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EPA Superfund
Record of Decision:

ABERDEEN PROVING GROUND (MICHAELSVILLE LANDFILL)
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ABERDEEN, MD
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MICHAELSVILLE LANDFILL
OPERABLE UNIT TWO,
ABERDEEN AREA
ABERDEEN PROVING GROUND

RECORD OF DECISION

FINAL

September 1997

THIS DOCUMENT IS INTENDED TO COMPLY WITH THE NATIONAL ENVIRONMENTAL POLICY ACT OF 1969.

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ACRONYMS

APG	Aberdeen Proving Ground
AWQC	Ambient Water Quality Criteria
COPCs	contaminants of potential concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DDTr	total of pesticides DDT, DDD, and DDE
FFA	Federal Facility Agreement
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HQ	hazard quotient
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
MCLs	Maximum Contaminant Levels
MDE	State of Maryland Department of the Environment
MLF	Michaelsville Landfill
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
OAA	Other Aberdeen Areas
OU	operable unit
PAHs	polynuclear aromatic hydrocarbons
RAB	Restoration Advisory Board
RBCs	risk-based concentrations
RfD	reference dose
RI	remedial investigation
RME	reasonable maximum exposure
ROD	record of decision
TRV	Toxicity Reference Value
UCL	upper confidence limit
USEPA	United States Environmental Protection Agency
WBA	Western Boundary Areas

1. THE DECLARATION

1.1 SITE NAME AND LOCATION

Groundwater, Operable Unit 2
Michaelsville Landfill
Aberdeen Proving Ground
Harford County, Maryland

1.2 STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) document presents the selected remedial action for groundwater, soil, surface water, and sediment at Michaelsville Landfill (MLF) Operable Unit 2 (OU 2) in the Aberdeen Area of Aberdeen Proving Ground (APG) and is intended to comply with the National Environmental Policy Act of 1969. The selection of the remedial action was conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Action of 1986, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for the site.

The Maryland Department of the Environment (MDE) concurs with the selected remedy at this site.

1.3 DESCRIPTION OF THE SELECTED REMEDY

The selected remedy at this site is no further action with monitoring to verify that no unacceptable exposures to potential hazards posed by conditions at MLF OU 2 will occur in the future.

1.4 DECLARATION STATEMENT

No remedial actions are necessary to ensure protection of human health, welfare, or the environment. There are no unacceptable human health risks presented by contamination in the surface soil, surface water, or sediment. APG has prohibited installation of drinking water wells within 1/4 mile of the perimeter of the landfill cap. These restrictions to the development of groundwater will eliminate exposure to the potential hazards from the groundwater. At this time, there are no unacceptable ecological risks presented by the contamination in soil, groundwater, surface water, or sediment. In accordance with NCP Section 300.430(f)(4)(ii), a 5-year review will be performed.

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2. DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

2.1.1 Site Name and Location

Michaelsville Landfill is located in the north-central portion of the Aberdeen Area of APG in Maryland. APG is a 72,500-acre Army Installation located in Harford and Baltimore counties on the western shore of the Upper Chesapeake Bay (Fig. 1). The installation is bordered to the east and south by the Chesapeake Bay; to the west by Gunpowder Falls State Park, the Crane Point Power Plant, and residential areas; and to the north by the towns of Edgewood, Joppa, Magnolia, and Aberdeen. The Bush River divides APG into the Edgewood Area to the west of the river and the Aberdeen Area to the east.

Michaelsville Landfill is located in the north-central portion of Aberdeen Area. The landfill encompasses about 20 acres and ed in the security-controlled portion of APG. OU 1 consists of the landfill proper and its contents. MLF OU 2 consists of groundwater, surface soil, surface water, and sediment in the vicinity of MLF.

2.1.2 Site Description

2.1.2.1 Topography

APG is in the Atlantic Coastal Plain Physiographic Province, which is characterized by low-lying, gently rolling terrain. The topography of MLF was changed in the course of installation of the new cap system in 1994. The landfill originally had elevations ranging from 28 to 46 feet above mean sea level, which included waste mounded to approximately 16 feet above the original surface elevation. The addition of the multilayered cap evened out the landfill topography, increased elevations by a minimum of 5 feet, and decreased the side slopes to 4%. The new landfill cap is covered with grass

and low vegetation. Beyond the limits of the landfill, the surrounding terrain is gently sloping and has numerous low-lying areas.

2.1.2.2 Geology.

The subsurface geology at MLF is characterized by lateral and vertical variations in lithology and texture explained by fluctuations in sea level and depositional history. The methods of deposition in the area are irregular and result in heterogeneous deposits. In roughly ascending order, the deposits consist of Precambrian bedrock, which is overlain by Lower Cretaceous Coastal Plain sediments of the Potomac Group. The Potomac Group is comprised of three formations that show no consistent boundaries: the Patuxent, a silty fine to medium sand with minor clay lenses, the Arundel, a silty clay to clayey silt with lenses of organic silty clay with traces of lignite and ironstone nodules; and the Patapasco, a fine to medium sand, silt, and clay. Overlying the Cretaceous sediments are the Quaternary formations consisting of fine to medium silty sand and mixtures of fine gravel and lenses of silt and clay.

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2.1.2.3 Surface Water

The surface water bodies around MLF are small, seasonal ditches that feed into one of two branches of Romney Creek approximately 1000 meters southwest of MLF. The seasonal ditches have a depth of 2 to 4 feet to the stream bed and do not show sips of eroding the upper silty clay. The Romney Creek tributaries are larger streams with well-defined channels and stream depths of 5 to 7 feet. The seasonal ditches contain flowing water during late fall, winter, and early spring; however, flow is limited in late spring and summer.

The surface water flow appears to be to the west-southwest toward the main branch of Romney Creek 2000 meters southwest of MLF. Romney Creek then enters the Chesapeake Bay a few miles south of MLF. The tidal nature of the Bay is thought to influence Romney Creek, but the degree of influence is not known. The areas around the seasonal ditches may be classified as wetlands. The silty clay allows the ponding of water on the ground surface and slows percolation of surface water into the upper aquifer.

A storm water management pond is located at the southern end of NMF, but it is not hydrologically connected to the ditches.

2.1.2.4 Hydrogeology

The geology and stratigraphy of MLF can be generalized into four zones: (1) the surface upper silt and clay (upper 5 to 12 feet); (2) upper sand and gravel or upper aquifer (thickness of 11 to 36 feet); (3) interbedded silt, clay, and sand groundwater unit (thickness of 11 to 96 feet); and (4) the lower clay unit (thickness of 50 to 60 feet). The upper aquifer is semiconfined because of the upper clay layer, the shallow monitoring wells are in the upper aquifer and the deep monitoring wells am in a silty sandy unit within the interbedded aquitard unit. Figure 2 shows the groundwater movement in the vicinity of MLF.

2.1.3 Ecology

The habitats at MLF OU 2 include upland forested areas fields, and wetland. The region to the northwest of MLF is mature deciduous forest with an open understory; to the north and are young forested wetlands and a stand of young trees that are predominantly red maple. The areas may support a diverse variety of species including, but not limited to, red fox, gray squirrel, flying squirrel, chipmunk, raccoon, opossum, white-tailed deer, and woodpeckers.

The remaining areas to the north and east are covered with grassy fields with intermittent wetlands along the ditches and now Romney Creek. Areas to the south are predominately grassy fields, and the area to the west is forested. Field species supported include field mice, voles, Eastern cottontail, bobwhite, mourning dove, killdeer, hawks, and other birds. Wetlands species include cattails, rushes, great blue heron, frogs, other amphibians, freshwater invertebrates, and a variety of aquatic and terrestrial insects.

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The drainage ditches near the landfill could support seasonal populations of insects, amphibians, and aquatic invertebrates. Some mummichog fish were present in the ditches downgradient from MLF, and they remain in the small areas that hold water throughout the summer.

Bald eagles, currently classified as a federal threatened species, are known to nest within 1 mile of MLF OU 2. Because the ditches surrounding MLF OU 2 are seasonal and intermittent, it is unlikely that bald eagles will forage at the site. Based on available facility natural resource information, no other threatened or endangered species are known to occur in the areas surrounding MLF OU 2.

2.1.4 Demography and Land Use

APG was established in 1917 and began testing ammunition and military materiel in 1918. Munitions, weapons, and materiel research and development activities supported military efforts during World War II and the Korean and Vietnam conflicts. This mission of APG continues to the present day. The Aberdeen Area of APG has been the site of weapons, aircraft, and other equipment testing. The types of munitions tested include bombs, small arms projectile, rockets, high explosive ammunition, antipersonnel mines and weapons, chemical munitions, and incendiary and smoke grenades. Chemical munitions have also been fired in the Aberdeen Area. MLF is situated in the security-controlled portion of APG. The 1-mile radius of MLF consists of APG property. The main industrial sector of the Aberdeen Area is located approximately 3300 feet north of MLF. Operations within 1500 feet of MLF include a firing range, an ammunition receiving and transfer facility, a metal scrap yard, a low-level radioactive waste short-term storage facility, and a former pistol firing range. APG barracks are located 1 mile north of MLF, and on-post family housing is located 2 miles north. The City of Aberdeen is approximately 4 miles north of MLF, and the City of Perryman is located approximately 2 miles west of MLF.

2.2 SITE HISTORY AND ENFORCEMENT ACTIV11TIES

2.2.1 Site History

Operations at MLF began in late 1969 and continued through 1980. Landfill operations included trench-and-fill disposal of domestic and nonindustrial waste from sources at APG. Based on verbal and written evidence, other material that may have been disposed of in MLF includes pesticide containers, rabbit droppings, swimming pool paint, asbestos, shingles, solvents, waste motor oil, transformer oil containing polychlorinated biphenyls, pesticides, rodenticides, and wastewater treatment sludges. Since waste was received from the Edgewood area, them is a possibility that substances contaminated with chemical warfare materiel may be present in MLF. Agent degradation compounds were found in a few wells supporting this possibility.

In 1981 the Harford County Department of Health recommended capping the landfill. In response, an impervious soil cap was placed on MLF in 1993. Follow-up inspections in 1983 and 1985 indicated that the landfill cap did not appear to be functioning properly to prevent water infiltration into the landfill. Leachate seeps occurred several times between capping in 1983 and 1991. In 1991, a leachate collection system was installed along the northwestern side of MLF to provide for proper disposal of the leachate.

In 1994 a new, multilayered cap system with a geosynthetic membrane was installed in accordance with MDE requirements for sanitary landfills. Installation of the new cap included surface water controls for seasonal precipitation and the installation of a methane gas venting system within the landfill cap system. The leachate collection system installed in 1991 was removed and replaced by a new drainage system. The contents of MLF are considered as OU 1 of MLF, and all actions taken on the landfill itself were handled under a ROD for the unit.

2.2.2 Enforcement

MLF was placed on United States Environmental Protection Agency's (USEPA) National Priorities List on October 4, 1989. Subsequently in March 1990, APG signed a Federal Facilities Agreement (FFA) with USEPA, Region III. The general purposes of the FFA are to:

- ensure that the environmental impacts associated with past and present activities are thoroughly investigated and appropriate responses taken to protect public health, welfare, and the environment;
- establish a procedural framework and schedule for developing, implementing, and monitoring appropriate environmental response actions;
- ensure integration with other environmental programs and permits; and
- facilitate cooperation, information exchange, and participation in such actions.

MLF is specifically described as a study area in the FFA.

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

APG currently has a Restoration Advisory Board (RAB) that consists of representatives from local government agencies, businesses, and the community groups playing an active role in the Installation Restoration Program (IRP) process. One active group represented on the RAB is the Aberdeen Proving Ground Superfund Citizens Coalition. The RAB meets monthly to discuss and concur on a variety of topics regarding the environmental program at APG. The board has the opportunity to review and comment on all documents addressing the IRP sites. APG offered opportunities for public input and community participation during the RI and Proposed Plan for MLF OU 2. The Proposed Plan was made available in the Administrative Record, which was housed in public facilities off the APG installation. The notice of availability of the Proposed Plan was published in The Aegis (Harford County local paper), the Kent County News (Kent County local paper), The Avenue (Baltimore County local paper), and the Cecil Whig (Cecil County local paper) on June 11, 1997, and in the APG News (installation newspaper) on June 11, 1997. A public comment period was hold from June 11 through July 25, 1997. The public comment period was not extended as there were no requests for an extension. APG held a public meeting on July 2, 1997, at 7:00 p.m. at the Aberdeen Senior Center, Aberdeen, Maryland, to discuss the investigation activities that occurred at MLF OU 2. Representatives from the USEPA, MDE, and APG were present to answer questions about APG, MLF OU 2, and the recommended alternative.

A summary of questions and responses from the public meeting is included in the Responsiveness Summary (Section 3). These community participation activities fulfill the requirements of Section 113(k)(2))(B)(I-v) and 117(a)(2) of CERCLA.

2.4 SCOPE AND ROLE OF THE OPERABLE UNIT

This ROD documents the selected remedy for surface soil, surface water, sediment, and groundwater at MLF. . MLF OU 2 represents one component of a comprehensive environmental investigation and cleanup being performed under the IRP at APG. Investigations completed or underway in the APG Aberdeen Area include Michaelsville Landfill OU 1 and OU 2, Western Boundary Areas Study, and Other Aberdeen Areas Study. The MLF OU 1 investigations addressed the landfill proper and the contents as a potential source of contamination. APG is conducting a more comprehensive investigation of ecological impacts in its Western Boundary Areas Study and the Other Aberdeen Areas Study that encompasses the entire Aberdeen peninsula. APG is evaluating groundwater contamination and its associated risks in the Western Boundary Area and Other Aberdeen Areas Studies. All existing data will be used in these risk assessments and the cleanup decision-making process. This ROD for MLF considers only the area in close proximity to the landfill. Protectiveness of this action will be evaluated during the five-year review process. Long-term monitoring data will be available for those reviews.

2.5 SITE CHARACTERISTICS

The MLF OU 2 RI generated geological and hydrogeological information and analytical data on current groundwater, surface water, sediment, and surface soil conditions.

2.5.1 Summary of Site Groundwater Characteristics

A preliminary screening of groundwater results used the USEPA Region III risk based concentrations (RBCs) and the USEPA maximum contaminant levels (MCLs) for drinking water. Thirty-two wells in shallow groundwater were investigated. Eleven of those were considered to be upgradient wells. Generally, inorganic analytes were more frequently detected than organic analytes. Aluminum, ammonia, antimony, arsenic, beryllium, cadmium, chromium, iron, lead, manganese, nickel, thallium, 1,2-dichloroethane, 1,1-dichloroethene, 1,2-dichloropropane, 1,1,2,2-tetrachloroethane, trans 1,3-dichloropropene, alpha benzene hexachloride, benzene, chloroform, trichloroethylene, and vinyl chloride were detected at concentrations that exceeded the RBCs or the MCLs. Chloroform and 1,1,2,2-tetrachloroethane were only detected in the upgradient wells. Aluminum, arsenic, beryllium, iron, manganese, and thallium exceeded RBCs or MCLs in the upgradient and down gradient wells. The distribution of contamination is not indicative of any distinct plume of contamination coming from MLF; however downgradient wells generally have a greater number of contaminants than upgradient wells. Arsenic generally is detected at much higher concentrations downgradient of the MLF than upgradient One upgradient shallow well exceeded the MCL for gross alpha radiation in 1995. The results were not confirmed during resampling in 1996. One downgradient shallow well exceeded the MCL for gross beta radiation in 1995. Thiodiglycol, isopropyl methyl phosphonic acid (IMPA), and methyl phosphonic acid (MPA) chemical warfare degradation products were detected in April 1996 samples of four downgradient wells. Confirmatory sampling with a refined analytical procedure in April 1997 detected only thiodiglycol at two MLF wells. There is no comparison value for thiodiglycol.

Eleven wells surrounding MLF are deep wells. They are situated in a semiconfined groundwater unit about 100 feet deep. Five of the wells are upgradient of MLF, and one well is in a different

hydrogeologic unit than the other wells. Arsenic, ammonia, iron, and manganese were detected in upgradient and downgradient deep wells at levels greater than the RBCs. Vinyl chloride and cadmium were also detected, but not at levels or frequencies indicative of unacceptable risk. One deep well reported one detection of gross alpha radiation higher than the MCL.

2.5.2 Summary of Site Surface Water Characteristics

Unfiltered surface runoff water results were compared to the USEPA Ambient Water Quality Criteria (AWQC), derived Final Chronic Values, or calculated values based on Great Lakes Water Quality Initiative Tier II methodology. No organic compounds were detected in surface water above comparison values. Barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, vanadium, and zinc were detected at concentrations exceeding the comparison values in the upgradient and downgradient locations. Nickel exceeded the comparison value only at an upgradient location. The highest lead concentrations were found in the upgradient samples, which may be indicative of another source area.

2.5.3 Summary of Site Sediment Characteristics

Sediment results were compared to human health RBCs, the USEPA-proposed Sediment Quality Criteria, or the National Oceanic and Atmospheric Administration's Effects Range Low values. The first round of downgradient samples contained cadmium, lead, zinc, bis(2-ethylhexyl)phthalate, and eight polynuclear aromatic hydrocarbons (PAHs)--such as benzo(a)pyrene--that exceeded RBCs. The location of benzo(a)pyrene and the other PAHs suggests that these detections may be related to a nearby railroad track or asphalt road. Additional sampling in December 1996 confirmed the presence of PAHs, but at concentrations below all comparison criteria.

2.5.4 Summary of Site Soil Characteristics

Five surface soil samples were collected: two from upgradient locations and three from locations around the perimeter of MLF not affected during capping activities. Arsenic was the only contaminant detected above the RBC for soil, and it was detected in upgradient and downgradient samples.

2.6 SUMMARY OF SITE RISKS

APG conducted a human health and ecological risk assessment as part of the RI to estimate the probability and magnitude of potential adverse human health effects and environmental effects from contaminants at the site.

2.6.1 Human Health Risk

The USEPA-approved human health risk assessment method followed a four-step process: (1) contaminant identification, which identified those hazardous substances of significant concern at the site; (2) exposure assessment, which identified actual or potential exposure pathways, characterized receptor population, and determined the extent of possible exposure; (3) toxicity assessment, which considered the types and magnitude of adverse human health effects associated with the contaminants; and (4) risk characterization, which summarized the potential risks posed by the site contaminants.

2.6.1.1 Contaminant Identification

The data were summarized by environmental medium. Shallow groundwater was grouped into location data sets: upgradient, northwestern, and southeastern. Sampling data were compared to quality control samples such as blanks. Data that were rejected in the quality review were not used in the risk assessment. Statistical calculations were performed to incorporate duplicate samples and nondetected values. The total frequency of detection was determined. The maximum-detected concentrations of the summarized data were rescreened to adjusted USEPA Region III RBCs using a calculated toxicity level of 1 x 10 -6 cancer risk level and 0.1 Hazard Index (HI). This adjustment provides a more health protective screening tool to account for synergistic or additive effects of contaminants. This screening resulted in the identification of more contaminants of potential concern (COPCs) than are listed in Section 2.5 of this ROD. Chemicals with maximum concentrations less than the adjusted RBCs were eliminated from further evaluation. The inorganic contaminants calcium, iron, magnesium, potassium, and sodium were eliminated because they are common nutrients that pose adverse health effects only at high concentrations. Inorganic compounds that were elevated above adjusted RBCs were compared statistically to upgradient values. Compounds with levels higher than the adjusted RBC but lower than the upgradient value were evaluated separately from contaminants that exceeded the adjusted RBC and the upgradient value.

No compounds, inorganic or organic, were identified as COPCs in the shallow northwestern

groundwater. In the shallow southeastern groundwater acetone, benzene, alpha-BHC, chlorobenzene, 1,2-dichloroethane, 1,1-dichloroethene, cis-1.2-dichloroethene, 1,2,-dichloropropane, trans-1,3-dichloropropene, trichloroethylene, vinyl chloride, antimony, arsenic, cobalt, manganese, and 2,2'-oxybis(1-chloropropane)--which has no toxicity comparison values--were COPCs. 2.2'-oxybis(1-chloropropane) is not used in quantitative risk assessment; it is retained as a COPC because of the uncertainty in the risk assessment process. In the deep groundwater, only carbon disulfide, vinyl chloride, arsenic, and cadmium were COPCs. No radiological screening criteria were exceeded using the statistical upper confidence limit for samples from MLE OU 2.

When arsenic was identified at levels greater than the RBC in soil, it was less than the background concentration. Titanium was the only COPC retained in the surface soil because titanium has no toxicity values and adds uncertainty to the risk assessment. The sediment samples were also separated into the northwestern and southeastern data sets. Titanium was the only COPC in the northwestern sediment data set and is not used in quantitative risk assessment; benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, arsenic, and titanium (not used in quantitative risk assessment) were COPCs identified in the southeastern sediment data set. In the northwestern surface water data set, titanium was the only COPC identified but is not used in quantitative risk assessment. In the southeastern surface water data set 4-methyphenol, antimony, cadmium, mercury, and titanium (not used in quantitative risk assessment) were identified as COPCs.

2.6.1.2 Exposure Assessment

The objective of the exposure assessment is to estimate the type and magnitude of potential exposures to chemicals that may be present at, or migrating from, the site. Exposure scenarios representative of the current and future potential exposures were developed. These scenarios for current land use included incidental ingestion and dermal absorption of COPCs in sediment by trespassers and dermal absorption of COPCs in surface water by trespassers. Under future land-use conditions, it was hypothesized that APG workers would ingest water from the MLF monitoring wells as a worst-case scenario. The exposure assessment uses an exposure-point concentration. Exposure-point concentrations are concentrations of a chemical in a given medium that a receptor may be exposed to at a specific location. The reasonable maximum exposure (RME) is the highest exposure that could reasonably be expected for a given pathway at a site and is intended to account for both uncertainty in the contaminant concentration and variability in the exposure parameters. To account for the uncertainty in the contaminant concentration, the 95% upper confidence limit (UCL) was calculated and used as the exposure point concentration. When the 95% UCL exceeded the maximum value, the maximum value was used. For a detailed discussion of the statistical treatment of data in the risk assessment, see Section 6.4 of the RI.

2.6.1.3 Toxicity Assessment

Human health risks or hazards are defined for two classes of chemical contaminants: carcinogens and noncarcinogens. Exposure to carcinogenic chemicals may result in an increased risk of a specific type of cancer. The risk of cancer is expressed as the chance of the occurrence of that type of cancer for an individual with the given exposure. These cancers are over and above the background rate of cancer in the United States (that is, they represent an excess cancer risk). A risk level of 1 in 1 million (1 x 10 -6) means that them is a 1 in 1 million increased chance of developing cancer as a result of exposure to the environmental contaminant. The USEPA has establish an excess cancer risk level of 1 in 1 million to 1 in 10 thousand 1 x 10 -6 to 1 X 10 -4) as the target risk range for determining the effectiveness and health protectiveness of an environmental remedial action. Cancer risks greater than 1 in 10 thousand generally warrant an evaluation of remedial actions to reduce human health risks.

Cancer risk is calculated using a USEPA-derived value called the cancer slope factor. The cancer slope factors for the MLF OU 2 RI were obtained from the USEPA Integrated Risk Information System (IRIS) if possible. If values were not available from IRIS, the USEPA Health Effects Assessment Summary Tables (HEAST) were used. The USEPA National Center for Environmental Assessment has provided provisional toxicity criteria for some contaminants at APG.

For noncarcinogenic contaminants, the USEPA reference dose (RfD) is used to create a numerical ratio called the Hazard Quotient (HQ). Values for the HQ of greater than 1.0 indicate that noncarcinogenic adverse health effects may be likely to occur. The RfDs are obtained from the USEPA IRIS and HEAST data sources. The RfD represents in intake level below which adverse health effects are unlikely and above which adverse effects may be likely to occur within an order of magnitude of uncertainty. The HQs for several pathways are added together to give a scenario or media total. This total is called the HI.

The toxicity values for carcinogenic and noncarcinogenic exposure are derived for oral exposures. In some cases it was appropriate to modify an aral RfD or slope factor to account for dermal exposure to

a hazardous chemical. The methodology and justification for this modification is given in Section 6.5 of the RI.

For the PAHs, USEPA relative potencies (toxicity equivalency factors) were used to adjust the slope factors for all carcinogenic PAHs based on the slope factor for benzo(a)pyrene. The relative potency for benzo(a)pyrene is given as 1.0; for dibenzo(a,h)anthracene 1.0; and for benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-c,d)pyrene 0.1.

2.6.1.4 Risk Characterization

Presented in Tables 1-3 is the cumulative human health risk for the exposure pathways chosen for MLF OU 2. Under the current land-use conditions, the total excess carcinogenic risk to trespassers is 3 in 1 million (3 x 10 -6) as a result of sediment exposure. The noncarcinogenic HI was less than 1.0 indicating no likelihood of adverse health effects. Under the future potential exposure conditions, the total cancer risk from ingestion of shallow groundwater by APG workers was 8 in 1 hundred thousand (8 x 10 -5) with vinyl chloride contributing the majority of the risk. The HI was 10, indicating the possibility for central nervous system damage contributed primarily from manganese exposure. In the deep groundwater the cancer risk was 2 in 1 hundred thousand (2 x 10 -5), with the risk contributed primarily from arsenic. The HI was 0.1 indicating noncancer adverse health effects were unlikely. The areas directly adjacent to this site include an active firing range. The presence of possible unexploded ordnance limits the future use of this site to military/industrial purposes. Drinking water well development is prohibited within 1/4 mile of the MLF cap perimeter.

2.6.2 Ecological Risk

The data were summarized by environmental medium and exposure area. Sampling data were compared to quality control samples such as blanks. Data that were rejected in the quality review were not used in the risk assessment. Statistical calculations were performed to incorporate duplicate Samples and non-detected values. The total frequency of detection was determined. A comparison to naturally occurring values was made for inorganic compounds and chemicals having low toxicities such as calcium, magnesium, potassium, sodium were not included in the ecological risk assessment unless they were present at very high levels. The data were rescreened using toxicity reference values specific for ecological risk and the environmental media. The ecological COPCs identified by this process are not necessarily the same as those contaminants identified in Section 2.5 of this ROD.

Because of the small number of samples per medium, the RME case was assumed. The RME is the high-end risk descriptor, using the reasonable worst case scenario. Under this assumption the risk is unlikely to be underestimated but may be overestimated. The likelihood that this RME scenario may actually occur is small because of the combination of conservative assumptions incorporated. The maximum value was used for the RME concentration. As an example of how the RME overestimates ecological risk is in the soil sampling activities. Purposive soil samples were collected in areas of known contamination. These areas represent the worst case and do not accurately represent the overall exposure the chemicals that a receptor population would encounter while inhabiting the site. Acetone, aluminum, and titanium were identified as ecological COPCs in surface soil. In ditches near MLF arsenic, selenium, titanium, DDT, DDE, DDD, Aroclor-1260, Endrin, 16 PAHs, and 9 other organic compounds were selected as ecological COPCs. In the surface water toluene, phenol, ethylbenzene, 4-methylphenol, carbon disulfide, bis(2-ethylhexyl)phthalate, 2-butanone, acetone, antimony, cadmium, mercury, selenium, silver, and titanium were selected as ecological COPCs.

No risk assessment was performed for the risks to terrestrial invertebrates such as earthworms because there are limited toxicity data available for terrestrial invertebrates. The surface soil concentration of aluminum was higher than the ecological toxicity reference value (TRV) for terrestrial plants; however, there was no evidence of distressed vegetation during the field biological survey, and the on-site concentrations of aluminum are comparable to regional reference values. (Regional reference values for soil are available in the administrative record in US Army Environmental Center, 1995. Reference Sampling and Analysis Program, Soil, Sediment, and Surface Water Reference Data Report, Final. March 1995. DAAA 15-91-D-0014.) It is likely that the vegetation has adapted to naturally occurring high aluminum levels. There are no TRVs for acetone and titanium in surface soil for plants.

In the seasonal ditch sediments, the pesticide DDT (and its metabolites DDD and DDE), PAHs, and arsenic exceed TRVs for aquatic invertebrate organisms. For all of these contaminants there are indicators of possible upstream contributions to the sediment contamination near MLF. MLF ditch sediments were used in a 28-day aquatic invertebrate growth test to determine actual toxicity. The MLF ditch sediments showed no adverse effects on aquatic invertebrate growth that were directly attributable to the MLF sediment contaminants.

The surface water in the MLF ditches did not have any organic contaminants that exceeded AWQCs. Cadmium, mercury, and silver did exceed the AWQCs and indicate a potential for adverse effects on aquatic life. However, given that then ditches are very shallow and seasonal in nature, very few species of aquatic invertebrates or other aquatic life are likely to be adversely affected. The AWQCs are designed to protect populations of aquatic life and are not intended to be applied to intermittent streams. Given that the aquatic life populations in the seasonal ditches are not stable due to their intermittent nature, the AWQCs are not relevant and appropriate at this site.

The possible effects of sediment and surface water contaminants in the context of a food web were evaluated. In this evaluation, it is assumed that contaminants accumulate in one species and are consumed by another species. The food web evaluated was that benthic (sediment) invertebrates in the seasonal ditches will be exposed to and could accumulate DDTr (the total of DDT, DDD, and DDE). Small fish (mummichogs) that were observed in some of the deeper areas of the ditches can accumulate DDTr from the ingestion of benthic invertebrates. Mummichog, in turn, represent potential food sources for birds and small mammals that may forage at the site. The great blue heron was selected as the fish-eating bird for this food web evaluation because birds are more sensitive to DDTr than mammals and a blue heron was seen at the site. The average sediment value for DDTr was used for this evaluation. Using some highly conservative assumptions, such as the great blue heron only ingests mummichog from MLF for all of its food, some potential for adverse health effects was seen from the pesticide DDTr. It is highly unlikely that any adverse health effects will be seen in birds eating fish from the MLF ditches because the ditches are seasonal and most birds will travel beyond the boundaries of MLF for their food supply. Using a more realistic assumption that the heron ingests 50% of its fish from MLF, there is no indication of adverse health effects to the heron.

2.7 DOCUMENTATION OF SIGNIFICANT CHANGES

There have been no significant changes since the Proposed Plan was presented.

2.8 THE PREFERRED ALTERNATIVE: NO FURTHER ACTION WITH MONITORING

No further action with monitoring will protect human health, welfare, and the environment at the MLF OU 2 site. The future use scenario is to maintain the site for military/industrial purposes, thus reducing the risk to people by limiting exposure to these areas. There are no unacceptable risks presented by contamination in the surface soil, surface water, and sediment. However, there is a potential risk from drinking ground water, therefore a restriction on the installation of drinking water wells has been implemented. The restriction prohibits the installation of drinking water wells within 1/4 mile of the perimeter of the landfill cap. This has been authorized by the Director of the Department of Public Works. These restrictions have been put into APG's Geographical Information System (GIS) which is utilized in the development of APG's Real Property Master Plan. These restrictions would be incorporated into any real property documents necessary for transferring owner from the Army, in the unlikely event that the Army sells this property. The real property documents would also include a discussion of the National Priorities List (NPL) status of this site, as well as a description of the groundwater. In addition, the Director of the Directorate of Safety, Health, and the Environment of APG will certify to USEPA on an annual basis that them have been no violations of the prohibitions. If a violation has occurred a description of the violation and corrective action to be taken will be provided. Therefore, no further action with monitoring protects human health and the environment and meets the requirements for both short-term and long-term effectiveness and permanence set forth in the NCP. A comprehensive monitoring plan for the site will be developed through a cooperative effort between the U. S. Army AFG, USEPA, and MDE, after this ROD is finalized. The plan will be available in the administrative record, as required by CERCLA.

Table 1. Summary of pathway-specific and cumulative human health risks, Michaelsville Landfill OU 2, current land use--trespassers in southeast area

Contaminant	Sediment ingestion	Sediment dermal adsorption	Surface water dermal absorption	Total
Carcinogens				
Benzo(a)anthracene	1e-07			
Benzo(a)pyrene	1e-06			
Benzo(b)fluoranthene	2e-07			
Dibenzo(a,h)anthracene	3e-07			
Indeno(1,2,3-cd)pyrene	6e-08			
Arsenic	6e-07	1e-06		
Total	2e-06	1e-06		3e-06
Noncarcinogens				
4-Methylphenol			5e-03	
Antimony			8e-03	
Arsenic	3e-03	6e-03		
Cadmium			6e-03	
Mercury			le-03	
Total	3e-03	6e-03	2e-02	3e-02

Notes:
No toxicity information exists for titanium.
Risk Assessment Guidance for superfund, Part A, 1989, United States Environmental Protection Agency, EPA/540/1-89/002. Section 8.2, Exhibits 8-2 and 8-3 present risk results with only one significant figure.

Table 2. Summary of pathway-specific and cumulative human health risk, Michaelsville Landfill OU 2, future land use--APG worker ingestion of southeast area shallow groundwater

Contaminant	Risk
Carcinogens	
Benzene	2e-07
alpha-BHC	7e-07
1,2-Dichlorethane	3e-07
1,1-Dichloroethene	1e-06
1,2-Dichloropropane	2e-07
trans-1,3-Dichloropropene	1e-07
Trichloroethylene	4e-08
Vinyl chloride	1e-05
Arsenic	7e-05
Total	8e-05
Noncarcinogens	
Acetone	2e-01
Chlorobenzene	3e-04
1,1-Dichloroethene	5e-04
cis-1,2-Dichloroethene	7e-03
trans-1,3-Dichloropropene	7e-03
Trichloroethylene	2e-03
Antimony	5e-01
Arsenic	4e-01
Cobalt	3e-02
Manganese	le+01
Total	1e+01

Notes:
No toxicity information exists for titanium or 2,2'-oxybis(1-chloropropane)
Risk Assessment Guidance for Superfund, Part A, 1989. United States Environmental Protection Agency, EPA/540/1-89/002,
Section 8.2, Exhibits 8-2 and 8-3 present risk results with only one significant figure.

Table 3. Summary of pathway-specific and cumulative human health risks, Michaelsville Landfill OU 2, future land use-APG worker ingestion of deep groundwater

Contaminant	Risk
Carcinogens	
Vinyl chloride	1e-06
Arsenic	2e-05
Total	2e-05
Noncarcinogens	
Carbon disulfide	1e-04
Arsenic	le-01
Cadmium	4e-02
Total	le-01

Notes:
Risk Assessment Guidance for Superfund, Part A, 1989, United State Environmental Protection Agency, EPA/540/1-89/002,
Section 8.2, Exhibits 8-2 and 8-3 present risk results with only one significant figure.

3. RESPONSIVENESS SUMMARY

The final component of the 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 at MLF and the Army's responses to these concerns.

During the public comment period, written comments were received by APG.

APG held a public meeting on July 2, 1997, 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 USEPA in selecting the final cleanup methods for the groundwater at MLF.

This responsiveness summary is divided into the following sections:

3.1 OVERVIEW

The Army has endorsed a preferred alternative for OU 2 at MLF. APG has proposed no further action with the exception of periodic sampling of the environment media. USEPA and MDE concurred with the preferred alternative.

The community generally seems to be in support of the preferred alternative.

3.2 BACKGROUND ON COMMUNITY INVOLVEMENT

Citizens' interest in MLF has been primarily expressed through discussions at RAB meetings (formerly Technical Review Committee meetings) and comments by the APG Superfund Citizens Coalition (recipient of USEPA Technical Assistance Grants). The major concern raised prior to the Proposed Plan was inclusion of data about MLF in studies of other sites in the Aberdeen Area.

APG has maintained, an active public involvement and information program. Highlights of the community's involvement in the Site and APGs activities during the last two years follows.

- APG began discussing possible cleanup methods for the MLF groundwater at the June 1995 RAB meeting. Other board meetings at which APG presented information on the Site were held November 1995, May 1996, and September 1996.

- APG released the Proposed Plan for MLF for public comment on June 11, 1997. Copies were available to the public at APG's information repositories at the Aberdeen and Edgewood Branches of the Harford County Library and the Miller Library at Washington College.

- 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 to APGs media list.

- A 45-day public comment period on the Proposed Plan ran from June 11 to July 25, 1997.

- APG placed newspaper advertisements announcing the public comment period and meeting in The Aegis, Cecil Whig, The Avenue, Essex Times, and the Kent County News. (See Attachment for sample advertisement.)

- APG prepared and published a fact sheet on the Proposed Plan. APG mailed copies of this fact sheet to more 2,590 citizens and elected officials on its IRP mailing list. The fact sheet included a form citizens could use to send their comments to APG.

- On July 2, 1997, APG held a public meeting at the Aberdeen Senior Center in Aberdeen, Maryland. Representatives of the Army, USEPA, and the MDE presented information on the site and their respective positions on the proposed cleanup alternatives.

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

Comments raised during the MLF public comment period on the Proposed Plan are summarized below. The comments are categorized by source.

3.3.1 Comments from Questionnaire Included with Fact Sheet

As part of its fact sheet on the Proposed Plant, APG included a questionnaire that residents could return with their comments. APG received four completed returns.
Responses on the completed returns were:

- 3 Agree with proposed plan.
- 0 Disagree with proposed plan.
- 1 See comment 1 below.

Comment 1: I appreciate being informed. However, I am not educated enough to agree or disagree (I did not attend the late evening meeting). In reading, what you are saying sounds good--anyway I am glad something is being done.

Response: APG appreciates the feedback and will continue to keep citizens informed through a variety of methods.

Comment 2: I am more than satisfied with Aberdeen Proving Ground's proposed action. I am also very pleased with the way the community is being kept informed.

Response: APG appreciates the feedback.

Comment 3: I believe APG has done a very good job of remediation of possible hazardous conditions. Recent findings indicate that little or no hazard still exists. Ground water sampling should insure that no leakage is occurring. Further extensive effort appears to be unnecessary.

Response: APG acknowledges the comment and agrees.

Comment 4: I agree with the proposed plan. My interest stems from being a retired APG engineer and current President of the Maryland Division of the Issac Walton League of America, a leader in conservation for 75 years.

Response: APG acknowledges the comment and appreciates the involvement of all community groups.

3.3.2 Comments from the July 2, 1997 Public Meeting

Two comments were made at the July 2 public meeting on the Proposed Plan. A full transcript of the meeting is at APG's information repositories.

Comment 5: One resident stated she would like to see a count of wildlife presently living in the vicinity of the Michaelsville Landfill included in the monitoring process apart from risk assessment studies.

Response: APG currently conducts population assessments of game species for Aberdeen Area. APG will not assess game populations separately around Michaelsville Landfill because it is covered by overall area assessment

Comment 6: One resident said he was a security guard at APG in 1980 before die landfill was shut down. He said he saw numerous trucks being taken into the landfill and drums disposed of at the landfill. He is opposed to stopping monitoring and recommended that additional wells be drilled. His concern is that current monitoring wells are not sufficient to detect contamination which might flow between the wells. He was also concerned about the closeness of City of Aberdeen and Harford County production wells.

Response: APG appreciates the additional historical information and invited the resident to personally visit the site with APG staff to discuss the information further. APG has conducted comprehensive sampling near the landfill and has not detected any contamination migrating from MLF. City of Aberdeen and Harford County production wells are not affected by groundwater at MLF; these production wells are also closely monitored. APG plans to continue to monitor the groundwater. In five years, APG and USEPA will conduct a full review as required by law and assess the need for any additional action.

Mr. Gerald Renoll, the previously mentioned resident, participated in a site visit to Michaelsville Landfill on August 25, 1997. Mr. Renoll was accompanied by representatives of APG and Mike Angerman of MDE. Mr. Renoll identified the approximate location where 55 gallon drums were placed in the landfill. Mr. Renoll believes the drums may contain a chemical agent precursor to Agent Orange. The Army has groundwater monitoring wells installed downgradient of this location and will continue long-term monitoring as proposed in this Record of Decision.

3.3.3 Comments from the Aberdeen Proving Ground Superfund Citizens Coalition, July 17,1997
(Comments prepared by Theodore Henry, University of Maryland, Program in Toxicology)

Comment 7: The selected alternative of no further action with monitoring is supported by the Program in Toxicology, based on the fact that the groundwater from beneath Michaelsville Landfill (MLF) is being evaluated with a holistic approach in the Western Boundary (WBA) and Other Aberdeen Areas (OAA) Study Areas. We interpret this to mean that, as data from other potential sources are evaluated, the already existing MLF data will be reassessed in conjunction with the new data. It is important for APG to clarify this issue in the text.

Response: All existing data will be used in the risk assessments and decision-making process for the Western Boundary Area and Other Aberdeen Areas Studies as described in paragraph 2.4 of this ROD.

Comment 8: With respect to the selected alternative, the current proposed plan is unclear as far as what monitoring will be conducted. APG needs to clarify whether this involves the collection of additional media samples in future years to track contaminant migration, or if this refers to the inclusion of already existing MLF data in WBA and/or OAA assessments.

Response: A monitoring plan for MLF for OU 2 will be developed by APG after the ROD is completed. All samples will be collected from the MLF area.

Comment 9: A few groundwater samples from MLF revealed radiological readings above comparison criteria; unfortunately, samples from well-5 were discarded before the specific isotope could be identified. While these data were not mentioned in the proposed plan, it should be noted that the Program in Toxicology is concerned with the lack of a clear risk assessment for radiological contamination. The TAG Group continues to work on this issue with APG and the involved regulatory agencies.

Response: It is agreed that radiological results were not carried through the risk assessment, however they were evaluated using a 95% upper confidence limit which demonstrated that they posed no unacceptable risk.

Comment 10: Lastly it should be noted that the Program in Toxicology disagrees with APG's decision to remove the future resident scenario from the information presented in this Proposed plan. While the projected land use for this area does not require APG to conduct any remediation based on the exceedences for carcinogenic and noncarcinogenic risks to the future resident, it does indicate that contamination is present and that future residential scenarios should be avoided. To exclude this information from the proposed plan gives the appearance that APG is withholding information from the public and only presenting positive results.

Response: APG acknowledges the stated concern. If the land at APG is transferred the provisions of section 120(h) of CERCLA which require an evaluation of intended use and any necessary remediation will be accomplished.

Comment 11: Page 2M6: The Restoration Advisory Board was informed that materials contaminated with mustard and nerve agents may have been dumped in MLF. Previous comments to include this information in the 3rd sentence of this paragraph were not incorporated accordingly. APG's response to our previous comments note the following sentence which acknowledges the use of chemical weapons on the peninsula. This is not the same, and the text should note the possibility that materials contaminated with CWM may be present in MLF. The inclusion of this information would be in agreement with the detection of chemical warfare degradation products in groundwater, as discussed on pages 5 & 6 of the proposed plan.

Response: APG has no records nor information that indicate chemical agents were placed in the MLF. Since waste was received from the Edgewood Area, there is the possibility the substances contaminated with chemical warfare materiel may be present in MLF. Agent degradation compounds were found in a few wells supporting this possibility. (This information is in paragraph 22.1 of this ROD). These degradation products were inconsistently detected and only at very low levels in the environment. Based on the limited toxicity information available for these degradation products we believe them to be present at levels below concern for public health and we feel that no further action is appropriate at this site.

Comment 12: Page 6M2: With regard to the PAHs detected in sediments, it was the Program in Toxicology's understanding that the main ditch in question would require clean-up. The proposed plan states that confirmation sampling only detected PAHs below comparison values, suggesting they may not be addressed. If APG is choosing to leave this contamination in place, it should be clearly stated.

The Program in Toxicology does not support such a decision, if this is the case.

Response: Confirmation sampling detected PAHs below comparison values. Therefore, there is no requirement and no plan for further action.

Comment 13: Page 7M4: At the end of this paragraph, the text reads that "no radiological comparison parameters were exceeded using the statistical upper confidence limit for samples from MLF OU-2." While this is true, it should be stated for the record that there were a few samples detected above comparison criteria, in similar fashion to discussion on previous pages regarding other classes of compounds. As stated in APG's responses to previous comments, "there typically is no forward risk calculation performed on gross radiological results because no specific radionuclide doses can be estimated." This is, in fact, the main reason radiological readings were not carried through the risk assessment process.

Response: It is true that a few samples had radiological results above comparison criteria but they were shown to pose no statistically unacceptable risk.

Comment 14: Page 8M3: Previous TAG comments raised concerns regarding site-specific effects on ecological receptors versus cumulative effects from ubiquitous compounds such as DDT, and other compounds found in localized hot spots. In response, APG's states: "There is no clear methodology to determine cumulative effects at this time. However, the Army is performing a river study in and around APG to assess possible contaminant inputs from APG. In general, a site-wide evaluation of the ubiquitous pesticide issue is proposed." Such open information regarding previously voiced concerns, as well as the limitations of ecological assessments and ongoing and proposed APG investigations, should be included. It would certainly enhance the working relationship that the IRP and the APGSCC strive toward.

Response: APG acknowledges the statement and concerns and always work with APGSCC on the approach to assessment of the ubiquitous DDT contamination.

Comment 15: Page 8M4: All references to the future resident scenario have been removed from this version, even though it was reported in the previous version that the hypothetical resident cancer risk for ingestion of shallow groundwater would be 3 in 10,000, and the noncarcinogenic hazard index for the hypothetical resident would be 30 (both in exceedence of the levels accepted by the EPA). This would become relevant if APG is ever placed on the BRAC list and targeted for closure; considering the down-sizing that has taken place in the last 15 years, this cannot be ruled out. The elimination of this information may be acceptable to the regulatory authorities, but this type of information is pertinent to the long-term tracking of this site, and should be included in this record.

Response: APG acknowledges the stated concern. However, the MLF area's future use is classified as military/industrial and not residential. If APG is ever closed under the BRAC program, the established BRAC clean-up criteria for base closure will be implemented, based upon the determined use of the area at that time.

ATTACHMENT

SAMPLE NEWSPAPER ANNOUNCEMENT