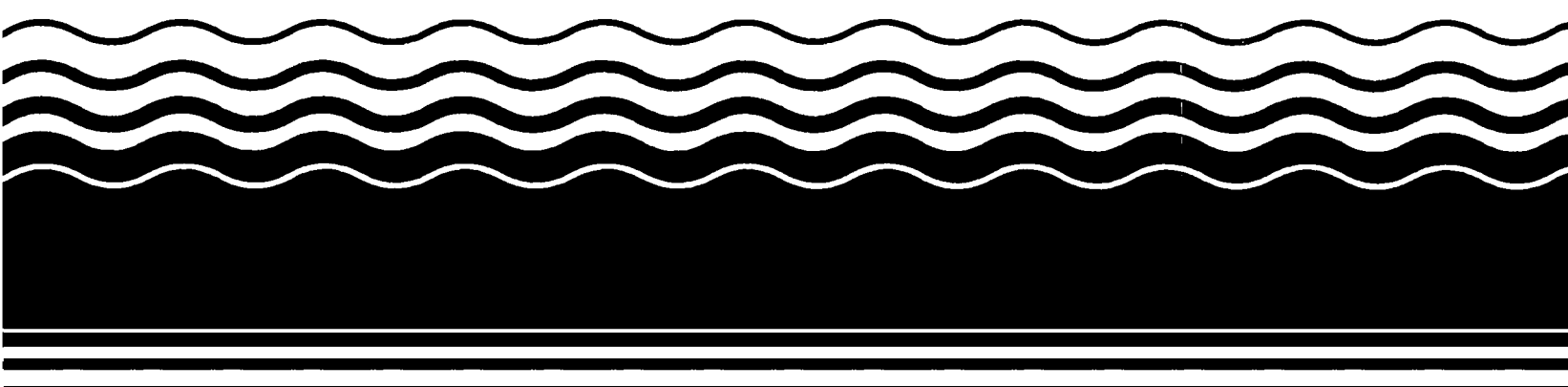




Superfund Record of Decision:

U.S. Defense General Supply
Center, VA



REPORT DOCUMENTATION PAGE		1. REPORT NO. EPA/ROD/R03-93/174	2.	3. Recipient's Accession No.																			
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16. Abstract (Limit: 200 words) The 71-acre U. S. Defense General Supply Center site is a supply and storage facility within the 640-acre Defense Logistics Agency located in Chesterfield County, Virginia. Land use in the area is predominantly residential, commercial, and light industrial, with a wetlands area located along the eastern edge of the site. Land surface at the site has been altered extensively by grading and filling operations, and surface drainage from the site flows into No Name Creek, ultimately reaching the James River less than two miles away from the site. Of the estimated 2,200 residents who live within one mile downgradient of the site, 10 residences use ground water for their drinking water supply; and many more use ground water for household activities. The site has been divided into three distinct geographic areas for remediation, which include the Open Storage Area (OSA), Area 50, and the National Guard Area (NGA). Since 1942, the 43-acre OSA has been used as a storage lot for bulk drummed chemicals. The majority of the 55-gallon drums contain petroleum oils and lubricants (POLs), but solvents, pesticides, herbicides, and other chemicals also are stored in this area. The northern end of the OSA was also a former drum recoupment area, which operated from the early 1960s until 1982. Area 50 is approximately 13 acres and was used as a landfill for construction debris and damaged containers of solid and liquid stock (See Attached Page)																							
17. Document Analysis <table border="0"> <tr> <td>a. Descriptors</td> <td colspan="5">Record of Decision - U.S. Defense General Supply Center, VA Third Remedial Action Contaminated Medium: gw Key Contaminants: VOCs (benzene, PCE, TCE)</td> </tr> <tr> <td>b. Identifiers/Open-Ended Terms</td> <td colspan="5"></td> </tr> <tr> <td>c. COSATI Field/Group</td> <td colspan="5"></td> </tr> </table>						a. Descriptors	Record of Decision - U.S. Defense General Supply Center, VA Third Remedial Action Contaminated Medium: gw Key Contaminants: VOCs (benzene, PCE, TCE)					b. Identifiers/Open-Ended Terms						c. COSATI Field/Group					
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18. Availability Statement			19. Security Class (This Report) None		21. No. of Pages 54																		
			20. Security Class (This Page) None		22. Price																		

Abstract (Continued)

chemicals in the 1960s and 1970s. Some of the contaminants disposed of in the area include photographic development chemicals, organic solvents, pesticides, herbicides, POLs, and PCBs. The NGA is a 15-acre area which was leased to the Virginia Army National Guard beginning in the 1950s. The NGA is currently used for vehicle maintenance operations which include engine cleaning and degreasing, fluid changes, lubrication, and engine rebuilding, all of which required the use of chlorinated and non-chlorinated solvents. In the past, underground and above-ground storage tanks in this area were used to store fuels, oils, and solvents. In 1984, EPA initiated investigations at the site which later revealed contamination of the soil and ground water by petroleum products, chlorinated and non-chlorinated solvents, pesticides, herbicides, and metals from improper chemical handling and storage activities conducted in the late 1950s and 1970s. Two 1992 RODs addressed source contamination in two separate areas, as OUs 1 and 5, respectively. This ROD addresses an interim remedy for the ground water, as OU9. Six future RODs are planned for the site; three will address source contamination as OUs 2, 3, and 4, and three will address ground water contamination as OUs 6, 7, and 8. The primary contaminants of concern affecting the ground water are VOCs, including benzene, PCE, and TCE.

The selected interim remedial action for this site includes extracting and treating ground water using air stripping; controlling air emissions using activated carbon adsorption, followed by either offsite treatment or offsite disposal of the spent activated carbon; discharging the treated ground water onsite to a series of infiltration trenches; and monitoring the ground water. The estimated present worth cost for this remedial action is \$594,067, which includes an estimated annual O&M cost of \$46,000.

PERFORMANCE STANDARDS OR GOALS:

Final goals for ground water have not been determined and will be implemented as part of OU6. Chemical-specific ground water interim action levels are based on SDWA MCLs or MCLGs, and include benzene 5 ug/l; PCE 5 ug/l; and TCE 5 ug/l.

RECORD OF DECISION
INTERIM REMEDIAL ACTION
DEFENSE GENERAL SUPPLY CENTER - OPERABLE UNIT 9

1.0 DECLARATION

1.1 SITE NAME AND LOCATION

Operable Unit 9
Open Storage Area/Area 50/National Guard Area Groundwater
Interim Remedial Action
Defense General Supply Center
Chesterfield County, Virginia

1.2 STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim remedial action for Operable Unit 9 (OU9) at the Defense General Supply Center (DGSC) in Chesterfield County, Virginia near Richmond. OU9 pertains to groundwater beneath Area 50, the Open Storage Area (OSA), and the National Guard Area (NGA). The action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. §§ 9601 et seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300. This decision is based on the administrative record for this Operable Unit. Both EPA and the Commonwealth of Virginia concur with the selected remedy.

1.3 ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from OU9 at DGSC, if not addressed by implementing the interim remedial action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

1.4 DESCRIPTION OF THE SELECTED REMEDY

This operable unit is the third of nine operable units that are currently being addressed at the DGSC. OU9 addresses interim treatment and containment of groundwater in the upper and lower aquifers beneath Area 50, the OSA, and the NGA. The other OUs, and the portions of the Site that each addresses are as follows:

- o OU1-Open Storage Area Source Area
- o OU2-Area 50 Source Area
- o OU3-National Guard Area Source Area
- o OU4-Fire Training Area Source Area
- o OU5-Acid Neutralization Source Area
- o OU6-OSA/Area 50/NGA Groundwater (Final Remedy)
- o OU7-Fire Training Area Groundwater
- o OU8-Acid Neutralization Pits Groundwater

RODs addressing OU1 and OU5 were signed in March and May 1992, respectively, and are currently being implemented.

OU6 and OU9 are the same geographic location. OU9 relates to interim treatment of the contaminated groundwater. OU6 relates to the final groundwater remedy for this location.

The primary objectives of this remedy for OU9 are to reduce risk to human health by impeding further spread of groundwater contaminated with volatile organic compounds (VOCs) in OU9 through groundwater extraction and treatment before the final remedial action is implemented, to lessen the migration of contaminated groundwater, to initiate the reduction of toxicity, mobility, and volume of the contaminants in the groundwater, and to collect data regarding changes in the aquifer and contaminant concentrations in response to remediation measures. This remedy is considered an interim action. Final cleanup goals for groundwater have not yet been determined. A final action that addresses the groundwater (OU6) will be selected after data generated during the implementation of this interim action are evaluated. This interim action for OU9 is expected to become part of the final action for OU6 and to provide for significant risk reduction early in the remedial process.

The major components of the selected remedy include:

- Withdrawal of contaminated groundwater from unconsolidated deposits through a series of extraction wells and intercepting trenches;
- Conveyance of contaminated groundwater through a pipe network to an on-site treatment facility;
- Treatment of contaminated groundwater through air stripping of VOCs and activated carbon treatment of related air emissions sufficient to meet Federal and State Applicable or Relevant and Appropriate Requirements (ARARs) for air and the receiving aquifer;
- Discharge of treated groundwater to a series of percolation trenches on DGSC property;
- Off-site disposal or treatment of spent activated carbon used to control air emissions of VOCs.
- Periodic groundwater monitoring to evaluate the performance and effectiveness of the groundwater extraction, treatment, and percolation system, and to establish final cleanup goals; and,
- Modification of the system as necessary based on periodic monitoring.

1.5 STATUTORY DETERMINATIONS

This interim action is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to this limited-scope action, and is cost effective. Although this interim action is not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action utilizes treatment and thus is in furtherance of that statutory mandate. Because this remedy does not constitute the final remedy for the Operable Unit, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed by the final response action. Subsequent actions are planned to address fully the threats posed by conditions at this Operable

Unit. Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment within five years after commencement of the remedial action.

/s/ Jan B. Reitman
Jan B. Reitman
Staff Director, Environmental and Safety Office
Defense Logistics Agency

date 9/16/83

/s/ Stanley L. Laskowski
Stanley L. Laskowski
Acting Regional Administrator
for United States Environmental Protection Agency-Region III

date 9/29/83

**RECORD OF DECISION
INTERIM REMEDIAL ACTION FOR OPERABLE UNIT 9
U.S. DEFENSE GENERAL SUPPLY CENTER
THE DECISION SUMMARY**

2.1.0 SITE NAME, LOCATION AND DESCRIPTION

**Operable Unit 9 (OU9)--
Area 50/Open Storage Area/National Guard Area--Groundwater
Interim Remedial Action
Defense General Supply Center
Chesterfield County, Virginia**

2.1.1 Introduction. The Defense General Supply Center (DGSC), a federal facility located near Richmond, Virginia, was placed on the National Priorities List (NPL) in 1987. The Defense Logistics Agency (DLA) is the lead Federal Agency for this Site and, in a Proposed Plan published on May 3, 1993, proposed that an interim remedial action be implemented at a portion of DGSC to lessen the migration of contaminated groundwater and treat contaminated groundwater. This document summarizes the decision process leading to the selection of this interim remedial action for Operable Unit 9 at DGSC. The activities described in this document are not the final remedy for the Site's contaminated groundwater. A ROD describing the final remedial action will be issued at a later date. This interim remedial action is expected to become part of the final remedial action.

The interim remedial action selected for Operable Unit 9 (OU9) consists of extracting the groundwater with wells and trenches, treating the groundwater with an air-stripper treatment system, and then discharging the treated water to a series of infiltration trenches above the contaminated groundwater. Resulting air emissions will be controlled through activated carbon treatment. The spent activated carbon will be shipped off-site for treatment or disposal.

2.1.2 Location and Mission. The Defense Logistics Agency, an agency of the Department of Defense, provides logistics support to the military services including procurement and supply support, contract administration and other services. DGSC, located in Chesterfield County, Virginia approximately 11 miles south of the City of Richmond is one of DLA's primary logistical centers providing such support (See Figure 1). Since 1942, DGSC's mission has been the managing and furnishing of military general supplies to the Armed Forces and several federal civilian agencies. Today DGSC manages more than 300,000 items at a facility valued at \$100 million and encompassing 640 acres. The facility includes more than 16 million square feet of covered storage space in 27 large brick warehouses and an additional one million square feet of office space.

2.1.3 Land Use. Land use in Chesterfield County in the vicinity of DGSC is primarily single family residential, intermixed with retail stores and light industry. DGSC is the major industry in the area. The area to the northeast and east of DGSC has been developed as both single family and multi-family housing. See Figure 4 showing the location of nearby residences.

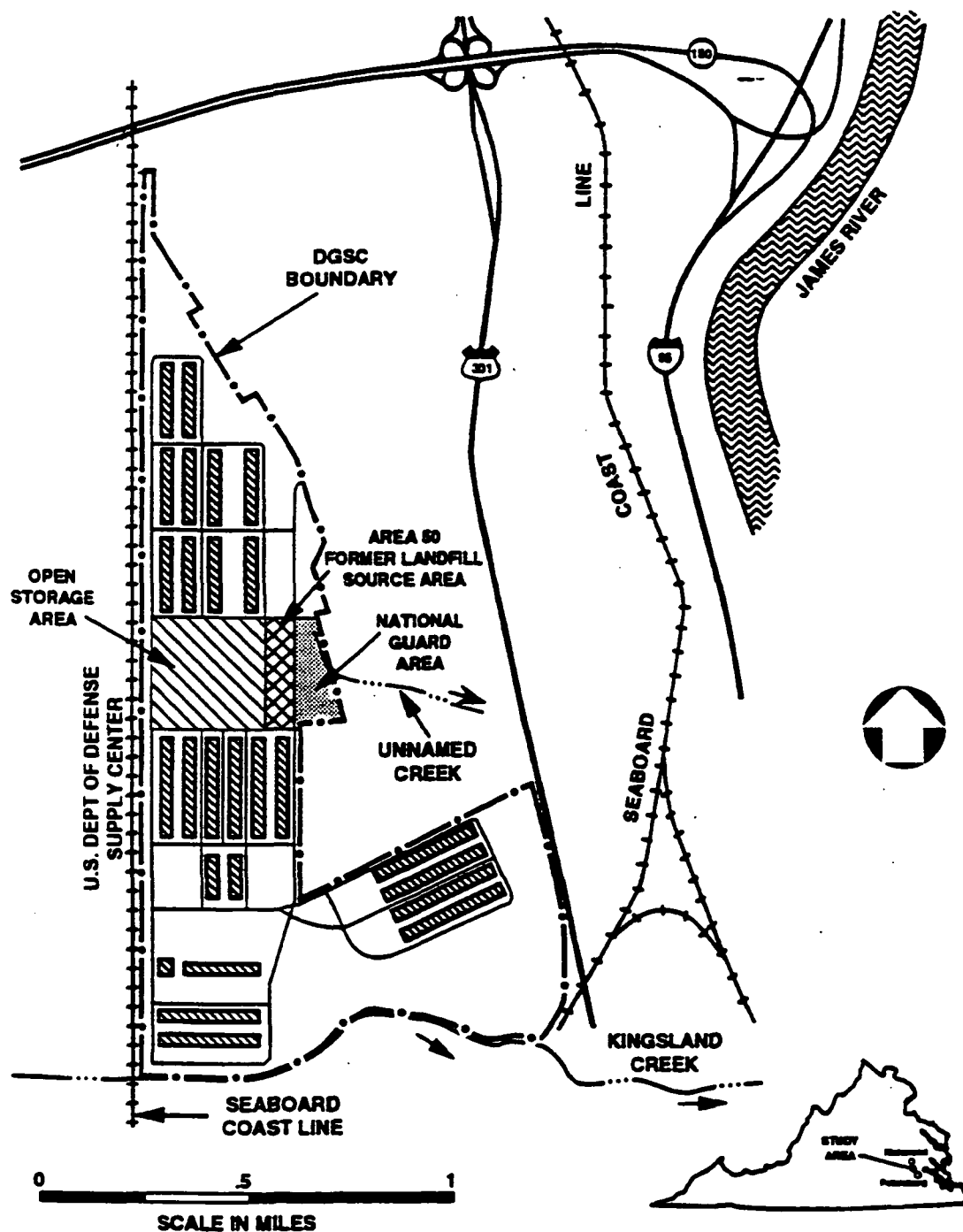
2.1.4 Climate. DGSC is located within the modified continental climatic zone, an area characterized by extreme variations in temperature and precipitation during the course of a year. Typically, the area experiences

warm summers, relatively mild winters and normally adequate rainfall. The mean annual temperature is between 55°F and 60°F. The average annual precipitation is 44.2 inches. The mean annual pan evaporation rate for the area is between 48 and 64 inches. Precipitation and pan evaporation are generally greatest during July and August. Wind direction in the vicinity of DGSC is variable, although the prevailing wind direction is southerly.

2.1.5 Topography. The land surface at DGSC has been extensively altered by grading and filling operations. The topography is generally flat with a slight slope towards the southeast. The maximum difference in the local topographic relief is approximately 30 feet. Elevations range from 125 feet above mean sea level (msl) at the northern boundary of the Site to 95 feet above msl near the southeastern corner. Surface drainage in the study area is towards a storm sewer system that drains eastward and discharges into No Name Creek. The Creek flows north-to-south along the eastern edge of the National Guard Area, turns to the east, and ultimately discharges into the James River, some 1 and 1/2 miles away from the Site.

2.1.6 Geology. The unconsolidated soils below DGSC have been divided into four formations by the U.S. Geological Survey. The Eastover Formation is present immediately below the land surface and consists of up to 25 feet of inter-layered beds of sand, silt and clay with occasional gravel. The predominantly gray clay and silt of the Calvert Formation underlies the Eastover throughout the area. The Calvert Formation is typically 11 feet thick. The Aquia Formation, approximately 7 feet of gray sand, gravel and clay, underlies the Calvert Formation. The Potomac Formation, which underlies the Aquia Formation, extends to the bedrock. The Potomac consists of approximately 40 feet of interbedded sand and gravel with occasional silt and clay seams. Bedrock in the region consists of the Petersburg Granite. (See Figure 3.)

FIGURE 1
SITE AREA
DEFENSE GENERAL SUPPLY CENTER
 RICHMOND, VIRGINIA



LAW ENVIRONMENTAL, INC.
 GOVERNMENT SERVICES DIVISION

SOURCE: REMEDIAL INVESTIGATION, AREA 50, OPEN STORAGE AREA
 AND NATIONAL GUARD AREA, DAMES & MOORE, JULY 28, 1989.

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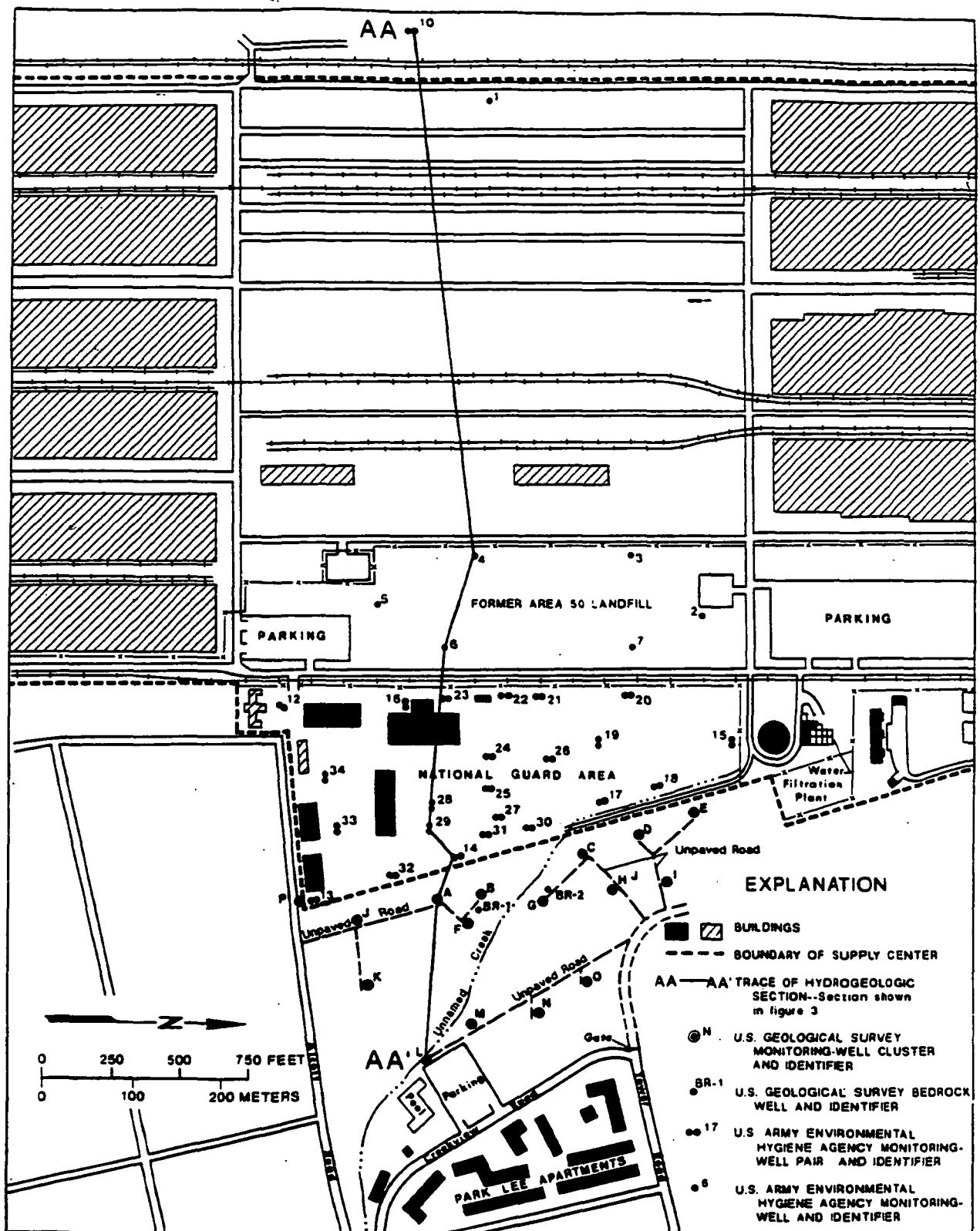


Figure 2.-- Location of U.S. Geological Survey monitoring-well clusters and selected U.S. Army Environmental Hygiene Agency wells.

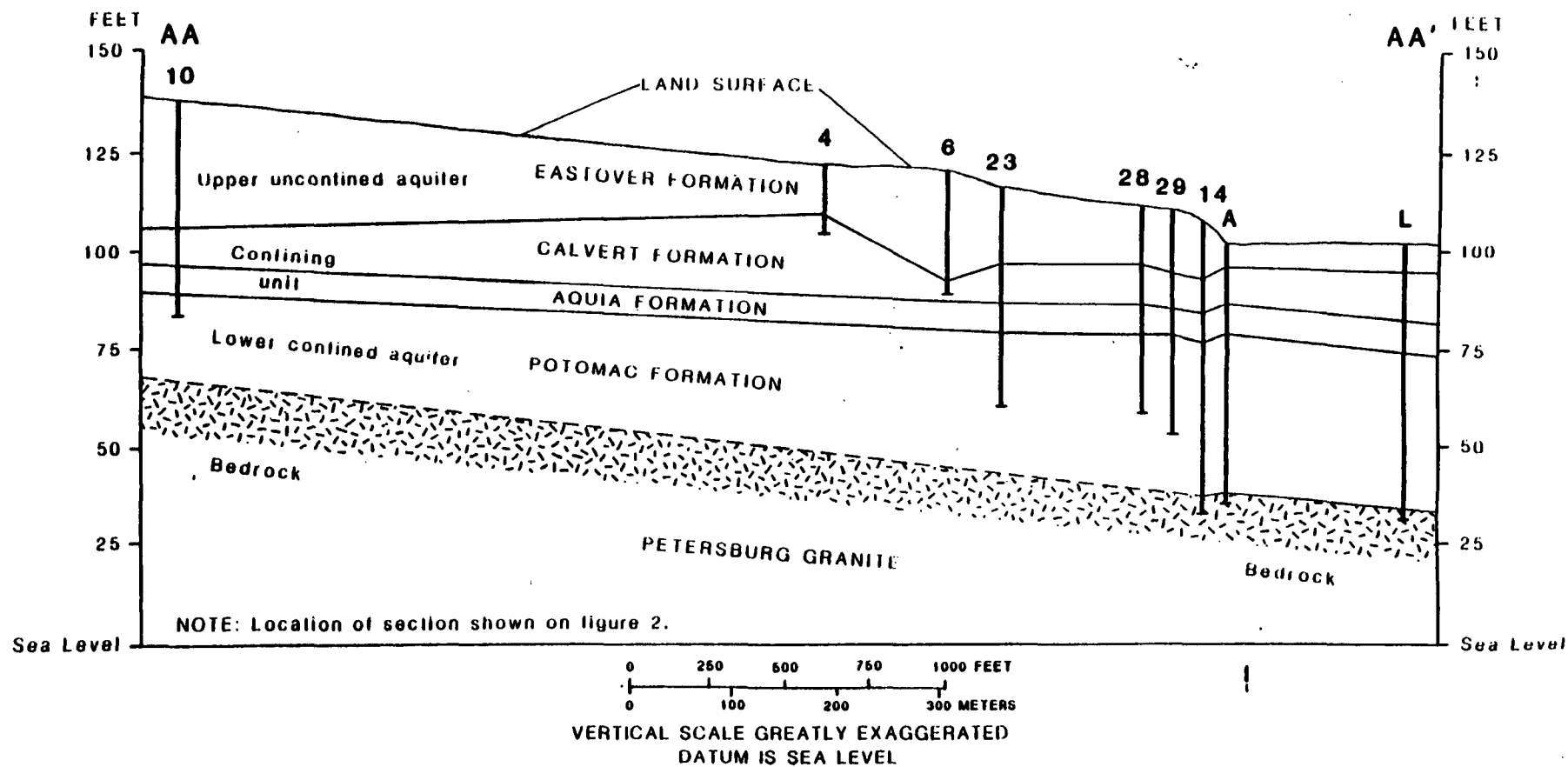
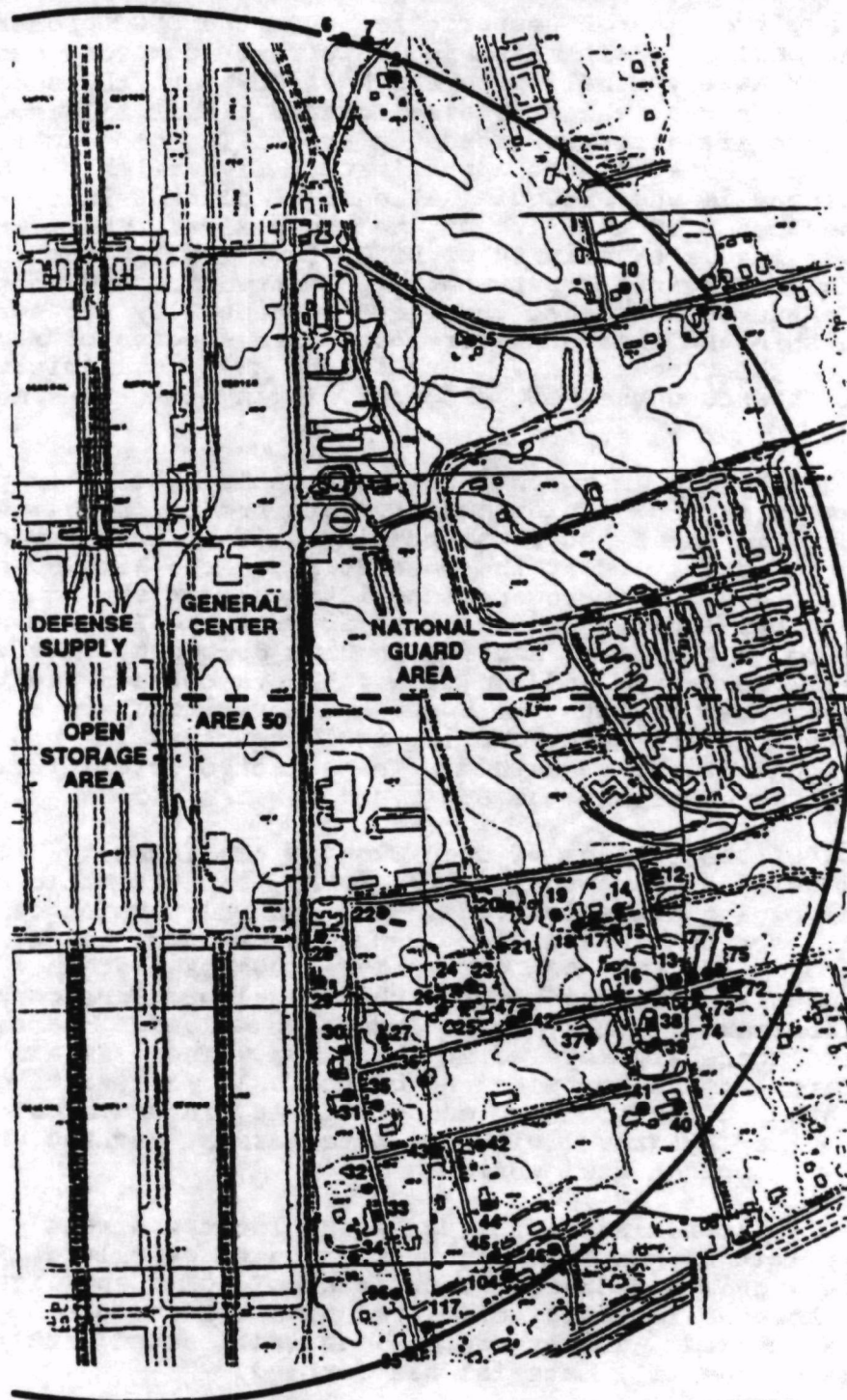


Figure 3.--Hydrogeologic section showing relations among formations.
 (view looking north; trace of section is shown in figure 2.)

FIGURE 4
LOCATION OF AREA WELLS
DEFENSE GENERAL SUPPLY CENTER, RICHMOND, VIRGINIA



SOURCE:
 RESIDENTIAL WELL SURVEY,
 TASK 4, ENGINEERING SCIENCE, INC.
 OCTOBER 1992

LEGEND
 ● LOCATION OF RESIDENTIAL WELL
 — .5 MILE RADIUS LINE



LAW ENVIRONMENTAL, INC.
 GOVERNMENT SERVICES DIVISION

1548.51

2.1.7 Natural Resources. The vegetation on DGSC is extremely limited due to buildings, warehouses, roads, etc., but the vegetation off-site around DGSC is composed of mixed woodlands and shrubs. Species which may utilize the limited additional habitat on-site include rodents, rabbits, squirrels, birds, reptiles, and amphibians.

There are two natural resource areas on the DGSC property. The first is a recreational pond with fish and waterfowl (domestic ducks and geese) located approximately a half mile south of OU9; and the second is the Bellwood Elk Preserve, which is also located a half mile south of OU9. Off-site, there are also two protected areas. The closest is the Pocahontas State Forest and Park located approximately five miles southwest of the Site. The second is the Presque National Wildlife Refuge, approximately ten miles southeast of the Site on the James River. There are no protected lands in the immediate vicinity of DGSC (Law, 1993). According to the Commonwealth of Virginia Department of Conservation and Recreation, Division of Natural Heritage, there are no Federally protected species occurring within the area. However, protected species of migratory birds may pass through or near DGSC. There is one critical habitat, wetlands, known to exist around the DGSC property. It is along No-Name Creek and lies on the eastern edge of OU9.

2.1.8 Hydrogeology. An unconfined water table aquifer is present within the Eastover Formation. This aquifer, referred to in this document as the Upper Aquifer, is the first water bearing unit affected by contamination resulting from activities at the Open Storage Area/Area 50/National Guard Area (See Figure 3). The low-permeability Calvert and Aquia Formations lie beneath the Upper Aquifer and separate it from the Potomac Formation which is referred to as the Lower Aquifer in this document. However, there are both naturally occurring and man-made pathways between the two aquifers. Generally the water in both the Upper and Lower Aquifers could be used as drinking water and the water quality would be class IIA under EPA's groundwater classification method. The selected interim remedy for OU9 addresses groundwater within the Upper and Lower Aquifers.

2.1.9 Physical Description of Open Storage Area/Area 50/National Guard Area. Area 50, the Open Storage Area (OSA), and the National Guard Area (NGA) are adjoining areas located in the central portion of DGSC as shown in Figure 2. The OSA is a 43-acre fenced area encompassing Open Storage Areas 38 through 47. The OSA currently serves as a storage lot for bulk drummed chemicals. The majority of the 55-gallon drums contain petroleum, oils, and lubricants (POLs), but solvents, pesticides, herbicides, and other chemicals are also stored in this area. There is also a former drum recoupment area at the northern end of the OSA. An existing recoupment area is located at the southern end of OSA-46, in and around Building 203. The OSA is primarily gravel with few paved areas, and the drums are stored horizontally on wooden stringers.

Area 50 is approximately 13 acres and located directly east of the OSA and directly west of the NGA. Area 50 was used as a landfill for construction debris and damaged containers of solid and liquid stock chemicals. Area 50 is relatively level with the surrounding land surface and is grass covered. Slight depressions are located within Area 50 because some of the fill material has settled.

The NGA is a 15-acre parcel located east of Area 50. Although DGSC owns the property, DGSC has leased the land to the Virginia Army National Guard since the 1950s. The NGA is currently used for vehicle maintenance

operations. These activities, which may use chlorinated and non-chlorinated solvents, include engine cleaning and degreasing, fluid changes, lubrication, and engine rebuilding. Existing storage tanks are shown in the Focused Feasibility Study (FFS) for the NGA (OU3). The NGA is covered with asphalt and concrete paving and gravel.

2.2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.2.1 General. DGSC was originally constructed in 1941 as two separate facilities: the Richmond General Depot and Richmond Holding and Reconsignment Point. In 1942, the two facilities were consolidated and in 1962 the installation became known as Defense General Supply Center. Past industrial operations at DGSC have included parachute manufacture and repair, mess kit and canteen repair, refrigerator repair, material handling, equipment overhaul, and engine rebuilding. Current industrial operations include the refurbishing of steel combat helmets and compressed gas cylinders using a dry (ball blasting) process, and tent and fabric repair. DGSC motor pool operations include minor vehicle repairs, fluid changes, and vehicle lubrication. These activities take place at the motor pool facility located in the southern portion of DGSC. There are underground gasoline and fuel storage tanks located throughout the Site. Chemical operations at DGSC have included storing and shipping flammable, toxic, corrosive and oxidizer chemicals for DLA. The majority of the chemicals are stored in warehouses at DGSC. Chemicals stored at DGSC have also included pesticides and herbicides for use at DGSC and as part of the chemical stock mission of DGSC.

2.2.2 Open Storage Area/Area 50/National Guard Area. Since 1942, the OSA has been used as a storage lot for bulk drummed chemicals, the majority of which were 55-gallon drums of POLs. The northern end of the OSA was also a former drum recoupment area which had been in operation from the early 1960s until 1982.

Although currently level with the surrounding grade, Area 50 was formerly a ravine which received construction debris and damaged containers of solid and liquid stock chemicals from the early 1960's until the early 1970's. Potentially hazardous substances that were present at the Site and may have been disposed of at Area 50 include toxic and reactive chemicals used in photographic development processes, organic solvents, pesticides and herbicides, POLs, polychlorinated biphenyls (PCBs), and other unidentified compounds. Some of the chemicals may have been disposed of in Area 50 in drums or damaged containers while others may have been disposed of as bulk liquids. Remediation of the soil and landfill in Area 50 has been identified as OU2, for which a remedy has not yet been selected.

The NGA has been leased from DGSC by the Virginia Army National Guard since the 1950's. The major activities in this area have included vehicle maintenance using both chlorinated and non-chlorinated solvents for degreasing purposes. Some waste solvents were reportedly disposed of in the storm sewer system or on unpaved areas of the NGA. In the past, underground and aboveground tanks were used for storing fuels, oils, and solvents in this area. A number of underground and above-ground storage tanks were located throughout the National Guard Area, most of which have since been removed.

2.2.3 In 1984, DGSC was recommended for placement on the CERCLA National Priorities List (NPL), and it was promulgated to the NPL in 1987. This

action was a result of a Hazard Ranking System (HRS) scoring performed for DGSC that was based on the conclusions of previous studies done at the Site by the United States Army Environmental Hygiene Agency (USAEHA) and the United States Army Toxic and Hazardous Materials Agency (USATHAMA). In August, 1986 the United States Environmental Protection Agency, Region III (EPA), issued a Corrective Action Permit to DGSC pursuant to the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §§ 9601 et seq. As part of RCRA activities conducted at the Site, Dames and Moore, a contractor of DGSC, prepared Remedial Investigation Reports for three areas at DGSC in 1989. The three reports were:

- Remedial Investigation for the Fire Training Area, May 1989;
- Remedial Investigation for the Acid Neutralization Pits Area, April 27, 1989; and
- Remedial Investigation for the Open Storage Area/Area 50/National Guard Area, July 1989.

In September, 1990, the DLA, DGSC, EPA, and the Commonwealth of Virginia entered into a CERCLA Interagency Agreement (IAG) pursuant to Section 120 of CERCLA, 42 U.S.C. § 9620, which contains the requirements for the implementation of remediation activities. DLA has been proceeding in accordance with the requirements of the Interagency Agreement, and no enforcement actions related to CERCLA responses have been initiated. A list of environmental studies performed at DGSC since 1984 is included in Appendix A of this ROD.

In March and May of 1992 the first two of nine Records of Decision (ROD) for DGSC were signed. Remedial design activities have been nearly completed for OU5 (soil vapor extraction near the Acid Neutralization Pits). No physical cleanup of the Site is planned under OU1, which includes maintenance of fencing and security to continue restriction of Site access and deed restrictions to restrict future development of the Site.

2.3.0 SUMMARY OF COMMUNITY PARTICIPATION

2.3.1 On February 23, 1984, DGSC organized an Interagency Task Force consisting of State regulatory agencies, EPA, County agencies, Virginia National Guard, representatives of nearby residential areas, and DGSC personnel. The purpose of this group was to ensure that actions carried out at the Site were done with input and review from affected parties. This group was active in the mid-1980s, but became less active after the County installed water supply lines to supply potable water to residents located near DGSC.

2.3.2 In May 1992 DGSC implemented a formal community relations program as required by CERCLA. DGSC mails a periodic newsletter to interested parties which describe current activities being performed in support of the remedial response activities at the Site. In addition, public meetings are held at important points during the remediation process to provide a means of community involvement. An administrative record file, open to the public, is maintained at the Chesterfield Public Library at the Chesterfield County Courthouse in Chesterfield, Virginia.

2.3.3 Community participation requirements in CERCLA, Sections

113(k)(2)(B) and 117 have been met for this interim action. The Proposed Plan for OU9 was released to the public on May 3, 1993. That document was made available to the public and included in the administrative record file. The notice of availability for the Proposed Plan was published in the Richmond Times Dispatch on May 3, 1993. The public comment period was held from May 3, 1993 to June 17, 1993. In addition, a public meeting was held on June 2, 1993. At this meeting, representatives from the DLA, EPA, and the U.S. Army Corps of Engineers answered questions concerning the remedial alternatives evaluated for Operable Unit 9. A transcript of the public meeting is available in the administrative record file. A response to the comments received during the public comment period is included in the Responsiveness Summary, which is attached to this ROD.

2.4.0 SCOPE AND ROLE OF THE RESPONSE ACTION WITHIN THE SITE STRATEGY

2.4.1 As with many Superfund sites, the problems at DGSC are complex. As a result, the work at DGSC has been organized into nine operable units, each of which addresses a portion of the contamination at DGSC. In addition to OU9, the operable units at this Site include:

- OU 1 - Open Storage Area Source Area
- OU 2 - Area 50 Source Area
- OU 3 - National Guard Area Source Area
- OU 4 - Fire Training Area Source Area
- OU 5 - Acid Neutralization Pits Source Area
- OU 6 - Area 50/Open Storage Area/National Guard Area Groundwater (Final Remedy)
- OU 7 - Fire Training Area Groundwater
- OU 8 - Acid Neutralization Pits Groundwater

Each of the operable units at DGSC is being investigated and remediated under a separate schedule. The process for evaluating an operable unit and selecting a final remedy can be complex and time consuming. In such cases, it may be beneficial to begin cleanup activities in the form of interim remedial actions before the final remedy is selected in order to reduce risk early in the remedial process. OU6 is a location where such interim activities are considered appropriate because contaminants are continuing to flow with the groundwater to previously uncontaminated areas at greater distances from the Site. An interim remedial action that reduces the "spread" (both horizontally and vertically in the subsurface) of contaminants and begins the process of collecting and treating hazardous substances is both possible and desirable. Therefore, the location designated as Operable Unit 6 is the location of this interim remedial action (OU9). Geographically, OU6 and OU9 are the same location and consist of the same contaminated groundwater. Administratively, they are different actions and are assigned different operable unit designations.

2.4.2 Consistency with Future Remedial Actions. The remedy selected in this ROD for interim action is the first step in the process to cleanup the contaminated groundwater at this location. Subsequent actions are planned to further address groundwater contamination at this Operable Unit. These actions will be determined when the Remedial Investigation/Feasibility Study (RI/FS) for OU6 is completed and will be subject to public comment. Because the interim remedial action selected for OU9 will remove contaminated groundwater from the aquifer, it is expected to provide early risk reduction and to become part of the total remedial action that will attain applicable or relevant and appropriate requirements (ARARs) of state

and federal environmental laws. See section 2.8.3 and Table 4 below.

2.4.3 Goals of the Interim Action. The goals of this interim action are to lessen the migration of contaminated groundwater, to initiate the reduction of toxicity, mobility, and volume of the contaminants in the groundwater, and to collect data regarding changes in the aquifer and contaminant concentrations in response to remediation measures. During treatment, VOCs removed from extracted groundwater will be captured and sent off-site for permanent disposal. This interim action will likely reduce the total volume of contaminated groundwater to be treated in the long run because dispersion will be reduced.

2.5.0 SUMMARY OF SITE CHARACTERISTICS

2.5.1 Contamination Sources. The types of contaminants that are present at the Site which are affecting OU9 include petroleum products, chlorinated and non-chlorinated solvents, pesticides, herbicides and metals. The sources of these contaminants are being addressed by several operable units. Contamination of the groundwater in OU9 is the result of chemical handling and storage activities conducted between the late 1950s and the mid-1970s. The primary source of the contamination in OU9 is the Area 50 landfill (OU2). Minor sources are the Open Storage Area (OU1) and the National Guard Area (OU3). Chemicals migrated downward from contaminated soil to contaminate the underlying groundwater. The contaminated groundwater migrated both downward and laterally within the Upper and Lower Aquifers, eventually moving beyond the DGSC boundary.

2.5.2 Contaminant Migration and Location of the Groundwater Plume. The OU9 groundwater was contaminated primarily by the OU2 Source Area and migrates eastward beyond the DGSC boundary (See Figures 5a, 5b, 5c, & 5d). There are two interrelated, but separate groundwater aquifers beneath the Site; the Upper Aquifer and the Lower Aquifer. The physical characteristics of the two aquifers are different. Both of the aquifers are contaminated but the plume size and shape varies between the two. According to the United States Geological Survey Report, *Ground-Water Contamination and Movement at the Defense General Supply Center, Richmond, Virginia*, prepared in 1990, groundwater flow in the Upper Aquifer is generally towards the north-northeast at an average rate of approximately 65 feet per year. The average depth to groundwater varies seasonally but typically ranges from 13 to 16 feet below ground surface. The hydraulic gradient varies from 0.05 percent to 0.12 percent. The low hydraulic gradient indicates that the rate and direction of groundwater flow are likely to exhibit minor seasonal changes in response to precipitation. Some, but not all, of the groundwater in the Upper Aquifer discharges into No-Name Creek. Groundwater flow direction in the Lower Aquifer is to the east beneath the OSA and Area 50, with a change of direction to the southeast as the water flows east of the NGA. Groundwater flow in the Lower Aquifer is approximately 225 feet per year. There are both naturally occurring and man-made pathways between the Upper and Lower Aquifers and contaminated groundwater can migrate between the two.

2.5.3 Size and Location of Plume. VOCs have been detected in the Upper and Lower Aquifers under DGSC property and an adjacent area. Maps showing the size and location of the contaminated plume in the Upper and Lower Aquifers are shown on Figures 5a, 5b, 5c, and 5d. These maps were developed by Dames and Moore, and the United States Geological Survey (U.S.G.S.) based upon data collected in 1986 and 1990. According to a

detailed investigation by the U.S.G.S., the plume has not yet spread to Rayon Park and other areas where individual water supply wells are located. See Figure 4. The volume of contaminated groundwater in the Upper Aquifer is estimated to be approximately eight million gallons. The volume of contaminated groundwater in the Lower Aquifer is approximately forty million gallons.

2.5.4 Organic Constituents in the Groundwater. Several rounds of sampling and analysis have been performed at OU9 to evaluate the magnitude and extent of groundwater contamination. Approximately 44 organic compounds have been detected in the groundwater in OU9. Most of the detected compounds were found at extremely low concentrations that are not expected to represent a risk to human health or the environment. However, some were found at concentrations significantly greater than Maximum Contaminant Levels (MCLs), promulgated pursuant to the Safe Drinking Water Act, 42 U.S.C. §§ 300f to 300j-26, and are of greater concern. See Table 1. The primary contaminants detected in the groundwater at OU9 are volatile organic compounds which have been found both on and off the Site. Contaminant concentrations are greatest beneath Area 50 and decrease as the plume moves down-gradient (East) beyond the Site boundary. Trichloroethene, a chlorinated solvent, has been detected at concentrations as great as 18,000 parts per billion. 1,2-Dichloroethene(trans) was found at concentrations up to 13,000 parts per billion. Other volatile organic compounds have been detected in off-site wells at lower, but still significant concentrations.

2.5.5 Inorganic Constituents in the Groundwater. Inorganic constituents were evaluated in a 1992 data collection study conducted by Law Environmental and in earlier sampling programs, in the general vicinity of the Area 50 Source Area (OU2). These data are listed in Tables 2 and 3. The maximum concentrations reported for the listed metals did not exceed the Maximum Contaminant Level Goals (MCLGs) for inorganic contaminants promulgated, at 40 C.F.R. § 141.51, pursuant to the Safe Drinking Water Act, 42 U.S.C. §§ 300f to 300j-26. However, there were isolated samples in which the maximum concentrations of some metals, notably zinc, iron, silver, selenium, lead, and copper, exceeded the Virginia Groundwater Standards, the Federal Ambient Water Quality criteria, or the Virginia Surface Water Standards. Although the latter two sets of criteria are not directly applicable to groundwater, they are shown in Tables 2 and 3 for reference in evaluating remedial alternatives in which extracted groundwater would be discharged to surface water.

The recently collected data on the Upper Aquifer are considered preliminary, and are under review by EPA and VDEQ. Upgradient samples were collected during these sampling programs and comparisons with this data will provide insight into the degree to which contaminants are present because of releases from source area operable units at the Site as opposed to natural conditions or some other cause.

TABLE 1

MAJOR ORGANIC CONTAMINANTS ENCOUNTERED AT OU9

Contaminant	Maximum Concentration Encountered ¹	Action Level	Basis
Vinyl Chloride	87	2	MCL
Trichloroethene	18,000	5	MCL
Tetrachloroethene	3,000	5	MCL
Methylene Chloride	560	5	MCL
1,2-Dichloroethane	376	5	MCL
1,2-Dichloropropane	240	5	MCL
Carbon Tetrachloride	30	5	MCL
Benzene	6	5	MCL
1,1 Dichloroethene	180	7	MCLG
Chlorobenzene	1,500	100	MCLG
1,2-Dichloroethene(trans)	13,000	100	MCLG
1,1,1-Trichloroethane	1,400	200	MCLG
Ethylbenzene	35	700	MCLG
Acetone	180	3700	IRIS

Concentrations are in micrograms per liter (equivalent to parts per billion).

MCL--Maximum Contaminant Levels for organic contaminants promulgated pursuant to the Safe Drinking Water Act, 42 U.S.C. §§ 300f to 300j-26. 40 C.F.R. § 141.61.

MCLG--Maximum Contaminant Level Goals for organic contaminants promulgated pursuant to the Safe Drinking Water Act, 42 U.S.C. §§ 300f to 300j-26. 40 C.F.R. § 141.50.

IRIS--EPA Integrated Risk Information System

¹Source: Dames & Moore (1989)

TABLE 2
DEFENSE GENERAL SUPPLY CENTER--OU9
Upper Aquifer Groundwater
Maximum Concentrations of Metals Detected in Well Samples in 1992

Parameter	Max. Conc.	Fed. ANQC	VA SW Std.	Fed. MCLG	VA GW Std.
Aluminum	3600	--	--	--	--
Arsenic	4.0	190	190	50 ^B	50
Barium	790	--	--	2,000	1,000
Beryllium	2.9	5.3	--	4	--
Cadmium	BDL(5.0)	1.1	1.1	5	0.4
Calcium	32,000	--	--	--	--
Chromium (total)	13	210	211	100	50
Cobalt	180	--	--	--	--
Copper	BDL(5.0)	12	11.8	1300	1,000
Iron	55,000	1,000	--	--	--
Lead	BDL(10.0)	3.2	3.2	15	50
Magnesium	14,000	--	--	--	--
Manganese	5,200	--	--	--	--
Mercury	BDL(0.2)	.012	.012	2	0.05
Nickel	30	160	161	100	--
Potassium	4,900	--	--	--	--
Selenium	BDL(1.0)	5	5	50	10

TABLE 2 (cont.)
DEFENSE GENERAL SUPPLY CENTER--OU9
Upper Aquifer Groundwater
Maximum Concentrations of Metals Detected in Well Samples in 1992

Parameter	Max. Conc.	Fed. AWQC	VA SW Std.	Fed. MCLG	VA GW Std.
Silver	BDL(4.0)	.12	--	--	--
Thallium	BDL(6.0)	40	--	0.5	--
Vanadium	BDL(7.0)	--	--	--	--
Zinc	120	110	107.8	--	50

NOTES:

1. "Max. conc." are the maximum concentrations of dissolved metals in the Upper Aquifer, in micrograms/liter, measured during the 1992 sampling program. See Law Environmental, Inc., April, 1993 in Appendix A.
2. "Fed. AWQC" are the Federal Ambient Water Quality Criteria established under section 304 or 303 of the Clean Water Act, 33 U.S.C.A § 1314 or 1313, for the protection of freshwater aquatic life from chronic toxicity.
3. "VA SW Std." are Virginia Surface Water Standards for the protection of freshwater aquatic life from chronic toxicity (four day average concentration not to be exceeded more than once every three years), VR 680-21-01.
4. "Fed. MCLG" are the Federal Maximum Contaminant Level Goals, 40 C.F.R. § 141.51.
5. "VA GW Std." are the Virginia Groundwater Quality Standards, VR 680-21-04.
6. All values are in micrograms/liter.
7. "BDL"--below detection limit, which is shown in parentheses.
8. No MCLG exists for arsenic. The Maximum Contaminant Level (MCL) for arsenic is 50. 40 C.F.R. § 141.62.

TABLE 3
DEFENSE GENERAL SUPPLY CENTER--OU9
Lower Aquifer Groundwater
Maximum Concentrations of Metals Detected in Well Samples in 1992

Parameter	Max. Conc.	Fed. AMQC	VA SW Std.	Fed. MCLG	VA GW Std.
Aluminum	924	--	--	--	--
Arsenic	4.6	190	190	50 ⁸	50
Barium	190	--	--	2,000	1,000
Beryllium	1.9	5.3	--	4	--
Cadmium	BDL	1.1	1.1	5	0.4
Calcium	19,900	--	--	--	--
Chromium (total)	BDL	210	211	100	50
Cobalt	5.2	--	--	--	--
Copper	19	12	11.8	1300	1,000
Iron	1,840	1,000	--	--	--
Lead	8.9	3.2	3.2	15	50
Magnesium	44,410	--	--	--	--
Manganese	162	--	--	--	--
Mercury	BDL	.012	.012	2	0.05
Nickel	41	160	161	100	--
Potassium	84,600	--	--	--	--
Selenium	19	5	5	50	10

TABLE 3 (cont.)

DEFENSE GENERAL SUPPLY CENTER--OU9
Lower Aquifer Groundwater
Maximum Concentrations of Metals Detected in Well Samples in 1992

Parameter	Max. Conc.	Fed. AWQC	VA SW Std.	Fed. MCLG	VA GW Std.
Silver	861	.12	--	--	--
Thallium	BDL	40	--	0.5	--
Vanadium	5.8	--	--	--	--
Zinc	467	110	107.8	--	50

NOTES:

1. "Max. conc." are the maximum concentrations of metals in the Lower Aquifer, in micrograms/liter, measured during the 1989 Dames & Moore sampling program. See Dames & Moore, July, 1989 in Appendix A.
2. "Fed. AWQC" are the Federal Ambient Water Quality Criteria established under section 304 or 303 of the Clean Water Act, 33 U.S.C.A § 1314 or 1313, for the protection of freshwater aquatic life from chronic toxicity.
3. "Va. SW Std." are the Virginia Surface Water Standards for the protection of freshwater aquatic life from chronic toxicity (four day average concentration not to be exceeded more than once every three years), VR 680-21-01.
4. "Fed. MCLG" are the Federal Maximum Contaminant Level Goals, 40 C.F.R. § 141.51. 5. "VA GW Std." are the Virginia Groundwater Quality Standards, VR 680-21-04.
6. All values are in micrograms/liter.
7. "BDL"--below detection limit.
8. No MCLG exists for arsenic. The Maximum Contaminant Level (MCL) for arsenic is 50. 40 C.F.R. § 141.62.

2.5.6 Contaminant Phases. Only dissolved groundwater contaminants have been encountered. Organic non-aqueous phase liquids (NAPLs) have not been detected at this Operable Unit nor do Site characterization data indicate they exist. However, if they are encountered during a future phase of work, system design can be modified to attempt their recovery and treatment.

2.5.7 Contamination in No-Name Creek. Chemical analyses have been performed on water collected from No-Name Creek, located near the downgradient edge of the contaminant plume. The Creek is a hydrologic discharge zone for some of the groundwater in the Upper Aquifer being remediated by OU9. The analyses indicate that the Creek is contaminated with a variety of organic contaminants similar to those found in the groundwater being remediated by OU9.

2.5.8 Potentially Affected Populations. There are approximately 350 houses and 400 apartments located downgradient within a 1-mile radius of OU9, with an estimated population of 2,200 residents. Figure 4 (Law, 1993) shows a map of the area one-half mile down-gradient from this Operable Unit. A few of the nearby residents rely on groundwater wells for their drinking water, but connection to the Chesterfield County water is available to all residents. Approximately ten families within a one-mile radius of OU9 continue to use wells for drinking water supplies. In addition, some nearby residents use groundwater for purposes such as bathing, cooking, clothes washing, and lawn or gardening purposes. Environmental receptors do not appear to be significantly affected directly by the groundwater. However, since the groundwater discharges to No-Name Creek, the Creek is a potential path for receptors to come in contact with contaminants. Human populations potentially affected include children and possibly fishermen attracted to the Creek. Environmental receptors include biota, fauna, and flora in and around the Creek.

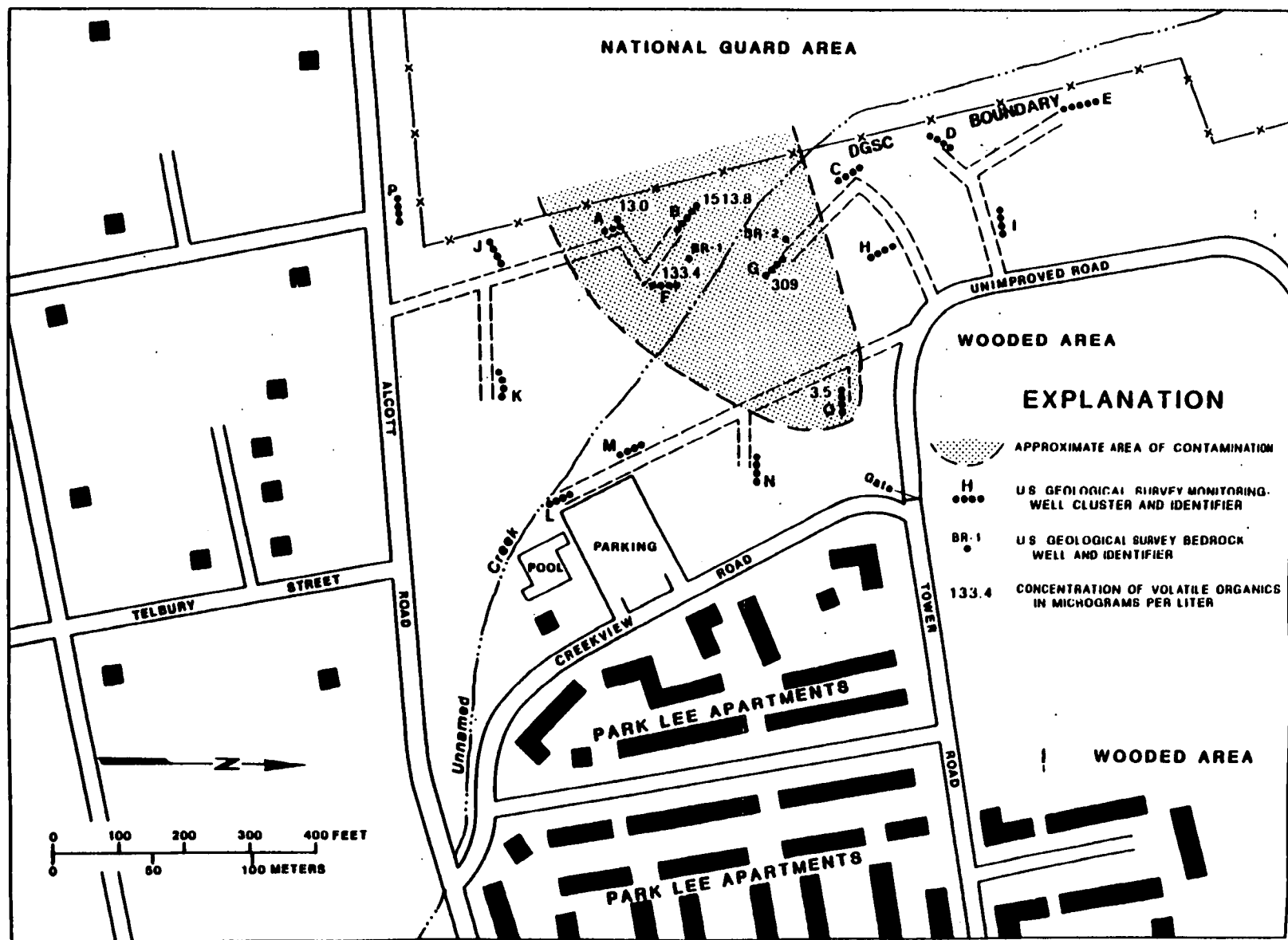
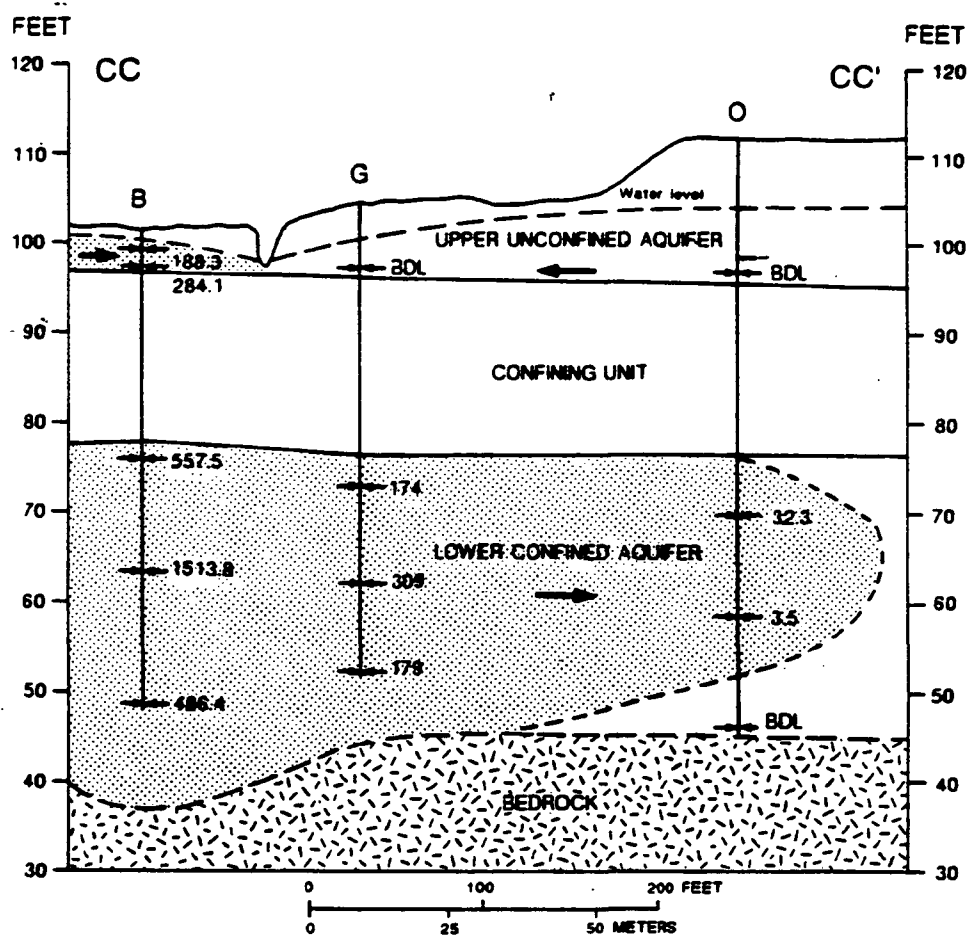


Figure 5b--Area of ground-water contamination in the middle part of the lower confined aquifer beyond the boundaries of the Defense General Supply Center, March 1990.

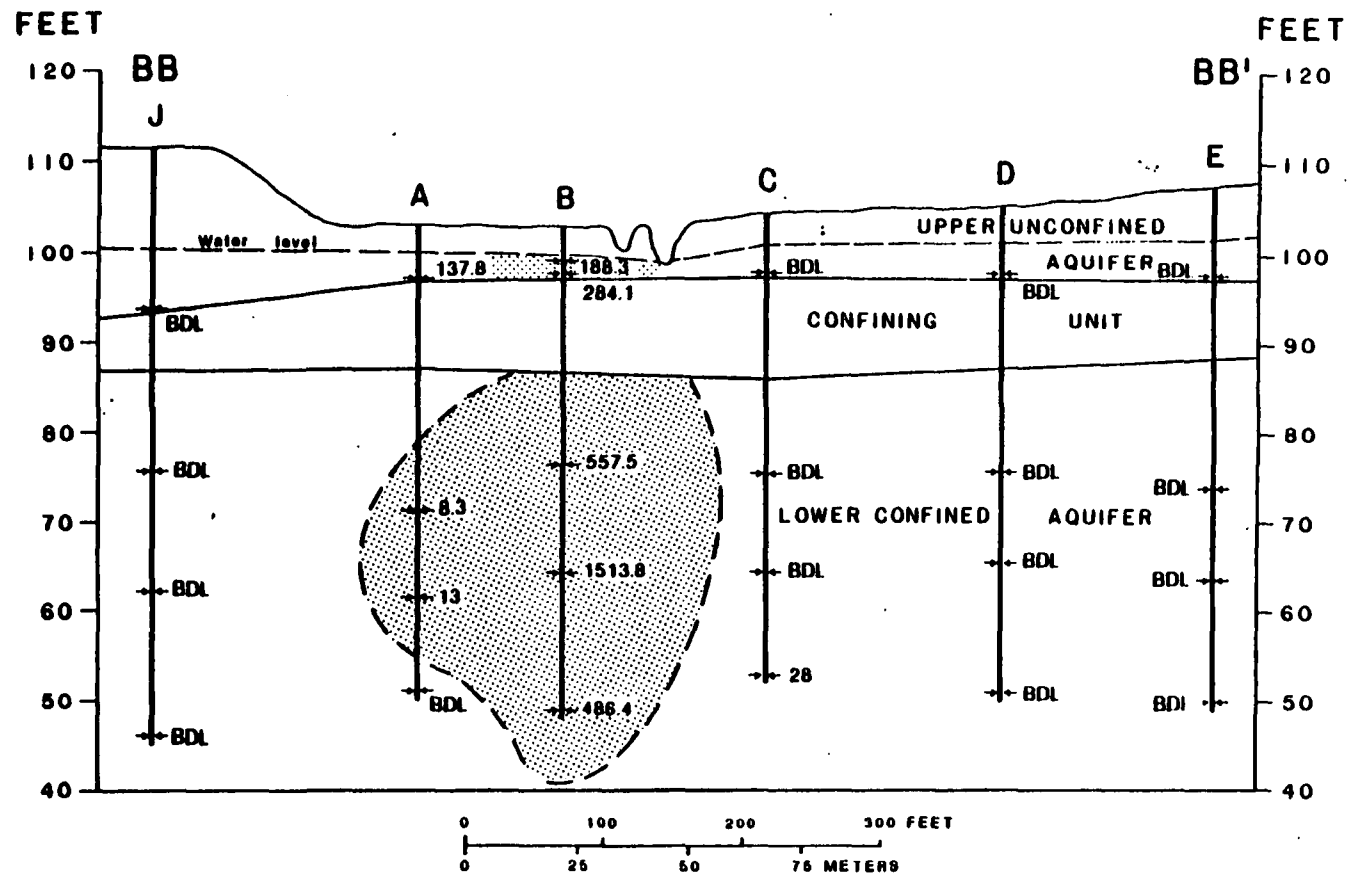


VERTICAL SCALE GREATLY EXAGGERATED
 DATUM IS NATIONAL GEODETIC VERTICAL DATUM OF 1929

EXPLANATION

- AREA OF CONTAMINATION
- B** U.S. GEOLOGICAL SURVEY MONITORING-WELL CLUSTER
- MIDDLE OF SCREENED INTERVAL
- 309** CONCENTRATION OF VOLATILE-ORGANIC COMPOUNDS, IN MICROGRAMS PER LITER
- BDL** BELOW DETECTION LIMITS
- DIRECTION OF GROUND-WATER FLOW

Figure 5c--Longitudinal hydrogeologic section of zone of contamination within the upper and lower aquifers, March 1990.



AREA OF CONTAMINATION

B

U.S. GEOLOGICAL SURVEY MONITORING
 WELL CLUSTER



MIDDLE OF SCREENED INTERVAL

137.8 CONCENTRATION OF VOLATILE ORGANIC COMPOUNDS,
 IN MICROGRAMS PER LITER

BDL BELOW DETECTION LIMITS

Figure 5d --Lateral hydrogeologic section of zone of contamination within the upper and lower aquifers looking upgradient, March 1990.

2.6.0 SUMMARY OF SITE RISKS

2.6.1 CERCLA directs that human health and the environment be protected from current and potential exposure to hazardous substances. In order to assess the current and potential risks at DGSC a full risk assessment is being conducted as part of the RI/FS of OU6. That risk assessment is not yet complete and is therefore not included in this Record of Decision. However, the levels of contamination within the Upper and Lower Aquifers are quite high and it is likely that the Operable Unit presents a significant potential risk to human health and the environment. Results of several rounds of groundwater sampling revealed that certain VOCs are present in the Upper and Lower Aquifers. The concentrations of several VOCs in the groundwater exceeded the national primary drinking water standards as established under the Safe Drinking Water Act. Some of the VOCs detected, including trichloroethene, the most common contaminant at this Operable Unit, are suspected human carcinogens. Vinyl chloride is a known human carcinogen which was detected in the groundwater of this Operable Unit.

Based on a preliminary review, EPA's Regional toxicologist estimates that the concentrations of vinyl chloride, trichloroethene, tetrachloroethene, 1,2-dichloroethane, 1,2-dichloropropane, and 1,1-dichloroethene in groundwater, reported in Table 1, all pose potential incremental cancer risks above 1.0×10^{-4} by the ingestion route alone. (Incremental cancer risk is a probability that is generally expressed in scientific notation. An excess lifetime cancer risk of 1.0×10^{-4} indicates that, as a plausible upper bound, an individual has a one in ten thousand chance of developing cancer as a result of Site-related exposure to a carcinogen for 30 years of a 70-year lifetime. EPA considers excess lifetime cancer risks in the range of 1.0×10^{-4} to 1.0×10^{-6} to be acceptable.) A single risk of that magnitude, alone, would be sufficient to justify initiation of remedial action. Actual or threatened releases of hazardous substances from this Operable Unit, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Although some metals are present in the groundwater at concentrations above background levels, their concentrations and extent are less than those of organic contaminants and they are not thought to present a significant short-term health risk which would warrant remediation under this interim action. However, this issue will be further examined during the development of the detailed risk assessment for OU6.

Environmental risk studies have been conducted at DGSC in the general area being addressed under OU9. Samples were collected from surface water and sediments in No-Name Creek, both upstream and downstream of the area believed to be affected by the groundwater plume. Low levels of VOCs were found in the surface water downstream of the DGSC boundary and chemical concentrations were found to be above Virginia Surface Water Standards for several metals. In addition, surface water and sediments were subject to standard toxicity tests, and the results of these tests are currently being reviewed. A benthic macroinvertebrate study was performed on No-Name Creek, with samples collected from both upstream and downstream locations. As previously stated, while the results of the studies are available, they are under review by the Region III Interagency Biological Technical Assistance Group and it is planned that the results of their review will be factored into the remedy selection for OU6, the final remedial action for

the groundwater in this area.

2.6.2 Toxicity Characteristics of Selected Contaminants in Operable Unit 9.

2.6.2.1 Acetone is a colorless liquid with a somewhat sweet odor. It is a volatile and highly flammable liquid solvent that has many industrial uses, but which can also occur naturally as a metabolic product released by plants and animals. Acetone is usually absorbed by inhalation, but can also be absorbed by dermal contact. Ingestion of acetone can include impaired motor coordination, dizziness, flushing, sweating, increased heart rate, nausea, and collapse into stupor. Chronic toxicity include irritation and inflammation of the eyes, nose, throat and gastrointestinal tract. Liver and kidney damage have also been reported. EPA classifies acetone as a non-carcinogen.

2.6.2.2 Chlorobenzene is a colorless, flammable liquid with an almond-like odor. It is manufactured for use as a solvent and as a chemical intermediate. The primary route of exposure is through inhalation. Acute toxicity of chlorobenzene is relatively low. The primary target organs for chlorobenzene are the brain, liver and kidney. Occupational exposure to chlorobenzene has been correlated with irritation of the eyes and nose, skin irritation and toxicity of the nervous system. Chlorobenzene is not classified as a carcinogen.

2.6.2.3 1,2-Dichloroethene is a colorless, flammable liquid generally used as a solvent for organic materials, dye extraction, perfumes and thermoplastics. 1,2-Dichloroethene is absorbed through oral, inhalation, and dermal routes. It is considered acutely toxic when absorbed, with the principal toxic effects occurring in the lungs and liver. Humans exposed to high concentrations of 1,2-Dichloroethene have exhibited central nervous system effects including drowsiness and nausea. Chronic effects of low doses on humans are unknown.

2.6.2.4 Ethyl Benzene. The major uses of ethyl benzene include use as an intermediate in the production of styrene, in the manufacture of cellulose acetate and synthetic rubber, and as a diluent in the paint industry, in agricultural sprays for insecticides, and in gasoline blends. Primary routes of exposure include drinking water, breathing air, and touching soil contaminated with ethyl benzene. Symptoms of short-term human exposure include irritation to the eyes, nose, throat and skin, dizziness, drowsiness, weakness and dermatitis. Ethyl benzene may cause liver and kidney injury.

2.6.2.5 Methylene Chloride is a colorless, odorless solvent found in insecticides, metal cleaners, paints and paint removers. Methylene Chloride is absorbed via inhalation or ingestion. At low doses Methylene Chloride can interfere with oxygen transport by the blood and result in cardio-respiratory stress. High exposures are associated with damage to the central nervous system as well as liver and kidney effects. EPA classifies Methylene Chloride as a probable human carcinogen.

2.6.2.6 Tetrachloroethene is a colorless, nonflammable liquid with a characteristic odor. It is a solvent widely used as a dry-cleaning agent, a degreaser, a chemical intermediate, and a fumigant. It is readily absorbed after ingestion or inhalation, but dermal absorption is poor. Exposure to high concentrations of tetrachloroethene in the atmosphere can result in dizziness, headache, sleepiness, confusion, nausea, difficulty in

speaking and walking, and possibly unconsciousness and death. EPA classifies Tetrachloroethene as a probable human carcinogen.

2.6.2.7 1,1,1-Trichloroethane is a colorless liquid with a sweet characteristic odor. It is used as a solvent for metal cleaning, in textile processing, as an aerosol propellant and in the manufacture of other chemicals. 1,1,1-Trichloroethane can enter the body through the lungs by breathing contaminated air or through the digestive system by eating or drinking contaminated food or water. Acute exposures to 1,1,1-Trichloroethane may result in dizziness, and loss of balance and coordination. Continued breathing of high concentrations of 1,1,1-Trichloroethane could lead to unconsciousness and death. Animal studies have shown that breathing 1,1,1-Trichloroethane can cause damage to breathing passages, lungs and liver. There are also cardiovascular effects associated with 1,1,1-Trichloroethane.

2.6.2.8 Trichloroethene is a colorless liquid with an odor similar to ether. The major use of Trichloroethene is as a solvent for degreasing metal parts. Trichloroethene is not acutely toxic by the inhalation or oral routes. Human epidemiology studies have not shown a clear connection between exposure to trichloroethene and increased cancer risk. However animals exposed to high concentrations of Trichloroethene have developed cancers in the lungs and liver. Therefore, EPA classifies Trichloroethene as a probable human carcinogen.

2.6.2.9 Vinyl Chloride is a colorless gas with a mild, sweet odor. It is used as a refrigerant gas, and in the manufacture of chlorinated compounds. Acutely toxic exposures in humans affect the central nervous system and death can result if humans are exposed to high levels. Inhalation of vinyl chloride has been reported to result in impaired liver function, liver damage and central nervous system effects. Chronic inhalation exposure has also resulted in a syndrome known as vinyl chloride disease. Symptoms include circulatory disturbances in the extremities, and blood, lung, and liver effects. The USEPA classifies vinyl chloride as a known human carcinogen.

2.6.2.10 Benzene is a clear, volatile, colorless, highly flammable liquid with a characteristic odor. Benzene is used as a constituent in motor fuels, as a solvent for fats, inks, oils, paints, plastics and rubber, as a chemical intermediate, and in the manufacture of detergents, explosives, pharmaceuticals, and dye-stuffs. Exposure to benzene can occur through skin and eye contact, ingestion and inhalation. Local exposure to benzene may result in skin and eye irritation and dermatitis. Short-term exposure to benzene may lead to central nervous system depression. Headache, dizziness, nausea, convulsions, coma, and death may result. Long-term exposure to benzene may lead to blood changes such as anemia. Occupational exposure to benzene may result in leukemia. EPA has classified benzene as a Group A human carcinogen.

2.6.2.11 1,2-Dichloroethane (also known as ethylene dichloride or EDC) is a colorless, flammable liquid which has a pleasant odor and sweetish taste. It has a wide variety of uses including the manufacture of polyvinyl chloride, nylon, viscose rayon, rubber and various plastics. It is a solvent for resins, asphalt, paint and it is also used as a degreaser, as an antiknock agent in gasoline, or in the drycleaning industry. The EPA considers 1,2-Dichloroethane as a class B2 carcinogen, based on evidence that it causes a variety of tumors in rats and mice and is mutagenic in bacteria. Inhalation exposure causes headache, dizziness, nausea,

vomiting, abdominal pain, irritation of mucous membranes, and liver and kidney damage. Dermal exposure may cause dermatitis.

2.6.2.12 1,2-Dichloropropane is a flammable organic liquid miscible with other organic solvents. 1,2-Dichloropropane caused an increased incidence of combined adenomas and carcinomas of the liver in male and female rats and caused a slight increase in mammary adenocarcinomas in female rats. High concentrations of 1,2-Dichloropropane cause nervous system depression and narcosis in humans and can adversely affect the liver, kidneys, adrenals, and heart.

2.6.2.13 1,1-Dichloroethylene (also known as 1,1-Dichloroethene) caused kidney tumors in male mice, and leukemia in both male and female mice in separate inhalation studies. Negative results were obtained in oral studies involving rats and mice. 1,1-Dichloroethylene is therefore considered to be a possible human carcinogen. It has been found to be embryotoxic and fetotoxic in rats and rabbits via inhalation. Chronic exposure by rats to low oral doses caused liver changes. Acute exposure to high doses causes central nervous system depression.

2.6.2.14 Carbon Tetrachloride (also known as Tetrachloromethane) is a colorless liquid with an ether-like odor. Damage to the liver and kidneys are associated with exposure to carbon tetrachloride in both animals and humans. Carbon tetrachloride has been found to be carcinogenic in mice, rats, and hamsters. It is classified by EPA as a probable human carcinogen.

2.7.0 DESCRIPTION OF ALTERNATIVES

2.7.1 To accelerate the process of identifying an interim remedy, only a limited number of groundwater extraction, treatment, and discharge alternatives for OU9 were identified and evaluated for effectiveness, implementability, and cost to attain the remedial goals of this interim action. The alternatives considered are described below.

2.7.2 Three interim remedial action alternatives were identified for evaluation. They are:

- **Alternative 1 - No Action**
- **Alternative 2a - Pump, Treat and Discharge to No-Name Creek**
- **Alternative 2b - Pump, Treat and Return into the Upper Aquifer**

A fourth alternative which would pump contaminated groundwater from the aquifers and then discharge the contaminated water into the local sewer system for conveyance to the local Publicly Owned Treatment Works (POTW) for subsequent treatment and discharge was also briefly considered. However, the local POTW is already operating at near capacity and does not have the excess capacity necessary to accept either untreated or treated groundwater from this interim remedial action. Therefore, the alternative was not considered further. The three alternatives which were considered are described below:

2.7.3 Alternative 1--No Action. The NCP requires that a "no action" alternative be evaluated at every site in order to establish a baseline for comparison. 40 C.F.R. § 300.430. Under this alternative, no further action would be taken at this Operable Unit to prevent exposure to the contaminated media or to reduce risk at the Operable Unit. However,

further remedial action would be evaluated for OU6.

2.7.4 Common Elements of Alternatives 2a and 2b--Pump and Treat System. Most of the components of Alternatives 2a and 2b are the same. Although specific details of the two systems have not yet been designed, the general configuration of either system would consist of the following:

2.7.4.1 Groundwater Extraction Trenches and Wells. To minimize further migration of contamination in the aquifer, a system of recovery trenches and wells will be installed to intersect groundwater within the Upper and Lower Aquifers at the downgradient (east) boundary of the National Guard Area on DGSC property. Trenches or wells will be used to intersect the Upper Aquifer. Only wells will intersect the Lower Aquifer. Submersible pumps will be installed in each of the wells so that contaminated groundwater can be withdrawn. The number of extraction wells and trenches, well depths, sizes and locations will be determined during the remedial design phase. In general, the actual design will be site-specific and intended to efficiently remove more highly contaminated water and to impede the flow of contaminated groundwater away from the Site. The rate of groundwater extraction is expected to be between 50 and 100 gallons per minute from all wells combined.

2.7.4.2 Air-Stripper. A series of pipes will connect the extraction wells and trenches to an air-stripper located on DGSC property, probably in the National Guard Area. Air-strippers typically consist of a hollow, cylindrical tower approximately 20 to 30 feet tall and 2 to 3 feet in diameter filled with plastic balls (or other material) called "packing". An air-blower near the base of the tower blows air up through the packing and out the open top of the tower. Simultaneously, contaminated water is pumped to the top of the tower and allowed to trickle down through the packing. After treatment in the air-stripper, the groundwater is expected to contain concentrations of VOCs equal to or less than the Action Levels listed in Table 1. Metals will not be removed by this system.

The air passing up through the packing and contaminated water in the tower evaporates or "strips" away certain volatile organic contaminants such as the ones encountered at DGSC. However, the contaminants are not destroyed. They are transferred from groundwater to the air passing through the air-stripper. To reduce emissions of VOCs to the atmosphere, VOCs are removed from the air by an air emissions control system such as Granular Activated Carbon (GAC), or some other effective technology, where they are adsorbed. If the air-stripper operates at 100 gallons per minute, and the average concentration of volatile organic compounds in the groundwater is approximately 1000 parts per billion, then approximately 1.6 pounds of VOCs will be emitted to the air emissions control system each day. Less than 2 and 1/2 percent of this amount, or less than .04 lbs./day, will be released to the atmosphere after the air passes through the air emissions control system. These VOC emissions rates are far below the limits established in applicable or relevant and appropriate state air emissions regulations listed in Table 4. The above emissions rates are also well below the "to be considered" level established by EPA policy which indicates that sources most in need of air emissions controls are those with actual VOC emissions rates in excess of 15 lbs./day in areas designated as nonattainment for National Ambient Air Quality Standards for ozone. (See OSWER Directive 9355.0-28--Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites.) If any GAC wastes are generated, they will be managed in accordance with the ARARs identified in Table 4. The ARARs for GAC wastes, which may contain VOCs at

concentrations subject to the Land Disposal Restrictions, 40 C.F.R. Part 268, include, among other things, requirements regarding waste analysis, proper storage, notification of appropriate treatment standards, manifesting, and transportation.

2.7.4.3 Monitoring. Air emissions from the air-stripper tower will be monitored to ensure compliance with applicable or relevant and appropriate requirements (ARARs) of state and federal environmental laws. See section 2.8.3 and Table 4 below. For either alternative, VOC concentrations in groundwater would be monitored periodically to evaluate the effectiveness of the pump and treat system, to provide operational data, and to obtain data on changes in contaminant concentrations in response to the interim remedy, which data are needed for the design of the remedial action for OU6. Monitoring locations and frequency will be determined during the design phase. Similarly, monitoring of the air-stripper, groundwater treated by the air-stripper, and air emissions from control equipment will be planned during the design phase to ensure that the air-stripper is effective.

2.7.4.4 Treated Groundwater Management. After the groundwater passes through the air-stripper most of the organic contaminants will have been removed from the groundwater. The treated groundwater will be discharged from the air-stripper at the same rate that contaminated groundwater is pumped from the ground. Alternatives 2a and 2b, described below, are two options available for the discharge of the treated groundwater.

2.7.5.1 Alternative 2a--Pump, Treat, and Discharge to No-Name Creek.

Capital Cost:	\$398,118
Annual O&M Costs:	\$ 46,000
Months to Implement:	8
Present Worth Costs:	\$561,234

After groundwater from the Upper and Lower Aquifers is extracted from the trenches and wells, and treated in an air-stripper as described above, the groundwater would be discharged to No Name Creek. See Figure 6. The groundwater extraction and treatment system would be designed and operated in accordance with the ARARs listed in Table 4.

The discharge of treated groundwater to No Name Creek would comply with the ARARs listed in Table 4 with the possible exceptions of Virginia Surface Water Standards for three metals (selenium, lead, and zinc), for which the highest concentrations observed in groundwater exceeded those Standards. See Tables 2 and 3. The Virginia Water Quality Standards are the basis of effluent limits, established pursuant to the Virginia Pollutant Discharge Elimination System (VPDES), for surface water discharges. The substantive requirements of the VPDES would be ARARs for on-site discharges of treated groundwater to surface water. ("On-site" includes "all suitable areas in very close proximity to the contamination necessary for implementation of the response action.") 40 C.F.R. § 300.400(e). Because the concentrations of these metals in the groundwater vary spatially and temporally, their concentrations in extracted groundwater cannot be predicted before the remedy is designed or becomes operational. Therefore, there is a possibility that the concentrations of one or more of these metals in the treated water might exceed the Virginia Surface Water Standards if this Alternative were selected. Consequently, either a waiver of compliance with those Standards might be required pursuant to section 300.430(f)(1)(ii)(C) of the NCP or additional treatment

(at additional cost) might be required to remove these metals from the water prior to its discharge to the Creek.

2.7.5.2 Alternative 2b - Pump, Treat, and Return to the Upper Aquifer.

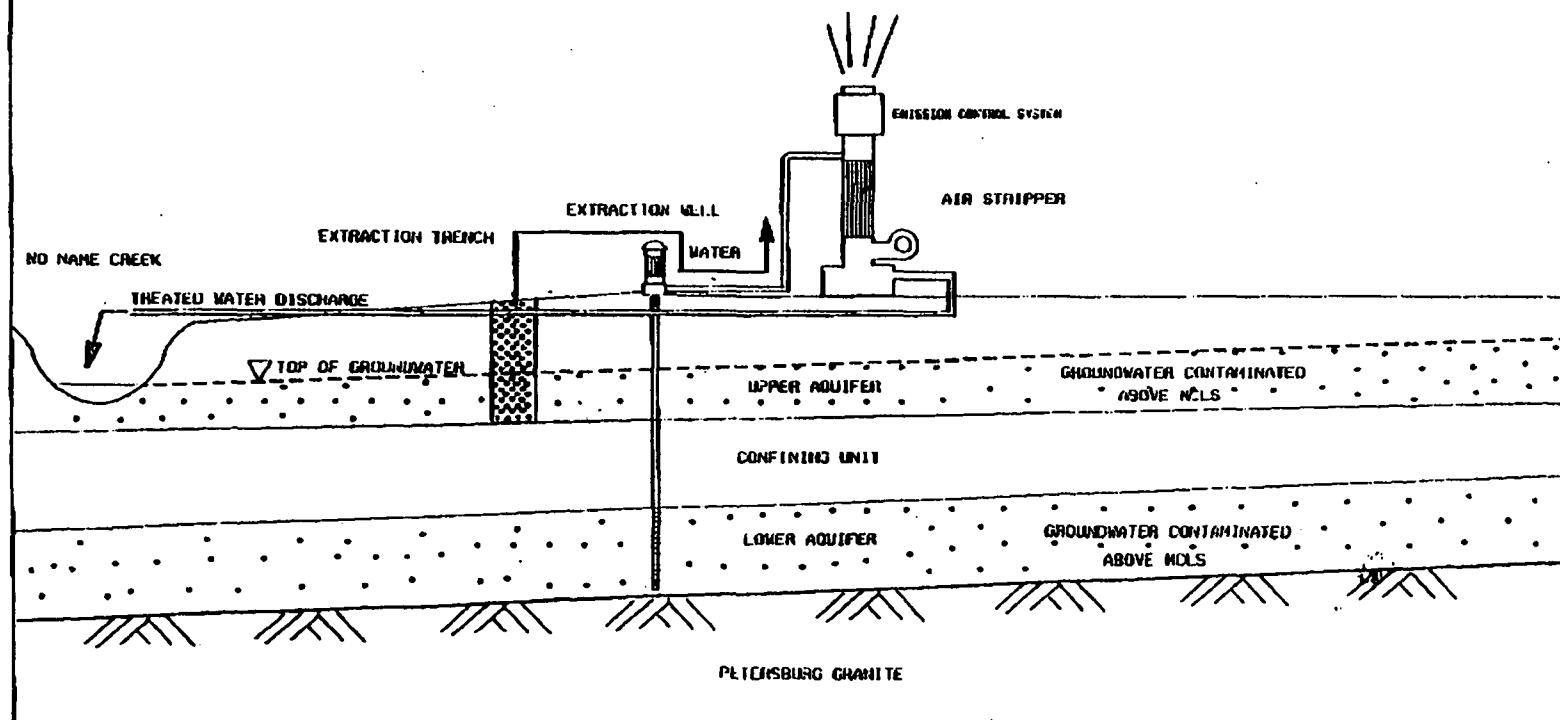
Capital Cost:	\$430,951
Annual O&M Costs:	\$ 46,000
Months to Implement:	8
Present Worth Costs:	\$594,067

Alternative 2b is identical to Alternative 2a from the extraction wells and trenches to the air-stripper discharge. However, beyond the air stripper discharge, the management of the treated water varies between the two systems. See Figure 7. In Alternative 2a, the treated water would be discharged to No-Name Creek. In Alternative 2b, the treated water would be discharged to a series of infiltration trenches located on DGSC property as shown in Figure 8. As with Alternative 2a, it is expected that this interim remedy would become part of a total remedial action that would attain ARARs. As discussed above, the groundwater extraction and treatment system would be designed and operated in compliance with the ARARs listed in Table 4.

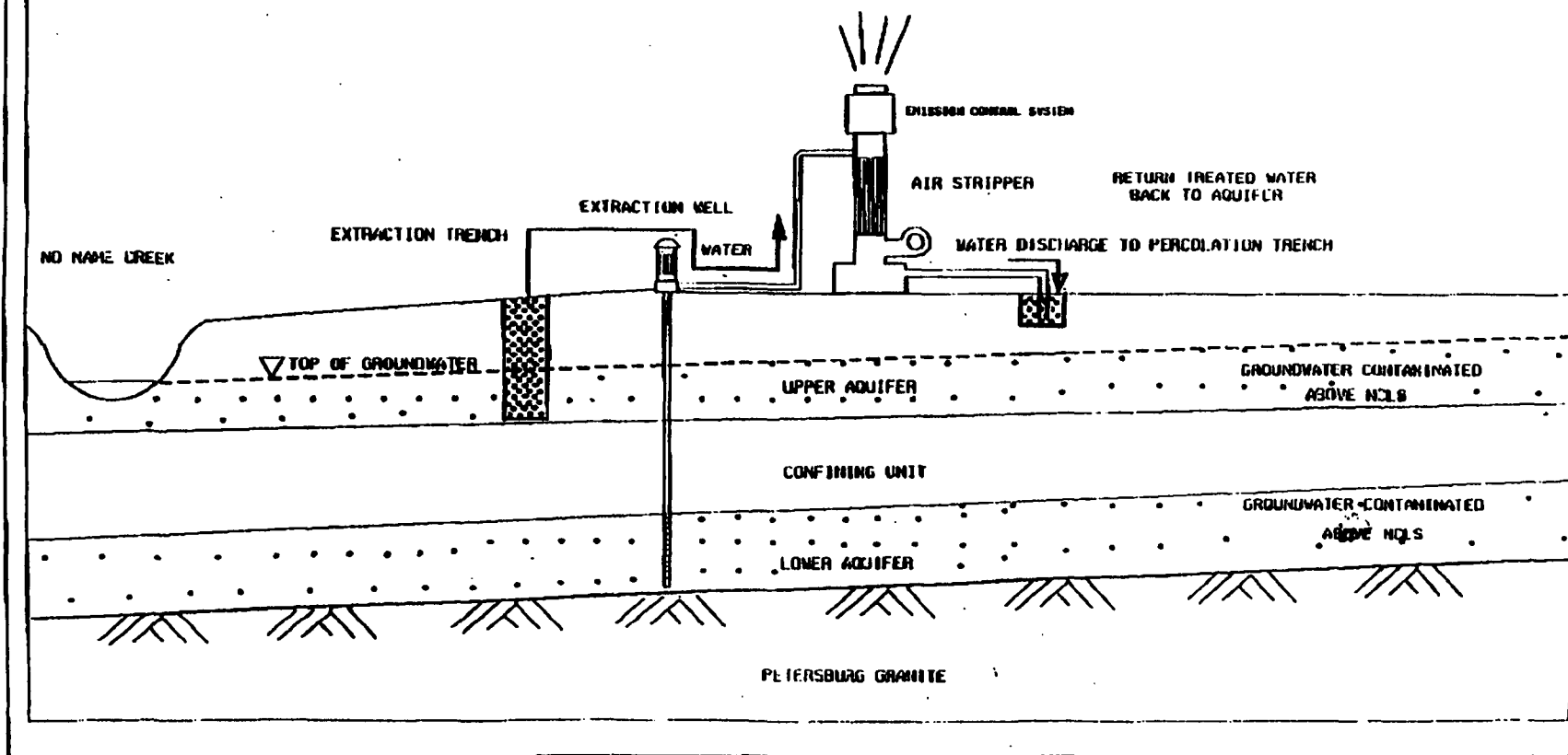
The discharge of treated groundwater to the infiltration trenches would comply with the ARARs listed in Table 4. Although certain metals might be discharged at concentrations exceeding the numerical limits of the Virginia Groundwater Standards, this discharge would nevertheless comply with those Standards because the only source of the metals discharged will be the aquifer from which the water is being pumped for treatment and the metals discharged will be the same as those contained in the groundwater originally.

2.7.6 Implementation Requirements and Schedule. The interim action at OU9 is scheduled to become operational by July 1995 (estimated). The interim remedy would continue to operate until the OU6 final remedy becomes operational.

DGSC OPERABLE UNIT 9 INTERIM REMEDIAL ACTION ALTERNATIVE 2A



DGSC OPERABLE UNIT 9 INTERIM REMEDIAL ACTION ALTERNATIVE 2B



2.7.7 Assumptions, Limitations and Uncertainties. A major assumption contained in this document is that pump and air-strip technology will be effective at this Operable Unit. At some sites where groundwater can be efficiently extracted and treated, groundwater contamination is not always reduced to the desired concentrations or in accordance with predicted schedules. This situation is a particular problem when Dense Non-aqueous Phase Liquids are present, which is not thought to be the case at DGSC. DLA believes that the selected interim action will be effective at DGSC. In addition, since this is only an interim measure, the effectiveness of this system will be carefully assessed and will be an important evaluation factor during the selection of the final remedial measure for OU6.

2.7.8.0 Physical Effects on the Environment. Factors affecting the environment which must be considered when evaluating the pump and treat alternatives include aquifer draw down and disposal of the treated groundwater. Treated groundwater will be discharged to infiltration trenches if Alternative 2b is implemented. If Alternative 2a is implemented the groundwater will be discharged to No Name Creek. The effects of these alternate methods of handling the treated groundwater are discussed in greater detail below.

2.7.8.1 Alternative 2a. No Name Creek in the vicinity of the NGA is an ephemeral stream and has very low flows. Alternative 2a would discharge approximately 50 to 100 gallons per minute to the Creek. However, contaminated groundwater from the Upper Aquifer naturally discharges into the Creek currently, so the net effect of the discharge on flow rates in the Creek would be less than 50 to 100 gallons per minute.

Because the water removed from the aquifer would not be replaced under Alternative 2a, groundwater levels of the Upper Aquifer would decrease in the vicinity of the groundwater extraction wells and trenches.

2.7.8.2 Alternative 2b. In Alternative 2b, treated groundwater would be discharged to infiltration trenches in the OSA/Area 50/NGA. Because the overall rate of groundwater extraction would equal the rate of treated water discharge to infiltration trenches, there would not be a widespread impact on groundwater. However, there would be localized areas of groundwater mounding and groundwater depressions in the vicinity of the plume. The water level elevation of the Upper Aquifer may decrease significantly in the vicinity of extraction wells and trenches. The groundwater level near the infiltration trenches would rise. However DLA and EPA do not anticipate major changes in groundwater levels east of No Name Creek.

With respect to stream flow changes, No Name Creek has been found to be a gaining stream (i.e., groundwater enters the Creek) in the area where it flows off the DGSC property. While the installation of an upgradient intercepting trench system could be expected to temporarily reduce stream flow, as the return flow reaches the creek watershed, steady state conditions are expected to develop which would result in return to near normal conditions. The operational controls for the remedy will be developed to take this point into consideration. The overall impact to the environment would be expected to be negligible. Accordingly, Alternative 2b would be an appropriate interim measure.

2.8.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

2.8.1 Below, each of the remedial action alternatives are compared on the basis of the nine evaluation criteria set forth in the NCP at 40 C.F.R. Section 300.430(e)(9). The information used in this comparison is derived mainly from the Focused Feasibility Study Report for OSA/Area 50/NGA Ground Water (Operable Unit 6), Law Environmental, Inc. April, 1993; Ground-Water Contamination and Movement at the Defense General Supply Center, U.S. Geological Survey, Richmond, Va., 1990; and, Remedial Investigation for Area 50/Open Storage Area/Natl. Guard Area, Dames & Moore, July, 1989, along with drafts of the OU9 Proposed Plan and ROD. All of these documents are in the administrative record file maintained by DGSC. The nine criteria are categorized below into three groups: threshold criteria, primary balancing criteria, and modifying criteria.

THRESHOLD CRITERIA

1. Overall protection of human health and the environment; and
2. Compliance with applicable or relevant and appropriate requirements (ARARs).

PRIMARY BALANCING CRITERIA

3. Long-term effectiveness and permanence;
4. Reduction of toxicity, mobility, or volume through treatment;
5. Short-term effectiveness;
6. Implementability; and
7. Cost.

MODIFYING CRITERIA

8. State/Support Agency acceptance; and
9. Community acceptance.

These evaluation criteria relate directly to requirements in Section 121 of CERCLA, 42 U.S.C. § 9621, which determine the overall feasibility and acceptability of the remedy.

Threshold criteria must be satisfied in order for a remedy to be eligible for selection. Primary balancing criteria are used to weigh major trade-offs between remedies. State/Support Agency and community acceptance are modifying criteria formally taken into account after public comment is received on the Proposed Plan. A summary of the relative performance of the alternatives with respect to each of the nine criteria follows. This summary provides the basis for determining which alternative provides the "best balance" of tradeoffs with respect to the nine evaluation criteria.

2.8.2 **Overall Protection of Human Health and the Environment.** A primary requirement of CERCLA is that the selected remedial action be protective of human health and the environment. A remedy is protective if it reduces current and potential risks to acceptable levels within the established risk range posed by each exposure pathway at the operable unit.

The No Action alternative would not be protective of human health and the environment because it allows the contaminants to continue to migrate away from the Site. The No Action alternative would not eliminate any exposure pathways or reduce the level of risk. Therefore, the No Action alternative will not be considered further in this analysis as an option

for this Operable Unit.

Both of the Pump and Treat Alternatives would protect human health and the environment by reducing or controlling the risk through treatment to begin reducing the concentration and volume of contaminants in the groundwater and by inhibiting the migration of contaminated groundwater in the aquifers. However, the concentrations of contaminants in the groundwater vary spatially and temporally and the concentrations of metals that will remain in groundwater after it is treated to remove VOCs cannot be predicted before the remedy is designed or operational. Thus, it is anticipated that the treated water effluent produced by Alternative 2a would contain certain metals, possibly in excess of applicable Virginia Surface Water Standards, since these metals were present at such concentrations in the most contaminated well samples. Alternative 2b would not include surface water discharge of the treated groundwater, but would discharge treated groundwater to an area that is already contaminated. Because Alternative 2a, which includes surface water discharge of treated water, poses the possibility of producing treated water effluent containing certain metals at concentrations exceeding Virginia Surface Water Standards, Alternative 2b is considered more protective of the environment.

2.8.3 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs). This criterion addresses whether a remedy will meet ARARs or provide grounds for invoking a waiver under the NCP at 40 C.F.R. Section 300.430(f)(1)(ii)(C). Under Section 121(d) of CERCLA, 42 U.S.C. Section 9621(d), remedial actions at CERCLA sites must attain applicable or relevant and appropriate standards, requirements, criteria, and limitations (collectively referred to as "ARARs") under federal environmental laws and promulgated State environmental or facility siting laws, unless such ARARs are waived pursuant to Section 121(d)(4) of CERCLA, 42 U.S.C. Section 9621(d)(4). See Table 4. Section 300.5 of the NCP defines "applicable requirements" as "those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site." "Relevant and appropriate requirements" are defined as "those cleanup standards, standards of control and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not 'applicable' to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site." 40 C.F.R. § 300.5.

In addition to ARARs, Table 4 lists "to-be-considered" (TBC) material identified as useful in evaluating and selecting this remedy. TBC material may include advisories, criteria, or guidance to be considered for a particular release. CERCLA does not require compliance with this TBC material. As in other aspects of this interim remedial action, the identified ARARs and TBCs relate only to the selection of an interim remedial action for OU9 and not to the final remedial action which will be selected at a later date for OU6.

All aspects of Alternative 2b, including groundwater extraction, treatment, and discharge to infiltration trenches, air emissions, and management of VOC-contaminated GAC waste, would comply with the ARARs identified in Table 4. With one exception discussed in the next paragraph,

all aspects of Alternative 2a would also comply with the ARARs identified in Table 4. Both Alternatives 2a and 2b would treat extracted groundwater to meet all currently promulgated federal and state water quality standards for VOCs in surface water or groundwater. See Table 1 for the VOC levels which these Alternatives would meet. Additionally, the air-stripper used in these Alternatives will be designed with an air emissions control system to meet all substantive and applicable requirements of Virginia air quality regulations listed in Table 4.

As previously stated, the discharge of treated groundwater to No Name Creek under Alternative 2a would comply with the ARARs listed in Table 4 with the possible exception of Virginia Surface Water Standards for selenium, lead, and zinc which were measured in the groundwater at concentrations exceeding those Standards. See Tables 2 and 3. In order to implement Alternative 2a, either a waiver of compliance with the Virginia Surface Water Standards pursuant to section 300.430(f)(1)(ii)(C) of the NCP or additional treatment to remove metals might be necessary. Alternative 2b would comply with all pertinent ARARs listed in Table 4. Because of the uncertainty regarding the ability of Alternative 2a to comply with the Virginia Surface Water Standards for certain metals, Alternative 2b is considered a better choice than Alternative 2a with reference to this criterion.

The final cleanup levels for contaminated groundwater remaining in the aquifer are not addressed in this ROD because such goals are beyond the scope of the selected interim remedial action, the purposes of which are limited to begin reducing the potential for current or future exposures to the contaminated groundwater in the Upper and Lower Aquifers, reducing the migration and dispersion of contaminants in groundwater of OU9, and obtaining data on changes in the aquifer and contaminant concentrations in response to the pump and treat system as a method for decontaminating groundwater at this Operable Unit. Thus, the ARARs that pertain to this interim action are simply those that relate to groundwater extraction, treatment to remove VOCs from extracted groundwater, management of wastes (e.g., spent activated carbon) generated during groundwater treatment, and discharge of treated groundwater. The question of whether or not MCLs, MCLGs, or chemical-specific ARARs are attained in the aquifer itself is beyond the scope of this interim remedy. The final cleanup levels for the aquifer will be addressed in the final remedial action ROD for OU6.

On-site activities will also be performed in compliance with other applicable legal requirements (e.g., worker health and safety laws and regulations, see 40 C.F.R. § 300.150) that are not within the scope of federal environmental or state environmental or facility siting laws. Off-site activities (e.g., off-site transportation, treatment, or disposal of spent activated carbon) performed under this interim remedial action will comply with all applicable laws and regulations.

TABLE 4

**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
AND "TO BE CONSIDERED" MATERIAL (TBCs)
Area 50 Landfill, Open Storage Area, and National Guard Area--Groundwater
Operable Unit 9
Defense General Supply Center, Richmond, Virginia.**

Standards, requirements, criteria, and limitations	Citation	Description of affected activities	Nature of Requirement	Alternatives affected by Requirement
Non-zero Maximum Contaminant Level Goals (MCLGs) and MCLs promulgated under the Safe Drinking Water Act, 42 U.S.C. § 300f to 300j-26. See Table 1 for MCLs and MCLGs relevant to this Operable Unit.	40 C.F.R. Part 141, Subparts F and G	Discharge of treated groundwater into trenches	Relevant and appropriate	2b
Underground Injection Control Program: Criteria and Standards	40 C.F.R. Part 146, Subpart F	Discharge of treated groundwater into trenches	Applicable	2b

TABLE 4 (cont.)

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
AND "TO BE CONSIDERED" MATERIAL (TBCs)
Area 50 Landfill, Open Storage Area, and National Guard Area--Groundwater
Operable Unit 9
Defense General Supply Center, Richmond, Virginia

Standards, requirements, criteria, and limitations	Citation	Description of affected activities	Nature of Requirement	Alternatives affected by Requirement
Virginia Groundwater Standards	VR680-21-04	Discharge of treated groundwater into trenches	Applicable	2b
Commonwealth of Virginia Regulations for the Control and Abatement of Air Pollution--Emission Standards for Odor; Emission Standards for Toxic Pollutants; Standards of Performance for Toxic Pollutants	VR 120-04-01, 120-04-02, 120-04-03, & 120-05-03	Atmospheric emissions from air-stripper	Relevant and Appropriate	2a & 2b

TABLE 4 (cont.)

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
AND "TO BE CONSIDERED" MATERIAL (TBCs)
Area 50 Landfill, Open Storage Area, and National Guard Area--Groundwater
Operable Unit 9
Defense General Supply Center, Richmond, Virginia

Standards, requirements, criteria, and limitations	Citation	Description of affected activities	Nature of Requirement	Alternatives affected by Requirement
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities--Air Emission Standards for Process Vents and Equipment Leaks	40 C.F.R. Part 264, Subparts AA and BB	Atmospheric emissions from air-stripper	Relevant and Appropriate	2a & 2b
VA Hazardous Waste Management Regulations (VHWMR) VR 672-10-1-- Identification and Listing of Hazardous Wastes; Notification of Hazardous Waste Management Activity; Manifest Regulations for Hazardous Waste Management; Regulations Applicable to Generators of Hazardous Waste; Regulations	VHWMR, Parts III, IV, V, VI, VII, and X	Treatment of groundwater. On-site management, manifesting, and off-site transport of spent activated carbon used to control air emissions from air-stripper.	Applicable	2a & 2b

TABLE 4 (cont.)

**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
AND "TO BE CONSIDERED" MATERIAL (TBCs)
Area 50 Landfill, Open Storage Area, and National Guard Area--Groundwater
Operable Unit 9
Defense General Supply Center, Richmond, Virginia**

S t a n d a r d s , r e q u i r e m e n t s , c r i t e r i a , a n d l i m i t a t i o n s	Citation	Description of a f f e c t e d a c t i v i t i e s	Nature o f R e q u i r e m e n t	Alternatives a f f e c t e d b y R e q u i r e m e n t
Applicable to Transporters of Hazardous Waste; Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities				

TABLE 4 (cont.)

**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
AND "TO BE CONSIDERED" MATERIAL (TBCs)
Area 50 Landfill, Open Storage Area, and National Guard Area--Groundwater
Operable Unit 9
Defense General Supply Center, Richmond, Virginia**

S t a n d a r d s , requirements, criteria, and limitations	Citation	Description of a f f e c t e d activities	Nature of Requirement	Alternatives affected by Requirement
Land Disposal Restrictions	40 C.F.R. Part 268	Notification (\$ 268.7), storage (\$ 268.50), manifesting, and off-site transportation requirements applicable to spent activated carbon used to control air emissions from air-stripper	Applicable	2a & 2b
Corrective Action for Solid Waste Management Units	40 C.F.R. Part 264, Subpart F	Groundwater extraction and discharge to infiltration trenches	Relevant and Appropriate	2a & 2b

TABLE 4 (cont.)

**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
AND "TO BE CONSIDERED" MATERIAL (TBCs)
Area 50 Landfill, Open Storage Area, and National Guard Area--Groundwater
Operable Unit 9
Defense General Supply Center, Richmond, Virginia**

S t a n d a r d s , r e q u i r e m e n t s , c r i t e r i a , a n d l i m i t a t i o n s	Citation	Description of a f f e c t e d a c t i v i t i e s	Nature o f R e q u i r e m e n t	Alternatives a f f e c t e d b y R e q u i r e m e n t
VA Surface Water Standards With General, Statewide Application, used in conjunction with the VA Pollutant Discharge Elimination System to establish contaminant limits for discharges to surface water	VR 680-21-01 and 680-14-01	Discharge of treated groundwater to surface water	Applicable	2a
Endangered Species Act of 1973	16 U.S.C. §§ 1531-1544	Groundwater extraction and discharge	Applicable	2a & 2b
VA Endangered Species Act	Va. Code §§ 29.1-563 et seq.	Groundwater extraction and discharge	Applicable	2a & 2b
VA Wetlands Regulations	VR 450-01-0051	Groundwater extraction and discharge	Applicable	2a & 2b

TABLE 4 (cont.)

**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
AND "TO BE CONSIDERED" MATERIAL (TBCs)
Area 50 Landfill, Open Storage Area, and National Guard Area--Groundwater
Operable Unit 9
Defense General Supply Center, Richmond, Virginia**

S t a n d a r d s , r e q u i r e m e n t s , c r i t e r i a , a n d l i m i t a t i o n s	Citation	Description of a f f e c t e d a c t i v i t i e s	Nature o f R e q u i r e m e n t	Alternatives a f f e c t e d b y R e q u i r e m e n t
Wetlands Protection	40 C.F.R. § 6.302 and Pt. 6, App. A, E.O. 11990	Groundwater extraction and discharge	Applicable	2a & 2b
VA Stormwater Management Regulations	VR 215-02-00	Treatment system construction and maintenance	Applicable	2a & 2b
Chesapeake Bay Preservation Area Designation and Management Regulations	VA Code §§ 10.2100 et seq.; VR 173- 02-01	Treatment system construction and maintenance	Applicable	2a & 2b
Guidelines for Specification of Disposal Sites for Dredged or Fill Material	40 C.F.R. Parts 230 and 232	Treatment system construction	Applicable	2a & 2b

TABLE 4 (cont.)

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)
AND "TO BE CONSIDERED" MATERIAL (TBCs)
Area 50 Landfill, Open Storage Area, and National Guard Area--Groundwater
Operable Unit 9
Defense General Supply Center, Richmond, Virginia

Standards, requirements, criteria, and limitations	Citation	Description of affected activities	Nature of Requirement	Alternatives affected by Requirement
Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites.	OSWER Directive # 9355.0-28	Groundwater remediation generally	TBC	2a & 2b

2.8.4 Long-Term Effectiveness and Permanence. This evaluation criterion addresses the long-term protection of human health and the environment once remedial action cleanup goals have been achieved, and focuses on residual risks that will remain after completion of the remedial action.

Extraction and treatment of contaminants in the Upper and Lower Aquifers will reduce groundwater contamination and will enhance the attainment of a permanent remedy for these aquifers. With reference to permanence, both alternatives would permanently remove VOCs from the groundwater extracted from the contaminated plume. Again, with reference to permanence, both Alternatives 2a and 2b are similar in that they are interim actions designed to function only until the remedy selected in the final ROD for this area can be implemented. Finally, Alternatives 2a and 2b would be about equally effective in that both would remove the same amount of VOCs and would produce operational data that could be used to accelerate selection and implementation of the final remedy.

2.8.5 Reduction of Mobility, Toxicity, and Volume Through Treatment. This evaluation criterion addresses the degree to which a technology or remedial alternative reduces the toxicity, mobility, or volume of a hazardous substance. Section 121(b) of CERCLA, 42 U.S.C. Section 9621(b), establishes a preference for remedial actions that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances. A combination of treatment and engineering controls may be used, as appropriate, to achieve protection of human health and the environment, as set forth in the NCP at 40 C.F.R. Section 300.430(a)(iii). Treatment should be utilized to address the principal threats (such as liquids, high concentrations of toxic compounds, and highly mobile materials) presented by a site and engineering controls such as containment will be considered for wastes that pose a relatively low long term threat or where treatment is impracticable. See 40 C.F.R. § 300.430(a)(iii).

The pump and treat system of both Alternatives 2a and 2b would reduce the toxicity, mobility, and volume of the contaminants in the extracted groundwater from the Upper and Lower Aquifers. Air-stripping of VOCs is a proven treatment process which has been demonstrated to effectively reduce VOC contamination by forcing an air stream through the water and causing the compounds to evaporate. Then, the activated carbon emissions control system would adsorb the compounds with the result that final emissions would be nearly at non-detect levels. Spent activated carbon would be removed from the system and incinerated or regenerated, resulting in the destruction of contaminants.

By pumping groundwater from the most contaminated areas of the Upper and Lower Aquifers, both Alternatives 2a and 2b would reduce the mobility of the contaminants by inhibiting the migration of contaminated groundwater in the aquifers. The discharge of treated groundwater to infiltration trenches under Alternative 2b could potentially further mobilize contaminants in the source area, however, this potential problem can be mitigated during the design phase. However, Alternative 2a might increase the movement of certain metal contaminants into No Name Creek and thus would be less desirable than Alternative 2b from this perspective.

2.8.6 Short-Term Effectiveness. This evaluation criterion addresses the period of time needed to achieve protection of human health and the environment, and any adverse impacts that may be posed during the

construction and implementation period of a remedy, until cleanup goals are achieved.

Both Alternatives 2a and 2b would be effective in the short-term because they would prevent further degradation of groundwater quality and would initiate reduction in toxicity, mobility, and volume of VOC contamination until a final action is selected and implemented. However, Alternative 2a would possibly increase the rate of discharge into No Name Creek of certain metallic contaminants at concentrations exceeding Virginia Surface Water Standards. No adverse effects on human health or the environment are expected from Alternative 2b.

Any short-term risk to workers involved in construction of the remedy would be reduced through implementation of a health and safety plan.

2.8.7 Implementability. This evaluation criterion addresses the technical and administrative feasibility of each remedy, including the availability of materials and services needed to implement the chosen remedy.

The pump and treat system is a treatment process which has been demonstrated to effectively reduce VOC contamination at many other NPL sites. Air-stripping technology is relatively simple and well-understood. The design stage can be completed in approximately eight months. There are many sources of air-stripping technology and equipment available for use at DGSC and no unusual services or materials are required. Alternative 2a, stream discharge, would probably require a discharge point into No-Name Creek which is located outside the DGSC boundary, and a delay to obtain access would be a possibility. Alternative 2b would be implemented entirely on property under the control of DGSC.

2.8.8 Cost. Section 121 of CERCLA, 42 U.S.C. Section 9621, requires selection of a cost-effective remedy that protects human health and the environment and meets the other requirements of the statute. The alternatives are compared with respect to present worth cost, which includes all capital costs and the operation and maintenance costs incurred over the life of the project. Capital costs include those expenditures necessary to implement a remedial action, including construction costs.

The estimated costs consist of capital, operating, and present worth values. The capital costs of the two Alternatives (\$398,118 for Alternative 2a versus \$430,951 for Alternative 2b) are nearly equivalent, which reflects the similarity between them. Also, the difference between the two estimates is not very significant because it is in the range of the uncertainty inherent in preliminary estimates of construction costs. A present worth analysis of each Alternative provided estimates of \$561,234 for Alternative 2a and \$594,067 for Alternative 2b, also indicating that the cost of either Alternative is about the same.

2.8.9 State/Support Agency Acceptance. This criterion indicates whether, based on its review of the RI/FS and Proposed Plan, the State and/or the Support Agency concurs with, opposes, or has no comment on the preferred alternative.

The Virginia Department of Environmental Quality (VDEQ) served as the support agency for the Commonwealth of Virginia. VDEQ has reviewed the remedial alternatives under consideration for the DGSC Site and has

provided EPA with technical and administrative requirements for the Commonwealth of Virginia. VDEQ agrees with the analysis of alternatives presented in this ROD.

Both the EPA and the Commonwealth of Virginia, upon review of the Proposed Plan, concur in the selection of the Pump and Treat Alternative 2b as an interim remedial action for DGSC OU9.

2.8.10 Community Acceptance. This criterion includes a determination of which components of the alternatives interested persons in the community support, have reservations about, or oppose based on public comments.

On June 2, 1993, a public meeting was held at the Bellwood Elementary School, near Richmond, Virginia to discuss the preferred alternative as described in the Proposed Plan. A public comment period for the Proposed Plan was held from May 3, 1993 through June 17, 1993. Comments received during the public meeting and the public comment period are discussed in the Responsiveness Summary attached to this ROD.

2.9.0 SELECTED REMEDY

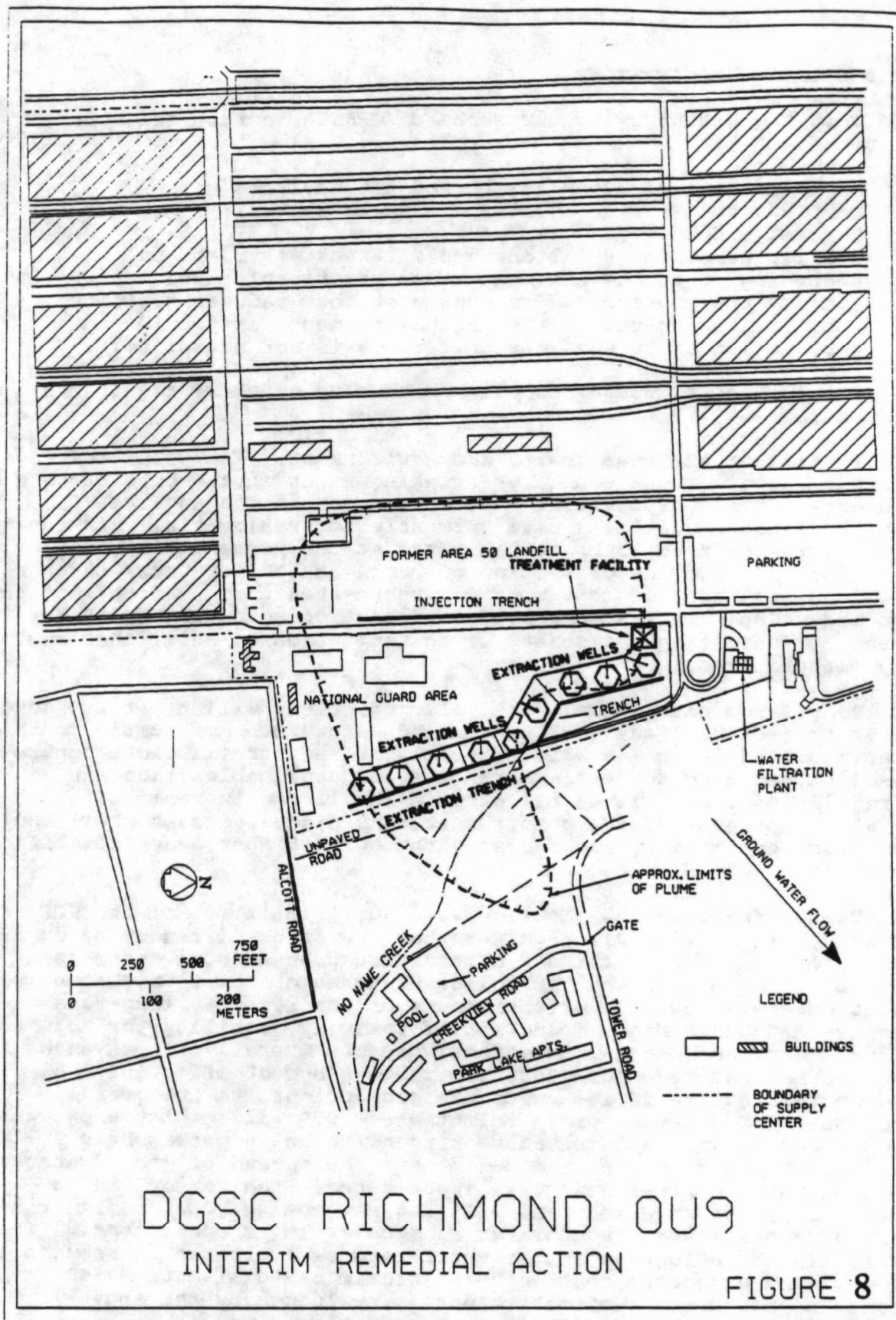
2.9.1 General Description of the Selected Remedy. Based upon consideration of the requirements of CERCLA, the detailed analysis of the alternatives, and public comments, DLA has selected Alternative 2b (Pump, Treat and Discharge into the Upper Aquifer) as the interim remedial action for the OU9. This action will achieve significant risk reduction early in the remedial process. The system will include the following basic components. Contaminated groundwater will be captured and removed from the Upper and Lower Aquifers through a series of extraction wells and trenches. Specific well locations and pumping rates have not yet been determined. However, initial evaluation is that the pumping rate will be between 50 and 100 gallons per minute. The water from the extraction wells and trenches will be transported to a centrally located air-stripper and treated. Following treatment, the groundwater will be discharged to a series of infiltration trenches located on DGSC property. See Figure 8.

The trenches are expected to be approximately ten feet deep and 600 to 1200 feet long. Air emissions from the air-stripper will be controlled with an activated carbon adsorption system. The interim system will be operated until the final ROD for OU6 is implemented. During this interim action, the air-stripper is expected to reduce VOC contaminant concentrations in treated groundwater to below the action levels shown in Table 1 prior to discharging it to infiltration trenches.

The selected remedy includes a groundwater monitoring program that will be developed and implemented during the remedial design and remedial action phases. Similarly, the treatment process itself will be monitored with respect both to the quantity and quality of the return flow, as well as to the air emissions control system.

2.9.2 Treatability Testing. Because pump and treat technology is well understood, and because this interim remedial action is not the final action, detailed treatability testing will not be performed at this Operable Unit. However, it is possible that limited additional chemical analysis of the groundwater will be performed during the design phase in

order to determine if any special pre-treatment or post-treatment of the water is necessary. During construction of the extraction wells, well development tests will be conducted on each well as it is completed. The number, spacing, and pumping rate of the wells and trenches will be adjusted according to the results of these tests. Some minor changes may be made to the design of this remedy as a result of these tests.



2.10.0 STATUTORY DETERMINATIONS

2.10.1 To meet the statutory requirements of CERCLA Section 121, the selected remedy must:

- Be protective of human health and the environment;
- Comply with ARARs (or justify an ARARs waiver);
- Be cost effective;
- Utilize permanent solutions and alternative treatment technologies to the maximum extent practicable; and
- Satisfy the preference for treatment that reduces toxicity, mobility, or volume as a principal element, or provide an explanation as to why this preference is not satisfied.

2.10.2 How the selected remedy complies with each of these requirements is summarized below:

2.10.2.1 Protection of Human Health and Environment. The Upper and Lower Aquifer system is a current source of drinking water in the area of DGSC and therefore presents a potential threat to human health and the environment. Although no wells used currently for residential drinking water supply are believed to be contaminated at the present time, the interim action will provide protection of human health for users through extraction and treatment of contaminated groundwater until a final action is determined. The remedy also provides protection to human health and the environment by inhibiting the spread of contamination to wells that are not currently contaminated.

2.10.2.2 Compliance with ARARs. The selected remedy will treat extracted groundwater to meet all Federal MCLGs and MCLs for VOCs applicable to this interim action. Additionally, the air-stripper and air emissions control system will be designed to meet substantive and applicable State air quality regulations, as well as all other ARARs listed in Table 4. Finally, all components of the pump, treat, and discharge system will be constructed and operated in accordance with the pertinent ARARs identified in Table 4.

2.10.2.3 Cost-Effectiveness. Section 300.430(f)(1)(ii)(D) of the NCP, 40 C.F.R. § 300.430(f)(1)(ii)(D), requires that the selected remedy be cost-effective. That section of the NCP states that cost-effectiveness is determined by first evaluating the following three of the five "balancing" criteria to determine overall effectiveness of the remedy: long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective. A remedy is cost-effective if its costs are proportional to its overall effectiveness. The interim remedy selected for OU9 will employ a proven technology which can be implemented year round to begin permanently removing VOCs from groundwater and to inhibit the spread of groundwater contamination until a final remedy is implemented. The remedy can be constructed in less than a year and will begin removing VOCs and limiting the spread of contaminated groundwater as soon as it is operational. The remedy will also be effective in the short-term as explained in section 2.8.6 above. The projected cost of this interim remedial action is proportional to its overall effectiveness as evaluated by the above criteria. Therefore, this remedy is cost-effective.

2.10.2.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable. The selected remedy is not designed or expected to be final, however, in light of its limited scope, it provides the best balance of trade-offs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, and cost, while also considering the statutory preference for treatment as a principal element and considering state and community acceptance. The objectives of this interim remedial action are to begin reducing the potential for current or future exposure to contaminated groundwater in the Upper and Lower Aquifers, through treatment and containment, and to reduce the migration of contaminants. Extraction and treatment of contaminants in the Upper and Lower Aquifers by the selected remedy will immediately begin to achieve significant reduction in the risk at the Site in the short-term by inhibiting the spread of contaminated groundwater and by permanently removing a portion of the VOCs, and will enhance implementation of a final remedy for this Operable Unit by providing operational data for use in selecting and designing the final action for OU6. Utilization of a permanent solution will be addressed in the final decision document for OU6.

2.10.2.5 Preference for Treatment as a Principal Element. Because this remedy does not constitute the final remedy for the Operable Unit, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this remedy, will be addressed by the final response action. The Pump and Treat remedy is a treatment process which has been demonstrated to effectively reduce VOC contamination of groundwater at other NPL sites. The VOCs removed by the air-stripper will be captured by air emissions controls and taken off-site for incineration or other treatment.

2.10.2.6 Documentation of Significant Changes. The Interim Proposed Plan for OU9 was released to the public on May 3, 1993. The Proposed Plan identified Alternative 2b - Pump, Treat and Discharge to the Upper Aquifer as the preferred alternative. All written and verbal comments submitted during the public comment period were reviewed. Upon review of the comments it was determined that no significant changes to the alternative, as it was originally identified in the Proposed Plan, were necessary prior to it becoming the selected remedy.

APPENDIX A
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