Engineering Evaluation/Cost Analysis for Cluster 2 Grenade/Incendiary Disposal/Burn Pits Westwood Study Area

December 1999
Aberdeen Proving Ground

Engineering Evaluation/Cost Analysis
For
Westwood Study Area Cluster 2
Grenade/Incendiary Disposal/Burn Pits
Aberdeen Proving Ground, Maryland

Prepared for

U.S. Army Garrison, Aberdeen Proving Ground
Directorate of Safety, Health and Environment
Aberdeen Proving Ground, Maryland

Contract DAAD05-97-D-7003

Prepared by

General Physics Corporation
500 Edgewood Road
Edgewood, Maryland 21040

GP-R-711E99071

December 1999

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	December 1999	Final

4. TITLE AND SUBTITLE
Engineering Evaluation/Cost Analysis for
Cluster 2 Grenade/Incendiary Disposal/Burn Pits
Westwood Study Area

5. FUNDING NUMBERS
Contract No.
DAAD05-97-D-7003

5. AUTHOR(S)

General Physics Corporation

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

General Physics Corporation
500 Edgewood Road, Suite 110
Edgewood, Maryland 21040

8. PERFORMING ORGANIZATION REPORT NUMBER

GP-R-711E99071

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Directorate, Safety, Health and Environment
AMSSB-GSH-ER
Aberdeen Proving Ground, Maryland 21010

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for Public Release. Distribution unlimited.

12b. DISTRIBUTION CODE

3280-A-1

13. ABSTRACT (Maximum 200 words)

This Engineering Evaluation/Cost Analysis evaluates removal action alternatives for several locations of ordnance and explosive waste dumping in the Westwood Area of Aberdeen Proving Ground. The alternatives evaluated include “No Action,” “Land Use Controls,” “Excavation and Disposal,” and a “Protective Cover”. The recommended removal alternative is Excavation and Disposal.

14. SUBJECT TERMS
Aberdeen Proving Ground, Westwood, ordnance and explosive waste, metals, explosives, white phosphorus

15. NUMBER OF PAGES

14

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

This page intentionally blank

U.S. Army Garrison Aberdeen Proving Ground
Directorate of Safety, Health and Environment
Aberdeen Proving Ground, Maryland

Engineering Evaluation/Cost Analysis
for
Cluster 2 Grenade/Incendiary Disposal/Burn Pits
Westwood Study Area

December 1999

CONCURRENCE:

Chief,
Environmental Conservation and Restoration Division
Directorate of Safety, Health and Environment

Kenneth Stachiw Date

Project Officer,
Environmental Conservation and Restoration Division
Directorate of Safety, Health and Environment

Cindy Powels Date

APPROVALS:

Program Manager
General Physics Corporation

Lester Y. Pilcher Date

Task Manager
General Physics Corporation

Jennifer A. Schaefer Date

This page intentionally blank

EXECUTIVE SUMMARY

This Engineering Evaluation/Cost Analysis presents a comparative analysis and selection of removal options proposed at the "Cluster 2 Grenade/Incendiary Disposal/Burn Pits" within the Westwood Study Area of Aberdeen Proving Ground. The Engineering Evaluation/Cost Analysis develops, evaluates and selects alternatives that will provide an effective interim remedy consistent with anticipated final remediation goals.

The "Cluster 2 Grenade/Incendiary Disposal/Burn Pits" is a former disposal site within the Westwood Study Area, in the Edgewood Area of Aberdeen Proving Ground. Ordnance and explosive waste from historical testing and/or training within the former Westwood Range was disposed at the site. The ordnance and explosive waste was disposed at three locations by dumping along a shallow ravine. The three locations are small in size, all less than 50 feet across.

The Cluster 2 Grenade/Incendiary Disposal/Burn Pits contain ordnance and explosive waste that possibly includes explosive and white phosphorus materials. These hazardous materials represent a health and safety threat to persons who inadvertently enter the site.

Constituents could be released to soil from the ordnance and explosive waste at the Cluster 2 Grenade/Incendiary Disposal/Burn Pits, and could be transported downstream from the site by surface water runoff. These constituents represent a potential threat to human and ecological receptors exposed to the soil, sediment and surface water.

Four removal action alternatives have been evaluated, "No Action"; "Land Use Controls with Monitoring"; "Protective Cover with Land Use Controls"; and "Excavation and Disposal". The Excavation and Disposal alternative is recommended because it offers the highest degree of protectiveness, and is a permanent remedy that does not depend on long-term land use controls and/or maintenance.

This page intentionally blank

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

This page intentionally blank

1 SITE CHARACTERIZATION

1.1 Site Description and Background

The "Cluster 2 Grenade/Incendiary Disposal/Burn Pits" is a former disposal site within the Westwood Study Area, in the Edgewood Area of Aberdeen Proving Ground (APG) (Figure 1). Ordnance and explosive waste (OEW) from historical testing and/or training was disposed at the site. The OEW was disposed at three locations by dumping along a shallow ravine (Figure 2). The three locations are small in size, having maximum dimensions of roughly 40, 30 and 20 feet. While the designated site name uses the term "pits," the disposal appears to have been by simple dumping rather than burial in pits. The area is now subject to a variety of physical security countermeasures to include random patrols by law enforcement personnel.

1.2 Previous Removal Actions

There have been no previous removal actions addressing OEW at the Cluster 2 Grenade/Incendiary Disposal/Burn Pits. A small number of intact ordnance items that were located on the ground surface have been removed from the site.

1.3 Source, Nature and Extent of Contamination

The three disposal locations are along the south side of a ravine that carries surface water runoff eastward to Reardon Inlet (Figure 3). The three disposal locations are approximately 250 feet from the installation boundary, and the easternmost of the three locations is roughly 700 feet west of Reardon Inlet. The disposal locations were identified during a survey of the area within ¼-mile of the installation boundary for unexploded ordnance (UXO).

"Area A," the easternmost disposal location, is approximately 40 feet in maximum dimension. The waste was dumped along the south side of the drainage ravine which is 12 feet in depth at this location. The waste material extends from the top edge of the ravine to the bottom, with most of the waste along the south wall. Exploratory excavation has not yet been accomplished, but visual observation and seismic refraction survey suggests that the waste has a maximum thickness of 2.5 feet.[1] Electromagnetic (EM) survey of the site suggests that most of the waste is within a 30 foot by 30 foot area. The total waste volume is estimated at 75 cubic yards, but could be as much as 120 cubic yards or less than 20 cubic yards. Initial inspection revealed the remains of expended M-23 rifle smoke grenades, M-15 white phosphorus (WP) grenades, parts of drums, and pieces of metal. The waste material is corroded and was possibly burned prior to disposal at this site.

[1] The seismic refraction survey determines the average velocity of shock waves through material. The survey technique cannot differentiate between humus-rich topsoil and uncompacted waste fill. Therefore, the survey can only provide an estimate of maximum possible depth of the fill material.

"Area B," the middle of the three areas, is about 30 feet by 30 feet in size. The waste material at Area B was also dumped along the south side of the ravine, which is about five feet in depth at this location. The waste identified by initial inspection at Area B includes burned and corroded residue of scrap metal, grenade parts, incendiary parts, metal buckets and molten slag. The seismic refraction survey indicates a maximum waste depth of approximately three feet, and the EM survey indicates that most of the waste is within a 30 foot by 12 foot area. The volume of waste is estimated to be 35 cubic yards, but could be as much as 50 cubic yards or less than 10 cubic yards.

"Area C" is the westernmost of the three disposal areas and is about 20 feet by 10 feet in size. The dumping at this location was into a tributary ditch on the south side of the ravine. The ditch is two to three feet in depth, and the ravine is roughly five feet deep at this location. Surface water runoff occurs through the disposed waste following precipitation events. The waste is exposed by erosion at this location and includes expended M-23 rifle smoke grenades, rifle blanks, 10-lb incendiaries, pieces of metal, and unidentifiable rifle grenades and WP rounds. Intact ordnance items at the surface were removed during the boundary UXO survey. The seismic refraction survey indicates a maximum waste thickness of approximately 1¾ feet. Because of the small size of the drainage feature, this estimate based on seismic refraction is possibly low and the actual waste thickness is probably about three feet. The total volume of waste at this location is estimated to be 10 cubic yards, but could be as much as 15 cubic yards or as little as 5 cubic yards.

Some of the waste material at all three locations appears to have been burned at another location and then hauled to the dump site for disposal. Visual site inspection also suggests that there was no burial of waste, and that the material was simply dumped into the ravine.

The EM survey was accomplished measuring both terrain conductivity and inphase response. The inphase response is primarily a measure of the relative concentration of metallic material in the subsurface. The terrain conductivity in vertical dipole mode measures changes in the electrical conductivity of subsurface materials. At both "Area A" and "Area B," a response was observed in both survey modes. At "Area C," a response was observed in only the inphase mode, indicating that the waste consists primarily of metallic materials.

A composite soil sample was collected from within each of the three disposal areas and analyzed for explosive-related compounds, target analyte list (TAL) metals, target compound list (TCL) volatiles, TCL semivolatiles, chemical agent degradation products, gross alpha radioactivity, and gross beta radioactivity. Tables 1 and 2 list the analytical results and screening concentrations for detected organic and inorganic analytes. The samples contained elevated concentrations of copper, zinc, mercury, nickel, cadmium and arsenic. The composite soil samples were also analyzed and determined not to be hazardous waste by characteristic.

During the remedial investigation for the Cluster 2 portion of the Westwood Study Area, surface water and sediment samples (SW/SD-13) were collected from the drainage ravine

roughly 500 feet downstream of the disposal site near Reardon Inlet (Figure 3) (GP, 1998). One sediment sample and two rounds of surface water were collected from this location.

No explosives-related compounds were detected in the sediment at location SD-13, and no metals exceeded both risk-based screening criteria and the range of reference background concentrations, thus suggesting that the Cluster 2 Grenade/Incendiary Disposal/Burn Pits have not adversely impacted Reardon Inlet sediment. The organic constituents detected in the sediment which exceeded ecological risk-based screening criteria were 4,4'-DDE (24 ug/kg estimated concentration) and 4,4'-DDT (9.2 ug/kg). Other detected organic constituents include 4,4'-DDD, fluoranthene and pyrene. These organic constituents are not related to OEW or chemical warfare materiel (CWM), are consistent with regional anthropogenic concentrations[2], and are not believed to be related to the Cluster 2 Grenade/Incendiary Disposal/Burn Pits. No constituents detected in the sediment sample had concentrations exceeding risk-based screening criteria for human health.

The second round surface water sample at location SW-13 contained 0.73 ug/L of cyclotrimethylene trinitramine (RDX).[3] The RDX is possibly associated with the Cluster 2 Grenade/Incendiary Disposal/Burn Pits, but could possibly have been released from a dump site located immediately north of SW-13. This dump site contains materials including discarded ammunition boxes. Site inspection has not identified surface UXO at this dump site.

1.4 Streamlined Risk Evaluation

The Cluster 2 Grenade/Incendiary Disposal/Burn Pits contain OEW that includes explosive and WP materials. These hazardous materials represent a health and safety threat to persons who inadvertently enter the site.

Constituents have been released to soil from the OEW at the Cluster 2 Grenade/Incendiary Disposal/Burn Pits, and could be transported downstream from the site by surface water runoff. These constituents represent a potential threat to human and ecological receptors exposed to soil and sediment.

Composite soil samples from the disposal sites contained elevated concentrations of certain metals that exceed risk-based screening levels for ecological receptors. Copper and zinc are the metals exceeding background and screening levels by the highest ratio, with mercury, cadmium, nickel and arsenic also exceeding both background and ecological screening levels. The concentrations of some of these metals also exceed risk-based screening levels for sediment. These results indicate that the disposal sites contain waste materials that have released constituents to the environment and that the wastes

[2] DDTr is commonly found in soil and sediment of the upper Chesapeake Bay region due to historical insect control, and polycyclic hydrocarbons (i.e., fluoranthene and pyrene) are ubiquitous because of atmospheric deposition of combustion products.

[3] RDX is an explosive compound that is used in certain explosive mixtures. RDX is used in some high explosive ordnance items and has also been used in some bursters in chemical ordnance items.

potentially threaten both terrestrial and aquatic ecological receptors. Concentrations of arsenic in soil also exceed risk-based criteria for protection of industrial workers and hypothetical future residents.

Initial site inspections have not identified any CWM at the Cluster 2 Grenade/Incendiary Disposal/Burn Pits that would represent a substantial threat to downwind human receptors via air transport. The former Westwood Range was used for a variety of pyrotechnic testing involving incendiary and WP bombs, and grenades. The range has historically been used for training involving chemical agents such as decontamination of equipment contaminated with chemical agent. The range was also used to test non-chemical munitions such as high explosive munitions. There is no information indicating that lethal agent chemical munitions were ever tested or buried in the Westwood Range area. Several range sweeps/surveys over the years confirm this conclusion. These surveys found WP, incendiary, pyrotechnic, high explosive and riot control ordnance items, but no lethal agent ordnance. If lethal agent chemical ordnance would be encountered during the removal action, the ordnance and situation would be managed by APG using standard emergency response procedures. These procedures are routinely implemented to manage situations where lethal agent chemical ordnance items have been discovered, and are effective in protecting the health and safety of response workers and the public.

2 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

The removal action objectives are to:

- Eliminate the threat to health and safety associated with direct human contact with OEW; and,

- Eliminate the potential for hazardous constituent release to soil, sediment and surface water.

2.1 Statutory Limits on Removal Actions

Removal actions are generally limited by statute to a maximum cost of 2 million dollars and a maximum duration of 12 months, except as provided for under 2 types of exemptions available (emergency and consistency). The 12-month time limit and 2 million dollar statutory limit are governed by applicable portions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104(b)(1). As described in this engineering evaluation/cost analysis (EE/CA), the proposed removal will be accomplished with a cost less than 2 million dollars and within a period of less than 12 months.

2.2 Determination of Removal Scope

The removal action will address only that OEW within the three small areas located by a survey for unexploded ordnance in the area adjacent to the installation boundary. There are no known similar sites near the installation boundary in the Westwood area (within

the ¼-mile wide survey area) where OEW has been exposed by erosion and where further erosion could expose additional waste. There are other Westwood locations near the installation boundary with substantial numbers of subsurface magnetic anomalies, some of which may be UXO. These areas are being addressed by an ongoing CERCLA feasibility study and are not within the scope of this removal action.

2.3 Determination of Removal Schedule

The response being considered is a non-time critical removal action as defined under CERCLA. While the action is technically non-time critical by CERCLA definition, the removal would be accomplished in an expedited manner, with work being initiated within 60 days after a decision is made. The time to implement the removal action is different for the various alternatives, but will not exceed 12 months for any alternative.

3 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Four alternatives have been identified for a removal action at the Cluster 2 Grenade/Incendiary Disposal/Burn Pits. These alternatives are "No Action," "Land Use Controls with Monitoring," "Protective Cover with Land Use Controls," and "Excavation and Disposal." These four alternatives are described and evaluated against the criteria of effectiveness, implementability and cost.

3.1 Alternative 1 – No Action

The "No Action" alternative would involve no actions specifically intended to address the Cluster 2 Grenade/Incendiary Disposal/Burn Pits. No actions would be taken to control or monitor constituent release from the site. No engineering measures would be implemented to prevent contact with wastes. However, access controls would exist with continuance of the existing physical security measures, to include random patrols by law enforcement personnel. Even with a "No Action" decision for removal, the Cluster 2 Grenade/Incendiary Disposal/Burn Pits would be evaluated and addressed by the feasibility study and remedial decision process for the Westwood Study Area, to be accomplished during the next several years.

The "No Action" alternative is possibly not protective of human health because contact with hazardous materials would not be controlled or prevented through engineering measures. This alternative is also possibly not protective of the environment because hazardous constituent release to soil and sediment is not prevented. The "No Action" alternative would not meet removal action objectives."

The "No Action" alternative is easily implemented. No capital cost is associated with this alternative. If a future "No Action" decision was again made with the CERCLA

record of decision (ROD), the only long-term costs would be for 5-year remedy reviews, which would have a present worth cost of approximately $50,000 for a 30-year period.[4]

3.2 Alternative 2 – Land Use Controls with Monitoring

Under Alternative 2, "Land Use Controls with Monitoring," land use controls (LUCs) would be implemented to control access to the site and ensure that a change in land use incompatible with health and safety considerations is not implemented. Monitoring would be accomplished to detect any further release of hazardous constituents from the waste locations.

This alternative would be effective in protecting human health and would identify any change in site status that represents an increasing risk to ecological receptors. Therefore, this alternative would be at least partially effective, and possibly fully effective, in meeting removal action objectives.

This LUCs and monitoring alternative is readily implemented, being technically and administratively feasible. While the capital cost of this alternative is small, the estimated total present worth cost is $857,000 because of the costs of security patrols and annual monitoring for a 30-year period.

3.3 Alternative 3 – Protective Cover with Land Use Controls

This alternative would consist of construction of a soil cover over the waste to control human contact with the waste and to control erosion. The construction would involve site preparation to clear access pathways and work areas, and would also require stream diversion to route drainage around the disposal locations. The soil cover would prevent direct air contact with WP in corroded ordnance items and rapid oxidation (burning) of WP. The cover would be stabilized to control erosion. Long-term maintenance would be performed to maintain the effectiveness of the cover.

This containment alternative would be effective in protecting human health and the environment by preventing human exposure to wastes and by controlling migration of constituents from the site. The construction of a soil cover would be readily implementable. The estimated total present worth cost is $240,000. The actual capital construction cost would be $135,000, while the long-term maintenance for a 30 year period is estimated to be $105,000.

3.4 Alternative 4 – Excavation and Disposal

Alternative 4 would consist of excavation and disposal of OEW wastes at the site. The excavation would be accomplished after clearing UXO from access pathways and work areas around the disposal locations. Because of the nature of the wastes, the excavation of wastes would be accomplished using primarily manual techniques by qualified

[4] The EPA guidance for cost estimates under CERCLA is to estimate the present worth cost for 30 years of operations and maintenance.

explosive ordnance disposal (EOD) personnel. The waste material would be managed using existing procedures and APG resources already in place for other similar projects. Following the excavation of wastes, the site would be stabilized to prevent erosion.

This alternative would be effective in protecting human health and the environment, would meet removal action objectives, and could be readily implemented. The cost of this alternative is estimated to be $327,000, and consists entirely of capital cost with no long-term operations and maintenance. The cost of this action is directly related to the volume of OEW present at the site and the nature of the waste (e.g., how much of the waste consists of live ordnance items). Because there is uncertainty concerning the exact volume and nature of the waste, there is also uncertainty in the actual cost of excavation and disposal.

4 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Both the containment and excavation alternatives (Alternatives 3 and 4, respectively) would be protective of human health and the environment. The LUC alternative would be protective of human health, but is possibly not protective of the environment. The No Action alternative would involve no actions to protect either human health or the environment. There are no chemical-specific applicable or relevant and appropriate requirements (ARARs) for soil or sediment at the Cluster 2 Grenade/Incendiary Disposal/Burn Pits. Both the excavation and containment alternatives would be implemented in a manner that complies with location and action-specific ARARs (fugitive dust emissions, erosion and sediment control, etc.). The containment and excavation alternatives would meet remedial action objectives, while the LUC alternative could possibly only partially meet objectives. The No Action alternative would possibly not meet remedial action objectives. All alternatives, except no action, would have long-term effectiveness. However, the LUC and containment alternatives would require long term action to maintain effectiveness.

All of the alternatives are readily implemented (technically feasible, implementable with readily available equipment and materials, and administratively feasible).

The No Action alternative would involve costs only for 5-year remedy reviews if the no action decision was carried forward as a long-term remedy in the ROD. The estimated costs of the four alternatives are:

No Action	$50,000
Land Use Controls with Monitoring	$857,000
Protective Cover with Land Use Controls	$240,000
Excavation and Disposal	$327,000

The four removal action alternatives have been evaluated for environmental considerations under the National Environmental Policy Act (NEPA). Table 3 presents a discussion of potential environmental impacts and satisfies NEPA requirements.

5 RECOMMENDED REMOVAL ACTION ALTERNATIVE

The Excavation and Disposal alternative is recommended because it offers the highest degree of protectiveness, and is a permanent remedy that does not depend on long-term LUCs and/or maintenance.

Figure 1. Location of Westwood Area Within Aberdeen Proving Ground

Figure 2. Location of Cluster 2 Grenade/Incendiary Disposal/Burn Pits

Figure 3. Cluster 2 Grenade/Incendiary Disposal/Burn Pits

Table 1. Organic Analytes Detected in Cluster 2 Grenade/Incendiary Disposal/Burn Pit Surface Soil

Compound	RBCSOIL[1] (µg/kg)	BTAG Soil[2] (µg/kg)	BTAG Sediment[2] (µg/kg)	Maximum Reference Value[3] (µg/kg)	Concentration in Composite Soil Samples (µg/kg)		
					Pit A SS-24	Pit B SS-25	Pit C SS-26
Acetone	**7,800,000**				11J	9J	--
di-n-Butylphthalate	**7,800,000**		**1,400**		--	51J	54J
Methylene chloride	**851,000**	**<300**			9	10	9
Styrene	**16,000,000**	**100**			--	--	26
Toluene	**16,000,000**	**100**			--	--	2J

1. USEPA Risk-Based Concentration (RBC) for Residential Soils, Table 10-27-99.
2. USEPA Region III Biological Technical Assistance Group (BTAG) Draft Table 1997.
3. Aberdeen Proving Ground Reference Sampling and Analysis Program Soil, Sediment, and Surface Water Reference Data Report (ICF Kaiser, Inc., 1995).

Laboratory Data Qualifier:

J = Estimated value. Analyte present at a level between the Method Detection Limit (MDL) and Contract Required Quantitation Limit (CRQL).

Table 2. Inorganic Analytes Detected in Cluster 2 Grenade/Incendiary Disposal/Burn Pit Surface Soil

Compound	RBCSOIL[1] (mg/kg)	BTAG Soil[2] (mg/kg)	BTAG Sediment[2] (mg/kg)	Maximum Reference Value[3] (mg/kg)	Concentration in Composite Soil Samples (mg/kg)		
					Pit A SS-24	Pit B SS-25	PitC SS-26
Aluminum	**7,800**	**1**		**17,300**	7,540	8,000	7,310
Arsenic	**0.43**	**328**	**8.2**	**5.29**	7	13.3	4.1
Barium	**550**	**440**		**125**	82.9	391	42.6B
Cadmium	**3.9**	**2.5**	**5.1**	**1.4**	--	3.8	--
Calcium				**1,980**	401B	1,370	412B
Chromium	**12,000**	**0.0075**	**0.005**	**68.9**	15	19.1	12.7
Cobalt	**470**	**100**		**25.6**	4.5B	9B	7.2B
Copper	**310**	**15**	**34**	**27.5**	56.3	215	31.6
Iron	**2,300**	**12**		**23,500**	15,000	62,400	11,300
Lead	**400**	**0.010**	**46.7**	**117**	77.4	112	41.3
Magnesium		**4.4**		**3,920**	663B	1,260	663B
Manganese	**160**	**330**		**1,140**	144	548	682
Mercury		**0.058**	**0.150**	**0.070**	0.13	0.29	0.07
Nickel	**160**	**2**	**20.9**	**24.1**	8B	32.3	5B
Potassium				**1,700**	258B	387B	257B
Silver	**39**	**0.0000098**		**0.983**	--	0.93B	--
Sodium				**937**	--	893B	--
Vanadium	**55**	**0.5**		**59.2**	24.3	21.7	24.3
Zinc	**2,300**	**10**	**150**	**242**	665	4,970	134

1. USEPA Risk-Based Concentration (RBC) for Residential Soils, Table 10-27-99. Table includes values for Cadmium – food, Chromium III, and Manganese – nonfood. Arsenic value is for carcinogenic effects (equivalent to a 10^{-6} risk level). Other metal values are decreased by an order of magnitude for noncarcinogenic effects (equivalent to a hazard quotient of 0.1)
2. USEPA Region III Biological Technical Assistance Group (BTAG) Draft Table 1997.
3. Aberdeen Proving Ground Reference Sampling and Analysis Program Soil, Sediment, and Surface Water Reference Data Report (ICF Kaiser, Inc., 1995).

Laboratory Data Qualifier: B = Analyte present at a level greater than the MDL but less than the CRQL.

Table 3. Environmental Considerations for Removal Action Alternatives

	Alternative 1 No Action	Alternative 2 Land Use Controls with Monitoring	Alternative 3 Protective Cover with Land Use Controls	Alternative 4 Excavation and Disposal
WETLANDS	No impacts	No impacts	Site is within ravine with intermittent drainage and implementation would need to be such that impact on wetland area is minimized	Site is within ravine with intermittent drainage and implementation would need to be such that impact on wetland area is minimized
ARCHEOLOGICAL RESOURCES	No impacts	No impacts	No impacts	No impacts
THREATENED / ENDANGERED SPECIES	No impacts	No impacts	Activities would be of short duration and limited to a small area, with no significant impacts to threatened/endangered species	The waste removal activities would be of short duration and limited to a small area, with no significant impacts to threatened or endangered species
SEDIMENT AND EROSION CONTROL	No impacts	No impacts	Implementation would require an approved sediment and erosion control plan	May require an approved sediment and erosion control plan, depending on the size of the area to be disturbed by excavation and supporting activities
NOISE POLLUTION	No impacts	No impacts	Noise associated with construction equipment, and noise control measures may need to be implemented to minimize impacts during any necessary onsite detonation of unexploded ordnance	Noise control measures may need to be implemented to minimize impacts during any necessary onsite detonation of unexploded ordnance
HAZARDOUS WASTE	No actions would be taken to mitigate threats associated with explosive wastes possibly present at the site	Effectiveness of removal would depend solely on long-term land use controls	The protective cover would mitigate any possible threats associated with direct human contact with explosive (reactive) wastes possibly present at the site	The excavation and disposal of waste would eliminate any possible threats associated with direct human contact with explosive (reactive) wastes possibly present at the site. Excavated wastes would be managed in accordance with Federal and State regulations
AIR POLLUTION	No impacts	No impacts	Dust suppression may be required during construction activities	Proper procedures would need to be implemented to control emissions of dust

APPENDIX A

REFERENCES

AEHA, 1989. *RCRA Facility Assessment, Edgewood Area, Aberdeen Proving Ground, Maryland*, Report No. 39-26-0490-90. US Army Environmental Hygiene Agency, Aberdeen Proving Ground, Maryland. December 1989.

General Physics, 1998. *Cluster 2 (Debris Landfill) and Cluster 6 (Radioactive Material Disposal Facility) Technical Memorandum, Westwood Study Area*. General Physics Corporation, Edgewood, Maryland. April 1998.

General Physics, 1999. *Technical Report for the Northern Boundary Survey, Canal Creek/Westwood Study Area*. General Physics Corporation, Edgewood, Maryland. June 1999.

USEPA, 1990. *Federal Facility Agreement Under CERCLA Section 120, Aberdeen Proving Ground, Maryland*, Administrative Docket Number III-FCA-CERC-004. US Environmental Protection Agency Region III and US Department of the Army. June 1990.

APPENDIX B

GLOSSARY

APG	Aberdeen Proving Ground
ARAR	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CWM	chemical warfare materiel
EE/CA	engineering evaluation/cost analysis
EM	electromagnetic
EOD	explosive ordnance disposal
LUC	land use control
NEPA	National Environmental Policy Act
OEW	ordnance and explosive waste
RDX	Royal Demolition Explosive, chemical name is cyclotrimethylene trinitramine
ROD	record of decision
UXO	unexploded ordnance
WP	white phosphorus