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Record of Decision:

ALABAMA ARMY AMMUNITION PLANT
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Final Record of Decision

RECORD OF DECISION

ALABAMA ARMY AMMUNITION PLANT
Area A

MARCH 1997

<IMG 97021A>

Final Record of Decision

Prepared for:
Alabama Army Ammunition Plant
Childersburg, Alabama
Area A

Prepared by:
Environmental Science & Engineering, Inc.
Gainesville, Florida

January 1997

ESE Project No. 3918359

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List of Acronyms and Abbreviations

AAC	Alabama Administrative Code
ADEM	Alabama Department of Environmental Management
ADEM	Alabama Department of Environmental Management
ALAAP	Alabama Army Ammunition Plant ALAAP
BRA	Baseline Risk Assessment
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeters
COC	chemical of concern
COPC	chemical of potential concern
CRP	Community Relations Plan
CSF	cancer slope factor
5C	degrees Celsius
5F	degrees Fahrenheit
DNT	dinitrotoluene
DOD	Department of Defense
EPA	U.S. Environmental Protection Agency
ESE	Environmental Science & Engineering, Inc.
FS	feasibility study
ft	foot
ft-msl	feet above mean sea level
gal	gallon
GOCO	government-owned/contractor-operated
gpm	gallons per minute
ha	hectares
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
IEUBK	Integrated Exposure Uptake Biokinetic
IOC	inorganic chemical
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
km	kilometer
km 2	square kilometers
LOEC	lowest-observed-effect concentration
m	meters
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/kg/day	milligram per kilogram per day
NC	nitrocellulose
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List

ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Act
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PbB	blood-lead
PPE	personal protection equipment
PPLV	preliminary pollutant limit value
PPM	parts per million
RA	risk assessment
RCRA	Resource Conservation and Recovery Act
RDA	recommended daily allowance
RfD	reference dose
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RMCS	retrievable monitored containment structure
ROD	Record of Decision
RPM	remedial project manager
SARA	Superfund Amendments and Reauthorization Act of 1986
SVOC	semi-volatile organic compound
tetryl	2,4,6-trinitropheny/methylnitramine
TNT	trinitrotoluene
TSS	total suspended solids
Ig/g	micrograms per gram
UR	unit risk
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Center
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USC	United States Code
USDA	U.S. Department of Agriculture
VOC	volatile organic compound
Weston	Roy F. Weston, Inc.
WoE	weight-of-evidence
WWII	World War II
yd	yard
yd 3	cubic yard

DECLARATION OF THE RECORD OF DECISION

SITE NAME AND LOCATION

Alabama Army Ammunition Plant
16559 Plant Road
Childersburg, Alabama 35044-0368

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected final remedial action for the soils and groundwater of Area A at Alabama Army Ammunition Plant (ALAAP), Childersburg, Alabama, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (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 the site.

Remedial investigations have progressed at the site since 1980. A soil removal action addressing all identified contaminated soils was begun prior to the site being placed on the National Priorities List (NPL). Following the removal action, additional sampling was conducted to verify completeness. This sampling identified additional areas requiring remediation and an interim response action was performed. Following all interim response actions, a supplemental investigation was completed to determine the contamination status of all media (soil, groundwater, surface waters, sediments) at the site following remediation. Samples were collected from all study areas, including those that had undergone interim removal actions. Based on this new data, a Final Remedial Investigation Report and Risk Assessment were completed utilizing the data collected during the supplemental investigation along with previously collected data. Based on this complete data set of the site as it exists now, the Risk Assessment determined that the only sites which still presented an unacceptable human health risk were Study Areas 13 and 14. Interim response actions completed at other study areas were determined to be sufficient to be protective of human health, welfare and the environment. All other media at all other study areas at the site have been approved for No Further Action.

This final ROD for Area A of ALAAP presents the preferred alternatives for contaminated soils within Study Areas 13 and 14. This document also presents an evaluation of the previous removal action and the interim response action with respects to all statutory criteria. Although the soil removal action was not required to meet the nine criteria as it was begun prior to NPL listing, this document presents an evaluation of the criteria for completeness of the record.

This final remedial action (Study Areas 13 and 14) is being taken to protect human health and the environment from unacceptable risks. This action is the final action for all media within Area A. All other Study Areas within Area A have been approved for No Further Action.

The U.S. Environmental Protection Agency (EPA) and the State of Alabama concur with the selected remedy.

ASSESSMENT OF THE SITE

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

DESCRIPTION OF THE SELECTED REMEDIES

Completed Actions

The Stockpile Soils Area OU, the first OU to address contaminated soils at ALAAP Area A, involved treating contaminated soils that were excavated from Area A and stored in retrievable monitored containment structures (RMCSs) in Area B. The initial remedial actions that led to the soils stockpiling were performed based on findings of the remedial investigation/feasibility study (RI/FS) of ALAAP completed in 1986. Cleanup activities at Area A included building decontamination and demolition and contaminated soil excavation and treatment. An interim ROD for treatment [i.e., incineration followed by solidification/stabilization (if required)] of the Stockpile Soils Area OU soils was signed on December 31, 1991. In 1990, EPA indicated that additional investigations needed to be conducted at Area A to ensure that no residual contamination remained on site; therefore, a supplemental remedial investigation (RI) was begun in 1991. Additional soils were removed and treated from Study Areas 12 and 30 based on initial results of the supplemental investigation. The final supplemental RI was completed in 1996. This investigation included a sampling of all media following completed remedial actions. This data set shows the site as is and was the basis for the completed Risk Assessment.

Donald F. Hurley, Jr. Date
Major OD
Commanding, Alabama Army Ammunition Plant

Proposed Final Actions

This Final Area A ROD addresses the last remaining principal threats from lead and semivolatile contamination by excavating and treating the newly identified contaminated soils from Study Areas 13 and 14 of Area A. Treatment of these contaminated soils will be offsite incineration of soils from Study Area 13 and solidification/stabilization of lead-contaminated soils from Study Area 14. The scope of action of this final ROD is limited to the soils of Study Area 13 and 14, acknowledges the interim response actions which have taken place prior to this document and is intended to be the final ROD for Area A actions. A Final Baseline Risk Assessment (RA) and Feasibility Study (FS) were developed upon completion of the final additional sampling at ALAAP Area A. The sampling effort was initiated to screen the site as a whole, post remedial action, to address soils not previously sampled for full scan analysis and to establish the background levels at Area A.

The major components of the selected remedy for the soils of Study Area 13 and 14 within Area A include:

- Excavation of approximately 12 cubic yards of Benzo(a)pyrene-contaminated soils from Study Area 13 and 46 cubic yards of lead-contaminated soils from Study Area 14 of Area A;
- Transportation of Benzo(a)pyrene contaminated soils from Area 13 to an off-site hazardous waste incinerator;
- Excavation and on-site treatment (in Area B) by solidification/stabilization of soils from Area 14.

The Risk Assessment completed for the site, based on data collected after the completion of all interim response actions, determined that all remaining study areas within Area A qualified for No Further Action.

STATUTORY DETERMINATIONS

This final action is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate for this limited

scope remedial action, and is cost-effective. This final action fully addresses the statutory mandate for permanence and treatment to the maximum extent practicable, and employs a treatment that reduces toxicity, mobility or volume as a principal element. Actual or threatened releases from Study Areas 13 and 14 of Area A, if not addressed by implementing the response action selected in this ROD, may present a current or potential threat to public health, welfare or the environment. All ARARs for the site will have been met for all Study Areas once the removal action at Study Areas 13 and 14 have been completed. As this remedy will not result in hazardous substances remaining onsite in Area A above health based levels, the 5-year review will not apply to this action.

RECORD OF DECISION

ALABAMA ARMY AMMUNITION PLANT
Area A

JANUARY 1997

Mr. Raymond J. Fatz
Acting Deputy Assistant Secretary of the Army
(Environment, Safety, and Occupational Health)

Date

DECISION SUMMARY

1.0 Site Name, Location, and Description

Alabama Army Ammunition Plant (ALAAP) is located in Talladega County in east-central Alabama, 30 miles east-southeast of Birmingham and 70 miles north of Montgomery, the State capital (Figure 1). The nearest town is Childersburg, Alabama, which is four miles south of ALAAP.

1.1 Physiography

ALAAP is located in the Coosa Valley and Ridge physiographic province [Environmental Science & Engineering, Inc. (ESE), 1986]. The border between the Valley and Ridge province and the Piedmont province is south of ALAAP between Talladega and Tallaseehatchee creeks. The terrain is level-to-rolling and largely suited to pasture and timberland, with elevations ranging from 117 to 183 meters (m) [384 to 600 feet above mean sea level (ft-msl)]. The bedrock underlying ALAAP has been mapped on a regional scale by Shaw [1970, 1973] and identified as undifferentiated Knox Group of Upper Cambrian to lower Ordovician age dolomite.

1.2 Climate

The climate in Talladega County is temperate; during fall, winter, and spring, the weather is controlled by frontal systems and contrasting air masses. Summer weather, which lasts from May or June until September or October, is almost subtropical, since maritime tropical air prevails along Bermuda high-pressure systems [ESE, 1981].

Average daily temperatures in the region are 24 degrees Celsius (C) [75 degrees Fahrenheit (5F)] for the high and 105C (505F) for the low. Summer high temperatures are commonly 325C or above, occasionally exceeding 385C.

Mean monthly rainfall is 5.5 centimeters (cm). The highest average monthly rainfall is 16.3 cm (6.4 inches), occurring in March. Talladega County has two annual rainy seasons. The winter rainy season is from December to April, and the summer rainy season lasts from May through September, with the highest rainfall occurring in June and July.

1.3 Surface Hydrology

Surface water flow at the site is in a general westerly direction, from ALAAP toward the Coosa River. The surface water from Area A drains to Area B along the border, (Figure 2) resulting in potential contaminant migration from surficial soil contamination at Area A. A small portion of the southeast and east side of ALAAP drains toward Talladega Creek, a tributary of the Coosa River, Prior to construction of ALAAP, the area consisted of farms, woodlands, and wetlands. Much of the western half of ALAAP was poorly drained. Small natural drainage ways were enlarged and rerouted to provide drainage at the sites of the various manufacturing operations. During site manufacturing operations, liquid industrial waste from the explosives manufacturing was conveyed west to the Coosa River by a manmade channel, the Red Water Ditch. No natural ponds existed on ALAAP during its operation. Two large storage lagoons were constructed to retain industrial wastes (Area B). Extensive wooded swamp and open pond areas have developed in the drainage systems at ALAAP since the beginning of demolition activities in 1973, mostly as a result of damming of drainways by beavers.

1.4 Geologic Setting

The bedrock underlying ALAAP has been mapped on a regional scale and has been identified as the undifferentiated Knox group of Upper Cambrian to Lower Ordovician age dolomite. The dolomite

underlying ALAAP is thick-to-medium-bedded, cherty, and penetrated by numerous cavities, joints, and fractures. The dolomite is overlain by residual soil derived from weathering processes. This soil matrix consists primarily of clay, with some silt, sand, and occasional chert boulders, and varies in thickness from less than 3 feet to more than 80 feet.

1.5 Land Use

ALAAP Area A is currently privately owned under an unrestricted deed with controlled access. The only activity occurring on ALAAP Area A is managed wildlife activity. Future land use of the ALAAP Area A property is expected to consist of wildlife habitat, hunting grounds, and occasional logging of wooded areas although the deed permits unrestricted usage.

1.6 Soils

The soils at ALAAP (Areas A and B) are generally divided into three associations. Soils of the Bodine-Minvale Association are found on the high ground of the eastern portion of ALAAP. This association is composed of deep, well-drained, steep, cherty, medium-textured soils derived from limestone and dolomite. Most of ALAAP is covered by soils of the Decatur-Dewey-Fullerton Association, which are also deep, well-drained, loam soils derived from limestone and dolomite. The soils of the floodplains of Talladega Creek and the Coosa River have been classified as the Chewacla-Chenneby-McQueen Association. These are deep, nearly level, alluvial loam soils that grade from somewhat poorly drained to well-drained and are subject to flooding.

These broad-based associations represent agricultural classifications rather than engineering descriptions. Soil constitution at ALAAP, and thus within Area A, lie within the three associations that range from soils consisting mainly of sand and silt with little clay to soils made up entirely of clay.

1.7 Groundwater

Groundwater from the dolomite aquifer of the Coosa Valley supplies the potable needs of the communities, homes, farms, woodlands and wetlands. Most of the wells draw water from solution cracks and cavities in the dolomite [ESE, 1981]. A few wells are finished in the residual soil, but these wells are less productive than those drilled into the dolomite. Groundwater in the surficial aquifer flows to the west-southwest or toward Area B at 7.31 meters per year [ESE, 1986].

1.8 Vegetation and Habitat/Community Structure

The environment at ALAAP has had 3 major perturbations in the past 40 years (agriculture, military operations, and woodland management). Prior to construction of the ALAAP facilities, the area was primarily cropland and woodland. Since the cessation of operations at ALAAP, a woodland management program was instituted that extensively modified the former demolition areas by allowing for planting of 1,381 hectares (ha) (3,411 acres). Currently, most of the formerly maintained drainages, pine plantations, and cleared areas have under-gone considerable vegetative overgrowth. The major existing vegetative systems are grassland/old field association, upland pine forest, oak forests, low moist pine woods and hardwood swamps [ESE, 1986].

Past and current land management activities, to a large degree, are responsible for the species composition of Area A. Relative areas and vegetative community types for sites in Area A have been estimated based on observations during 1991 ecological surveys by ESE. Since deactivation of industrial operations on the installation, much of the land in Area A has been managed for the production of pine resources. In recent times, small, isolated areas have been disturbed in

the process of decontaminating industrial sites; these areas were subsequently abandoned. They became colonized with early successional species and, in the short-term, support fewer primary producers. Consequently, they are of limited use as wildlife habitat. More recently, heavy logging and clearcutting of pines has occurred. These clearcuts are being revegetated with wildlife forage and cover crops that favor game species. The existing pine stands have been managed as densely grown pine plantations or less dense pine stands supporting old field and early successional herbaceous and shrub species at the ground stratum. Much of the ground cover is dominated by Japanese honeysuckle (Lonicera japonica) and blackberry (Rubus sp.).

More natural communities occur and still remain along drainage features, a reflection of less intense management geared toward pine production. Dominant or common tree species occurring in these communities include red oak (Quercus rubra), white oak (Q. alba), sweetgum (Liquidambar styraciflua), American beech (Fagus grandiflora), flowering dogwood (Cornus florida), hickories (Carya spp.), water oak (Q. nigra) and laurel oak (Q. laurifolia). Associated shrub and herbaceous vegetation are also supported along relatively undisturbed drainages. A more complete description of communities and species composition is included in the Area B RI/FS document [ESE, 1990]. Section 5.0 (Critical Habitat) of the RI/FS addressed ecological composition of Areas A and B and includes a list of vegetation, communities, and habitats [ESE, 1990].

Hardwood swamps occur throughout and have been affected by past logging practices. Some hardwood swamps are remnants of natural systems, but others have become established in areas where changes in the hydrology have occurred. These hydrologic changes are a result of either human-induced factors or beaver activity, which has created more hydric conditions favoring the establishment of wetland species. Natural hardwood swamps onsite support mature tree stands. Those more affected by logging activities are covered with younger trees. Hardwood swamps onsite are dominated by red maple, box-elder, pop ash, sugarberry, winged elm, sweetgum, parsley haw and red haw. Common shrubs include buttonbush and willow. A mature bottomland hardwood swamp is a prominent feature of Study Area 11. Within this site, surface water drains internally to the low-lying area that is the swamp. Standing water is present during the wet season.

Hardwood knolls also occur and are dominated by hardwood tree species and support fewer pine species. The degree of canopy cover is variable and in part determines the density and species composition of herbaceous and shrub stratum vegetation.

Old field communities exist in different degrees of succession. Study Area 30 is relatively natural in its reestablishment and represents a young community. This area was recently disturbed (1988) during mitigation activities. During investigation activities, the vegetation composition in this old field community was characterized to reflect background conditions for comparison with other similar systems that were known to be contaminated. Other areas that have also been recently disturbed reflect different species composition and diversity because of age (time since disturbance) and degree of management. This is apparent at Study Areas 31 (Disposal Area) and 13 (Small Arms Ballistics Range). Conditions at Study Area 31 reflect expanses of bare ground; or a result of recent disturbance or contaminated conditions, preventing revegetation; or both. Study Area 13 reflects a much less diverse system because of management disturbances. Here, much of the area is vegetated by Lespideza, which was planted for wildlife. This plant species dominates the area and excludes the occurrence of other species.

Several areas within Area A are being managed for production of local game species. Forage and cover vegetation has been planted in disturbed field communities and along roadsides in Area A. Species grown for wildlife use include two species of Lespideza, white and red clover, cowpeas, Austrian winter peas, oats, rye, wheat, sorghum, hairy vetch, bahia grass, browntop millet and sawtooth oak. Lespideza is the most commonly used species and is a tall growing herb that excludes most native species once established.

Shrub and thicket communities are found throughout the site. They have grown up along drainage features, forested edges, and the edges along permanent roadways and logging roads. These thickets are composed of shrub species, including smooth sumac (Rhus glabra), wax myrtle (Myrica cerifera), saplings of common tree species, vines including honeysuckle and briars (Smilax sp.), and blackberry.

2.0 Site History and Enforcement Activities

ALAAP was established on 13,233 acres of land near the junction of Talladega Creek and the Coosa River. The plant was built in 1941 and operated during World War II (WWII) as a government-owned/contractor-operated (GOCO) facility. ALAAP produced nitrocellulose (NC), single-based smokeless powder, and nitroaromatic explosives [i.e., trinitrotoluene (TNT), dinitrotoluene (DNT); and 2,4,6-trinitrophenylmethylnitramine (tetryl)]. Activities at ALAAP included in the manufacture of explosives were the production of the chemicals sulfuric acid H 2 SO 4), aniline, N,N-dimethylaniline, and diphenylamine. Spent acids were recycled and wastes resulting from these operations were disposed of. In August 1945, operations were terminated at ALAAP and the plant was converted to standby status.

The plant was maintained in various stages of standby status until the early 1970s. In 1973, the Army declared ALAAP excess to its needs. Since that time, several parcels of the original property, including Area A, were sold or returned to their previous owners. Area A, encompassing 2,714 acres, was auctioned by GSA in May 1990. Currently the property consists of wildlife habitat used occasionally for hunting and some logging. The property was sold with an unrestricted deed.

In 1978, the U.S. Army Environmental Center [formerly the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA)], managing the Army's Installation Restoration Program (IRP), conducted a record search which concluded that specific areas of the facility were potentially contaminated by explosives and lead compounds. Further studies at ALAAP confirmed soils contamination with explosives compounds, asbestos, and lead. Several investigations were conducted between 1981 and 1983 to define contamination further. In 1984, ALAAP was proposed for inclusion on the CERCLA (Superfund) National Priorities List (NPL).

An RI/FS under the Department of Defense (DOD) IRP was initiated in 1985 to determine the nature and extent of contamination at ALAAP and the alternatives available to clean up the site. For the purposes of the RI/FS, the facility was divided into two general areas. Area A consisted of the eastern portion of the facility, and Area B consisted of the western portion. The initial RI under the IRP confirmed the existence of explosives, asbestos, and lead contamination in the soil in Area A, and in the soil, sediment, and groundwater in Area B. The RI for Areas A and B was completed in 1986. As a result of the findings of the RI, cleanup activities at Area A were conducted in 1986 and 1987, which included building decontamination and demolition, soil excavation, and stockpiling. Initially, 21,400 cubic yards of contaminated soils were excavated from Area A and stockpiled in Area B in 2 covered buildings and on a concrete slab. In July 1987, ALAAP was placed on the NPL.

Area A includes the Magazine Area (Study Area 11), Old Burning Ground (Study Area 12), Small Arms Ballistic Range (Study Area 13), Cannon Range (Study Area 14), Old Well (Study Area 15), the eastern portion of the Propellant Shipping Area (Study Area 17) and a parcel of woodland outside the security fenceline. Additional areas identified during subsequent investigations conducted at the site include the Rubble Pile (Study Area 29), the New Trench Area (Study Area 30), the Disposal Area (Study Area 31), the Number 2 Rubble Pile (Study Area 32), the Henningsburg Area (Study Area 33) and the 229 Area (Study Area 34). An overall layout of Area A showing the locations of all study areas is presented in Figure 3. The study areas within Area A

and their descriptions are presented in Table 1.

In 1990, EPA indicated that additional investigations needed to be conducted at Area A to ensure that no residual contamination remained following the initial removal actions. Area A was conveyed to private buyers in August 1990, with the provision that additional investigations and any required cleanups would be performed by the Army.

In 1991, a supplemental RI was begun to verify the effectiveness of the completed removal actions in Area A. The supplemental RI initially determined that soils at two study areas within Area A (Study Areas 12 and 30) continued to contain lead and explosives at unacceptable concentrations. The supplemental RI/FS concluded that approximately 2,200 cubic yards of lead-contaminated soil from Study Area 12 and approximately 5 cubic yards of explosives-contaminated soil from Study Area 30 required further remediation.

A Record of Decision (ROD) for the Stockpile Soils Operable Unit (OU) was issued in December 1991 and recommended incineration as the preferred alternative. The incineration of the Stockpile Soils commenced in May 1994 and was completed in August 1994.

An interim ROD for the Area A Soil OU (Study Areas 12 and 30) was submitted in April 1994. During the latter half of 1994, Study Area 12 soils (2,179 cubic yards) were excavated, stabilized and placed on the on-site backfill area in Area B. Explosives contaminated soils from Study Area 30 (5 cubic yards) were excavated, incinerated and placed in the on-site backfill area in Area B.

Following completion of the interim response actions, samples of all media across the site were collected. This sampling provided a complete assessment of the status of the site following the completed remedial actions. This data was the basis for the Risk Assessment.

The following documents outline the results of the initial assessment of ALAAP, cleanup actions conducted in Area A, and the investigations of the Area A. More detailed information is available in documents for public review at the Earle A. Rainwater Memorial Library, Childersburg, Alabama.

1. Installation Assessment of Alabama Army Ammunition Plant, Report 130, May 1978.
2. Alabama Army Ammunition Plant, Area A Remedial Actions, Final Report, February 1988.
3. Stockpile Characterization Report for Alabama Army Ammunition Plant, Childersburg, Alabama, July 1991.
4. Feasibility Study for the Alabama Army Ammunition Plant Stockpile Area, October 1991.
5. Proposed Plan for Early Remedial Action of Stockpile Soils at Alabama Army Ammunition Plant Stockpile Soils Area OU, November 1991.
6. ROD for Early Remedial Action of Stockpile Soils at Alabama Army Ammunition Plant Stockpile Soils Area OU, December 1991.
7. Supplemental Remedial Investigation/Feasibility Study for Area A, Alabama Army Ammunition Plant, Final Baseline Risk Assessment, August 1995.
8. Supplemental Remedial Investigation/Feasibility Study for Area A, Alabama Army Ammunition Plant, Final Feasibility Study, February 1996.
9. Interim ROD for Soils within the Alabama Army Ammunition Plant Study Areas 12 and 30 of the Area A Soils OU.
10. Supplemental Remedial Investigation/Feasibility Study for Area A, Alabama Army Ammunition Plant, Final Remedial Investigation Report, May 1996.
11. Supplemental Remedial Investigation/Feasibility Study for Area A, Alabama Army Ammunition Plant, Remedial Investigation Report Addendum, Low-Flow

Purge/Sampling of Selected Wells, August 1996.

12. Final Proposed Plan for Remedial Action of Contaminated Soils at the Alabama Army Ammunition Plant Area A, August 1996.

3.0 Highlights of Community Participation

In accordance with the Army's Community Relations Plan (CRP) for ALAAP, October 1990, all decision documents were released to the public for review and comment. All documents were made available to the public at the Earle A. Rainwater Memorial Library, Childersburg, AL.

3.1 Completed Interim Actions

The FS and the Proposed Plan for the Areas 12 and 30 ROD were released to the public on March 31, 1993. The public comment period started on April 1, 1993, and ended on April 30, 1993. The notice of availability of the Proposed Plan was published in Daily Home, Birmingham News, Anniston Star, and Montgomery Advertiser on March 30, 1993.

In accordance with the CRP, a public meeting was held at Central Alabama Community College on April 20, 1993 to inform the public of the preferred alternative and to seek public comments. At this meeting, representatives from ALAAP, EPA, the Alabama Department of Environmental Management (ADEM), the U.S. Army Corps of Engineers (USACE), and U.S. Army Environmental Center (USAEC) were present and answered questions about the site and the remedial alternatives under consideration. ALAAP, EPA, ADEM, USACE, and the USAEC reviewed all written and verbal comments submitted during the public comment period. Review of these comments caused no significant changes to the preferred remedy outlined in the Proposed Plan. A response summary to the public comments received during the public comment period and hearing was included in the Responsiveness Summary section of the ROD for Areas 12 and 30.

The Proposed Plan identified Alternative ID as the preferred remedy. Alternative ID, which was described in the FS, consists of excavation of Area A contaminated soils, transportation to Area B, storage with stockpiled soils, on-site treatment (in Area B) along with the stockpiled soils, and on-site disposal of treated soils at a designated area in Area B.

3.2 Proposed Final Action

The FS and the Proposed Plan for the final ROD were released to the public on August 16, 1996. The public comment period started on August 16, 1996, and ended on September 15, 1996. Documents were made available to the public at the Earle A. Rainwater Memorial Library, Childersburg, AL. The notice of availability of the Proposed Plan was published in the Daily Home and the Birmingham News on August 15, 1996.

In accordance with the CRP, a public meeting was held at Central Alabama Community College on September 10, 1996 to inform the public of the preferred alternative and to seek public comments. At this meeting, representatives from ALAAP, EPA, the Alabama Department of Environmental Management (ADEM), the USACE, and USAEC were present and answered questions about the site and the remedial alternatives under consideration. A response summary to the public comments received during the public comment period and hearing is included in the Responsiveness Summary section of this report.

The Proposed Plan identified Alternative 13-6 as the preferred remedy for soils within Study Area 13 and Alternative 14-3 as the preferred alternative for contaminated soils within Study Area 14. Alternative 13-6, which is described in the FS, consists of excavation of contaminated soils and transportation to a hazardous waste landfill for incineration. Alternative 14-3, which is described in the FS, consists of excavation of all contaminated soils followed by solidifica-

tion/stabilization of soils prior to on-site disposal. These actions are a final action for all media within Area A. The Risk Assessment completed for the site, based on data collected after the completion of all interim response actions, determined that all remaining study areas qualified for No Further Action.

ALAAP, EPA, ADEM, USACE, and the USAEC reviewed all written and verbal comments submitted during the public comment period. Review of these comments caused no significant changes to the preferred remedy outlined in the Proposed Plan. All questions, either written or verbally presented in the public meeting have been addressed.

4.0 Scope and Role of the Area A Soil OU

OUs are defined as discrete actions that comprise incremental steps toward the final overall remedy. These actions may completely address a geographic portion of a site or a specific problem. OUs may also be interim actions; however, they must be followed by subsequent actions to address the scope of the problem definitely. This document addresses both completed interim actions and proposed final actions at the installation.

4.1 Completed Interim Actions

The Stockpile Soils Area OU, the first OU to address contaminated soils at ALAAP Area A, involved treatment of contaminated soils that were excavated. from Area A and stored in RMCSs in Area B. The initial removal actions that led to the soils stockpiling were performed based on findings of the RI/FS of ALAAP completed in 1986. Cleanup activities at Area A included building decontamination and demolition and contaminated soil excavation and stockpiling. A ROD for treatment [i.e., incineration followed by solidification/stabilization (if required)] of the Stockpile Soils Area OU soils was signed on December 31, 1991. In 1990, EPA indicated that additional investigations needed to be conducted at Area A to ensure that no residual contamination remained on site; therefore, a supplemental RI was conducted in 1991. An interim action covering soils of Study Areas 12 and 30 within Area A addressed the contaminated soils that were identified during the initial supplemental investigation.

The contaminated soils of the Stockpile Soils Area OU as well as soils from Study Areas 12 and 30 within have been remediated. Onsite incineration was the selected remedy in the ROD for the Stockpile Soils Area OU and for the soils removed from Area 30. The ash from the incinerator was tested for lead contamination and treated by solidification/stabilization (if required) prior to final disposal. Soils removed from Study Area 12 during the interim action have also been solidified.

4.2 Proposed Final Actions at Study Areas 13 and 14

The action proposed in this plan is a final action and is intended to address all remaining contaminated soils (Study Areas 13 and 14) within Area A. The threats addressed in this final remedial action are the contaminated soils located at Study Areas 13 and 14. Actual or threatened release of hazardous substances from these contaminated soils, if not addressed by implementing the selected early action, may present a current or potential threat to public health, welfare, and the environment. Following completion of these actions, there will be no remaining media within Area A requiring action. This action represents the final action to be completed at the site.

4.3 Proposed No Further Action

The sampling associated with the supplemental investigation provided a completed assessment of all media as it exists following the completion of all interim response actions. This data set

was the basis for the completed Risk Assessment for the site. The Risk Assessment has determined that all remaining Study Areas, with the exception of those presented in Section 4.2 (Study Areas 13 and 14), qualify for No Further Action.

5.0 Summary of Site Characteristics

Remedial investigations at the site have been completed in several phases. Early investigations focused on determining the horizontal and vertical extent of contamination within the soils and groundwater. These initial investigations were the basis for the interim response actions completed at the site. Following completion of an interim action, samples were once again collected from the affected study areas to verify that the actions completed were effective. This verification sampling led to the interim action completed at Study Areas 12 and 30 where additional contamination was detected. Following the completion of this (Areas 12 and 30) interim action, samples were once again collected from across the entire installation to determine if any final actions were required prior to site closure. As a part of this effort, samples from all site media were collected. Table 2 presents a summary of the average detected background concentrations of inorganics compared to the average detected concentrations detected at each Study Area. These supplemental data were the basis for completing the final Baseline Risk Assessment (BRA) for the site. The final BRA was prepared to assess the impact(s) of the contaminants at each site on human and environmental concerns and to determine appropriate remediation levels. The BRA identified Area 13 and 14 as requiring additional remedial actions. These are the only areas identified as still having contamination present in the soils exceeding health based cleanup levels. A summary of chemicals of potential concern (COPCs) detected at each area is presented in Table 3.

The following discussion summarizes the site characteristics for each study area and includes a description of the fate and transport of site contaminants. This summary is based on the supplemental data collected following the initial removal actions across all of Area A and the interim actions completed in Areas 12 and 30. These data are post removal and reflect the effectiveness of interim response actions completed to date.

5.1 Magazine Area (Study Area 11)

The Magazine Area, located in the north central portion of Area A and consisting of a series of storage buildings, is the largest study area in ALAAP Area A. The Series 260 Buildings are designated for storing DNT, the Series 1010 Buildings for storing tetryl, and the Series 811 Buildings for storing TNT.

Soils, groundwater, surface water and sediments were analyzed. Metals concentrations were detected in all media, and polycyclic aromatic hydrocarbons (PAHs) were also present in the soil. Minor concentrations of volatile contaminants (trichloroflouormethane) were detected in soil and sediment samples. The primary migration pathways of contaminants detected in soil are fugitive dust or particulate emission, contact, and ingestion. In addition, due to the proximity of a hardwood swamp near Study Area 11, the potential exists for chemicals in soil to migrate to the swamp via surface runoff during periods of heavy rainfall.

5.2 Old Burning Ground (Study Area 12)

This study area is located in the northern section of Area A and was the primary disposal site for unacceptable batches of explosives, propellants, and other reactive wastes. Periodic burning of the study area's vegetation was practiced during plant operation to minimize the danger of wildfires. This study area also included a former Lead Remelt Facility. Surface water flow in this area is intermittent and occurs only during heavy rain events. Two interim response actions have been completed at this site to address explosives and lead contamination.

Supplemental sampling has been completed in this area to verify the effectiveness of the completed remedial actions. Organic and metallic chemicals were detected at this study area during the supplemental sampling. The primary migration pathways of munitions and metals detected in soil are fugitive dust or particulate emission, contact and ingestion. In addition, the potential exists for chemicals in soil to migrate via surface runoff during periods of heavy rainfall. The potential for contaminants to reach groundwater from this area is high due to the creation of a pond following recent remedial actions, however, contaminant concentrations in the soil are low, minimizing the actual threat.

5.3 Small Arms Ballistics Range (Study Area 13)

This study area is approximately 3.7 acres, located centrally at the northern boundary of Area A. This area was covered by gravel during the operational period and was used as a test range for small arms ballistics. A ballistics laboratory for powder blending and bullet loading was adjacent to this area during the operational period. Lead-contaminated soils and timbers were removed in an interim action (1986 to 1987). Currently, no buildings exist on this site.

Groundwater and soil samples have been collected from this area to verify the effectiveness of the completed remedial actions. The supplemental sampling results indicated the presence of metals in the groundwater and metals and PAHs in the soil. The primary migration pathways of PAHs and metals detected in soil are fugitive dust or particulate emission as well as contact and ingestion. In addition, the potential exists for chemicals in soil to migrate via surface runoff during periods of heavy rainfall. The amount of PAH contamination reaching groundwater from this area is expected to be low because of the low concentrations detected in the soils and the immobile nature of the compounds.

5.4 Cannon Range (Study Area 14)

This study area, used for cannon test firing, is approximately 13 acres located at the northeast corner of the northern boundary of Area A. Since operations ceased at ALAAP, all buildings have been removed and the remaining area has not been maintained.

Soil samples were collected from this area during the supplemental investigation. Metals, phthalates and a single munitions hit were detected at this study area. The primary migration pathways of contaminants detected in soil are fugitive dust or particulate emission, contact, and ingestion.

5.5 Old Well (Study Area 15)

The Old Well was a relict hand-dug well, located in the northeast portion of Area A, which served a farm or residence prior to construction of ALAAP and was reportedly approximately 30 ft deep and 5 ft in diameter. During the razing of the laboratory building that supported the explosives manufacturing operations, laboratory reagents, non-sparking paints, 55-gallon (gal) drums of a tar-like material, fire retardant paint, containers of other unidentifiable materials, and old tires were reportedly disposed of in this well.

Soil and groundwater samples were collected from this study area. Soil and groundwater samples contained metals and the phthalates. The well and surrounding soils were removed during an interim removal action in 1986 to 1987. No follow-up sampling was required during the supplemental investigation due to the complete removal of the structure and surrounding soils.

5.6 Propellant Shipping Area (Study Area 17)

The propellant shipping houses are located in the south-central portion of ALAAP. The shipping house area (Series 229 Buildings) used to store propellant prior to shipment and consisted of 48 buildings, 13 of which are located on the land previously sold to Kimberly Clark. The remaining 35 buildings, located within the current ALAAP boundary, comprise Study Area 17 and are split between Area A and Area B.

The shipping houses (except for the foundations) and contaminated soil were removed during a removal action completed in 1986 to, 1987. Supplemental sampling was completed in this area to verify the effectiveness of the completed remedial action. Metals and a single nitroaromatic hit were detected in this study area. The primary release mechanism for lead at this site would be through release to the atmosphere as particulate or dust emissions, contact, and ingestion.

5.7 New Trench Area (Study Area 30)

During remedial activities conducted by Roy F. Weston, Inc. (Weston) in 1986 to 1987, Study Area 30 was identified. This area is approximately 2.9 acres located north of Study Area 11. Area 30 was used for disposing of equipment and other general wastes. Contaminated soil was removed at the time of discovery.

Nitroaromatic compounds were detected in 3 of the 34 soil samples collected during the Supplemental Investigation. All three samples, which were collected from the 0- to 3-ft depth, contained 246-TNT, with one sample containing a high concentration [13,900 parts per million (ppm)] of this compound. Although the concentration of 246-TNT in the second sample was an order of magnitude lower (1,400 ppm), the results suggested the presence of an area of high nitroaromatic contamination. Of the three samples that contained 246-TNT, two also contained 135-TNB. The presence of these contaminants is due to past disposal practices in the area. This area was the subject of an interim removal action to address the nitroaromatics. Supplemental sampling was completed following the removal action to verify that the actions completed were effective.

Metals were detected in the soils following the removal action. The primary migration pathways of the organics and metals detected in soil are fugitive dust or particulate emission, contact, and ingestion. In addition, the potential exists for chemicals in soil to migrate via surface runoff during periods of heavy rainfall. The important fate and transport processes of the metals in the terrestrial environment are adsorption/desorption, precipitation/dissolution, and speciation. The rate and extent of these processes are influenced by pH, ionic strength, inorganic and organic ligands, and redox conditions,

5.8 Disposal Area (Study Area 31)

During removal activities conducted by Weston in 1986 to 1987, Study Area 31 was identified. This area comprises less than 1 acre and is located north of Study Area 11 and east of Study Areas 30 and 12. Study Area 31 was used for disposing of equipment and other general wastes. Remediation of the area was completed following discovery. Supplemental sampling was completed to verify the effectiveness of the remedial actions.

No nitroaromatic contamination was detected in any of the soil samples collected as part of the supplemental investigation. Only metals were detected at this study area. The important fate and transport processes of the metals in the terrestrial environment are adsorption/ desorption, precipitation/dissolution, and speciation. The rate and extent of these processes are influenced by pH, ionic strength, inorganic and organic ligands, and redox conditions.

5.9 Rubble Pile (Study Area 29) and Number 2 Rubble Pile (Study Area 32)

During removal activities conducted by Weston in 1986 to 1987, Study Areas 29 and 32 were identified. These tracts were suspected to have been localized areas used for the disposal of equipment and other general wastes. Study Area 29 is located near the Area A northwest boundary, and Study Area 32 is directly across the road. Contaminated soil was removed from both areas following discovery. Supplemental sampling was completed to verify the effectiveness of the removal actions.

Soil and groundwater samples were collected from this study area. Metals were detected in the soil and groundwater and a single nitroaromatic hit was detected in a groundwater sample. This compound was not detected during a follow-up sampling.

5.10 Henningsburg Area (Area 33)

During removal activities conducted by Weston in 1986 to 1987, Study Areas 33 was identified. This area was suspected to have been a localized area used for the disposal of equipment and other general wastes. Contaminated soil was removed shortly after discovery. Study Area 33 is located centrally near the Area A east boundary.

Supplemental sampling was completed to verify the effectiveness of the removal actions. Metals and minor concentrations of volatile compounds were detected.

5.11 229 Area (Study Area 34)

During removal activities conducted by Weston in 1986 to 1987, Study Area 34 was identified. This area was used for disposing of equipment and other general wastes and is located directly south of Study Area 17. Contaminated soil was removed following discovery. Supplemental sampling was completed to verify the effectiveness of the removal action.

Soil and groundwater samples were collected from this area during the supplemental investigation. Metals were detected in both media. The primary release mechanism for the metals at this site would be through the atmosphere as particulate or dust emissions, contact, and ingestion.

6.0 Summary of Site Risks

6.1 Introduction

In 1991 through 1995, a supplemental RI was conducted at the request of EPA Region IV to verify the effectiveness of the completed interim response actions in Area A. A baseline risk assessment (RA) was conducted as part of the RI to determine if chemicals detected in unposed soil and groundwater pose a significant risk to human health and the environment. The supplemental RI and baseline RA determined that soils at two study areas within Area A (Study Areas 13 and 14) continue to contain lead and explosives at unacceptable concentration and, therefore, require further remediation.

All media in all Study Areas were sampled after interim response actions were completed. These data were used to develop the RA for the site. Risks due to site contamination were estimated for current and future risks to verify that the remedial actions completed to date were effective. Feasibility efforts were focused on the remaining site contamination that was not addressed by the earlier remediation efforts. Identified areas with excessive contamination were Study Areas 13 and 14. Risks identified are presented in the summary section (Section 6.2). The methods implemented to estimate the risks are in accordance with the risk assessment guidance for CERCLA sites and are summarized in Sections 6.3 through 6.7. The reader is urged to review the complete RA for a detailed understanding of the remedial assessment process as it applies to

this site.

6.2 Health Risks

The methods used in assessing the risks associated with reasonable maximum exposure (RME) to the site contaminants are those presented in EPA's Risk Assessment Guidance for Superfund (RAGS), Human Health Evaluation Manual (1989a); RAGS Supplemental Guidance, Standard Default Exposure Factors (1991); and other EPA guidance. According to RAGS, actions at Superfund sites should be based on an estimate of the RME expected to occur under both current and future land-use conditions. The RME is defined in RAGS as "the highest exposure that is reasonably expected to occur at a site." The intent of the RME is to estimate a conservative exposure case (i.e., well above the average case) (EPA, 1989a).

Based on RAGS, RME human health risks were determined for each exposure pathway at each study area and receptor location (Sec. 6.2.5) based on RME concentrations and factors [Sec. 3.0 and App. C of the RA (ESE, 1995)]. Because of the uncertainty associated with any estimate of exposure concentration, the upper confidence limit [i.e., the 95 percent upper confidence limit (MCL 95)] on the mean is the preferred exposure concentration to use in determining potential health risks. However, according to RAGS, if there is great variability in measured or modeled concentration values, the MCL 95 may be high, and could exceed the maximum detected value. In this case, the maximum detected or modeled concentration was used as the exposure concentration. Exposure factor values (i.e., contact rate, body weight, averaging time, exposure duration) used in calculating chemical intakes were the 95th percentile values when available; otherwise, the 90th percentile was used. A majority of the exposure factors were provided in RAGs while several were site-specific factors obtained from site information (e.g., climactic conditions conducive to dermal exposure).

The health risks were evaluated separately for carcinogenic and noncarcinogenic effects, with potential carcinogens evaluated for their carcinogenic and noncarcinogenic effects, where a specific carcinogen has published noncarcinogen criteria.

Risk estimates relevant to aquifer uses are presented for hypothetical future unposed exposure pathways. Worker exposure to contaminated groundwater exceeding MCLs was not evaluated under the current use exposure scenario since these individuals are not currently using groundwater. Risk estimates relevant to direct contact and incidental ingestion of surface soil and dust are presented for both current and hypothetical future onsite exposure scenarios. Current unposed risks are evaluated based on a worker and recreational hunter exposure scenario, while the future unposed risks are evaluated based on a hypothetical future residential exposure scenario. The RA was conducted in five sequential steps, each of which are summarized below.

Ecological risks, risks to aquatic and terrestrial wildlife, were also evaluated. Ecological risks were assessed for aquatic receptors (e.g., fish and invertebrates) and terrestrial receptors (e.g., plants and animals).

6.2.1 Media of Concern

The risk assessment process outlined in the RA (ESE, 1996) involves a consideration of chemicals of potential concern (COPCs) for each medium (e.g., soil, groundwater, surface water, and sediment) and routes of current and future exposure for human and nonhuman populations.

6.2.2 COPCs

During the initial steps of the RA, COPCs for human and nonhuman receptors were developed based on the information contained in the Supplemental RI (ESE, 1996). COPCs are those chemicals

detected at the site that may pose health concerns to human health and/or environment, and are included for further quantitative risk evaluation. COPCs were selected based on a detailed evaluation of the analytical and historical data according to procedures outlined in EPA's risk assessment guidance (EPA, 1989a) which selects COPCs based on potential toxicity to humans and wildlife and discounts chemicals that are associated with the natural concentrations of metals and inorganics present in site-specific background soil. The data considered in the RA were taken from several ESE sampling events (1979 to 1995) to include supplemental sampling that occurred as part of the interim response actions at areas where removal actions occurred. COPCs were developed and evaluated separately for all environmental media. The final list of COPCs for the ALAAP RA include the following:

Volatile Organic Compounds (VOCs)

Acetone	Bromomethane	Chloroform
Methyl butyl ketone	Methyl isobutyl ketone	Methylene Chloride
1,1,2,2,-Tetrachloroethane	Trichloroethene	Trichlorofluoromethane

Semivolatile Organic Compounds (SVOCs)

Miscellaneous

Bis(2-ethylhexyl)phthalate	Carbazole	Dibenzofuran
Di-n-butyl phthalate	Diethyl phthalate	1,2,4-Trichlorobenzene

Polycyclic Aromatic Hydrocarbons (PAHs)

Acenaphthene	Acenaphthylene	Anthracene
Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
Benzo(k)fluoranthene	Chrysene	Fluoranthene
Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene	Naphthalene
Fluorene	Pyrene	Phenanthrene
Benzo(b)naphtho (1,2-D)thiophene		

Munitions/Nitroaromatic Chemicals

1,3-Dinitrobenzene	2,4-Dinitrotoluene	2,6-Dinitrotoluene
N-Nitrosodiphenylamine	1,3,5-Trinitrobenzene	2,4,6-Trinitrotoluene

Inorganic Chemicals

Aluminum	Arsenic	Barium
Beryllium	Cadmium	Chromium
Cobalt	Copper	Iron
Lead	Manganese	Mercury
Nickel	Vanadium	Thallium

Table 2 provides a summary of COPCs detected in each medium at each study area at the site.

6.2.3 Exposure Assessment

Exposure is defined as the contact of an organism with a chemical or a physical agent. The exposure assessment is the determination or estimation of the magnitude, frequency, duration, and route of exposure. An exposure assessment provides a systematic analysis of the potential mechanism by which a receptor may be exposed to chemical or physical agents at or originating from a site. The objectives of an exposure assessment are to:

- Define exposure pathways;
- Identify potentially exposed population(s); and
- Measure or estimate the magnitude, duration, and frequency of exposure for each

receptor (or receptor group).

Factors influencing contaminant migration are also considered during an exposure pathway assessment.

6.2.3.1 Potentially Exposed Human Populations

Currently, operations at the site are completely inactive, no military activity is ongoing. Under future projected land use conditions, the current owner (Woodlander, Inc.) plans to use the site for hunting purposes. The types of activities expected include wildlife management for future hunting purposes by planting grass for deer and building bird feeding areas. These activities will be carried out by a wildlife biologist employed by the current owner. No residential communities exist nor are planned at the boundary or downgradient of Area A.

The 1986 RI report (ESE, 1986) contains information regarding the residential areas, municipal water service, and water sources near [within 1.6 to 3.2 kilometers (km)] ALAAP. County tax records indicate that the density of residences is low near ALAAP. A total of 140 residences or structures was identified within an area of approximately 47 square kilometers (km) adjacent to ALAAP boundaries. Housing density ranged from 0 to 57 residences per section (2.6 km 2). Most residences were concentrated in the communities of Kymulga, southeast of ALAAP, and Laniers, north of the site.

6.2.3.2 Current Land Use

Portions of ALAAP are developed to be released as excess property, which requires certification that the released property is free of contamination and may be released for unrestricted land use. Parcels of the site have already been approved for property transaction, upon confirmation of the absence of contamination. Area A is one such parcel having been auctioned to private owners. No restrictions were placed on the deed and the Army retains responsibility for all cleanup operations resulting from past Army use of the property.

The future land use, as currently stated by the landowner (Woodlander, Inc.), will be primarily recreational hunting. However, the remedial project manager (RPM) indicated that, at one time, a chemical manufacturing firm had negotiated to rent Study Area 11 for special chemical storage purposes. A similar future use is possible for this study area. Chemical exposure under this type of use will be primarily to the worker. No plans exist for the site to be used for residential purposes in the near future. However, due to the unrestricted land use designation on the property, a conservative approach to risk estimation is taken by considering future residential exposure to children and adults.

6.2.3.3 Human Subpopulations of Potential Concern

Currently, no identifiable human population of potential concern exists at Area A. Under the future land use conditions, the property and wildlife maintenance workers and hunters visiting the area are the potential receptors of concern. No residential receptors are currently in the area, nor are they likely in the foreseeable future. However, since unrestricted land use is permitted, a projected residential exposure is considered in the RA to represent a worst-case exposure and impact scenario. Currently, no sensitive human subpopulation lives within the area, but risks to a child in a residential exposure scenario are evaluated to cover worst-case conditions. The human exposure pathways used in the RA follow methods outlined by EPA (1989a).

6.2.3.4 Potentially Exposed Wildlife

Because of the degree and type of management within Area A, the availability of well-developed,

distinct communities is low. Therefore, many of the resources across the site are fairly uniform and do not represent distinct habitat types that support unique wildlife populations. Much of the region surrounding ALAAP is managed for forest resources at a level exceeding the management observed at ALAAP. Practices such as controlled burning to reduce understory and groundcover vegetation have been absent in recent decades at ALAAP. This has allowed the growth of dense thickets of briars, blackberry, honeysuckle, and other herbaceous vegetation favoring wildlife species such as gray catbird (Dumetella carolinensis), northern mockingbird (Mimus polyglottos), Carolina wren (Thryothorus ludovicianus), and rufous-sided towhee (Pipilo erythropthalmus).

Although much of Area A is uniform in wildlife resources, significant differences are apparent when comparing the wooded and logged areas with areas that have received recent remedial activity. The wooded and logged areas continue to support vegetation associated with pine and mixed pine hardwood communities. The areas that have been remediated, however, represent earlier successional systems ranging from bare soil to old field vegetation with no canopy cover, little shrub cover, and sparse to moderate herbaceous cover.

Most of the avian species observed across the site are permanent residents. However, others like the acadian flycatcher (Empidonax virescens), blue-gray gnatcatcher (Polioptila caerulea), chimney swift (Chaetura pelagica), eastern kingbird (Tyrannus), summer tanager (Piranga rubra), and swallow are summer breeding species that had not yet migrated south during the late September bird survey. Several more breeding birds can be expected to use site resources during the spring and summer seasons.

The only wintering nonresident birds observed were the northern harrier (Circus cyaneus) and house wren (Troglodytes). Several more winter residents can be expected to be present for portions of the fall and winter. The oak-dominated swamp in Study Area 11 is known to support several wood ducks (Aix sponsa) during late fall and early winter.

Although some standing water is intermittently present at some study areas in Area A, no significant permanent aquatic resources are supported within known areas of contamination. Although the hardwood swamp within Study Area 11 represents a sensitive habitat, the swamp is removed from the igloo area where localized soil contamination was observed in the 1980 samples. Surface water runoff may carry small quantities of contaminants toward the swamp, but the watershed is large relative to the known areas of contamination. Therefore, concentrations of contaminants would be expected to be low in the wetland.

6.2.3.5 Representative Wildlife Receptors

Due to the number and diversity of nonhuman receptors at a site, it is not feasible to evaluate each species present. EPA guidance indicates that biological receptors (ecosystem components expected to reflect adverse effects of pollutant stress) and endpoints (type of actual or potential impact due to contaminant exposure by a receptor) be selected to represent indicators of any potential adverse effects to all ecosystem components (EPA, 1988). Initial screening was done to identify receptors present at the site. EPA guidance also indicates that consideration be given to rare, threatened, and endangered species, and to species of commercial or sport value (EPA, 1989a). Sensitive populations or subpopulations that could be more adversely affected by the contaminants of concern, such as juveniles and species with predicted higher-than-average exposure rates, should also be considered.

A survey was completed as part of the RI process (ESE, 1990) to determine if threatened or endangered species were present onsite. Particular emphasis was placed on assessing red-cockaded woodpecker resources. It was determined at that time that red-cockaded woodpeckers do not reside at the ALAAP property nor are they likely to forage there. The only other listed wildlife species likely to occur at the site is the bald eagle, which might overwinter along the river,

but is not likely to forage in Area A. Inventories were conducted during the spring flowering period to determine if federally listed plant species occurred onsite (ESE, 1990). None of the listed species was located and little habitat that could support these species was identified onsite. As a result of these survey efforts, it has been assumed for the purposes of the RA that threatened or endangered species do not occur onsite and do not require further evaluation.

Species were selected as indicator organisms at the different study areas based on the results of field investigations and the likelihood of each species being distributed in the habitat at each study area. Indicator organisms selected for each study area include:

Study Area 11	Peromyscus mice, Raccoon, Whitetail Deer, Blackberry, Daphnia, Scenedesmus, Chironomis
Study Area 12	Peromyscus mice, Bobwhite, Whitetail Deer, Blackberry
Study Area 13	Whitetail Deer, Slender Bush Clover, Daphnia, Scenedesmus, Chironomis
Study Area 14	Whitetail Deer, Slender Bush Clover
Study Area 17	Whitetail Deer, Blackberry
Study Area 29	Whitetail Deer, Blackberry
Study Area 30	Peromyscus mice, Bobwhite, Whitetail Deer, Blackberry
Study Area 31	Peromyscus mice, Whitetail Deer, Blackberry
Study Area 32	Whitetail Deer, Slender Bush Clover
Study Area 33	Peromyscus mice, Raccoon, Whitetail Deer, Blackberry
Study Area 34	Whitetail Deer, Blackberry

6.2.3.6 Identification of Exposure Pathways

An exposure pathway describes the course a chemical or physical agent takes from the source to the exposed receptor. An exposure pathway analysis links the sources, locations, and types of releases with population locations and physical activity patterns to determine the significant human and nonhuman exposure pathways.

For an exposure pathway to be complete, the following four components are essential:

- A source or a release from a source,
- A probable environmental migration pathway (e.g., leaching, volatilization, or partitioning from one medium to another) of a site-related chemical or physical agent,
- An exposure point where receptors may come in contact with a site-related chemical or physical agents, and
- A route by which potential receptors may be exposed to a site-related chemical or physical agent (i.e., inhalation, direct dermal contact, or incidental ingestion).

If any of the four components are missing, the exposure pathway is incomplete and does not suggest exposure from the site.

As required by EPA Superfund guidance, the exposure pathways for Area A were analyzed based on current and future unrestricted use of the site.

6.2.3.7 Identification of Potential Human Exposure Pathways by Study Area

Exposure scenarios at each study area were identified based on the type of activities carried out in the area. Each area was evaluated separately to identify the potential exposure and the areas of contamination needing remediation. Significant complete exposure pathways were selected based on the type of contamination onsite and the environmental medium contaminated, as well as the activities of the hypothetical human population at the site.

The human exposure scenarios evaluated in the RA include

Current Hunter	Ingestion, dermal, and inhalation exposure to surface soil.
Current Residential	Ingestion of venison from deer harvested unposed.
Future Residential	Ingestion, dermal, and inhalation (dust and vapors) exposure to surface soil, groundwater, surface water, and sediment.
Future Worker	Ingestion, dermal, and inhalation exposure to surface soil and groundwater.

6.2.3.8 Identification of Potential Ecological Exposure Pathways

Animals may be present in or on the soil and, depending on their physiological capabilities and behavior, may migrate or burrow between various contaminated soil, layers. They may also migrate between various contaminated areas. In Area A, limited contact with surface water may provide an exposure pathway to terrestrial organisms. Terrestrial animals would likely be exposed on an intermittent basis due to the limited extent of the water and its ephemeral nature. Exposure to soil can occur through ingestion, dermal contact, inhalation of dust, and ingestion of food living/growing in soil. Terrestrial plants can be exposed to contaminants in soil via root exposure or deposition of contaminated dust onto leaves.

Aquatic species inhabiting surface water would be exposed via uptake across cellular membranes (algae) and digestive and/or gill surfaces (invertebrates).

Sediments, particularly fine-grained sediments in depositional environments, often act as a sink for contaminants. These bottom sediments may provide an exposure pathway to terrestrial animals in Area A, especially since these are generally exposed (e.g., not covered by water). Benthic-dwelling organisms would have constant exposure. Potential exposure pathways via bottom sediments may include ingestion/dermal intake of contaminated sediments or consumption of contaminated prey or food items.

6.2.3.9 Quantification of Exposure

Quantifying the magnitude of exposure and assessing the frequency and duration of exposure to the population involves two stages: exposure point concentration estimation and pathway-specific intake estimation.

Exposure point concentrations are the contaminant concentrations that a receptor may come in contact with at a site. The monitoring data for Area A were collected over a period of time and illustrate the potential environmental migration and degradation of the chemicals. The site was operational during the 1940s, and essentially no manufacturing-related activity has occurred since 1945. Most of the sampling was done in 1989, 1991, 1994, and 1995, and the exposure concentrations were calculated using the site monitoring data. Exposure point concentrations were calculated following the statistical methods described in the Baseline Risk Assessment (ESE, 1995).

Pathway-specific intake is an estimation of how much chemical enters a receptors body and is a function of exposure frequency, duration and receptor-specific factors such as inhalation rates, body weight, skin surface area, etc. The exposure factors used in calculating intakes are presented in Appendix C and Section 3.0 of the RA.

6.2.4 Toxicity Assessment

The objective of the toxicity assessment is to characterize the nature of the health effects to human and wildlife receptors associated with the COPCs identified at ALAAP. The characterization includes a qualitative evaluation of the available pharmacokinetic and health effects data and a quantitative evaluation of the available dose-response information to provide values for estimating acceptable intake levels and quantifying risks.

6.2.4.1 Human Toxicity Assessment

Cancer slope factors (CSFs) have been developed by EPA's Carcinogenic Assessment Group for estimating lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CSFs, which are expressed in units of milligrams per kilogram per day (mg/kg-day) -1, are multiplied by the estimated intake of a potential carcinogen, in 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 CSF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. CSFs 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.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are 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 effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Tables 3 and 4 provide a summary of the available noncarcinogenic and carcinogenic chronic dose-response information for both the oral and inhalation exposure routes for each chemical of concern (COC). When insufficient data are available to determine dose-response values for human risk characterization, health-based values are developed using the available regulatory references and resources for human health dose-response values.

6.2.4.2 Chemicals Having No EPA Human Toxicity Values

Noncarcinogenic effects were evaluated for all of the COPCs identified at Area A, including potentially carcinogenic chemicals. EPA has developed toxicity values for most, but not all, of the compounds identified at Area A.

An RfD has not been developed for any of the potentially carcinogenic PAHs. For comparative purposes, the oral RfD for the PAH pyrene (0.03 mg/kg/day) was used to evaluate potential noncarcinogenic hazards associated with exposure to the carcinogenic PAHs detected at the site. This surrogate approach is outlined in EPA Region IV guidance (EPA, 1995).

With respect to the inorganic COPCs, no RfDs, are available for metallic thallium. The oral RfD for thallium chloride (the most toxic thallium salt) is used to evaluate this metal. Also, no RfDs are available for the heavy metal lead. Due to the high toxicity of lead in children, EPA recommends using the Integrated Exposure Uptake Biokinetic (IEUBK) Model (EPA, 1994b) on a site-by-site basis to evaluate blood-lead (PbB) levels instead of the RfD approach. In addition, a soil screening level of 400 mg/kg (EPA, 1994a) is available to evaluate soil lead and an

action level of 15 Ig/L is available to screen lead in groundwater (EPA, 1994b).

The macro- and micro-nutrients calcium, magnesium, potassium, sodium, zinc, and iron were regularly selected as COPCs at many of the study areas because their soil concentrations exceeded background soil concentrations and no RfDs or CSFs were available to evaluate them further in the screening process. These inorganics are required for normal cellular function in mammals and for skeletal integrity. To determine if soil concentrations of calcium; magnesium, sodium, iron, zinc, and potassium present at the site are sufficient to provide required quantities of these chemicals, daily intakes (from soil ingestion) were compared to the U.S. Department of Agriculture's (USDA's) recommended daily allowance (RDA). The ratio of daily intake to the RDA is less than 10 for adults and children at each study area where calcium, magnesium, sodium, zinc, or potassium were identified as COPCs. This means that soil ingestion alone will not supply these people with enough calcium, magnesium, or potassium to meet their daily requirements. It can be assumed from this analysis that the concentrations of these macronutrients in the soils are at insufficient levels to be toxic to humans. Therefore, they were not considered further in the BRA. Iron did exceed 10 times the nutritionally essential levels at some study areas, and was therefore retained for further analysis.

Of the inorganic COPCs at Area A, lead is currently classified as a Group B2 suspect human carcinogen. However, no CSF values are available for this metal, and the potential carcinogenicity associated with exposure to this metal cannot be evaluated. Only the potential noncarcinogenic hazards associated with exposure to lead were evaluated.

6.2.4.3 Evaluating Toxicity to Ecological Receptors

Risks to ecological receptors are quantitatively evaluated by comparing the chemical intake (for terrestrial receptors) or exposure concentration (for aquatic receptors) to a toxicity reference value (TRV) for that chemical in the specific receptor. TRVs ecotoxicity data for terrestrial and aquatic organisms are discussed in the toxicity profiles for the major COPCs in Appendix E of the RA (ESE, 1995). Ecotoxicity benchmark values were chosen from the scientific literature for each COPC for comparison with estimated site exposures. Selected benchmarks for the COPCs at Area A were obtained from the available literature and were chosen based on the following considerations:

- Including acute and chronic effects,
- Choosing results of tests using organisms as closely related taxonomically to representative receptors as possible,
- Choosing tests with ecologically relevant endpoints, and
- Choosing tests conducted with an ecologically relevant exposure pathway.

The preferred value that was sought was a chronic no-observed-adverse-effect level (NOAEL). This NOAEL value was then adjusted for extrapolation of toxicity data between species. When no NOAEL value was available for a chemical in the literature, other values such as lethal doses for 50 percent of an exposed group (LD 50 S) were used to derive a TRV. The toxicity data were adjusted to account for extrapolation uncertainties according to guidance provided by the U.S. Army (USAERDEC, 1994). The TRVs used in the RA of wildlife are presented in the RA (Tables 4.4-1 through 4.4-5).

TRVs are derived from raw ecological benchmarks using the following equation:

<IMG 97021B>

6.2.5 Risk Characterization

The objective of the risk characterization is to assess current and future risks to human health and the environment from site contamination by integrating the information derived in the exposure and toxicity assessments (Sections 3.0 and 4.0). The methods used for risk calculations are those outlined by EPA regionwide, EPA Region IV guidance, and other relevant guidance [Oak Ridge National Laboratory (ORNL), 1986] pertaining to human and ecological risk characterization.

6.2.5.1 Site-Specific Human Risk Characterization

The carcinogenic risks and HIs were calculated for all Study Areas. Because the activities performed at each of the study areas differ and the areas are not in close proximity to each other, the risks were presented separately for each area. Characterizing each study area separately allows for prioritization of remedial activities that may be required.

The potential site risks were compared to EPA's risk range of 1 in 1,000,000 to 1 in 10,000 (10 -6 to 10 -4), this range is generally considered to be represent as the acceptable health risk range [40 Code of Federal Regulations (CFR) 300, 430:62]. EPA uses the 10 -6 to 10 -4 risk range as a "target range" within which EPA strives to manage risk as part of Superfund cleanup. Therefore, the risk results for this study are summarized to highlight those individual chemicals and media that exceed the lower bound of the risk range, 10 -6 . The 10 -6 risk level serves as a starting point, or point-of-departure to provide focus on those chemicals that may require further evaluation as part of subsequent studies (i.e., feasibility studies) if the cumulative site risk exceeds 10 -4. When a cumulative carcinogenic risk to an individual under the assumed exposure conditions at the site exceeds 1 in 10,000 (10 -4), CERCLA generally requires remedial action at the site (EPA, 1991).

If the cumulative risk is less than 10 -4, action generally is not required but may be warranted if a risk-based chemical-specific standard [e.g., maximum contaminant level (MCL)] is violated, a HI exceeds 1, ecological impacts are posed, or a risk manager indicates that a lower risk level must be achieved due to site-specific reasons.

Table 5 presents a summary of the human exposure pathways and chemicals that contribute to a total risk of 1 x 10 -6, and an HI > 1. As noted, none of the current exposure pathways exceeded carcinogenic or noncarcinogenic target risk levels. The chemical specific HI and risk results for all COPCs and all exposure scenarios are presented in App. G of the RA (ESE, 1995).

Only two study areas, Study Areas 13 an 14, presented unacceptable human health risks which are to be addressed in the recommended remedial actions. A description of the risk associated with these sites is presented in the following paragraphs.

Study Area 13

Hunter and Current Resident - The cumulative HIs for the adult hunter exposed to site soils and the current resident exposed to affected venison caught by the hunter are below the target HI of 1, indicating that this area does not pose adverse human health effects to a hunter or current resident based on the exposure information evaluated.

The cumulative risks for the hunter and current resident exposure scenarios, 7E-06 and 6E-07, respectively, are within or below EPA's acceptable risk range based on the exposure information evaluated.

Future Resident and Worker-Future adult and child residents have a potential for adverse health effects predominantly as a result of exposure to manganese in groundwater [approximately 83 percent contribution to the hazard index (HI)] (Apps. D and G). The cumulative HIs for a future

residential and adult are 66 and 120, respectively, and the future worker HI is 24. Lesser contributors to the HI include cadmium, aluminum, chromium, barium, and vanadium for adult and child residents and nickel and cobalt for child residents. Future workers have a potential for adverse health effects largely (around 83 percent of HI) as a result of exposure to manganese in groundwater. Other chemicals that contributed to the HI to a smaller extent are cadmium, aluminum, and chromium. The exposure concentration for lead in the groundwater at Study Area 13 is 748 Ig/L, which exceeds EPA's action level of 15 Ig/L.

The cumulative risk for the future residential exposure scenario of 2E-04 exceeds EPA's upperbound of the acceptable risk range. This risk is explained primarily by exposure to benzo(a)pyrene in soil, which contributed approximately 71 percent to the risk (Apps. D and G). Chemicals contributing to a lesser extent to the soil risk are benzo(b)fluoranthene, benz(a)anthracene, indeno(1,2,3-cd)pyrene, beryllium, and benzo(k)fluoranthene. The cumulative risk for the future worker exposure scenario of 3E-05 is within EPA's acceptable risk range based on the exposure information evaluated.

Chemicals contributing to a majority of the risk in groundwater include manganese, aluminum, cadmium, chromium, lead, and barium. The elevated metals concentrations were detected in well P-86, which was installed in spring 1995 and has only been sampled once. This well is approximately 1,200 ft from the operational boundary of the study area in the undeveloped portion of the site and is completed into soils contained in the Chewlacla soils group. Manganese, aluminum, chromium, lead, and barium were detected in every surficial soil sample collected from this soil group and in every sample collected with depth (except barium and chromium, which were BDL in two samples), including samples collected at 50 ft-bgs (in the soil boring for well P-86). As such, it is inferred that the concentrations detected in the unfiltered samples are a result of sample turbidity, reflecting the local soil group, which has been shown to contain these metals.

The single hit of cadmium was detected only in the unfiltered sample. Although this compound was not detected as frequently in the soil, its occurrence is still assumed to be related to the silty nature of the water sample from a well that has been purged and sampled only once.

To continue to assess the relationship between groundwater sample turbidity and metals content, a decision was made to conduct a low flow purge/sampling of selected wells within Area A. ADEM developed a list of wells where groundwater concentrations of certain metals (lead, beryllium, cadmium, chromium, and manganese) had exceeded Alabama maximum contaminant levels (MCLs) or health based action levels during recent sampling events. The wells selected were P-75 (Study Area 11), P-80 (A-B Divide), P-82 (Study Area 34), P-86 (Study Area 13), P-88 (Study Area 121) and P-89 (Study Area 13).

Low flow purging involved setting a small submersible pump to the screen depth in the well. The well would then be pumped at a low pumping rate [typically 0.5 to 1 gallon per minute (gpm)]. Discharge water was monitored at 5-minute intervals for pH, conductivity, and temperature to determine when water was being produced directly from the aquifer. Purging continued until the measured parameters were within 5 percent of preceding readings for 3 monitoring periods. As the pump was made of stainless steel and Teflon (R), a groundwater sample could be collected from the pump discharge at the end of the purge cycle. The advantage to this method is that sediments within the well and those within the sand pack were not disturbed during purging and sampling, which in the past had led to a turbid sample. To measure the degree of turbidity associated with each sample, total suspended solids (TSS) were measured from each sample in the lab.

Sample analysis showed the expected reduction in the metals concentrations. Cadmium, beryllium, and lead were not detected in any of the samples collected. Chromium was detected in two of the

samples at concentrations well below the 100 Ig/L ADEM MCL. Manganese, which is the most soluble of the metals of concern, was detected in each of the samples at concentrations below any health action level: A complete presentation of the analytical results from this sampling episode can be found in the RI addendum.

Study Area 14

Hunter and Current Resident - The cumulative HIs for the adult hunter exposed to site soils and the current resident exposed to affected venison caught by the hunter are below the target HI of 1, indicating that this area does not pose adverse human health effects to a hunter or current resident based on the exposure information evaluated.

The cumulative risks for the hunter and current resident exposure scenarios, 3E-08 and 2E-08, respectively, are below EPA's acceptable risk range based on the exposure information evaluated.

Future Resident and Worker - The cumulative HIs for the future resident and worker scenario are below 1, indicating that these receptors are not expected to have an increased potential for (noncarcinogenic) adverse health effects as a result of exposure to chemicals in soil at this study area. However, the exposure concentration for lead in Study Area 14 soil is 13,500 milligrams per kilogram (mg/kg), which exceeds EPA's guidance levels of 400 mg/kg for residential exposure and 1,000 mg/kg for worker exposure.

The cumulative risks for the future resident and worker exposure scenarios, 1E-06 and 2E-07, respectively, are within or below EPA's acceptable risk range based on the exposure information evaluated.

6.2.5.2 Ecological Risk Summary

Methods are still being developed to quantify risks to aquatic and terrestrial ecosystems. Variability in population dynamics and other parameters is often great even under natural conditions. However, comparisons of ecotoxicological benchmarks and potential exposure concentrations can be made to screen for potential problems. Ecologists then evaluate the results of those comparisons to estimate the potential for adverse effects to the natural systems. One important difference between ecological and human health evaluations is that the emphasis is placed on populations, communities, and ecosystems in nonhuman systems (unless the site evaluation must include one or more rare or endangered species). Therefore, the potential effects predicted for individuals must then be extrapolated to populations and communities to evaluate the potential for measurable adverse impacts to the ecosystem.

For the RA, soil exposure point concentrations were converted to daily intakes benchmarks for terrestrial animals, which were then compared directly to the ecological TRVs. The TRVs for terrestrial plants were compared directly to MCL 95 or maximum concentrations at each study area as were benchmarks for aquatic receptors. Concentrations of contaminants in the sediments were converted to porewater concentrations via standard equilibrium partitioning methods. Porewater concentrations were then compared to toxicity information for chironomids, when available, or to ambient water quality criteria (AWQC) for the protection of freshwater aquatic life or other appropriate freshwater aquatic life benchmarks when chironomid data were unavailable.

To determine if the potential exists for adverse ecological impacts, potential exposure concentrations of a chemical are compared to the ecotoxicity benchmarks for that chemical in the specified medium to produce an ecotoxicity quotient (EQ). Similar to human HIs, EQs less than 1.0 suggest that the benchmark effect is unlikely to occur in the individual organism. EQs greater than 1.0 can indicate the potential for adverse impacts to the individual organism and require further evaluation. Although the quotient method does not provide an estimate of

uncertainty and is not an estimation of risk, it is a commonly used method for screening ecological effects resulting from exposure to hazardous chemicals (EPA, 1989b).

According to U.S. Army ecological risk assessment guidance (Wentsel et al., 1994), in general, EQs exceeding 1 indicate a potential risk; however, since EQs merely provide point estimates, effects probabilities cannot easily be specified. The following interpretation of EQs was suggested in the Army guidance: chemicals with EQs between 1 and 10 have "some small potential" for adverse effects, between 10 and 100 have "significant potential" for adverse effects, and greater than 100 have "expected" adverse effects. This interpretation can be used as a rule of thumb for evaluating EQs. A summary of the EQs exceeding 1 is presented in Table 6. A summary of a summary of all EQs for all media can be located in the RA in Tables 5.4-1, 5,4-2, and 5.4-3.

6.2.5.3 Summary of Human and Ecological Risks

As shown in Table 5 and 6, the chemicals contributing to risk more than 1 x 10 -6, HIs more than 1, and EQs more than 1 are primarily metals. These chemicals that are the primary risk contributors are referred to as the final COCs. Historical data inicated isolated detections of munitions in groundwater above risk and HI levels, however, no munition compounds contributed to HIs or EQs more than 1. Although, the primary chemicals associated with the manufacture of munitions are nitroaromatics (e.g., TNT, 24DNT, 26TNT) none of these compounds resulted in excess health risks. Only one organic compound, benzo(a)pyrene, resulted in excess risks at one area, Study Area 13 soil. The presence of benzo(a)pyrene is most likely from past controlled burns in the area. Except for lead, which may be associated with ballistics and cannons, the inorganic COPCs are distributed across all areas in Area A at similar concentration ranges in soil and groundwater, indicating that the inorganics are not unique to the munitions operations of a particular area. Therefore, with the exception of lead, the inorganics are not site-related and represent the metals typically identified in natural background soils in the region.

As with soil, the presence of metals/inorganic compounds in gourndwater have been demonstrated by RI field studies and comparison to site-specific background, to be representative of concentrations expected in regional groundwater. Therefore, inorganics, with the exception of lead, were determined not to be site-related.

In summary, the human and ecological RA indicated that the COCs requiring evaluation in the FS are lead in soil.

6.2.6 Uncertainty Analysis

The risk measures used in Superfund site RAs are not fully probabilistic estimates of risk but are conditional estimates given a set of assumptions about exposure and toxicity. It is important to specify the assumptions and uncertainties inherent in the RA fully to place the risk estimates in proper perspective (EPA, 1989a). A qualitative analysis of each human and ecological RA component is often sufficient and is presented in Tables 7 and 8.

7.0 Description of Remedial Alternatives

Two interim response actions were completed at the site prior to the issuance of this document. The first action, completed in 1986 to 1987 was accomplished without the issuance of an interim ROD. This action was initiated prior to the site being included on the NPL in July 1987. In this action, soils considered to be contaminated were excavated from within Area A and transported to Area B without treatment. These soils subsequently became the Stockpile Soils OU within Area B of the Installation. A ROD for the Stockpile Soils OU was issued in December 1991 and recommended incineration as the preferred alternative.

During the initial stages of the supplemental investigations, it was determined that soils in Study Areas 12 and 30 contained lead and explosives at unacceptable concentrations. An interim ROD for soils in Study Areas 12 and 30 was submitted in April 1994 which recommended incineration as the preferred alternative.

Supplemental investigations were completed following the second remedial action. This investigation included collecting samples from all media within all study areas to determine the contamination status of the site following the completion of interim response actions. These investigations determined that soils within Study Areas 13 and 14 contained PAHs and lead at unacceptable concentrations. The RA completed for the site, based on data collected after the completion of all interim response actions, determined that all remaining study areas qualified for No Further Action. The remainder of this section details alternatives presented to complete the final remedial action.

The following is a brief description of final remedial alternatives developed for Study Areas 13 and 14.

7.1 Study Area 13 Alternatives

7.1.1 No Action (Alternative 13-1)

No action is taken to reduce constituent concentrations in soil media. The no action alternative is used as a baseline for comparison with the other soil media alternatives. This alternative was retained for detailed analysis.

7.1.2 In Situ Bioremediation (Alternative 13-2)

Bioremediation is a preferred means of cleanup for soils containing organic pollutants because it can provide a final solution through complete decomposition of the target compounds to acceptable residual levels. Bioremediation is often a very cost-effective method for remediation of various amounts of contaminated soils. The in situ bioremediation alternative uses organic amendments to increase the ability of the soil matrix to provide water and nutrients to target compound-degrading microorganisms, and transiently bind pollutants, thereby reducing the acute toxicity of the soils aqueous phase, which allows microorganisms to survive in soils containing high concentrations of toxicants. The bioremediation process consists of nutrient addition to the soil matrix, distribution of nutrients throughout the matrix, and monitoring of the active microbial population until the bioremediation process is complete. This alternative was retained for detailed analysis.

7.1.3 Excavation, Solvent Extraction, and Disposal (Onsite) (Alternative 13-3)

This alternative uses a specialized solvent system to treat the BAP-contaminated soils. The solvent is a mixture of polar and nonpolar components that break emulsions of oil, water, and inorganic constituents. The treatment process consists of three unit operations: pre-treatment, extraction, and solvent fractionation. The process can extract organics from wastes with concentrations as high as 40 percent by weight and discharge a relatively nonhazardous stream of inorganics with less than 0.1 percent organics. Any recovered water containing dissolved organics in the low parts per million range can be biologically treated prior to disposal. The organic-phase-containing solvent and the contaminants from the extraction stage are distilled in a fractionation train. The solvent system is recovered at a temperature of less than 50 degrees Centigrade and is recycled to the process. The contaminants are collected for further disposal or reuse. This alternative was not retained for detailed analysis.

7.1.4 Excavation, Thermal Desorption, and disposal (Onsite) (Alternative 13-4)

This alternative applies thermal technology to treat BAP-contaminated soils. Contaminated soil is fed into a thermal treatment unit with a front end loader. Large rocks and debris are initially screened off. Contaminated soil is heated in the primary treatment unit (counter flow rotary kiln) and process gas temperatures rise. The process gas combines with evaporated soil mixture and volatilized hydrocarbons. Maximum soil temperatures of 900!F occur prior to soil discharges into a cooling chamber for rehydration and fugitive dust control. The process gas stream is filtered in a baghouse and then combusted in the, secondary treatment unit (thermal oxidizer). Baghouse fines are kept hot and combined with the treated soil. This alternative was not retained for detailed analysis.

7.1.5 Excavation, Slurry Phase Bioremediation, and Disposal (Onsite) (Alternative 13-5)

This alternative uses a bioslurry reactor, similar to conventional suspended growth processes, such as activated sludge treatment, to treat BAP-contaminated soil. The process treats waste in the form of a slurry or sludge. Soils are mixed with water to form a slurry of approximately 20 percent solids prior to treatment. Waste is placed into the bioreactor and air is introduced for mixing and aeration. A nutrient and inoculum solution is added to the bioreactor as needed. Mechanical mixing devices are often required to ensure a homogeneous mixture in the reactor vessel. The contaminants are biologically degraded as they move to the aqueous phase through biological or chemical/physical action. The treated solids require dewatering prior to final disposal of the material. This alternative was not retained for detailed analysis.

7.1.6 Excavation and Disposal (Offsite) (Alternative 13-6)

This alternative includes the excavation of all BAP-contaminated soils, staging of soils, and loading of trucks for transportation to the Chemical Waste Management hazardous waste incineration facility in Port Arthur, Texas, via the Emelle, Alabama, facility for treatment and disposal. A single truck with a 22-ton payload would be required to transport the estimated 11.85 yd3 of contaminated soils. Once at the facility, the waste would be incinerated and a TCLP test would be conducted prior to disposal in the landfill. This alternative was retained for detailed analysis.

7.2 Study Area 14 Alternatives

7.2.1 No Action (Alternative 14-1)

No action is taken to reduce constituent concentrations in soil media. The no action alternative is used as a baseline for comparison with the other soil media alternatives.

7.2.2 In Situ Bioremediation (Electrokinetic) (Alternative 14-2)

This alternative uses in situ bioremediation to treat metals-contaminated soil. The innovative technology of bio-electrokinetics is based on the principle of accelerated movement of groundwater in subsurface sands, silts, and clay. Increased groundwater flow is induced by application of a direct current over graphite electrodes immersed in the soil media. The groundwater in the immediate vicinity of the electrodes is electrolyzed. Hydrogen ions are generated at the anode and hydroxyl ions are generated at the cathode. A clay-derived acid is formed at the anode. The clay-derived acid provides the transport mechanism for movement of contaminants. The movement of the concentrated acid is by the advection of pore fluid due to prevailing electro-osmotic flow, and the internally or externally applied hydraulic potential differences, diffusion from concentration gradients, and ion migration due to electrical gradients. (Remediation of Hazardous Waste Contaminated Soils, 1994). This alternative was not retained for detailed analysis.

7.2.3 Excavation, Solidification/Stabilization, and Disposal (Onsite) (Alternative 14-3)

This alternative includes the excavation of all contaminated soils. Following excavation, soils will be screened and solidified/stabilized prior to on-site disposal. Solidification/ stabilization of lead-contaminated soils from Study Area 14 (Cannon Range) would be accomplished using a mobile mixing plant (pug mill) to handle, meter, and mix the reagents with the contaminated soils. A typical mobile mixing plant consists of a silo for storage of the cement, a weight batcher to control the cement feed, and a ribbon blender for mixing the reagents and the waste. A typical mobile mixing plant is capable of solidifying/stabilizing waste materials at a rate of 50 to 75 yd3per hour. Front-end loaders would be used to load the pre-staged contaminated soils into a feed hopper.

The solidification/stabilization technique selected for the lead-contaminated soils found in Study Area 14, is a pozzolan-Portland cement system. The process is generally the least expensive, most adaptable, and most versatile of the solidification processes and is compatible with the waste constituents in Study Area 14 soils. The process is expected to require additional curing time due to the clayey nature of soils found within Area A of ALAAP. This system uses Portland cement and pozzolan (fine-grained, reactive silica) to bind the contaminated soils into a solidified matrix. Free calcium hydroxide in the cement is bound to the waste, thus improving the strength and chemical resistivity of the final product. Other materials may be added to change the physical characteristics of the final product, such as the solubility of wastes, setting time, and, final strength. TCLP analyses would be conducted on the solidified material to verify that the matrix meets TCLP criteria. This alternative was retained for detailed analysis.

7.2.4 Excavation, Detoxification, and Disposal (Onsite) (Alternative 14-4)

This alternative includes excavation of all contaminated soils within Study Area 14. Once excavated, the soils will be classified (screened) to remove solid debris in preparation for treatment. This alternative uses the synergetic application of specific inorganic and organic reagents that readily percolate through the contaminated soils. The reagents react with the metals in the soils. The redox reaction reduces the valence of the metals to the lowest state and renders the metals insoluble as stable organometallic complexes. The resulting precipitate is essentially insoluble and tends to increase its insolubility with time. This alternative was not retained for detailed analysis.

7.2.5 Excavation, Acid Extraction, and Disposal (Onsite) (Alternative 14-5)

This alternative includes excavation of all contaminated soils within Study Area 14. Once excavated, the soils will be classified (screened) to remove solid debris in preparation for treatment. This alternative involves soil washing, leaching, mixing, centrifugation, additional leaching in a horizontal washer and metal recovery via ion exchange. The process is continued until desired constituent concentrations are obtained. The treated soils are reblended and neutralized before discharge for onsite disposal. This alternative was not retained for detailed analysis.

7.2.6 Excavation and Disposal (Offsite) (Alternative 14-6)

This alternative includes the excavation of all contaminated soils, staging of soils, and loading of trucks for transportation to the Chemical Waste Management hazardous waste landfill facility in Emelle, Alabama, for treatment and disposal. A total of three trucks with 22-ton payloads would be required to transport the estimated 46.3 yd3, of contaminated soils. Once at the facility, the waste would be solidified/stabilized and a TCLP test would be conducted prior to disposal in the landfill. This alternative was retained for detailed analysis.

8.0 Summary of the Comparative Analysis of Alternatives

Two interim response actions were completed at the site prior to issuing this document. The first action, completed in 1986 to 1987 was accomplished without the issuance of an interim ROD. This action was initiated prior to the site being placed on the NPL in July 1987. In this action, soils considered to be contaminated were excavated from within Area A and transported to Area B without any treatment being completed. These soils subsequently became the Stockpile Soils OU within Area B of the Installation. A ROD for the Stockpile Soils OU was issued in December 1991 and recommended incineration as the preferred alternative.

During the initial stages of the supplemental investigations, it was determined that soils in Study Areas 12 and 30 contained lead and explosives at unacceptable concentrations. An interim ROD for soils in Study Areas 12 and 30 was submitted in April 1994, which recommended incineration as the preferred alternative.

Supplemental investigations were completed following the second remedial action. This investigation included collecting samples from all media within all study areas to determine the contamination status of the site following the completion of the interim response actions. These investigations determined that Soils within Study Areas 13 and 14 contained PAHs and lead at unacceptable concentrations. The RA completed for the site, based on data collected after the completion of all interim response actions, determined that all remaining study areas qualified for No Further Action.

Presented within each of the completed interim RODs is the detailed Summary of Comparative Analysis of Alternatives selecting the final alternative for each interim action. The remainder of this section details alternatives presented to complete this final remedial action.

8.1 Threshold Criteria

8.1.1 Overall Protection of Human Health and the Environment

Upon completion of Alternatives 13-2, 13-6, 14-3, and 14-6, the contaminant concentrations in the soils in Study Areas 13 and 14 within Area A would be reduced to levels that are protective of human health and the environment through excavation, treatment, and disposal outside of Area A of contaminated soils from the Study Areas. Alternative 13-1 and 14-1 would not be protective of human health or the environment since contaminants would be left in the soils and risks to the community, workers, and the environment would remain.

8.1.2 Compliance with ARARs

No federal or state chemical-specific ARARs regulate implementation of any of the alternatives. Soils will be remediated according to health-based cleanup levels determined to be protective to human health and the environment. Completion of Alternatives 13-2, 13-6, 14-3, and 14-6 would achieve the health- and risk-based cleanup levels.

With Alternatives 13-1 and 14-1, the contaminated soils would be left onsite, untreated, and would not achieve the remediation levels since the contamination would not be removed or destroyed.

The following location-specific ARARs may be applicable within ALAAP:

- Within 100-year floodplain: Resource Conservation and Recovery Act (RCRA): 40 CFR 264.18(b)--Facility must be designed, constructed, operated, and maintained to avoid washout by a 100-year flood.

- Within floodplain: Executive Order 11988; 40 CFR 6, App. A: Floodplain Management --Requires actions to avoid adverse effects, minimize floodplain destruction, restore and preserve natural and beneficial values, and minimize impact of floods on human safety, health, and welfare.
- Wetland: Executive Order 11990; 40 CFR 6, App. A: Protection of Wetlands--Requires action to avoid adverse impact, minimize potential harm, and to preserve and enhance wetlands to the extent possible.
- Within an area affecting stream or river: Fish and Wildlife Coordination Act [16 United States Code (USC) 661 et seq.]--Must take action to protect affected fish or wildlife resources, and prohibits diversion, channeling, or other activity that modifies a stream or river and affects fish or wildlife. 40 CFR Part 230--Section 404(b)(1) Guidelines For Specification of Disposal Sites For Dredged Or Fill Material--The purpose of these Guidelines is to restore and maintain the chemical, physical, and biological integrity of waters of the United States through the control of discharges of dredged or fill material.
- Critical habitat upon which endangered or threatened species depends: Endangered Species Act of 1973 (16 USC 1531 et seq.); 50 CFR 402--Requires action to conserve endangered or threatened species. Must not destroy or adversely modify critical habitat.
- Aquatic Systems: Section 404 of the Clean Water Act--Dredge and Fill Standards --regulates the discharge of dredged or fill material into waters of the U.S. This program is implemented through regulations set forth at 33 CFR Parts 320 and 330 and 40 CFR Part 230. These regulatory requirements ensure that proposed discharges are evaluated with respect to impacts on the aquatic ecosystem.

However, none of the location-specific ARARs are expected to apply to implementing any of the alternatives being evaluated since all activities associated with the Area. A remediation would be conducted in areas located away from sensitive environment (i.e., the river, 100-year floodplain, or critical habitat).

The following action-specific ARARS may apply to implementing of these alternatives, excluding Alternatives 13-1 and 14-1 (No Action):

- Clean Air Act (CAA):
  - 40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards--Establishes standards for ambient air quality to protect public health and welfare.
  - 40 CFR Part 61: National Emission Standards for Hazardous Air Pollutants--Sets emission standards for designated hazardous pollutants.

- RCRA
  - 40 CFR Part 261: Identification and Listing of Hazardous Waste--Provides guidelines for classifying wastes as hazardous waste.
  - 40 CFR Part 262: Standards Applicable to Generators of Hazardous Waste--Establishes standards for generators of hazardous waste.
  - 40 CFR Part 264: Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities--Establishes minimum national standards which define the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or dispose of hazardous waste.

- Alabama Administrative Code (AAC)
  - Chapters 13-1 through 13-7: Alabama Solid Waste Management Regulations--Establishes minimum criteria for the processing, recycling and

disposal of solid wastes and the design, location, and operation of solid waste disposal facilities.

- Chapters 335-3-1 through 335-3-14: Alabama Air Pollution Control Rules and Regulations--Sets emission standards and establishes permitting requirements for air pollutants.
- Chapter 335-14-5.15(4)(a)1: Performance Standards for Incinerators--Provides standards for the performance of incinerators. Incinerators treating hazardous wastes must provide at least 99.99 percent destruction efficiency for each principal organic hazardous constituent.

• Code of Alabama
  - Title 22, Chapter 27: Alabama Solid Waste Act--Establishes a statewide program to provide for the safe management of nonhazardous wastes.
  - Title 22, Chapter 28: Alabama Air Pollution Control Act of 1971--Provides for a coordinated statewide program of air pollution prevention, abatement, and control.
  - Title 22, Chapter 30: Alabama Hazardous Waste Management and Minimization Act-Establishes a statewide program to provide for the safe management of hazardous wastes, including hazardous waste generation, transportation, and land disposal.

• ADEM
  - Chapter 14-1: Alabama Hazardous Waste Management Regulations--Establishes standards that define the acceptable management of hazardous waste for owners and operators of facilities that treat, store, or dispose of hazardous waste.

8.2 Primary Balancing Criteria

8.2.1 Short-Term Effectiveness

Upon completion of remedial activities, Alternatives 13-2, 13-6, 14-2, and 14-6 would satisfy the remedial action objectives. Residual soil concentrations in Study Areas 13 and 14 within Area A would be below the remediation levels. No significant risks to the community, the workers implementing remedial actions; or the environment are expected during implementation of these four alternatives, provided that proper safety precautions are taken. During the excavation phase of these alternatives, appropriate precautions, such as the construction of surface runoff controls and the proper containment and covering of excavated soils, would reduce impacts to the environment. During the transportation phase, appropriate RCRA and DOT guidelines for transporting hazardous wastes would be followed to reduce impacts to the environment and the community. Primary risks to workers would be reduced by wearing protective clothing, designating exclusion zones for excavation areas, and adhering to proper decontamination procedures.

It is expected that each of these alternatives could be completed in less than 6 weeks. Based on a comparison of these three alternatives, no difference exists in their short-term effectiveness. Alternative 13-1 and 14-1 would present unacceptable risks to human health and the environment since no remediation of the contaminated soils would occur; therefore, this alternative would not be effective in the short term.

8.2.2 Long-Term Effectiveness and Permanence

Alternatives 13-2, 13-6, 14-3 and 14-6 would be effective in reducing the long-term risk of exposure at Study Areas 13 and 14 within Area A. With these alternatives, the magnitude of

residual risks will be removed as all of the contaminants are excavated and removed from Study Areas 13 and 14 within Area A. No treatment residuals or untreated wastes would remain in Study Areas 13 and 14 within Area A following completion of this interim action. Alternatives 13-1 and 14-1 would not be effective in the long term since the contamination sources would remain intact, yielding no reduction in the unacceptable pathways or associated risks.

8.2.3 Reduction of Contaminant MTV

Alternatives 13-2, 13-6, 14-3, and 14-6 would reduce onsite MTV within Study Areas 13 and 14 within Area A. Treatment of the contaminated soils would result in a significant decrease in toxicity and a slight decrease in volume of material. Because the contaminants in the soils would not be destroyed, removed, or treated under Alternatives 13-1 and 14-1, the MTV of the contaminants would remain unchanged.

8.2.4 Implementability

All retained alternatives are technically and administratively feasible. Alternatives 13-2, 13-6, 14-3, and 14-6 are all implementable, with required labor, equipment, and materials available from various suppliers near ALAAP. Alternative 13-2 and 14-3 would require treatability tests. No remedial actions would be implemented for Alternative 13-1 and 14-1.

8.2.5 Cost

The total present-worth costs of remediation, based on 1996 unit costs are $48,420 for Alternative 13-2; $40,351 for Alternative 13-6; $10,387 for alternative 14-3; and $38,938 for Alternative 14-6. These costs include construction costs, O&M costs (alternatives 13-2 and 14-3 only), engineering, and contingency fees. No cost is associated with Alternatives 13-1 and 14-1.

8.3 Modifying Criteria

8.3.1 ADEM/EPA Acceptance

EPA and ADEM have concurred with the choice of Alternatives 13-6 and 14-3.

8.3.2 Community Acceptance

In accordance with the Army's CRP for ALAAP, October 1990, the FS and the Proposed Plan for this ROD were released to the public on August 16, 1996. The public comment period began August 16, 1996, and ended September 15, 1996. Documents were made available to the public at the Earle A. Rainwater Memorial Library, Childersburg, Alabama. The notice of availability of the Proposed Plan was published in the Daily Home and the Birmingham News on August 15, 1996.

In accordance with the CRP, a public meeting was held at Central Alabama Community College on September 10, 1996, to inform the public of the preferred alternative and to seek public comments. At this meeting, representatives from ALAAP, EPA, ADEM, USACE, and USAEC were present and answered questions about the site and the remedial alternatives under consideration. No comments in opposition to the preferred alternative were voiced at the meeting or presented during the public comment period.

A response summary to the public comments received during the public comment period and hearing is included in the Responsiveness Summary section of this report.

9.0 Selected Remedy and Remediation Levels

9.1 Completed 1986 to 1987 Interim Action

The 1986 to 1997 interim action was a removal action only, completed without the issuance of an interim ROD. This action was initiated prior to the site being included in the NPL in July, 1987. Soils were treated at a later date under an interim ROD in Area B of ALAAP. The selected alternative called for implementing an interim response action to protect human health and the environment from the contaminated soil in Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33, and 34 within Area A at ALAAP. This action was an interim action for only the contaminated soils in the identified Study Areas within Area A.

Based on the CERCLA requirements and a screening of the alternatives, ALAAP, in consultation with EPA and ADEM, had determined that the selected alternative was the most appropriate remedy for soils in Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33, and 34 within Area A at ALAAP.

The interim remedy for soils in Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33, and 34 within Area A at ALAAP for source control included:

- Excavation of approximately 21,400 yd3 of lead- and explosives-contaminated soils from Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33, and 34 within Area A
- Transportation of contaminated soils to Area B for final treatment
- Onsite treatment (in Area B) by incineration followed by solidification/stabilization (of lead contaminated soils when required) or solidification only (if applicable) of lead-contaminated soils.
- Onsite disposal of treated soil at a designated area in Area B

The remediation level [in micrograms per gram (Ig/g)] for excavation of contaminated soil at Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33, and 34 within Area A were calculated using the preliminary pollutant limit value (PPLV) approach developed by the U.S. Army Medical Bioengineering Research and Development Laboratory (Rosenblatt and Small, 1981). The PPLV approach involves the development of health-based cleanup goals based on risk assessment procedures. The PPLVs used as cleanup goals within Area A were as follows:

- 2,4-DNT 0.42
- 2,6-DNT 0.40
- 2,4,6-TNT 1.92
- 1,3-DNB 1.1
- 1,3,5-TNB 5.5
- Tetryl 1.7
- Lead 117

Lead-contaminated materials that result in a TCLP extract in excess of 5 mg/L are considered hazardous under RCRA. Explosives-contaminated material that is ignitable or reactive is considered hazardous waste under RCRA.

Implementing the selected interim action resulted in the removal from Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33 and 34 within Area A of all identified contaminated soils at concentrations above the remediation levels as presented, resulting from DOD operations.

Excavated soils were stockpiled in Area B of ALAAP within a building and on a concrete pad covered with a membrane liner. An FS was completed for the stockpile soils, now within Area B, in October 1991. A ROD for the Stockpile Soils Area OU (part of Area B) was issued in December 1991 and recommended incineration as the preferred alternative. The incineration of Stockpile Soils commenced in May 1994 and was completed in August 1994.

Implementing the selected remedy met the following standards for treating the COCs in the excavated soils from soils in Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33, and 34 within Area A:

- Explosives--The ash generated from the incineration of explosives-contaminated soil was tested for destruction of explosives, as required by RCRA.
- Lead-Concentration of less than 5 mg/L in the TCLP extract, as required by RCRA.
- Particulate Emissions--Routine analysis of stack gases was performed to ensure processes were operating efficiently and within acceptable air emissions standards for the State of Alabama.
- Confirmatory sampling along with remediation was conducted to include broad scan analyses, following the remediation to ensure that all contaminants of concern resulting from DOD operations that would pose a risk to public health or the environment had been addressed.

9.2 Completed 1994 Interim Action

The selected alternative called for implementing an interim response action to protect human health and the environment from the contaminated soil in Study Areas 12 and 30 within the Area A Soil OU at ALAAP. This action was an interim action for only the contaminated soils in Study Areas 12 and 30 within Area A.

Based on the CERCLA requirements and the detailed analysis of the alternatives, ALAAP, in consultation with EPA and ADEM, had determined that the selected alternative was the most appropriate remedy for soils in Study Areas 12 and 30 within Area A.

The interim remedy for soils in Study Areas 12 and 30 within Area A for source control included:

- Excavating approximately 3,800 yd3 of lead-contaminated soils from Study Area 12 and 5 yd3 of explosives-contaminated soils from Study Area 30
- Transporting contaminated soils to Area B for final treatment
- Onsite treatment (in Area B) by incineration followed by solidification/stabilization (of lead contaminated soils when required) or solidification only (if applicable) of lead contaminated soils.
- Onsite disposal of treated soil at a designated area in Area B.

The remediation level for excavation of 2,4,6-TNT-contaminated soil at Study Area 30 in Area A was 21 mg/kg, a health-based level developed using EPA RA methodology. The remediation level for excavation of lead-contaminated soil at Study Area 12 in Area A was 400 mg/kg, the guidance level established by EPA.

Lead-contaminated materials that result in a TCLP extract in excess of 5 mg/L are considered hazardous under RCRA. Explosives-contaminated material that is ignitable or reactive is considered hazardous waste under RCRA.

Implementing the selected interim action resulted in the removal of all contaminated soils at concentrations above the remediation levels of 21 mg/kg for 246TNT and 400 mg/kg for lead resulting from DOD operations from Study Areas 12 and 30 within Area A. Implementing the selected remedy also met the following standards for treating the COCs in the excavated soils from soils in Study Areas 12 and 30 within Area A:

- Explosives--The ash generated from the incineration of explosives-contaminated soil was tested for destruction of explosives, as required by RCRA.
- Lead-Concentration of less than 5 mg/L in the TCLP extract, as required by RCRA.
- Particulate Emissions--Routine analysis of stack gases was performed to ensure processes

were operating efficiently and within acceptable air emissions standards for the state of Alabama.
- Confirmatory sampling along with remediation was conducted to include broad scan analyses, following the remediation to ensure that all contaminants of concern resulting from DOD operations that would pose a risk to public health or the environment had been addressed.

9.3 Proposed Final Action

The selected alternatives (Alternative 13-6 and 14-3) require implementing a remedial action to protect human health and the environment from the contaminated soil in Study Areas 13 and 14 within the Area A at ALAAP. This action is a final action for the contaminated soils in all Study Areas within Area A. Interim actions completed have been shown to be sufficient. The Risk Assessment completed for the site, based on data collected after the completion of all interim response actions, determined that all remaining study areas qualified for No Further Action.

Based on the CERCLA requirements and the detailed analysis of the alternatives, ALAAP, in consultation with EPA and ADEM, has determined that Alternatives 13-6 and 14-3 are the most appropriate remedies for soils in Area A.

The final remedy for soils in Study Areas 13 and 14 within Area A for source control includes:

- Excavation of approximately 12 yd3 of PAH-contaminated soils from Study Area 13 and 46 yd3 of lead-contaminated soils from Study Area 14
- Transporting contaminated soils from Study Area 13 to a waste incineration facility in Port Arthur, Texas
- Onsite solidification of soils from Study Area 14
- Onsite disposal of treated soil from Study Area 14 at designated area in Area B

Since the selected alternatives can be completed in a short time period, no periodic O&M costs associated with the incinerator are expected. The following are the costs for the selected remedies for Study Areas 13 and 14.

Study Area 13

Estimated Construction Cost	$40,351
Estimated O&M Cost	None
Estimated Total Present--Worth Cost, including Engineering and Contingency	$40,351

Study Area 14

Estimated Construction Cost	$10,387
Estimated O&M Cost	None
Estimated Total Present--Worth Cost, including Engineering and Contingency	$10,387

The remediation level for excavation of benzo(a)pyrene-contaminated soil at Study Area 13 in Area A is 7 mg/kg. The remediation level for excavation of lead-contaminated soil at Study Area 13 in Area A is 400 mg/kg.

Implementing the selected interim action will result in the removal of all contaminated soils at concentrations above the remediation levels from Study Areas 13 and 14 within Area A. The Risk

Assessment completed for the site, based on data collected after the completion of all interim response actions, determined that all remaining study areas qualified for No Further Action. The completion of this final action along with the completed interim actions will result in no further risk present within any media in any study area.

10.0 Statutory Determinations

Remedial investigations have progressed at the site since 1980, and two interim response actions were completed. At the completion of all interim response actions, a supplemental investigation was performed to determine the contamination status of all media (soil, groundwater, surface waters, sediments) at the site following remediation. Samples were collected from all study areas, including those that had undergone interim removal actions. A Final Remedial Investigation Report and Risk Assessment were completed using the data collected during the supplemental investigation along with previously collected data. Based on this complete data set of the site as it exists now, the Risk Assessment determined that the only sites that continue to present an unacceptable human health risk were Study Areas 13 and 14, and that no study areas within Area A present an unacceptable ecological risk. Interim response actions completed at other study areas were determined to be sufficient to be protective of human health, welfare, and the environment.

This final remedial action (Study Areas 13 and 14) is being taken to protect human health and the environment from unacceptable risks. This action is the final action for all media within Area A. All other study areas within Area A have been approved for No Further Action.

10.1 Completed 1986 to 1987 Interim Action

The 1986 to 1987 interim action was a removal action only, completed without the issuance of an interim ROD. This action was initiated prior to the site being included in the NPL in July 1987. Soils were treated at a later date under an interim ROD in Area B of ALAAP. The completed interim alternative called for implementing an interim response action to protect human health and the environment from the contaminated soil in Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33, and 34 within Area A. This action was an interim action for only the contaminated soils in the identified study areas within Area A.

The completed interim alternative satisfied the requirements under Sec. 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, and
- Satisfy the preference for treatment as a principal element.

10.1.1 Protection of Human Health and the Environment

The completed interim alternative protects human health and the environment through excavation, treatment, and disposal of contaminated soils from Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33, and 34 within Area A.

During remediation activities, adequate protection was provided to the community by reducing the short-term risks posed by air emissions from the thermal treatment unit and reducing dust potentially generated during material excavation and handling activities. In addition, workers were provided with personal protection equipment during all phases of remediation activities.

Long-term protection to human health and the environment was provided by leaving no residual risk from the DOD-related contaminants and reducing or eliminating the impact on the environment.

Controls employed in the alternative were adequate and reliable. This completed interim alternative had no unacceptable short-term or long-term impacts on human health or the environment.

10.1.2 Compliance with ARARs

The completed interim alternative complied with all ARARs. All the COCs in soils of Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33, and 34 within Area A at ALAAP had met required regulatory treatment/disposal standards prior to disposal.

No federal or state chemical-specific ARARS prevented implementing the completed interim alternative. Soils were removed based on health-based cleanup levels determined to be protective to human health and the environment.

No location-specific ARARS prevented the use of the completed interim alternative. All activities associated with implementing this alternative were conducted away from sensitive environments (i.e., river or 100-year floodplain).

The following action-specific ARARS will be met with implementation of this alternative:

- Workers were provided with personal protection equipment (PPE) during all phases of the completed interim remedy, in compliance with the Occupational Safety and Health Act (OSHA) (29 USC ss. 651-678). Adequate protection was provided to the community by reducing dust potentially generated during material excavation and handling activities.

If the excavated soils were determined to be a hazardous waste, the following action-specific ARARS would be applicable:

- Wastes will be properly classified under guidelines for RCRA (40 CFR Part 261: Identification and Listing of Hazardous Waste and 40 CFR Part 262: Standards Applicable to Generators of Hazardous Waste) and the State of Alabama (Code of Alabama, Title 22, Chapter 30: Alabama Hazardous Waste Management and Minimization Act and ADEM Chapter 14-1: Alabama Hazardous Waste Management Regulations).

10.1.3 Cost Effectiveness

The completed interim remedies for soils in Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33, and 34 within Area A had been determined to provide overall effectiveness proportionate to its costs.

10.1.4 Use of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected interim action was not designed or intended to be a final action for all soils within Area A but rather was intended to address only the soils within Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33, and 34 within Area A. As such, the alternative meets the statutory requirements to use permanent solutions and treatment technologies to the maximum extent practicable to achieve remediation goals at only these two study areas. The criteria used in selecting the alternative include:

- Short-term Effectiveness--The completed interim alternative did not involve off-facility transportation of contaminated soils, thereby eliminating the risks to the community due to spillage and dust emissions. The community, workers, and environment were protected during remedial actions by implementing appropriate protective measures. Long-Term Effectiveness and Permanence--The completed interim alternative provided for remediation of contaminated soils from Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33, and 34 within Area A. Direct exposure pathways were eliminated until the soils could be remediated. Upon treatment, the magnitude of residual risks were removed as all of the contaminants were treated and disposed of in accordance with applicable regulations.
- Reduction of Contaminant MTV--Contaminant mobility was significantly decreased due to the placement of the contaminants in lined storage buildings. Contaminant toxicity and soil volume was reduced upon final treatment.
- Implementability--All elements of the completed, interim alternatives were performed on site. Required labor, equipment, and materials were available from various suppliers near ALAAP.
- Cost--The completed interim remedies for soils in Study Areas 11, 12, 13, 15, 17, 29, 30, 31, 32, 33, and 34 within Area A were determined to provide overall effectiveness proportionate to its cost.

10.1.5 Preference for Treatment as a Principal Element

The completed interim action used removal only. Treatment was completed within Area B under a separate interim ROD.

10.2 Completed Interim Action for Study Areas 12 and 30

The completed interim alternative called for implementing an interim response action to protect human health and the environment from the contaminated soil in Study Areas 12 and 30 within Area A at ALAAP. This action was an interim action for only the contaminated soils in Study Areas 12 and 30 within Area A.

The completed interim alternative satisfied the requirements under Sec. 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.

10.2.1 Protection of Human Health and the Environment

The completed interim alternative protected human health and the environment through excavation, treatment, and disposal of contaminated soils from Study Areas 12 and 30 within Area A.

During remediation activities, adequate protection was provided to the community by reducing the short-term risks posed by air emissions from the thermal treatment unit and reducing dust potentially generated during material excavation and handling activities. In addition, workers were provided with personal protection equipment during all phases of remediation activities.

Long-term protection to human health and the environment was provided by leaving no residual risk from the DOD-related contaminants and reducing or eliminating the impact on the environment.

Controls employed in the alternative were adequate and reliable. This alternative had no unacceptable short-term or long-term impacts on human health or the environment.

10.2.2 Compliance with ARARs

The completed interim alternative complied with all ARARs. All the COCs in soils of Study Areas 12 and 30 within Area A (i.e., explosives and lead) met required regulatory treatment/disposal standards prior to disposal.

No federal or state chemical-specific ARARS prevented implementing the completed interim alternative. Soils were removed based on health-based cleanup levels determined to be protective to human health and the environment. Lead-contaminated soils were remediated to achieve the health-based soil lead concentration of 500 mg/kg (based on blood-lead uptake levels in children). Soils contaminated with 246TNT were remediated to achieve the health-based soil 246TNT concentration of 21 mg/kg (based on the resultant risk for adult residents and the contributing HI due to exposure concentration for child residents).

No location-specific ARARS prevented the use of the completed interim alternative. All activities associated with implementing this alternative were conducted away from sensitive environments (i.e., river or 100-year floodplain).

The following action-specific ARARS were met with implementation of this alternative:

- Incinerator ash was routinely tested for destruction of explosives, as required by RCRA (40 CFR Part 264: Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities) and the state of Alabama [Alabama Administrative Code Chapter 335-14-5.15(4)(a)1: Performance Standards for Incinerators)
- TCLP extract analysis on incinerator ash was performed to ensure lead concentrations in the treated soil were less than 5 mg/L prior to disposal, as required by RCRA (40 CFR Part 264: Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities). Incinerator ash that did not pass TCLP was solidified/stabilized prior to disposal.
- Incinerator ash and solidified/stabilized material (if required) was disposed of onsite in Area B in accordance with RCRA (40 CFR Part 264: Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities) and the State of Alabama (Code of Alabama, Title 22, Chapter 27: Alabama Solid Waste Act and Alabama Administrative Code Chapters 13-1 through 13-7: Alabama Solid Waste Management Regulations).
- Routine analysis of stack gases was performed to ensure incinerator processes were operating efficiently and within acceptable air emissions standards, as required by the CAA (40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards and 40 CFR Part 61: National Emission Standards for Hazardous Air Pollutants) and the State of Alabama (Code of Alabama, Title 22, Chapter 28: Alabama Air Pollution Control Act of 1971 and Alabama Administrative Code Chapters 335-3-1 through 335-3-14: Alabama Air Pollution Control Rules and Regulations).
- Workers were provided with PPE during all phases of the completed interim remedy, in compliance with OSHA (29 USC ss. 651-678). Adequate protection was provided to the community by reducing risks posed by air emissions from the thermal treatment unit and reducing dust potentially generated during material excavation and handling activities.

If excavated soils were determined to be a hazardous waste, the following action-specific ARARS were applicable:

- Wastes were properly classified under guidelines for RCRA (40 CFR Part 261: Identification

and Listing of Hazardous Waste and 40 CFR Part 262: Standards Applicable to Generators of Hazardous Waste) and the State of Alabama (Code of Alabama, Title 22, Chapter 30: Alabama Hazardous Waste Management and Minimization Act and ADEM Chapter 14-1: Alabama Hazardous Waste Management Regulations).

10.2.3 Cost Effectiveness

The completed interim remedy for soils in Study Areas 12 and 30 within the Area A have been determined to provide overall effectiveness proportionate to its costs. Although this alternative was more expensive than other alternatives screened, it took advantage of the special equipment, operators, site preparation, and treatment system mobilization already in place for treatment of the Stockpile Soils Area OU.

10.2.4 Use of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The completed interim action was not designed or intended to be a final action for all soils within Area A but rather was intended to address only the soils within Study Areas 12 and 30. As such, the alternative met the statutory requirements to use permanent solutions and treatment technologies to the maximum extent practicable to achieve remediation goals at only these two study areas. The criteria used in selecting the alternative included:

- Short-term Effectiveness--The completed interim alternative did not involve off-facility transportation of contaminated soils, thereby eliminating the risks to the community due to spillage and dust emissions. The community, workers, and environment were protected during remedial actions by implementing appropriate protective measures.
- Long-Term Effectiveness and Permanence--The completed interim alternative provided for remediation of contaminated soils from Study Areas 12 and 30 within Area A. Direct exposure pathways were eliminated until the soils could be remediated with the Stockpile Soils Area OU. Upon treatment, the magnitude of residual risks was removed as all of the contaminants were treated and disposed of in accordance with applicable regulations.
- Reduction of Contaminant MTV--Contaminant mobility was significantly decreased due to the placement of the contaminants in lined storage buildings. Contaminant toxicity and soil volume was reduced upon treatment along with the Stockpile Soils Area OU.
- Implementability--All elements of the completed interim alternative were performed onsite. Required labor, equipment, and materials were available from various suppliers near ALAAP. Treatment of contaminated soil did not require any additional special equipment or system mobilization since these components were already be in place for the Stockpile Soils Area OU.
- Cost--Although the completed interim remedy was more expensive, it took advantage of special equipment and thermal treatment system mobilization costs that were incurred during treatment of the Stockpile Soils Area OU.

10.2.5 Preference for Treatment as a Principal Element

The completed interim action used treatment for the soils of Study Areas 12 and 30 within the Area A Soils OU. Any additional required actions for these two Study Areas as well as for all the soils of Area A are addressed (Section 10.3) in this final Decision Document for Area A.

10.3 Proposed Final Action

The selected alternative satisfies the requirements under Sec. 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.

The RA completed for the site, based on data collected after the completion of all interim removal actions, determined that all remaining study areas qualified for No Further Action.

10.3.1 Protection of Human Health and the Environment

The selected alternative protects human health and the environment through excavation, treatment, and disposal of contaminated soils from Study Areas 13 and 14 within the Area A. The Risk Assessment completed for the site, based on data collected after the completion of all interim removal actions, determined that all remaining study areas qualified for No Further Action.

During removal activities, adequate protection will be provided to the community by reducing the short-term risks posed by air emissions from the thermal treatment unit and reducing dust potentially generated during material excavation and handling activities. In addition, workers will be provided with PPE during all phases of remediation activities.

Long-term protection to human health and the environment will be provided by leaving no residual risk from the DOD-related contaminants and reducing or eliminating the impact on the environment.

Controls employed in the alternative are adequate and reliable. This alternative has no unacceptable short-term or long-term impacts on human health or the environment.

10.3.2 Compliance with ARARs

The selected alternative complies with all ARARs. All the COCs in soils of Study Areas 13 and 14 within Area A are expected to meet required regulatory treatment/disposal standards prior to disposal. The Risk Assessment completed for the site, based on data collected after the completion of all interim response actions, determined that all remaining study areas qualified for No Further Action.

No federal or state chemical-specific ARARS prevent implementation of the selected alternative. Soils will be remediated based on health-based cleanup levels determined to be protective of human health and the environment. Lead-contaminated soils will be remediated to achieve the health-based soil lead concentration established by EPA (EPA, 1994a) of 400 mg/kg (based on blood-lead uptake levels in children). Soils contaminated with BAP will be remediated to achieve the health-based soil concentration of 7 mg/kg. This concentration of 7 mg/kg was developed using EPA risk assessment guidance for developing preliminary remedial goals (EPA, 1991), referred to as remedial goal options (RGOs) by EPA Region IV. The RGO of 7 mg/kg was based on a future residential exposure using standard default exposure assumptions.

No location-specific ARARS prevent the use of the selected alternative. All activities associated with implementing this alternative will be conducted away from sensitive environments (i.e., river or 100-year floodplain).

The following action-specific ARARS will be met with implementation of this alternative:

- Incinerator ash will be routinely tested for destruction of explosives, as required by

RCRA (40 CFR Part 264: Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities) and the State of Alabama (AAC Chapter 335-14-5.15(4)(a)1: Performance Standards for Incinerators).

- Solidified/stabilized material (if required) will be disposed of onsite in Area B in accordance with RCRA (40 CFR Part 264: Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities) and the State of Alabama (Code of Alabama, Title 22, Chapter 27: Alabama Solid Waste Act and Alabama Administrative Code Chapters 13-1 through 13-7: Alabama Solid Waste Management Regulations).
- Workers will be provided with PPE during all phases of the selected remedy, in compliance with OSHA (29 USC ss. 651-678). Adequate protection will be provided to the community by reducing risks posed by air emissions from the thermal treatment unit and reducing dust potentially generated during material excavation and handling activities.

If the excavated soils are determined to be a hazardous waste, the following action-specific ARARS would be applicable:

- Wastes will be properly classified under guidelines for RCRA (40 CFR Part 261: Identification and Listing of Hazardous Waste and 40 CFR Part 262: Standards Applicable to Generators of Hazardous Waste) and the State of Alabama (Code of Alabama, Title 22, Chapter 30: Alabama Hazardous Waste Management and Minimization Act and ADEM Chapter 14-1: Alabama Hazardous Waste Management Regulations).

10.3.3 Cost Effectiveness

The selected remedies for soils in Study Areas 13 and 14 within Area A have been determined to provide overall effectiveness proportionate to its costs.

The Risk Assessment completed for the site, based on data collected after the completion of all interim response actions, determined that all remaining study areas qualified for No Further Action.

10.3.4 Use of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The selected interim action is designed and intended to be a final action for all soils within Area A. As such, the alternative meets the statutory requirements to use permanent solutions and treatment technologies to the maximum extent practicable to achieve remediation goals at only these two study areas. The criteria used in selecting the alternative include:

- Short-term Effectiveness--The selected alternative does not involve off-facility transportation of contaminated soils, thereby eliminating the risks to the community due to spillage and dust emissions. The community, workers, and environment will be protected during remedial actions by implementing appropriate protective measures.
- Long-Term Effectiveness, and Permanence--The selected alternative provides for remediation of contaminated soils from Study Areas 13 and 14 within Area A. Direct exposure pathways would be eliminated.
- Reduction of Contaminant MTV--Contaminant mobility would be significantly decreased due disposal and solidification of the soils. Contaminant toxicity and soil volume would be reduced upon treatment.
- Implementability--Required labor, equipment, and materials are available from various suppliers near ALAAP. Treatment of contaminated soil will not require any additional special equipment or system mobilization since these components will already be in place.

- Cost--The alternatives selected are the most cost effective available.

The preferred alternatives were selected based on the cost of implementation. Several alternatives screened were effective and permanent, each reducing contaminant MTV. Screened alternatives which were considered final options were each easily implementable. When these factors were weighed, the lower cost alternatives were selected as the preferred alternatives.

The Risk Assessment completed for the site, based on data collected after the completion of all interim response actions, determined that all remaining study areas qualified for No Further Action.

10.3.5 Preference for Treatment as a Principal Element

The selected action uses treatment for the soils of Study Areas 13 and 14 within Area A. The Risk Assessment completed for the site, based on data collected after the completion of all interim response actions, determined that all remaining study areas qualified for No Further Action.

11.0 Documentation of Significant Changes

The selected alternatives (Alternative 13-6 and 14-3) are the preferred alternatives presented in the Proposed Plan.

12.0 References

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U.S. Environmental Protection Agency (EPA). 1995. Risk-Based Concentration Table, January - June 1995. Technical Support Section, Region III, Philadelphia, PA. March 7, 1995.

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Responsiveness Summary

1.0 Overview

The public reaction to the selected final remedy is primarily acceptance. All public comments have been addressed, and the public appears to have no concern about implementing the selected remedy. Continued community relations activities will be held to maintain public awareness of the status of remedial activities at ALAAP.

2.0 Background On Community Involvement

General community interest in the ALAAP site has historically not been great. Since the site was declared excess to Army needs in 1973, more interest has come from private groups or industry hoping to develop portions of the site. The southern part of the site (i.e., the former nitrocellulose manufacturing area) was sold to the Kimberly Clark Corporation in the late 1970s, and a paper products plant was constructed. In the mid-1980s, in response to interest in purchasing the eastern part of ALAAP (Area A), this section was remediated by the Army and the contaminated soil was stockpiled in the western portion of ALAAP (Area 13), creating the Stockpile Soils Area OU.

In 1990, EPA indicated that additional investigations were required at Area A to ensure that no residual contamination remained following the initial remedial actions. Area A was conveyed to private buyers in August 1990, with the provision that additional investigations and any required cleanups would be performed by the Army.

In 1991, a supplemental RI was begun to verify the effectiveness of the completed remedial actions in Area A. The supplemental RI initially determined that soils at two study areas within Area A (Study Areas 12 and 30) continued to contain lead and explosives at unacceptable concentrations. The supplemental RI/FS concluded that approximately 2,200 yd3 of lead-contaminated soil from Study Area 12 and approximately 5 yd3 of explosives-contaminated soil from Study Area 30 required further remediation.

A ROD for the Stockpile Soils OU was issued in December 1991 and recommended incineration as the preferred alternative. The incineration of the Stockpile Soils began in May 1994 and was complete in August 1994.

An interim ROD for the Area A Soil OU (Study Areas 12 and 30) was submitted in April 1994. During the latter half of 1994, Study Area 12 soils (2,179 yd3) were excavated, stabilized, and placed on the onsite backfill area in Area B. Explosives-contaminated soils from Study Area 30 (5 yd3) were excavated, incinerated, and placed in the onsite backfill area in Area B.

Notice of the public comment period and meeting for the Area A Final Proposed Plan was placed in two local newspapers on August 15 and September 10, 1996, and the public comment period extended from August 16 through September 15, 1996. No written public comments were received. The public meeting was held on September 10, 1996, at the Central Alabama Community College, located about 5 miles from the ALAAP site. The questions asked were mainly to obtain more detailed information on the identified contamination and the proposed remedy.

3.0 Summary of Public Comment and Agency Response

At the public meeting held on September 10, 1996, the public was given the opportunity to comment and ask questions about the Proposed Plan. All questions were addressed at the meeting. A transcript of the meeting is available in the Record Archive at the Earle A. Rainwater

Memorial Library, Childersburg, Alabama.

4.0 Remaining Concerns

All of the public comments have been adequately addressed. The public appears to have no concerns about implementing the selected remedy.

Table 1. ALAAP STUDY AREAS

Study Area	Description
11	Magazine Area
12	Old Burning Ground
13	Small Arms Ballistics Range
14	Cannon Range
15	Old Well
17	Propellant Shipping Area (Eastern Portion)
29	Rubble Pile
30	New Trench Area
31	Disposal Area
32	No. 2 Rubble Pile
33	Henningburg Area
34	229 Area

Source: ESE, 1994

Table 2. Summary of Chemicals of Potential Concern (COPCs) at AAAP Area A (Page 1 of 3)

Chemicals of Potential Concern	Study Area 11				Study Area 12				Study Area 13				Study Area 14			
	GW	SE	SO	SW	GW	SE	SO	SW	GW	SE	SO	SW	GW	SE	SO	SW
Volatile Organic Compounds (VOCs)																
Acetone					GW											
Bromomethane		SE														
Chloroform																
Methyl butyl ketone				SW												
Methylene chloride																
Methyl isobutyl ketone																
Tetrachloroethane, 1,1,2,2-		SE														
Trichloroethene																
Trichlorofluoromethane		SE		SW												
Semivolatile Organic Compounds (SVOCs)																
Benzo(b)naphtho(1,2-D)thiophene										SE	SO					
Bis(2-ethylhexyl)phthalate	GW	SE	SO	SW	GW		SO		GW	SE	SO				SO	
Carbazole											SO					
Dibenzofuran											SO					
Diethyl phthalate										SE	SO					
Di-n-butyl phthalate			SO				SO			SE	SO				SO	
Trichlorobenzene, 1,2,4-																

Polycyclic Aromatic Hydrocarbons (PAHs)											
Acenaphthene									SO		
Acenaphthylene			SO								
Anthracene			SO						SO		
Benz(a)anthracene			SO						SO		
Benzo(a)pyrene			SO						SO		
Benzo(b)fluoranthene			SO						SO		
Benzo(ghi)perylene			SO						SO		
Benzo(k)fluoranthene			SO						SO		
Chrysene									SO		
Fluoranthene			SO						SO		
Fluorene									SO		
Indeno(1,2,3-cd)pyrene			SO						SO		
Naphthalene			SO						SO		
Phenanthrene			SO			SO			SO		
Pyrene			SO			SO			SO		
Nitroaromatic Chemicals											
Dinitrobenzene, m-					GW		GW				
Dinitrotoluene, 2,4-					GW	SO	GW				SO
Dinitrotoluene, 2,6-					GW		GW				
Nitrosodiphenylamine, N-						SO		SE	SO		
Trinitrobenzene, 1,3,5-											
Trinitrotoluene, 2,4,6-						SO					
Inorganic Chemicals											
Aluminum	GW	SE		SW	GW		GW				
Arsenic		SE		SW	GW						
Barium	GW	SE	SO	SW	GW	SO	GW				
Beryllium			SO		GW				SO		
Cadmium					GW		GW				
Chromium	GW	SE	SO		GW	SO	GW				
Cobalt	GW				GW		GW		SO		
Copper	GW	SE		SW	GW	SO	GW		SO		SO
Iron	GW				GW		GW				
Lead	GW	SE	SO	SW	GW	SO	GW	SE			SO
Manganese	GW	SE		SW	GW		GW				
Mercury	GW	SE			GW	SO	GW				
Nickel	GW	SE			GW	SO	GW			SW	SO
Thallium		SE									
Vanadium	GW	SE	SO				GW				

Table 2. Summary of Chemicals of Potential Concern (COPCs) at AAAP Area A (Page 2 of 3)

Chemicals of Potential Concern	Study Area 15				Study Area 17				Study Area 29				Study Area 30			
	GW	SE	SO	SW	GW	SE	SO	SW	GW	SE	SO	SW	GW	SE	SO	SW
Volatile Organic Compounds (VOCs)																
Acetone	GW															
Bromomethane																
Chloroform																
Methyl butyl ketone																
Methylene chloride	GW															
Methyl isobutyl ketone	GW															
Tetrachloroethane, 1,1,2,2-																
Trichloroethene																
Trichlorofluoromethane							SO				SO				SO	
Semivolatile Organic Compounds (SVOCs)																
Benzo(b)naphtho(1,2-D)thiophene																
Bis(2-ethylhexyl)phthalate	GW						SO									
Carbazole																
Dibenzofuran																
Diethyl phthalate																
Di-n-butyl phthalate							SO				SO					
Trichlorobenzene, 1,2,4-																

Polycyclic Aromatic Hydrocarbons (PAHs)					
Acenaphthene					
Acenaphthylene					
Anthracene					
Benz(a)anthracene					
Benzo(a)pyrene					
Benzo(b)fluoranthene					
Benzo(ghi)perylene					
Benzo(k)fluoranthene					
Chrysene					
Fluoranthene					
Fluorene					
Indeno(1,2,3-cd)pyrene					
Naphthalene					
Phenanthrene					
Pyrene		SO			
Nitroaromatic Chemicals					
Dinitrobenzene, m-					
Dinitrotoluene, 2,4-		SO	GW		
Dinitrotoluene, 2,6-		SO			
Nitrosodiphenylamine, N-					
Trinitrobenzene, 1,3,5-					SO
Trinitrotoluene, 2,4,6-					SO
Inorganic Chemicals					
Aluminum	GW	SO	GW		
Arsenic	GW				
Barium	GW	SO	GW		
Beryllium		SO			
Cadmium					
Chromium	GW				SO
Cobalt					SO
Copper	GW	SO			SO
Iron					
Lead	GW	SO			SO
Manganese	GW		GW		
Mercury					
Nickel	GW	SO			SO
Thallium					
Vanadium	GW				

Table 2. Summary of Chemicals of Potential Concern (COPCs) at AAAP Area A (Page 3 of 3)

Chemicals of Potential Concern	Study Area 31				Study Area 32				Study Area 33				Study Area 34				A/B DIVIDE			
	GW	SE	SO	SW	GW	SE	SO	SW	GW	SE	SO	SW	GW	SE	SO	SW	GW	SE	SO	SW
Volatile Organic Compounds (VOCs)																				
Acetone																				
Bromomethane																				
Chloroform													GW				GW			
Methyl butyl ketone																				
Methylene chloride																				
Methyl isobutyl ketone																				
Tetrachloroethane, 1,1,2,2-																				
Trichloroethene																	GW			
Trichlorofluoromethane			SO				SO				SO				SO					
Semivolatile Organic Compounds (SVOCs)																				
Benzo(b)naphtho(1,2-D)thiophene																				
Bis(2-ethylhexyl)phthalate							SO				SO		GW		SO		GW			
Carbazole																				
Dibenzofuran																				
Diethyl phthalate																				
Di-n-butyl phthalate							SO													
Trichlorobenzene, 1,2,4-											SO									

Polycyclic Aromatic Hydrocarbons (PAHs)	
Acenaphthene	
Acenaphthylene	
Anthracene	
Benz(a)anthracene	
Benzo(a)pyrene	
Benzo(b)fluoranthene	
Benzo(ghi)perylene	
Benzo(k)fluoranthene	
Chrysene	
Fluoranthene	
Fluorene	
Indeno(1,2,3-cd)pyrene	
Naphthalene	
Phenanthrene	
Pyrene	
Nitroaromatic Chemicals	
Dinitrobenzene, m-	
Dinitrotoluene, 2,4-	GW
Dinitrotoluene, 2,6-	
Nitrosodiphenylamine, N-	
Trinitrobenzene, 1,3,5-	
Trinitrotoluene, 2,4,6-	

Inorganic Chemicals					
Aluminum		GW		GW	GW
Arsenic					
Barium		GW		GW	GW
Beryllium			SO	GW	GW
Cadmium					
Chromium	SO			GW	GW
Cobalt				GW	
Copper	SO			GW	GW
Iron				GW	GW
Lead	SO			GW	GW
Manganese		GW		GW	GW
Mercury				GW	
Nickel	SO			GW	GW
Thallium					
Vanadium			SO	GW	GW

Note:
GW = groundwater
SE = sediment
SO = soil
SW = surface water

Source: ESE (1995)

Table 3. Chronic Oral and Inhalation RfDs for the COPCs at ALAAP Area A (Page 1 of 4)

Chemical	Oral RfD (UF)*	Oral Target Organ/System	Inhal RfD (UF)**	Inhal Target Organ/System
IOCs				
Aluminum	1.0E+00 ## (na)	na	--	--
Arsenic	3.0E-04 (3)	Skin	--	--
Barium	7.0E-02 (3)	Cardiovascular	1.4E-04 # (1,000)	Fetotoxicity
Beryllium	5.0E-03 (100)	Decreased body weight	--	--
Cadmium (aqueous matrix)	5.0E-04 (10)	NOAEL	--	--
Chromium, total 11	5.0E-03 (500)	NOAEL	nd 12	--
Cobalt	6.0E-02 ** (na)	na	--	--
Copper	3.7E-02 13 (2)	Gastrointestinal	--	--
Iron	--	--	--	--
Lead	-- 14	--	--	--
Manganese (aqueous matrix)	5.0E-03 (1)	CNS	--	--
Manganese (solid matrix)	1.4E-01 (1)	CNS	1.4E-05 (1,000)	CNS
Mercury	3.0E-04 # (1,000)	Kidney	8.6E-05 # (30)	CNS
Nickel	2.0F-02 15 (300)	Whole body, major organs	--	--
Selenium	5.0E-03 (3)	Whole body	--	--
Silver	5.0E-03 16 (3)	Skin	--	--
Thallium	8.0E-05 17 (3,000)	Blood, liver	--	--
Vanadium	7.90E-03 # (100)	na	--	--
Zinc	3.0E-01 (3)	Blood	--	--
Munitions/Nitroaromatics				
Dinitrobenzene, 1,3-	1.0E-04 (3,000)	Spleen	--	--
Dinitrotoluene, 2,4-	2.0E-03 (100)	CNS, blood	--	--
Dinitrotoluene, 2,6-	1.0E-03 # (3,000)	CNS, blood, kidney	--	--
Nitrosodiphenylamine, N-	5.0E-02 N1 (100)	Bladder	--	--
Trinitrobenzene, 1,3,5-	5.0E-05 (10,000)	Spleen	--	--
Trinitrotoluene, 2,4,6-	5.0E-04 (1,000)	Liver	--	--

Table 3. Chronic Oral and Inhalation RfDs for the COPCs at ALAAP Area A (Page 2 of 4)

Chemical	Oral RfD (UF)*	Oral Target Organ/System	Inhal RfD (UF)**	Inhal Target Organ/System
PAHs				
Acenaphthene	6.0E-02 (3,000)	Liver	--	--
Acenaphthylene	3.0E-02 H1 (3,000)	Kidney	--	--
Anthracene	3.0E-01 (3,000)	NOAEL	--	--
Benz(a)anthracene	3.0E-02 H1 (3,000)	Kidney	--	--
Benzo(b)fluoranthene	3.0E-02 H1 (3,000)	Kidney	--	--
Benzo(b)naphtho[1,2-D]thiophene	3.0E-02 H1 (3,000)	Kidney	--	--
Benzo(k)fluoranthene	3.0E-02 H1 (3,000)	Kidney	--	--
Benzo(ghi)perylene	3.0E-02 H1 (3,000)	Kidney	--	--
Benzo(a)pyrene	3.0E-02 H1 (3,000)	Kidney	--	--
Chrysene	3.0E-02 H1 (3,000)	Kidney	--	--
Fluoranthene	4.0E-02 (3,000)	Kidney, liver, blood	--	--
Fluorene	4.0E-02 (3,000)	Blood	--	--
Indeno(1,2,3-cd)pyrene	3.0E-02 H1 (3,000)	Kidney	--	--
Naphthalene	4.0E-02 (1,000)	NOAEL	--	--
Phenanthrene	3.0E-02 H1 (3,000)	Kidney	--	--
Pyrene	3.0E-02 (3,000)	Kidney	--	--
SVOCS, misc.				
Bis(2-ethylhexyl) phthalate	2.0E-02 (1,000)	Liver, kidney	--	--
Carbazole	5.0E-02 S1 (100,000)	na	--	--
Di-n-butyl phthalate	1.0E-01 (1,000)	Whole body	--	--
Dibenzofuran	4.0E-03 ## (na)	na	--	--
Diethyl phthalate	8.0E-01 (1,000)	Whole body	--	--
Trichlorobenzene, 1,2,4-	1.0E-02 (1,000)	Adrenal	5.7E-02 # (1,000)	Liver
VOCs, misc.				
Acetone	1.0E-01 (1,000)	Liver, kidney	--	--
Bromomethane	1.4E-03 (1,000)	Forestomach, kidney	1.4E-03 (100)	Heart, gastrointestinal
Chloroform	1.0E-02 (1,000)	Liver	--	--

Table 3. Chronic Oral and Inhalation RfDs for the COPCs at ALAAP Area A (Page 3 of 4)

Chemical	Oral RfD (UF)*	Oral Target Organ/System	Inhal RfD (UF)**	Inhal Target Organ/System
VOCs, misc., cont.				
Methylene chloride	6.0E-02 (100)	Liver	8.6E-01 # (100)	Liver
Methyl butyl ketone	2.6E-02 V1	na	--	--
Methyl isobutyl ketone	8.0E-02 # (1,000)	Kidney, liver	2.0E-02 # (1,000)	Kidney, liver
Tetrachloroethane, 1,1,2,2-	3.2E-03 V2 (100,000)	Liver	--	--
Trichloroethene	6.0e-03 ## (na)	Liver	--	--
Trichlorofluoromethane	3.0E-01 (1,000)	Whole body	2.0E-01 # (10,000)	Kidney, lungs

Note:
RfD = reference dose [mg/kg/d].
UF = uncertainty factor.
MF = modifying factor.
inhal = inhalation.
na = not applicable/unknown.
nd = not determined.
MCL = EPA maximum contaminant level.
LOAEL = lowest-observed-adverse-effect level.
NOAEL = no-observed-adverse-effect level.
LD 50 = dose resulting in death in 50 percent of a study population.
CNS = central nervous system.
mg/kg/day = milligrams per kilogram per day.
mg/L = milligrams per liter.
Ig/L = micrograms per liter.
L/day = liters per day.

(H1) No RfD is available for this PAH; the lowest non-naphthalene value (pyrene) is used for comparison, only.
(I1) All values are for hexavalent chromium, a less conservative oral RfD of 1.0E+00 mg/kg/day for trivalent chromium is also available.
(I2) Inhalation RfD for chromium has been withdrawn from IRIS pending further EPA review.
(I3) Oral RfD for copper based on the MCL of 1.3 mg/L (56 FR 26460) and assumes that a healthy 70 kilogram adult consumes 2 L/day water.

Table 3. Chronic Oral and Inhalation RfDs for the COPCs at ALAAP Area A (Continued, Page 4 of 4)

(14) EPA prefers to use a biokinetic uptake model to evaluate lead exposure rather than the reference dose method (EPA, 1991e).
(15) Oral RfD for soluble nickel salts.
(16) Oral RfD for silver based on aesthetic endpoint (argyria).
(17) No oral RfD is available for metallic thallium; the listed value for thallium chloride is from HEAST (EPA, 1994).
(N1) Oral RfD for N-nitrosodiphenylamine based on a chronic oral LOAEL for rats of 50 mg/kg/day (ATSDR, 1987) and an uncertainty factor of 1,000 (10 for sensitive human subpopulations, 10 for animal-to-human extrapolation, and 10 for LOAEL-to-NOAEL extrapolation).
(S1) Oral RfD for carbazole based on an acute oral LD 50 for rats of >5,000 mg/kg (HSDB, 1995), an uncertainty factor of 10,000 (10 for sensitive human subpopulations, 10 for animal-to-human extrapolation, 10 for acute-to-chronic extrapolation, and 10 for LD 50-to-NOAEL extrapolation), and a modifying factor of 10 (accounts for the lethal endpoint of the study).
(V1) Oral RfD for methyl butyl ketone based on an acute oral LD 50 for rats of 2,590 mg/kg/day (RTECS, 1995), an uncertainty factor of 10,000 (10 for sensitive human subpopulations, 10 for animal-to-human extrapolation, 10 for acute-to-chronic extrapolation, and 10 for LD 50-to-NOAEL extrapolation), and a modifying factor of 10 (accounts for the lethal endpoint of the study).
(V2) Oral RfD for 1,1,2,2-tetrachloroethane based on an interim oral LOAEL for rats of 3.2 mg/kg/day (ATSDR, 1988) and an uncertainty factor of 1,000 (10 for sensitive human subpopulations, 10 for animal-to-human extrapolation, and 10 for LOAEL-to-NOAEL extrapolation).

*All oral RfDs are available in IRIS (1995), unless otherwise noted.
**RfDs are based on the inhalation RfC available in IRIS (1995) and assume that a healthy 70-kilogram adult inhales 20 m3/day air, unless otherwise noted.
#Value available in HEAST, 1994 Annual Update (EPA, 1994).
##Provisional value available from EPA's Environmental Criteria and Assessment Office (ECAO) and presented in EPA Region III's Risk-Based Concentration Table, January - June 1995 (EPA, 1995).

Source: ESE.

Table 4. CSFs and WoEs for the Known/Potential Carcinogenic COPCs at ALAAP Area A, (Page 1 of 2)

Chemical	Oral CSF*	Oral WoE*	Inhal CSF**	Inhal WoE*
IOCS				
Arsenic	1.5E+00	A	1.5E+01 #	A
Beryllium	4.3E+00	B2	8.4E+00 #	B2
Chromium, total H1	nc		4.1E+01 #	A
Lead	nd 12	B2	nd 12	B2
Nickel	nc		8.4E-01 I3	A
Munitions/Nitroaromatics				
Dinitrotoluene, 2,4-	6.8E-01 N1	B2	nd N2,#	B2
Dinitrotoluene, 2,6-	6.8E-01 N1	B2	nd N2,#	B2
Nitrosodiphenylamine, N-	4.9E-03	B2	nd N2,#	B2
Trinitrotoluene, 2,4,6-	3.0E-02	C	nd N3	C
PAHs				
Benz(a)anthracene	7.3E-01 H1	B2	6.1E-01 H1	B2
Benzo(b)fluoranthene	7.3E-01 H1	B2	6.1E-01 H1	B2
Benzo(k)fluoranthene	7.3E-02 H1	B2	6.1E-02 H1	B2
Benzo(a)pyrene	7.3E+00	B2	6.1E+00	B2
Chrysene	7.3E-03 H1	B2	6.1E-03 H1	B2
Indeno(1,2,3-cd)pyrene	7.3E-01 H1	B2	6.1E-01 H1	B2
SVOCS, misc.				
Bis(2-ethylhexyl)phthalate	1.4E-02	B2	nd S1	B2
VOCS, misc.				
Chloroform	6.1E-03	B2	8.1E-02 #	B2
Methylene chloride	7.5E-03	B2	1.6E-03	B2
Tetrachloroethane, 1,1,2,2-	2.0E-01	C	2.0E-01	C
Trichloroethene	1.1E-02 V1,##	B2	6.0E-03 V1,##	B2

Note: CSF = cancer slope factor [(mg/kg/day)-1].
WoE = weight of evidence for ranking as a human carcinogen.
inhal = inhalation.
nd = not determined.
mg/kg/day = milligrams per kilogram per day.
mg/L = milligrams per liter.
Ig/L = micrograms per liter.
L/day = liters per day.

(H1) CSF for this potentially carcinogenic PAH is an interim value from EPA ECAO and listed in EPA Region III's Risk-Based Concentration Table, January to June 1995 (EPA, 1995). The value is based on the CSF for benzo(a)pyrene and the following Toxicity Equivalency Factors: benz(a)anthracene, 0.1; benzo(b)fluoranthene, 0.1; benzo(k)fluoranthene, 0.01; chrysene, 0.001; dibenz(ah)anthracene, 1.0; and indeno(1,2,3-cd)pyrene, 0.1.

Table 4. CSFs and WoEs for the Known/Potential Carcinogenic COPCs at ALAAP Area A (Continued, Page 2 of 2)

(I1) All values are for hexavalent chromium; a less conservative oral RfD of 1E+00 mg/kg/day for trivalent chromium is also available.
(I2) Although EPA has classified lead as a Group B2 suspect human carcinogen via ingestion and inhalation, no CSF has been developed for either of these exposure pathways.
(I3) Inhalation CSF for nickel refinery dust.
(N1) No oral CSF is available for this munitions compound alone; the listed value is for 2,4-dinitrotoluene/2,6-dinitrotoluene mixture.
(N2) Although EPA has classified this chemical as a Group B2 suspect human carcinogen via inhalation, no CSF has been developed for this exposure pathway.
(N3) Although EPA has classified this chemical as a Group C possible human carcinogen via inhalation, no CSF has been developed for this exposure pathway.
(S1) Although EPA has classified, this SVOC as a Group B2 suspect human carcinogen via inhalation, no CSF has been developed for this exposure pathway.
(V1) CSFs and WoEs for this VOC have been withdrawn from IRIS pending further review.

*All oral CSFs and WoEs are available in IRIS (1995), unless otherwise noted.
**Inhalation CSFs are based on the inhalation UR available in IRIS (1995) and assume that a healthy 70-kilogram adult inhales 20 m3/day air, unless otherwise noted.
#Value available in HEAST, 1994 Annual Update (EPA, 1994).
##Provisional value available from EPA's Environmental Criteria and Assessment Office (ECAO) and presented in EPA Region III's Risk-Based Concentration Table, January - June 1995 (EPA, 1995).

Source: ESE.

Table 5. Summary of Media and Chemicals of Concern (COCs) Exceeding Human Health Risks of 10-6 and Hazard Indices (HIs) of 0.1 (Page 1 of 5)

Area	Scenario	Media	Carcinogenic Risk	Noncarcinogenic Hazard Index (HI) Adult	Child		Chemicals of Concern (COCs) a	Risk
11	Future Resident	Groundwater	2 x 10-6	54	99	C: NC:	B2EHP Mn, Al, V, Co, Cr, Cu, Ni, Pb b	NC(A&C)
		Soil	2 x 10-5	<0.1	0.3	C: NC:	Be, BAP, Cr No individual chemicals exceed 0.1	C NC(C)
		Surface Water	1 x 10-6	0.2	0.6	C: NC:	As Mn	
	Future Worker	Groundwater	<1 x 10-6	19	NA c	NC:	Mn, Al, V, Pb b	NC(A)
		Soil	5 x 10-6	<0.1	NA	C:	Cr, Be	
	Hunter	Soil	1 x 10-6	<0.1	NA	C:	No individual chemicals exceed 10-6	C
12	Future Resident	Groundwater	3 x 10-4	6	11	C: NC:	Be, As, B2EHP, 26DNT, 24DNT Mn, Cd, As, Al, Cr d	C NC(A&C)
		Soil	9 x 10-6	<0.1	0.2	C: NC:	Cr Cr d	
	Future	Groundwater Worker	7 x 10-5	2.1	NA	C: NC:	Be, As Mn	NC(A)
		Soil	4 x 10-6	<0.1	NA	C:	Cr	
	Hunter	Soil	1 x 10-6	<0.1	NA	C:	Cr	
13	Future Resident	Groundwater	3 x 10-6	66	120	C: NC:	B2EHP, 24DNT Mn, Cd, Al, Cr, Ba, V, Ni d, Pb b	NC(A&C)

Table 5. Summary of Media and Chemicals of Concern (COCs) Exceeding Human Health Risks of 10-6 and Hazard Indices (HIs) of 0.1 (Page 2 of 5)

Area	Scenario	Media	Carcinogenic Risk	Noncarcinogenic Hazard Index (HI) Adult	Child		Chemicals of Concern (COCs) a	Risk
13	Future Resident (Cont.)	Soil	2 x 100-4	<0.1	<0.1	C:	BAP, BBFANT, BAANTR, ICDPYR, Be, BKFANT	C
	Future Worker	Groundwater	<1 x 10-6	24	NA	NC:	Mn, Cd, Al, Cr, Pb b	NC(A)
		Soil	3 x 10-5	<0.1	NA	C:	BAP, BBFANT, BAANTR, ICDPYR, Be	
	Hunter	Soil	7 x 10-6	<0.1	NA	C:	BAP	
14	Future Resident	Soil	1 x 10-6	<0.1	<0.1	C: NC:	No individual chemicals exceed 10-6 Pb c	NC(A&C)
	Future Worker	Soil	<1 x 10-6	<0.1	NA	NC:	Pb f	NC(A)
15	Future Resident	Groundwater	1 x 10-6	11	21	C: NC:	No individual chemicals exceed 10-6 Mn, Al, Cr d, Ni d, V d	NC(A&C)
	Future Worker	Groundwater	<1 x 10-6	4	NA	NC:	Mn	NC(A)
17	Future Resident	Soil	2 x 10-5	<0.1	0.4	C: NC:	Be Al d, Ba d	
	Future Worker	Soil	2 x 10-6	<0.1	NA	C:	Be	
29	Future Resident	Groundwater	1 x 10-6	0.6	1.2	C: NC:	24DNT Mn, Al d	NC(C)

Table 5. Summary of Media and Chemicals of Concern (COCs) Exceeding Human Health Risks of 10-6 and Hazard Indices (HIs) of 0.1 (Page 3 of 5)

Area	Scenario	Media	Carcinogenic Risk	Noncarcinogenic Hazard Index (HI) Adult	Child		Chemicals of Concern (COCs) a	Risk
29 (cont)	Future Worker	Groundwater	<1 x 10-6	0.2	NA	NC:	Mn	NC(A)
30	Future Resident	Soil	6 x 10-6	<0.1	0.2	C: NC:	Cr 135TNB	
	Future Worker	Soil	3 x 10-6	<0.1	NA	C:	Cr	
31	Future Resident	Soil	6 x 10-6	<0.1	0.1	C: NC:	Cr No individual chemicals exceed 0.1	
	Future Worker	Soil	3 x 10-6	<0.1	NA	C:	Cr	
32	Future Resident	Groundwater	1 X 10-6	0.6	1.2	C: NC:	24DNT Mn, Al d	NC(C)
		Soil	1 x 10-5	<0.1	0.2	C: NC:	Be V d	
	Future Worker	Groundwater	<1 x 10-6	0.2	NA	NC:	Mn	
		Soil	1 x 10-6	<0.1	NA	C:	Be	
34	Future Resident	Groundwater	6 x 10-4	42	76	C: NC:	Be, B2EHP, CHCL3 Mn, Al, V, Cr, Ni, Ba d, Cu d, Be d	C NC(A&C)
	Future Worker	Groundwater	2 x 10-4	15	NA	C: NC:	Be Mn, Al, V, Cr	C NC(A)

Table 5. Summary of Media and Chemicals of Concern (COCs) Exceeding Human Health Risks of 10-6 and Hazard Indices (HIs) of 0.1 (Page 4 of 5)

Area	Scenario	Media	Carcinogenic Risk	Noncarcinogenic Hazard Index (HI) Adult	Child	Chemicals of Concern (COCs) a		Risk
A/B Divide	Future Resident	Groundwater	5 x 10-4	16	28	C: NC:	Be, CHCL3, B2EHP Mn, Al, Ni d, V d, Cr d, Pb b	C NC(A&C)
	Future Worker	Groundwater	1 x 10-4	5.6	NA	C: NC:	Be Mn, Al, Pb b	C NC(A)

Notes:

This table only includes media for scenarios at areas with risks greater than or equal to (1 x 10-6, with hazard indices (HIs) 0.1, or where lead was a concern (see footnotes b, e, and f).

C = carcinogenic risk
NC = noncarcinogenic risk
NC(A) = noncarcinogenic risk to adults
NC(C) = noncarcinogenic risk to children
NC(A&C) = noncarcinogenic risk to adults and children
135TNB = 1,3,5-trinitrobenzene
24DNT = 2,4-dinitrotoluene
26DNT = 2,6-dinitrotoluene
Al = aluminum
As = arsenic
B2EHP = bis(2-ethylhexyl)phthalate
Ba = barium
BAANTR = benz(a)anthracene
BAP = benzo(a)pyrene
BBFANT = benzo(b)fluoranthene

Table 5. Summary of Media and Chemicals of Concern (COCs) Exceeding Human Health Risks of 10-6 and Hazard Indices (HIs) of 0.1 (Page 5 of 5)

Notes (Continued):

Be = beryllium
BKFANT = benzo(k)fluoranthene
Cd = cadmium
CHCL3 = chloroform
Co = cobalt
Cr = chromium
Cu = copper
ICDPYR = indeno(1,2,3-cd)pyrene
Mn = manganese
Ni = nickel
Pb = lead
V = vanadium

a Chemicals of concern (COCs) are those analytes with carcinogenic risks exceeding 1 x 10-6 or noncarcinogenic hazard indices (HIs) exceeding 0.1. Carcinogenic COCs are in descending order from highest risk to lowest risk; noncarcinogenic COCs are in descending order from highest HI to lowest HI. The first chemicals listed in the COCs column contributed to over 70% of the risk or over 80% of the HI.

b Concentration of lead in groundwater exceeds the U.S. Environmental Protection Agency (EPA) action level of 15 micrograms per liter (Ig/L).

c NA = not applicable.

d Exceeded HI of 0.1 for children only. If analyte does not have this footnote, the HI exceeded 0.1 for both adults and children.

e Concentration of lead in soil exceeds the EPA health-based guidance level of 400 milligrams per kilogram (mg/kg) for residential exposure.

f Concentration of lead in soil exceeds the EPA guidance level of 1,000 mg/kg for worker exposure.

Source: ESE (1995)

Table 6. Summary of Media and Chemicals of Concern (COCs) Exceeding Terrestrial and Aquatic Ecological Ecotoxicity Quotients (EQs)

Area	Scenario	Media	Chemical(s) of Concern [COC(s)] a and EQs
11	Mammal		
	(Raccoon)	Soil	Ba (9.9), Cr (1.4), Pb (4.3), V (48)
	(Peromyscus Mouse)	Soil	Ba (4.9), Pb (1.4), V (32)
	(Whitetailed Deer)	Soil	Ba (1.6), V (8.0)
	Plant		
	(Blackberry)	Soil	V (5.0)
	Aquatic Organism		
	(Daphnia)	Surface Water	Al (1.3)
12	Bird		
	(Bobwhite)	Soil	Ba (10), Cr (2.7)
	Mammal		
	(Peromyscus Mouse)	Soil	Ba (3.7), Cr (1.4), Pb (1.3)
	(Whitetailed Deer)	Soil	Ba (1.2)
14	Mammal		
	(Whitetail Deer)	Soil	Pb (160)
	Plant		
	(Slender Bush Clover)	Soil	Pb (57), Cu (5.0)
17	Mammal		
	(Whitetailed Deer)	Soil	Ba (4.2)
	Plant		
	(Blackberry)	Soil	Al (430)
30	Bird		
	(Bobwhite)	Soil	Cr (2.0), Cu (1.2)
	Mammal		
	(Peromyscus Mouse)	Soil	Cr (1.0)
32	Mammal		
	(Whitetailed Deer)	Soil	V (12)
	Plant		
	(Slender Bush Clover)	Soil	V (7.5)

Notes: a Chemicals of concern (COCs) are those analytes with ecotoxicity quotients (EQs) exceeding 1.

Al = aluminum
Cr = chromium
Cu = copper
Pb = lead
V = vanadium

Source: ESE, 1995.

Table 7. Uncertainties in the Human Risk Assessment Process

RA Component	Potential for Uncertainty
Hazard Identification	* Initial section of COCs * Tentatively identified compounds (TICs) * Chemical monitoring data * Current and future land uses
Toxicity Assessment	* Selection of toxicity values * Factors used in derivation of reference doses (RfDs), including interspecies extrapolation * Weight-of-evidence for human carcinogenicity * Derivation of carcinogenic slope factors (CSFs) * Extrapolation of less-than-lifetime exposure to lifetime cancer risks Interaction of multiple substances
Exposure Assessment	* Selection of site-specific exposure pathways * Estimation of exposure concentrations without monitoring data * Estimation of exposure to multiple substances * Estimation of exposure parameters * Use of modeled values for future exposure conditions
Risk Characterization	* Addition of risks across multiple exposure pathways * Addition of risks from multiple substances

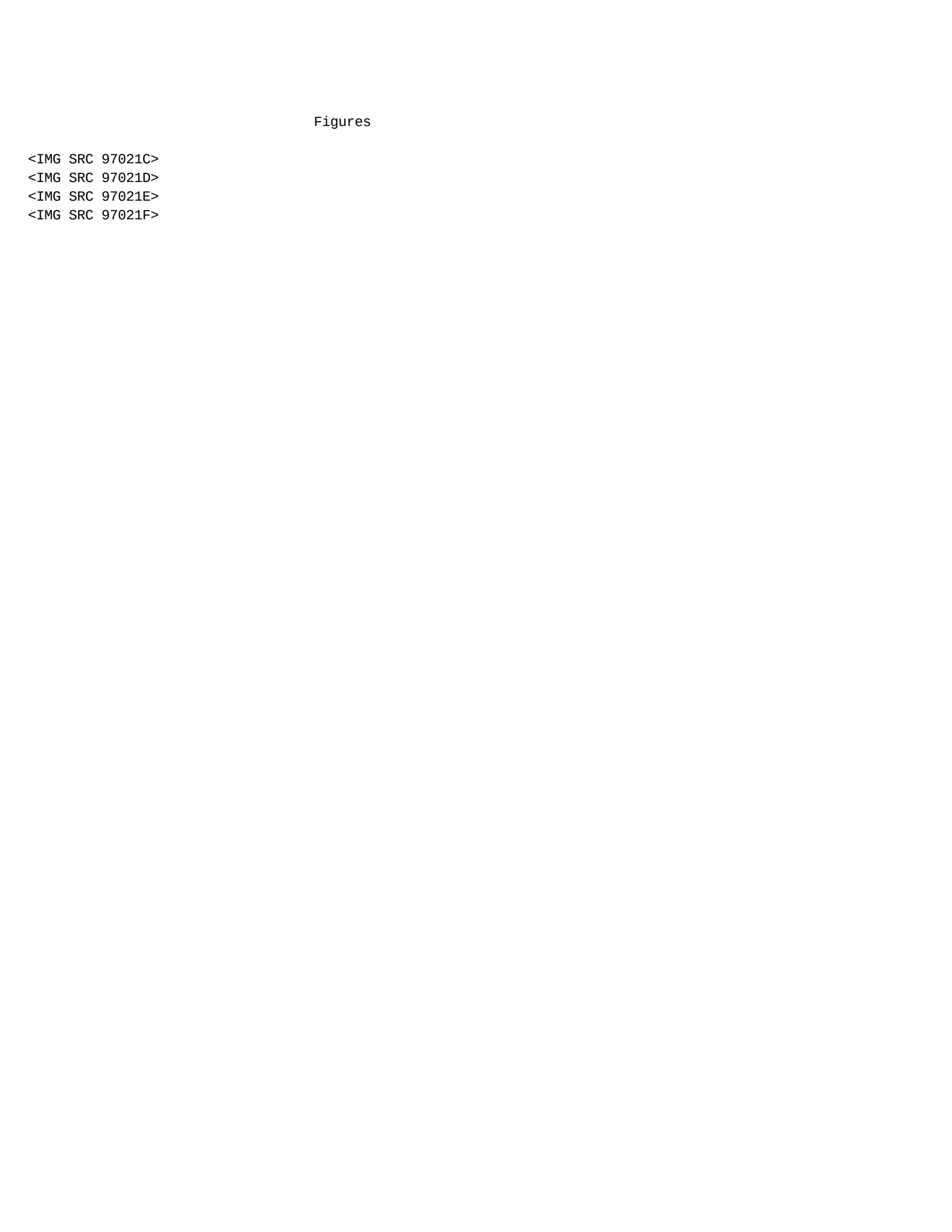
Source: ESE.

Table 8. Uncertainties in the Ecological Risk Assessment Process

ERA Component	Potential for Uncertainty
COPC Selection	* Chemical monitoring data collected over time, analyzed by different laboratories, and evaluated using varying quality assurance methodology * Presence of tentatively identified compounds (TICs) * Current and future land uses * Lack of site-specific background data
Exposure Assessment	* Selection of terrestrial and aquatic indicator species * Selection of site-specific exposure pathways * Estimation of surface water and sediment concentrations without monitoring data * Estimation of exposure to multiple substances * Estimation of exposure parameters
Toxicity Assessment	* Selection of benchmark values * Uncertainty factors used in derivation of toxicity reference values (TRVs), including interspecies extrapolation * Interaction of multiple substances
Risk Characterization	* Evaluation of risks from multiple exposure pathways * Addition of risks from multiple substances * Use of generalized ambient water quality criteria (AWQCs) and water quality standards (WQSs) to evaluate risks to aquatic life

Source: ESE.

Figures



4WD-FFB

Certified Mail
Return Receipt Requested

Mr. Randy Nida
U.S. Army Industrial Operations Command
Building 390, 4th Floor, NW Wing
AMSID-EQE
Rock Island, Illinois 61299-6000

SUBJ: Concurrence with Final Record of Decision for Operable Unit 5
Alabama Army Ammunition Plant (AAAP), Childersburg, Alabama

Dear Mr. Nida:

The U.S. Environmental Protection Agency (EPA) Region IV has reviewed the above referenced decision document and concurs with the Final Record of Decision (ROD) for Operable Unit 5, Areas A Soil and Groundwater, as supported by the Remedial Investigation and Baseline Risk Assessment Reports.

The selected remedies ares Alternative 13-6 for Study Area 13, Alternative 14-3 for Study Area 14, and No Further Action for all remaining Study Areas and groundwater. EPA concurs with the selected remedy as detailed in the ROD.

This action is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action and is cost effective.

<IMG SRC 97021G>

cc: Richard Isaac, U.S. Army Environmental Center
Kenneth Gray, U.S. Army Corps of Engineers
C.H. Cox, Alabama Department of Environmental Management