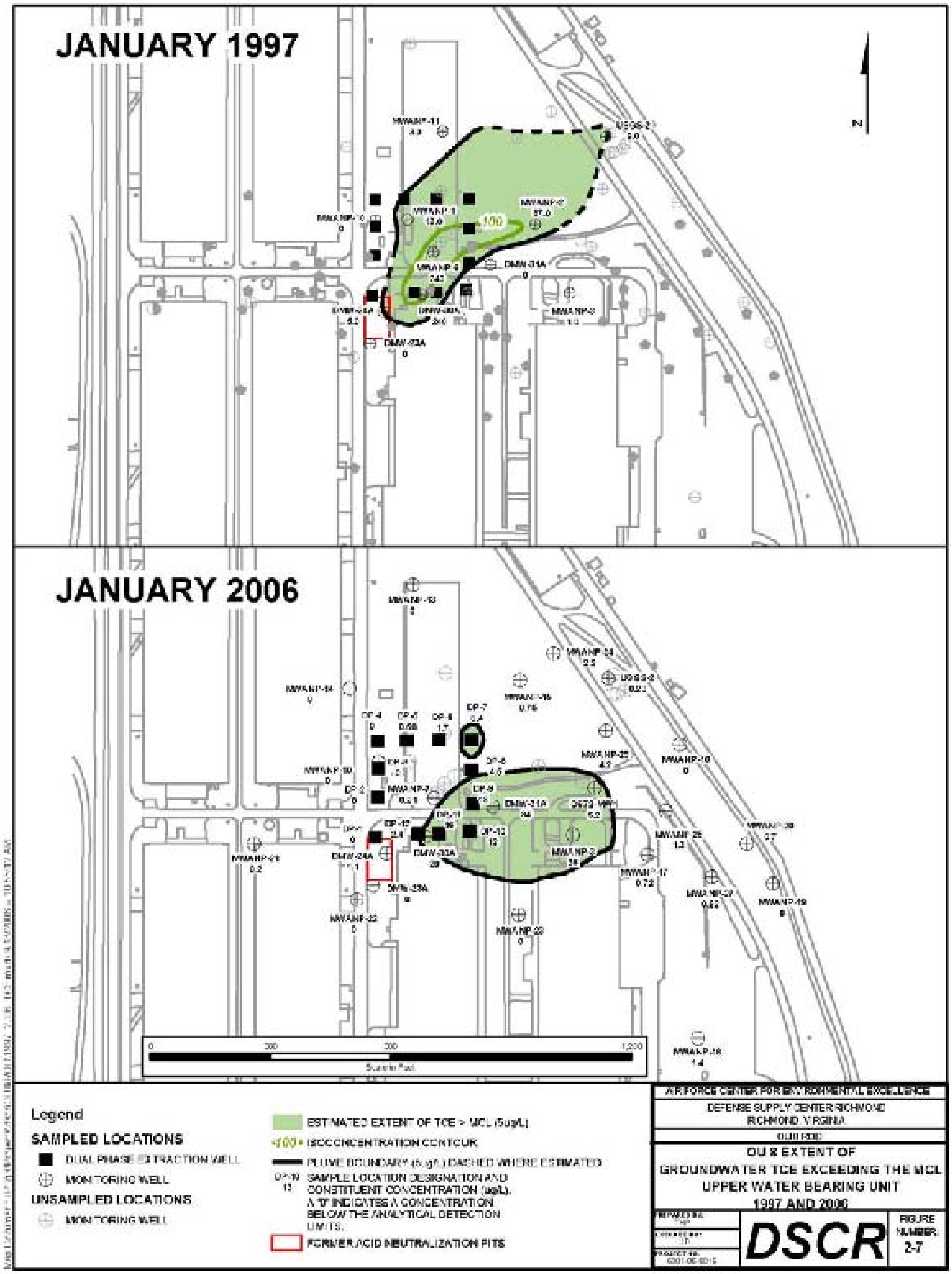
The approximate extent of the TCE plume in 1997 before operation of the DPE system is shown in Figure 2-7. In 1997, TCE concentrations exceeding the drinking water MCL of 5 micrograms per liter (µg/L) extended almost to the installation boundary. By contrast, TCE concentrations exceeding the MCL in January 2006, also shown in Figure 2-7, were significantly less, and the plume had retracted from the installation boundary approximately 300 feet. Reductions in concentration and extent are attributable to source removal, operation of the DPE system, and natural attenuation processes.

VC, a degradation product of TCE, was not detected until 2004, when it was identified in well DMW-30A. This well location is immediately downgradient (less than 100 feet) of the former ANPs at Warehouse 65 and is within the installation boundary. VC was also detected in this well in 2005 and 2006. VC concentrations ranged from 1.5 to 3.5 µg/L with three of the five samples exceeding the drinking water MCL of 2 µg/L.

2.5.3 Exposure Pathways

The following receptors and potentially complete pathways were evaluated in the HHBRA:

- <u>Current on-site industrial workers</u> exposed to volatiles in indoor air emitted from groundwater. Workers were assumed to inhale vapors in one of the six warehouses at OU 8.
- <u>Future on-site industrial workers</u> exposed to volatiles in indoor air emitted from groundwater. Workers were assumed to inhale vapors in a future, hypothetical one-story office building located directly above the current groundwater plume.
- <u>Future on-site construction workers</u> in a trench. Workers were assumed to ingest groundwater during excavation, have dermal contact with groundwater during excavation, and inhale vapors during excavation.
- <u>Future off-site residents</u> at the installation boundary. Future hypothetical residents (children and adults) were assumed to ingest groundwater (as tapwater), have dermal contact with groundwater during showering, inhale vapors during showering, and inhale vapors in indoor air.


JANUARY 1997
JANUARY 2006
N
Legend
SAMPLED LOCATIONS
DUAL PHASE EXTRACTION WELL
MONITORING WELL
UNSAMPLED LOCATIONS
MONITORING WELL
ESTIMATED EXTENT OF TCE > MCL (5ug/L)
ISOCONCENTRATION CONTOUR
PLUME BOUNDARY (5ug/L) DASHED WHERE ESTIMATED
SAMPLE LOCATION DESIGNATION AND CONSTITUENT CONCENTRATION (ug/L).
BELOW THE ANALYTICAL DETECTION LIMITS.
FORMER ACID NEUTRALIZATION PITS
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
DEFENSE SUPPLY CENTER RICHMOND
RICHMOND, VIRGINIA
OU 8 EXTENT OF
GROUNDWATER TCE EXCEEDING THE MCL
UPPER WATER BEARING UNIT
1997 AND 2006
DSCR
FIGURE NUMBER:
2-7

The industrial workers were assumed to work indoors for the full workday, which is a conservative assumption because any time spent outdoors would reduce indoor vapors inhaled. Residences generally east of the installation have been served by public water supply since June 1987. Some of these residences also have private groundwater wells. According to the well survey conducted in 2001, approximately 20 residents near the installation use their wells for potable water purposes. The other well owners do not use their wells at all or use the water for car washing and lawn watering (Law Engineering and Environmental Services [Law], 2001).

On-site groundwater is not used for potable water at the installation, and future potable groundwater use has been restricted installation-wide. COCs have not been detected at the installation boundary downgradient of OU 8. Results of groundwater fate and transport modeling used in the HHBRA indicated that, under a realistic scenario, COCs could migrate to the installation boundary in 15 to 20 years, but concentrations at that time would be below MCLs.

2.6 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The installation is expected to remain an industrial facility. The installation is also expected to remain the property of the federal government for the foreseeable future. The ARARs for TCE and VC (the two COCs in groundwater at a 10^{-5} risk level) include current drinking water MCLs of 5 and 2 µg/L, respectively. Because the installation is federal property, fenced, and regularly patrolled, institutional controls at OU 8 are readily enforceable. In the event of future property transfer for civilian use, land and groundwater use controls in effect at the time of transfer would be attached to the property deed.

Groundwater beneath the installation is not used for potable purposes, and future potable groundwater use has been restricted. Until 1988, the installation obtained potable water from the Falling Creek Reservoir. From November 1988 to 1993, the installation received its drinking water from Chesterfield County. The installation currently obtains drinking water from the City of Richmond Water System.

Public water supply is widely available off-installation, and where available it must be used as the potable water supply source in accordance with county ordinances (Code, County of Chesterfield, Virginia Chapter 18, Section 18-60). Off-installation receptors are not located at the property boundary, and future residential construction along the boundary is unlikely because most land immediately off-installation is developed. In addition, groundwater in the upper WBU is not used as a potable water supply source due to capacity limitations associated with iron fouling problems.

2.7 SUMMARY OF SITE RISKS

A risk assessment summary based on the updated 2006 HHBRA is provided below. The original risk assessment (Law, 1995) considered potential residential land use on-installation. Since future on-installation land use will be restricted to industrial purposes, the risk assessment was revised to evaluate industrial and construction workers on-installation and residents off-installation.

2.7.1 HHBRA Methodology

Because OU 8 is part of the DSCR NPL site, the HHBRA was conducted using methods from USEPA's applicable risk assessment guidance (USEPA, 1989; USEPA, 1991b; USEPA, 2004b) and other applicable guidance, including relevant USEPA Region 3 guidance (USEPA, 1994; USEPA, 1999; USEPA, 2003). The HHBRA was conducted using a conservative and protective approach that included the following four components:

- Identification of constituents of potential concern (COPCs), also known as the hazard identification.
- Exposure assessment, including identifying and characterizing exposure pathways and estimating chemical intakes.
- Toxicity assessment of the COPCs.
- Risk characterization.

2.7.2 Identification of COPCs

COPCs are chemicals selected for the risk assessment process because they exceed a screening value. A conservative comparison of maximum groundwater concentrations to screening criteria (Virginia drinking water MCLs and USEPA risk-based concentrations [RBCs] for tapwater) was conducted. Data were also statistically compared to background concentrations. Constituents exceeding MCLs or RBCs were identified as COPCs. The COPCs were then evaluated to identify the COCs that require remediation to protect human health.

Five inorganic compounds and 12 VOCs were identified as COPCs in the upper WBU. No COPCs were identified for the lower WBU.

2.7.3 Exposure Assessment

The exposure assessment included identifying the following:

- The receptors (e.g., workers) that may be exposed to COPCs.
- The exposure pathways (i.e., how the COPCs could reach receptors).
- The magnitude of exposure for these receptors.

An exposure pathway is complete only if all four of the following elements occur:

- A COPC is present in the environment.
- A transport mechanism exists for the COPC to reach a receptor exposure point (i.e., through soil, water, or air).
- A potential receptor (current or future) is present at the exposure point.
- A potential exposure route (e.g., ingestion, dermal contact, or inhalation) exists at the exposure point.

Evaluating exposure requires the development of an exposure-point concentration (EPC), the COPC concentration that someone may contact. For this assessment, the EPC was either based on the 95 percent upper confidence limit (95UCL) on the mean or the maximum detected concentration, whichever was lower. For the statistical computations (i.e., 95UCL), a concentration equal to one-half the method detection limit was used when COPCs were not detected.

EPCs were calculated for each indirect pathway. Indirect pathways involve at least one media transfer step, such as inhalation of volatiles in air emitted from groundwater. The current industrial worker pathway utilized the Johnson and Ettinger vapor intrusion model to estimate VOC concentrations in indoor air. Inhalation concentrations for future construction workers in a trench were based on estimates recommended in the VDEQ Voluntary Remediation Program (VDEQ, 2005). The BIOCHLOR model published by USEPA was used to estimate future COPC concentrations (Groundwater Surfaces, Inc, 2002).

Exposure doses were estimated in milligrams of constituent per kilogram of body weight per day exposure (mg/kg-day). For example, the number of milligrams of a constituent entering the body could be calculated via an air inhalation rate multiplied by the constituent concentration in the air. The exposure doses were estimated using default values for input parameters. Default values are intended to be conservative and therefore are likely to overestimate actual exposure.

2.7.4 Toxicity Assessment

The toxicity assessment describes the potential adverse health effects associated with exposure to COPCs. Noncarcinogenic effects are characterized by a reference dose (RfD), which is a threshold below which no harmful health effects are anticipated. USEPA establishes RfDs for ingestion and inhalation routes (dermal toxicity is based on the oral RfD) using a margin of safety to protect sensitive individuals. RfDs are derived from human epidemiological studies or subchronic animal studies from which extrapolations are made to humans using uncertainty factors (UFs). The UF helps to ensure that the extrapolation of experimental data does not underestimate the potential for noncarcinogenic effects to occur in humans.

Carcinogens are classified into Groups A through E by USEPA, based on the weight-of-evidence about a particular chemical causing human cancer. Group A represents known human carcinogens, while Group E chemicals are noncarcinogenic. Carcinogenicity is quantified with a slope factor (SF), or the cancer risk per unit daily intake of the chemical, expressed in $(mg/kg\text{-}day)^{-1}$. The SF represents the 95UCL of the slope of the dose-response curve. The SF multiplied by the exposure dose equals the upper-bound risk estimate of developing cancer from COPC exposure. “Upper-bound” refers to a conservative risk estimate calculated from the cancer SF to ensure that actual cancer risks are not underestimated. As in the RfD, UFs built into these SFs allow for the extrapolation of subchronic animal studies to chronic human exposures.

2.7.5 Risk Characterization

The risk characterization combines toxicity and exposure assessment information. The risk characterization estimates quantitative carcinogenic risk and noncarcinogenic hazards for each COPC, exposure route, and receptor.

The quantitative measure of noncarcinogenic effects is the hazard quotient (HQ). HQs for individual chemicals, equal to the exposure dose divided by the RfD, are summed to give a combined (multi-chemical) hazard index (HI) for COPCs affecting the same target organ (e.g., the liver). For the OU 8 HHBRA, HQs were conservatively summed for all COPCs, regardless of target organ. If the HI for all noncarcinogens does not exceed 1, then no chronic health effects are expected. If the HI is greater than 1, adverse health effects are possible.

For carcinogens, risk is the probability that an individual will develop cancer over a lifetime as a result of exposure to a carcinogen (USEPA, 1989). In the OU 8 HHBRA, the risks from individual carcinogenic COPCs were added. USEPA has established an acceptable carcinogenic risk range of 1×10^{-4} (a 1 in 10,000 chance of developing cancer) to 1×10^{-6} (a 1 in a million chance) for CERCLA sites. In general, cancer risks greater than 1×10^{-4} should be considered in a risk management evaluation, and cancer risks less than 1×10^{-6} do not warrant further attention.

The results of the HHBRA are summarized in Table 2-1. All carcinogenic risks were within the acceptable range (1×10^{-4} to 1×10^{-6}) established by USEPA in the NCP at 40 CFR Section 300.430(e)(i)(A)(2). Noncancer hazards were below the target threshold of 1 for all receptors except the future construction worker for whom the HI was 2. This HI was due to volatile emissions during work in a trench. The organ-specific HI for this pathway was 2 for both the kidney and liver due to TCE in shallow groundwater.

Because the noncarcinogenic HI for the construction worker exceeded the target value of 1, remediation was considered. The approach was based on conservative assumptions that can overestimate potential risk and provides protection for the current and future industrial workers as well. Modeling results indicated that COPCs would not reach the installation boundary for 15 to 20 years or more, if ever, and predicted concentrations at the installation boundary were all below MCLs.

2.7.6 Human Health and Ecological Risk Characterization of No Name Creek

The storm drain running west of Warehouse 65 discharges to No Name Creek in the general vicinity of the National Guard Area. An HHBRA and a three-year monitoring program were performed to evaluate conditions in No Name Creek (MACTEC, 2006f and 2006g, respectively). The Creeks HHBRA found no unacceptable human health risk associated with dermal exposure to surface water and sediment in No Name Creek. The macroinvertebrate study indicated no significant impacts to species diversity or abundance in No Name Creek. These assessments were updated in 2006. Both human and ecological risk estimates were acceptable in accordance with the NCP and USEPA guidance.

TABLE 2-1

RISK CHARACTERIZATION SUMMARY FOR GROUNDWATER
OPERABLE UNIT 8
Defense Supply Center Richmond
Richmond, Virginia

		Hazard Index	Excess Cancer Risk
Current Industrial Worker			
	Indoor Air Vapor Intrusion	**0.0003**	**1.E-07**
Future Industrial Worker			
	Indoor Air Vapor Intrusion	**0.002**	**7.E-07**
Future Construction Worker			
	Incidental Ingestion of Groundwater	0.01	2.E-08
	Dermal Contact with Groundwater	0.1	5.E-07
	Vapor Emissions from Trench	2	2E-05
	TOTALS	**2**	**2.E-05**
Future Off-Installation Residential Child			
	Ingestion of Potable Groundwater	0.5	3.E-05
	Dermal Contact with Potable Groundwater	0.09	3.E-06
	Indoor Air Vapor Intrusion	0.005	2.E-06
	TOTALS	**0.6**	**4.E-05**
Future Off-Installation Residential Adult			
	Ingestion of Potable Groundwater	0.2	1.E-05
	Dermal Contact with Potable Groundwater	*	*
	Inhalation of Chemical Vapors while Showering	0.005	2.E-06
	Indoor Air Vapor Intrusion	0.002	1.E-06
	TOTALS	**0.2**	**2.E-05**
Future Off-Installation Residential Child/Adult			
	Ingestion of Potable Groundwater	NA	5.E-05
	Dermal Contact with Potable Groundwater	NA	3.E-06
	Inhalation of Chemical Vapors while Showering	NA	2.E-06
	Inhalation for Indoor Air Intrusion	NA	3.E-06
	TOTALS	**NA**	**6.E-05**

Notes:

NA Not applicable to noncarcinogenic risks.

* Under Region 3 guidance, dermal risk is not estimated for residential adult.

PREPARED/DATE: MKB 2/1/06
CHECKED/DATE: LMS 2/3/06

2.7.7 Basis for Action

Based on the updated OU 8 HHBRA, the response action selected in this ROD is necessary to protect public health or welfare. Potential unacceptable hazards were found for a future construction worker in a trench due to TCE vapor emissions from groundwater.

2.8 REMEDIAL ACTION OBJECTIVES

The primary goal of a response action is to protect human health and the environment from exposure to COCs that could potentially cause adverse effects. RAOs are the response action completion criteria that can be practicably achieved to ensure reliable protection of human health and the environment within a reasonable time. Factors considered during the selection of RAOs include constituents and media of concern, ARARs, and current and future exposure pathways.

The RAOs for OU 8 groundwater in the upper WBU are to:

1. Prevent unacceptable risk to human health and the environment from exposure to COCs in groundwater.
2. Reduce groundwater COCs within the OU 8 plume to meet chemical-specific ARARs (MCLs).

Appropriate health and safety practices will be implemented during the response action to prevent groundwater ingestion, dermal contact with groundwater, and vapor emissions from groundwater while working in a trench on-installation.

2.9 DESCRIPTION OF ALTERNATIVES

Remedial action alternatives were developed in the FFS by combining technologies and administrative strategies. Alternatives evaluated in the FFS were:

- Alternative 1 No action
- Alternative 2 Institutional controls (including land use controls) and MNA, with a contingency for *in situ* bioremediation
- Alternative 3 Institutional controls (including land use controls) and *in situ* bioremediation

Following are brief descriptions of each alternative.

2.9.1 Alternative 1

CERCLA requires that "No Action" be evaluated to establish a baseline for comparison to other remedial alternatives. No action will leave the impacted groundwater in place without measures to prevent exposure. The only cost included was for the five-year reviews. The estimated present worth (PW) costs were based on a 30-year period (6 five-year reviews) and a 2.5 percent annual discount rate.

Estimated Capital Cost:	$ 0
Estimated Five-year Review Cost:	$ 10,500 each
Estimated Total PW Cost:	$ 54,300

2.9.2 Alternative 2

Natural attenuation of COCs will be monitored and groundwater use for potable purposes will be prohibited on the installation. The land use will be solely for industrial purposes until conditions allow for unlimited use and unrestricted exposure to groundwater. LUCs will be attached to the property deed to restrict groundwater use and prohibit residential development or land use for schools or childcare facilities, should the property change ownership in the future before completion of the remedy. MNA relies on natural biological, chemical, and physical processes that, act without human intervention to reduce and destroy constituent mass and concentrations in groundwater (via chemical decomposition and digestion). A contingency plan such as, but not limited to, *in situ* bioremediation (adding chemicals or nutrients to enhance natural attenuation) would be implemented if concentrations at pre-sentinel wells consistently exceed threshold levels or if natural attenuation rates are significantly slower than predicted by modeling. (These criteria are intended to prevent potential off-installation migration at concentrations exceeding MCLs.) The DPE system (air injection and extraction system) was not included as the contingency response since lower and asymptotic (i.e., not changing significantly over time) concentrations have been reached. The DPE system was most effective when COC concentrations were higher, and *in situ* bioremediation was included in this alternative as the next level of treatment.

The estimated PW costs include a 30-year monitoring period, 6 five-year reviews, semi-annual sampling in years 1 to 3, annual sampling in years 4 to 30, and a 2.5 percent annual discount rate. These costs do not include implementation of a contingency plan.

Estimated Capital Cost:	$ 92,100
Estimated Five-year Review Cost:	$ 15,000 each
Estimated Annual O&M (Yrs 1-3):	$ 98,500
Estimated Annual O&M (Yrs 4-30):	$ 35,500
Estimated Total PW Cost:	$ 1.5 million

2.9.3 Alternative 3

In addition to MNA, Alternative 3 includes chemical and/or nutrient injection in areas of higher concentrations to enhance treatment and/or accelerate the natural attenuation rate. The cost estimate was based on a natural attenuation rate that could triple with enhancement. The remedial action duration would therefore be reduced from the 30 years estimated in Alternative 2 to 10 years.

The estimated costs considered a 10-year monitoring period, 2 five-year reviews, bench-scale testing in year 1, a field pilot study in years 2 to 3, semi-annual monitoring in years 4 to 7, annual monitoring in years 8 to 10, and a 2.5 percent annual discount rate.

Estimated Capital Cost:	$ 92,100
Estimated Five-year Review Cost:	$ 15,000 each
Estimated Annual O&M (Yr 1):	$ 153,500
Estimated Annual O&M (Yrs 2-3):	$ 852,500
Estimated Annual O&M (Yrs 4-7):	$ 98,500
Estimated Annual O&M (Yrs 8-10):	$ 43,500
Estimated Total PW Cost:	$ 3.1 million

2.10 COMPARATIVE ANALYSIS OF ALTERNATIVES

The three remedial action alternatives were evaluated using the nine criteria to compare alternatives and select an appropriate remedy required by the NCP at 40 CFR Section 300.430(e)(9)(iii). These criteria fall into three groups: threshold criteria, balancing criteria, and modifying criteria. The threshold criteria must be met for an alternative to be eligible for selection. The balancing criteria are used to compare the relative strengths and weaknesses of alternatives. The modifying criteria are taken into account after public and regulatory comments are received to evaluate acceptance.

The threshold criteria are:

- Overall protection of human health and the environment and how an alternative reduces potential risk.
- Compliance with ARARS or justification for a waiver.

Primary balancing criteria are:

- Long-term effectiveness and permanence with respect to risk, the adequacy and reliability of controls, and the ability to achieve the RAOs.
- Reduction of toxicity, mobility, or volume (TMV). The statutory preference is for alternatives that employ treatment. This criterion also includes the irreversibility of the treatment and the type and quantity of residuals.
- Short-term effectiveness relative to protection of workers and the community during implementation of the alternative and the environmental impacts from implementing the alternative.
- Implementability, as measured relative to the technical and administrative feasibility as well as the availability of necessary goods and services.
- Cost, which includes the PW of capital and O&M costs. Estimated costs are expected to provide an accuracy of plus 50 percent to minus 30 percent (USEPA, 1988) and do not necessarily represent the total actual cost to achieve response complete status.

Additional NCP modifying criteria include regulatory agency acceptance and community acceptance, which were addressed based on comments received on the FFS, Proposed Plan, and during the public meeting. DSCR's response to public comments received on the Proposed Plan is provided in the Responsiveness Summary (Section 3.0). State acceptance is documented by a letter of concurrence with the Final ROD.

The comparison of remedial alternatives using the nine CERCLA evaluation criteria is provided below.

2.10.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is the primary objective of remedial action. Alternative 1 does not satisfy the protectiveness criterion since it does not limit exposure or provide monitoring to confirm that conditions remain protective. Alternative 2 limits exposure through institutional controls and provides monitoring to document that natural attenuation is effective and the plume remains stable or reduced in size. The protectiveness of Alternative 3 is similar to Alternative 2, but the time to meet RAOs should be shorter with Alternative 3 since bioremediation is enhanced from the onset.

2.10.2 Compliance with ARARs

ARARs include groundwater MCLs for COCs. Compliance with ARARs cannot be verified for Alternative 1 since monitoring is not conducted on- or off-installation. Alternative 2 would meet ARARs on-installation when MNA reduces concentrations below MCLs and would monitor that concentrations above MCLs do not migrate off-installation. Alternative 3 is similar to Alternative 2, but ARARs could be attained in a shorter timeframe. In addition, substantive compliance with applicable permitting requirements would be necessary for injection wells with Alternative 2 (if the contingency is implemented) and with Alternative 3.

2.10.3 Long-Term Effectiveness and Permanence

Alternative 1 is not effective because exposure to groundwater on the installation is not restricted. In addition, concentrations at the property boundary would not be verified. Under Alternatives 2 and 3, institutional controls can be very effective in limiting exposure and therefore in managing risk to receptors. MNA has been shown to reduce constituent concentrations and mass over time at numerous sites, including DSCR. Monitoring will document effectiveness, and contingency plans can be initiated if needed to prevent/minimize off-installation migration. Under *in situ* bioremediation, constituent degradation rates would be faster. Once constituent concentrations are reduced by MNA, treatment is permanent.

2.10.4 Reduction of TMV

Natural attenuation is a treatment component of each alternative and is a process where constituent concentrations or mass are reduced over time. TMV are correspondingly reduced over time. Intermediate degradation compounds (daughter products) can be more toxic or mobile, but these are temporary and are eventually reduced as well. Under Alternative 1, monitoring is not conducted, and therefore, the attenuation process is not documented. COC concentrations will be quantified and compared to risk-based levels or MCLs with both Alternatives 2 and 3.

2.10.5 Short-Term Effectiveness

Short-term effectiveness is used to evaluate risk to on-site workers and the nearby community during remedial action implementation. This criterion does not apply to Alternative 1 in the absence of any construction. Under Alternatives 2 and 3, institutional controls are administrative restrictions and are effective immediately. Groundwater sampling and analysis would pose minimal risk to workers and no risk to the community. Subsurface injection with Alternative 2 (if the contingency is implemented) and Alternative 3 is not expected to adversely impact workers and should not pose a risk to the community.

2.10.6 Implementability

Alternative 1 is the simplest to implement. No construction, specialized equipment, or materials are utilized. Only agency approval of five-year reviews is required. With Alternatives 2 and 3, groundwater monitoring is straightforward to implement since materials and services are readily available. Institutional controls require some coordination with USEPA, VDEQ, and local/county agencies. Some construction would occur during injection well installation with Alternative 2 (if the contingency is implemented) and with Alternative 3.

2.10.7 Cost

The cost comparison of alternatives is based on total PW including capital and O&M costs. PW costs were calculated using a 2.5 percent annual discount rate. A 30-year monitoring period was used for Alternatives 1 and 2, and a 10-year monitoring period was used for Alternative 3. Alternative 1 is the least expensive, and Alternative 3 is the most expensive.

Alternative 1:	Total PW Cost	=	$ 54,000
Alternative 2:	Total PW Cost	=	$ 1.5 million
Alternative 3:	Total PW Cost	=	$ 3.1 million

2.10.8 State and Community Acceptance

Alternative 1 does not document protectiveness and does not prevent potential exposure. Therefore, Alternative 1 is not preferred. USEPA and the VDEQ support Alternative 2 because it is predicted to be protective of human health and the environment in a cost-effective manner. If future monitoring determines that RAOs are not being achieved, a contingency such as *in situ* bioremediation to enhance natural attenuation can be implemented.

Community acceptance of the preferred alternative is based on comments received during the public comment period for the Proposed Plan. The Responsiveness Summary, included as Section 3.0, addresses technical questions regarding water supply, groundwater flow, future land use, and cost. No comments were received during the public comment period or public meeting indicating pubic objection to selection of Alternative 2.

2.11 PRINCIPAL-THREAT WASTE

A principal-threat waste is highly toxic or highly mobile and cannot be reliably contained (USEPA, 1991a). Examples of principal-threat wastes include free product floating on an aquifer and liquid wastes in lagoons. Principal-threat wastes present a significant threat to public health or the environment should exposure occur. A principal-threat waste typically requires treatment.

Source materials (soils) that resulted in the OU 8 groundwater impacts were treated as part of the OU 5 remediation that has been completed. Under current conditions, groundwater at the installation is not used for potable purposes. Future groundwater use for potable purposes has been restricted installation-wide until concentrations are reduced to levels that allow unlimited exposure and unrestricted use. The extent of impacted groundwater in the upper WBU at OU 8 has been reduced over time, and off-installation migration (mobility) exceeding MCLs has not been predicted by modeling. Therefore, there are no known or anticipated realistic exposure scenarios.

Given source treatment, reduced groundwater concentrations and extent over time, no known or anticipated realistic exposure, and limited migration based on modeling, no principal-threat wastes have been identified at OU 8.

2.12 SELECTED REMEDY

Based on the evaluation of alternatives, DLA, DSCR, and USEPA, with concurrence from VDEQ, have selected institutional controls and MNA with *in situ* bioremediation as a possible contingency (Alternative 2) to be the preferred remedy to address impacted groundwater in the upper WBU at OU 8.

2.12.1 Institutional Controls

Potable groundwater use has been prohibited installation-wide. Land use will be solely for industrial purposes until conditions allow for unlimited use and unrestricted exposure to groundwater. LUCs will be attached to the property deed to restrict groundwater use and prohibit residential development and land use for schools or childcare facilities, should the property change ownership in the future before completion of the remedy. An assessment by the DSCR environmental group will be required before construction activities can be undertaken at OU 8 to ensure that conditions will not present an unacceptable risk to construction workers. Prior to excavation, monitoring data will be reviewed to determine potential vapor hazards and any associated health and safety requirements.

The selected remedy includes implementation and enforcement of institutional controls. An Environmental LUCIP for the entire installation (MACTEC, 2006e) is amended to include each OU as RODs are finalized. In accordance with the FFA, within 21 days of ROD signature, DLA and DSCR will propose a submission deadline for USEPA and VDEQ review of the Environmental LUCIP updated to include OU 8. The specific OU 8 institutional controls will be outlined in an individual appendix of the Environmental LUCIP.

An annual inspection will be conducted to determine whether the institutional controls remain effective and that land and groundwater use restrictions are being achieved. The annual inspections will describe deficiencies or violations and proposed measures or corrective actions taken or required. In the unlikely event of a deficiency or violation, DSCR will take appropriate corrective action.

DLA is responsible for implementing, maintaining, reporting on, and enforcing institutional controls. Although DLA may transfer procedural responsibilities to another party by contract, property transfer agreement, or other means, DLA shall retain ultimate responsibility for remedy integrity.

2.12.2 MNA

MNA relies on natural biological, chemical, and physical processes that, under favorable conditions, act without human intervention to reduce the mass and concentration of groundwater COCs. Natural attenuation processes include biodegradation, dispersion, dilution, adsorption, volatilization, and abiotic destruction. Under this alternative, groundwater will be monitored to document that (1) off-installation concentrations remain below MCLs and (2) concentrations or mass are being reduced by MNA. Biological and geochemical parameters will be monitored semi-annually for three years. Monitoring will be conducted annually thereafter.

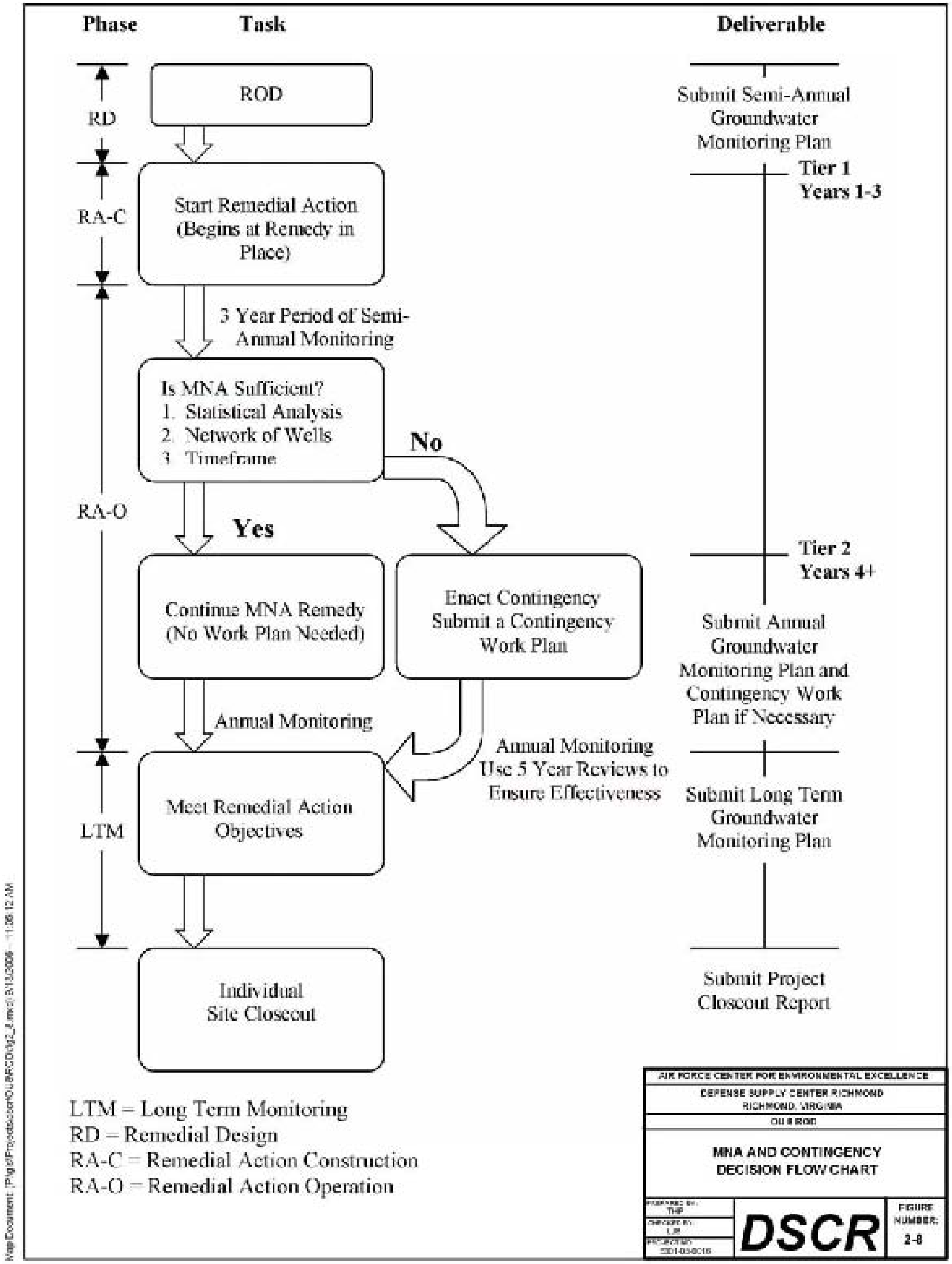
A review of historical groundwater data suggests that aquifer conditions are favorable and natural attenuation is occurring. As presented in the FFS, TCE concentrations were reduced by approximately 99 percent from January 1987 to January 1995, and the extent of the plume retracted approximately 300 feet. The decreases in concentration and extent indicate mass reduction. Reductions have occurred, likely attributable to the DPE system, a source removal and natural attenuation, but recent degradation rates have not been determined and will be evaluated during an initial three-year monitoring period.

In accordance with USEPA protocols (USEPA, 1998), the MNA processes will be scored to indicate if biodegradation is occurring at a sufficient rate to achieve RAOs. As shown in Figure 2-8, a two-tiered approach will be used to confirm MNA. In Tier 1, natural attenuation processes will be confirmed and attenuation rates will be determined during a three-year period. The three-year period will commence immediately after determining the remedy in place. Tier 1 will be based on the field and analytical data from the semi-annual monitoring events for the three-year period. Tier 2 begins the annual groundwater monitoring phase (beginning in Year 4). Specific sampling locations, parameters, and frequency will be established in groundwater monitoring plans developed at the beginning of Tier 1, Tier 2 and once RAOs are achieved to commence the long-term monitoring phase. A Contingency Work Plan will be prepared at the onset of Tier 2 if trigger criteria are met.

2.12.3 Trigger Criteria

Under Alternative 2, multiple and converging lines of evidence will be used to evaluate natural attenuation of COCs and daughter products in groundwater. These lines of evidence include historical data trends (showing plume stabilization and/or loss of constituent mass or concentration over time) and geochemical data (showing suitable conditions for biodegradation). The following will be evaluated:

- Groundwater monitoring will be conducted to statistically evaluate data trends over time and demonstrate the effectiveness of natural attenuation. The EPA MNA screening protocol will be used to determine if biodegradation is occurring. If there is no adequate evidence of biodegradation, including but not limited to the degradation of parent compounds, then the *in situ* bioremediation contingency will be implemented.
- A network of boundary wells (sentinel locations) and point-of-compliance wells (pre-sentinel locations between the boundary and the plume) will be used to verify model predictions and protect downgradient receptors. If threshold concentrations are exceeded at the point-of-compliance wells at a statistically significant frequency, and it is determined that MCLs could be exceeded at boundary wells, then the *in situ* bioremediation contingency will be implemented. The threshold criteria and frequency of detection will be established in the Tier 1 Groundwater Monitoring Plan (post-ROD document).


Phase
Task
Deliverable
ROD
RD
Submit Semi-Annual Groundwater Monitoring Plan
Start Remedial Action (Begins at Remedy in Place)
RA-C
Tier 1 Years 1-3
3 Year Period of Semi-Annual Monitoring
Is MNA Sufficient?
1. Statistical Analysis
2. Network of Wells
3. Timeframe
No
RA-O
Yes
Tier 2 Years 4+
Continue MNA Remedy (No Work Plan Needed)
Enact Contingency Submit a Contingency Work Plan
Submit Annual Groundwater Monitoring Plan and Contingency Work Plan if Necessary
Annual Monitoring
Annual Monitoring Use 5 Year Reviews to Ensure Effectiveness
Meet Remedial Action Objectives
LTM
Submit Long Term Groundwater Monitoring Plan
Individual Site Closeout
Submit Project Closeout Report
LTM = Long Term Monitoring
RD = Remedial Design
RA-C = Remedial Action Construction
RA-O = Remedial Action Operation
AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
DEFENSE SUPPLY CENTER RICHMOND RICHMOND, VIRGINIA
OU 8 ROD
MNA AND CONTINGENCY DECISION FLOW CHART
DSCR
FIGURE NUMBER: 2-8

2.12.4 Expected Outcomes of the Selected Remedy

Land use at OU 8 is expected to remain industrial, and groundwater exposure to COCs will be limited through institutional controls until concentrations are reduced to acceptable levels for unlimited exposure and unrestricted use. The treatment effectiveness of natural attenuation will be measured by comparing COC concentrations to MCLs. MCLs for the two COCs at a 10^{-5} risk level are currently: TCE 5 µg/L and VC 2 µg/L.

As required by CERCLA, five-year reviews will be conducted to ensure that the remedy remains protective of human health and the environment until site conditions allow for unlimited use and unrestricted exposure.

2.12.5 Five-year Review Process

In accordance with CERCLA, Section 121(c), and 40 CFR 300.430(f)(4)(ii), performance of the selected remedy will be evaluated every five years. The five-year reviews will assess protectiveness of the remedy and will serve as justification for amendment of this ROD if human health is not being effectively protected. Five-year reviews are required where constituents remain on-installation at concentrations that do not allow for unrestricted use. DSCR will document these reviews in the Administrative Record.

2.12.6 Post-ROD Documents

In accordance with the FFA, within 21 days of the signature of this ROD, DSCR will submit a schedule for post-ROD documents to be submitted to USEPA and VDEQ. The following post-ROD documents will be submitted:

- Environmental LUCIP update (new appendix)
- Annual Land Use Controls Reports
- Tier 1 Groundwater Monitoring Plan
- Tier 2 Groundwater Monitoring Plan and Contingency Work Plan (if trigger criteria are met)
- Long-Term Groundwater Monitoring Plan
- Project Close Out Report

2.13 STATUTORY DETERMINATIONS

2.13.1 Statutory Requirements

This section discusses how the selected remedy meets the statutory requirements of CERCLA, Section 121. Specifically, a remedy should:

- Protect human health and the environment.
- Comply with ARARs (unless a waiver is justified).
- Be cost-effective.
- Utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
- Satisfy the preference for treatment as a principal element to reduce TMV, or explain why treatment is not needed.

2.13.2 Protection of Human Health and the Environment

Institutional controls will limit human exposure to impacted groundwater, and monitoring will ensure that conditions remain protective. No adverse impacts to ecological or environmental receptors were identified, even without further reductions in constituent mass and concentration. The selected remedy will be deemed protective as long as the installation remains industrial, a future construction worker cannot inhale vapors during trench excavation, potable groundwater use is restricted on-installation, and COCs above MCLs do not migrate off-installation. If necessary, based on exceedances of threshold concentrations in pre-sentinel wells or significantly lower degradation rates, contingency treatment through *in situ* bioremediation will be added to ensure protectiveness.

Institutional controls for OU 8 will be added to the Environmental LUCIP. Enforcement will be verified by annual inspections and conducted by DSCR environmental staff. Long-term protectiveness will be assessed no less frequently than every 5 years for as long as hazardous substances and constituents remain at the site preventing unlimited use and unrestricted exposure.

2.13.3 Compliance with ARARs

The selected alternative would meet ARARs on the installation when MNA reduces concentrations below MCLs and would monitor to ensure that concentrations above MCLs do not migrate off-installation.

Additional remedial action treatment technologies may be implemented in the future if trigger criteria are met. Administrative compliance with permitting requirements would not be required for injection wells (if contingency treatment is implemented), in accordance with CERCLA Section 121(e)(1). However, the substantive requirements of permitting would be met.

2.13.4 Cost-Effectiveness

Capital expenditures include costs to implement institutional controls such as, but not limited to, installing warning signs. Operating costs include preparation of sampling plans, sample collection, laboratory analysis, data validation, annual inspections, reporting, and five-year reviews. A 30-year project duration was used for costing purposes. The cost estimate for the selected remedy is provided in Table 2-2.

2.13.5 Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

Natural attenuation is subsurface treatment by natural processes. Reductions in COC concentrations (toxicity) and mass (volume) are permanent. MNA has been selected at numerous CERCLA sites and has been shown to be effective under favorable geochemical and hydrogeologic conditions, including conditions at DSCR. Intermediate daughter products may be generated temporarily until less toxic byproducts are produced. The selected remedy will reduce risks to on-site workers through institutional controls. These controls would remain with the property even if ownership is transferred.

DSCR, DLA, and USEPA Region 3, with concurrence from VDEQ, have determined that the selected remedy is the most appropriate response action for OU 8. The best balance of tradeoffs is provided related to the following evaluation criteria:

- The selected remedy will be effective and permanent over the long-term.
- The selected remedy will meet RAOs through exposure controls and natural attenuation processes.
- A contingency for *in situ* bioremediation or other suitable treatment is provided if concentrations exceeding MCLs could reach the installation.
- MNA has been effective at other sites with similar COCs, and has been effective at the installation based on data collected from 1987 to 1997.

TABLE 2-2

ESTIMATED COST FOR ALTERNATIVE 2 - INSTITUTIONAL CONTROLS AND MNA

OPERABLE UNIT 8
Defense Supply Center Richmond
Richmond, Virginia

ASSUMPTIONS:
Institutional controls consist of deed restrictions and warning signs
3-year MNA confirmation period consists of semi-annual sampling for VOCs, field parameters, and geochemical parameters
27 years of subsequent monitoring consist of annual sampling for VOCs and field parameters
Annual site inspections to verify adherence with institutional requirements in conjunction with monitoring events
Mothballing current DPE System as a potential contingency for hydraulic control

Category	Unit	Quantity	Cost/Unit ($)	Current ($)	Present Worth ($)
Capital Costs:					
Mothballing DPE System	LS	1	$81,000.00	$81,000	
		Subtotal - Capital Costs		**$81,000**	
Implementation of Institutional Controls					
Environmental Consultant	Hrs	60	$105	$6,300	
Legal	Hrs	30	$160	$4,800	
			Sub Total	**$11,100**	
			Total	**$92,100**	**$92,100**
Annual Operating Costs:					
Annual Costs (Year 1-3):					
Groundwater Sampling and Site Inspections	LS	2	$15,000	$30,000	
Semi-annual Reporting	LS	2	$20,000	$40,000	
Report Review Meetings	LS	1	$2,500	$2,500	
Laboratory analysis	LS	40	$650	$26,000	
		Year 1-3 Annual Costs:		**$98,500**	
		Total Year 1-3 Costs:		**$295,500**	**$281,300**
Year 4-30 Annual Costs:					
Groundwater Sampling and Site Inspections	LS	1	$12,000	$12,000	
Annual Reporting	LS	1	$15,000	$15,000	
Report Review Meetings	LS	1	$2,500	$2,500	
Laboratory analysis	LS	20	$300	$6,000	
		Year 4-30 Annual Costs:		**$35,500**	
		Total Year 4-30 Costs:		**$958,500**	**$691,000**
Present Worth of Annual Costs = Annual Costs $\frac{(1+i)^n - 1}{i \times (1+i)^n}$				**$1,346,100**	**$1,064,400**
Five Year Reviews:					
Single Payment Present Worth = 5-Year Review $\frac{1}{(1+i)^n}$					
	LS	1 at Year 5	$15,000	$15,000	$10,700
	LS	1 at Year 1	$15,000	$15,000	$7,600
	LS	1 at Year 1	$15,000	$15,000	$5,400
	LS	1 at Year 2	$15,000	$15,000	$3,900
	LS	1 at Year 2	$15,000	$15,000	$2,800
	LS	1 at Year 3	$15,000	$15,000	$2,000
		Total Cost of Reviews:		**$90,000**	**$32,400**
Subtotal Present Worth of Annual Costs and Reviews:				**$1,436,100**	**$1,096,800**
		Contingency (30%)		$329,040	$430,800
		TOTAL COSTS:		**$1,765,140**	**$1,527,600**

Notes:
LS Lump Sum
The equations for the Present Worth calculation are from *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study,* EPA 540-R-00-002, OSWER 9355.0-75, July 2000 (USEPA, 2000)
Present Worth calculation assumes (n) years of operation with an annual discount rate (i) of 2.5%

PREPARED/DATE: FKM 8/26/05
CHECKED/DATE: GJW 8/26/05

- Monitoring will be conducted to document protectiveness.
- The remedy is straight forward to implement (no special techniques, materials, or labor are required), and no short-term adverse impacts were identified.
- Off-installation concentrations comply with MCLs and on-installation concentrations will continue to be reduced to MCLs over time.
- The selected remedy is the most cost-effective protective alternative.
- The selected remedy is acceptable to USEPA, VDEQ, and the community.

Implementation of *in situ* biological treatment from the onset, as in Alternative 3, is not the most cost-effective approach. Since Alternative 2 has a contingency in place for additional treatment based on performance metrics, the reliability is considered to be high.

2.13.6 Preference for Treatment as a Principal Element

Natural attenuation meets the regulatory preference for treatment to reduce constituent concentrations and extent of the plume.

2.13.7 Five-year Review Requirements

As long as groundwater concentrations preclude unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of the response action to ensure that the remedy is, or will be, protective of human health and the environment. Protectiveness reviews will be conducted no less frequently than every five years thereafter, until site conditions provide for unlimited use and unrestricted exposure, or review requirements are otherwise terminated by statutory amendment.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

There are no significant changes in the selected remedy from the description of Alternative 2 presented in the Proposed Plan.

3.0 RESPONSIVENESS SUMMARY

The purpose of this responsiveness summary is to document public comments on the OU 8 proposed remediation. A public meeting was held on 27 June 2006, at the Bensley Community Center in Richmond, Virginia. The meeting was attended by DLA, USEPA Region 3, VDEQ, DSCR, Restoration Advisory Board, MACTEC Engineering, and several community members. A list of community members who signed the attendance log is provided in Appendix A. Questions raised during the public meeting and the associated responses are also provided in Appendix A in the public meeting transcript. Written questions received during the public meeting or the 45-day public comment period (1 June to 17 July 2006) are addressed below.

3.1 STAKEHOLDER COMMENTS AND LEAD AGENCY RESPONSES

The following written comments were received. As the lead agency for restoration programs at DSCR, DLA responses are provided.

Question 1: What changes will be done to prevent the plume from going off site?

> *DLA Response 1:* Due to a combination of factors including: (1) closure of the acid neutralization pits (source removal), (2) soil vapor extraction of impacted soils surrounding the former acid neutralization pits (source treatment), (3) operation of a dual phase extraction system from 1997 to 2004 (engineered groundwater treatment), and (4) natural attenuation (passive groundwater treatment), the size of the plume and constituent concentrations have decreased over time. Referring to Figure 2-7 of the ROD, the TCE plume has retracted away from the installation boundary over time as can be seen by comparing the extents in 1997 and 2006. Continued reductions in chemical concentrations and size of the plume are expected to continue with ongoing natural attenuation. Both contaminant concentrations and size of plume will continue to be monitored during the remedy. In the event that trigger concentrations in point-of-compliance wells (pre-sentinel wells between the plume and the installation boundary) are exceeded at a statistically significant frequency, and it is determined that MCLs could be exceeded at boundary wells, then additional treatment chemical/nutrient addition for enhanced *in situ* bioremediation will be implemented. If natural degradation rates are significantly slower than expected and modeling indicates that MCLs will be exceeded at the installation boundary, *in situ* treatment will also be initiated. Monitoring concentrations in pre-sentinel wells and evaluating the adequacy of degradation rates is intended to prevent plume migration off-site at concentrations exceeding drinking water standards (maximum contaminant levels).

Question 2: How does the $ (cost) estimated for Alternative 2 include the cost of monitoring every 5 years for 30 years?

DLA Response 2: The cost estimate for Alternative 2 includes capital and annual operating costs. Groundwater sampling, analysis, and reporting were included in the annual operating costs. In years 1 to 3, it was assumed that monitoring would be conducted semi-annually. In years 4 through 30, it was assumed that monitoring would be conducted annually. The present worth cost was then calculated using an annual discount rate of 2.5 percent. Computing the present worth cost allows evaluation of expenditures that occur at different times by discounting all costs to a common base year. The present worth method also allows the comparison of different remedial action alternatives.

Question 3:

(a) Please explain the Chesterfield County requirement for using county water vs. well water. People in Chesterfield can use well water for drinking? What about watering vegetable gardens?

(b) How is the plume to reach the boundary when it is moving (SW) against the flow of groundwater NE?

(c) Institutional controls means that this area could never be used as a residential area?

DLA Response 3:

(a) Chesterfield County Ordinances (at Chapter 18, Section 18-60) require that structures, including residences, be connected to public utilities if the structure is located within 200 feet of the utility or the structure is located on a lot of less than one acre. The county utilities department maintains maps of water supply lines and determines the connections to the county water supply system. Irrigation or agricultural wells may be used in some zones, but these wells must be approved by the county health department. Close proximity to drain fields would preclude the use of well water for irrigation. If county water is not available, a permit is required prior to private well installation. According to Chesterfield County Ordinance Chapter 12, Section 12-51(c), a hydrologic evaluation (to evaluate the quantity and quality of groundwater) is also required prior to private well installation.

(b) As shown in Figure 2-6 of the ROD, the direction of groundwater flow in the upper water bearing unit is northeast. The groundwater plume is moving in the direction of groundwater flow as can be seen by Figure 2-7 in the ROD where the plume begins at the acid neutralization pits and extends northeasterly. Natural attenuation and source removal have reduced the size of the plume over time.

(c) One institutional control specified by this ROD is that the installation will not be used as a residential area. This restriction will be added to the property deed in the event that the property is ever sold in the future. The institutional controls specified in the ROD apply to the installation only.

3.2 TECHNICAL AND LEGAL ISSUES

No technical or legal issues are outstanding. No issues that would potentially impede remediation were identified.

4.0 REFERENCES

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APPENDIX A

PUBLIC MEETING ATTENDEES AND TRANSCRIPT

-Defense Supply Center Richmond-
Public Meeting For OU-8 Proposed Plan

Bensley Community Center
2900 Drewry's Bluff Road
Richmond, VA 23237

June 27, 2006 – 7:30 p.m.

Name	Address	Add to Mailing List?
TRISH TAYLOR	1650 ARCH STREET, PHILADELPHIA, PA.	yes
JANET MOE	6350 DALEBROOK DR R 23234	
SARAH CLARKE	3428 Kingsland Rd. Richmond, VA 23237	
Cathy Hopkins	4205 Quebec Ave, Prince George, Va 23875	NO
Jim Cutler	VDEQ - 625 E. Main St. Richmond	

DEFENSE SUPPLY CENTER RICHMOND
ENVIRONMENTAL RESTORATION PROGRAM
PUBLIC MEETING - June 27, 2006

Bensley Community Center
2900 Drewrys Bluff Road
Richmond, Virginia

NOTE: 7:30 p.m. Meeting called to order.

MR. CRIST: Small crowd today. Let's get started. Good evening. Thank you for taking the time to participate in this important public process. I hope you had an opportunity to look at the exhibits, and talk to the staff before this meeting started. If not, there will be another opportunity this evening.

My name is Wayne Crist. I'm the moderator for tonight's meeting of the Defense Supply Center of Richmond. I'm with Tri-Star Communications. My job tonight is to make sure we cover the agenda topics and everybody gets a fair opportunity to voice their concerns and their questions.

At this time, I would like to introduce Adrianne Moore, who is the Center's Chief Environmental Safety and Occupational Health Officer. There are a few other people who are here in an official capacity that I would also like to recognize. From the EPA Community in the Baltimore office, we have Trish Taylor.

MS. TAYLOR: Jack couldn't be here tonight. He's in West Virginia, so I'm here on his behalf.

MR. CRIST: And we have Jim Cutler from the Virginia Department of Environmental Quality.

From DSCR, one of the environmental engineers,

Mark Leeper, and Steve Edlavitch. And we also have Kim Turner from the Public Affairs Office.

The purpose of the meeting tonight is for the DSCR environmental team to present the proposed remedy plan for Operable Unit 8. In a few minutes you will hear the presentation. I'm going to ask you to hold your questions until our comment and question time. I will moderate the session which you are encouraged to offer comment or ask questions about the proposed plan and other alternatives.

One of my roles this evening is to ensure everyone who wants to provide a formal comment on or ask a question about the proposed plan and alternative is allowed that opportunity. I'm also responsible for keeping us on topic and on schedule, and ensure that everyone observes a few basic ground rules that will provide for a fair and respectful participation by all.

One of the directives influencing the Center's environmental program through your participation, the meeting, therefore, has three purposes. To exchange information about the OU proposed plan, answer your questions about the proposed plan, and to hear and receive your comments. Let's go through tonight's agenda so everyone will understand the process and the

ground rules.

There are four parts to the meeting. First will be open discussion and the exhibit area, which will remain open throughout the meeting. Posters right there. Second consists of minor remarks and a presentation by Ms. Moore. You will hear the presentation of the proposed plan. Following the presentation we will take a short break. After the presentation, you will have an opportunity to ask questions regarding the presentation and make any formal comments. After we adjourn, subject experts will be available to talk with you.

On the question and answer period, if you wish to ask a question or get a comment, we ask that you fill out a speaker card. And those are available at that table. And give it to me or the person at the reception table. If you wish a written response please indicate with the question on the back of the card. I will recognize speakers during the question and answer period in the order I receive them. I want to emphasize that the question and answer session is not a debate. There will be no response to a comment. If an answer is available to your question, it will be given. Speakers are allotted up to four minutes each if you wish to comment.

I urge you to make your comment concise and to the point. If you have a longer written statement, please feel free to summarize your comments early and submit the written document in its entirety. The document in its entirety will be included in the final document. If you believe you will need more than the allowed time let me know and I will be pleased to provide additional time after everyone first had an opportunity to comment. Also if you would prefer to have me read your comment or question rather than speak, please say so when I call your name. You may submit your comments by dropping them at the table. Those comments can also be mailed in to the Center's Public Affairs Office.

That's it for the agenda, meeting format, and the manner in which comments may be made. Do you have any questions at this point? (No response.) Very good.

Thank you for your cooperation in making this meeting productive and respectful and I look forward to your participation. And, now, Ms. Moore.

MS. MOORE: Good evening. Welcome to the our public meeting on Operable Unit 8 or OU 8 as we call it. I'm going to brief you on the background of DSCR, our Environmental Restoration Program and on Operable Unit 8. Next slide.

DSCR is located about eleven miles south of the City of Richmond in Chesterfield County. We are the field activity of the Defense Logistics Agency, and we provide supplies and logistics to the war fighters. Next.

DSCR was placed on the Superfund list in 1987. And in 1990 we signed an agreement with our partner that established DLA as the lead agency. We manage 13 sites or Operable Units in which six have a Record of Decision. Next slide.

This slide shows the location of all Operable Units. Tonight we will be focusing on Operable Unit 8, which is located in this area right here. Next slide.

OU 8 is known as the former acid neutralization pits, groundwater. From 1958 to the early 1980s the pits were used for waste water for metal cleaning operations that was in Warehouse 65. In 1985 the contents of the pits were cleaned and removed, and in 1992 the soils of the site were addressed in a Record of Decision.

Tonight we will present the proposed plan for the remedial alternative for the groundwater. Thank you for coming out tonight and we look forward to answering your questions.

MR. CRIST: Thank you, Ms. Moore. Now we move on to the OU 8 presentation. I am pleased to introduce Cynthia Draper from MACTEC Engineering and Consulting, Incorporated. She will be giving a presentation on Operable Unit 8.

MS. DRAPER: Good evening. Thank you everyone for attending. As Adrianne said we will be discussing the proposed plan for OU 8 which is groundwater. Go to the next slide, please.

Before we go there, let's talk a little bit about the process of becoming an NPL or Superfund site, the studies that are done, the Feasibility Studies, et cetera and where we are today. As Adrianne mentioned, this site was put on the Superfund list. After it's put on the Superfund list we go into a study phase; a remedial investigation that simply means it is studied a lot. We've been taking samples here since the 1980s to the present day.

Then we begin the Feasibility Study. Sometimes we call that FS. That's when we take different solutions or remedial alternatives to clean up the groundwater and evaluate them and select the best one for the site. Today we're right here in this box here. The Feasibility Study has been completed and the final document was approved by USEPA and DEQ in

May of this year. And we prepared a proposed plan for the OU. And that's part of the handout that you've been given tonight. It's simply a brief summary of the results to date and the alternative review and the proposed alternative. That document, the proposed plan, is also available in the Chesterfield County library. It's been there for the past thirty days. You can also get that document off of the admin records web site, adminrecords.com.

Once you have the proposed plan developed, it goes to the ROD or the Record of Decision. The Record of Decision is a legal document. It's an agreement between DLA, EPA, and DEQ that says this is the preferred or selected remedy for this site. Once you have that legal document in place, remedial design and remedial action, final implement of all the things you've been talking about, once it's implemented, you go through an element phase and then you reach the objective or purpose for remediation and you can have site close out. Next slide, please.

There is a graphic showing the base, and you'll notice in this case the north is to our left, so the site is a little bit sideways from the figure that Adrianne showed previously. We've broken the base into different zones and that's simply for ease of

study. So we study a zone. OU 8 is in zone 1, right here. The facility is right in this area here. Then highway 95 and James River run in this direction here. In here is the Chippenham area. Next slide.

This is the expanded view of the OU 8 area. Here. Right here is where the former acid neutralization pits were. They have been removed or the contents have been removed in the 1980s. And groundwater flows from the pit area to the north, northeast in this direction here to the Installation boundary. This is simply a blow up of that area. Next slide.

The slide is populated with all the monitoring wells that we installed since the 1980s. There's been a lot of them. We'll come back to this area, this map a little bit later when we talk about the study results. Next slide.

Okay. The concrete pits, the acid neutralization pits were installed from the 1950s to the mid '80s. In 1985 the material within the pits was removed and the pits were cleaned out. The pits were filled with clean soil and a concrete cover was placed on top of it, so they would never to be used again. Right here is a picture of the pits. They're shown right in here. Those are the concrete covers. That's what

they look like today. Can everyone hear me okay? (No response.)

The concrete pits received waste water from a metal cleaning operation. But we also suspect that they received solvents from other operations in the area. Next slide, please.

Here's another photograph of the pits. Here, they are right here, covered today, what they look like. The source, we considered this the source, removal was done in 1985. As I mentioned, the material was removed, pits were washed and back covered. So that--next slide.

That addressed the acid neutralization pits area. Let's talk about the soils around those pits. The soils around the pits were also investigated and we call that OU 5. And in 1992 constituents of concern or chemicals in the soil no longer exceeded the clean up goal for that as part of the remediation and ROD. After it was determined that the soil for beneath the clean up goal no further action was approved by the EPA. Can you flip back?

This picture here we're very proud of our field technicians. They're out there sampling the area in the vicinity of OU 8 in that slide.

We talked about the source and we've talked about

the soil around the pits. Let's talk about the groundwater in those pits. The groundwater is OU 8, that's what we're here to talk about today. In 1997 to January 2004, a groundwater remediation system was installed by DSCR as an interim action. And that system, and you see in the literature, is often referred to as the DPE System, which is the Dual Phase Extraction System. With the Dual Phase Extraction system you pump groundwater that's been contaminated to the surface. At the same time, you blow air into the groundwater and then take a vacuum and vacuum, extract that air. And the reason you do that is because solvents in groundwater evaporate very easily. You can get more solvents off the groundwater pull those vapors up from the ground surface.

That operated from 1970 to January 2004. The system was installed to remove most of the mass of those chemicals. And it was felt that it had done its job, did what it was supposed to do, and we shut that system down in January 2004. It's been monitoring the groundwater in that are ever since.

Groundwater concentrations have decreased. In a few minutes I will show you the graphs and some of the plume area to show how that looks. We've seen the groundwater concentration decrease and we feel that

there are three reasons why the concentrations have decreased over time. And one is the source removal. That is very important. Two is natural attenuation. Natural attenuation in this case would be caused by organisisms present in the groundwater. They're there all by themselves. We didn't put them there. They've been there for a long time. And these particular organisms under the right condition will degrade or decay that solvent into compounds that are not harmful. And the final one was the interim groundwater remediation that was done through the DPE system.

Let's talk about the results of the study I mentioned earlier, where the plume was and where it is today. In the top here you will see the plume. It's just a footprint of the groundwater that has these chemicals in it. The outer boundary here we graph as drinking water level. The maximum contaminant level of drinking water. The inner part of this plume is what I call the heart of the plume and that's where the chemicals are the highest concentration. This area is over 100 parts per billion and this edge of the plume is at 5 parts per billion. That was in 1997.

This is a plume of the solvent trychloroethene.

And it extends from the source area towards the edge of the boundary of the Installation in the direction of the groundwater flow. This plume here is from data collected in July of 2005. You can see that is a much smaller area. Not only a smaller area, but the heart of the plume, the area that had the highest concentration of the chemicals. It's much smaller today.

When you reduce the area and you reduce the concentration, you reduce the mass of chemicals in that groundwater. If you could hit the little animation that shows how the plume has moved over time. Oh, no, it worked just a few minute ago. There is it. It's working.

That's in 1997. This is just after the DPE system was shut down. And the next one is a year and a half after the DPE system was shut down. You can see there's not a lot of change between when the system was shut down and a year and a half later.

MS. TAYLOR: Do it again.

MS. DRAPER: That's 1997. January 2004. July 2005. The next slide is a graph. It's busy. Let me kind of explain each part of it. This is a graph and it's chemicals that we're graphing. They're constituents of potential concern. The primary

chemicals that are in the groundwater. The first one here tetrachloroethene, PCE. And that is a solvent typically used by dry cleaners, dry clean our clothes. Trichloroethene, TCE is also a solvent and it's a very common degreaser like we often use a degreaser to clean parts. Cis-1,2 dichloroethene, referred to as DCE is a designation product. We call it a daughter product. So the TCE and the PCE are the parent compounds or parent chemicals and they degrade. And they degrade to the daughter product. And the first daughter product is DCE. DCE further degrades and degrades to vinyl chloride, VC. Vinyl chloride further degrades to ethene and ethene is harmless.

If you could go back to the OU 8 map. I can show you the well that this data is taken from. On this map the monitoring well is right in here. Goes to this map here. Right here. So, the monitoring well that the data comes from is immediately down gradient from what used to be the source. Here's the source area and here's the monitoring well of the data that we're looking at. Go back to the results. Okay.

The graph here on the bottom shows time. And in 1985--and that's not on this graph. I put it about right here. That's when the tank materials were removed and the tanks were taken out of service. In

'97 is when the dual phase extraction was incurred until 2004.

The line you see here represents different chemicals. This line is the PCE, one of the parents. This is TCE, one of the parents. The blue and kind of darker one on the bottom here are the DCE and the vinyl chloride. And that is the natural progression of PCE to TCE; TCE degrades to DCE, DCE degrades to vinyl chloride, and vinyl chloride degrades to ethene. What this graph shows is that before we actually started the DPE system, before we did anything out here, these constituents were degrading on their own.

Now part of that could be source removal, but source removal alone cannot explain the sharp decrease in these concentrations and the subsequent increase of the daughter products. We see that the decay of these constituents started when we started collecting the data in the 1980s and the 1990s. This is the area that the dual phase operated. And this is the time frame where it was shut down and we were monitoring it.

You'll notice here that some of these concentrations particularly the DCE in the blue increased. That's what we would expect. We would expect parent products to decay and daughter products to increase. But you'll notice we're not anywhere near the concentration level that we saw in the 1990s. We have not rebound back to those high levels. Next slide, please.

We looked at the source that's been removed. We looked at the soils that's around the tanks and we cleaned those soils up. We looked at where the groundwater, chemicals in the groundwater historically and where they are today. But where are they going? We want to know what's going to happen in the future.

And we use a model called Biochlor. It's approved by the USEPA. This model is specifically for situations like this where we have solvents in the groundwater that can decay through the organisms that live naturally in the groundwater. A model predicted that in 15 to 20 years the plume would get to the Installation boundary. But it would get to the boundary at or near or below the drinking water standards. So that's the good news. Yes, we'll get there and when it gets there, it will meet the standard set up by EPA. Next slide, please.

We are required to perform a risk assessment according to the EPA protocol. And we did so. Our receptor in this case, on this site, is simply a person. It could be a residential person who lives out of the Installation. It could be someone who comes to work everyday. It could be a construction worker. It could be people who are here now or people that will be here in the future.

For noncarcinogenic is simply risk that is not--that will not cause cancer. There is carcinogenic risk that can cause cancer. And the on-site risk, on-installation receptors level fell below the EPA targeted range for risk. The risk for the future, 15, 20 years should the plume get to the boundary is one in, excuse me, 6 in 100,000. But that's not a current risk. That's in the future should the plume ever get there. If you could go on to the next slide.

One of the remediation objectives is to never let it get there. This risk is likely overestimated for a few reasons. One, we feel very conservative, things that make risk higher, assumption. This is a risk assessment added into our model. Right now there are no off-site receptors. No known risk receptors who use groundwater as a potable water source on a daily basis.

The groundwater in this aquifer--this is a very shallow aquifer, 20 to 30 feet. When you pump this aquifer, you tend to get minimal clogging things up.

And we found other areas on the site. So it's not necessarily a practical way to extract all the potable groundwater from the system. Publicly supplied water available from the County in the area downgradient of this site. Also County ordinance to use publicly supplied water as potable water. Next slide.

Remedial action objectives. That's simply what do we want our remediation to accomplish on this site? And one of the goals that I mentioned earlier, DSCR does not want this plume to get to the Installation boundary, a concentration that would be above the drinking water level. That's our first goal. Prohibited use of groundwater as a potable water source on the site. We also want to reduce the chemical concentration on site. Next slide.

We removed the source. We addressed the soil around the tanks. DSCR has a groundwater system that took away the larger mass of chemicals that were there at one time. What more can we do to make sure we meet our objectives that we mentioned in the earlier slide. Well, the first alternative is no action. That's simply a baseline comparison that's required by EPA. The second alternative is Institutional Controls and Monitored Natural Attenuation (MNA) for three years with a contingency for in-situ bioremediation.

Let me explain each of those terms.

Institutional controls are administrative and physical means by which we prohibit or reduce exposure to these chemicals. Monitor Natural Attenuation. And if you could back to the results slide. Monitor Natural Attenuation is the natural decay of these chemicals. It causes things like this to happen. These concentrations go way down. Go back to the alternative.

We want to look at that for a period of three years. During that three year period, if for some reason we think that the natural organisms down there aren't doing the job fast enough or good enough, we have plan B ready. Plan B, in-situ bioremediation, is simply these organisms like food just like we do. They like their equivalent of oxygen just like we do. So we pump those substances into the groundwater, give them lots of food, lots of oxygen. They have a great party. They produce more and more organisms. They decay the chemicals faster. And that's what we're talking about when you see in-situ bio remediation. We're just taking what's already there, what nature provided and make it work faster in an engineering fashion. That's our plan B.

Alternative 3 is kind of the same thing except we

don't monitor natural attenuation for three years. We say let's go right to the engineers, feeding of these organisms and skip the monitoring part.

USEPA has a list of nine criteria of evaluation.

Compliance with ARARs. That simply means meeting drinking water standard for the State. Number nine, Community Acceptance. That's what we're here today for. We want to explain our thoughts and strategies for the site and get your input. Next slide.

Alternative number 2, which is the Monitor Natural Attenuation, institute controls with plan B ready in-situ bio remediation. We like to monitor the MNA for a period of three years. If for some reason during that period we determine from the EPA and the State that things aren't happening quick enough, fast enough, good enough, then we'll go to plan B.

As part of the Superfund process, every five years, every five years the site will be reviewed by EPA to determine that it is still protective and still working as planned.

Some advantages of this preferred alternative I've listed here. I'd like to highlight a few. The second bullet is we have plan B ready if for some reason the organisms that are there need a boost. We documented that this decay has happened historically.

It's happened in the past. It's happening now. We expect it to happen in the future.

And the last bullet is this is performance based solution. We're going to be monitoring the results as the chemicals decay and we can make changes as we need to to make sure that that plume does not go off site in the future. Next slide.

Community Participation. Many of you know about the RAB, the Restoration Advisory Board that meets monthly. They meet monthly to go over topics for educational purposes and overall understanding and also for the Base to get their input into that. A newspaper notice was placed for the proposed plan and the public meeting. This proposed plan is available for review at the County library as well as on our web site. And we have a public comment period from July 1 until July 17th to formally receive your comments. Of course, we will be taking your comments and questions this evening. You can go to the next slide.

We started with this slide and I wanted to end with it as well. After the proposed plan is development, our next step in the process is to sign the legal document, the Record of Decision, which is the agreement between the three agencies. It says this is what we're going to do to remediate

groundwater at this site.

The remedial design. We expect that to be implemented the last part of this year. And in 2007 we design our monitoring system and implement that remedial action.

That's the end of my presentation.

MR. CRIST: Thank you, Ms. Draper. We will now take a very short break. Give you an opportunity to fill out your comment card and turn that in. After that time we will start our comment period. We'll give you about five or six minutes.

NOTE: A break is had from 7:55 p.m. to 8:05 p.m.

MR. CRIST: Let's start our comment and answer period. If you want to ask a question, provide a comment and have filled out a comment card, now is the time to do it. I have three cards. And I'll take them in the order I received them. I want to emphasize this is a question and answer session. It's not a debate. There will be no response to your comment. If an answer is available to your question, it will be provided. Speakers are alloted up to four minutes to make their comments. I urge you to make them concise and to the point. I keep track of time. I will give you a high sign when you've got about a minute left. I don't believe anybody has a written

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statement. Great.

We should have plenty of time if you have a follow up question. If you rather I read your comment let me know, otherwise you're more than welcome to use the card to read your comment.

And our first speaker, as a matter of fact, we have three cards and they're all from the same person. Okay. Janet Moe.

MS. MOE: I'll read it because I took kind of--

MR. CRIST: One at a time.

MS. MOE: This one has three questions.
MR. CRIST: That's okay.
MS. MOE: You made the statement about Chesterfield County requiring people to use County water. I don't think that's a requirement because people still have shallow wells. What is the impact if someone uses a shallow well for vegetable gardens or edibles if that plume should go off Center?
MR. EDLAVITCH: Do you want to try that one, Cynthia?
MS. DRAPER: Janet, right now there is no impact on that. The plume is on-site. It's our goal to keep it on-site and, in fact, have it reduce concentrations on-site. So there would be no impact on that. Chesterfield County does have an ordinance for potable

water. They can use potentially a well for watering a garden, but have to get their drinking water from the County system.
MS. MOE: Okay. Thank you.
MS. CRIST: You have another question there.
MS. MOE: I understand that the plume is in the upper aquifer. How is the plume moving against the flow of water? I can understand it's shrinking. Okay. I have no problem with that, but I can't understand how it's going against the flow of water by moving southwest when the flow of water is northeast.
MS. DRAPER: The plume really isn't moving

backward. What it is is there are different forces at work here. Groundwater is going in this direction to the northeast and wants to move any chemicals in that direction. Working against that is decay. As water is flowing in this direction, it's also decaying. So the concentration decreases as it flows. So on these plumes, it has the appearance of flowing backward. It's really just shrinking because it's decaying. If you can decay faster than you can move, you shrink. If you decay slower than you move, you don't. This site we're seeing the decay working faster than the groundwater can flow.

MS. MOE: Institutional Control mean this area

will never be used for residential sites; is that correct?

MR. EDLAVITCH: I'll take that one. There are Institutional Controls that will be in place that will ensure that the future use of this site will remain industrial only.

MS. MOE: Okay.

MR. CRIST: The second card is also from Janet Moe.

MS. MOE: You mentioned that if the plume starts moving toward off Center, that there are things that you can do to prevent it. What kind of things?

MS. DRAPER: Things that you will do is the in-situ bioremediation. It's fairly easy to implement. You inject that area with a food source and the equivalent of an oxygen source that the bugs like. That's what we would use. That's what you would do. You would need to make this decision well before anything really got to the Installation boundary. You wouldn't wait until it got to the boundary, and, oh, we should do something. You have to get that information further inside the boundary, so you would have enough time to act for that to be effective before anything gets to the boundary.

MS. MOE: Thank you.

MR. EDLAVITCH: Do you understand?

MS. MOE: Yes. The last one is a question on the Alternative 2 part, you've got 1.3{SIC} million. Does that also include the $325,000 it costs to monitor every five years for the next thirty years?

MS. DRAPER: Yes, it does.

MS. MOE: Thank you.

MR. CRIST: According to my three cards, that's all of our comments. I don't think I missed anybody. Very good. I do want to remind everybody that you have until the 17th of July to submit a comment through the Public Affairs Office on the OU 8 proposed plan. Are both local residents members of the RAB?

MS. MOE: Yes.

MR. CRIST: That's what I thought. So I won't mention that we have applications for RAB membership at the table. Thank you for you attention.

NOTE: 8:17 p.m. Meeting concluded.

CERTIFICATE OF COURT REPORTER

I, Kathleen Chancey, hereby certify that I was the court reporter in the public meeting of the Defense Supply Center Richmond, Environmental Restoration Program.

Further, that to the meeting was taken down by me by stenotype at the time of the meeting herein, and was thereafter reduced to typescript under my supervision; that the hearing was faithfully reported and accurately transcribed to the best of my ability, and that the foregoing is a full and complete transcript of said meeting.

Given under my hand this 18th day of July, 2006.

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Kathleen Chancey, CCR

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