FINAL
PROPOSED PLAN
FOR LHAAP-35B (37), CHEMICAL LABORATORY and LHAAP-67, ABOVEGROUND STORAGE TANK FARM

ISSUED BY: U.S. ARMY

Longhorn Army Ammunition Plant
Karnack, Texas

June 2008

THE U.S ARMY ANNOUNCES PROPOSED PLAN FOR LHAAP-35B (37) and LHAAP-67

Dates to remember: June 17 to July 16, 2008
MARK YOUR CALENDER

PUBLIC COMMENT PERIOD:
June 17, 2008 to July 16, 2008
The U.S. Army will accept written comments on the Proposed Plan during the public comment period.

PUBLIC MEETING: The U.S. Army will hold a public meeting to explain the Proposed Plan for LHAAP-37 and LHAAP-67. Oral and written comments will be accepted at the meeting. The meeting will be held on June 23, 2008 from 6:00 p.m. to 8:00 p.m. at Karnack Community Center.

For more information, see the Administrative Record at the following location:

Marshall Public Library
300 S. Alamo
Marshall, Texas 75670
Business Hours:
Monday – Thursday (10:00 a.m. – 8:00 p.m.)
Friday – Saturday (10:00 a.m. – 5:00 p.m.)

For further information on LHAAP-35B (37) and LHAAP-67, please contact:
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Site Manager
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Ratcliff, Arkansas, 72951
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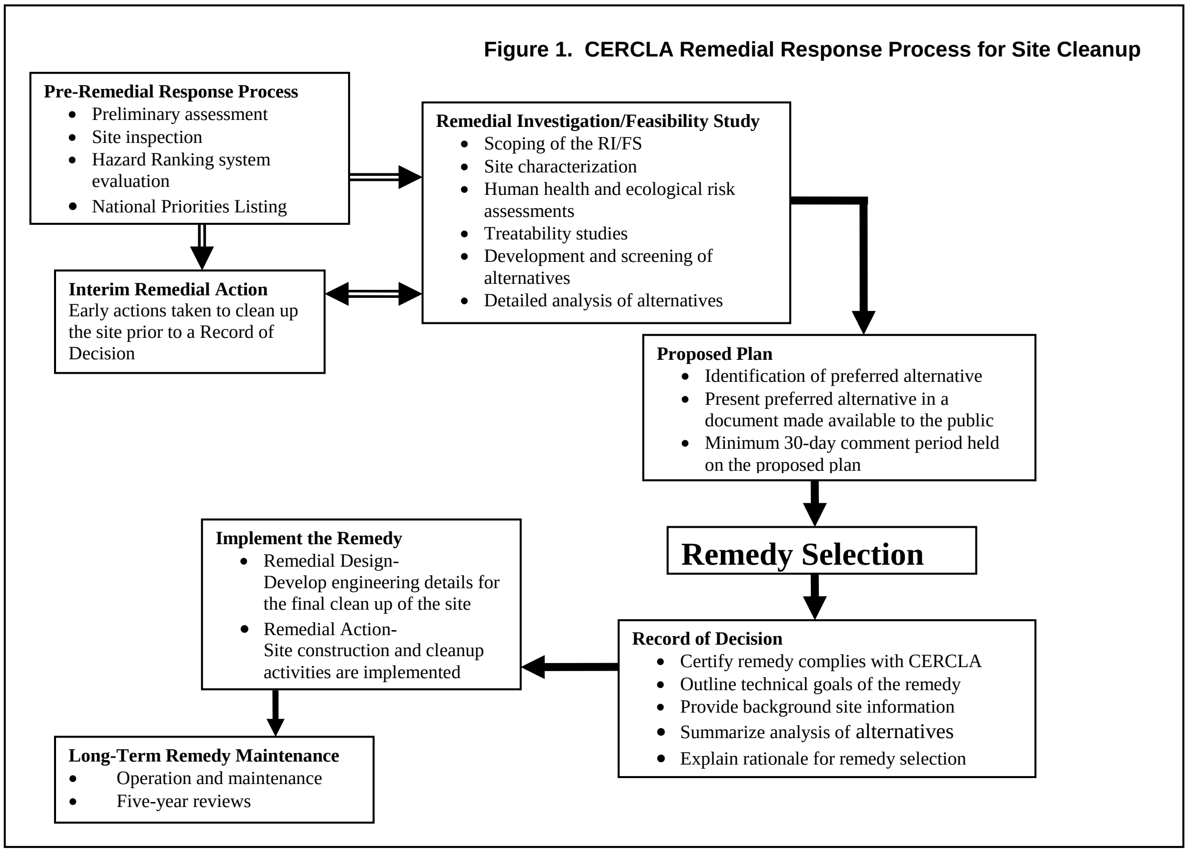
Direct No.: 479.635.0110

The purpose of this Proposed Plan is to present for public review, the remedial alternatives for LHAAP-35B (37) and LHAAP-67. This Proposed Plan identifies the Preferred Remedial Alternative for LHAAP-35B (37), site of a former chemical laboratory, and LHAAP-67, a former aboveground storage tank farm, at the former Longhorn Army Ammunition Plant (LHAAP). In addition, this plan includes summaries of other potential remedial alternatives evaluated for implementation at these sites. The primary purpose of the Proposed Plan is to facilitate public involvement in the remedy selection process. The Proposed Plan will provide the public with basic background information about LHAAP-35B (37) and LHAAP-67, identify the preferred final remedies for potential threats posed by the chemical contamination at these sites, explain the rationale for the preference, and describe other remedial options considered.

The U.S. Army is issuing this Proposed Plan for public review, comment, and participation to fulfill part of its public participation responsibilities under Section 117(a), 113(k)(2)(B), and 121(f)(1)(G) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986, and under Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The CERCLA prescribes a step-wise progression of increasingly complex activities to respond to risk posed by contaminated sites **(Figure 1)**. The preparation and review of a Proposed Plan is a distinct step required by CERCLA. This Proposed Plan summarizes information that can be found in greater detail in the Remedial Investigation (RI) Report, the Final RI Report Addendum, the Feasibility Study (FS) Reports, the Monitored Natural Attenuation (MNA) Modeling Report, the Natural Attenuation Evaluation Report, the Installation-Wide Baseline Ecological Risk Assessment (BERA), and other supporting documents that are contained in the Administrative Record for LHAAP-35B (37) and LHAAP-67. The project management team, including the U.S. Army, U.S. Environmental Protection Agency (USEPA), and the Texas Commission on Environmental Quality (TCEQ),



encourages the public to review these documents to gain a more comprehensive understanding of the environmental conditions at LHAAP-35B (37) and LHAAP-67, and also to review and comment on the alternatives presented in this Proposed Plan.

The U.S. Army, the lead agency for environmental response actions at LHAAP is acting in partnership with USEPA Region 6 and TCEQ. As the lead agency, the U.S. Army is charged with planning and implementing remedial actions at LHAAP. Regulatory agencies assist the U.S. Army by providing technical support, project review, project comment, and oversight in accordance with the Federal Superfund law and the existing Federal Facilities Agreement.

SITE BACKGROUND

LHAAP is located in central-east Texas in the northeastern corner of Harrison County **(Figure 2)**. The installation originally occupied over 8,400 acres between State Highway 43 at Karnack, Texas, and the western shore of Caddo Lake. The nearest cities are Marshall, Texas, approximately 14 miles to the southwest, and Shreveport, Louisiana, approximately 40 miles to the southeast.

Caddo Lake, a large freshwater lake situated on the Texas-Louisiana border and a drinking water source for multiple communities, bounds LHAAP to the north and east.

The U.S Army has transferred approximately 7,000 acres to the U.S. Fish and Wildlife Service (USFWS) for

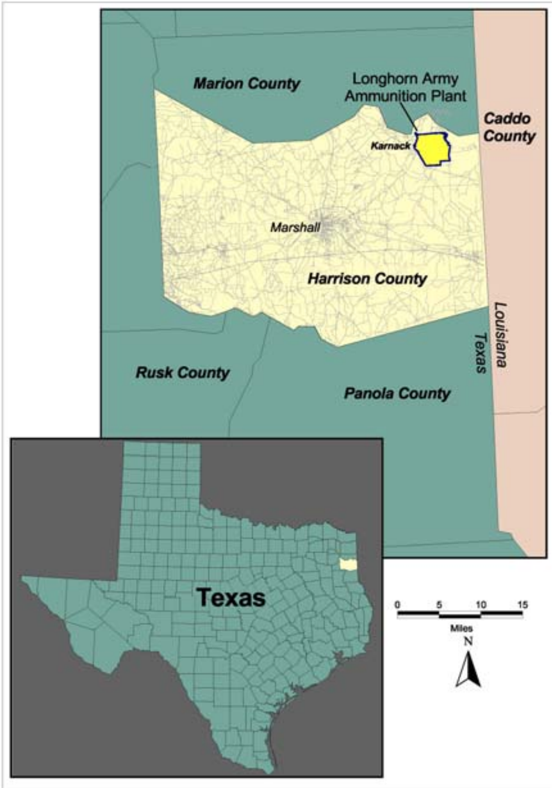


Figure 2 Location of the Longhorn Army Ammunition Plant, Harrison County, Texas

management as the Caddo Lake National Wildlife Refuge. The property transfer process is continuing as response is completed at individual sites.

Due to releases of chemicals from operation and maintenance (O&M) activities at the facility, LHAAP was placed on the Superfund National Priorities List (NPL) on August 9, 1990. Activities to remediate contamination associated with the listing of LHAAP as a Superfund site began in 1990. After being listed on the NPL, the U.S. Army, the USEPA, and the Texas Water Commission (currently known as the TCEQ) entered into a CERCLA Section 120 Federal Facility Agreement (FFA) for remedial activities at LHAAP. The FFA became effective December 30, 1991. LHAAP operated until 1997 when it was placed on inactive status and classified by the U.S. Army Armament, Munitions, and Chemical Command as excess property.

Although not listed in the FFA, LHAAP-35B (37) and LHAAP-67 have been identified to have environmental concerns and are being addressed as NPL sites. Site characteristics, scope and role of response action, and summary of site risks are addressed separately for each site. This is then followed by a presentation of the remedial action objectives (RAOs) and summary of remedial alternatives combining both LHAAP-35B (37) and LHAAP-67 since the RAOs and remedial alternatives (summary, evaluation, and preferred alternative) are the same for each site, as documented in its respective Feasibility Study. Finally, an evaluation of alternatives and summary of the preferred alternative is presented combining both sites.

LHAAP-35B (37)

LHAAP-35B (37), known as the Chemical Laboratory, is located in the north-central portion of LHAAP near the southwestern corner of LHAAP-47 **(Figure 3)**. The site covers approximately 12.2 acres. The Chemical Laboratory, built during the construction of Plant 3 (1953-1955), was originally used to support the production activities at LHAAP. These support activities included research and testing of materials used in the production processes and quality assurance testing. Also, one waste rack sump was located at the site. In 1998, the site was used as a staging area in support of investigation activities. LHAAP-35B (37) was active through 1999.

LHAAP-35B (37)

Site Characteristics

The surface features at LHAAP-35B (37) include a mixture of asphalt-paved roads and parking area, several administration buildings, the former Chemical Laboratory (Building 29-A), and a mixture of wooded and grassy vegetation-covered areas. The topography in this area is relatively flat with the surface drainage flowing into Goose Prairie Creek. The creek runs perpendicular to the western border of the site and then turns south through the east-central portion of the site and eventually drains into Caddo Lake. The lake is a source of drinking water for several neighboring communities in Louisiana.

Groundwater at the site was encountered at 12 to 33 feet below ground surface (bgs) in the upper shallow zone, to 47 feet in the lower shallow zone and at about 70 feet in the intermediate zone. Groundwater flow at the site has a general east-northeast flow direction, although the groundwater flow direction may vary locally during high water table conditions due to the influence of Goose Prairie Creek. Based on a comparison between the surveyed elevation of the Goose Prairie Creek bed and the elevation of the shallow groundwater zone during certain seasons of the year, groundwater likely does not discharge to Goose Prairie Creek. However, due to uncertainties regarding the seasonal variations in the water table elevation, it is assumed that the shallow groundwater may discharge into the creek when the water table is high. In contrast, because the intermediate groundwater zone is deeper than the shallow groundwater zone, the groundwater from the intermediate zone is not likely to discharge into Goose Prairie Creek.

The average groundwater velocity is 1.74 feet/day for LHAAP-35B (37), based on the average hydraulic conductivity, hydraulic gradient and effective porosity (Shaw, 2007a). For LHAAP-35B (37), modeling results indicated that groundwater contaminants will either not appear (tetrachloroethene [PCE] and 1,1-dichloroethene [1,1-DCE]) or will be below maximum contaminant level (MCL) (trichloroethene [TCE]) at the point of entry to surface water.

Between 1993 and 1998 several investigations were conducted in a phased approach to determine the nature and extent of contamination at LHAAP-35B (37). Media investigated included soil and groundwater.

Multiple chemicals including metals and low levels of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), dioxins and pesticides were detected in soil. Based on a human health risk assessment conducted for the site, none of the soil contaminants were determined to have unacceptable carcinogenic risk or non-carcinogenic hazard to a future maintenance worker under an industrial scenario.

Metals and multiple chlorinated constituents were detected in shallow and intermediate groundwater bearing zones. Groundwater contamination was detected in one shallow well and in one intermediate well. The intermediate well is located several hundred feet and potentially upgradient from the shallow well. The contamination in the intermediate well may be due to an undocumented historic release in the vicinity of the well. Alternatively, potential variations in local groundwater flow direction may have caused contamination from a historic source located within the vicinity of the shallow well to migrate to the intermediate zone. Eleven different VOCs were detected in the shallow well and six different VOCs were detected in the intermediate well during the sampling events.

The primary contaminants detected in groundwater at the site included the following chlorinated solvents:

1,1-DCE, TCE, and PCE at maximum concentrations of 58, 330, and 34 parts per billion (ppb), respectively. Except for two detections of carbon disulfide and TCE, the VOCs in groundwater were not detected in the soil samples collected from the site.

In 2004, as part of the groundwater data gaps investigation, additional groundwater sampling was conducted at the site. The concentrations of the primary contaminants detected during this investigation were lower than historical concentrations (Shaw, 2007b).

New monitoring wells were installed in 2006 and 2007 (Shaw, 2007c). The purpose of these wells was to define the downgradient extent of contamination, determine whether the contamination was in the upper or lower shallow groundwater zone, replace an improperly screened well, and evaluate natural attenuation in groundwater. Chemicals of concern (COCs) were not detected in the lower shallow groundwater zone suggesting that PCE and TCE are only present in the upper shallow groundwater zone. 1,1-DCE was either nondetect or was below the MCL in all monitoring wells. VOC results for the down-gradient monitoring well were less than their reporting limit.

LHAAP-35B (37) contaminants are confined to the upper shallow groundwater zone and have not migrated into the lower shallow or intermediate zones. Natural attenuation has effectively controlled plume migration and appears to have stabilized the VOC plume. The groundwater data collected at LHAAP-35B (37) indicate a decrease in PCE and TCE concentrations from their historical high values in 37BWW59 (35BWW08) over the 12 year monitoring period and have remained relatively stable in MW58. The monitored natural attenuation evaluation demonstrates that natural attenuation mechanisms including reductive biodegradation, dilution, dispersion, sorption, and volatilization, may all be contributing to the observed reduction in COC concentrations at LHAAP-35B (37). Biodegradation pathways such as cometabolic or oxidative dechlorination may also contribute to the reduction of COCs (Shaw, 2007c).

Based on the human health risk assessment, groundwater poses an unacceptable carcinogenic risk and non-carcinogenic hazard to a future maintenance worker under an industrial scenario. The COCs are 1,1-DCE, TCE, and PCE due to their contribution to the unacceptable cancer risk and non-cancer hazard. Although contaminated groundwater poses a risk, it is not considered a “principal threat” as defined by USEPA guidance.

Scope and Role of the Action

The recommended remedial action at LHAAP-35B (37) will prevent potential risks associated with exposure to contaminated groundwater. Although groundwater at Longhorn is not currently being used as drinking water, nor will it be used in the future based on its reasonably anticipated use as a national wildlife refuge, the State of Texas views all groundwater as a potential drinking water source. Therefore, drinking water standards (MCLs) are viewed as relevant and appropriate.

The preferred remedial action will also ensure containment of the plume to prevent potential impact to surface water. The potential exists for contaminated shallow groundwater to migrate toward and discharge into nearby Goose Prairie Creek, which could ultimately affect Caddo Lake, a source of drinking water.

In addition, the preferred action will include groundwater monitoring to demonstrate that the plume is not migrating at levels that present a potential impact to nearby Goose Prairie Creek and to verify that contaminant levels are being reduced to MCLs when land use controls (LUCs) may be terminated.

Summary of LHAAP-35B (37) Site Risks

The reasonably anticipated future use of this site is industrial/recreational as part of the Caddo Lake National Wildlife Refuge. This anticipated future use is based on a Memorandum of Agreement (U.S. Army, 2004) between the USFWS and the United States Army which documents the transfer process of the LHAAP acreage to USFWS to become the Caddo Lake National Wildlife Refuge. Presently the Caddo Lake National Wildlife Refuge occupies approximately 7,000 acres of the former installation. The property must be kept as a National Wildlife Refuge unless there is an act of Congress which removes the parcel or the land is exchanged in accordance with the National Wildlife Refuge System Administration Act of 1966 and the National Wildlife Refuge System Act Amendments of 1974.

As part of the RI/FS, a baseline human health risk assessment and screening ecological risk assessment were conducted for LHAAP-35B (37) to determine current and future effects of contaminants on human health and the environment to support technical review and risk management decisions.

Human Health Risks

During the RI, cancer risk and the non-cancer hazard index (HI) were calculated based on future maintenance worker exposure to the site environmental media (e.g., soil and groundwater) under an industrial scenario. Despite the detections of multiple chemicals in the soil, none of the contaminants were determined to have unacceptable carcinogenic risk or non-carcinogenic hazard to a future maintenance worker under the industrial scenario. The human health risk assessment indicated that the cancer risk and non-cancer hazard for soil were below the lower end of the target risk range, which is 10^{-6}, and HI of 1, respectively. However, the groundwater was determined to pose an unacceptable carcinogenic risk of 5.8×10^{-4} and a hazard index of 16 to the future maintenance worker under the industrial scenario. 1,1- DCE and TCE accounted for approximately 90 percent of the total groundwater carcinogenic risk (Jacobs, 2003). TCE, thallium, and antimony account for approximately 96 percent of the groundwater HI.

The primary COCs in groundwater are 1,1-DCE, TCE, and PCE due to their contribution to an unacceptable human health risk and hazard to the future maintenance worker. The maximum detected concentrations of 1,1- DCE, TCE, and PCE were 58, 330, and 34 ppb, respectively. The maximum detected concentrations exceed the MCLs of 7 ppb for 1,1-DCE and 5 ppb for TCE and PCE which are federal and state drinking water standards. Although the risk assessment reported that thallium and antimony contributed to the groundwater non-carcinogenic hazard, the maximum detections of thallium and antimony in groundwater were low and also J-qualified (i.e., the reported values were estimated values since they were below the reporting limit). Furthermore, although groundwater samples collected during multiple sampling events were analyzed for metals, thallium and antimony were only detected during one event.

Because the risk evaluation was based on the reasonably anticipated future use as a wildlife refuge, Texas Administrative Code requires that a notification be filed in the county disclosing that the site has not been evaluated for unrestricted use. Additionally, limited monitoring in the form of Five-Year Reviews will serve to document that the use of the site remains consistent with the industrial/recreational exposure scenario evaluated in the risk assessment.

Ecological Risks

The ecological risk for site LHAAP-35B (37) was addressed in the installation-wide Baseline Ecological Risk Assessment (BERA) (Shaw, 2007d). For the BERA, the entire installation was divided into three large sub-areas (i.e., the Industrial Sub-Area, Waste Sub-Area, and Low Impact Sub-Area) for the terrestrial evaluation. The individual sites at LHAAP were grouped into one of these sub-areas, which were delineated based on commonalities of historic use, habitat type, and spatial proximity to each other. The conclusions regarding the potential for chemicals detected at individual sites to adversely affect the environment must be made in the context of the overall conclusions of the sub-area in which the site falls. Site LHAAP-35B (37) lies within the Industrial Sub-Area.

The BERA concluded that no unacceptable risk was present in the Industrial Sub-Area (Shaw, 2007d) and therefore, no action is needed at LHAAP-35B (37) for the protection of ecological receptors.

It is the current judgment of the U.S. Army that the preferred alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

LHAAP-67

LHAAP-67, a former aboveground storage tank farm, is located in the central portion of LHAAP on the southeast corner of 48th Street and Ignatius Avenue **(Figure 3)**. The site covers an area of 1.91 acres. When operational the site consisted of seven aboveground storage tanks of unknown size. The tanks were surrounded with earthen dikes designed to contain potential spills. Site personnel indicated that the tanks were used for solvent storage. The tanks have been removed and the only structure remaining at the site is a railroad bed.

LHAAP-67 Site Characteristics

LHAAP-67 is relatively flat. The nearest significant surface water body to LHAAP-67 is Central Creek located approximately 870 feet southeast of the site. Runoff from LHAAP-67 could potentially discharge to surface water in Central Creek which flows into Caddo Lake. The lake is a source of drinking water supply for several neighboring communities in Louisiana. Groundwater at the site was encountered at depths of

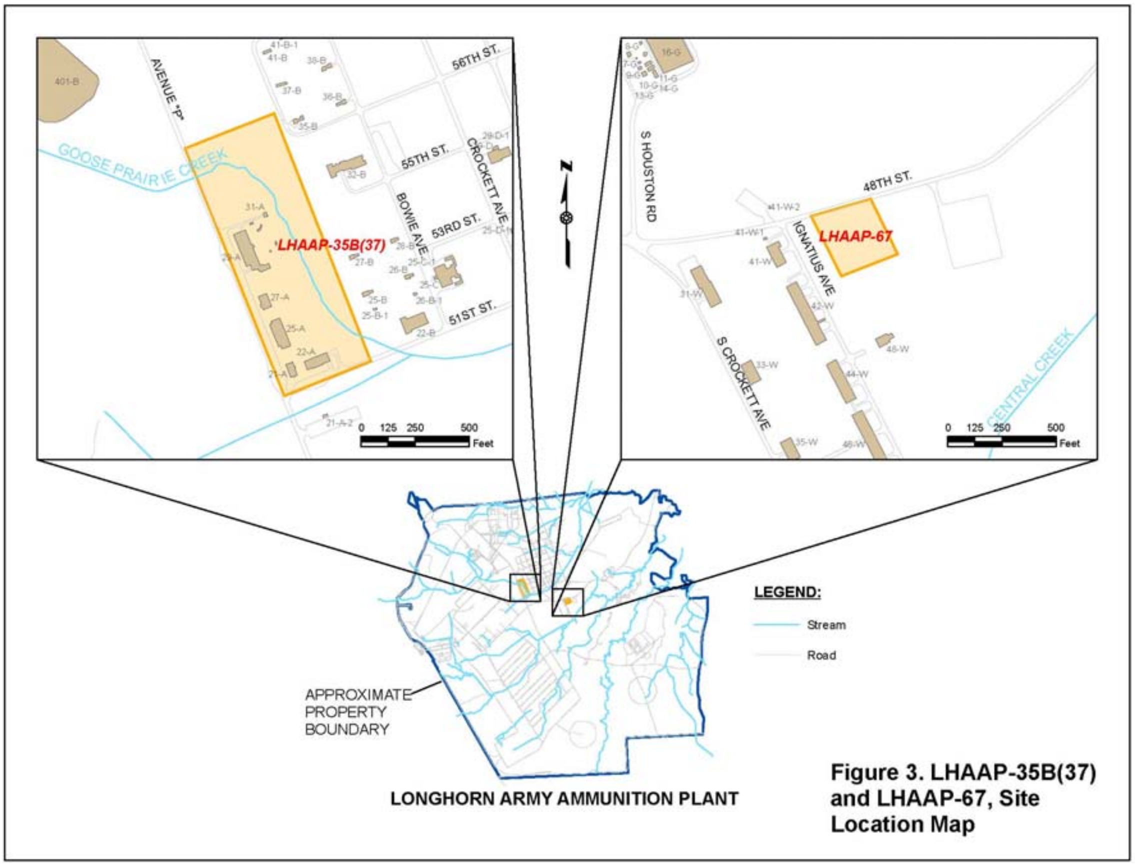


Figure 3. LHAAP-35B(37) and LHAAP-67, Site Location Map

17 to 20 feet bgs, has an easterly and southeasterly flow and may likely discharge into Central Creek which flows to Caddo Lake. Elevation data from U.S. Geological Survey topographic maps indicate that the shallow groundwater may be several feet below the bottom of Central Creek. Therefore, the shallow groundwater may not discharge into Central Creek. However, due to the uncertainty in the exact elevation of Central Creek near LHAAP-67, it is assumed that the groundwater may discharge into Central Creek during certain seasons of the year when the water table is high.

The average groundwater velocity is 14.7 feet/day for LHAAP-67, based on the average hydraulic conductivity, hydraulic gradient and effective porosity (Shaw, 2007a). For LHAAP-67, based on modeling, current maximum contaminant concentrations at the source are lower than medium specific concentrations protective of surface water. Contaminant levels decrease substantially with mixing and dilution to levels that are below the MCL at the point of discharge into Central Creek.

Between 1998 and 2000, remedial investigations were conducted to determine the nature and extent of contamination at LHAAP-67. Media investigated included soil and groundwater.

Multiple metals and one VOC, methylene chloride, were detected in soil. However, based on a human health risk assessment conducted at the site, none of the contaminants were determined to have unacceptable carcinogenic risk or non-carcinogenic hazard to a future maintenance worker under an industrial scenario.

Five VOCs, multiple metals and anions were detected in groundwater in three wells located in the central portion of the site. VOCs detected in the groundwater exceeding their respective MCLs included 1,1,1-trichloroethane (TCA), 1,1,2-TCA, 1,2-dichloroethane (DCA), TCE, and 1,1-DCE at maximum concentrations of 1800, 33, 27, 6.3, and 380 ppb, respectively (Jacobs, 2002).

Chlorinated compounds were not detected above their respective MCLs in the groundwater samples collected from the site perimeter wells indicating that contamination had not migrated far from the source.

In 2004, as part of the groundwater data gaps investigation, additional groundwater sampling was conducted at the site (Shaw, 2007b). Groundwater analytical results indicate that chlorinated compounds detected above the MCLs were present in only one shallow monitoring well and at concentrations that were lower than those reported during the RI.

In December 2006, additional groundwater sampling was conducted at the site. Analytical results indicate that only one well (67WW01) exhibited concentrations of TCE, 1,1-DCE, and 1,2-DCA exceeding their respective MCLs. Currently, 1,1,1-TCA and 1,1,2-TCA are not exceeding the MCLs (Shaw, 2007c).

At LHAAP-67, the evaluation of historical VOC trends provides strong evidence that natural attenuation processes have contributed to a significant reduction in COC concentrations and prevented plume migration. This data also suggests that natural attenuation mechanisms other than reductive biodegradation such as dilution, dispersion, sorption, and volatilization are likely the primary contributors to the reduction in COC concentrations at LHAAP-67. Other biodegradation pathways such as cometabolic or oxidative dechlorination may also contribute to the reduction of COCs (Shaw, 2007c).

Natural attenuation effectively controls plume migration and has stabilized the size of the area exhibiting COC concentrations exceeding MCL values.

Scope and Role of the Action

The recommended remedial action at LHAAP-67 will prevent potential risks associated with exposure to contaminated groundwater. Although groundwater at Longhorn is not currently being used as drinking water, nor will it be used in the future based on its reasonably anticipated use as a national wildlife refuge, the State of Texas views all groundwater as a potential drinking water source. Therefore, drinking water standards (MCLs) are viewed as appropriate and relevant.

The preferred remedial action will also ensure containment of the plume to prevent potential impact to surface water. The potential exists for contaminated shallow groundwater to migrate toward and discharge into nearby Central Creek, which could ultimately affect Caddo Lake, a source of drinking water.

In addition, the preferred action will include groundwater monitoring to demonstrate that the plume is not migrating at levels that present a potential impact to nearby Central Creek and to verify that contaminant levels are being reduced to MCLs when LUCs may be terminated.

Summary of LHAAP-67 Site Risks

The reasonably anticipated future use of this site is industrial/recreational as a national wildlife refuge. This anticipated future use is based on a Memorandum of Agreement (U.S. Army, 2004) between the USFWS and the United States Army which documents the transfer process of the Longhorn Army Ammunition Plant acreage to USFWS to become the Caddo Lake National Wildlife Refuge. Presently the Caddo Lake National Wildlife Refuge occupies approximately 7,000 acres of the former installation. An act of Congress is required to remove acreage from a national wildlife acreage.

As part of the RI/FS, a baseline human health risk assessment and screening ecological risk assessment were conducted for LHAAP-67 to determine current and future effects of contaminants on human health and environment and to support technical review and risk management decisions.

Human Health Risks

During the RI, cancer risk and the non-cancer HI were calculated based on future maintenance worker exposure to the site environmental media (e.g., soil and groundwater) under an industrial scenario. Despite the detection of the metals and methylene chloride in the soil, none of the contaminants were determined to have unacceptable carcinogenic risk or non-carcinogenic hazard to a future maintenance worker under an industrial scenario. The human health risk assessment indicated that the cancer risk and non-cancer hazard for soil were below the target risk range of 10^{-4} to 10^{-6} and HI of 1, respectively. However, the groundwater was determined to pose an unacceptable cancer risk of 3.1×10^{-3} and a hazard index of 4.1 to the future maintenance worker.

The primary COCs in groundwater are 1,1,1-TCA, 1,1,2-TCA, 1,2- DCA, TCE, and 1,1- DCE because of their contribution to an unacceptable human health risk and hazard to the future maintenance worker. 1,1-DCE accounted for approximately 98 percent of the total groundwater carcinogenic risk (Jacobs 2003).

The maximum detected concentrations of 1,1,1-TCA, 1,1,2-TCA, 1,2- DCA, TCE, and 1,1- DCE were 1800, 33, 27, 6.3, and 380 ppb, respectively. The maximum detected concentrations exceed the MCLs of 200 ppb for 1,1,1-TCA, 5 ppb for 1,1,2-TCA, 1,2-DCA, and TCE; and 7 ppb for 1,1-DCE, which are federal and state drinking water standards.

Because the risk evaluation was based on the reasonably anticipated future use as a wildlife refuge, Texas Administrative Code requires that a notification be filed in the county disclosing that the site has not been evaluated for unrestricted use. Additionally, limited monitoring in the form of Five-Year Reviews will serve to document that the use of the site remains consistent with the industrial/recreational exposure scenario evaluated in the risk assessment.

Ecological Risk

The ecological risk for site LHAAP-67 was addressed in the installation-wide Baseline Ecological Risk Assessment (BERA) (Shaw, 2007d). For the BERA, the entire installation was divided into three large sub-areas (i.e., the Industrial Sub-Area, Waste Sub-Area, and Low Impact Sub-Area) for the terrestrial evaluation. The individual sites at LHAAP were grouped into one of these sub-areas, which were delineated based on commonalities of historic use, habitat type, and spatial proximity to each other. The conclusions regarding the potential for chemicals detected at individual sites to adversely affect the environment must be made in the context of the overall conclusions of the sub-area in which the site falls. Site LHAAP-67 lies within the Industrial Sub-Area.

The BERA concluded that no unacceptable risk was present in the Industrial Sub-Area (Shaw, 2007d) and therefore, no action is needed at LHAAP-67 for the protection of ecological receptors.

It is the current judgment of the U.S. Army that the preferred alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

REMEDIAL ACTION OBJECTIVES

During the feasibility studies for LHAAP-35B (37) and LHAAP-67, the final RAOs were established to address contamination associated with the media at the sites. The RAOs for LHAAP-35B (37) and LHAAP-67 include:

- Protection of human health by preventing human exposure to the contaminated groundwater
- Protection of human health and the environment by preventing contaminated groundwater from migrating into nearby surface water at levels that exceed applicable or relevant and appropriate requirements (ARARs)

SUMMARY OF REMEDIAL ALTERNATIVES

The feasibility studies identified and screened remedial technologies and associated process options that may be appropriate for satisfying the RAOs for LHAAP-35B (37) and LHAAP-67 with respect to effectiveness, implementability, and cost. The following remedial alternatives were developed from the retained remedial technologies carried forward after the initial screening:

- Alternative 1 – No Action
- Alternative 2 – Land Use Controls (LUCs) with Monitored Natural Attenuation (MNA)
- Alternative 3 – In Situ Bioremediation, Land Use Controls (Short Term)
- Alternative 4 – Groundwater Extraction, On-Site Treatment, Surface Water Discharge, and Land Use Controls (short term)

Alternative 2 is recommended as the preferred alternative.

Common Elements. Because contamination would be left in place at LHAAP-35B (37) and LHAAP-67 for Alternative 2, and because contamination would be present for the duration of remedial activities in Alternatives 3 and 4, LUCs would be common to these alternatives. The LUCs would support the RAOs. The Army intends to provide details of the LUCs implementation actions in a remedial design (RD) document for the two sites.

The LUCs to prevent human exposure to residual groundwater contamination presenting an unacceptable risk to human health:

- Ensure no withdrawal or use of groundwater beneath the sites for anything other than environmental monitoring and testing

The U.S. Army would be responsible for implementation, maintenance, inspection, reporting, and enforcement of the LUCs. The Army intends to provide details of the LUCs implementation and maintenance actions in an RD for LHAAP-35B (37) and LHAAP-67. The groundwater restriction LUCs shall be maintained until the concentrations of contaminants in groundwater have been reduced to levels below their respective MCLs. In addition, the Texas Department of Licensing and Regulation responsible for notifying well drillers of groundwater restrictions would be notified and a notification and/or recordation with the Harrison County Courthouse would include a map showing the areas of groundwater restriction at the site as well as the area that has not been evaluated for unrestricted use.

In order to transfer this property (LHAAP-35B (37) and LHAAP-67), an Environmental Condition of Property (ECOP) document will be prepared and attached to the letter of transfer. The property will be transferred subject to the land use and restriction covenants that are identified in the ECOP. These restrictions would prohibit or restrict property uses that may result in exposure to the contaminated groundwater (e.g., drilling restrictions, residential/agricultural land use restrictions, drinking water well restrictions).

Alternatives 2, 3, and 4 also include inspection and long-term groundwater monitoring activities. Monitoring would be continued as required to demonstrate effectiveness of the remedies, compliance with ARARs, to-be-considered requirements, RAOs, and to support CERCLA Five-Year Reviews.

Although the U.S. Army may later pass these procedural responsibilities to the transferee by property transfer agreement, the U.S. Army shall retain ultimate responsibility for remedy integrity.

Alternative 1 – No Action. As required by the NCP, the no action alternative provides a comparative baseline against which the action alternatives can be evaluated. Under this alternative, the groundwater would be left "as is" without implementing any additional containment, removal, treatment, or other mitigating actions. No other actions would be implemented to prevent potential human exposure to contaminated groundwater or to demonstrate that nearby surface water bodies are protected from groundwater impacts.

LHAAP-35B (37):

Estimated Capital Cost: $0

Estimated O&M Cost: $0

Estimated Duration: -

Estimated Present Worth Cost: $0

LHAAP-67:

Estimated Capital Cost: $0

Estimated O&M Cost: $0

Estimated Duration: -

Estimated Present Worth Cost: $0

Alternative 2 – Land Use Controls and Monitored Natural Attenuation

Alternative 2 is the preferred alternative. The goals of this alternative are containment of the plume for the protection of surface water through monitored natural attenuation of contaminants and protection of the industrial worker by preventing exposure to contaminated groundwater through LUCs.

MNA is an active remedy that relies on natural biological, chemical, and physical processes to reduce the mass and concentration of groundwater COCs under favorable conditions. MNA would assure the protection of human health and the environment by documenting containment of contaminated groundwater and preventing migration of contaminants into nearby surface water at levels that exceed MCLs. The LUCs would remain in effect until MCLs are met.

Based on groundwater modeling, groundwater MCLs are expected to be met through natural attenuation in 28 to 38 years for PCE, 39 to 43 years for TCE, and 16 to 21 years for 1,1-DCE at LHAAP-35B (37) (Shaw, 2007e and U.S. Army, 2008). Considering the lithologic variability, particularly the lateral and vertical change from sand to clay, the times to MCL may range to an order of magnitude greater. For LHAAP-67, MCLs would be met through natural attenuation in 17 to 66 years for TCE, 20 to 34 years for 1,1-DCE, and 21 to 43 years for 1,2-DCA. Although the times to MCL for 1,1,1-TCA and 1,1,2-TCA were originally modeled to be 22 and 20 years respectively, these two VOCs are no longer detected above MCLs at LHAAP-67 (Shaw, 2007e, U.S. Army, 2008). The LUCs would be included in the property transfer documents.

LHAAP-35B (37):

Estimated Capital Cost: $79,000

Estimated O&M Cost: $393,000

Estimated Duration: 30 years

Estimated Present Worth Cost: $282,000

LHAAP-67:

Estimated Capital Cost: $47,000

Estimated O&M Cost: $607,000

Estimated Duration: 30 years

Estimated Present Worth Cost: $316,000

Alternative 3 – In Situ Bioremediation, Land Use Controls (Short Term). The goals of this alternative are containment of the plume for the protection of surface water through in situ bioremediation and protection of the industrial worker by preventing exposure to contaminated groundwater. To achieve these goals, this alternative utilizes in situ bioremediation to reduce groundwater contaminant concentrations to the MCLs, and maintains LUCs only until such time that the MCLs are met for groundwater contaminants through remediation.

LHAAP-35B (37):

Estimated Capital Cost: $2,535,000

Estimated O&M Cost: $317,000

Estimated Duration: 6 years

Estimated Present Worth Cost: $2,664,000

LHAAP-67:

Estimated Capital Cost: $1,691,000

Estimated O&M Cost: $367,000

Estimated Duration: 6 years

Estimated Present Worth Cost: $1,793,000

Alternative 4 – Groundwater Extraction, On-Site Treatment, Surface Water Discharge, and Land Use Controls (Short Term). The goals of this alternative are similar to those of Alternative 3: containment of the plume for the protection of surface water through groundwater extraction and protection of the industrial worker by preventing exposure to contaminated groundwater. To achieve these goals, this alternative uses groundwater extraction to remove contaminants from groundwater for treatment and maintains LUCs only until such time that the MCLs are achieved for groundwater contaminants. The extracted groundwater would be piped to the existing groundwater treatment plant.

LHAAP-35B (37):

Estimated Capital Cost: $1,271,000

Estimated O&M Cost: $1,764,000

Estimated Duration: 30 years

Estimated Present Worth Cost: $2,095,000

LHAAP-67:

Estimated Capital Cost: $1,211,000

Estimated O&M Cost: $1,904,000

Estimated Duration: 30 years

Estimated Present Worth Cost: $1,957,000

EVALUATION OF ALTERNATIVES

Nine criteria identified in the NCP are used to evaluate the different remediation alternatives individually and against each other in order to select a remedy. This section profiles the relative performance of each alternative against the nine criteria, noting how it compares to the other options under consideration. The nine evaluation criteria are discussed below. The "Detailed Analysis of Alternatives" can be found in the FSs for the two sites (Shaw 2005a, 2005b).

1. Overall Protection of Human Health and the Environment

The four alternatives provide varying levels of human health protection. Alternative 1, no action, does not achieve the RAOs and provides the least protection of all the alternatives; it provides no reduction in risks to human health or the environment because no measures would be implemented to eliminate the pathway for human exposure to the groundwater contamination and potential groundwater impacts to Goose Prairie Creek and Central Creek would not be addressed.

Alternatives 2, 3, and 4 all satisfy the RAOs for LHAAP-35B (37) and LHAAP-67. Alternatives 2, 3 and 4 provide confirmation that human health and the environment are protected because monitoring would be conducted to document that the plumes are contained and prevented from impacting Goose Prairie Creek and Central Creek at levels that could present a risk to human health. Furthermore, LUCs would protect human health by preventing access to the contaminated groundwater until contaminants in groundwater are reduced to the MCLs.

2. Compliance with ARARs

Alternative 1 does not comply with chemical-specific ARARs because no remedial action or measures would be implemented. Alternatives 2, 3 and 4 do comply with groundwater and surface water chemical specific ARARs because they are active remedial processes.

Location-specific and action-specific ARARs would not apply to Alternative 1 since no remedial activities would be conducted. Alternatives 2, 3, and 4 comply with all location-specific and action-specific ARARs.

3. Long-Term Effectiveness and Permanence

Alternative 1 would be the least effective and permanent in the long term because no contaminant removal or treatment would take place and no measures would be implemented to control exposure risks posed by contaminated site groundwater. Also, the potential exists for contaminated groundwater to migrate toward and discharge into Goose Prairie Creek and Central Creek and then subsequently into Caddo Lake, a drinking water supply. However, the results of plume migration modeling indicate that the maximum concentrations of the COCs within Goose Prairie Creek and Central Creek after plume impact would be below groundwater and surface water ARARs, which also would be protective of Caddo Lake. Alternatives 2, 3 and 4 are all active treatments that would permanently reduce contaminant levels in groundwater over time with Alternatives 2 and 4 taking the longest and approximately equal amount of time and Alternative 3 taking the least.

Although different mechanisms are prevailing at LHAAP-35B (37) and LHAAP-67, MNA effectively controls plume migration and has stabilized the size of the areas exhibiting COC concentrations exceeding MCL values. Alternatives 3 and 4 would also work to control plume migration through contaminant reduction. However, uncertainty exists regarding the ability of in situ bioremediation or groundwater extraction to fully control the plume, and therefore further evaluation would be required. Should in situ bioremediation or groundwater extraction be considered ineffective after implementation, the remedy may need to be reevaluated. Alternatives 2, 3 and 4 rely on LUCs for the protection of human health until the MCLs are achieved.

4. Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 does not employ treatment and would not result in a reduction of toxicity, mobility, or volume of contaminants.

MNA, in situ biodegration, and groundwater extraction are irreversible treatment processes that would permanently reduce the mass and concentration of contaminants and, therefore, the volume, toxicity and mobility of the contaminants. Alternatives 2 and 3, however, include the generation of daughter products that may temporarily increase toxicity or mobility of the contaminant plume, with in situ biodegradation working in a shorter time frame, but with MNA at a lower cost. Both alternatives include monitoring so that daughter products would be quantified, documented and evaluated.

Alternative 4 would provide the greatest degree of permanent reduction in toxicity, mobility and volume of the groundwater contaminants because no daughter products are generated in situ since the contaminant plume is extracted and treated ex situ.

It is noted, however, that this reduction would only occur if the results of pre-design testing and further evaluations of in situ bioremediation or groundwater extraction are favorable. MNA has already been evaluated as effective.

5. Short-Term Effectiveness

Because Alternative 1 does not involve any remedial measures, no short-term risk to workers, the community or the environment would exist. The activities associated with Alternative 2 would have little potential for short-term risk to workers or the environment, other than the minimal risks to workers associated with the exposure to contaminants during groundwater monitoring activities.

Alternatives 3 and 4 both involve potential short-term risks to workers associated with exposure to contaminated groundwater and operation of drilling/construction equipment.

Alternatives 2, 3 and 4 all contain LUCs as elements of their remedies and would provide almost immediate protection because the LUCs would be implemented relatively quickly.

The time period to achieve the groundwater remediation levels is the most significant difference between Alternative 3 versus Alternatives 2 and 4. Alternative 3 is expected to take less time to achieve RAOs, provided treatability testing for in situ bioremediation is favorable. The implementation of Alternatives 2 and 4 would require more time than Alternative 3.

6. Implementability

Under the no action alternative, no remedial action would be taken. Therefore, no difficulties or uncertainties would be associated with its implementation. Alternative 2 is easily implemented from a technical standpoint because no construction activities would be performed, although routine maintenance of the LUCs, evaluation of MNA, and sampling would be required.

Alternatives 3 and 4 are also technically implementable, although less so than Alternative 2 because of the uncertainties associated with the ability of in situ bioremediation or groundwater extraction to lower contaminant levels sufficiently to contain the whole plume with levels above the MCLs. Alternative 3 would be somewhat more difficult to implement than Alternative 4 from a technical standpoint due to the specialized expertise required to design and construct the in situ bioremediation treatment elements.

Administratively, all of the alternatives are implementable.

7. Cost

Cost estimates are used in the CERCLA FS process to eliminate those remedial alternatives that are significantly more expensive than competing alternatives without offering commensurate increases in performance or overall protection of human health or the environment. The cost estimates developed are preliminary estimates with an intended accuracy range of +50 to –30 percent. Final costs will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final scope, final schedule, final engineering design, and other variables.

Costs developed are capital costs (including fixed-price remedial construction) and long-term O&M costs (post-remediation). Overall 30-year present worth costs are developed for each alternative assuming a discount rate of 7 percent.

The progression of present worth costs from the least expensive alternative to the most expensive alternative is as follows: Alternative 1, Alternative 2, Alternative 3, and Alternative 4. No costs are associated with Alternative 1 because no remedial activities would be conducted.

Alternative 2 has the lowest present worth and capital costs of the active remedial alternatives. The present worth cost for Alternatives 2 and 3 is lower than that of Alternative 4, primarily due to O&M of the groundwater extraction system under Alternative 4. The highest capital cost is associated with Alternative 3 primarily due to the activities associated with the injection phase of in situ bioremediation.

8. State/Support Agency Acceptance

The USEPA and TCEQ have reviewed the Proposed Plan. Comments received from the USEPA and TCEQ during the Proposed Plan development have been incorporated as appropriate.

9. Community Acceptance

Community acceptance of the preferred alternative will be evaluated after the public comment period ends and will be described in the record of decision (ROD) for the site.

SUMMARY OF THE PREFERRED ALTERNATIVE

Alternative 2, LUCs with MNA, is the preferred alternative for LHAAP-35B (37) and LHAAP-67 and is consistent with the intended future use of the sites as a wildlife refuge. This alternative will satisfy the RAOs for the sites through groundwater use restriction LUCs which will ensure protection of human health by preventing human exposure to contaminated groundwater. The LUCs will remain in place until ARARs are met. Furthermore, monitored natural attenuation will assure protection of human health and the environment by preventing contaminated groundwater from migrating into nearby surface water bodies at levels that exceed ARARs. The monitoring and reporting associated with the MNA remedy will continue until MCLs are achieved. Based on groundwater modeling, groundwater ARARs are expected to be met through natural attenuation in 28 to 38 years for PCE, 39 to 43 years for TCE, and 16 to 21 years for 1,1-DCE at LHAAP-35B (37). Considering the lithologic variability, particularly the lateral and vertical change from sand to clay, the times to MCL may range to an order of magnitude greater. For LHAAP-67, ARARs would be met through natural attenuation in 17 to 66 years for TCE, 20 to 34 years for 1,1-DCE, and 21 to 43 years for 1,2-DCA.

Although the times to MCL for 1,1,1-TCA and 1,1,2-TCA were originally modeled to be 22 and 20 years respectively, these two VOCs are no longer detected above MCLs at LHAAP-67. For both the sites, the groundwater flow rates are within the normal range for the formation material at these sites. Thus no adverse impact is expected to the surface water during the time it would take natural attenuation to reduce contaminant concentrations to MCLs. The selected alternative offers a high degree of long-term effectiveness, can be easily and immediately implemented, and costs less than the other alternatives.

Based on information currently available, the U.S. Army believes the preferred alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the CERCLA criteria used to evaluate remedial alternatives.

The Army intends to present details of the LUCs implementation plan, groundwater monitoring plan, and MNA remedy implementation in a RD for the two sites.

The remedy selected in the ROD may change from the preferred alternative presented here, based on public comment.

Notification of industrial/recreational use will accompany all transfer documents and will be recorded in the County Courthouse. Five-Year Reviews will be performed to document that the land use remains consistent with the industrial/recreational exposure scenario evaluated in the risk assessment.

COMMUNITY PARTICIPATION

The U.S. Army, USEPA, and TCEQ provide information regarding LHAAP-35B (37) and LHAAP-67 through public meetings, the Administrative Record file for the facility, and announcements published in the Shreveport Times and Marshall News Messenger newspapers. The public is encouraged to gain a more comprehensive understanding of these two sites and the Superfund activities that have been conducted at these sites.

The dates for the public comment period, the date, location, and time of the public meeting, and the locations of the Administrative Record files are provided on the front page of this Proposed Plan.

Any significant changes to the Proposed Plan, as presented in this document, will be identified and explained in the ROD.

Primary Reference Documents for LHAAP 35B (37) and LHAAP-67

Jacobs Engineering Group Inc. (Jacobs), 2002a, *Final Remedial Investigation Report for the Group 4 Sites 35A, 35B, 35C, 46, 47, 48, 50, 60, and Goose Prairie Creek, at the Longhorn Army Ammunition Plant, Karnack, Texas,* January.

Jacobs, 2003, *Final Baseline Human Health and Screening Ecological Risk Assessment for the Group 4 Sites (Sites 04, 08, 35A, 35B, 35C, 46, 47, 48, 50, 60, 67, Goose Prairie Creek, Saunder's Branch, Central Creek, and Caddo Lake), Longhorn Army Ammunition Plant, Karnack, Texas,* June.

Shaw, 2005a, *Final Feasibility Study, LHAAP-67, Aboveground Storage Tank Farm, Group 4, Longhorn Army Ammunition Plant, Karnack, Texas,* August.

Shaw, 2005b, *Final Feasibility Study, LHAAP-35B (37), Chemical Laboratory, Group 4,, Longhorn Army Ammunition Plant, Karnack, Texas,* October.

Shaw, 2007a, *Final Modeling Report, Derivation of Soil and Groundwater Concentrations Protective of Surface Water and Sediment, Longhorn Army Ammunition Plant, Karnack, Texas,* February.

Shaw, 2007b, *Final Data Gaps Investigation Report, Longhorn Army Ammunition Plant, Karnack, Texas,* April.

Shaw, 2007c, *Final Natural Attenuation Evaluation LHAAP-12, LHAAP-35B (37), and LHAAP-67, Longhorn Army Ammunition Plant, Karnack, Texas,* June.

Shaw, 2007d, *Installation-Wide Baseline Ecological Risk Assessment, Longhorn Army Ammunition Plant, Karnack, Texas, Volume I: Step 3 Report*, Houston, Texas, November.

Shaw, 2007e, *Final Results of Modeling for Natural Attenuation of Chlorinated Solvents in Groundwater at LHAAP-35B (37) and LHAAP-67, Longhorn Army Ammunition Plant, Karnack, Texas,* July.

United States Army, 2004, *Memorandum of Agreement Between the Department of the Army and the Department of the Interior for the Interagency Transfer of Lands at the Longhorn Army Ammunition Plant for the Caddo Lake National Wildlife Refuge, Harrison County, Texas,* Signed by the Department of the Interior on April 27, 2004 and the Army on April 29, 2004.

United States Army, 2008, Letter with enclosures from LHAAP Site Manager, Rose M. Zeiler, to TCEQ Remediation Division Project Manager, Fay Duke, *Revised MNA Modeling Results for Time to MCL, LHAAP-37 and LHAAP-67, Longhorn Army Ammunition Plant, Karnack, Texas,* June 5.

GLOSSARY OF TERMS

Administrative Record — The body of reports, official correspondence, and other documents that establish the official record of the analysis, cleanup, and final closure of a CERCLA site.

ARARs — Applicable or relevant and appropriate requirements. Refers to the federal and state requirements that a selected remedy will attain.

Attenuation — The process by which a compound is reduced in concentration over time, through absorption, adsorption, degradation, dilution, and/or transformation.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) — This law authorizes the Federal Government to respond directly to releases (or threatened releases) of hazardous substances that may be a danger to public health, welfare, or the environment. The U.S. Army currently has the lead responsibility for these activities.

Environmental Media —Major environmental categories that surrounds or contact humans, animals, plants, and other organisms (e.g. surface water, ground water, soil or air) and through which chemicals or pollutants move.

Exposure — Contact of an organism with a chemical or physical agent. Exposure is quantified as the amount of the agent available at the exchange boundaries of the organism (e.g., skin, lung, digestive tract, etc.) and available for absorption.

Groundwater — Underground water that fills pores in soil or openings in rocks to the point of saturation.

Hazard Index — Where appropriate, the sum of more than one chemical-specific hazard quotients and/or multiple exposure pathways. When the hazard index exceeds unity, there may be concern for potential health effects.

Maximum Contaminant Level (MCL) — The maximum contaminant level is based on the National Primary Drinking Water Standard. The TCEQ has adopted MCLs at the regulatory cleanup level for both industrial and residential uses. Any detected compound in the groundwater samples with a MCL were evaluated by comparing them to their associated MCL. MCL comparisons are performed using an average or other site-representative concentration.

Proposed Plan — A report for public comment highlighting the key factors that form the basis for the selection of the preferred remediation alternative.

Remedial Action — The actual construction or implementation phase of a Superfund site cleanup that follows remedial design.

Risk Assessment — An analysis of the potential adverse health effects (current and future) caused by hazardous substances at a site in the absence of any actions to control or mitigate these releases (i.e., under an assumption of no action). The assessment contributes to decisions regarding appropriate response alternatives.

Superfund — The common name used for CERCLA; also referred to as the Trust Fund. The Superfund Program was established to help fund cleanup of hazardous waste sites. It also allows legal action to force those responsible for sites to clean them up.

ACRONYMS

ARARs	applicable or relevant and appropriate requirements
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chemical of concern
DCA	dichloroethane
DCE	dichloroethene
ECOP	environmental condition of property
FFA	Federal Facility Agreement
FS	feasibility study
HI	hazard index
LHAAP	Longhorn Army Ammunition Plant
LUC	land use control
MCL	maximum contaminant level
MNA	monitored natural attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	operation and maintenance
PCE	tetrachloroethene
ppb	parts per billion
RAO	remedial action objective
RD	remedial design
RI	remedial investigation
ROD	record of decision
SVOC	semivolatile organic compound
TCA	trichloroethane
TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the LHAAP-35B (37) and LHAAP-67 is important to the U.S. Army. Comments provided by the public are valuable in helping the U.S. Army select a final remedy for these sites.

You may use the space below to write your comments, then fold and mail to Dr. Rose M. Zeiler, P. O. Box 220, Ratcliff, Arkansas 72951. Comments must be postmarked by July 16, 2008. If you have questions about the comment period, please contact Dr. Rose M. Zeiler at 903.679.3192 or directly at 479.635.0110. Those with electronic communications capabilities may submit their comments to the U.S. Army via Internet at the following e-mail address: rose.zeiler@us.army.mil