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EPA Superfund
Record of Decision:

ABERDEEN PROVING GROUND (EDGEWOOD AREA)
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CLUSTER 1, FORMER NIKE SITE
EDGEWOOD AREA
ABERDEEN PROVING GROUND

RECORD OF DECISION

Submitted to

Environmental Conservation and
Restoration Division
Aberdeen Proving Ground, Maryland 21010

Submitted and Prepared by

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LIST OF ACRONYMS

AEHA	Army Environmental Hygiene Agency
APG	Aberdeen Proving Ground
ARARs	applicable or relevant and appropriate requirements
AWQC	Ambient Water Quality Criteria
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COMAR	Code of Maryland Regulations
CPF	cancer potency factor
CWM	chemical warfare material
ERA	Ecological Risk Assessment
FS	Feasibility Study
HI	Hazard Index
HQ	hazard quotient
MCL	maximum contaminant level
MDE	Maryland Department of the Environmental
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	operations and maintenance
OSHA	Occupational Safety and Health Administration
PAHs	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
RA	Risk Assessment
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RfDs	reference doses
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SBR	sequencing batch reactor
SQC	sediment quality criteria
TCE	trichloroethene, trichloroethylene
TEU	Technical Escort Unit
TRVs	toxicity reference values
USEPA	U.S. Environmental Protection Agency
UV	ultraviolet
UXO	unexploded ordnance
VOCs	volatile organic compounds

1. DECLARATION OF THE RECORD OF DECISION

1.1 SITE NAME AND LOCATION

Cluster 1, former Nike Missile Site (Nike Site), Edgewood Area, Aberdeen Proving Ground (APG), Maryland.

1.2 STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) document presents the remedial actions selected to reduce the risks posed by contaminated shallow groundwater, the Launch Southwest Landfill, and Launch Area septic/siphon tanks and sewer lines (hereinafter referred to as sanitary sewer system), and six decommissioned Nike missile silos located at the Nike Site (Cluster 1 of the Lauderick Creek Area) at APG, Maryland. These remedial actions were developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for this site. Documents contained in the Administrative Record are identified in Sect. 2.2.

The U.S. Environmental Protection Agency (USEPA) and the Maryland Department of the Environment (MDE) concur on the selected remedies.

1.3 ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the site, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

1.4 DESCRIPTION OF THE SELECTED REMEDIES

The Cluster 1 cleaning is part of a comprehensive environmental investigations and cleanup currently being performed at APG under the CERCLA program. APG is divided into 13 study areas comprising 55 clusters that encompass potential sources of contamination. Cluster 1 of the Nike Site is part of the Lauderick Creek Study Area. The remaining clusters of the Lauderick Creek Study Area and the other study areas are being addressed as separate actions.

This action addresses the principal threats at the Nike Site in four ways: extracting and treating contaminated groundwater, isolating the Launch Southwest Landfill as a potential source of contamination by installing an impermeable composite cap, removing contaminants from the sanitary sewer system and filling the system with an inert material, and accepting the interim missile silo remedial action (removal of contaminated liquids and filling the silos with an inert material) as the final action. This four-part remedy minimizes the risk associated with exposures to contaminated materials by removing the source(s) of contamination where possible, by isolating from the environment potential contaminants that will remain in place (Launch Southwest Landfill), and by limiting access to the site and affected groundwater. The major components of the selected remedy, arranged by site/feature, are presented in the following sections.

1.4.1 Selected Remedy for Contaminated Groundwater

Removal of groundwater using extraction wells and treatment of the water using aboveground reductive dehalogenation.
Discharge of treated water to a tributary of the Bush River.
Long-term groundwater monitoring to ensure reduction of contaminants to clean-up levels.
Land-use restrictions prohibiting the use of on-site groundwater.

1.4.2 Selected Remedy for Launch Southwest Landfill

Installation of a composite cap over the landfill (approximately 1.1 acres).
Institution of land-use restrictions.
Installation of a chain link fence.
Installation of groundwater monitoring wells and long-term groundwater monitoring.

1.4.3 Selected Remedy for Sanitary Sewer System

Remove sludge from sewer system.
High-pressure water blast sewer lines, manhole, and tanks to clean the system.
Fill clean tanks, manholes, and pipes with inert material (e.g., concrete grout or slurry mixture).
Remove all surficial structures, regrade, and vegetate.

Dispose of the sludge and wash water off-site.

1.4.4 Selected Remedy for Nike Missile Silos

No further action will be concluded on the Nike Missile Silos. It is recommended that the removal action-which included pumping the lead-contaminated water from the six silos, transporting the water off-site for treatment, and filling the six missile silos with concrete-be accepted as the final action.

1.5 STATUTORY DETERMINATIONS

The selected remedies are protective of human health and the environment, comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost-effective. The remedies use permanent solutions and alternative treatment technologies to the maximum extent practicable. The selected remedy for contaminated groundwater (on-site treatment) meets the statutory preference for remedies employing treatment that reduces the toxicity, mobility, or volume as a principal element. The capping of the landfill and the off-site transport and disposal of sludge reduce the mobility of contaminants by placing them in controlled, monitored locations. However, these remedies do not meet the statutory preference for treatment that reduces the volume or toxicity of contaminants. With respect to landfill wastes, the potential presence of unexploded ordnance (UXO), and the fact that no major sources of contaminants have been identified, support a contaminant rather than a removal remedy. Because some of the remedies discussed above do not allow for unrestricted future use of the site, a review will be conducted within 5 years after commencement of remedial actions to ensure adequate long-term protection of human health and the environment is maintained.

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2. DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

Cluster 1 is located in the Lauderick Creek Study Area of APG, in Harford County, approximately 45 miles north of Baltimore, Maryland (see Fig. 1). APG is bordered to the east and south by the Chesapeake Bay; to the west by Gunpowder Falls State Park, the Crane Power Plant, and residential areas; and to the north by the towns of Edgewood, Joppa, Magnolia, Perryman, and Aberdeen. APG is divided by the Bush River into two main areas; the Edgewood Area of APG lies to the west of the river and the Aberdeen Area lies to the east. The Edgewood Area, including Graces Quarters and Carroll Island, is listed in the National Priorities List (NPL). The NPL is USEPA's list of U.S. hazardous waste sites considered priorities for long-term remedial evaluation and response.

The Nike Site, also referred to as Cluster 1 of the Lauderick Creek Area, is located in the northeast portion of the Edgewood Area. The Nike Site is bordered to the west and north by the installation boundary, the Amtrak railroad tracks, and residential areas; and by wooded and marshy areas of the Lauderick Creek Area to the south and east. The Nike Site consists of approximately 300 acres, of which a 102.2-acre portion was originally designated for closure under the Department of Defense Base Realignment and Closure (BRAC) program. The site is no longer considered part of this program, and all further actions will be conducted as a standard CERCLA activity. The launch area, located at the northern end of Cluster 1 to the west of Monks Creek (see Fig. 2), includes six abandoned missile silos, several buildings, a 1.1-acre landfill, and a septic tank/subsurface sand filter bed system. An abandoned underground fuel oil storage tank was removed from the launch area in 1991. The barracks area, located southwest of the launch area (see Fig. 2), consists of five buildings, a septic tank, and a subsurface sand filter bed. In addition, five underground fuel oil storage tanks were installed in the barracks area in 1957, four remain in use.

Cluster 1 and the surrounding area consist of forest, open field, and wetlands. The adjacent area north of the Amtrak line consists of forest and a resident subdivision. Residential subdivisions exist and, based on zoning, may be built throughout the area north of the Amtrak line in the near future. All residents are expected to use the public water supply; according to the Harford County Health Department, the use of wells for domestic water supply in homes scattered in the area was discontinued in the 1970s when public water service was established.

Ground elevations at Cluster 1 range from bay-level along creeks to about 40 ft above mean sea level at high points immediately south of Amtrak right-of-way. Terrain consists of subtly rolling flatlands separated by shallow swales and a tributary to Lauderick Creek and Monks Creek. The overall slope of the terrain is to the south and east toward the Bush River and the Chesapeake Bay. A very small portion of the site lies in the 100-year floodplain.

There are two predominant groundwater aquifers in the vicinity of Cluster 1: the surficial aquifer and the confined aquifer. The surficial aquifer is hydraulically unconfined, with underwater tending to move toward and discharge to adjacent creeks and intermittent tributaries. The second aquifer is located about 40 ft below the surficial aquifer and is hydraulically confined, which impedes hydraulic communication with the surficial aquifer.

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2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.2.1 History of Cluster 1

The Lauderick Creek Area cover approximately 1,530 acres and encompasses Cluster 1. It was used by the U.S. Army Chemical School for a wide variety of chemical warfare training activities between 1920 and 1951. Training activities included the use and firing of chemical ordnance; identification of chemical agents, riot control agents, and smokes; decontamination of personnel and equipment; clothing impregnation and laundering; and handling and maintenance of chemical warfare equipment. The training also provided instruction, and possibly field practice, in the disposal of chemical agents, riot control agents, smokes, chemical ordnance, and chemical-agent-contaminated material. The materials used in training included smoke and tear gas, high explosives, and lethal-agent-filled munitions. As a result of these training activities, UXO has often been found and is still present in the Lauderick Creek Area.

The Nike Site, constructed in School Fields Four and Seven of the Lauderick Creek Area, was used for the deployment of Nike antiaircraft missiles between 1954 and 1973. The Army deployed Nike missiles at many sites throughout the United States to protect major cities and strategic military installations from aerial attack. There were two types of Nike missiles: the Nike Ajax, which was used between 1954 and 1959, and the Nike Hercules, which was used between 1959 and 1973. Both were two-stage missiles; the Ajax was armed with a high-explosives warhead and the Hercules was armed with either a high-explosives or a nuclear warhead. The Nike missiles were removed from the missile silos when the Nike Site was decommissioned in 1973.

The Nike Site at APG consists of the missile silo area (i.e., Launch Area), the Barracks Area, and the Control Area. In the Nike Site missile silo area, Nike missile were assembled, stored, and maintained within each of the six silos. The Barracks Area consists of five buildings used as living quarters and office space. The Control Area is being investigated under CERCLA as part of the Lauderick Creek Study Area and therefore is not included as part of the Nike Site.

The Maryland National Guard has leased the Lauderick Creek Area, including the Nike Site, from the Army since 1973. The Maryland National Guard uses the area for lightly infantry training.

UXO was recovered during activities at the Launch Area during range-clearing surface sweeps in 1977 and 1984 and during site clearance for the facility investigation drilling. UXO may be present throughout Cluster 1.

2.2.2 Enforcement Activities

2.2.2.1 Resource Conservation and Recovery Act Facility Assessment

In 1989, the U.S. Army Environmental Hygiene Agency (AEHA) conducted a RCRA Facility Assessment (RFA) that addressed the entire Edgewood Area, including the former Nike Site. AEHA recommended that a number of sites within the former Nike battery area be designated as RCRA solid waste management units requiring further investigation and possible remediation. These sites included parts of the wastewater systems, suspected landfill sites south and southwest of the Launch Area, an alleged French drain near Building E6871, the vehicle washpad, and concrete-lined ditches within the Launch Area.

2.2.2.2 Resource Conservation and Recovery Act Facility Investigation

While preparing the RFA, AEHA also sampled areas of probable or suspected contamination in and around the former Nike Site. The sample analyses became the basis of the RCRA Facility Investigation (RFI) conducted for the site in 1990 to identify contaminants related to prior usage of the area, verify contaminant movement pathways, and provide source characterization data. The RFI concluded that past Nike-related activities caused limited contamination and that contamination was probably limited to known points of release. It was also suggested that past chemical warfare material (CWM)-related releases might be scattered throughout the area. The RFI concluded that any future release of this property for "unrestricted" use would be severely affected by contamination related to UXO and to past training at the Chemical Warfare School.

2.2.2.3 Enhanced Preliminary Assessment/Sampling Design Plan

An Enhanced Preliminary Assessment of the Nike Site, conducted by the U.S. Army Corps of Engineers' (USACE's) Toxic and Hazardous Materials Agency (currently the U.S. Army Environmental Center) in 1990 recommended additional investigation and sampling. This request resulted in the preparation of a Sampling Design Plan in 1990 that focused on potential contaminant sources, locations of existing and former facilities, and past installation activities.

2.2.2.4 Environmental Assessment and Remediation of Nike Missile Silos

An Environmental Assessment for the Nike Missile Silos performed in 1993 for the USACE by Roy F. Weston recommended the silo water be removed and treated off-site and the silos be filled with an inert material. In July of 1993, a Work Plan to perform the work was prepared; the recommended remedial actions were implemented in late 1993 and early 1994.

2.2.2.5 Remedial Investigation and Feasibility Study

A remedial investigation and feasibility study (RI/FS) for Cluster 1 was initiated in 1990 to determine the nature and extent of contamination and to identify alternatives available to clean up the area.

The remedial investigation (RI) identified four contaminated areas and media, including the Launch Area septic tanks and lines, the unconfined groundwater, the Launch Southwest Landfill, and UXO. The feasibility study (FS) recommended the remedial actions presented herein, with the exception of UXO. Although UXO was considered in the FS, it is not discussed herein because it is being addressed separately.

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The RI/FS and Proposed Plan for Cluster 1 of the Lauderick Creek Study Area were released to the public on April 24, 1996. The public comment period began on that date and ended on June 8, 1996. The documents constituting the Administrative Record were made available to the public at the following locations:

Harford County Public Library, Aberdeen and Edgewood Branches;
Essex Community College Library, Baltimore, Maryland;
Aberdeen Proving Ground, TECOM Public Affairs Office (in the Aberdeen Area of APG): and
Miller Library Washington College, Chestertown, Maryland.

The notice of availability of the Proposed Plan was published in the several local newspaper in Harford and Baltimore Counties. A public meeting was held at the Edgewood Middle School, Edgewood, Maryland, on May 8, 1996, to inform the public of the preferred alternatives and to seek public comments. At the meeting, representatives from APG, the USAEC, USEPA, MDE, ICF-Kaiser (an environmental consultant), and Dames & Moore (an environmental consultant) answered questions about conditions at the site and the remedial alternatives under consideration. Responses to the comments received during this period are included in the Responsiveness Summary appended to this ROD.

2.4 SCOPE AND ROLE OF CLUSTER 1

Cluster 1 represents one component of a comprehensive environmental investigation and cleanup currently being performed at APG to comply with CERCLA requirements. This ROD addresses Cluster 1 of the Lauderick Creek Study Area, which includes contaminated shallow groundwater, a landfill, a sanitary sewer system, and decommissioned Nike missile silos. These areas pose potential future risks because of possible human exposure to site contaminants through dermal contact, inhalation, or ingestion. The purpose of this response is to prevent current or future exposure of individuals to the contaminated groundwater, landfill wastes, sewer system, and decommissioned missile silos by removing contaminants where possible or isolating the contaminants to prevent further migration (e.g., capping the Launch Southwest Landfill) where removal is not possible.

2.5 SUMMARY OF SITE CHARACTERISTICS

The RI report investigated 19 sites and features at Cluster 1. The RI concluded that widespread low-level organic chemical contamination poses no current threat to human populations or the environment. Sources of this contamination are neither conspicuous nor evident by sight or smell at the ground surface. However, the RI did identify three sites and features with significant contamination, that is, where at least one organic chemical parameter exceeded a preliminary screening criterion (USACE 1994). Refer to Fig. 2 for their locations.

Surficial Aquifer Groundwater Trichloroethene (TCE)-contaminated groundwater in the surficial aquifer is the preliminary environmental concern at Cluster 1. The contaminant plume is defined as groundwater with concentrations of TCE exceeding 1 microgram per liter (:g/L) as shown in Fig. 3. Concentrations of up to 299 :g/L TCE have been detected near the center of the plume. Table 1 summarizes the chemicals of concern detected in the surficial aquifer groundwater that were not eliminated based on risk-based or background-level screening criteria. The exact source of TCE contamination at Cluster 1 is unknown. Based on water level data collected during the RI, it appears the predominant direction of groundwater flow in the vicinity of the site is to the south-southeast, toward Monks Creek. A small component of groundwater at the northern boundary appears to flow in a northerly direction. The surficial and confined aquifers do not appear to be hydraulically interconnected due to the presence of a continuous confining layer of clay. Therefore, the surficial aquifer contamination is not expected to migrate downward.

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Table 1.
Summary of Chemicals of Potential
Concern Detected in Surficial Aquifer
Groundwater at Cluster 1 Not Eliminated
Based on Risk-Based or Nike Site Background Levels

Compound	Detected on-site concentrations (:g/L)	Detected background concentrations (:g/L)
delta-BHC	0.021	-
Benzene	1.0-6.0	-
Carbon disulfide	11.0	23.0
1,4-dichlorobenzene	3.0	-
bis(2-ethylhexyl) phthalate	3.0-109	14-31
Heptachlor	0.018	-
Heptachlor epoxide	0.018	-
Tetrachloroethene	10.0	2.0
Trichloroethene	1.0-299	1.0
Arsenic (total)	4.0-5.3	-
Beryllium (total)	0.80-1.6	-
Mercury (total)	0.20-2.8	-
Nickel (total)	31.5-207	-
Arsenic (dissolved)	4.3-5.8	-
Beryllium (dissolved)	0.71-1.1	1.1-1.2
Mercury (dissolved)	0.47	-
Nickel (dissolved)	32.3-210	-

Launch Southwest Landfill The Launch Southwest Landfill contains construction rubble with asbestos waste. In addition, several 55-gal drums labeled hydraulic fluid were found lying empty on their sides at the site, which suggests waste may have been disposed of there. Predesign field investigation sampling detected asbestos in surface soil samples at the landfill. The landfill is approximately 275 ft long by 175 ft wide and has an average depth of 8 ft. Because soil and groundwater near the landfill were found to be uncontaminated except for the asbestos, most contamination is believed to be limited to buried wastes.

Launch Area Sanitary Sewer System Based on results from the RI, the Launch Area septic sewer system contains relatively small volumes of sludge and residues contaminated with a variety of chemicals including trace metals, solvents, and pesticides. Table 2 summarizes chemicals of potential concern detected in the sewer system sludge that could not be eliminated based on background contaminant levels. Investigations during the RI determined that the sewer line sludge and residue contamination are confined to within the sewer lines (USACE, 1994). The contaminated sludge and residue are likely distributed along the length of the 800-ft line. Although the contamination is confined within the sewer lines, there is a small potential for contaminants to be released to the environment if groundwater infiltrates the deteriorating lines or rainwater flushes the contaminants out of the lines to the surrounding soils.

Nike Missile Silos In addition to the three sites/features identified in the RI, the six Nike missiles silos were addressed in a separate interim action (USACE 1993). Water in the missile silos was found to contain elevated levels of lead. Therefore, the water was removed and disposed of off-site and the silos were filled with an inert material. There is no longer a potential source of contamination in the missile silos. It is recommended that the interim action, which has already completed, be accepted as the final remedy for the missile silos and that no further action be taken. For the purposes of this document, it is assumed this recommendation will be accepted and the missile silos will not be discussed further.

2.6 SUMMARY OF SITE RISKS

2.6.1 Human Health Risks

A Human Health Baseline Risk Assessment (RA) was conducted as part of the RI to determine the potential risk posed to human health if cleanup activities were not performed at Cluster 1. The Human Health RA incorporated contaminant concentrations detected in samples collected during the RI, the toxicity of those contaminants, and the possible human exposure to these contaminants. Based on this information, conservative estimate of risk were determined using USEPA guidance to ensure potential health effects are not underestimated. The Human Health RA consisted of contaminant identification, exposure assessment, toxicity assessment, and risk characterization.

The purpose of contaminant identification is to evaluate the chemicals detected in various site media and to identify the contaminants posing potential human health risk. Chemical of potential concern were selected for evaluation in the RA based on an evaluation of the data, on a comparison to background concentrations for inorganic chemicals, and on USEPA Region III's risk-based screening procedure (USEPA 1994). Contaminants of concern were selected for groundwater (surficial and confined aquifer), surface soil, surface water (Lauderick Creek and Monks Creek), and sediment (Lauderick Creek and Monks Creek). Table 3 summarizes the contaminants of concern selected for each medium of concern.

Table 2.
Parameters Indicated by Analysis of Sludge
in Septic Sewer Lines That Exceed Preliminary
Screening Criteria and Cannot Be Disregarded
Based on Background or Risk-Based Levels

Parameter	Maximum concentration detected	Preliminary screening criteria
1,4-dichlorobenzene	610,000 :g/kg	27,000 :g/kg
bis (2-ethylhexyl) phthalate	20,000 :g/kg	46,000 :g/kg
Aroclor-1254	13,000 :g/kg	83 :g/kg
Aroclor-1260	1500 :g/kg	83 :g/kg
Arsenic	5.3 mg/kg	2.3 mg/kg
Beryllium	0.75 mg/kg	0.15 mg/kg
Cadmium	26.8 mg/kg	3.9 mg/kg
Chromium	112 mg/kg	3.9 mg/kg
Manganese	257 mg/kg	39 mg/kg
Mercury	3.56 mg/kg	2.3 mg/kg

Table 3.
Summary of Chemical of Potential Concern
at Cluster 1, Aberdeen Proving Ground

Compound	Groundwater		Surface soil	Surface water		Sediment	
	Surficial	Confined		Lauderick Creek	Monks Creek	Lauderick Creek	Monks Creek
Organics							
delta-BHC	X						
Benzene	X						
Benzo(a)pyrene						X	
Carbon disulfide	X						
1,4-dichlorobenzene	X						
1,2-dichloroethene (total)	X						
bis (2 ethyl-hexyl) phthalate	X	X					
Heptachlor	X						
Heptachlor Epoxide	X						

Table 3. (Continued)

Compound	Groundwater		Surface soil	Surface water		Sediment	
	Surficial	Confined		Lauderick Creek	Monks Creek	Lauderick Creek	Monks Creek
Tetrachloroethane	X						
Trichloroethene	X	X					
Inorganics							
Antimony		X					
Arsenic	X	X			X		X
Beryllium	X						X
Cadmium				X			
Manganese					X		X
Mercury	X						
Nickel	X						
Vanadium							X
Vanadium							

X - Selected as a chemical of potential concern for this medium.

The objective of the exposure assessment is to estimate the type and magnitude of potential exposures to the contaminants of concern that are present at, or migrating from, a site. Under the current land-use scenario, exposure pathways evaluated include incidental ingestion of chemicals in surface soil by a caretaker or trespasser, incidental ingestion of chemicals in Lauderick Creek and Monks Creek sediment by a trespasser, dermal absorption of chemicals in Monks Creek surface water by a trespasser, and incidental ingestion and dermal absorption of chemicals in Lauderick Creek surface water by a trespasser. The future uses of Cluster 1 that were considered include military, industrial, and residential. The residential land-use scenario is the most conservative scenario and therefore it was selected for quantitative evaluation. Exposure pathways evaluated for the future residential land-use scenario include ingestion of groundwater from the surficial or confined aquifer by an on-site resident, inhalation of volatile organic compounds (VOCs) in groundwater from the surficial and confined aquifers while showering by an on-site resident, dermal absorption of chemicals in groundwater from the surficial and confined aquifers while bathing by an on-site child, and incidental ingestion of chemicals in soil by an on-site resident. Exposures to surface water and sediment are expected to be similar to those under the current land-use conditions and therefore were not evaluated under the future land-use scenario.

Exposure point concentrations in soil, groundwater, surface water, and sediment were calculated as the 95% upper confidence limit on the arithmetic mean sample concentration or the maximum detected concentration (whichever was lower). This was used as the reasonable maximum exposure (RME) concentration (i.e., the maximum exposure that is reasonably expected to occur at a site).

Groundwater data were grouped into plumes and hot spots, and all rounds of groundwater data available for the wells of each group were used to calculate the exposure point concentration. To evaluate potential exposure to VOCs released from water while showering, a model was used in which indoor air concentrations are based in the exposure point concentration in groundwater, the rate of chemical release into the air, the buildup and decay of VOCs in shower room air, and the time-weighted average VOC concentrations for the duration of the shower room exposure. Exposures were estimated by combining measured or calculated environmental concentrations at the selected points with the extent, frequency, and duration of exposure for each receptor of concern. The major assumptions about exposure frequency and duration were consistent with USEPA guidance (USEPA 1989a, 1989b, 1991, 1992). For example, for the future residential land-use scenario, an exposure frequency of 350 days/year (based on exposures of 7 days/week for 50 weeks/year) and an exposure duration of 30 years [which is the USEPA (1989a, 1991) upper bound value for living at one residence] were used.

The purpose of the toxicity assessment is to assess the toxicological hazards of contaminants of concern as a function of the anticipated route of exposure. Quantitative indices of toxicity include cancer potency factors (CPFs) and reference doses (RfDs). USEPA's Carcinogenic Assessment Group developed CPFs for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in the reciprocal dose 1/(milligram per kilogram per day), [1/(mg/kg-day)], are multiplied by the estimated intake of a potential carcinogen, in milligrams/kilogram/day (mg/kg-day), to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term upper bound reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. CPFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

RfDs have been developed by USEPA to indicate the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, expressed in units of mg/kg/day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict the effects on humans). These uncertainty factors help ensure the RfDs will not underestimate the potential for adverse noncarcinogenic effects. CPFs and RfDs identified for the contaminants of concern are summarized in Tables 7.9 and 7.10 of the RA.

The purpose of the risk characterization is to relate exposure estimates to toxicity data to estimate potential health hazards/risks. Excess lifetime cancer risks are determined by multiplying the intake level by the CPF. These risks are probabilities that are generally expressed in scientific notation (e.g., 1 x 10-6 or 1E-06). An excess lifetime cancer risk 1 x 10-6 indicates that, as a plausible upper bound, an individual has a 1 in 1 million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions. USEPA's acceptable risk range for cancer is 1 x 10-4 to 1 x 10-6, meaning there is 1 additional chance in 10,000 (1 x 10-4) to 1 additional chance in 1 million (1 x 10-6) that a person will develop cancer.

Noncarcinogenic effects of a single contaminant in a single medium are expressed as the hazard quotient (HQ), which is the ratio of the estimated intake-derived from the contaminant concentration in a given medium-to the contaminant's RfD. The Hazard Index (HI) can be generated by adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. An HI of 1 or less indicates the human population is not likely to experience adverse health effects.

Table 4 summarizes pathway-specific and cumulative risks calculated for the current land-use scenario. All risks for pathway-specific exposures under current land-use conditions were below 1 x 10-6--the low end of USEPA's target risk range. In addition, none of the HIs for any of the exposure pathways were greater than 1, indicating adverse noncarcinogenic effects are not likely to result from exposures through any of the pathways evaluated. Cumulative risks were calculated for multiple pathways where the same receptor could potentially be exposed via multiple exposure scenarios. Under current land-use conditions, the combined risks for both caretakers and trespassers were lower than USEPA's risk range for health protectiveness at Superfund sites (see Table 4). In addition, the combined HIs for caretakers and trespassers were less than 1 (see Table 4), indicating noncarcinogenic effects are unlikely to occur as a result of combined exposures through the pathways evaluated.

Table 5 summarizes pathway-specific and cumulative risks calculated for future land-use conditions at Cluster 1. Under future land-use conditions, the pathways that resulted in potential cancer risks greater than 1 x 10-6 were ingestion of surficial and confined groundwater by an on-site resident, inhalation of VOCs from surficial groundwater while showering by an on-site resident, and dermal absorption of chemicals in surficial and confined aquifer groundwater while bathing by a child resident. However, these risks were still within USEPA's target risk range of 1 x 10-4 to 1 x 10-6; and HIs for these pathways were less than 1, with the exception of one isolated detection of arsenic in a confined groundwater well. Potential cancer risks associated with the remaining future land-use scenario pathways were below 1 x 10-6, and HIs were less than 1.

Table 4.
Summary of Pathway Specific and Cumulative Risks,
Cluster 1, Current Land-Use Conditions

Exposure pathway	Potential risks to adult caretakers		Potential risks to child/teenage trespassers	
	Excess upper-bound lifetime cancer risk	Hazard Index	Excess upper-bound lifetime cancer risk	Hazard Index
Incidental ingestion of surface soil	NA	<1 (4E-03)	NA	< 1 (3E-03)
Incidental ingestion of Lauderick Creek sediment	NE	NE	1E-08	NA
Incidental ingestion of Monks Creek sediment	NE	NE	2E-07	<1 (3E-03)
Incidental ingestion of Lauderick Creek surface water	NE	NE	NA	<1 (4E-04)
Dermal contact with Lauderick Creek surface water	NE	NE	NA	<1 (1E-03)
Dermal contact with Monks Creek surface water	NE	NE	4E-09	<1 (7E-02)
Total	NA	<1 (4E-03)	2E-07	<1 (8E-02)

NE = Not evaluated; pathway not complete
NA = Not applicable; either no chemicals were present for this pathway or chemicals selected lacked toxicity criteria.

Table 5.
Summary of Pathway Specific and Cumulative Risks,
Cluster 1, Future Land-Use Conditions

Exposure pathway	Potential risks to hypothetical future residents	
	Excess upper-bound lifetime cancer risk	Hazard Index
Incidental ingestion of on-site surface soil by 0-30-year-old residents	NA	<1 (2E-02)
Ingestion of groundwater by adult resident		
Surficial aquifer		
Organic chemicals		
Group 1 (Wells 2A, 2B, 3A, 6B 7A, 21A, 22A, 29A, 36A)	8E-06	<1 (1E-01)
Group 2 (Wells 33A, 34A)	1E-05	<1 (9E-02)
Group 3 (Well 16A)	2E-05	<1 (1E-01)
Inorganic chemicals		
Group 6 (Wells 15A, 16A)	1E-04	<1 (5E-01)
Group 7 (Wells 26B, 9A)	7E-05	<1 (3E-01)
Group 8 (Wells 21A, 2A, 2B, 34A)	4E-05	<1 (4E-03)
Group 9 (Well 26B)	NA	<1 (3E-01)
Group 10 (Well 36A)	NA	<1 (2E-02)
Group 11 (Wells 22A, 2A)	NA	<1 (1E-01)
Group 13 (Wells 16A, 18A, 5A) 9A)	NA	<1 (2E-01)
Confined aquifer		
Organic chemicals		
Group 4 (Well 1C)	3E-05	<1 (3E-01)
Group 5 (Well 36B)	5E-07	<1 (3E-02)
Inorganic chemicals		
Group 13 (Well 36B)	2E-04	<1 (9E-01)

Table 5. (continued)

Exposure pathway	Potential risks to hypothetical future residents	
	Excess upper-bound lifetime cancer risk	Hazard Index
Inhalation of volatile organics released from groundwater while showering by adult residents		
Surficial aquifer		
Group 1 (Wells 2A, 2B, 3A, 6B, 7A, 21A, 22A, 29A, 36A)	2E-06	<1 (4E-01)
Group 2 (Wells 33A, 34A)	5E-07	<1 (3E-01)
Confined aquifer		
Group 5 (Well 36B)	2E-07	NA
Dermal absorption of chemicals in groundwater while bathing by child residents		
Surficial chemicals		
Organic chemicals		
Group 1 (Wells 2A, 2B, 3A, 6B, 7A, 21A, 22A, 29A, 36A)	1E-06	<1 (9E-02)
Group 2 (Wells 33A, 34A)	4E-07	<1 (1E-02)
Group 3 (Well 16A)	8E-07	<1 (3E-02)
Inorganic chemicals		
Group 6 (Wells 15A, 16A)	1E-07	<1 (2E-03)
Group 7 (Wells 26B, 9A)	NA	NA
Group 8 (Wells 21A, 2A, 2B, 34A)	4E-06	<1 (2E-03)
Group 9 (Well 26B)	NA	NA
Group 10 (Well 36A)	NA	NA
Group 11 (Wells 22A, 2A)	NA	<1 (4E-03)
Group 12 (Wells 16A, 18A, 5A, 9A)	NA	<1 (7E-03)
Confined Aquifer		
Organic chemicals		
Group 4 (Well 1C)	2E-06	<1 (7E-02)

Table 5. (continued)

Exposure pathway	Potential risks to hypothetical future residents	
	Excess upper-bound lifetime cancer risk	Hazard Index
Group 5 (Well 36B)	9E-08	<1 (1E-02)
Total Risk - Adult Resident (a)	2E-04	>1 (2E+00)
Total Risk - Child Resident (b)	6E-06	<9E-02

NA = Not applicable; pathway was not evaluated because (1) no chemicals exhibiting carcinogenic/noncarcinogenic effects were selected as chemicals of potential concern for this pathway/medium combination, (2) chemicals selected lacked toxicity criteria, or (3) pathway not complete.

(a) =Total risk to adult resident assumes ingestion and dermal contact with soil and ingestion and inhalation of groundwater. The groundwater well groupings associated with the highest risks for organics (Group 4 for ingestion and Group 1 for inhalation) and for inorganics (Group 13 for ingestion).

(b) = Total risk to child resident assumes ingestion and dermal contact with soil and dermal contact with groundwater. The groundwater well groupings associated with the highest risks for organics (Group 4) and for inorganics (Group 8) were conservatively used to calculate cumulative risk.

Under future land-use conditions, multiple pathway risks were calculated for an on-site resident. Based on assumed exposure to the maximum detected concentration in one well for both organic and inorganic analytes, the total cancer risk to an on-site resident for incidental ingestion of surface soil and ingestion and inhalation of contaminants in groundwater was 2 x 10-4. The child resident's cumulative cancer risk for incidental ingestion of surface soil and dermal contact with groundwater was 6 x 10-6. The cumulative risk for the adult resident was just above USEPA's target risk range of 1 x 10-4 to 1 x 10-6, while the cumulative risk for the child resident was within USEPA's target risk range. The HI associated with the child resident is less than 1, indicating noncarcinogenic effects are not likely to occur to a child resident as a result of combined exposures through the pathways evaluated. However, the HI for the adult exceeds 1, which indicates a potential for noncarcinogenic effects.

In addition to the health risks caused by the chemical contaminants in groundwater, a hazard may be posed by CWM-filled containers and asbestos found in the landfill. Containers filled with CWM present a human safety hazard if they accidentally rupture or corrode, thereby releasing contaminants to the environment. Asbestos is an inhalation hazard and has been shown to cause lung cancer.

As in any RA, there is a large degree of uncertainty associated with the estimates of human health risks. Because an RME case was evaluated in the RA to place a conservative upper bound on the potential risks, the risks presented in this RA are likely to be overestimated. Consequently, the estimates calculated for Cluster 1 should not be construed as absolute estimates of risk but rather as conditional estimates based on a number of assumptions regarding environmental sampling and analysis, exposure parameter estimation, and toxicological data.

2.6.2. Environmental Risks

An Ecological Risk Assessment (ERA) was conducted as part of the RI to evaluate potential impacts to both terrestrial and aquatic population or communities if cleanup activities were not performed at Cluster 1. Risks were characterized by combining estimates or measures of exposure with estimates or measures of toxicity. Toxicity is characterized by defining the relationship between chemical concentration and a given ecological effect. Chemical and bioassay data collected as part of the RI and biological assessment studies being conducted at Cluster 1 were used in conjunction with data from the scientific literature to characterize exposure, toxicity, and risks.

The ERA focused on chemicals with the greatest potential to impact ecological communities. Chemicals of potential concern in surface soils include the pesticide 4,4'-DDT,4,4'-DDE, polynuclear aromatic hydrocarbons (PAHs) [e.g., benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene], other organics (e.g., benzoic acid, di-n-butylphthalate, ethylbenzene, styrene, toluene, and xylenes), and metals (e.g., beryllium, iron, manganese, nickel, and zinc).

Arsenic, copper, manganese, and nickel were selected as inorganic chemicals of potential concern in Monks Creek surface water. In Monks Creek sediment, beta-BHC, benzoic acid, 4,4'-DDD, 4,4'-DDE, methoxychlor, 4-methylphenol, fluoranthene, pyrene, cadmium, cobalt, manganese, and selenium were identified as chemicals of potential concern. In Lauderick Creek sediment, the PAHs [e.g., benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, 2-methyl-naphthalene, chrysene, acenaphthene, anthracene, fluoranthene, naphthalene, phenanthrene, pyrene], 4,4'-DDT, 4,4'-DDD and 4,4'-DDE, dibenzofuran, 2-methylphenol, nitrobenzene, and xylenes were selected for evaluation.

Aquatic organisms could potentially be exposed to chemicals in Lauderick Creek and Monks Creek by direct contact with contaminated water and sediment, by the respiration of chemicals in water and sediment, and by ingestion of contaminated sediment and food. Terrestrial plants may be exposed to chemicals of potential concern in soil as a result of direct contact and uptake via the roots. Soil-dwelling invertebrates may be exposed to chemicals via dermal absorption and via the ingestion of contaminated soils. Because of their intimate contact with soil and the availability of data, earthworms were used as the receptor species for evaluating potential impacts to terrestrial invertebrates. Terrestrial vertebrates may be exposed to chemicals of concern through the ingestion of contaminated food items (e.g., soil dwelling invertebrates). Shrews were used as the receptor species for evaluating potential impacts to small mammals because they are insectivorous and thus have a significant potential exposure to chemicals from soil invertebrates. Birds were not selected for evaluation because they are likely to have less intimate contact with the soil than small mammals. Birds generally have a larger home range than small mammals and are not likely to receive as much exposure to the site.

Potential risks to aquatic organisms were calculated by comparing surface water concentrations (average and RME) of the chemicals of potential concern in Monks Creek with available toxicity reference values (TRVs) [e.g., Ambient Water Quality Criteria (AWQC), toxicity data for aquatic life]. Sediment concentrations of the chemicals of potential concern in Lauderick Creek and Monks Creek were compared with available TRVs [e.g., sediment quality criteria (SQC)] and the results of invertebrate bioassay tests.

Potential risks to terrestrial organisms were evaluated by comparing surface soil concentrations (average and RME) with derived TRVs. TRVs were derived from available toxicity data.

A comparison of surface water concentrations in Monks Creek with TRVs indicates the calculated RME for copper exceeds its TRV. However, copper was detected in only 1 of 9 surface water samples collected, and the average concentration was below the TRV. Therefore, adverse chronic effects to aquatic life in Monks Creek are not expected. Comparison of sediment concentration data to site-specific TRVs suggests benthic invertebrates may be at risk for chronic toxicity as a result of exposure to DDT metabolites in Monks Creek. However, bioassays conducted with Monks Creek sediment and C. tentans and H. azteca suggest the chronic toxicity potential is low. The sediment bioassay test result should be weighted more heavily than the predicted potential toxicity resulting from comparison of exposure point concentrations with TRVs.

Samples from two locations in the sediment from Lauderick Creek showed concentrations of a number of organic contaminants [anthracene, benzo(a)anthracene, 2-methylnaphthalene, fluorene, pyrene, 2-methylphenol, 4,4'-DDE and 4,4'-DDD] that exceed site-specific TRVs, which indicates benthic invertebrates in Lauderick Creek may potentially be effected as a result of exposure to these compounds in sediment. However, this area is outside the Former Nike Site and is not addressed in this document. A comparison of surface soil concentrations to derived TRV's indicates terrestrial organisms-including plants, soil invertebrates, and small mammals-are not expected to be adversely affected by exposure to the potential contaminants of concern because surface soil concentrations were below derived TRVs.

It should be noted there is a large degree of uncertainty associated with the estimation of toxicity and exposure of ecological receptors. Uncertainty exists in the toxicity data used to develop TRVs for terrestrial plants, wildlife, and aquatic organisms, in the development of exposure point concentrations, in the derivation of SQC from AWQC, and in the assumptions regarding bioconcentration of DDT from soil by earthworms and their consumption by shrews. Therefore, the results of the ERA should not be construed as absolute conclusions but instead as general indications of potential ecological effects.

2.7 GROUNDWATER REMEDIATION

The Army used the conclusions from the RI, the remedial action objectives (RAOs) listed in the FS, and applicable or relevant and appropriate requirements (ARARs) to set cleanup objectives for groundwater contamination at Cluster 1. The cleanup objectives for groundwater are to prevent human exposure to on-site contaminated groundwater, to prevent off-site migration of contaminated groundwater, and to remediate on-site groundwater to the maximum contaminant level (MCL) of 5 :g/L. Actual or threatened releases of hazardous substances from surficial groundwater at this site, 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.

2.7.1 Description of Alternatives

2.7.1.1 Alternative 1: No Action

The no-action alternative includes no remedial actions to contain, remove, or treat the contaminant plume at Cluster 1. Evaluation of the no-action alternative provides a baseline against which no measure other alternatives. Groundwater monitoring, including annual sampling and analysis for 30 years, will determine whether contaminant migration is occurring.

The following major ARARs are cited as part of Alternative 1:

Because of the presence of contaminants in the surficial aquifer, federal MCLs [40 Code of Federal Regulations (CFR) 141, 143], Maryland groundwater quality criteria (COMAR 26.08.02.09), and Maryland drinking water standards (COMAR 26.04.01) are exceeded. This alternative does not achieve cleanup to a level that meets these standards. The human health risks present in Sect. 2.6.1 under a future land-use scenario for on-site residents are not reduced, and TCE contamination in groundwater as high as 299 :g/L can continue.

The costs for Alternative 1 are as follows:

Capital costs: $0
Operations and maintenance (O&M) cost: $12,570/year
Net present worth: $193,232 for 15 years
There is no implementation time required for this alternative.

2.7.1.2 Alternative 2: Treatment in Biological Sequencing Batch Reactors

This alternative involves the extraction of groundwater, treatment in sequencing batch reactors (SBRs), and discharge of treated water to a tributary of the Bush River. The major components of this remedial alternative are described below.

Groundwater is removed by extraction wells in accordance with Maryland water appropriation or use regulations (COMAR 08.05.02), which govern the construction of monitoring wells and the extraction of groundwater from the subsurface.

The extracted groundwater is treated in an aboveground SBR system that employs microorganisms to reduce TCE levels in the aquifer to below 5 :g/L to meet federal MCLs. The treatment system will be designed, operated, and closed in accordance with Maryland standards for chemical, physical, and biological treatment of hazardous waste (COMAR 26.13.05.18) and in accordance with air quality requirements for construction and operation of processes that generate potentially hazardous air emissions (COMAR 26.11.01 and .06). Hazardous sludge that may be generated as a result of the treatment process will be stored, handled, characterized, and disposed of in accordance with Maryland hazardous waste management regulations (COMAR 26.13) and likely disposed of off-site, depending on its characteristics. The specific treatment system configuration and operational procedures for the SBR will be developed during the design phase.
The treated groundwater is discharged to a tributary of the Bush River. The treatment system will be designed and implemented in accordance with the substantive requirements of the National Pollutant Discharge Elimination System (NPDES) program. Long-term groundwater monitoring is performed in accordance with RCRA closure and postclosure requirements (COMAR 26.13.05.06-.07). Land-use restrictions are implemented to minimize human exposure to contaminants.

This alternative meets groundwater cleanup objectives by treating the contaminated surficial aquifer to 5 :g/L TCE, by preventing human exposure through treatment and land-use restrictions, and by preventing off-site migration of contaminants through groundwater extraction.

The costs for Alternative 2 are as follows:

Capital costs: $1,465,830
O&M cost: $103,763/year
Net present worth: $2,542,890 for 15 years
This alternative is expected to reach the MCL within 15 years.

2.7.1.3 Alternative 3: Treatment by Ultraviolet-catalyzed Oxidation

This alternative involves the extraction of groundwater, treatment by ultraviolet (UV)-catalyzed oxidation, and discharge of treated water to a tributary of the Bush River. The major components of this remedial alternative are described below.

Groundwater is removed by extraction wells in accordance with Maryland water appropriation or use regulations (COMAR 08.05.02) that govern the construction of monitoring wells and the extraction of groundwater. The extracted groundwater is treated in an aboveground UV-oxidation system that employs UV irradiation in conjunction with oxidizers such as ozone or peroxide to reduce TCE levels in the aquifer to below 5 :g/L to meet the federal MCL. The treatment system will be designed, operated, and closed in accordance with Maryland standards for chemical, physical, and biological treatment of hazardous waste (COMAR 26.13.05.18) and in accordance with air quality requirements for construction and operation of processes that generate potentially hazardous air emissions (COMAR 26.11.01 and .06). The specific treatment system configuration and operational procedures will be developed during the design phase. The treated groundwater is discharged to a tributary of the Bush River. The treatment system will be designed and implemented in accordance with the substantive requirements of the NPDES program.

Long-term groundwater monitoring is performed in accordance with RCRA closure and postclosure requirements (COMAR 26.13.05.06-.07).
Land-use restrictions are implemented to minimize human exposure to contaminants.

This alternative meets groundwater cleanup objectives by treating the contaminated surficial aquifer to 5 :g/L TCE, by preventing human exposure through exposure treatment and land-use restrictions, and by preventing off-site migration of contaminants through groundwater extraction.

The costs for Alternative 3 are as follows:

Capital costs: $511,491
O&M cost: $144,991/year
Net present worth: $2,018, 106 for 15 years

This alternative is expected to reach the MCL within 15 years.

2.7.1.4 Alternative 4: Treatment in Place Using Reductive Dehalogenation

This alternative involves funneling groundwater through permeable subsurface treatment sections, performing long-term groundwater monitoring, and imposing land-use restrictions on groundwater use during the remediation period. The major components of this remedial alternative are described below.

This in situ reductive dehalogenation system design consists of a "funnel and gate" system in which the funnel is a sealable joint sheet pile wall that directs groundwater flow to the gate, which is filled with an iron-sand mixture that provides a reducing environment capable of abiotic degradation of TCE. The groundwater is treated until it reaches TCE concentrations below the MCL of 5 :g/L as it flows through the iron and sand mixture. Construction is performed in accordance with Maryland standards for chemical, physical, and biological treatment of hazardous waste (COMAR 26.13.05.08) and air quality requirements for construction and operation of processes that generate potentially hazardous air emissions (COMAR 26.11.01 and .06). All trenching and other construction activities will be performed in accordance with Occupational Safety and Health Administration (OSHA) Standards (29 CFR 1926) governing construction safety. The approximately 16,518 cubic yards of soil excavated during construction will be characterized in accordance with RCRA Subtitle C Requirements (40 CFR 261) to determine its hazard characteristics. The excavated material is expected to be nonhazardous and will be used as backfill material during construction in accordance with Maryland erosion and sediment control regulations (COMAR 26.09.01). Laboratory permeability tests and a treatability study are performed before full-scale implementation of this alternative.

Long-term groundwater monitoring is performed at the site. Monitoring wells are installed upgradient and downgradient of the treatment sections in accordance with Maryland groundwater monitoring and protection requirements (COMAR 26.13.05.06) and regulations governing the construction of monitoring wells and extraction of groundwater (COMAR 08.05.02) to evaluate the long-term effectiveness of treatment and to accurately determine whether contaminant migration is occurring. Sampling would occur annually for a period of 60 years-the estimated duration of the groundwater treatment process.

Land-use restrictions. Temporary land-use restrictions are implemented to prohibit on-site use of contaminated groundwater for the duration of the groundwater treatment process (60 years). This alternative meets groundwater cleanup objectives by treating the contaminated surficial aquifer to 5 :g/L TCE; by preventing human exposure through groundwater treatment and land-use restrictions; and by preventing off-site migration of contaminants through groundwater extraction and treatment.

The costs for Alternative 4 are as follows:

Capital costs: $3,565,095
O&M cost: $52,860/year
Net present worth: $4,565,698 for 60 years
This alternative is expected to reach the MCL within 60 years.

2.7.1.5 Alternative 5: Treatment by Aboveground Reductive Dehalogenation

This alternative involves:

Extraction of contaminated groundwater as described in Sect. 2.7.1.2. A treatability study is performed before the alternative is implemented, and pump tests are conducted before final design of the system. Treatment using aboveground reductive dehalogenation. Reactive media composed of grindings of metallic iron produce a reducing environment capable of abiotic degradation of TCE. The treatment system will be designed, operated, and closed in accordance with Maryland standards for chemical, physical, and biological treatment of hazardous waste (COMAR 26.13.05.18) and with air quality requirements for construction and operation of processes that generate potentially hazardous air emissions (COMAR 26.11.01 and .06). Hazardous sludge that may be generated as a result of the treatment process will be stored, handled, characterized, and disposed of in accordance with Maryland hazardous waste management regulations (COMAR 26.13) and likely disposed of off-site, depending on its characteristics. The specific treatment system configuration and operational procedures for the reductive dehalogenation system will be developed during the design phase. Discharge of treated groundwater to a tributary of the Bush River. The treatment system will be designed and implemented in accordance with the substantive requirements of the NPDES program. Long-term groundwater monitoring is performed in accordance with RCRA closure and postclosure requirements (COMAR 26.13.05.05.06-.07). Land-use restrictions are implemented to minimize human exposure to contaminants.

This alternative meets groundwater cleanup objectives by treating the contaminated surficial aquifer to 5 :g/L TCE, by preventing human exposure through groundwater treatment and land-use restrictions, and by preventing off-site migration of contaminants through groundwater extraction.

The costs for Alternative 5 are as follows:

Capital costs: $706,901
O&M cost: $83,850/year
Net present worth: $1,737,266 for 15 years
This alternative is expected to reach the MCL within 15 years.

2.7.1.6 Alternative 6: Treatment by Air Stripping

This alternative involves:

Extraction of contaminated groundwater as described in Sect. 2.7.1.2, including a treatability study and pump test. Air stripping using stripping towers to reduce TCE concentrations in the aquifer to below the MCL of 5 :g/L by volatilizing the TCE from the groundwater. The treatment system will be designed, operated, and closed in accordance with Maryland standards for chemical, physical, and biological treatment of hazardous waste (COMAR 26.13.05.18) and air quality requirements for construction and operation of processes that generates potentially hazardous air emissions (COMAR 26.11.01 and .06). Hazardous sludge that may be generated as a result of the treatment process will be stored, handled, characterized, and disposed of in accordance with Maryland hazardous waste management regulations (COMAR 26.13) and likely disposed of off-site, depending on its characteristics. The specific treatment system configuration and operational procedures will be developed during the design phase. Treatment of effluent gases using granular activated carbon in accordance with air emissions regulations previously discussed. Contaminated air passes through an activated carbon adsorption unit if treatment of off-gases is necessary. Spent carbon is picked up and disposed of by the vendor. Discharge of treated groundwater to a tributary of the Bush River. The treatment system will be designed and implemented in accordance with the substantive requirements of the NPDES program. Long-term groundwater monitoring is performed in accordance with RCRA closure and postclosure requirements (COMAR 26.13.05.06-.07). Land-use restrictions to minimize human exposure to contaminants.

This alternative meets groundwater cleanup objectives by treating the contaminated surficial aquifer to 5 :g/L TCE, by preventing human exposure through groundwater treatment and land-use restrictions, and by preventing off-site migration of contaminants through groundwater extraction.

The costs for Alternative 6 are as follows:

Capital Costs: $1,143,104
O&M cost: $81,467/year
Net present worth: $1,988,708 for 15 years.
This alternative is expected to reach the MCL within 15 years.

2.7.2 Summary of the Comparative Analysis of Alternatives

As required by CERCLA, the remedial alternatives listed above were evaluated using nine criteria specific by USEPA (see Table 6). This section and Table 7 summarizes the relative performance of each of the landfill remediation alternatives with respect to seven of the nine CERCLA evaluation criteria. The last two evaluation criteria, state and community acceptance, are evaluated in Section 2.7.2.3.

Table 6.
USEPA Evaluation Criteria for
Remediation (Cleanup) Alternatives

1. Overall Protection of Human Health and the Environmental addresses whether a cleanup method provides adequate protection to human health and the environment and describes how risks presented by each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with ARARs addresses whether a cleanup method will meet all applicable or relevant and appropriate requirements (federal and state environmental requirements).

3. Long-Term Effectiveness and Permanence is the ability of a cleanup method to maintain reliable protection of human health and the environment over time after the action is completed.

4. Reduction of Toxicity, Mobility, or Volume Through Treatment is the anticipated ability of a cleanup method to reduce the toxicity, mobility, or volume of the hazardous substances present at the site through treatment.

5. Short-Term Effectiveness addresses the period of time needed to complete the cleanup and any adverse impacts on human health and the environment that may occur during the construction and operation period.

6. Implementability is the technical and administrative feasibility of a cleanup method, including the availability of materials and services required by the method.

7. Cost includes the estimated capital and operation and maintenance costs of each cleanup method.

8. State Acceptance indicates whether the State of Maryland agrees with the preferred cleanup method.

9. Community Acceptance indicates whether concerns are addresses by the cleanup method and whether the community has a preference for a cleanup method. Public comment is an important part of the final decision. This ROD represents APG's request to the community to provide comments on the proposed cleanup.

Table 7.
Comparison of Groundwater Remedial Action Alternatives

Remedial alternative	Overall protection to human health and the environment	Compliance with ARARs	Long-term effectiveness and permanence	Reduction of Toxicity, Mobility, and Volume	Short-Term Effectiveness	Implementability	Cost
			Evaluation criteria				
Groundwater Alternative 1--No action with monitoring and land use restrictions	May provide adequate protection. RAOs are partially met.	Not met.	May not be effective long-term; groundwater monitoring will indicates if conditions change.	No reduction other than natural processes.	No impacts on community or worker health or the environment	No construction, equipment, storage, or disposal needs.	Capital $4,800 O&M $12,570/year NPW $198,032
Groundwater Alternative 2--SBRs	Reduce risks to potential receptors; prevents off-site migration; RAOs are met.	Compliance with all ARARs.	8 to 13 years are required to reduce all TCE contamination below MCL. Long-term O&M is high.	Permanence reduction of toxicity, mobility, and volume. Process is destructive and nonreversible. Contaminated sludge may be generated.	Minor short term increase in noise and dust.	Required labor, equipment, and materials are readily available. Presence of CWM-filled containers could delay implementation. Proven Technology.	Capital O&M $103,763/year NPW $2,542,890
Groundwater Alternative 3--UV-ox	Reduces risks to potential receptors; prevents off-site migration; RAOs are met.	Compliance with all ARARs.	8 to 13 years are required to reduce all TCE contamination below MCL. Long-term O&M in high.	Permanent reduction of toxicity, mobility, and volume. Process is destructive and nonreversible and no hazardous byproducts are produced.	Minor short-term increase in noise and dust.	Required labor, equipment, and materials are readily available. Presence of CWM-filled containers could delay implementation. Proven technology.	Capital $511,491 O&M $144,991/year NPW $2,018,106
Groundwater Alternative 4-in situ reductive dehalogenation	Reduces risks to potential receptors; prevents off-site migration; RAOs are met.	Compliance with all ARARs.	Approximately 60 years are required to reduce all TCE contamination below MCL. Long-term O&M is low.	Permanent reduction of toxicity, mobility, and volume, mobility, and destructive, nonreversible, and no hazardous byproducts are expected.	Extensive excavation required, moderate increase in noise and dust. Greater potential for workers to contact groundwater and CWM-filled containers.	Required labor, equipment, and materials are readily available. Presence of CWM-filled containers could delay implementation. Most previous studies have been bench-scale; may be more difficult to implement.	Capital $3,365,095 O&M $52,860/year NPW $4,565,698
			Evaluation criteria				
Groundwater Alternative 5--aboveground reductive dehalogenation	Reduces risks to potential receptors; prevents off-site migration, RAOs are met.	Compliance with all ARARs.	8 to 13 years are required to reduce all TCE contamination below MCL. Long-term O&M is high.	Permanent reduction of toxicity, mobility, and volume. Process is destructive nonreversible and no hazardous byproducts are expected.	Minor short-term increase in noise and dust.	Required labor, equipment, and materials are available. Presence of CWM-filled containers could delay implementation. Proven at the bench scale level.	Capital $706,901 O&M $83,850/year NPW $1,737,266
Groundwater Alternative 6--air stripping With Gas Treatment	Reduces risks to potential receptors; prevents off-site migration; RAOs are met.	Compliance with all ARARs.	8 to 13 years are required to reduce all TCE contamination below MCL. Long-term O&M is high.	Reduction of toxicity and mobility. Process is nondestructive. Contaminant is transferred to atmosphere or gas treatment unit.	Minor short-term increase in noise and dust.	Required labor, equipment, and materials are readily available. Presence of CWM-filled containers could delay implementation. Proven technology. May need air emission permit.	Capital $1,143,104 O&M $81,467/year NPW $1,988,708

Overall protection of human health and the environment. The five treatment alternatives involve groundwater treatment and provide adequate protection of human health and the environment by reducing TCE concentrations to below the MCL of 5 :g/L. Because contaminant concentrations will be reduced through treatment, the discharge of treated groundwater to a tributary of Bush River is not expected to have any adverse environmental impacts. Alternative 1, no action, provides no protection of human health and the environment, even though monitoring determines if the TCE plume is approaching the site boundary or Monks Creek. Achievement of ARARs All five treatment alternatives comply with all ARARs including reducing TCE concentrations below the MCL of 5 :g/L. Alternative 1 does not comply with ARARs.

2.7.2.2 Primary Balancing Criteria

Long-term effectiveness Alternatives 2, 3, 5 and 6 (SBRs, UV-oxidation, aboveground reductive alogenation, and air stripping, respectively) provide relatively similar high levels of long-term effectiveness and permanence. Alternative 4 (in situ reductive dehalogenation) requires considerably more time than the other treatment alternatives to achieve the same level of remediation. Alternative 1 (no action) does not provide long-term effectiveness and permanence. Reduction in toxicity, mobility, or volume of contaminants Alternatives 2 through 5 (SBRs, UV-oxidation, in situ reductive dehalogenation, and aboveground reductive dehalogenation, respectively) reduce the contaminant toxicity, mobility, and volume in a relatively similar manner by a magnitude assumed to be comparable to the destruction of the contaminant. Alternative 2 and 6 (SBRs and air stripping, respectively) result in hazardous byproducts (sludge or carbon filters). In addition, Alternative 6 (air stripping) is a nondestructive technology (TCE is not destroyed but merely transferred to another medium). Alternative 1 does not reduce the toxicity, mobility, or volume of contaminated groundwater. Short-term effectiveness Alternative 1 is highly effective in the short term because public access to Cluster 1 is currently restricted. Alternatives 2 through 6 involve extensive construction activities that may pose some short-term risks to workers, the community, and the environment through dust generation, exposure to potentially contaminated soil and groundwater during construction, and potential encounters with UXO. These risks would be mitigated by using engineering controls and personal protective equipment during construction activities. Alternative 4 (in situ reductive dehalogenation) may pose the greatest short-term risk because of the increased potential for workers to contact contaminated groundwater and the extensive excavation that would be required to install a slurry/treatment wall around the plume. The extensive excavation may also increase the likelihood of accidental UXO detonation. Alternatives 2, 3, 5, and 6 are expected to reduce TCE concentrations below the MCL within 15 years, while Alternative 4 (in situ reductive dehalogenation) may require 60 years, resulting in lower short-term effectiveness. Implementability Alternative 1 (no action) is easily implementable because it requires minimal construction, no equipment, and minimal handling of contaminated materials. Alternatives 2, 3, and 6 (SBRs, UV-oxidation, and air stripping, respectively) are relatively easy to implement because the required labor, equipment, and materials are readily available and because they are proven technologies commonly used to treat contaminated water. As with all the treatment alternatives, UXO presence may delay implementation. In addition, air emission permits may be required for Alternatives 2, 3, and 6. Alternative 5 (aboveground reductive dehalogenation) is expected to be moderately easy to implement. The required labor, equipment, and materials are readily available.

However, this alternative has not been demonstrated on a full-scale basis at similar sites, so unforeseen implementation difficulties may arise. This possibility is believed to be offset by the advantage gained by demonstrating an innovative technology. As with the other treatment alternatives, UXO presence may delay implementation, and an air emissions permit may be required. Alternative 4 (in situ reductive dehalogenation) is expected to be moderately difficult to implement. Although the labor, equipment, and materials are readily available, the construction of a slurry wall around the entire plume or plumes will be complicated by shoring, dewatering of the trench, and the presence of UXO. In addition, this alternative has not been employed on a full-scale basis at other similar sites, so unforeseen implementation difficulties may be encountered. Cost The estimated capital, O&M, and net present worth costs for each groundwater remedial alternative are summarized in Table 7.

2.7.2.3 Modifying Criteria

State Acceptance MDE has been involved in the selection of the alternatives for groundwater cleanup at Cluster 1 and in identifying cleanup objectives for groundwater (concentrations of TCE below the MCL of 5 :g/L). In addition, the State of Maryland is satisfied that the appropriate remedial action process was followed in evaluating remedial action alternatives for the groundwater at Cluster 1 and concurs with the selected remedy. Public Acceptance APG solicited input from the public on the development of alternatives and on the alternatives identified in the proposed plan. The public is in agreement with the cleanup objectives, and most of the commenters were in agreement with the preferred alternative. Several members of the public preferred a different treatment system, such as air stripping, for cleanup of the groundwater. During the comment period, APG provided these commenters with additional information regarding their concerns. It appears the additional information satisfied their concerns A detailed summary of comments and APG's responses are presented in section 3.0.

2.7.3 Selected Remedy

The selected remedy to clean up the groundwater contamination at Cluster 1 is Alternative 5, aboveground reductive dehalogenation, using a groundwater cleanup objective of 5 :g/L for TCE, based on ARARs. Alternative 5 is highly protective of human health and the environment; complies with all ARARs; has a high level of long-term effectiveness and permanence; reduces the toxicity, mobility, and volume of contamination through treatment; has a high level of short-term effectiveness; is expected to be easily implementable; and is relatively cost-effective. Because the TCE plume is not an immediate threat to human health or the environment, this alternative presents a unique and ideal opportunity to evaluate an innovative technology that has already been shown to effectively treat site groundwater in bench-scale testing. There are no negative impacts to human health or the environment by employing such an innovative technology. Alternative 5 will contain the plume on-site (by groundwater extraction) and will provide treatment to reduce TCE levels to below the MCL of 5 :g/L.

The major components of the selected remedy include:

Extraction of contaminated groundwater using extraction wells to include an artificial cone of depression within the water table and to remove contaminated groundwater from the aquifer. The well characteristics are based on groundwater modeling. Pump tests are conducted before final design of the system to determine/confirm the transmissivity, pumping rate, hydraulic conductivity, and cone of influence of the recovery wells. A pilot-scale treatability study is performed before implementation of the alternative.

Treatment using aboveground reductive dehalogenation vessels, which contain reactive media composed of metallic iron filings. The readily oxidizable medium produces a reducing environment capable of abiotic degradation of TCE.

Discharge of treated groundwater to a tributary of Bush River. Sampling will be conducted before and after discharge to ensure that the discharge is not causing an exceedence of Ambient Water Quality Criteria.

Long-term groundwater monitoring including annual sampling for 15 years.

Land-use restrictions to prohibit the on-site use of groundwater.

The costs for Alternative 5 are summarized in Table 8.

The goal of this remedial action is to restore groundwater to its beneficial use, which is, at this site, as a potential drinking water source. Based on information obtained during the remedial investigation and on a careful analysis of all remedial alternatives, it is believed the selected remedy will achieve this goal. It may become apparent, during implementation or operation of the groundwater extraction system and its modifications, that contaminant levels have ceased to decline and are remaining constant at levels higher than the remediation goal over some portion of the contaminated plume. In such a case, the system performance standards and/or the remedy may be reevaluated.

The selected remedy will include groundwater extraction for an estimated period of 15 years, during which the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include any or all of the following:

Cessation of pumping at individual wells where cleanup goals have been attained.

Alternating pumping at wells to eliminate stagnation points.

Pulse pumping to allow aquifer equilibration and to allow adsorbed contaminants to partition into groundwater. Installation of additional extraction wells to facilitate or accelerate cleanup of the contaminant plume.

At those wells where pumping has ceased, the aquifer will be monitored every 5 years following discontinuation of groundwater extraction to ensure cleanup goals continue to be maintained.

The estimated net present worth cost of Alternative 5 is $1,737,266. The estimated time for remediation is 15 years.

2.7.X Performance Standards

The contaminants plume of TCE will be contained and treated until the MCL of 5 ug/L is attained within the Former Nike Site and areas affected by this TCE plume. Groundwater monitoring will be conducted to ensure the plume is not migrating and that levels of TCE are being reduced to 5 ug/L. Discharge of the treated water will meet the substantive requirements of the NPDES Permit program.

2.7.4 Statutory Determinations

The selected remedy discussed in Sect.2.7.3 satisfies the requirements under Sect.121 of CERCLA to:

Protect human health and the environment.
Comply with ARARs.
Be cost-effective.
Use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
Satisfy the preference for treatment as a principal element.

2.7.4.1 Protection of Human Health and the Environment

The selected remedy, Alternative 5, will reduce risks to future users of Cluster 1 by treating the groundwater via extraction, followed by treatment using aboveground reductive dehalogenation then discharge of the treated groundwater to a tributary of the Bush River. After groundwater is treated, no adverse health effects are anticipated if humans, animals, or vegetation are exposed to the treated groundwater. Groundwater extraction and treatment are expected to reach the MCL of 5 :g/L TCE within 15 years, which is protective of human health and the environment. Temporary land-use restrictions will minimize the risks to human health and the environment until the MCL is reached. Groundwater extraction prevents the off-site migration of contaminants and the potential discharge of groundwater to Monks Creek by creating a hydraulic gradient in the direction of the pumping wells. No unacceptable short-term risks or cross-media impacts will be caused by implementing Alternative 5 because UXO clearance will be performed before excavation or drilling begin. During remediation, short-term increases in noise and dust are not expected to affect adjacent communities; remediation workers will wear adequate personal protective equipment.

2.7.4.2 Compliance with ARARs

The selected remedy will comply with all chemical-, location-, and action-specific ARARs. Through the use of a reductive dehalogenation treatment system with appropriate engineering controls to minimize release of pollutants to air, land, or water, the remedy will achieve the ARARs listed below.

Chemical-specific ARARs

- Maryland standards applicable to generators of hazardous waste (COMAR 26.13.03), which apply to the generation of potentially contaminated spent media from the reductive dehalogenation unit (applicable).

- Maryland regulations for groundwater monitoring and protection (COMAR 26.13.05.06), which apply to groundwater monitoring and groundwater quality criteria (applicable).

- Maryland NPDES regulations (COMAR 26.08.04) apply to treated effluent discharged to surface water of the state (applicable).

- Maryland surface water quality criteria (COMAR 26.08.02.03) may apply to treated effluent discharged to surface water (relevant and appropriate).

- Maryland drinking water quality standards (COMAR 26.04.01) apply to potable groundwater (relevant and appropriate).

- Maryland air quality regulations (COMAR 26.11.01-26.11.02) apply to general or toxic process emissions and construction activities that generate particulates (applicable).

Location-specific ARARs

None.

Action-specific ARARs

- Maryland standards applicable to tanks and containers (COMAR 26.13.05.09-.10) such as may be sued to temporarily store groundwater before treatment/disposal (applicable).

- Maryland transportation and disposal standards (26.13.04) which apply to off-site shipment of potentially contaminated spent reductive dehalogenation media (applicable).

- Maryland landfill standards (COMAR 26.13.05.14) apply to disposal of potentially contaminated spent reductive dehalogenation media (applicable).

- Maryland chemical, physical, and biological treatment standards (COMAR 26.13.05.18) apply to treatment systems such as the aboveground reductive dehalogenation system (applicable).

- Federal standards for miscellaneous units (40 CFR 264 Subpart X) may apply to any UXO encountered during construction activities (relevant and appropriate).

- Federal Fish and Wildlife Coordination Act applies to the conservation of wildlife resources (such as bald eagle) that may nest in the Edgewood area (applicable).

- Maryland nontidal wetlands regulations (COMAR 08.05.04) apply to any actions, such as groundwater extraction, that may affect wetlands near Cluster 1 (applicable).

- Maryland water appropriation or use regulations (COMAR 08.05.02) apply to groundwater extraction (applicable).

- Maryland regulations for well drillers (COMAR 26.05) apply to groundwater monitoring and extraction well construction (applicable).

2.7.4.3 Cost-Effectiveness

The selected remedy is cost-effective because it has been determined to provide overall effectiveness proportional to its cost (the net present worth is $1,737,266). Of the five action alternatives, the selected remedy is more cost-effective than the other alternatives. This technology is further recommended because of the destructive nature of the technology and for the advancement of this innovative technology during a full-scale application of this system at a hazardous waste site. USEPA and Department of Defense guidance encourages implementation of innovative technologies at federal facilities.

2.7.4.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy, Alternative 5, is a permanent solution that uses alternative treatment technologies to the maximum extent practicable and provides the best balance of tradeoffs among the alternatives. Alternative 1 fails to meet several criteria and thus appears to be unacceptable. The remaining five treatment alternatives meet the threshold criteria and are comparable in terms of long-term effectiveness. and permanence; reduction in toxicity, mobility and volume of contaminants; and short-term effectiveness. They differ in terms of implementability and cost. Alternatives 2 and 4 are the most costly. Alternative 6, while least costly, is a nondestructive technology. Unlike the other alternatives, the selected remedy uses an innovative technology but requires treatability testing to determine its effectiveness before implementation. There will be no negative impacts to human health or the environment from using an innovative technology.

The support of the state and community in the evaluation process and the selection of Alternative 5 further justify its selection.

2.7.4.5 Preference for Treatment as a Principal Element

The statutory preference for treatment is satisfied by using aboveground reductive dehalogenation to treat TCE-contaminated groundwater at Cluster 1.

2.8 LANDFILL REMEDIATION

The Army set cleanup objectives for the launch Southwest Landfill by using the conclusions from the RI, and RAOs listed in the FS, and ARARs.

Although the Launch Southwest Landfill was reportedly used for the disposal of construction debris, approximately 10 empty 55-gal drums were encountered there. It is possible that other wastes were disposed of at the landfill. These wastes could include currently intact containers of potential contaminants that may be released in the future. Therefore, the cleanup objectives for the landfill are to prevent the contamination of groundwater or surface water by any potential contaminants of concern that may be present in the landfill and to minimize the potential for human contact with the water.

Actual or threatened releases of hazardous substances from the landfill, 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.

2.8.1 Description of Alternatives

2.8.1.1 Alternative 1: No Action.

The no-action alternative involves no remedial action. No efforts are made to contain or remove the landfill contents. However, long-term monitoring will be conducted. Evaluation of the no-action alternative provides a baseline against which to measure other alternatives.

With respect to ARARs, RCRA requirements for a general closure (COMAR 26.13.05.07) and closure of a landfill (COMAR 26.13.05.14) are not met because controls to reduce contaminated runoff and to protect human health and the environment are not implemented. In addition, long-term liquid or precipitation migration through the closed landfill are not minimized. However, the required groundwater monitoring is performed through the installation of additional monitoring wells and annual groundwater sampling and analysis. This alternative does not achieve the protection of human health and the environment within the guidelines of the NCP. The safety risks presented in Sect. 2.6.1 for on-site residents are not reduced.

The costs for Alternative 1 are as follows:

Capital costs: $51,500
O&M cost: $4,100
Net present worth: $94,058 for 15 years
This alternative is expected to require 7 months to implement.

2.8.1.2 Alternative 2: Installation of a Composite Cap

This alternative includes the following:

Clearance of the entire landfill site for UXO before and during excavation; Technical Escort Unit (TEU) will be notified of and responsible for the disposal of any UXO identified on-site in accordance with ARMY regulations.
Performance of site grading, sediment and erosion control, and installation of a geonet to convey landfill gases to a venting system, if required.
Installation of a capping system in accordance with USEPA guidance for the closure of a hazardous waste landfill.
Maintenance and repair operations as needed (e.g., cutting vegetation, regrading, revegetating).
Long-term groundwater monitoring in accordance with RCRA closure and postclosure requirements (COMAR 26.13.05.06-.07).
Future land-use restrictions prohibiting construction on the landfill cap or any activities that might compromise the integrity of the landfill cap.
Installation of a perimeter chain link fence.

This alternative meets the cleanup objectives for the landfill. It prevents contamination of groundwater or surface water and minimizes the potential for human contact with the waste by isolating the source with an impermeable cap to prevent infiltration of liquids; this also minimizes contaminant transport to groundwater or surface water.

The costs for Alternative 2 are as follows:

Capital costs: $1,041,132
O&M cost: $25,860/year
Net present worth: $1,438,665 for 30 years
This alternative is expected to require 12 to 24 months to implement.

2.8.1.3 Alternative 3: Conventional Excavation of Landfill Contents in an Armored, Filtered-Air Shelter and Off-site Disposal of Excavated Waste

This alternative involves:

Clearance of the entire landfill site for UXO before and during excavation with TEU notified of, and responsible for, the disposal of any UXO identified on-site in accordance with Army regulations.
Conventional excavation within an armored, filtered-air shelter of the entire volume of waste in the landfill (estimated 18,538 cubic yards of material) in accordance with OSHA construction safety requirements (29 CFR 1926) and Maryland erosion and sediment control regulation (COMAR 26.09.01).
Segregation of waste into soil, debris, and rubble fractions.
Off-site disposal of excavated waste fractions in accordance with Maryland Solid Waste Regulations (COMAR 26.04.07) and Maryland Hazardous Waste Regulations (COMAR 26.13) governing storage, transport, characterization, and disposal of hazardous waste. Disposal location will depend on whether the waste is hazardous or nonhazardous.
Backfill, compaction, seeding, and mulching of landfill area.

Table 8

COST ESTIMATE
GROUNDWATER ALTERNATIVE 5

Groundwater Extraction with Vertical Well Manifolds;
Treatment by Above Ground Reductive Dehalogenation;
Discharge of Treated Water to Surface Water;
Long Term Groundwater Monitoring; Land Use Restrictions
Cluster 1, Aberdeen Proving Ground

CAPITAL COSTS

Item	Rate ($)	Quantity	Unit	Cost ($)	
Site Preparation					
- Site clearing, grubbing, hauling and disposal	3825 /acre	0.09	acre	344	
- UXO clearance (10-hour day)(a)	1350 /day	2	days	2,390	
Site Preparation Subtotal					2,734
Groundwater Extraction System					
- Vertical Well Installation (b) (c)	180 /foot	310	foot	55,800	
Includes labor, materials, well development, containerization of cuttings/fluids					
- Disposal of Cuttings (d)	35 /ton	3.5	ton	123	
- Transportation/Disposal of Cuttings (e)	100 /ton	3.5	ton	350	
- Soil Sample collection/ TCLP chemical profiling of soil cuttings (f)	1,200 /sample	3	sample	3,600	
- Baker Tanks (3) 6,500 gallon (g) (h)	600 /tank/mo.	3	tank	1,600	
- Tank Delivery/Pickup (3 tanks) (h)	800 /trip	2	trips	1,600	
- Water Samples (Full Suite TCL) (f)	1,200 /sample	3	samples	3,600	
- UXO Support (10-hour day)(a)	1,350 /day	3	days	4,050	
- Field installation oversight (labor and materials - 3 sites) (i)	640 /day	21	days	17,640	
Groundwater Extraction System Subtotal					
Groundwater Conveyance System					
- 1Hp Submersible pumps (7), piping; sensors; pitless adapters - installed (j)	1,350 /well	7	well	9,450	
- ALT.1 160 psi, 2"/6" Dual-wall piping/connectors, installed (k)(l)	29 /lf	600	lf	17,400	
- ALT.1 Trenching/backfilling (12" W by 36" D; includes mob/demob.) (m)	1.59 /lf	600	lf	954	
- Electrical, installed (15% of other conveyance system cost) (i)				5,489	
- 4" PVC treatment discharge piping/connectors, installed (m)	16.34 /lf	150	lf	2,450	
- Trenching/backfilling (12" W by 36" D) (m)	0.59 /lf	150	lf	89	
- Rip-rap (18" thickness), installed (m)	56 /sy	3	sy	168	
- Installation oversight (i)	840 /day	5	days	4,200	
- UXO support (8-hour day) (a)	940 /day	2	days	1,880	
Groundwater Conveyance System Subtotal				42,079	

This alternative meets the cleanup objectives for the landfill of preventing contamination of groundwater or surface water and minimizing the potential for human contact with the waste by removing the source from the site.

The costs for Alternative 3 are as follows:

Capital costs: $9,787,633 (excavated waste is considered hazardous)
$3,954,862 (excavated waste is considered nonhazardous)
O&M cost: $0/year
Net present worth: (equal to capital costs)
This alternative is expected to require 18 to 24 months to implement.

2.8.1.4 Alternative 4: Telerobotic Excavation of Landfill Contents in an Armored, Filtered-Air Shelter and Off-site Disposal of Excavated Waste

This alternative involves:

Clearance of the entire landfill site for UXO before and during excavation, with TEU notified of, and responsible for, the disposal of any UXO identified on-site in accordance with Army regulations. Telerobotic excavation of the entire volume of waste in the landfill (estimated 18.538 cubic yards of material) within an armored, filtered-air shelter to provide additional safety and to reduce the likelihood of a release to the environment in the unlikely event of accidental detonation of UXO. The shelter will be tested after assembly to determine if chemical agents could leak in the event of accidental detonation of chemical agent UXO. Real-time are monitoring for chemical agents may be used to protect workers and nearby residents. This work is performed in accordance with OSHA construction safety requirements (29 CFR 1926) and Maryland erosion and sediment control regulations (COMAR 26.09.01). Segregation of waster into soil, debris, and rubble fractions. Off-site disposal of excavated waste fractions in accordance with Maryland solid waste regulations (COMAR 26.04.07) and Maryland hazardous waste regulations (COMAR 26.13) governing storage, transport, characterization, and disposal of hazardous waste. Disposal location will depend on whether the waste is hazardous or nonhazardous. Backfill, compaction, seeding, and mulching of landfill area.

This alternative meets the cleanup objectives for the landfill of preventing contamination of groundwater or surface water and minimizing the potential for human contact with the waste by removing the source from the site.

The costs for Alternative 4 are as follows:

Capital costs: $9,662,333 (excavated waste is considered hazardous)
$3,829,562 (excavated waste is considered nonhazardous)
O&M cost: $0/year
Net present worth: (equal to capital costs).

This alternative is expected to require 18 to 24 months to implement.

2.8.2 Summary of the Comparative Analysis of Landfill Cleanup Alternatives

As required by CERCLA, remedial alternatives listed above were evaluated using nine criteria specified by USEPA (see Table 6). This section and Table 6 summarizes the relative performance of each of the landfill cleanup alternatives with respect to the nine CERCLA evaluation criteria.

2.8.2.1 Threshold Criteria

Overall protection of human health and the environment.
Alternative 2 (composite cap) provides a high level of overall protection to human health and the environment by preventing transport of, and human contact with, contaminants through the containment of wastes beneath an impermeable cap. In addition, the disturbance of the wastes during construction is minimized, thereby minimizing short-term risks to human health and the environment. Alternatives 3 and 4 (conventional excavation and telerobotic excavation, respectively) also have high levels of overall protection to human health and the environment because the waste is removed from the site. However, there may be significant short-term risks to human health and the environment during transport of the wastes. Alternative 1 (no action) does not provide overall protection of human health and the environment.

Achievement of ARARs. Alternatives 2, 3, and 4 comply with all ARARs. Alternative 1 (no action) does not comply with ARARs.

2.8.2.2 Primary Balancing Criteria

Long-term effectiveness Alternatives 3 and 4 may provide greater long-term effectiveness and permanence than Alternative 2 because the landfill contents are permanently removed from the site thereby eliminating any potential for leaching of contaminants into groundwater or surface water. However, if the cap is properly maintained, Alternative 2 can also provide a high level of long-term effectiveness. Alternatives 1 (no action) provides no long-term effectiveness. Reduction in toxicity, mobility, or volume of contaminants Alternatives 3 and 4 result in a permanent reduction in the toxicity, mobility, and volume of the waste because it is excavated and removed from the site. Alternative 2 reduces the mobility of contaminants in the landfill but does not reduce their toxicity or volume. Alternative 1 (no action) provides no reduction in toxicity, mobility, or volume of contaminants.

Short-term effectiveness Alternatives 2, 3, and 4 involve construction activities that can generate short-term impacts from dust, soil erosion, or accidental detonation of UXO. However, Alternative 2 (composite cap) provides fewer short-term impacts than Alternatives 3 and 4 because the waste is not disturbed. Short-term impacts may be greater for Alternatives 3 and 4 because of the extensive excavation conducted, the greater potential for encountering UXO, and the need to transport wastes. However, the use of an armored, filtered-air shelter during excavation can mitigate some of these risks. Alternative 1 (no action) provides no short-term effectiveness.

Implementability Alternative 2 (composite cap) is expected to be relatively easy to implement because the labor, equipment, and materials are readily available and because capping is a well-demonstrated technology at similar sites. Alternatives 3 and 4 (conventional excavation and telerobotic excavation, respectively) are expected to be moderately difficult to implement because the use of an armored, filtered-air shelter or telerobotic excavation is not well demonstrated at similar sites and may result in encountering unforeseen implementation difficulties. In addition, the excavation and transport of waste materials is more difficult than the construction of a cap. Alternative 1 (no action) requires no effort to implement.

Cost The estimated capital, O&M, and net present worth cost for each landfill remedial alternative are summarized in Table 9.

2.8.2.3 Modifying Criteria

State Acceptance MDE took part in the selection of the remediation alternatives for landfill cleanup at Cluster 1 and in identification of cleanup objectives (preventing accidental detonation of UXO and leakage of contaminants to the environment). In addition, the State of Maryland is satisfied that the appropriate remedial action process was followed in evaluating remedial action alternatives for the landfill at Cluster 1 and concurs with the selected remedy. Public Acceptance APG solicited input from the public on the development of alternatives and on the alternatives identified in the proposed plan. The public is in agreement with the cleanup objectives, and most of the commenters were in agreement with the preferred alternative. One community group requested additional site characterization for the landfill and other members of the public preferred the landfill be excavated. During the comment period, APG provided those commenters with additional information on their concerns. It appears the additional information satisfied their concerns. A detailed summary of concerns and APG's responses are contained in section 3.0.

2.8.3 Selected Remedy

The selected remedy for the cleanup of the Southwest Launch Landfill is Alternative 2, composite cap. This alternative is highly protective of human health and the environment, complies with all ARARs, has a high level of long-term effectiveness and permanence if the cap is properly maintained, reduces the mobility of contaminants through containment, has a high level of short-term effectiveness, is expected to be easy to implement, and is relatively cost-effective. Alternative 2 involves:

Site preparation: clearing the area of trees, vegetation, root mat, and debris, and stripping an average of 6 in. of soil. Debris is disposed of at an off-site landfill or wood chipping facility in accordance with Maryland solid waste regulations (COMAR 26.04.07) governing disposal of debris. This work is performed in accordance with Maryland erosion and sediment control regulations (COMAR 26.09.01) and OSHA construction safety guidelines (29 CFR 1926). Clearance of the entire landfill site for UXO, TEU will be notified of, and responsible for, the disposal of any UXO identified on-site in accordance with Army regulations. Stabilization of seep areas or soft, loose soil with geogrid to support the cap.

Performance of site grading, sediment and erosion control, and installation of a geonet to convey landfill gases to a venting system, if required. Installation of a capping system in accordance with USEPA guidance for the closure of a hazardous waste landfill, including:

- A geosynthetic clay layer substituted for the typical compacted 2-ft-thick clay layer of low permeability.
- A layer of synthetic geomembrane.
- A drainage layer overlain by filter fabric to prevent clogging by fines.
- A final earthen cover with a 3% minimum slope and vegetative stabilization.

Inspection of cap system at regular intervals to check for signs of erosion, settlement, or invasion by deep-rooted vegetation and burrowing animals in accordance with Maryland hazardous waste management regulations governing closure and postclosure care (COMAR 26.13.05.07). Maintenance and repair operations as needed (e.g., cutting vegetation, regrading, revegetating). Installation of groundwater monitoring wells in accordance with Maryland water appropriation and use regulations (COMAR 08.05.02) governing well construction and groundwater extraction and Maryland hazardous waste regulation (COMAR 26.13.05.06) governing closure requirements to detect off-site contaminant migration, with sampling and analysis conducted annually. Future land-use restrictions prohibiting construction on the landfill cap or activities that compromise the integrity of the landfill cap.

Installation of a perimeter chain link fence.

This selected remedy meets the landfill cleanup objectives by containing the waste to prevent migration of contaminants to the environment and to prevent human contact with waste materials.

The costs for Alternative 2 are summarized in Table 10.

Table 9.
Comparison of Landfill Remedial Action Alternatives

	Evaluation criteria						
Remedial alternative	Overall protection to human health and the environment	Compliance with ARARs	Long-term effectiveness and permanence	Reduction of toxicity, mobility, and volume	Short-Term effectiveness	Implementability	Cost
No Action	Does not provide adequate protection. RAOs are not met.	Not met.	Risks are not reduced.	No reduction of toxicity, mobility, and volume.	No impacts on community or worker health or the environment.	No construction, equipment, storage, or disposal needs.	No associated capital or O&M costs.
Landfill Alternative 2--RCRA cap	High level of protection.	Complies with all ARARs.	Significantly reduces risks as a result of leaching of contaminating into groundwater or surface runoff of contaminant water. O&M is required.	Reduces contaminated mobility but not contaminated volume or toxicity.	Minor, short-term increases noise and dust.	Required labor, materials, and equipment are readily available.	Capital $1,041,132; O&M $25,860/year; NPW $1,438,665.
Landfill Alternative 3-conventional excavation	High level of protection.	Complies with all ARARs.	More effective because the source of potential contamination is removed. No O&M is required.	Permanent reduction in toxicity, mobility, and volume.	Moderate short-term increases in noise and dust. Potential for accidental detonation of UXO. Greater risk because of disturbance of waste.	Required labor and equipment are readily available.	Hazardous capital $9,787,633; nonhazardous capital $3,954,862. No O&M.
Landfill Alternative 4--telerobotic excavation	High level of protection.	Complies with all ARARs.	More effective because the source of potential contamination is removed. No O&M is required.	Permanent reduction in toxicity, mobility, and volume.	Moderate short-term increase in dust. Potential for accidental UXO detonations. Greater risk because of disturbance of waste.	Required labor and equipment are available. Use of specialized equipment could delay implemenation.	Hazardous capital $9,662,333; nonhazardous capital $3,829,562.

2.8.X Performance Standards

The landfill cap will prevent migration of contaminants from the waste to the groundwater. The cap will have a permability of 1X10-7 cm/s. The cap and groundwater will be monitored in accordance with an approved Operation and Maintenance Plan. A 5 year review will be conducted in accordance with Section 121(c), CERCLA Cleanup Cleanup Standards, to ascertain if the cap has maintained its integrity and ontamination is not leaching to the groundwater.

2.8.4 Statutory Determinations

The selected remedy discussed in Section 2.8.3 satisfies the requirements under Section 121 of CERCLA to:

Protect human health and the environment.
Comply with ARARs.
Be cost-effective.
Use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
Satisfy the preference for treatment as a principal element.

2.8.4.1 Protection of Human Health and the Environment

The selected remedy, Alternative 2, composite cap, will reduce risks to future users of Cluster 1 through containment of the entire volume of waste in the landfill with an impermeable cap. Alternative 2 is highly protective of human health and the environment because it prevents migration of contaminants to the environment by preventing infiltration of precipitation and eliminating the potential for direct contact with the waste. Also, the potential for surface waster contamination due to runoff is eliminated, as is the potential for airborne dispersion of potentially contaminated dust, except during construction activities. However, surrounding communities are sufficiently distant to be relatively unaffected by noise and dust. Precautions will be taken to ensure the safety of site workers, who will wear appropriate personal protective equipment. Dust and erosion control measures are implemented to minimize off-site migration of sediment and particulates. All work is conducted in compliance with applicable OSHA regulations, and workers have all appropriate health and safety certifications.

No adverse environmental impacts are expected from capping activities under this alternative.

2.8.4.2 Compliance with ARARs

The selected remedy will comply with all chemical-, location-, and action-specific ARARs. By containing the waste beneath an impermeable cap and using appropriate engineering controls during construction, operations, and maintenance to prevent release of pollutants to air, land or water, the selected remedy will achieve the ARARs listed below.

Table 8 (Con't)

COST ESTIMATE
GROUNDWATER ALTERNATIVE 5

CAPITAL COSTS

Item	Rate ($)	Quantity	Unit	Cost ($)
Groundwater Treatment (**)				
ALT.1 - Vessels at 3 Sites (*)				
- (3) 10,000 gallon vessels (8370x1.5=$12,555) (n)	12,555 /tank	3	tanks	37,665
- (1) 5,000 gallon vessels (2977 x 1.5 = $4,465) (o)	4,465 /tank	1	tanks	4,465
- Reactive Media (p)	477 /ton	472	tons	225,144
- (3) Pre-fabricated treatment system buildings, including heating, insulation vents, etc. Footings and concrete slab ($6000 additional) for (2) sites. (i)				57,000
Groundwater Treatment Subtotal				324,274
Land Use Restrictions for Groundwater				4,000
Construction Subtotal				461,650
Construction Contingencies (20%)				92,330
Health and Safety Training and Equipment (2.5%)				11,541
Total Construction Cost				565,521
Design, Engineering, and Construction Management (25%)				141,380
TOTAL CAPITAL COST				706,901

NOTE:
* ALT 1 = Treatment units at 3 contamination sites; 1-10,000 gallon at each and an additional 5,000 gallon tank at silos.

** The capital costs for the above ground treatment units shown in this table are estimates based on bench scale results for TCE degradation rates
The costs for implementation of full scale operation will vary based on the results of a pilot scale field testing program.

Table 8 (Con't)

COST ESTIMATE
GROUNDWATER ALTERNATIVE 5

O&M COSTS

Item	Rate ($)	Quantity	Unit	Cost ($)
Annual Groundwater Monitoring				
- Sample Analysis (VOCs) (30-day turnaround) (f)	145 /sample	7	sample	1,015
- QA/QC Sample analysis (field and trip blanks) (f)	145 /sample	4	sample	580
- Sample containers and shipment (i)	100 ea	2	ea	200
- Labor (i)	1,200 /day	2	days	2,400
- Field supplies (i)	225 /sample	7	sample	1,575
- Report preparation and sample management (i)	3,000 ea	1	ea	3,000
Annual Sampling Subtotal			8,770	
Above Ground Reductive Dehalogenation System				
- Visual Inspection (2 hours per day) (i)	40 /day	365	days	14,600
- Influent and effluent sampling including VOC's analysis, blanks, containers, shipping, field supplies, and report preparation (8 [Alt 1]x12x$145x1.5)(f) (6[Alt 2]x12x$145x1.5)(f)				20,880
- Spare parts (average) (i)				1,600
System Subtotal				37,080
Pumps	0.653 /1000 gal.	36792		24,025
Annual O&M Subtotal				69,875
Contingency and Overhead (20%)				13,975
Annual O&M Cost				83,850
TOTAL O&M COST (15 YEARS @ 5% DISCOUNT FACTOR)				870,365
Reactive Media Replacement (Assumed at 7.5 years $250,000 PW @ 5%)				160,000
NET PRESENT WORTH OF GROUNDWATER ALTERNATIVE 5				1,737,266

Table 8 (Con't)

COST ESTIMATE
GROUNDWATER ALTERNATIVE 5

NOTES

Unless otherwise stated costs were obtained from R.S. Means, 1993.

(a) Vendor Quote: Human Factors Applications, Maryland.
(b) Vendor Quote: Hardin-Huber, Inc., Baltimore, Maryland.
(c) Drilling length of 310 feet = 2 wells @ 30', 2 wells @ 50', and 3 wells @ 50' (silos)
(d) Approximately 3.5 tons = 310 linear feet x 6" dia borehole x 100 lb/CF
Soil will be stored on plastic sheeting onsite; should testing reveal the presence of minimal to no contamination, cuttings may be disposed by spreading them onsite.
(e) Typical cost for loading, hauling, and incineration of soil at Soil Safe, Baltimore, MD (if necessary).
(f) Vendor Quote; General Physics, Gaithersburg, Maryland.
(g) One 6,500 tank per treatment site; volume development water = 20gpm x 2 hours x 2 wells (or 3 wells).
(h) Vendor Quote; Baker Tanks
(i) Dames & Moore estimate
(j) Vendor Quote: Drillers Services, Inc. Millersville, Md/Hardin-Huber, Inc., Baltimore, Maryland
(k) Pipe length/trenching estimate from southern and northern contamination areas to central treatment facility at silo pad.
(l) Material based on vendors quote: J.P. McElvenny Co., Inc., Exton, Pa. Installation cost based in R.S. Means.
(m) Rates were obtained from R.S. Means, 1992. Unit costs for hazardous waste were increased by 50%.
(n) Vendor Quote: Chem-Tainer, West Babylon, New York.
(o) Vendor Quote: Tarus Equipment Co., Columbus Ohio
(p) Vendor Quote: Environmental Technologies, Inc., Ontario, Canada.

Table 10

COST ESTIMATE
LANDFILL ALTERNATIVE 2

Installation of a Composite Cap and Land Use Restrictions
Cluster 1, Aberdeen Proving Ground

CAPITAL COSTS

Item	Rate ($)(a)	Quantity	Unit	Cost ($)
Site Preparation				
- Site clearing, grubbing, hauling and disposal (a)	3825 /acre	1.1	acre	4,028
- UXO clearance (h)	1195 /day	10	days	11,950
- Site grading material (a)	19.97 /cy	2228	cy	44,493
- Proofrolling (a)	1.43 /sy	5347	sy	7,646
Site Preparation Subtotal				68,297
Landfill Cap				
- Geosynthetic Clay Liner (c)	0.55 /sf	49,000	sf	26,950
- Synthetic geomembrane (installed and tested) (d)	3.62 /sf	49,000	sf	177,380
- Synthetic geonet for drainage (installed and tested) (d)	0.90 /sf	49,000	sf	44,100
- Geotextile filter fabric (installed) (d)	4.00 /sy	5400	sy	21,600
- Topsoil (2 ft., installed) (a)	21.07 /cy	4456	cy	93,888
- Vegetation (a)	1.96 /sy	1,815	sf	3,557
- Vent system (including 2 wells, filter fabric, and geonet for gas collection) (d,f)				68,700
- Anchor trench (including excavation, loading, hauling, disposal, gravel, topsoil and filter fabric) (a,d)				106,118
- Mobilization/demobilization (f)				9,000
Landfill Cap Subtotal				551,293
Land Use Restrictions (including perimeter chain link fence and land use restrictions) (a,f)				27,000

Table 10

COST ESTIMATE
LANDFILL ALTERNATIVE 2

CAPITAL COSTS

Item	Rate ($)(a)	Quantity	Unit	Cost ($)
Well Abandonment				
- Abandon 2 well (160 feet) (b, f)				11700
- Chemical analysis of drummed waste (TCLP)(i)	1,600 /sample	3	samples	4,500
- Disposal of drummed solid waste (f)	390 /drum	18	drums	7,020
- Disposal of drummed decon rinseate (RCRA organic extraction) (f)	1.25 /gal	110	gals	138
- Transportation of drum shipment (solid & liquid) (f)	300 /shipment	1	shipment	300
Well Abandonment Subtotal				23,658
Installation of Monitoring Wells (b)	3,225 /well	3	wells	9,675
Construction Subtotal				679,923
Construction Contingencies (20%)				135,985
Health and Safety Training and Equipment (including dust control equipment)(2.5%)				16,998
Total Construction Cost				832,905
Design Engineering, and Construction Management (25%)				208,226
TOTAL CAPITAL COST				1,041,132

Table 10 (con't)

COST ESTIMATE
LANDFILL ALTERNATIVE 2

O&M COSTS

Item	Rate ($)(a)	Quantity	Unit	Cost ($)
Annual Groundwater Monitoring				
- Sample Analysis (VOCs, semi VOC's, metals, and pesticides) (g)	1,225 /sample	3	sample	3,675
- QA/QC sample analysis (field and trip blanks) (g)	1,225 /sample	2	sample	2,450
- Sample containers and shipment (f)	100 ea	1	ea	100
- Labor (f)	1,200 /day	1	days	1,200
- Field supplies (f)	225 /sample	3	sample	675
- Report preparation and sample management (f)	3,000 ea	1	ea	3,000
Annual Sampling Subtotal				11,000
Inspection and Maintenance of Landfill Cap				
- Routine Inspection and minor repairs (20 days/year) (f)	500 /day	20	days	10,000
- Mowing of the cap (assume mowed 3 times/year) (f)	225 /ac	2	ac	450
Inspection and Maintenance Subtotal				10,450
Annual O&M Subtotal				21,550
Contingency and Overhead (20%)				4,310
Annual O&M Cost				25,860
TOTAL O&M COST (FOR 30 YEARS @ 5% DISCOUNT FACTOR)				397,533
NET PRESENT WORTH OF LANDFILL ALTERNATIVE 2-SYNTHETIC CAP				1,438,665

(a) Unless otherwise stated costs were obtained from R.S. Means, 1993
(b) Vendor quote; Environmental Drilling, Inc., Baltimore, Maryland.
(c) Vendor quote; James Clem, Corp., Fairmont, Georgia
(d) Vendor quote; Miller Company, Fallston, Maryland.
(e) Vendor quote; Hardin and Huber, Baltimore, Maryland
(f) Dames & Moore estimate.
(g) Vendor quote; Savannah Laboratories, Savannah, Georgia
(h) Vendor quote; UXB International, Inc., Chantilly, Virginia.
(i) Includes one sample of soil cutting from each well abandonment borehole and one sample of rinsewater.

Chemical-Specific ARARs

- Maryland standards for groundwater monitoring and protection (COMAR 26.13.05.06) apply to groundwater quality in the vicinity of the landfill as determined by periodic groundwater monitoring (applicable).

- Maryland air quality regulations (COMAR 26.11.01-26.11.02.21) apply to cap construction, operations, and maintains activities that may result in the discharge of pollutants to the atmosphere (applicable).

Location-Specific ARARs

- Maryland Natural Resources Code annotated, Sects. 8.1801 to 8.1816, applies to construction activities in the Chesapeake Bay critical area (applicable).

Action-Specific ARARs

- Maryland hazardous waste management requirements for closure and postclosure (COMAR 26.13.05.07) that apply to wastes left in place, requiring a cover (applicable).

- Maryland hazardous waste management landfill standards (COMAR 26.13.05.14) that provide design requirements for hazardous waste landfill caps (applicable).

- RCRA Subtitle C Standards for miscellaneous units (40 CFR 264 Subpart X) may apply to UXO encountered during cap construction activities (relevant and appropriate).

- Fish and Wildlife Coordination Act, which governs the conservation of wildlife resources (such as the bald eagle) that may rest in the Edgewood Area and be distributed during constructions activities (applicable).

- Maryland erosion and sediment control regulation (COMAR 26.09.01) apply to disturbance of significant quantities of earth such as would be expected with construction of a cap (applicable).

- Maryland regulations for well drillers (COMAR 26.05) apply to construction of monitoring wells near the landfill (applicable).

2.8.4.3 Cost-Effectiveness

The selected remedy is cost-effective because it has been determined to provide overall effectiveness proportional to its cost, the net present worth being $1,438,665. The estimated cost of the selected remedy is less than the cost of conventional excavation or telerobotic excavation of the landfill contents.

2.8.4.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

Alternative 2 is a permanent solution that uses alternative treatment to the maximum extent practicable. Alternative 1 fails to meet the threshold criteria of overall protection and compliance with ARARs and is thus clearly unacceptable. Alternatives 2, 3, and 4 meet the threshold criteria. Alternative 2 is preferred because although landfill contents are not removed-and the toxicity and volume of contaminants are not reduced-the mobility of the contaminants and short-term risks are minimized. Alternatives 3 and 4 are comparable in terms of the degree of long-term effectiveness and reduction in toxicity, mobility, and volume of waste. They differ primarily in terms of short-term impacts and implementability. The selected remedy provides more short-term protection than Alternatives 3 and 4 because no wastes are disturbed and therefore risk to the community is minimized. Alternatives 3 and 4 are more difficult to implement because of the innovative nature of the air shelter and the significant amount of waste that must be excavated.

The support of the state and community in the evaluation process and the selection of Alternative 2 further justify the selection of Alternative 2.

2.8.4.5 Preference for Treatment as a Principal Element

The statutory preference for treatment is not satisfied by the selected remedy because neither the volume nor toxicity of the waste is reduced. However, the size of the landfill, the potential presence of UXO in the waste, and the fact that no major sources of contamination have been identified support a containment rather than a removal remedy. Because this remedy will result in hazardous substances remaining on-site above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

2.9 SLUDGE (SANITARY SEWER SYSTEM) REMEDIATION

The Army used the conclusions from the RI, the remedial action objectives listed in the FS, and ARARs to set cleanup objectives for the sludge in the sewer lines at Cluster 1. Four septic tanks and one siphon tank in the launch area and the sewer line and manhole that connect Building E6872 with the septic tanks and distribution box are considered to be of concern. Elevated levels of both organic and inorganic contaminants were detected in sludge samples (see Table 2) collected from several of the septic tanks and the manhole. The cleanup objective for the sanitary system is to prevent the migration of contamination from the sludge to groundwater and surface water/sediment.

Actual or threatened releases of hazardous substances from the sewer line, 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.

2.9.1 Description of Alternatives

2.9.1.1 Alternative 1: No Action

In this alternative, no remedial actions are performed at the site. No efforts are undertaken to contain, remove, or treat contaminants. However, annual sampling and analysis of septic/syphon tanks and/or the sand filters is performed for 15 years. Evaluation of the no-action alternative provides a baseline against which to measure other alternatives.

With respect to ARARs, although no receptors are currently exposed to the sludge, the RCRA requirements for closure and postclosure, as implemented by COMAR 26.13.05.07, are not met because no controls are implemented to protect human health and the environment from the contaminated sludge over the long-term.

This alternative does not achieve the protection of human health and the environment within the guidelines of the NCP. The safety risks presented in Sect. 2.6.1 for on-site residents are not reduced.

The costs for Alternative 1 are as follows:

Capital costs: $0
O&M cost: $3,430
Net present worth: $35,603 for 15 years
This alternative is expected to require no time to implement.

2.9.1.2 Alternative 2: Clean and Close Sanitary Sewer System in Place

This alternative involves:
Pumping contaminated sludge from four 1,000-gal septic tanks and one 1,000-gal siphon tank.
Cleaning the tanks, one manhole, and the launch area sewer lines by high-pressure water blasting.
Filling tanks with inert material.
Removing surface structures, grading, and vegetating of disturbed areas.
Disposing of contaminated sludge and wash water at a licensed RCRA facility in accordance with Maryland regulations governing the transportation and disposal of hazardous waste (COMAR 26.13.04) at a licensed RCRA facility.

This alternative meets the sanitary sewer system cleanup objective of preventing the migration of contamination from the sludge to groundwater or surface waster/sediment by eliminating the source of contamination from the site and eliminating the containment transport pathway.

The costs for Alternative 2 are as follows:

Capital Costs: $89,884 to $151,632 (depending on sludge disposal method)
O&M cost: $0
Net present worth: (Equal to capital costs)
This alternative is expected to require 1 to 2 months to implement.

2.9.1.3 Alternative 3: Clean and Excavate the Sanitary Sewer System

This alternative involves:

Pumping contaminated sludge from four 1,000-gal septic tanks and one 1,000-gal siphon tank.

Cleaning the tanks, one manhole, and the launch area sewer lines via high pressure water blasting.
Excavating the sewer lines, manhole, and five tanks after cleaning in accordance with Maryland erosion and sediment control regulations (COMAR 26.09.01) and OSHA construction safety guidelines (29 CFR 1926).

Disposing of contaminated sludge, washwater, and excavation debris (tanks, manhole, pipes) at a licensed RCRA facility in accordance with hazardous waste management regulations (COMAR 26.13.04). The excavation debris may be disposed of at a sanitary landfill if it is deemed nonhazardous in accordance with Maryland solid waste management regulations (COMAR 26.04.07).
Temporary stockpiling of excavated hazardous waste to await off-site disposal in accordance with hazardous waste management regulations for waste piles (COMAR 26.13.05.12).
Shipping hazardous waste off-site in compliance with Maryland regulations governing the transportation and disposal of hazardous waste (COMAR 26.13.04).

This alternative meets the sanitary sewer system cleanup objective of preventing the migration of contamination from the sludge to groundwater or surface water/sediment by eliminating the source of contamination from the site and eliminating the contaminant transport pathway.

The costs for Alternative 3 are as follows:

Capital costs: $205,031 to $291,068 (depending on sludge and debris disposal method)
O&M cost: $0
Net present worth: (Equal to capital costs)
This alternative is expected to require 4 to 6 months to implement.

2.9.2 Summary of the Comparative Analysis of Sanitary Sewer System Cleanup Alternatives

As required by CERCLA, the remedial alternatives listed above were evaluated using the nine criteria specified by USEPA (see Table 6). This section and Table 11 summarize the relative performance of each of the Sanitary Sewer System remediation alternatives with respect to the nine CERCLA evaluation criteria.

2.9.2.1 Threshold Criteria

Overall protection of human health and the environment Alternatives 2 and 3 (clean and close in situ and clean and excavate, respectively) provide overall protection of human health and the environment by removing the source of contamination and eliminating the contaminant migration pathway. Alternative 1 (no action) provides no overall protection of human health and the environment.

Achievement of ARARs Alternatives 2 and 3 comply with all ARARs. Alternative 1 (no action) does not comply with ARARs.

2.9.2.2 Primary Balancing Criteria

Long-term effectiveness Although both Alternatives 2 and 3 provide long-term effectiveness, Alternative 3 may provide a slightly greater degree of long-term effectiveness because the sewer lines, manhole, and tanks are permanently removed from the site, thereby eliminating and potential for water to infiltrate the loose-fitting pipes and mobilize any potentially present contaminant residues. Alternative 2 minimizes this possibility by filling the lines, tanks, and manhole with an inert material. Alternative 1 (no action) provides no long-term effectiveness.

Reduction in toxicity, mobility, or volume of contaminants Alternatives 2 and 3 achieve relatively similar degrees of reduction in the mobility, toxicity, and volume of waste because the contaminated sludge is removed in both cases. Alternative 1 (no action) provides no reduction in toxicity, mobility, or volume of contaminants.

Short-term effectiveness Both alternatives may involve short-term impacts from worker exposure to contaminated sludge and confined space entry. Alternative 2 has a slightly higher level of short-term effectiveness than Alternative 3 because disturbance of the system and surrounding solid is minimized by leaving the system components in place. Alternative 3 has a lower level of short-term effectiveness than Alternative 2 because of the potential for accidental detonation of UXO during excavation activities. In addition, because the sewer lines are composed of cement-asbestos pipes, Alternatives 3 requires more extensive health and safety precautions that Alternative 2. Alternative 1 (no action) provides no short-term effectiveness.

Table 11.
Comparison of Sludge Remedial Action Alternatives

Remedial alternative	Overall protection to human health and the environment	Compliance with ARARs	Long-term effectiveness and permanence	Reduction of toxicity, mobility, and volume	Short-Term Effectiveness	Implementability	Cost
No action	Does not provides adequate protection. RAOs are not met.	Not met.	Risks are not reduced.	No reduction of toxicity, mobility, and volume.	No impacts on community or worker health or the environment.	No construction, equipment, storage, or disposal needs.	No associated capital or O&M costs.
Sludge Alternative 2-clean and close in situ	High level of protection. Potential source of contamination is removed and the physical hazard of tank collapse is eliminated.	Compliance with all ARARs.	Highly effective in removing contaminants. Eliminates potential source of groundwater or source of groundwater contamination. No O&M is required.	Permanent reduction in toxicity, mobility, and volume.	No impacts on community health or the environment. Workers need to wear appropriate protective clothing.	Required labor, materials, and equipment are readily available.	Capital $89,884 or capital $151,632; no O&M. Depends on sludge disposal.
Sludge Alternative 3-clean and excavate	High level of protection. Potential source of contamination is removed. Sewer lines, manhole and tanks are removed, thus preventing water infiltration into sewer system.	Complies with all ARARs.	Highly effective in removing contaminants. Eliminates potential source of groundwater or surface water/sediment contamination. No O&M is required.	Permanent reduction in toxicity, mobility, and volume.	Impact on community health or the environment is greater because of excavation. Workers need to wear appropriate protective clothing and equipment, especially because of adequate pipes.	Required labor, materials, and equipment are readily available.	Capital $205,031 or capital $291,068, no O&M. Depends on sludge and debris disposal.

Implementability The labor, equipment, and material necessary to implement Alternatives 2 and 3 are readily available. Alternative 2 is expected to be relatively easy to implement. Alternative 3 is expected to be more difficult to implement that Alternative 2 because the system will be excavated, involving significant demolition and grading activities, along with increased risk for encountering UXO. Alternative 1 (no action) requires no effort to implement.

Cost The estimated capital, O&M, and net present worth costs for each sewer system remedial alternative are summarized in Table 11.

2.9.2.3 Modifying Criteria

State Acceptance MDE took part in selecting the remedial alternatives for sewer system cleanup at Cluster 1 and identifying cleanup objectives (preventing accidental detonation of UXO and leakage of contaminants to the environment). In addition, the State of Maryland is satisfied that the appropriate remedial action process was followed in evaluating remedial action alternatives for the sewer system at Cluster 1 and concurs with the selected remedy.

Public Acceptance APG solicited input from the public on the development of alternatives and on the alternatives identified in the proposed plan. The public is in agreement with the cleanup objectives, and most of the commenters were in agreement with the preferred alternative. Several members of the public preferred that the sanitary sewer system be excavated. During the comment period, APG provided these commenters with additional information on their concerns. It appears the additional information satisfied their concerns. A detailed summary of concerns and APG's responses are contained in section 3.0.

2.9.3 Selected Remedy

The selected remedy to clean up the sewer system at Cluster 1 is Alternative 2, Clean and Close Sanitary System in Place. This alternative is highly protective of human health and the environment, meets all ARARs, has a high level of long-term effectiveness and permanence, reduces the mobility and volume of waste by removing the sludge from the site, has a high level of short-term effectiveness, is expected to be easily implementable, and is relatively cost-effective. The selected remedy involves:

Pumping contaminated sludge from four 1,000-gal septic tanks and one 1,000-gal siphon tank.
Cleaning the tanks, one manhole, and the launch area sewer lines via high-pressure water blasting.
Filling the tanks, manhole, and lines with inert material.
Removing surface structures, grading, and vegetating disturbed areas.
Disposing of contaminated sludge and washwater at a licensed RCRA facility.

The costs for Alternative 2 are summarized in Table 12. This alternative would prevent the migration of contamination from the sludge to groundwater or surface water/sediment by removing the sludge from the site and eliminating the potential transport pathway.

2.9.X Performance Standards

The system will be cleaned by water blasting and filled with an inert material to prevent collapse of the piping system. Sludge, wash water, and any other generated waste will be removed and disposed of or treated in accordance with Federal and state requirements.

2.9.4 Statutory Determinations

The selected remedy discussed in Sect. 2.9.3 satisfies the requirements under Sect. 121 of CERCLA to:

Protect human health and the environment.
Comply with ARARs.
Be cost-effective.
Use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
Satisfy the preference for treatment as a principal element.

Table 12

COST ESTIMATE
SANITARY SEWER SYSTEM ALTERNATIVE 2

High Pressure Water Blast Sewer Lines, Manhole, and Septic Tanks;
Fill Tanks, Sewer Lines with Inert Material
Offsite Disposal of Sludge/Cleaning Fluid at a Licensed RCRA Facility
Cluster 1, Aberdeen Proving Ground

CAPITAL COSTS

Item	Rate ($)(a)	Quantity	Unit	Cost 1 ($)(b)	Cost 2 ($)(c)
Removal of Sludge	1.45 /gal	5,000	gal	7,250	7,250
High Pressure Water Blast using line pigging (including equipment, labor, and materials)				5,000	5,000
Inert Fill Material (Flo-Ash assumed)	1.04 /gal	5,000	gal	5,200	5,200
Disposal					
- Septic waste (RCRA stabilization)	390.00 /drum	100	drums	39,000	
- Septic waste (RCRA incineration)	775.00 /drum	100	drums		77,500
- Rinse Water (RCRA treatment)	0.52 /gal	2,500	gal	1,300	
- Rinse Water (RCRA organic extraction)	1.25 /gal	2,500	gal		3,125
Transportation					
- Drum Shipment (sludge)		100	drums	300	300
- Vacuum Truck (rinse water)				650	650
Subtotal				58,700	99,025
Contingency (20%)				11,740	19,805
Health and Safety Plan and Equipment (2.5%)				1,468	2,476
Subtotal				71,908	121,306
Design, Engineering, and Management (25%)				17,977	30,326
TOTAL CAPITAL COST				89,884	151,632

(a) All quotes were provided by the Clean Harbors Environment Services, Inc.
(b) Assumes RCRA stabilization of septic waste, RCRA treatment of rinse waters.
(c) Assumes RCRA incineration of septic waste, RCRA organic extraction of rinse waters.

2.9.4.1 Protection of Human Health and the Environment

The selected remedy, Alternative 2, will reduce risks posed to future users of Cluster 1 through high-pressure water blasting of sewer system components and tanks, filling of components with an inert material, and off-site disposal of sludge and wash water. Under this alternative, the source of potential contamination (sludge) is removed and the physical hazard of tank collapse is eliminated. Although the potential for water to infiltrate the loose-fitting pipes still exists, it is minimized by filling the system with an inert material. In addition, the permanent removal of contaminated sludge from the sewer lines reduces the potential for migration of any residual contamination to groundwater and surface water. However, the transportation of the contaminated sludge to be disposed of poses some risks to human health and the environment because fluid may leak from the vehicle during transport or an accident may release contaminated fluid to the environment. Engineering controls and rigorous safety practices will minimize such risks. No construction activities are anticipated with this alternative. Exposure of workers to contaminants via inhalation and dermal contact is possible, especially during removal of contaminated sludge from the 1,000-gal tanks and the manhole. However, workers will wear protective clothing to minimize contact with contaminated sludge.

2.9.4.2 Compliance with ARARs

The selected remedy will comply with all ARARs. The selected remedy will achieve the ARARs listed below by removing the sludge from the site and filling the sewer system with an inert material, thereby preventing future release or transport of contaminants to the environment. In addition, appropriate engineering controls will be employed during a remediation to prevent release of pollutants to air, land, or water.

Chemical-Specific ARARs

- Maryland standards applicable to generators of hazardous waste (COMAR 26.13.03) apply to the generation of hazardous sludge and washwater as a result of cleaning the sewer lines (applicable).

- RCRA Subtitle C identification and listing of hazardous waste (40 CFR 261) applies to the characterization of sludge and washwater before disposal (applicable).

- Toxic Substances Control Act polychlorinated biphenyl (PCB) requirements (40 CFR 761) apply to PCB-containing materials (applicable).

Location-Specific ARARs

None.

Action-Specific ARARs

- Maryland standards applicable to tanks and containers (COMAR 26.13.05.09-.10) apply if hazardous sludge or washwater is stored in tanks or containers prior to disposal (applicable).

- Maryland transportation and disposal standards (COMAR 26.13.04) apply to shipment of hazardous sludge and washwater off-site (applicable).

- Federal Fish and Wildlife Coordination Act requirements govern the conservation of wildlife resources (such as bald eagles) that may be present as the Edgewood Area and may be disturbed during construction activities (applicable).

2.9.4.3 Cost-Effectiveness

The selected remedy is cost-effective because it has been determined to provide overall effectiveness proportional to its cost, the net present worth cost being $89,884 or $151,632, depending on the sludge disposal method. The estimated cost of the selected remedy is less than the cost of cleaning the sewer system and excavating it.

2.9.4.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy, Alternative 2, is a permanent solution that uses treatment to the maximum extent practicable. Alternative 1 fails to meet the threshold criteria of overall protection and compliance with ARARs and is thus clearly unacceptable. Both Alternatives 2 and 3 meet the threshold criteria. They are also comparable in terms of reduction in toxicity, mobility, and volume of contaminants; implementability; and degree of protection. They differ primarily in terms of cost. Alternative 3 may generate additional short-term impacts as a result of activity-generated dust, soil erosion, or accidental detonation of UXO. The increase in long-term protection afforded by Alternative 3's permanent removal of sewer system components is only slightly greater than that of Alternative 2. Because Alternative 2 is less costly while providing a high degree of protection and fewer short-term impacts, it is the preferred alternative.

The support of the state and community in the evaluation process and the selection of Alternative 2 further justify the selection of Alternative 2.

2.9.4.5 Preference for Treatment as a Principal Element

The statutory preference for treatment is satisfied by using off-site treatment of the sludge (by stabilization or incineration) and washwater (by organic extraction or RCRA treatment) as the primary means for disposing of the contaminants.

2.10 DOCUMENTATION OF SIGNIFICANT CHANGES

The selected remedies were the preferred alternatives presented in the Proposed Plan. No changes have been made.

3. RESPONSIVENESS SUMMARY

The final component of the Record of Decision (ROD) is the Responsiveness Summary. The purpose of the Responsiveness Summary is to provide a summary of the public's comments, concerns, and questions about the groundwater, landfill, sanitary sewer system, and former missile silos at the Aberdeen Proving Ground (APG) Nike Site and the Army's responses to these concerns.

During the public comment period, written comments, concerns, and questions were received by APG and the Environmental Protection Agency (EPA).

APG held a public meeting May 8, 1996, to formally present the Proposed Plan and to answer questions and receive comments. The transcript of this meeting is part of the Administrative Record for the site. All comments and concerns summarized below have been considered by the Army and EPA in selecting the final cleanup methods for the groundwater, landfill, and sanitary sewer system at the Nike Site.

This responsiveness summary is divided into the following sections:

3.1 Overview
3.2 Background on Community Involvement
3.3 Summary of Comments Received During Public Comment Period and APG's Responses
3.4 Sample Newspaper Notice Announcing Public Comment Period and the Public Meeting

3.1 OVERVIEW

At the time of the public comment period, the Army had endorsed preferred alternatives for the cleanup of the groundwater, landfill, and sanitary sewer system at the Nike Site. For the groundwater, APG recommended aboveground treatment by reductive dehalogenation. APG's preferred alternative for the landfill was to construct a composite cap. For the sanitary sewer system, APG proposed cleaning and properly closing the system. As part of the Proposed Plan, APG also recommended taking no further action at the missile silos. EPA concurred with the preferred alternatives. Maryland Department of the Environment supported the Army's plan and stated it would finalize its position after the public comment period.

The public agreed there was a need to remediate the groundwater. The majority of the commenters agreed with treatment by aboveground reductive dehalogention. A few community members and a community group, Neighbors Involved in the Community of Edgewood (NICE), preferred treatment by air stripping. Aberdeen Proving Ground Superfund Citizens Coalition (APGSCC) agreed with the Army's preferred alternative but believed the ROD should not be signed until additional site characterization had been completed.

The majority of the public who returned comment forms agreed with the preferred alternative for the landfill of installing a composite cap. Approximately 45% of the individuals who returned comment forms expressed a preference for conventional or telerobotic excavation. The community group NICE also preferred excavation. APGSCC commented that additional characterization of the landfill should be performed before making a decision on a cleanup method.

Approximately 70% of the community members who returned comment forms agreed with cleaning and closing the sewer system in place. Several commenters, including the community group NICE, recommended the sewer system be excavated. APGSCC originally supported the preferred alternative, assuming the property remained under Army control, in later comments, APGSCC supported excavation, considering it quite possible that parts of APG would be returned to civilian ownership.

The public indicated support for the preferred alternative for the missile silos of closure in place.

APG has summarized and addressed questions and concerns raised by the public in Sect. 3.3. APG hopes this additional information will clarify further the rationales for the decisions made for the Nike Site cleanup.

3.2 BACKGROUND ON COMMUNITY INVOLVEMENT

Citizen's interest in the Nike Site increased substantially in the spring of 1995 after the appearance of several newspaper articles about the Nike Site. Prior to this time, interest primarily came from the Restoration Advisory Board meetings (formerly Technical Review Committee meetings) and from the Executive Director of the APGSCC.

Concerns raised before the Proposed Plan included interest in the extent of the groundwater contamination and whether it had moved off-post. APG has been keeping the community informed about its investigation results through the monthly Restoration Advisory Board meetings, fact sheets, and personal discussions. Residents also were concerned about the possibility of munitions' still being present at the site. APG is addressing munitions as a separate removal action and will continue to work closely with the community on this project.

APG has maintained an active public involvement and information program for the Nike Site. Highlights of the community's involvement in the site and APG's activities during the last 2 years follows.

APG began discussing possible cleanup methods for the Nike Site at Technical Review Committee meetings in July 1994. Other Technical Review Committee/Restoration Advisory Board meetings where APG presented information on the Nike Site cleanup included February 1995, April 1995, August 1995, October 1995, November 1995, January 1996, February 1996, March 1996, and April 1996.

APG's Commanding General, Major General Tragemann, sent a letter in March 1995 to more than 20,000 residents who live along APG's Edgewood Area northern boundary. Although the letter primarily discussed the possibility of ordnance along the boundary, it also invited residents to join the restoration program's mailing list. The letter also invited residents to attend one of the availability sessions scheduled for April.

APG held availability sessions on April 1, April 8, and April 19, 1995. More than 500 people attended and had information available to them on the proposed cleanup plans for the Nike Site.

APG held four tours of the APG Edgewood Area for the public on May 6, 1995. The tours included the O-Field groundwater treatment facility, the Nike Site, and the Lauderick Creek Study Area. Displays on APG's cleanup activities were set up at the Conference Center. Approximately 100 citizens attended.

On May 10, 1995, APG met with representatives of NICE to answer their questions about the Nike Site cleanup plans.

On May 12, 1995, APG met with representatives of the APGSCC and their advisors regarding the Nike Site. APG staff have met on several other occasions with the Executive Director of the coalition and their advisors to discuss the Nike Site.

APG made presentations on the Nike Site to the National Association of Independent Fee Appraisers on May 9, 1995; the Harford County Homebuilders on May 11, 1995; Edgewood Middle School students on May 31, 1995; and the Harford County Board of Realtors on June 20, 1995.

APG prepared a question and answer fact sheet on ordnance and mailed the fact sheet in July 1995 to approximately 23,000 residents in the Edgewood, Joppa, and Abingdon area and to all citizens on its mailing list. APG again invited residents to join the mailing list.

APG made a presentation on the Nike Site to the Harford County Realtors Million Dollars Association on August 2, 1995.

In December 1995, APG sent a letter to 450 residents on its mailing list who live near the Nike Site asking if they were interested in attending small group interview sessions on the Nike Site planned for early 1996. Interested residents returned postcards noting the best days and times to hold the meetings.

In February 1996, APG held five small interview sessions with citizens residing closest to the Nike Site to hear their concerns. APG held similar meetings for on-post residents living near the site and employees who work near the site.

APG released the Proposed Plan for the Nike Site for public comment from April 24 to June 8, 1996. In response to a request from Congressman Ehrlich and a citizens group. APG and EPA extended the comment period an additional 30 days to July 8, 1996. Copies were available to the public at APG's information repositories at the Aberdeen and Edgewood Branches of the Harford County Library, Miller Library at Washington College, and the Baltimore County Department of Environmental Protection.

APG issued a press release announcing the availability of the Proposed Plan, the dates of the public comment period, and the date and time of the public meeting in The Aegis, The Cecil Whig, and Avenue, and the Kent County News.

APG prepared and published a fact sheet on the Proposed Plan. APG mailed copies of this fact sheet to more than 2,500 citizens and elected officials on its Installation Restoration Program mailing list. The fact sheet included a form that citizens could use to send their comments to APG.

On May 4, 1996, APG held a tour of the Nike Site for the public.

On May 8, 1996, APG held a public meeting at the Edgewood Middle School. Representatives of the Army, EPA, and the Maryland Department of the Environment answered questions about the proposed alternatives under considerations.

3.3 SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND AGENCY RESPONSES

Comments raised during the Nike Site public comment period on the Feasibility Study and the Proposed Plan are summarized below. The comments are categorized by topic and by source.

COMMENTS FROM QUESTIONNAIRE INCLUDED WITH FACT SHEET

As part of its fact sheet on the Proposed Plan, APG included a questionnaire that residents could return with their comments. APG received 31 completed returns.

Groundwater

Responses on the completed returns were:

1	Alternative A: Take no action
2	Alternative B: Treatment in sequencing batch reactors
1	Alternative C: Treatment by ultraviolet catalyzed oxidation
1	Alternative D: Treatment in place using reductive dehalogenation
20	Alternative E: Treatment by aboveground reductive dehalogenation
4	Alternative F: Treatment by air stripping
2	Have no preference

Comment 1: One person recommended taking no action and testing every month.

APG Response: APG appreciates the desire for effective use of resources. However, it is important to take action now to restore the groundwater as a resource. One of the EPA'a criteria for evaluating cleanup actions is whether the action complies with all applicable or relevant and appropriate requirement, which includes federal and state regulations. The groundwater at the Nike Site is considered potential drinking water. Therefore, it is a requirement that the groundwater be cleanup up to EPA drinking water standards.

Comment 2: One person preferred air stripping because it would be "simpler to run, easier to control reaction, no sludge generated, no sludge handling costs, proven technology." Another person preferred air stripping because it "should clean the water better than the rest."

APG Response: All treatment alternatives were shown to be equally effective in treating the water at the Nike Site. A treatment study was conducted for the preferred alternative, reductive dehalogenation, which showed reductive dehalogenation would be effective in treating the groundwater. Air stripping does not break down the trichloroethene (TCE); it merely transfers the TCE to another media such as a carbon filter. The filter must then be handled as waste. Reductive dehalogenation, however, completely breaks down the TCE into nontoxic compounds and does not produce any sludge or by-products. Reductive dehalogenations is also easy to run and maintain.

Comment 3: One resident commented "I just hope it's not too late for those in Harford County who have been exposed for years unknowingly." Another resident expressed concern for her mother who died from cancer and had drank the well water at their home in Edgewood.

APG Response: APG places a high priority on protection of human health. The area of groundwater containing the TCE is mostly on-post with only a very small area extending onto the Amtrak property. There are no residential water wells near this groundwater. Because no one is drinking the water, no one has been exposed to the TCE.

Comment 4: Several residents asked about how and when the discharge would be monitored and the impacts on Bush River or marine life.

APG Response: The discharge would be monitored in accordance with state requirements under the National Pollution Discharge Elimination System (NPDES). These state requirements are in place to ensure protection of the streams and marine life receiving the discharge. In addition, these requirements dictate where and when samples would be collected to evaluate the discharge. Generally, samples are collected at the discharge point on a regular basis. A sampling program will be developed to collect samples during and after startup from the treatment system before water is discharged to the Bush River or a tributary of the Bush River to verify the treatment system is working correctly and in accordance with the NPDES permit.

Comment 5: One resident commented that "It is difficult for a lay person to judge which is a safer, more efficient, and cost-effective approach."

APG Response: APG understands that many issues are complex and technical in nature and will, therefore, strive to provide the public with accurate and understandable information. The public is encouraged to ask questions at meetings or call APG for more details. An Information Line is available to ask questions or obtain information 24 hours a day; the number is (410) 272-8842 or 800-APG-9998.

Comment 6: A resident asked "What is the effectiveness of ultraviolet oxidation versus iron treatment?"

APG Response: They are both equally effective in treating the contaminated groundwater.

Comment 7: Two residents asked about the 60 years required for in-place reductive dehalogenation and whether the cost was per year or total.

APG Response: The cost shown for in-place reductive dehalogenation is the total estimated cost to install and operate the system for 60 years. This alternative employs a technology that is installed below ground (in situ) to treat the groundwater in place. The groundwater is treated as it flows through the iron media. The other technologies extract the groundwater and treat it above ground. Extracting the groundwater at various locations in the plume allows a larger area of the plume to be treated at one time. This decreases the amount of time it takes to treat the plume to concentrations below EPA required limits. This is why the in situ technology has an estimated time for cleanup of 60 years and the other pumping and treatment technologies require only 15 years.

Landfill

Responses on the completed returns were:

0	Alternative A: Take no action
17	Alternative B: Installation of a composite cap
8	Alternative C: Conventional excavation and off-site disposal
6	Alternative D: Telerobotic excavation and off-site disposal
0	Have no preference on the alternative

Comment 8: Several residents expressed a preference for conventional excavation and off-site disposal. They believe it fixes the problem and eliminates the need to take any other action in the future. One person preferred Alternative C "only if it could be guaranteed that no gases and chemicals would become airborne during detonation." Another suggested the telerobotic excavator being used at O-Field could be used to validate the cost estimate for excavation.

APG Response: The telerobotic excavator is being used to place sand on top of the O-Field Landfill. Because it is not being used for excavation with all the ancillary safety requirements, the costs would not be comparable to excavation of the landfill contents at the Nike Site. APG agrees that excavating the landfill provides a permanent solution for the Nike Site. Capping the landfill was chosen because it is an equally effective solution and provides the same level of risk reduction as would be achieved with excavation. Capping of the Nike Site landfill is especially effective because the waste is located above the groundwater table and the cap prevents water from infiltrating into the waste, thus preventing unknown hazardous substances from moving out of the landfill.

Comment 9: One person agreed with the composite cap solution but expressed a concern about the "slow breakdown of containers and leaking of chemicals into the soil."

APG Response: APG shares this concern and has investigated this possibility through its sampling program. The available information about the landfill indicates construction debris was disposed of at the site. As part of the remedial investigation of the landfill, APG collected groundwater, sediment, surface water, and soil samples. The analytical results identified no hazardous waste leaching from the landfill. Because the landfill is more than 40 years old, and leaching from containers would have begun by now. Capping the landfill will eliminate infiltration of water into the landfill, which will prevent unknown hazardous substances from moving out to the landfill. Strategically placed monitoring wells around the landfill will provide an early warning of any unanticipated problems with the groundwater under the landfill.

Comment 10: One person asked "What are the federal and state requirements for disposal?"

APG Response: Federal requirements for disposal include Title 40 Code of Federal Regulations (CFR) Part 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities. State requirements include Title 26, Subtitle 13, Disposal of Controlled Hazardous Substances. These regulations described how waste defined as hazardous will be managed during the cleanup process. They implement the statutory requirements under the Resource Conservation and Recovery Act (RCRA), which regulates waste from "cradle to grave." This means that once a waste is created, RCRA imposes requirements on those who generated it; those who transport it; and those who ultimately treat, store, or dispose of it. These federal and state requirements will dictate how the landfill at the Nike Site is properly closed.

Sanitary Sewer System

Responses on the complete returns were:

0 Alternative A: Take no action
22 Alternative B: Clean and close in place
8 Clean and excavate
1 No preference on the alternative

Comment 11: Several residents preferred the sanitary sewer system be excavated; their comments included a preference for what seemed to be a more permanent solution, a concern for civilian or recreational use of the land in the future, and a concern that cost not be a factor in the decision.

APG Response: Cleaning and closing the system in place is an equally effective and permanent solution as it removes contaminants and is in accordance with industry standard practices. There are many man-made features at the Nike Site, such as the missile silos, that will remain in place along with the sanitary sewer system. If the land were to be turned over, which the Army does not foresee, these features would be handled at that time. Furthermore, cleaning and closing the sanitary sewer system in place effectively removes any risks associated with the substances that currently remain in the system. In addition, the EPA requires cost be considered when evaluating each alternative, however, protection of human health and the environment is the more important criteria for evaluation.

Missile Silos

Responses on the completed returns were:

20 Take no action
4 Have no preference
6 No response indicated

Comment 12: One resident asked if the silos are "absolutely harmless" and if not, suggested they be removed. One resident suggested capping the silos like the landfill. Another resident asked if there were any alternatives.

APG Response: Because an action has already been taken at the Nike Missile Silos, there are no alternatives to present. Alternatives were evaluated before the removal action was conducted. This action is in the Proposed Plan without remedial alternatives because EPA requires removal actions be presented in the Proposed Plans to obtain final approval of the action.

The contamination associated with the missile silos was contained within the silos. All contamination inside the silos was removed and the silos were filled with flowable fill concrete. Removing the contamination eliminated any threat it posted. Filling the silos with concrete prevents groundwater from infiltrating into the silos. The structure that make up the silos are not contaminated. It was the contamination inside the silos that was the problem; therefore, the silos no longer pose any threat to human health and the environment.

Miscellaneous Comments

Comment 13: Several residents expressed their appreciation for APG's continuing to take action and encouraged APG to "keep up the good work."

APG Response: APG acknowledges and appreciates the feedback.

Comment 14: One resident commented that "the briefings and communications, like this booklet, give me confidence you are doing a good job. You should know that reducing fear and worry is a very important health benefit of your good work. Thank you."

APG Response: APG acknowledges and appreciates the feedback.

Comment 15: A resident commented "the inclusion of this questionnaire causes me to pay much closer attention to the details of information provided. My input makes me feel more involved and responsible in this clean-up task."

APG Response: APG acknowledges and appreciates the feedback.

COMMENTS AT MAY 8, 1996, PUBLIC MEETING

Following are comments that were raised verbally at the May 8 public meeting on the Proposed Plan. A full transcript of the meeting is at APG's information repositories.

Groundwater

Comment 16: If charcoal filters were used in the air stripping treatment method, is disposal at a landfill the only disposal option?

APG Response: Charcoal filters can be regenerated using steam so the filters can be reused. This is generally more expensive than disposal at a hazardous waste landfill. The solvent, TCE, which would be removed from the filters, would then require proper disposal as a hazardous waste.

Comment 17: What is the least number of years the cleanup using reductive dehalogenation would take?

APG Response: The cleanup could be completed in as few as 7 years or could take as many as 20. This will be better evaluated through the startup of the system and initial results.

Landfill

Comment 18: When was the landfill first found?

APG Response: The records search done as part of an environmental study in the late 1980s found the first evidence of the landfill in records and aerial photos from the 1950s.

Comment 19: A resident asked if there is a State of Maryland law that requires landfills under 10 acres to be excavated? He strongly prefers the landfill to excavated and believes it is not because of the cost.

APG Response: There is not a Maryland State Law that requires landfills under 10 acres to be excavated. Through information searched and discussions with Maryland Department of Environment (MDE) it was determined there is no law, regulation, or guideline that requires landfills to be excavated. MDE allows site closure alternatives to be proposed on a site-by-site basis. MDE allows either excavation or capping to be considered, regardless of the size.

Comment 20: A resident asked the state if they had data that showed the cap will safety contain a detonation from a high explosive round with possible chemical rounds nearby.

APG Response: The landfill cap will be designed to contain chemical rounds. The design of the landfill will be based on the largest expected chemical munition at the Nike Site.

Comment 21: One resident was concerned the landfill is having an impact on his property values. Two other residents were concerned about their property values' being impacted by the Nike Site in general.

APG Response: APG appreciates the concern over what is, for most people, their largest financial asset. In discussions with the community, APG has heard concerns from many people about property values. APG will continue to distribute accurate information about the Nike Site to the community and, as requested, to potential home buyers.

Sewer System

Comment 22: Should the land be turned over and someone want to build on that land, won't they have to dig the sanitary sewer system up? More cost-effective for taxpayer to dig it up so the next guy coming along doesn't have to dig it up.

APG Response: There are many man-made features at the Nike Site (such as the missile silos) that will be remaining in place along with the sanitary sewer system. If the land were to be turned over, which the Army does not foresee, these features would be handles at that time. Cleaning and closing the sanitary sewer system in place effectively removes any risks associated with the substances that currently remain in the system. This alternative is also in accordance with industry standard practice for abandonment of sanitary sewer lines.

Miscellaneous

Comment 23: A resident suggested advertising meetings on Channel 4.

APG Response: We agree this is a good idea and have been discussing the use of cable television in our public information program. We will keep the community informed on this idea.

Comment 24: A resident stated insufficient amounts of information are being disclosed to buyers of new homes.

APG Response: While mandatory disclosures of information in under the county's control, APG continues to be in favor of information on former activities' at APG being disclosed to new buyers. APG has made several presentations to organizations such as the Harford County Board of Realtors, Harford County Homebuilders, National Association of Independent Fee Appraisers, and the Harford County Realtors Million Dollars Association. Many realtors are giving prospective buyers copies of APG fact sheets, and many of the buyers contact us through our Information Line to obtain additional information. APG will continuing preparing fact sheets and issuing news releases.

COMMENTS FROM ABERDEEN PROVING GROUND SUPERFUND CITIZENS COALITION

At the public meeting on May 8, 1996, the APGSCC submitted comments on various APG documents, including the Proposed Plan. Following is a summary of the comments from these documents. (APGSCC is the recipient of two Technical Assistance Grants from the U.S. Environmental Protection Agency.)

Groundwater

Comments from Aberdeen Proving Ground Superfund Citizens Coalition dated February 28, 1996

Comment 25: APGSCC agrees with the Army's preferred alternative but recommends the selected alternative not become part of a ROD until the plume is sufficiently characterized.

APG Response: The preferred treatment alternatives is capable of effectively treating the contaminants in the plume regardless of the size of the plume and will not affect the selection of the treatment alternative in the ROD. Delineation of the plume will be completed before final design of the system.

Specific questions raised by APGSCC are:

(a) Is a groundwater flow model being considered for this site similar to that being conducted in the Westwood Area?

APG Response: A model similar to that as Westwood will not be conducted. However, modeling will be conducted to determine the placement of the extraction well to ensure the entire groundwater plume will be captured.

(b) "Have any efforts been made to predict the effects of different seasons on groundwater flow?"

APG Response: Yes, groundwater contour maps have been made at different times of the year to assess seasonal changes in flow. Water level measurements continue to be collected periodically as more monitoring wells and piezometers are installed. Groundwater contour maps will continue to be updated.

(c) "Are other effects on groundwater flow (e.g., shallow residential wells or historical activities) going to be considered when analyzing surficial aquifer flow direction?"

APG Response: There are no documented shallow wells that would have any influence on surficial aquifer flow direction. Historical activities have no influence on the current groundwater flow direction. All pertinent information for analyzing surficial aquifer flow direction will be taken into account.

(d) "Are piezometers going to be used off-base to characterize the extent of hydrogeological flow off-base?"

APG Response: Yes, piezometers are located off-base to the north of the Nike Site near the Amtrak Property.

(e) "What is the current plan regarding the utilization of HydroPunch to characterize contamination off-base?"

APG Response: Hydropunch has been used to characterize the plume along the Amtrak Property. Hydropunch and monitoring wells will be installed north of the Amtrak property to fully delineate the plume.

(f) "Have chemical data from the `background' wells been compared to results from the Reference Sampling Program to verify that using on-base wells as representatives of natural background for the study area is appropriate?"

APG Response: No, the data were not available at the time the Remedial Investigation was conducted. However, the background samples that were collected were approved by the EPA for use in the risk assessment and are upgradient in areas that were unaffected by Army activities.

(g) "Has APG considered the fact that past activities and the millions of unexploded ordnance (UXO) may have increased the natural background levels of certain compounds making the use of on-site concentrations for comparison unreliable (e.g., arsenic, gross beta)?

APG Response: Background samples for the Nike Site were collected from areas that are upgradient and unaffected by past activities at the Nike Site. Therefore, they were appropriate background samples to use in the risk assessment for comparison to site inorganic concentrations.

Comment 26: "It is the Installation Restoration Program's (IRP) consistent stance that groundwater is not flowing off-base even though their data indicate otherwise." "APG should present clear evidence that worse-case scenarios regarding water flow potentials towards the communities have been constructed and that, regardless of what is encountered, the current water-treatment concept can be modified to resolve any problems." Record of Decisions (RODs) present cost for remedial alternatives and actually rule out certain alternatives based in projected costs. Therefore, it is important to have a clear grasp on the extent of contamination and the major forces which will affect design since these directly affect the cost of the operation. One design phase issue worth mentioning in these comments is that the selected alternative for the treatment of groundwater cannot be supported by the citizens without proper chemical analysis of the effluent of the proposed treatment process, including monitoring for chemical agent breakdown products and radionuclides."

APG Response: It is the Army's policy to present draft data and documents at Restoration Advisory Board meetings to provide the community with the most current information. As the data are analyzed and as studies progress and new data are obtained, material being presented to the community may change. The initial information on the groundwater did not indicate it was flowing off-base, and APG presented this information to the Restoration Advisory Board. As APG's studies continued and as EPA and the U.S. Geological Survey continued to examine the data, a small area at the northern boundary where the groundwater flow appears to be reversing was discovered. APG immediately presented these data to the Restoration Advisory Board and the community.

APG's design for the groundwater treatment system will be completed only after the area of affected groundwater is fully characterized. Because the plume is close to being fully characterized, there will be minimal impact on cost of the alternative. The type of contamination was identified in the Remedial Investigations Report making selection of the treatment alternative feasible at this time. A bench-scale treatability study was performed over a 2-month period on the groundwater that contained the highest concentration of TCE from the Nike Site using reductive dehalogenation (the preferred alternative). Chemical analyses were performed before, during, and after the study to determine the effectiveness of the treatment technology. Reductive dehalogenation proved to completely destroy chemicals of concern. In addition, when the treatment system is installed, water entering the system, water being treated, and final effluent will be monitored. Substantive monitoring and reporting requirements of an NPDES permit will be followed to ensure the discharged water has no adverse effect on the environment.

Comments in Undated One-page Handout Regarding Aberdeen Proving Ground's Proposed Plan

Comment 27: "Local communities could be at risk from private shallow wells which may exist. There is also a possibility of exposure to TCE vapors in basements of homes if the plume was to migrate to the communities." "TCE has been detected off APG property at concentrations above the acceptable level, making the map in the PP wrong."

APG Response: Data are currently being evaluated and maps are being constructed to show the full area of known contamination. The contaminated groundwater that exists off-post has recently been discovered and information regarding the concentrations of TCE were not available when the Proposed Plan was written. There are no documented residential wells in the shallow groundwater that could be affected by the off-post contamination. Extraction wells and a pumping system will be installed to capture any contamination and reverse the flow of the contaminated groundwater pulling it toward the base boundary, not to other communities.

To date, the contamination off-base has very low concentrations and is small is size. Efforts are currently being taken to find the farthest extent of the plume. The residential homes closest to the area of groundwater receive their water supply from the county. The TCE concentrations in the groundwater are too low to present a vapor hazard to any residents who might have basements.

Landfill

Comments dated February 28, 1996

Comment 28: APGSCC does not support capping the landfill at the present time. APGSCC recommends APG "wait for the data to determine if capping is the best route to take, or if long-term monitoring would be more practicable." "This citizens group would like to hear from APG and the regulatory agencies why they believe that capping this site is the best alternative, in light of the lack of contamination, costs of the project, and limited remedial funds for the fiscal year."

APG Response: The landfill has been fully delineated; there are no outstanding data. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process requires that applicable or relevant state and federal requirements be followed when considering the type of remediation to be instituted at a given site. Two pieces of evidence that suggest the Nike Site landfill could be a problem are the drums that once contained hydraulic fluid found on top of the landfill and tiles containing asbestos that were found within the landfill. Given this information, the CERCLA process and the EPA required that APG look at alternatives for remediating the landfill; therefore, capping and excavation alternatives were evaluated. Long-term monitoring is not considered remediation and could not be used as a separate remediation alternative. Long-term monitoring can be used in conjunction with other alternatives such as institutional controls or capping.

Capping the landfill was chosen because it is an equally effective solution and provides the same level of risk reduction as would be achieved with excavation. Capping the Nike Site landfill is especially effective because the waste is located above the groundwater table and the cap prevents water from infiltrating into the waste and thus prevents unknown hazardous substances from moving out of the landfill. Given the known information about the landfill, sufficient data have been gathered to make an informed decision regarding the landfill.

Comment 29:

(a) "How many drums were labeled as hydraulic fluid?"

APG Response: The labels on three drums indicated they contained hydraulic fluid.

(b) "Were any or all of these drums swiped or sampled to determine their original contents?"

APG Response: Thirteen drums were rusty and empty. One additional drum contained 3 in. of bright-red liquid. Organic vapor levels taken from the drum indicated the contents of the drum contained volatile organics. The contents of the drum were sampled for organics and inorganics.

(c) "Were soil samples collected at their location?"

APG Response: Two composite surface soil samples were collected in February 1995. Composite surface soil samples were collected from six locations at 60°-are intervals and 10 ft from center point location.

Discrete sample for volatile compounds were collected from the center points. One sample were collected from the site of the ten toppled drums at the northwest potion of the landfill. A second soil sample was collected from the site of the four upright drums at the east end of the landfill. In addition, a sludge sample of the red liquid removed from the rusted drums was collected.

(d) "What contamination was documented from such effects?"

APG Response: The contamination assessment is documented in the "Nike Missile Battery Site Removal Actions Report," which is located in the Administrative Record. The Administrative Record is located at four separate locations: Harford County Library, Aberdeen Branch; Harford County Library, Edgewood Branch; Kent County, Washington College Miller Library; and the Baltimore County Department of Environmental Protection.

The soil was sampled for volatile organic compounds (VOCs), semivolatile organic compounds, pesticides/polychlorinated biphenyls, and total metals. No contamination was detected in the samples. The red liquid found in the drum did not indicate the presence of organics or inorganics above the detection limits using the Toxicity Characteristic Leaching Procedure. The liquid was disposed of by APG's waste contractor.

(e) "In addition to 2S (a single sampling point for VOCs), were any other soil samples tested for VOCs at the landfill?"

APG Response: Yes, sample 3S was analyzed for VOCs. Sample 2S was centrally located near the drums and 3S was taken downslope of the site. The samples did not contain VOCs above the detectable limit. These data are available in the Remedial Investigation Report for Cluster 1 contained in the Administrative Record.

(f) "Did the perimeter of the composite sample (2S) fall outside the location of the drums?"

APG Response: The sample was taken before the drums were removed and had to be taken outside of the location of the drums. However, 2S was taken near the drums.

(g) "What current characterization efforts are underway for this Operable Unit?"

APG Response: Two monitoring wells existed at the landfill. Additional characterization at the landfill included push-probe sampling at 5 locations where samples were collected from multiple depths and 24 groundwater samples were collected. Installation of four 3/4-in. drive-point piezometers and installation of eight 1-in. monitoring wells occurring during April 1996.

(h) "Have the proposed piezometer and geoprobe locations been altered since the October RAB presentation, since these locations are too close to the landfill itself and appear to largely neglect directions considered to be downstream by previous APG investigations?"

APG Response: Yes, the locations were altered. They were moved further from the limits of the waste in the landfill and placed radially around the landfill in locations agreed upon by APG and the EPA.

(i) "Besides empty drums on the surface and the known disposal of asbestos, is there any historical information suggesting significant contamination?"

APG Response: "Historical information is contained in the RCRA Facility Assessment Report (AEHA, 1990). There is no information suggesting "significant contamination".

(j) "What data supports the assumed landfill depth of 8 feet?"

APG Response: Electromagnetic and ground-penetrating radar, two types of geophysical techniques, were used to determine the depth of the landfill.

(k) "Does any part of the landfill site below the water-table level on a seasonal or permanent basis?"

APG Response: No.

(l) "How much soil covers the actual debris in the landfill?"

APG Response: In some places there is no soil covering the debris; in other locations there is as much as 1 ft of cover.

(m) "If it is capped, what follow-up would there be?"

APG Response: There would be inspection of the cap at regular intervals to check for signs of erosion, settlement, or invasion by deep-rooted vegetation or burrowing animals; maintenance and repair operations as needed such as cutting vegetation, regarding or revegetating; and installation of monitoring wells with sampling and analysis conducted annually.

(n) "Has spontaneous detonation been considered with regards to the selected alternative?" "Can the type of cap selected withstand and contain an explosion? If so, how large of an explosion?"

APG Response: Yes, detonation of unexploded ordnance has been considered with regard to all alternatives. The landfill cap will be designed to contain a high explosive round and/or chemical rounds. The design of the landfill will be based on the largest expected unexploded ordnance at the Nike Site.

Comment 30: "Due to the limited characterization of this landfill, it is not possible to assess the protective value of capping the site." "APGSCC has had difficulty in determining if the cap will be protective. Characterization issues remain unresolved regarding he actual contents of the landfill, and APGSCC believes the UXOs, as well as the other contents, should be excavated. Many concerned citizens agrees that removal of the landfill is most protective of future generations. APGSCC supports excavation in light of the unknown contents. Capping the site will leave the site without a permanent solution, posing unknown risks for years to come."

APG Response: As discussed in response to Comment 28, capping the landfill was chosen because it is an equally effective solution and provides the same level of risk reduction as would be achieved with excavation. Capping of the Nike Site landfill is especially effective because the waste is located above the groundwater table and the cap prevents water from infiltrating into the waste and prevents hazardous substances from moving out of the landfill. In addition, further characterization of the landfill such as intrusive work including drilling or digging through the landfill was not approved by the EPA. Therefore, given the known information about the landfill, sufficient data have been gathered to make an informed decision regarding capping the landfill.

Comment 31: "The originally selected alternative for remediating this site was the telerobotic excavation alternative. In addition to permanence and long-term effectiveness, a major reason for the original selection was the fact that MDE guidelines require excavation of landfills less than two acres in area. The most recent PP should address this issue, and explain why the MDE guidelines are not going to be followed. Furthermore, APGSCC is interested in why the selected alternative was changed."

APG Response: Through information searches and discussions with MDE, it was determined there is no law, regulation, or guideline that requires landfills that are less than 2 acres in area to be excavated. MDE allows site closure alternative be proposed on a site-by-site basis. MDE allows either excavation or capping to be considered, regardless of the size. Therefore, through further evaluation using the nine criteria it was determined capping the landfill is the best solution.

Comment 32: "A review of the information in the RI/FS did not turn up any contaminants at concentrations believed to be a concern at the site. This conclusion, however, is based on limited data since sampling of soil and groundwater was limited. While the data collected there has not uncovered a problem, it is not clear that it is comprehensive enough to determine that there isn't any contamination. We are confused by the fact that contamination has not been found at the SW Landfill to date, yet the IRP intends to place an impermeable cap over the landfill which is estimated to cost 1.4 million dollars."

APG Response: It was determined by APG and EPA that the sampling at the landfill was sufficient for characterization. Soil, surface waster, and groundwater sampled were collected. See Comment 29 for more details. Because contamination was not found in soil on top of the landfill or in groundwater around the landfill does not mean there is not waste in the landfill that could cause a problem in the future if no action is taken.

Sanitary Sewer System

Comments Dated February 28, 1996

Comment 33: APGSCC supports the selected alternative, assuming the Lauderick Creek Study Area permanently remains the property of the U.S. Army. "APGSCC has raised various concerns regarding the integrity of the system, the potential for the sewer system to contaminate the surrounding soil during blasting, the permanence of excavation, and how it may be easier to remove the system now instead of twenty years down the road when it is being returned to civilian ownership. These issues do not concern APG and their intention to leave the system in place has not changed. In response, APGSCC strongly urges APG to explore routes to ensure that this property is not returned to private ownership." APGSCC expressed a concern that "in a future residential land-use scenario, the risk of cancer and non-cancer health outcomes are above acceptable guidelines for the adult based on the RI/FS calculations, as well as above regulatory limits for children based on our calculations (Attachment I).

APG Response: There are many man-made features at the Nike Site (such as the missile silos) that will be remaining in place along with the sewer system. If the land were to be turned over, which the Army does not foresee, these features would be handled at that time. Cleaning and closing the sanitary sewer system in place effectively removes any risks associated with the substances that currently remain in the system, and the flowable fill will ensure the structural integrity. Because of the concerns raised by APGSCC and further evaluation of the solution of closing the sanitary sewer system in place, APG will be performing a camera survey of the piping system to ensure its integrity before proceeding.

Comment 34: APGSCC has asked why this action is part of the Proposed Plan as opposed to being conducted as a removal action.

APG Response: The sewer system could have been dealt with as a removal action; however, it would still have to be brought to closure by presenting it in the Proposed Plan.

Comment 35: "APGSCC is concerned with leaving this system in place. APGSCC believes such sources should be removed, when possible. It is quite possible that parts of APG will be returned to civilian ownership in the future, so citizens should have a significant part in deciding if such operable units are removed or left behind. Excavation of this site would allow APG to assess if the soil beneath the system is contaminated and in need of remediation."

APG Response: Soil sampling and soil gas survey did not detect or show any indication of contamination outside of the piping system. APG agrees the citizens should have a part in deciding which remediation alternative will be chosen. Because of concerns regarding the structural integrity of the piping system, the sewer system will be surveyed to ensure the system is intact and cleaning and closing the system in place will be the most appropriate solution for this problem.

Missile Silos

Comments Dated February 6, 1996, and February 28, 1996

Comment 36: "APGSCC supports the interim removal action being accepted as a permanent action." APGSCC has the same concerns regarding long-term ownership as discussed above on the sanitary sewer system. APGSCC feels monitoring should be conducted around the silos to ensure the actions taken by the Army continue to be effective.

APG Response: Long-term monitoring of this area is already proposed in conjunction with the groundwater cleanup alternative.

Miscellaneous

Comments Dated February 28, 1996

Comment 37: APGSCC has objected of ordnance cleanup being handled as a removal action instead of being part of the Proposed Plan and has submitted questions regarding this project.

APG Response: APG acknowledges APGSCC's objectives to the ordnance cleanup being handled as a removal action. APG will be issuing an Engineering Evaluation/Cost Analysis for this removal action, which is similar to a Proposed Plan. At the end of the public comment period on this document, APG will prepare a Responsiveness Summary, similar to this document. The Responsiveness Summary will respond to questions on the ordnance removal action.

Comment 38: "APG stated that EPA's acceptable risk for cancer is 1 in ten-thousand to 1 in one-million. What is the reference for this range? Is one more appropriate than the other depending on the scenario (i.e. industrial vs. residential setting)?"

APG Response: The reference for the EPA document that discusses the target risk range of 1 x 10-6 to 1 x 10-4 is USEPA 1991, Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions, OSWER Directive 9355.0-30, April 2, 1991. The document states that "EPA uses the general 1 x 10-6 to 1 - 10-4 risk range as a `target range' within which the Agency strives to manage risks as part of a Superfund cleanup process. This risk range is not specific to a particular type of exposure scenario (i.e., residential or industrial). The EPA risk manager of the site made the ultimate decision as to what the target risk is for the site.

Comment 39: "Will creek data be reviewed and strengthened during future remedial efforts in the Lauderick Creek Study Area, or is this the total extent to which APG plans to investigate Monks Creek? How can APG feel confident that the few detected localized hot spots mentioned in this section represent most of the contamination in these surface water bodies? Doesn't it seem quite possible that many more contaminated sites exist in Lauderick and Monks creeks but were missed due to limited sampling sites in these tributaries?"

APG Response: Sampling of streams and tributaries was conducted in conjunction with possible contaminant sources. The Remedial Investigations was designed to identify and define hot spots. The risk assessment determined there was no unacceptable risk; therefore, there is no justification for further sampling.

Comment 40: "The nine criteria are divided into three groups: threshold criteria, primary balancing criteria, and modifying criteria. This terminology is new to us and we would like to show what agency devised this approach, and why this change was made.

APG Response: The nine criteria are divided into three groups in accordance with the EPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA and the EPA Proposed Plan/Record of Decision Guidance Document. There has been no change in the evaluation criteria; they have just been grouped in accordance with EPA requirements. The EPA Proposed Plan/Record of Decision Guidance Document states the following regarding the three groups:

> The nine criteria are categorized into three groups: threshold criticism primary balancing criteria, and modifying criteria. The threshold criteria must be satisfied in order for an alternative to be eligible for selection. The primary balancing criteria are used to weigh major tradeoffs among alternatives. Generally, the modifying criteria are taken into account after public comment is received on the Proposed Plan.

Comment 41: "What was the logical basis for discontinuing testing for explosives after two rounds of sampling? Was this approach taken for all the different types of media sampled? Were various media samples tested for degradation products of explosives? Were various media samples tested for degradation products of explosives? Were various media samples tested for chemical agents and their degradation products?"

APG Response: If explosives were not found after two rounds of sampling that were conducted quarterly, testing was discontinued. This approach was taken for groundwater samples that were sampled in two rounds. Samples were taken for degradation products of explosives. Samples were also taken for mustard and their breakdown products.

Comments Dated January 31, 1996

Comment 42: APGSCC submitted comments regarding the risk calculations contained in the Nike Site risk assessment including comments on why additional calculations were not performed for children, particularly under the future-use scenario, and why additional possible exposure pathways were not included.

APG Response: The exposure pathways that were evaluated in the Nike Site risk assessment were selected based on the likelihood they would account for the greatest risks at the site. The selection of the most important pathways was based on an understanding of which pathways are typically of most concern in risk assessments and on having evaluated other pathways for other assessments (e.g., ingestion of game) and knowing they would not likely drive risks in the Nike Site risk assessment. In addition, it should be noted the pathways evaluated in the Nike Site risk assessment were approved by EPA Region III, indicating the estimation of the most significant pathways was appropriate.

It is recognized that risks to other receptors could occur at the Nike Site (especially under hypothetical future land use conditions); however, as noted above, instead of evaluating all possible pathways through which individuals could be exposed to chemicals of potential concern, the pathways through which the greatest risks could occur were evaluated. It should be noted the final conclusions of the risk assessment (i.e., groundwater is contaminated with chemicals that would result in unacceptable risks if consumed by hypothetical future residents) would not change if other exposure pathways had been evaluated.

COMMENTS FROM NEIGHBORS INVOLVED IN THE COMMUNITY OF EDGEWOOD

Representatives of the community group (NICE) submitted questions and comments to APG through a letter from their President and through individual comments. The comments from the six individuals indicated five preferred treatment by air stripping and one preferred treatment in place using reductive dehalogenation. Five preferred telerobotic excavation and off-site disposal as the remedy for the landfill, and one individual preferred the composite cap be installed. Cleaning and excavating the sewer system was selected by five individuals, and one individual agreed with the preferred alternative of closing the sewer system in place. The individual who preferred closing the system in place noted "this ground could never become civilian property because of the ground's history and uncertainty of content." Five individuals agreed no further action was needed for the former missile silos, and one individual indicated no preference.

The following is a summary of other comments and questions from NICE.

Groundwater

Comment 43: Prefer air stripping as treatment method.

APG Response: All of the treatment alternatives were known to be equally effective in treating the water at the Nike Site. A treatment study was conducted for the preferred alternative, reductive dehalogenation, which showed that reductive dehalogenation would be effective in treating the groundwater. Air stripping does not break down the TCE; it merely transfers the TCE to another media such as a carbon filter. The filter must then be handled as waste. Reductive dehalogenation, however, completely breaks down the TCE into nontoxic compounds and does not produce any sludge or by-products. Reductive dehalogenation is also easy to operate.

Landfill

Comment 44: Army has no idea what is in the landfill; landfill is a hazardous waste landfill and may also contain unexploded ordnance. Since the Army does not know what is buried at this site, there is no way of knowing if this site contains other hazardous waste that will potentially cause further contamination of the groundwater.

APG Response: The available information about the landfill indicates construction debris was disposed of at the site. However, 14 drums were found on top of the landfill, and tiles containing asbestos were found within the landfill. As part of the remedial investigation of the landfill, groundwater, sediment, surface water, and soil samples were collected. The analytical results identified no hazardous waste leaching from the landfill. Because the landfill is more than 40 years old, any leaching from containers would have begun by now. Capping the landfill will eliminate infiltration of water into the landfill, which will prevent unknown hazardous substances from moving out of the landfill.

The landfill cap will be designed to contain a high explosive round and/or chemical rounds. The design of the landfill will be based on the largest expected unexploded ordnance at the Nike Site.

Comment 45: Original plan called for excavation of the landfill and off-site disposal.

APG Response: APG is trying to be as responsive as possible to citizens' requests for information and thus supplies draft documents to the public. These are, however, draft documents that are still being reviewed within the Army and by regulators; information may change by the time a final document is issued. This occurred with the draft Proposed Plan.

As discussed in response to Comment 28, capping the landfill as chosen because it is an equally effective solution and provides the same level of risk reduction as would be achieved with excavation. Capping of the Nike Site landfill is especially effective because the waste is located above the groundwater table and the cap prevents water from infiltrating into the waste, thus preventing hazardous substances from moving out of the landfill.

Comment 46: Army is placing economic considerations above the health and safety of residents.

APG Response: Protection of human health and the environment is the first criteria any cleanup method must meet; cost only becomes a factor after alternatives are shown to be equally effective.

Comment 47: Landfill was not a planned facility.

APG Response: The landfill was not a "permitted" facility because permits for landfills were not issued in the 1950s.

Comment 48: TCE is leaching toward water sources that lead into nearby streams that feed the Chesapeake Bay.

APG Response: The RI sampling did not detect TCE in the groundwater at the landfill location. It is not leaching from the landfill, and it was not detected in streams. The groundwater contaminated with TCE is located at the Missile Silo area. The groundwater will be cleaned up without an impact on any streams or the Chesapeake Bay.

Comment 49: Several wells that provide drinking water to residents of the area are within one mile of the facility.

APG Response: A well survey was conducted in the winter of 1993. The survey identified two wells in

Edgewood near the Nike Site boundary. Only one the wells, on Freys Road, is used for drinking. These wells could not be impacted by the contaminated groundwater as they are too far away and too shallow. In addition, the contaminated groundwater will be cleaned up using extraction wells that will be placed to capture the contaminated groundwater and reverse the flow of groundwater to the Base boundary.

Comment 50: If the landfill is capped, there is no way for the site to be used for future development.

APG Response: The Army has no plans to release the site for future development. With existing technology limitations, APG could not declare the site free of unexploded ordnance, even after the proposed clearance. Therefore, any future plans for uses of the site would be very speculative.

Comment 51: The cost of $1.6 million for capping the landfill does not take into account that the Army will need to monitor this site for 20 to 30 years.

APG Response: The costs for monitoring for 30 years are included in the $1.4 million to $1.6 million estimated cost of installing the landfill cap.

Comment 52: If during the monitoring period, waste from the landfill is found to be causing further contamination, the Army will have to excavate the site, potentially causing many times the 10 million dollar estimate at this time.

APG Response: Capping the landfill will effectively eliminate the route of migration from the landfill to the groundwater by stopping infiltration of water. Therefore, it is highly unlikely the groundwater will become contaminated from the landfill. If this were to happen, the landfill would not be excavated; the groundwater would be treated.

Sewer system

Comment 53: Prefer sewer system be excavated.

APG Response: Cleaning and closing the sewer system in place effectively removes any risks associated with the substances that currently remain in the system. The procedure also is in accordance with industry standards for the closure of sewer systems.

Unexploded Ordnance

Comment 54: Opposes decision to handle as removal action; believe the U.S. Army needs to be held accountable to an outside agency, preferably the EPA.

APG Response: The removal action will be conducted under CERCLA. EPA has oversight of all CERCLA actions, both removal and remedial.

Comment 55: Strongly encourage the investigation of all anomalies, regardless of their depth below the surface, and safe removal of all UXO from the facility. Strongly oppose any open detonation of recovered rounds, particularly in the "boundary area."

APG Response: Each metallic anomaly will be detected and investigated by the best technology available.

APG agrees open denotation near the boundary is undesirable. Open detonation is always a last resort. The first preference is to move and store the item. The second choice, if the item is not safe to store, is to move the item to a remote, approved location and detonate the item there. The last alternative, detonation in place, is used only when an item cannot be moved without risking the lives of the ordnance experts handling the item. At the present time, detonation in place is the only option when a unexploded ordnance cannot be moved. For the removal action, APG is looking at ways to mitigate to the greatest extent possible any impacts to the community. Any other necessary protective actions also would be taken.

Comment 56: Current infrastructure could not support an evacuation.

APG Response: For the removal action, an evacuation is highly unlikely. The most likely protective action would be to shelter in place for a very brief time. It is also possible a small portion of the community might occasionally be asked to evacuate for a short time. An evacuation would be planned and therefore could be done without changes to the current infrastructure. APG is working with the Harford County Department of Emergency Operations in preparing a response plan for the project. It is recognized that an extensive community information and education effort will be needed.

COMMENTS FROM MR. JAMES GAIBROIS

Comment 57: Mr. Gaibrois questioned why there were substantial differences in the length of time it would take to clean up the groundwater under the different alternatives.

APG Response: The cost shown for in-place reductive dehalogenation is the total estimated cost to install and operate the system for 60 years. This alternative employs a technology that is installed below ground (in situ) to treat the groundwater in place. The groundwater is treated as it flows through the iron media. The other technologies extract the groundwater and treat it above ground. Extracting the groundwater at various locations in the plume allows a larger area of the plume to be treated at one time. This decreases the distance the TCE must move to be treated and, therefore, decreases the amount of time it takes to treat the plume to concentrations below the EPA required limits. This is why the in situ technology has an estimated time for cleanup of 60 years and the other pumping and treatment technologies require only 15 years.

Comment 58: Mr. Gaibrois questioned whether the cost estimates included costs for any possible law suits or road improvements.

APG Response: Costs were considered for just activities associated with the remedial actions; therefore, law suits were not included in the cost estimate. Road improvements are not needed and, therefore, not included.

Comment 59: Mr. Gaibrois stated the cost figures should use worse case scenarios so adequate funding would be allocated for the project and to prevent delays from having to request additional funding.

APG Response: The EPA requires cost estimates in the Proposed Plan to be within +50 and -30%. These cost estimates were conducted in accordance with these requirements. A more detailed cost estimate will be performance during the remedial design phase.

Comment 60: Mr. Gaibrois questioned the use of present worth in estimating the cost of the alternatives. He also questioned whether federal government procurement staff reviewed the cost estimates presented in the Proposed Plan and whether the cost estimates shown are adequate for contracting purposes.

APG Response: The EPA requires that present worth be calculated for each alternative. These costs are used for comparing one alternative to another. They are not used for contracting purposes.

Comment 61: Mr. Gaibrois questioned some of the assumptions used in the cost estimates, including general installation support costs and operation and maintenance costs. Mr. Gaibrois also questioned why there are costs shown for the no action alternative.

APG Response: All items included in the cost estimate are required for the remedial actions. The final cost estimate, provided with the remedial design, will be more detailed and accurate. The no action alternative can include sampling for any contaminants left in place to monitor possible movement.

4. REFERENCES

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