LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS

ADMINISTRATIVE RECORD

Volume 2 of 16

2011

Bate Stamp Numbers

00099919 – 00100422

Prepared for

Department of the Army
Longhorn Army Ammunition Plant

1976 – 2011

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
ADMINISTRATIVE RECORD – CHRONOLOGICAL INDEX

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2011

A. Title: Public Notice – Proof of Publication Marshall News Messenger and Shreveport Times Newspaper Notices and Media Release for LHAAP-29 Proposed Plan, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: March 6, 2011
Bate Stamp: 00099919 – 00099927

B. Title: Letter – Army Response to EPA Letter of June 11, 2010 Regarding Munitions Constituents Data Summary Report Response to Comments
Author(s): U.S. Army, Rose M. Zeiler, Longhorn AAP Site Manager
Recipient: U.S. Environmental Protection Agency, Steve Tzhone
Date: March 10, 2011
Bate Stamp: 00099928 – 00099934

C. Title: Report – Final Proposed Plan for LHAAP-29, Former TNT Production Area, Group 2, Longhorn AAP, Karnack, Texas
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: March 15, 2011
Bate Stamp: 00099935 - 00099962

D. Title: Meeting Minutes – Longhorn AAP Monthly Managers' Meeting
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: March 21, 2011
Bate Stamp: 00099963 - 00099970

E. Title: Meeting Minutes – LHAAP Restoration Advisory Board (RAB) Meeting
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: March 22, 2011
Bate Stamp: 00099971 – 00100006

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F. Title: Public Meeting Presentation of LHAAP-29 Proposed Plan at Karnack Community Center, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: March 22, 2011
Bate Stamp: 00100007 – 00100062

G. Title: Transcript of Public Meeting for LHAAP-29 Proposed Plan at Karnack Community Center, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Accurate Reporting of Shreveport, Inc. (Court Reporting Services)
Recipient: All Stakeholders
Date: March 22, 2011
Bate Stamp: 00100063 – 00100098

H. Title: Meeting Minutes – Longhorn AAP Monthly Managers' Meeting
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: April 21, 2011
Bate Stamp: 00100099 – 00100107

I. Title: Meeting Minutes – Longhorn AAP Monthly Managers' Meeting
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: May 24, 2011
Bate Stamp: 00100108 – 00100116

J. Title: 2011 Installation Action Plan-- Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): U.S. Army
Recipient: All Stakeholders
Date: (printed) June 13, 2011
Bate Stamp: 00100117 – 00100178

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K. Title: Meeting Minutes – Longhorn AAP Monthly Managers' Meeting
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: June 23, 2011
Bate Stamp: 00100179 – 00100186

L. Title: Meeting Minutes – LHAAP Restoration Advisory Board (RAB) Meeting
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: June 30, 2011
Bate Stamp: 00100187 – 00100208

M. Title: Report—Final Munitions Constituents Data Summary Report for South Test Area/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc.
Recipient: All Stakeholders
Date: June 30, 2011
Bate Stamp: 00100209 – 00100369

N. Title: Report—Final Proposed Plan for South Test Area/bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc.
Recipient: All Stakeholders
Date: June 30, 2011
Bate Stamp: 00100370 – 00100389

O. Title: Meeting Minutes – Longhorn AAP Monthly Managers' Meeting
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: July 21, 2011
Bate Stamp: 00100390 – 00100397

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KARNACK, TEXAS
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P. Title: Transcript of Public Meeting for Military Munitions Response Program Proposed Plan Public Meeting (LHAAP-001-R [Site 27] and LHAAP-003-R [Site 54]), Karnack Community Center, Longhorn Army Ammunition Plant, Karnack, Texas

Author(s): Sunbelt Reporting and Litigation Services (Court Reporting Services)
Recipient: All Stakeholders
Date: July 21, 2011
Bate Stamp: 00100398 – 00100422

00099919

Proof of Publication

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MARSHALL NEWS MESSENGER

P.O. BOX 730 MARSHALL, TX 75670 (903) 935-7914

#3973 $390.50

STATE OF TEXAS
COUNTY OF HARRISON

PUBLIC NOTICE

THE UNITED STATES ARMY INVITES PUBLIC COMMENT ON THE PROPOSED PLAN

FOR ENVIRONMENTAL SITE LHAAP-29, FORMER TNT PRODUCTION AREA LONGHORN ARMY AMMUNITION PLANT, TEXAS

PUBLIC MEETING ON MARCH 22, 2011 AT THE KARNACK COMMUNITY CENTER, KARNACK, TX

The U.S. Army is the lead agency for environmental response actions at Longhorn Army Ammunition Plant (LHAAP). In partnership with Texas Commission on Environmental Quality and U.S. Environmental Protection Agency Region 6 (USEPA), the U.S. Army has developed the Proposed Plan for site LHAAP-29, Former TNT Production Area. Although the Proposed Plan for LHAAP-29 identifies the preferred remedy for the site, the U.S. Army welcomes the public's review and comments. Beginning on March 18, 2011, copies of the Proposed Plan and supporting documentation will be available for public review at the Marshall Public Library, 300 S. Alamo, Marshall, Texas, 75670. The public comment period is March 21, 2011, through April 19, 2011. **The public meeting will be held on Tuesday, March 22, 2011, at the Karnack Community Center, Karnack, TX beginning at 7:30 PM.** Karnack Community Center is located at Highway 134 and Spur 449 near the front gate of the former Longhorn Army Ammunition Plant. Questions, comments, and responses on the Proposed Plan will be recorded by a court reporter during the public meeting. Written comments will be accepted throughout the public comment period.

Longhorn Army Ammunition Plant (LHAAP) is an inactive, government-owned, formerly contractor-operated industrial facility located in central-east Texas in the northeastern corner of Harrison County. The installation occupies nearly 8,416 acres between State Highway 43 at Karnack, Texas, and the western shore of Caddo Lake. LHAAP was established in December 1941 near the beginning of World War II for the manufacture of trinitrotoluene. Other past industrial operations at the installation included the use of secondary explosives, rocket motor propellants, and various pyrotechnics, such as illuminating and signal flares and ammunition. LHAAP was found to have actual and potential releases of hazardous substances or pollutants or contaminants associated with past operations, and it was added to the National Priorities List (NPL) in 1990.

LHAAP-29, former TNT Production Area, encompasses an area of approximately 85 acres in the western-central portion of LHAAP. The site was used as a TNT manufacturing facility from October 1942 to August 1945. The facility produced approximately 400 million pounds of flake TNT during its operation using six TNT production lines. Since the end of World War II, the only activity that has been documented to have occurred at LHAAP 29 is the "soak out" or solvent bath of out-of-specification rocket motors. This took place from 1959 to the mid-1970s and involved the use of a methylene chloride-based industrial solvent at tank 801-F.

The current Proposed Plan for LHAAP-29 addresses contamination in soil, process lines and groundwater at LHAAP-29. The full list of alternatives evaluated are: 1) No action; 2) Excavation and offsite disposal of soil; plugging of process lines; MNA for shallow groundwater; in situ chemical oxidation for intermediate groundwater and land use controls (LUCs), 3) Excavation and offsite disposal of soil; plugging of process lines; groundwater extraction for intermediate zone groundwater; MNA for shallow groundwater and LUCs. Based on available information, the preferred remedy is Alternative 2 which would remove contaminated soil from LHAAP-29 with off-site disposal; plug process lines thereby eliminating potential for contaminants to leach into groundwater, reduce groundwater contamination throughout the intermediate zone groundwater contaminant plume via in situ chemical oxidation; use MNA for shallow groundwater to assure protection of human health and the environment by documenting that the contaminated groundwater remains localized and that contaminant concentrations are being reduced to MCLs, and implement LUCs to protect human health by preventing human exposure to contaminated groundwater.

For further information or to submit written comments, contact:
Dr. Rose M. Zeiler, Longhorn Army Ammunition Plant, P.O. Box 220, Ratcliff, Arkansas, 72951;
phone number 479-635-0110 or email
rose.zeiler@us.army.mil.

On this 10th day of March, 20 11
sonally appeared before me the undersigned, a Notary Public
nd for said county and state.

DIANNE GRAY

the MARSHALL NEWS MESSENGER, a daily newspaper lished at MARSHALL, County of HARRISON, State of KAS, who, being by me duly sworn, states that the attached ertisement, a true copy of which is hereto annexed, was lished in said newspaper in its issues thereof on the following es:

6th day of March 20 11
day of 20
day of 20
day of 20
day of 20
day of 20

Dianne Gray
TURE

Subscribed and sworn to before me this 10th of March 20 11.

Deborah M Green
Notary Public, Harrison County, Texas

mmision
s 7.17.2012

DEBORAH M. GREEN
NOTARY PUBLIC
STATE OF TEXAS
My Commission Expires 07-17-2012

00099920

The Times

PROOF OF PUBLICATION

STATE OF LOUISIANA

PARISH OF CADDO

Before me, the undersigned authority, personally came and appeared

Altheas Critton personally known to me,
Who being duly sworn, deposes and says that she is the Assistant to the Classified Advertising Manager of The Times, and that the attached Advertisement entitled:

PUBLIC NOTICE THE UNITED STATES ARMY INVITES PUBLIC COMMENT ON THE PROPOSED PLAN FOR ENVIRONMENTAL SITE LHAAP-29, FORMER TNT PRODUCTION AREA LONGHORN ARMY AMMUNITION PLANT, TEXAS PUBLIC MEETING ON MARCH 22, 2011 AT THE KARNACK COMMUNITY CENTER, KARNACK, TX

March 6, 2011

(Signed) Altheas Critton

Sworn to and subscribed before me this 7th day of March, 2011

Diana W. Barber

(Notary)

DIANA W. BARBER, NOTARY PUBLIC # 60491
CADDO PARISH, LOUISIANA
MY COMMISSION IS FOR LIFE

GANNETT

Egyptian wrath aimed at state security agency

By Sarah El Deeb
The Associated Press

CAIRO — Three weeks after President Hosni Mubarak's ouster, Egyptians are turning their anger toward his internal security apparatus, storming the agency's main headquarters and other offices Saturday and seizing documents to keep them from being destroyed to hide evidence of human rights abuses.

What to do with Egypt's tainted security agencies remains one of the most contentious issue facing the military rulers who took charge after Mubarak was forced to step down on Feb. 11 after an 18-day popular uprising.

The 500,000-strong internal security services are accused of some of the worst human rights abuses in the suppression of dissent against Mubarak's nearly 30-year rule. The protesters are demanding the agency be dismantled and its leaders face a reckoning.

The ruling military council's bind was evident on Friday and Saturday when thousands of protesters — including some people who said they were victims of abuse by security agents — marched on several state security buildings in Alexandria, Cairo and other cities.

Protesters stormed inside at least six of the buildings, including the agency's main headquarters in Cairo's northern Nasr City neighborhood, confronting officers face-to-face and attacking some in a surreal reversal of roles.

"We are inside, hundreds of us," Mohammed Abdel-Fattah, one of the protesters who barged into the Nasr City compound on Saturday, said in a telephone interview. "We are fetching documents and we are looking for detainees."

Cries of "Allahu akbar," or "God is great," could be heard in the background, as one of the protester's found a file with Mubarak's name on it.

Around 2,500 people swept into the compound, according to the state news agency.

Abdel-Fattah said they barged in from the back doors, and the military, which had cordoned off the building, couldn't stop them. They scoured the building for official documents, many of which were already shredded in piles in what they believe was an attempt to hide evidence incriminating senior officials in abuses.

Some also searched the building for secret detention rooms. Others prayed in the compound's mosque.

Army officers tried to get protesters out of the compound, but did not use force. One army officer rescued a State Security officer from the hands of angry protesters and ushered him into a tank.

Egypt's State Security Services, which were given a free hand by emergency laws under Mubarak to suppress dissent, are some of the most powerful symbols of his regime. Many protest leaders say despite the fall of Mubarak and his government, the agency remains active in protecting the old regime and trying to sabotage the revolution.

The agency was the most pervasive security force, collecting intelligence on regime opponents and supporters alike, said Ammar Ali Hassan, a political analyst.

"It was the planning brain behind everything during Mubarak's reign. ... Mubarak only trusted the State Security."

Hassan said after Mubarak's fall, the agency has continued to play the role of main provider of intelligence to the current military rulers of Egypt, who have no recent experience in running civil affairs.

"It seems that the agency has realized that the military council is being responsive to the demands of the revolutionaries, and may start to consider their calls" to dissolve the agency.

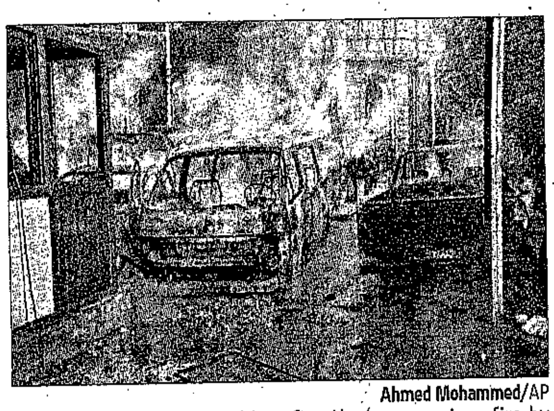
The military council has replaced the head of the agency, but it is not yet clear if it is considering restructuring it or redefining its mission as it charts Egypt's path toward a freer political system and an eventual return to civilian rule.

Among the other buildings targeted by demonstrators Saturday, fire poured out of the agency's offices in the Nile Delta town of Sharqia, the north coast city of Matrouh and the oasis city of Fayoum south of the capital.

It was not clear if protesters set the fires or if they were started by security officers burning documents, said a military official who spoke on condition of anonymity because he was not authorized to release the information.

The targeting of the agency's buildings began Friday night in Alexandria. More than 1,000 people stormed the building there after officers opened fire on the crowd from inside. Four protesters were wounded and more than 20 security officers were badly beaten, witnesses and security officials said.

Kutb Hassanein, a protester in Alexandria, said most of those who stormed the building were activists who had been abused or detained by the State Security. He said the crowd also included many Islamists, who Mubarak considered his chief enemy.



Ahmed Mohammed/AP

State security cars smoulder after they were set on fire by protesters outside the police security headquarters in Alexandria, Egypt on Friday. Hundreds of Egyptian protesters attempted to storm a building belonging to the internal security service in Alexandria in an outpouring of anger at the agency blamed for some of the worst human rights violations during ousted President Hosni Mubarak's rule.

Rescuers: 2 dogs shot in the head at S.C. landfill

The Associated Press

CHESTERFIELD, S.C. — Animal rescuers in South Carolina said Saturday that they have found two dogs believed to be from a local shelter shot in the head and buried at a landfill, and they suspect there may be more.

Whitney Knowlton, founder of Last Chance Animal Rescue Fund, said the two dogs were found Friday at a landfill. She said she believes that the dogs were from the county-run shelter and that they were killed by animal control officers.

Chesterfield County Sheriff Sam Parker told WSOC-TV, which first reported the story, that his office is investigating. A message left with a dispatcher for the sheriff's office by The Associated Press was not immediately returned Saturday morning. The sheriff's office oversees animal control.

"We've got nothing at all to hide here," Parker told WSOC. "We're doing interviews, and we'll get to the bottom of it."

Knowlton said rescuers who regularly work with the shelter in Chesterfield, S.C., were first tipped off by an inmate working there. Some inmates working at the shelter had been saying that dogs were being taken off-site and weren't coming back, Knowlton said. One told a rescuer working with the shelter that dogs were being taken to the landfill and being shot.

"He was so unnerved by it," Knowlton said.

When that allegation was made, fellow rescuer Debbie Farhi grabbed a shovel and started digging at the landfill, Farhi said. She found one dog with fresh blood on it that had been shot in the head, then dug up another. At that point, Knowlton said, Farhi was told by animal control officers to leave. Knowlton said activists want the state Law Enforcement Division to investigate the dead dogs.

MEDIA RELEASE

The United States Army has prepared a Proposed Plan for the environmental site LHAAP-29, Former TNT Production Area, at the Longhorn Army Ammunition Plant. The Proposed Plan is the document that describes LHAAP-29 and its proposed remedies. The Proposed Plan was developed to facilitate public involvement in the remedy selection process.

The public comment period is March 21, 2011 through April 19, 2011. Copies of the Proposed Plan and other supporting documentation for LHAAP-29 are available for public review at the Marshall Public Library, 300 S. Alamo, Marshall, Texas, 75670, starting March 18, 2011.

A public meeting will be held on March 22, 2011, starting at 7:30 p.m. at the Karnack Community Center, Highway 134 and Spur 449, Karnack, Texas, 75661, located near the front gate of the former Longhorn Army Ammunition Plant.

All written public comments on the Proposed Plan for LHAAP-29 must be postmarked on or before April 19, 2011. Written comments may be provided to Dr. Rose M. Zeiler, Longhorn Army Ammunition Plant, P. O. Box 220, Ratcliff, Arkansas, 72951 or emailed to rose.zeiler@us.army.mil. Emailed comments must be submitted by close of business on April 19, 2011.

Norris, Mary

From: faxadmin [faxadmin@shawgrp.com]
Sent: Thursday, March 10, 2011 9:08 AM
To: Norris, Mary
Subject: Fax: Tx 'ok' Report

This message was sent via FAXCOM, a product from Biscom Inc. http://www.biscom.com/

-------Fax Transmission Report-------

To:	KTBS3 at 9033340288
Subject:	Media Release
Result:	The transmission was successful.
Explanation:	All Pages Ok
Pages Sent:	2
Connect Time:	0 minutes, 51 seconds
Transmit Time:	03/10/2011 09:07
Transfer Rate:	14400
Status Code:	0000
Retry Count:	1
Job Id:	6547
Unique Id:	ENTBTRFAX01_SMTPFaxQ_1103101456341315
Fax Line:	3
Fax Server:	127.0.0.1

00099924

(2)

Norris, Mary

From: faxadmin [faxadmin@shawgrp.com]
Sent: Thursday, March 10, 2011 8:58 AM
To: Norris, Mary
Subject: Fax: Tx 'ok' Report

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To:	KMSS at 3186314194
Subject:	Media Release
Result:	The transmission was successful.
Explanation:	All Pages Ok
Pages Sent:	2
Connect Time:	0 minutes, 54 seconds
Transmit Time:	03/10/2011 08:56
Transfer Rate:	14400
Status Code:	0000
Retry Count:	0
Job Id:	6546
Unique Id:	ENTBTRFAX01_SMTPFaxQ_1103101456281314
Fax Line:	3
Fax Server:	127.0.0.1

3

Norris, Mary

From:	faxadmin [faxadmin@shawgrp.com]
Sent:	Thursday, March 10, 2011 8:58 AM
To:	Norris, Mary
Subject:	Fax: Tx 'ok' Report

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-------Fax Transmission Report-------

To:	KSLA at 3186776705
Subject:	Media Release
Result:	The transmission was successful.
Explanation:	All Pages Ok
Pages Sent:	2
Connect Time:	0 minutes, 51 seconds
Transmit Time:	03/10/2011 08:57
Transfer Rate:	14400
Status Code:	0000
Retry Count:	0
Job Id:	6548
Unique Id:	ENTBTRFAX01_SMTPFaxQ_1103101457011316
Fax Line:	1
Fax Server:	127.0.0.1

Norris, Mary

From: faxadmin [faxadmin@shawgrp.com]
Sent: Thursday, March 10, 2011 8:59 AM
To: Norris, Mary
Subject: Fax: Tx 'ok' Report

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To:	KTBS3 at 3182194680
Subject:	Media Release
Result:	The transmission was successful.
Explanation:	All Pages Ok
Pages Sent:	2
Connect Time:	0 minutes, 50 seconds
Transmit Time:	03/10/2011 08:58
Transfer Rate:	14400
Status Code:	0000
Retry Count:	0
Job Id:	6549
Unique Id:	ENTBTRFAX01_SMTPFaxQ_1103101457371317
Fax Line:	3
Fax Server:	127.0.0.1

Norris, Mary

From: faxadmin [faxadmin@shawgrp.com]
Sent: Thursday, March 10, 2011 9:00 AM
To: Norris, Mary
Subject: Fax: Tx 'ok' Report

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-------Fax Transmission Report-------

To:	KETK at 9035612459
Subject:	Media Release
Result:	The transmission was successful.
Explanation:	All Pages Ok
Pages Sent:	2
Connect Time:	0 minutes, 49 seconds
Transmit Time:	03/10/2011 08:58
Transfer Rate:	14400
Status Code:	0000
Retry Count:	0
Job Id:	6550
Unique Id:	ENTBTRFAX01_SMTPFaxQ_1103101458191318
Fax Line:	7
Fax Server:	127.0.0.1

00099928

DEPARTMENT OF THE ARMY
LONGHORN ARMY AMMUNITION PLANT
POST OFFICE BOX 220
RATCLIFF, AR 72951

March 10, 2011

DAIM-ODB-LO

Mr. Stephen Tzhone
US Environmental Protection Agency
Superfund Division (6SF-AT)
1445 Ross Avenue
Dallas, TX 75202-2733

Re: Army response to EPA Letter of June 2010
Munitions Constituents Data Summary Report Response to Comments (RTCs)
Longhorn Army Ammunition Plant, Karnack, Texas

Dear Mr. Tzhone,

In response to EPA's letter June 11, 2010 regarding Munitions Constituents Data Summary Report RTCs, the Army is in agreement with the following path forward with respect to perchlorate:

- On LHAAP-001-R (LHAAP-27), the following will take place:
    - Redevelopment of existing monitoring wells
    - Three annual ground water sampling events before the next Five Year Review (post-ROD)

- On LHAAP-003-R (LHAAP-54), the following will take place:
    - Redevelopment of existing monitoring wells
    - One annual ground water sampling event before the next Five Year Review (post-ROD)

The ROD document will proceed as a No Further Action Record of Decision with limited monitoring. Army will address the path forward for metals separately.

The point of contact for this action is the undersigned. I may be contacted at 479-635-0110, or by email at rose.zeiler@us.army.mil.

Sincerely,

Rose M. Zeiler

Rose M. Zeiler, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
Fay Duke, TCEQ, Austin, TX
Paul Bruckwicki, Caddo Lake NWR, TX
Aaron Williams, COE – Tulsa District, OK
John Lambert, COE – Tulsa District, OK
Marilyn Plitnik, AEC
Praveen Srivastav, Shaw – Houston, TX (Administrative Record)

00099930

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS TX 75202-2733

[illegible] 2010

Ms. Rose M. Zeiler, Ph.D.
Department of the Army
Longhorn Army Ammunition Plant
Post Office Box 220
Ratcliff, AR 72951

Re: Munitions Constituents Data Summary Report
Longhorn Army Ammunition Plant, Karnack, Texas

Dear Ms. Zeiler,

The U.S. Environmental Protection Agency (EPA) has reviewed: the *Army Response to Comments Pertaining to Data Gap Issues, Munitions Constituents Data Summary Report, Longhorn Army Ammunition Plant, Karnack, Texas,* dated August 2009; the *EPA Monitoring Results Evaluation, Munition Sites 27 and 54*, dated December 2009; and the *Army Presentation of Longhorn Army Ammunition Plant's Perspective on Perchlorate at MRS LHAAP-001-R-01, South Test Area/South Bomb Area*, dated February 2010.

Our decision to move forward on LHAAP-001-R (LHAAP-27) and LHAAP-003-R (LHAAP-54) is as follows:

- On LHAAP-001-R (LHAAP-27), the following must take place:
    - Replacement of stainless steel monitoring wells
    - Three annual ground water sampling events before the issuance of the Record of Decision or the next Five Year Review for these constituents:
        - Perchlorate
        - All Metals

- On LHAAP-003-R (LHAAP-54), the following must take place:
    - Redevelopment of existing monitoring wells and one ground water sampling event before the issuance of the Record of Decision or the next Five Year Review for these constituents:
        - Perchlorate
        - All Metals

- For both sites, if the sampled constituents are not detected above the EPA Maximum Contaminant Level or the TCEQ Risk Reduction Rule Industrial Standard, then a no action Record of Decision can be issued or a recommendation of completion for the limited ground water sampling remedy can made at the Five Year Review. Otherwise, for both sites, the same monitoring frequency identified above will remain in effect between consecutive Five Year Reviews, as part of an overall limited ground water monitoring remedy.

Referenced documents from this letter are enclosed for your information. Please feel free to contact me at (214) 665-8409, or by email at tzhone.stephen@epa.gov, if there are any questions or comments.

Sincerely,

Stephen L. Tzhone
Remedial Project Manager

Enclosures (3)

cc: Ms. Fay Duke, TCEQ
Mr. Paul Bruckwicki, FWS
Mr. Richard Mayer, EPA

Response to Comments Pertaining to Data Gap Issues
Munitions Constituents Data Summary Report (April 2009)
South Test Area/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R
Longhorn Army Ammunition Plant, Karnack, Texas
August 2009

Reviewer: Stephen L. Tzhone, EPA
Respondents: Agnes Mayila and John Elliott, Shaw Environmental, Inc.

1. Respondent Concurs (C), Does Not Concur (D), or Takes Exception (E)
2. Commenter Agrees (A) with response, or Does not Agree (D) with response.

Comment #	Page	Section/ Paragraph	Comment	C, D[1], or E	Response	A or D[2]
General Comments						
1			The report should have a list/table of each ordinance used/disposed at each site (27 & 54) and the explosive constituents or contaminants contained in each ordnance. Also, a conceptual model of each munitions site should be described in the report.	D	The list of ordnance used/disposed at each site and the list of munitions debris removed from the site can be found in the MEC Removal Action Report (2009). Conceptual models of Sites 27 and 54 are likewise included in the MEC Removal Action Report for MEC. Conceptual models for these two sites are also included in the EE/CA (2008) for MCs.	
2			The sampling approaches taken (all the different sampling events since 1982) at Site 27 and 54 appears outdated and inadequate. EPA understands that the majority of the samples taken at the two sites were performed before the Multi-Increment Sampling (MIS) approach for munitions constituents were developed by the U.S. Army Corps of Engineers (USACE CRREL research Lab in Maine) and EPA. The MIS approach is recommended using the "decision unit concept" as the sampling area where soil samples are taken. Appropriate MIS areas for Site 27 would be the Photo Flash Cartridge Disposal Area, the Open Burning/Open Detonation Area, and the Test Pad. Appropriate MIS areas for Site 54 would be the Rocket Mortar Test Area, the Former Mortar Test Area, and the firing points for the former Mortar Test Area.	D	The sampling approaches taken were the best available at the time and were approved by the EPA for work plans and in the technical process planning meetings.	
3			The Data summary tables (for all sampling events) in the document do not contain: 1) the analytical method used to analyze for explosives and perchlorate (in fact for all constituents analyzed); 2) the detection limit for each constituent analyzed; and 3) the individual explosive, volatile, and semi-volatile constituents analyzed for. This information needs to be included.	C	The Data Summary Tables provided in the MC Data Summary Report (Appendices A and B) were obtained and presented in summary form from the documents referenced on the first page of each Appendix. This information will be provided.	

00099933

Response to Comments Pertaining to Data Gap Issues
Munitions Constituents Data Summary Report (April 2009)
South Test Area/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R
Longhorn Army Ammunition Plant, Karnack, Texas
August 2009

Reviewer: Stephen L. Tzhone, EPA
Respondents: Agnes Mayila and John Elliott, Shaw Environmental, Inc.

1. Respondent Concurs (C), Does Not Concur (D), or Takes Exception (E)
2. Commenter Agrees (A) with response, or Does not Agree (D) with response.

Comment #	Page	Section/ Paragraph	Comment	C, D[1], or E	Response	A or D[2]
4			**Groundwater Results for Site 27:** As far as the perchlorate sampling at Site 27, 2 of the 4 wells sampled at Site 27 (27WW01 & 27WW04) in the April-May sampling event of 2000 contained perchlorate (52.6 & 16.4 µg/l), with the remaining two sampling events not detecting perchlorate. It should be noted that two of the monitoring wells (27WW02 & 27WW03) at Site 27 were sampled only once for perchlorate, with another well, 132, only being sampled twice.	C	Noted, perchlorate was below detection limits in Wells 27WW02, 27WW03 and MW-132. In the two wells 27WW01 and 27WW04 where perchlorate was initially (April-May, 2000) detected at concentrations of 52.6 and 16.4 µg/L, respectively, the concentrations were well below the conservative comparison criteria for TCEQ GW-Ind value of 72 µg/L. Subsequent sampling results (August-September-October, 2000 and January-February 2001) indicated that perchlorate was below detection limits in both wells. Also note that the existing six monitoring wells that were sampled were located in areas with the highest potential for impact from site activities and in the direction of groundwater flow across the site from west to east towards Harrison Bayou.	
5			**Groundwater Results for Site 54:** Monitoring well 18WW16 contained perchlorate in two of the three sampling events taken. Monitoring wells MW-127 and 128 were sampled only twice for semi-volatiles, volatiles, explosives, and metals. Both wells had MCL exceedances of nickel, cadmium, and thallium in 1982 samples results but none in the 1993 sampling event. Monitoring wells MW-127 and 128 contained perchlorate at 26.8 and 20.4 µg/l in the April-May sampling event, but did not contain perchlorate in the following two events. The detection limits for two out of the three geoprobe groundwater samples taken in the April/June 2001 event were high (<40 µg/l). The detection limits should be <4ug/l.	C	Perchlorate concentrations of 22.7 and 8 µg/L were detected in monitoring well 18WW16. Both detections were well below the conservative comparison criteria for TCEQ GW-Ind value of 72 µg/L. In wells 127 and 128 where perchlorate was initially (April-May, 2000) detected at concentrations of 26.8 and 20.4 µg/L, respectively, the concentrations were also well below the TCEQ GW-Ind value of 72 µg/L. Subsequent sampling results (August-September-October, 2000 and January-February 2001) indicated that perchlorate was below detection limits in both wells. Also note that the existing three monitoring wells that were sampled are located adjacent to the three surface water features that drain the entire Signal Test Area. Because the shallow groundwater flow pattern is heavily influenced by	

Response to Comments Pertaining to Data Gap Issues
Munitions Constituents Data Summary Report (April 2009)
South Test Area/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R
Longhorn Army Ammunition Plant, Karnack, Texas
August 2009

Reviewer: Stephen L. Tzhone, EPA
Respondents: Agnes Mayila and John Elliott, Shaw Environmental, Inc.

1. Respondent Concurs (C), Does Not Concur (D), or Takes Exception (E)
2. Commenter Agrees (A) with response, or Does not Agree (D) with response.

Comment #	Page	Section/ Paragraph	Comment	C, D[1], or E	Response	A or D[2]
					surface water flow in this area, the wells represent groundwater from the entire site. Acknowledge the detection limits for the two geoprobe groundwater samples were high (<40 ug/l) but the detection limit was still below the TCEQ GW-Ind value of 72 ug/L. EPA's questions about metals exceeding MCLs should be referred to the 1998 No Further Action RODs for these sites, in which the metals were addressed. Army will provide comment responses separate from the MMRP Sites response.	
Specific Comments						
6	Page 3-9	Section 3.4 Conclusion	EPA recommends that a groundwater monitoring program be developed for Site 54 as well. For example: Monitoring well 18WW16 contained perchlorate in the last sampling event performed in Jan-Feb of 2001. Thus, groundwater sampling would be recommended to continue for monitoring well 18WW16.	D	Perchlorate was detected in well 18WW16 at a concentration of 8 μg/L during the last sampling event; a decrease from the initial concentration of 22.7 μg/L, and a level that is an order of magnitude lower than the TCEQ GW-Ind value of 72 μg/L. In addition, perchlorate was not detected in the two other wells that represent groundwater from the entire site.	

Shaw® Shaw Environmental, Inc.

Date: ***March 15, 2011***

Project No.:117591

TRANSMITTAL LETTER:

To: Mr. Aaron Williams

Address**:** US Army Corps of Engineers - Tulsa
CESWT-PP-M
1645 South 101st East Ave
Tulsa, Oklahoma 74128

Re: Final Proposed Plan for LHAAP-29, Former TNT Production Area, Group2
Longhorn Army Ammunition Plant

Contract No. W912QR-04-D-0027/DS02

For: Review____ As Requested____ Approval____ Corrections____ Submittal____ Other X____

Item No:	***No. of Copies***	***Date:***	***Document Title***
1	2	March 2011	**Final Proposed Plan for LHAAP-29, Former TNT Production Area, Group 2, Longhorn Army Ammunition Plant, Karnack, Texas**

Aaron,
Enclosed are two copies of the above-named document. Copies have been distributed as indicated below. Please call with any questions or comments.

Sincerely:

Praveen Srivastav
Project Manager

CC: **Distribution List:**
Mr. J. Lambert – USACE, Tulsa (sent to A. Williams for distribution)
Ms. M. Plitnik – USAEC
Ms. Rose Zeiler – BRAC-LHAAP
Mr. S. Tzhone – EPA Region 6 (2)
Ms. F. Duke– TCEQ, Austin (2)
Mr. D. Vodak– TCEQ, Tyler
Mr. P. Bruckwicki– U.S. Fish and Wildlife Service

00099936

DEPARTMENT OF THE ARMY
LONGHORN ARMY AMMUNITION PLANT
POST OFFICE BOX 220
RATCLIFF, AR 72951

March 16, 2011

DAIM-ODB-LO

Mr. Stephen Tzhone
US Environmental Protection Agency
Superfund Division (6SF-AT)
1445 Ross Avenue
Dallas, TX 75202-2733

Re: Final Proposed Plan for LHAAP-29, Former TNT Production Area, Group 2
Longhorn Army Ammunition Plant, Karnack, Texas, March 2011

Dear Mr. Tzhone,

The above-referenced document is being transmitted to you for your records. The document has been prepared by Shaw Environmental, Inc. (Shaw) on behalf of the Army as part of Shaw's performance based contract for the facility.

The point of contact for this action is the undersigned. I ask that Praveen Srivastav, Shaw's Project Manager, be copied on any communications related to the project. I may be contacted at 479-635-0110, or by email at rose.zeiler@us.army.mil.

Sincerely,

Rose M. Zeiler

Rose M. Zeiler, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
F. Duke, TCEQ, Austin, TX
D. Vodak, TCEQ, Tyler, TX
P. Bruckwicki, Caddo Lake NWR, TX
J. Lambert, USACE, Tulsa District, OK
A. Williams, USACE, Tulsa District, OK
M. Plitnik, USAEC, TX
P. Srivastav, Shaw – Houston, TX (for project files)

00099937

DEPARTMENT OF THE ARMY
LONGHORN ARMY AMMUNITION PLANT
POST OFFICE BOX 220
RATCLIFF, AR 72951

March 16, 2011

DAIM-ODB-LO

Ms. Fay Duke (MC-136)
SSDAT/Superfund Section
Remediation Division
Texas Commission on Environmental Quality
12100 Park 35 Circle, Bldg D
Austin, TX 78753

Re: Final Proposed Plan for LHAAP-29, Former TNT Production Area, Group 2
Longhorn Army Ammunition Plant, Karnack, Texas, March 2011
SUP 126

Dear Ms. Duke,

The above-referenced document is being transmitted to you for your records. The document has been prepared by Shaw Environmental, Inc. (Shaw) on behalf of the Army as part of Shaw's performance based contract for the facility.

The point of contact for this action is the undersigned. I ask that Praveen Srivastav, Shaw's Project Manager be copied on any communications related to the project. I may be contacted at 479-635-0110, or by email at rose.zeiler@us.army.mil.

Sincerely,

Rose M. Zeiler

Rose M. Zeiler, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
S. Tzhone, USEPA Region 6, Dallas, TX
D. Vodak, TCEQ, Tyler, TX
P. Bruckwicki, Caddo Lake NWR, TX
J. Lambert, USACE, Tulsa District, OK
A. Williams, USACE, Tulsa District, OK
M. Plitnik, USAEC, TX
P. Srivastav, Shaw, Houston, TX (for project files)

00099938

FINAL

PROPOSED PLAN
FOR LHAAP-29
FORMER TNT PRODUCTION AREA
GROUP 2

ISSUED BY: U.S. ARMY

Longhorn Army Ammunition Plant
Karnack, Texas

March 2011

INTRODUCTION

The purpose of this Proposed Plan is to present for public review the remedial alternatives for LHAAP-29. This Proposed Plan identifies the Preferred Remedial Alternative for LHAAP-29, site of the former trinitrotoluene (TNT) Production Area, at Longhorn Army Ammunition Plant (LHAAP). This plan includes summaries of other potential remedial alternatives evaluated for implementation at the site. The primary purpose of the Proposed Plan is to facilitate public involvement in the remedy selection process. The Proposed Plan provides the public with basic background information about LHAAP-29, identifies the preferred final remedy (page 18) for the potential threats posed by the chemical contamination at the site, explains the rationale for the preference, and describes other remedial options considered. The preferred alternative for LHAAP-29 is Alternative 2: excavation and off-site disposal of soil; plugging of wood and transite TNT wastewater pipelines and clay cooling water lines; monitored natural attenuation (MNA) and land use controls (LUCs) for shallow zone groundwater; in situ chemical oxidation, MNA and LUCs for intermediate zone groundwater.

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) 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). CERCLA prescribes a step-wise progression of 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 provides background information that can be found in greater detail in the Remedial Investigation (RI) Report, the Data Gaps Investigation, and the Feasibility Study (FS) (including the Natural Attenuation Evaluation Report and the Additional Investigation Data Summary Report), the Installation-Wide Baseline Ecological Risk Assessment (BERA), and other supporting documents that are contained in the LHAAP-29 Administrative Record

Dates to remember: March 21, 2011 to April 19, 2011
MARK YOUR CALENDER

PUBLIC COMMENT PERIOD:
March 21, 2011 to April 19, 2011
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-29. Oral and written comments will be accepted at the meeting. The meeting will be held on March 22, 2011 starting at 7:30 p.m. at Karnack Community Center.

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

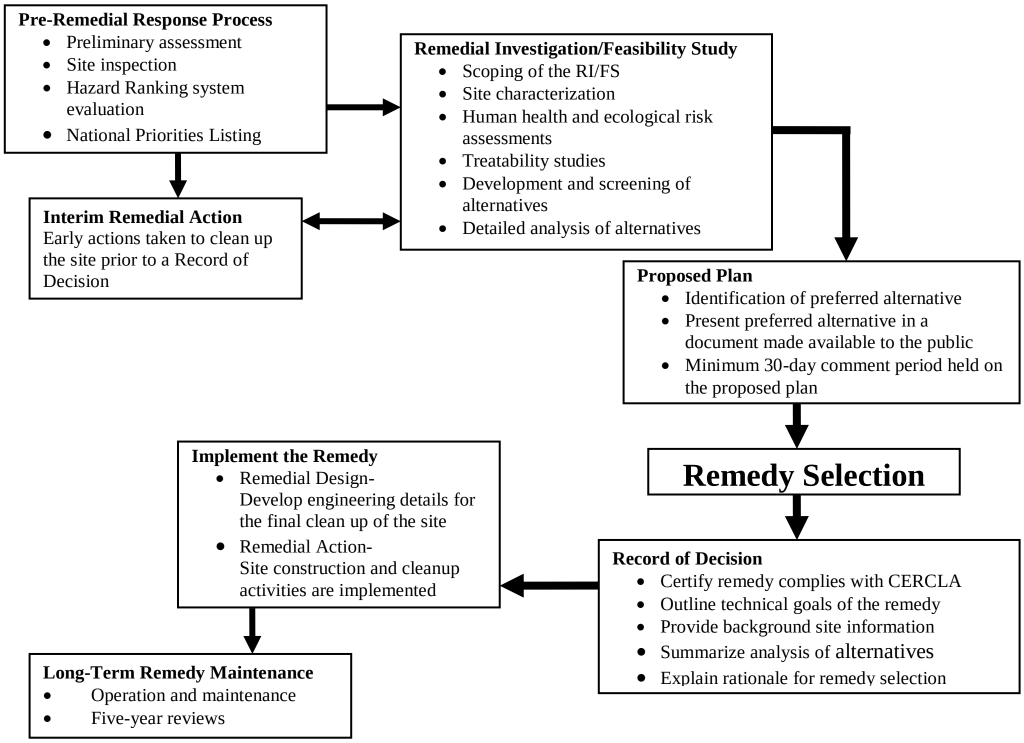
Marshall Public Library
300 S. Alamo
Marshall, Texas 75670

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-29, please contact:

Dr. Rose M. Zeiler
Site Manager
Longhorn Army Ammunition Plant
P.O. Box 220
Ratcliff, Arkansas 72951
Direct No.: (479) 635-0110
E-mail address: rose.zeiler@us.army.mil

Figure 1. CERCLA Remedial Response Process for Site Cleanup



and is publicly available in the Marshall Public Library. 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 and comment on the alternatives presented in this Proposed Plan.

The U.S. Army is acting in partnership with USEPA Region 6 and TCEQ. As the lead agency for environmental response actions at LHAAP, the U.S. Army is charged with planning and implementing remedial actions at LHAAP. The regulatory agencies assist the U.S. Army by providing technical support, project review, project comment, and oversight in accordance with the CERCLA and the NCP as well as the Federal Facility Agreement (FFA).

The Proposed Plan summarizes site characteristics, scope and role of the response action, and site risks. This is followed by a presentation of the remedial action objectives (RAOs) and a summary of remedial alternatives for LHAAP-29. Finally, an evaluation of alternatives and a summary of the preferred alternative are presented.

SITE BACKGROUND

LHAAP is located in central-east Texas in the northeastern corner of Harrison County **(Figure 2)**. The installation occupies approximately 1,400 of its former 8,416 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, bounds LHAAP to the north and east.

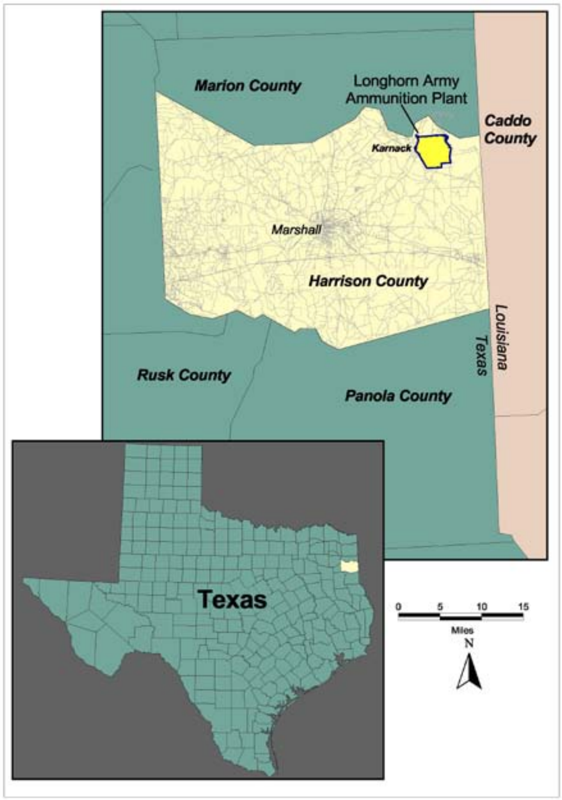


Figure 2 Location of the Longhorn Army Ammunition Plant, Harrison County, Texas

The U.S. Army has transferred nearly 7,000 acres to the U.S. Fish and Wildlife Service (USFWS) for management as the Caddo Lake National Wildlife Refuge.

The property transfer process is continuing as responses are completed at individual sites. The local restoration advisory board has been kept informed of previous investigations at this site through quarterly meetings. Additionally, the administrative record is updated at least twice per year and is available at the local public library.

Due to releases of chemicals from facility operations, 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. The U.S. Army, the USEPA, and the Texas Water Commission (currently known as the TCEQ) have entered into a CERCLA Section 120 FFA since that time 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. LHAAP-29 was originally listed as an NPL site in the FFA due to threatened releases of hazardous substances, pollutants or contaminants. The shallow and intermediate groundwater zones and the soil at LHAAP-29 are contaminated.

LHAAP-29, known as the former TNT Production Area, is located in the western-central portion of LHAAP **(Figure 3)**. The site covers approximately 85 acres.

The site was used as a TNT manufacturing facility from October 1942 to August 1945. The facility produced approximately 400 million pounds of flake TNT during its operation using six TNT production lines (five active and one standby). The TNT production facility was inactive from August 1945 to 1959. In 1959, most of the buildings and ASTs were removed. The debris was burned or flashed at Burning Ground No. 2/Flashing Area (LHAAP-17). Concrete foundations, open-top concrete-lined pits, most of the underground utilities, and a network of underground pipelines still remain at the site. Since the end of World War II, the only activity that has been documented to have occurred at LHAAP-29 is the “soak out” or solvent bath of out-of-specification rocket motors. This took place from 1959 to the mid-1970s and involved the use of a methylene chloride-based industrial solvent at tank 801-F. Waste from this operation was sent to LHAAP-18/24 (Jacobs, 2001).

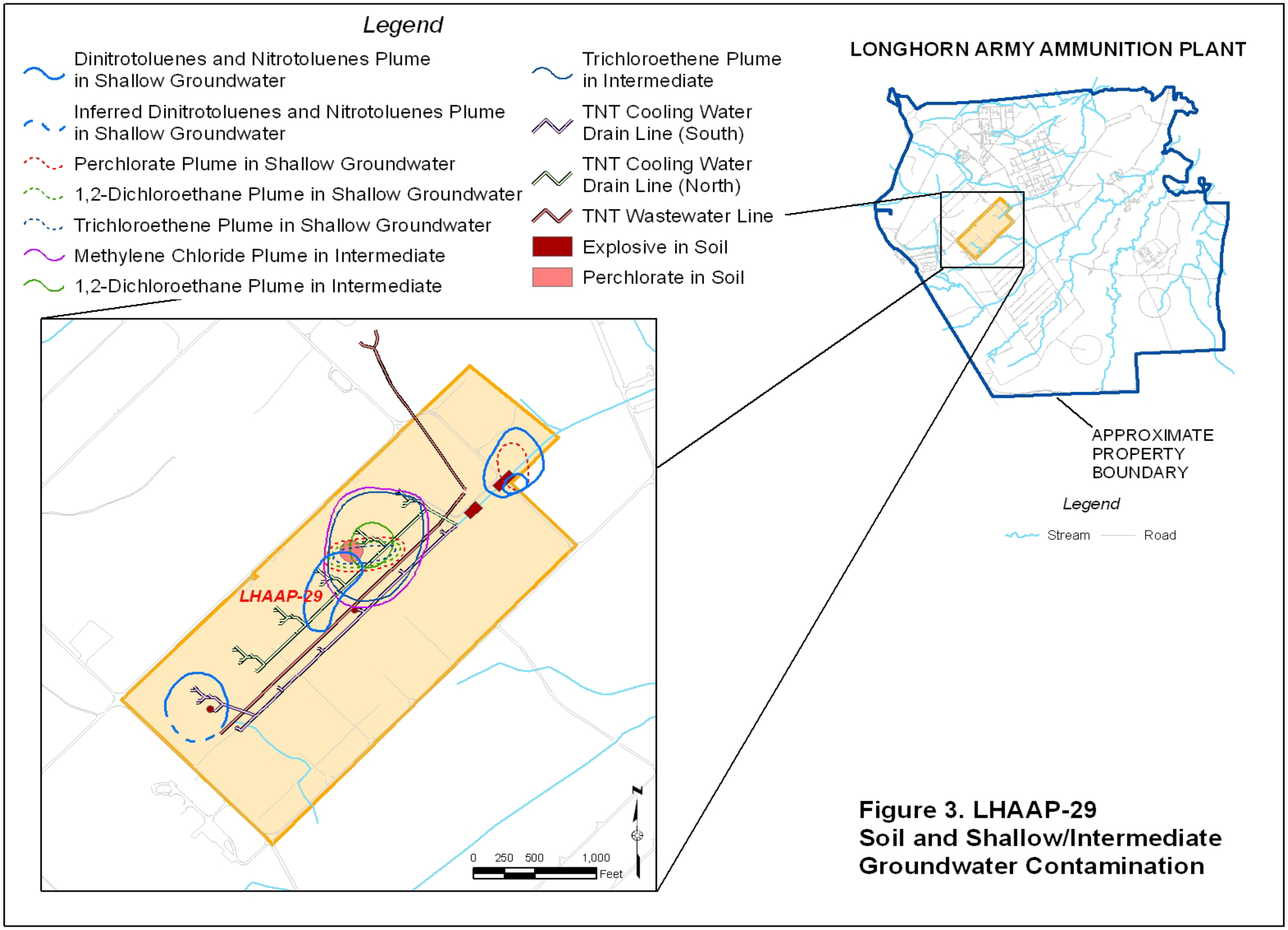


Figure 3. LHAAP-29
Soil and Shallow/Intermediate Groundwater Contamination

Between 1984 and 2009, numerous investigations were conducted in a phased approach to determine the nature and extent of contamination at LHAAP-29. Media investigated included soil, groundwater, surface water, sediment, and residue in process lines. These investigations included a Pre-RI investigation in 1982 and 1987; and Phase I, Phase II, and Phase III RIs conducted in 1993, 1995, and 1998, respectively. The results of these investigations are summarized in the Final Remedial Investigation Report – Group 2 Sites (Group 2 RI) (Jacobs, 2001). The Baseline Human Health Risk Assessment (BHHRA) was performed using the data presented in the Group 2 RI. The BHHRA identified TNT, dinitrotoluene (DNT), and perchlorate as chemicals of concern (COCs) for soil and dichloroethane (DCA), trichloroethene (TCE), DNT, 2-nitrotoluene, 3-nitrotoluene, 4-nitrotoluene, methylene chloride, and perchlorate as COCs for groundwater at LHAAP-29.

Additional investigations were conducted after the BHHRA was completed. In 2002, a site-wide perchlorate investigation was conducted and reported in the Final Project Report – Plant-Wide Perchlorate Investigation (STEP, 2005). In 2003-2004, an Environmental Site Assessment Phase I and II was conducted (Plexus, 2005).

Between 2004 and 2009, several follow-up investigations were performed to further delineate the extent of contamination identified during previous sampling events. These include the data gaps investigation in 2004 (Shaw, 2007a), additional explosives and perchlorate sampling in December 2004 and February 2005, and explosives sampling by USACE at a building foundation in February 2005 (Shaw, 2010), and the BERA in 2006 (Shaw, 2007b). Between August 2006 and February 2008, additional investigation activities for various environmental media were conducted. The objective of this sampling event was to collect samples of the solid residue and liquid remaining in the transite wastewater line, sediment samples along the former cooling water ditch, and groundwater from existing and newly installed monitoring wells to further delineate the extent of contamination at the site. A treatability study was completed in 2006 to evaluate the effectiveness of chemical oxidation using activated sodium persulfate to treat the methylene chloride in the intermediate zone. Additional groundwater samples were collected and analyzed for metals and volatile organic compounds (VOCs) in the shallow and intermediate zones in October 2008 and January 2009 which are all reported in the Final FS (Shaw, 2010).

SITE CHARACTERISTICS

The surface features at LHAAP-29 include the foundations for the former production facilities and the underground pipe lines that were originally built for cooling water drainage and TNT wastewater conveyance. The site is currently heavily wooded. Surface runoff is collected by ditches constructed in 1942 when the production facility was built. Surface runoff from the northern part of the site (about 40 percent of the site) enters Goose Prairie Creek located approximately 1,500 feet to the north and east of the site. Surface water runoff in the southern portion of the site (about 60 percent of the site) flows into a tributary of Central Creek located near the southeast portion of the site. Eventually, runoff from the two creeks enters Caddo Lake. The lake is a source of drinking water for several neighboring communities in Louisiana.

Clay or silty layers separate the three groundwater zones at LHAAP-29: shallow, intermediate, and deep. Depth of the shallow groundwater at the site generally ranges from 17 to 45 feet below ground surface (bgs) because of variable ground surface elevations across the site. The intermediate zone is less defined, but its depth is measured approximately 88 feet bgs. The deep groundwater zone extends to about 155 feet bgs. Groundwater monitoring wells at LHAAP-29 include 29 shallow wells, 12 intermediate wells, and 3 deep zone wells. Based on the 2007 water levels and historic potentiometric maps, the predominant groundwater flow in the shallow zone is east/southeast and is east/northeast in the intermediate zone. The shallow groundwater flows to the southeast from the site towards Central Creek. Although the plume is expected to remain stable, to be conservative, modeling was conducted to evaluate a groundwater to surface water pathway and indicated that 1) the VOC contaminants in the shallow zone will not reach Central Creek, and 2) if perchlorate were to reach the creek under that conservative scenario, the concentration in surface water will be below the surface water action level (Shaw, 2007c). On the eastern end of the site, there is a ditch that flows to Goose Prairie Creek. Based on data since 2000, the groundwater elevations have been at least six feet below the surface of the ditch. Thus, shallow groundwater will not impact surface waters.

The results of the additional data since the BHHRA did not change the overall outcome of the risk assessment, even though the list of COCs was modified. Although COCs have been detected in the shallow and intermediate groundwater zones beneath LHAAP-29, the horizontal extent of contamination is not widespread and appears to be isolated to a few specific areas at the site. The deep groundwater zone is not contaminated.

The COCs identified for the shallow groundwater zone are:

VOCs

- 1,2-DCA
- TCE

Explosives

- 2,4-DNT
- 2,6-DNT
- 2-nitrotoluene
- 3-nitrotoluene
- 4-nitrotoluene

Anion

- Perchlorate

Metals

- Arsenic
- Mercury
- Nickel

The COCs in the intermediate zone are:

- Methylene chloride
- 1,2-DCA
- TCE
- Arsenic

The shallow zone has approximately 9 million gallons of contaminated groundwater and the intermediate zone has approximately 21 million gallons (Shaw, 2010).

Explosive compound releases resulting from the manufacturing process of TNT, releases from process tanks and process pipelines, are the suspected contamination sources. Potential sources of contamination at the site are co-located wood and transite TNT wastewater pipelines, cooling water lines and manholes, explosives compounds in stained soils around the foundation of buildings, isolated perchlorate-containing soils in the northeastern portion of LHAAP-29, and TNT-contaminated sediment in the cooling water outfall ditch.

There are approximately 3,900 cubic yards of contaminated soil. The COCs identified for soil in the FS are:

- 2,4,6-TNT
- 2,4-DNT
- Perchlorate
- 2,6-DNT
- 2-amino-4,6-DNT
- 4-amino-2,6-DNT

Additionally, contaminated solid residue and liquid were detected in the transite TNT wastewater line and the vitrified clay cooling water lines and include:

- 2,4,6-TNT
- 2,4-DNT
- 2,6-DNT
- 2-amino-4,6-DNT
- 4-amino-2,6- DNT

The lines are buried and their contents are not subject to unintentional access and associated human exposure.

Within the intermediate groundwater zone at LHAAP-29, methylene chloride concentrations have been consistently detected at very high concentrations with a maximum concentration of 10,300,000 µg/L and a calculated solubility of 13,200,000 µg/L. There has been no direct observation of non-aqueous phase liquid, nor do groundwater data indicate that the methylene chloride plume is migrating. However, the groundwater concentrations indicate that soil in the saturated zone is likely to contain methylene chloride as residual source material in fractures and pores. Since there is a high cancer risk associated with exposure to groundwater from this region of the intermediate zone, such residual source material may be considered a principal threat waste.

SCOPE AND ROLE OF THE PROPOSED ACTION

The scope and role of the action discussed in this Proposed Plan includes all the remedial actions planned for this site. The recommended remedial action at LHAAP-29 will prevent potential risks associated with exposure to contaminated soil and groundwater in both the shallow and intermediate zones. Groundwater at Longhorn is not currently being used as drinking water, nor may be used in the future based on its reasonably anticipated use as a national wildlife refuge. However, when establishing the RAOs for this response action, the U.S. Army has considered the NCP's expectation to return useable groundwater to its potential beneficial use wherever practicable. The U.S. Army has also considered the State of Texas designation of all groundwater as potential drinking water, unless otherwise classified, consistent with Texas Administrative Code, Title 30, §335.563 (h)(1). The Army intends to return the contaminated shallow and intermediate groundwater zones at LHAAP-29 to its potential beneficial uses, which is considered to be the attainment of Safe Drinking Water Act maximum contaminant levels (MCLs) to the extent practicable, and consistent with Code of Federal Regulations, Title 40, §300.430(e)(2)(i)(B&C). If an MCL is not available for a chemical, the promulgated TCEQ medium-specific concentration (MSC) for groundwater that could be used for industrial purposes will be used. If return to potential beneficial use is not practicable, the NCP expectation is to prevent further migration of the plume, prevent exposure to contaminated groundwater, and evaluate further risk reduction.

Laboratory results from the groundwater at LHAAP-29 have indicated that possible "pools" of dense non-aqueous phase liquids may be residing as residual source material in fractures and pores in the subsurface. As a component of this groundwater, the hazardous contaminant methylene chloride is characterized as a highly toxic source material and, thus, potentially a principal threat waste. In accordance with the NCP, treatment alternatives have been evaluated through the remedy selection process. The preferred remedial alternative includes an active remedial component that would mitigate the potential principal threat. By instituting an in situ chemical oxidation treatment of the groundwater, this active treatment would be applied to the highest concentration area in the methylene chloride groundwater plume and would comply with NCP expectations regarding treatment of affected media where principal threat may be considered.

The preferred remedial action will include groundwater monitoring to demonstrate that the plume is not migrating and to verify that contaminant levels are being reduced. LUCs that restrict groundwater use may be terminated when groundwater contaminant levels are reduced to the cleanup levels.

The removal of source soils will positively impact groundwater by eliminating the potential for the leaching of contaminants from the soil into groundwater and will remove the contamination that poses a risk to ecological receptors. Plugging the inlets and outlets of the underground lines with a bentonite slurry mix including the manholes of the process cooling water lines would minimize contact with the hypothetical future maintenance workers and prevent water from infiltrating and transporting contaminants.

SUMMARY OF SITE RISKS

The reasonably anticipated future use of this site is nonresidential use 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 U.S. 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 nearly 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 BHHRA and screening ecological risk assessment were conducted for LHAAP-29 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

Using data presented in the RI, the baseline risk assessment estimates the risk that the site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The applicable receptor scenario for future use as a national wildlife refuge is a hypothetical future maintenance worker. For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen and are expressed in scientific notation (e.g.

1×10^{-6}). USEPA's acceptable risk range for site-related exposures is 1×10^{-4} to 1×10^{-6}, i.e., one-in-ten thousand to one-in-one million. The potential for non-cancer effects is expressed by a ratio of the exposure to the toxicity. An individual chemical ratio less than 1 indicates that toxic non-cancer effects from that chemical are unlikely. A non-cancer hazard index (HI) is calculated when all the ratios for the individual chemicals are summed. An HI greater than 1 indicates that site-related exposures may present a risk to human health. Thus, an HI of less than 1 is acceptable since it indicates toxic non-cancer effects are unlikely.

The cancer risk and the non-cancer HI were calculated based on a hypothetical future maintenance worker exposure to the site environmental media (e.g., soil and groundwater) under an industrial scenario. The human health risk assessment concluded that chemicals in soil pose an unacceptable non-cancer hazard (HI of 1.3) for a hypothetical future maintenance worker under an industrial scenario. The groundwater was also determined to pose an unacceptable cancer risk (3.9×10^{-1}) and an unacceptable non-cancer hazard (HI of 3,000) to a hypothetical future maintenance worker. The risk and HI values are based on the industrial exposure scenario that includes drinking the water or using the water for hand washing or showering. Soil contaminants retained as COCs in the FS are 2,4,6-TNT, 2,4-DNT, 2,6-DNT, and perchlorate.

Soil

The potential soil-to-groundwater pathway was evaluated for the emerging contaminant perchlorate (found in groundwater) and the explosives posing risks or hazards in soil. The concentrations of these chemicals were compared to their TCEQ soil MSCs for industrial use based on groundwater protection (GWP-Ind), which is more stringent than the MSCs for industrial use based on inhalation, ingestion, and dermal contact. Because the GWP-Ind is more stringent, they are the proposed soil cleanup levels for human health. The maximum detected concentrations of the COCs and GWP-Ind (proposed as the cleanup levels) are presented in **Table 1**.

Table 1. Soil Chemicals of Concern

Chemical	Maximum Concentration (mg/kg)	GWP-Ind (mg/kg)
2,4,6-Trinitrotoluene	26,000	5.1
2,4-Dinitrotoluene	8,000	0.042
2,6-Dinitrotoluene	15	0.042
Perchlorate	8.6	7.2

Notes:
mg/kg milligrams per kilogram
GWP-Ind Texas Commission on Environmental Quality soil MSC for industrial use based on groundwater protection

Since these soil cleanup levels apply to the soil-to-groundwater pathway and not direct human contact, they would apply to soil at a depth interval from the surface down to where groundwater is encountered.

Groundwater

Groundwater contaminants identified as COCs in the FS contributing to human health cancer risk and non-cancer hazard are methylene chloride, TCE, 1,2-DCA, 2,4-DNT, 2,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 4-nitrotoluene, and perchlorate. TCE degrades to cis-1,2-dichloroethene (DCE) and vinyl chloride, which are also considered COCs. The proposed cleanup level is the MCL, where it exists. Where an MCL has not been promulgated, the TCEQ groundwater MSC for industrial use (GW-Ind) is the proposed cleanup level. Separate lists of COCs have been identified for the shallow and intermediate zone groundwater. The maximum detected concentrations of the COCs from the most recent sampling event and the MCLs or GW-Ind (proposed as the cleanup levels) for the shallow and intermediate zones are presented in **Tables 2** and **3**, respectively.

Table 2. Shallow Groundwater Zone Chemicals of Concern

Chemical	Most Recent Maximum Concentration (µg/L)	MCL (µg/L)
Methylene chloride	3	5
Trichloroethene	344	5
1,2-Dichloroethane	8180	5
1,1-Dichloroethene	19.2	7
cis-1,2-Dichloroethene*	below MCL	70
trans-1,2-Dichloroethene*	below MCL	100
Vinyl chloride*	below MCL	2
Arsenic	141	10
Mercury	6.1	2
		GW-Ind (µg/L)
2,4-Dinitrotoluene	50.9	0.42
2,6-Dinitrotoluene	239	0.42
2-Nitrotolune**	8,140	13
3-Nitrotolune**	451	1,000
4-Nitrotolune**	1,400	180
Perchlorate	16,800	72
Nickel	8,400	2,000

Notes:
* trichloroethene daughter products
**GW-Ind has been recalculated to reflect 2010 toxicity values
µg/L micrograms per liter
GW-Ind groundwater MSC for industrial use using updated toxicity information through March 31, 2010
MCL maximum contaminant level

Table 3. Intermediate Groundwater Zone Chemicals of Concern

Chemical	Most Recent Maximum Concentration (µg/L)	MCL (µg/L)
Methylene chloride	10,300,000	5
Trichloroethene	4,340	5
1,2-Dichloroethane	14.3	5
cis-1,2-Dichloroethene*	315 J	70
trans-1,2-Dichloroethene*	below MCL	100
Vinyl chloride*	22.4	2
Arsenic	44	10

Notes:
* trichloroethene daughter products
µg/L micrograms per liter
MCL maximum contaminant level
J concentration is estimated

Cooling and Wastewater Lines

At LHAAP-29 there are transite and wooden TNT wastewater lines and vitrified clay cooling water lines with manholes (north and south). The transite TNT wastewater line has solid residues contaminated with explosives at concen-trations above the GWP-Ind, as shown in **Table 4**. The wooden TNT wastewater line was flushed and abandoned, and it was determined that no further action is necessary for this line. The north and south cooling water lines have liquid and solid residues contaminated with explo-sives at concentrations that are above the GW-Ind (liquid) and the GWP-Ind (solid residue), which are presented in **Tables 5** and **6**, respectively. The GW-Ind and GWP-Ind are the proposed cleanup levels.

Table 4. Transite TNT Wastewater Line Solid Residue Chemicals of Concern

Chemical	Maximum Concentration (mg/kg)	GWP-Ind (mg/kg)
1,3-Dinitrobenzene	1.08	1
2,4,6-Trinitrotoluene	526	5.1
2,4-Dinitrotoluene	89	0.042
2-amino-4,6-Dinitrotoluene	19 JH	1.7
4-amino-2,6-Dinitrotoluene	13.3	1.7

Notes:
GWP-Ind Soil MSC for industrial use based on groundwater protection
JH concentration is estimated and biased high
mg/kg milligrams per kilogram

Table 5. Cooling Water Drain Line Liquid Chemicals of Concern

Chemical	Maximum Concentration (µg/L)	GW-Ind (µg/L)
2,4,6-Trinitrotoluene	5,200	51
2,4-Dinitrotoluene	15	0.42
2,6-Dinitrotoluene	27	0.42
2-amino-4,6-Dinitrotoluene	220	17
4-amino-2,6-Dinitrotoluene	290	17

Notes:
µg/L micrograms per liter
GW-Ind groundwater MSC for industrial use

Table 6. Cooling Water Drain Line Solid Residue Chemicals of Concern

Chemical	Maximum Concentration (mg/kg)	GWP-Ind (mg/kg)
2,4,6-Trinitrotoluene	11	5.1
2,4-Dinitrotoluene	1.1	0.042
2,6-Dinitrotoluene	0.30 J	0.042
2-amino-4,6-Dinitrotoluene	9	1.7
4-amino-2,6-Dinitrotoluene	7.8	1.7

Notes:
J concentration is estimated
mg/kg milligrams per kilogram
GWP-Ind Soil MSC for industrial use based on groundwater protection

Ecological Risks

The ecological risk for LHAAP-29 was addressed in the installation-wide BERA (Shaw, 2007b). 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 were made in the context of the overall conclusions of the sub-area in which the site falls. Site LHAAP-29 lies within the Industrial Sub-Area.

The ecological HQs are simple ratios of an ecological receptor's estimated chemical intake (in units of milligrams of chemical ingested per kilograms of receptor body weight per day) to either an assumed safe- or effect-level dose of the same chemical, in the same units as the chemical intake. HQs have a number of limitations, primary among them that they are not measures of risk. Even though the BERA concluded that ecological hazards were acceptable for the Industrial Sub-Area, elevated concentrations of nitrotoluenes (Shaw, 2007b) (2,4-DNT, 2,6-DNT, and 2,4,6-TNT) and dioxin were identified at one location. The HQ screening values for these three constituents at LHAAP-29 were greater than 1 (9682, 18,844, and 16.9 respectively). Detected concentrations of these chemicals in one hot spot exceeded the Industrial Sub-Area ecological preliminary remediation goal and are targeted for excavation. Some of the areas are co-located with excavation for human health. For ecological receptors, the depth of excavation varies since they are based on the different ecological receptors (deer mouse from 0 to 0.5 feet and the short- tailed shrew from 0 to 3 feet).

Proposed soil cleanup levels for the ecological receptors are as follows:

- 2,4,6-TNT – 6.1 mg/kg (0 to 0.5 feet)
  4.7 mg/kg (0 to 3 feet)
- 2,4-DNT – 12 mg/kg (0 to 3 feet)
- 2,6-DNT – 2.7 mg/kg (0 to 0.5 feet)
  6.8 mg/kg (0 to 3 feet)

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

The Army recognizes USEPA's policy to return all groundwater to potential beneficial uses, based upon the non-binding programmatic expectation in the NCP.

The RAOs for LHAAP-29, which address contamination associated with the media at the site and take into account the future uses of LHAAP surface water, land, and groundwater are:

- Protection of human health by preventing human exposure to the contaminants in the soil, sediment, transite TNT wastewater line, cooling water lines, and groundwater,
- Protection of human health and the environment by preventing the migration of contaminants to groundwater and surface water from potential sources in the soil, sediment, and process lines (TNT wastewater and cooling water),
- Protection of human health and the environment by preventing contaminated groundwater from migrating into nearby surface water,
- Protection of ecological receptors by preventing exposure to the contaminated soil and sediment, and
- Return of groundwater to its potential beneficial uses as drinking water, wherever practicable.

SUMMARY OF REMEDIAL ALTERNATIVES

The FS identified and screened remedial technologies and associated process options that may be appropriate for satisfying the RAOs for LHAAP-29 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 – Excavation and Off-site Disposal for Soil; Plug Lines; In Situ Chemical Oxidation, MNA and LUCs for Intermediate Zone Groundwater, and MNA and LUCs for Shallow Zone Groundwater
- Alternative 3 – Excavation and Off-site Disposal for Soil; Plug Lines; Intermediate Zone Groundwater Extraction, MNA and LUCs for Groundwater

Common Elements. Five elements, MNA, LUCs, inspection and long-term monitoring, plugging lines, and soil excavation and off-site disposal, are common to Alternatives 2 and 3. These elements are described below.

Monitored Natural Attenuation. MNA is a passive remedial action 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 that the contaminated groundwater remains localized with minimal migration and that contaminant concentrations are being reduced to MCLs. Historical data in conjunction with two years of quarterly sampling results will be evaluated for monitoring the degradation of contaminant concentrations in accordance with standard MNA practices.

Land Use Controls. The LUCs would be implemented to support the RAOs. 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 LUC implementation actions in a remedial design (RD) document. Until cleanup levels are met in the groundwater for Alternatives 2 and 3, the LUCs would prevent human exposure to residual groundwater contamination presenting an unacceptable risk to human health by ensuring there is no withdrawal or use of groundwater beneath the sites for anything other than treatment, environmental monitoring, or testing. The groundwater restriction LUCs would be maintained until the concentrations of contaminants in groundwater have been reduced to cleanup levels. In addition, the Texas Department of Licensing and Regulation will be requested to notify well drillers of groundwater restrictions. The recordation of the LUCs with the Harrison County Courthouse would be completed and would include a map showing the areas of groundwater restriction at the site. These restrictions would prohibit or restrict property uses that may result in exposure to the contaminated groundwater.

In order to transfer this property (LHAAP-29), an environmental condition of property (ECP) document would be prepared and the Environmental Protection Provisions from the ECP would be attached to the letter of transfer. The ECP would include LUCs for groundwater as part of the Environmental Protection Provisions. The property would be transferred subject to the LUCs identified in the ECP. 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). Although the U.S. Army may later pass these procedural responsibilities to the transferee by property transfer agreement, the U.S. Army would retain ultimate responsibility for remedy integrity.

Inspection and Long-term Monitoring. Alternatives 2 and 3 include inspection and long-term groundwater monitoring activities. Monitoring would be continued as required to demonstrate effectiveness of the remedies, to demonstrate compliance with applicable or relevant and appropriate requirements (ARARs), to-be-considered requirements, and RAOs, and to support CERCLA Five-Year Reviews. After the initial MNA monitoring period of 2 years, semiannual monitoring would be continued for 3 years. Then sampling frequency would be reduced to annually until the next CERCLA Five-Year Review. Future sampling frequencies would be evaluated in the CERCLA Five-Year Review.

Groundwater LUCs would remain in effect until cleanup levels are met.

Plug and Abandon Lines. The transite TNT wastewater line will be flushed with water, then the inlets and outlets will be inspected and plugged with a bentonite slurry mix or equivalent. The cooling water lines will be evaluated further during the RD in order to base the remedial action on up-to-date data. The lines will be flushed with water and inspected. Rinsate water will be containerized and characterized for waste handling. If the quantity of residue is insufficient for sampling or the samples indicate no GW-Ind or GWP-Ind exceedances, and the residue is characterized as nonhazardous, the pipe and manholes will be plugged and abandoned without flushing using a bentonite slurry mix or equivalent.

Excavation and Off-site Disposal of Contaminated Soil. Soil contamination would be excavated at LHAAP-29 under Alternatives 2 and 3, and disposed off site. This action would eliminate ecological risk from direct contact as well as human health risk associated with both direct contact and the soil-to-groundwater pathway.

Contamination is primarily present from the surface to where groundwater is encountered. The soil will be excavated in several small areas, totally approximately 3,900 cubic yards.

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. Compliance with the ARARs would not be achieved.

Estimated Capital Present Worth Cost: $0

Estimated Operation and Maintenance (O&M) Present Worth Cost: $0

Estimated Duration: –

Estimated Total Present Worth Cost: $0

Alternative 2 – Excavation and Off-site Disposal for Soil; Plug Lines; In Situ Chemical Oxidation, MNA and LUCs for Intermediate Zone Groundwater, and MNA and LUCs for Shallow Zone Groundwater

Alternative 2 would include excavation of the contaminated soil from LHAAP-29. The transite TNT wastewater line would be flushed, plugged, and abandoned in place. The vitrified clay cooling water lines would be inspected, flushed depending on line contents, plugged, and abandoned in place. MNA would be used for the contaminated shallow groundwater. In the intermediate groundwater zone, in situ chemical oxidation would be used to treat the highest concentration area in the methylene chloride plume. During in situ oxidation, chemical oxidant would be injected in targeted locations to oxidize organic constituents in the saturated zone. Groundwater would be extracted to help distribute the oxidant. The extracted groundwater would be conveyed to the on-site groundwater treatment plant for treatment and discharge. Monitoring of both the shallow and intermediate zones would confirm that groundwater contamination remains localized and degrades over time. Monitoring of the intermediate zone would also confirm that the concentrations have been reduced to a level conducive to natural attenuation. MNA is estimated to take approximately 70 years in the shallow groundwater zone based on the attenuation of 1,2-DCA. The in situ treatment in the intermediate zone is estimated to take approximately 3 years. In situ treatment would be followed by MNA in the intermediate zone, which is estimated to take about 90 years based on the attenuation of TCE. Other COCs are expected to require less time to attenuate. MNA would continue until cleanup levels are met. LUCs would be implemented to prevent exposure to the contaminated groundwater until cleanup levels are achieved. Compliance with ARARs is expected to be achieved.

Estimated Capital Present Worth Cost: $2,109,000

Estimated O&M Present Worth Cost: $919,000

Cost Estimate Duration: 30 years

Estimated Total Present Worth Cost: $3,028,000

Alternative 3 – Excavation and Off-site Disposal of Soil; Plug Lines; Intermediate Zone Groundwater Extraction and Treatment, MNA and LUCs for Intermediate and Shallow Zone Groundwater

As with Alternative 2, contaminated soil would be removed and contamination in the lines would be mitigated. Groundwater contamination would be reduced throughout the intermediate zone groundwater contaminant plume via groundwater extraction until VOC levels are reduced. The extracted groundwater would be conveyed to the onsite groundwater treatment plant for treatment. Monitoring of both the shallow and intermediate zones would confirm that groundwater contamination remains localized and degrades over time to a level conducive to natural attenuation. MNA is estimated to take approximately 70 years in the shallow groundwater zone based on the attenuation of 1,2-DCA. The extraction in the intermediate zone is estimated to take approximately 3 years followed by MNA. MNA is estimated to take about 90 years in the intermediate zone based on the attenuation of TCE. As in Alternative 2, LUCs would be implemented to prevent exposure to the contaminated groundwater until cleanup levels are achieved. Compliance with ARARs is expected to be achieved.

Estimated Capital Present Worth Cost: $1,360,000

Estimated O&M Present Worth Cost: $1,558,000

Cost Estimate Duration: 30 years

Estimated Total Present Worth Cost: $2,918,000

EVALUATION OF ALTERNATIVES

Nine criteria identified in the NCP, §300.430(e)(9)(iii), 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 alternatives under consideration. The nine evaluation criteria are discussed below. The "Detailed Analysis of Alternatives" can be found in the FS for LHAAP-29 (Shaw, 2010).

1. Overall Protection of Human Health and the Environment

The three 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 soil or to the groundwater contamination. Additionally, the soil pathway for ecological receptors would not be addressed. Although natural attenuation will continue to occur under Alternative 1 that would result in contaminant removal, the possibility that the RAO would be achieved in a timely manner is least likely since the potential principal threat waste source remains in place.

Alternatives 2 and 3 satisfy the RAOs for LHAAP-29. They would remove the contaminated soil and residue in lines, restore the groundwater to cleanup levels, and provide access and use restrictions for residual contamination. Alternatives 2 and 3 would rely on LUCs to prevent access to the groundwater until cleanup levels are achieved by MNA. Both Alternatives 2 and 3 provide treatment of the primary COC, methylene chloride, for human health in the intermediate zone. Alternative 3 provides a level of overall protection similar to Alternative 2, but Alternative 2 will accelerate the methylene chloride cleanup time in the intermediate zone.

2. Compliance with ARARs

Alternative 1 does not comply with chemical-specific ARARs because no remedial action or measures would be implemented. Alternatives 2 and 3 do comply with all chemical-specific ARARs for soil because the contaminated soil above the chemical-specific ARAR will be removed, and all chemical-specific groundwater ARARs because they will return the contaminated groundwater at LHAAP-29 to its potential beneficial use wherever practicable, in compliance with Safe Drinking Water Act MCLs as relevant and appropriate.

Location-specific and action-specific ARARs would not apply to Alternative 1 since no remedial activities would be conducted. Alternatives 2 and 3 would 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 source removal or treatment would take place and no measures would be implemented to control exposure risks posed by contaminated site soil, sediment, surface water and groundwater. Although natural attenuation will continue to occur resulting in contaminant removal, the likelihood that the RAO would be achieved in a timely manner is remote unless the source is removed.

Alternative 2 and 3 would provide a moderate degree of long-term effectiveness by removing the source soils and providing restoration of the groundwater by MNA. Alternative 2 provides a slightly higher level of effectiveness than Alternative 3 since the intermediate groundwater zone would reach concentrations amenable to natural attenuation in a shorter time frame. By requiring a shorter time frame, Alternative 2 allows the opportunity to evaluate the impact of the in situ treatment and re-inject if necessary. Alternative 3 will require more time to reduce concentrations amenable to MNA than Alternative 2, and will require a longer period of active operations and maintenance. Alternatives 2 and 3 rely on the LUC for the protection of human health exposure until concentrations attain cleanup levels. As is consistent with the required 5-year CERCLA reviews, both Alternatives 2 and 3 would be monitored and performance of controls will be assessed, in compliance with the risk reduction goals.

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.

Natural attenuation and in situ chemical oxidation or pumping/treatment coupled with excavation would permanently reduce the mass and concentration of contaminants and, therefore, the toxicity, mobility, and volume of the contaminants. MNA is a passive remedial action and in situ chemical oxidation is an active treatment process.

Alternatives 2 and 3 would generate daughter products that may temporarily increase toxicity or mobility of the contaminant plume, with in situ chemical oxidation working in a shorter time frame and pumping and treatment working to reduce concentrations initially. The alternatives include monitoring so TCE daughter products would be quantified, documented and evaluated. Daughter product concentrations would be reduced under these alternatives to levels below their cleanup levels to return groundwater to its potential beneficial use as drinking water wherever practicable.

For Alternative 2, achievement of cleanup levels in groundwater would be expedited more than Alternative 3 by implementing in situ chemical oxidation in areas of highest contaminant concentrations. Monitoring for contaminants would be performed to assess the effectiveness of the treatment. It is also anticipated that COCs would remain in the plume outside the treated areas and continue to attenuate to cleanup levels over time.

The soil excavation in Alternatives 2 and 3 would reduce mobility because perchlorate and explosive contaminated soils would be removed from the site and placed in a permitted disposal facility. Toxicity and volume would not be reduced by the excavation portion of the alternatives as the form and quantity of the contaminants would not be altered.

There is an NCP expectation to use treatment to address principal threat wastes, wherever practicable. Remedial Alternatives 2 and 3, as presented in this Proposed Plan, satisfy the NCP expectation by including treatment components that address the potential for principal threat wastes associated with the high concentrations of methylene chloride in the intermediate zone.

5. Short-Term Effectiveness

Alternative 1 would not involve any remedial measures; therefore, no short-term risk to workers, the community or the environment would exist. The activities associated with Alternatives 2 and 3 would be protective to the surrounding community from short-term risks except for minimal potential short-term risks during transport (possible accident when soil is transported off site) of perchlorate and explosive contaminated soil.

Alternatives 2 and 3 would involve potential short-term risks to workers associated with exposure to contaminated groundwater from monitoring and/or operation of drilling/construction equipment.

Alternative 2 would have short-term risks to remediation workers associated with exposure while performing in situ chemical oxidation activities, including handling of additives/materials.

Alternatives 2 and 3 include LUCs as elements of their remedies and would provide almost immediate protection from the contaminated groundwater by prohibiting installation of potable water wells through relatively quick LUC implementation. The time period to achieve groundwater cleanup levels is the most significant difference between Alternative 1 versus Alternatives 2 and 3. Alternatives 2 and 3 are expected to take less time to achieve RAOs.

Alternative 3 would have short-term risks to the workers associated with exposure during increased operations at the LHAAP groundwater treatment system, which include chemical handling (caustic acids) and operation of a high-temperature catalytic oxidizer. The implementation of Alternative 3 would require more time than Alternative 2.

6. Implementability

Under Alternative 1, no remedial action would be taken. Therefore, no difficulties or uncertainties would be associated with its implementation. For Alternatives 2 and 3 soil excavation would require extensive coordination between excavation, sampling, transportation and disposal. For groundwater, Alternative 2 is technically implementable, but because of the uncertainties associated with hydrogeologic conditions would require specialized expertise to design and construct the in situ chemical oxidation treatment elements. Those conditions may impact the ability of in situ chemical oxidation to lower methylene chloride concentrations quickly to levels that would be more amenable to MNA of TCE.

Alternative 3 would involve the use of a groundwater treatment system which currently exists at the LHAAP and is easily accessible to the site; therefore, groundwater extraction for Alternative 3 technically would be readily implementable.

Administratively, all of the alternatives are implementable.

7. Cost

Cost estimates are used in the CERCLA FS process to eliminate those remedial alternatives that would be 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 –30 to +50 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.

The cost estimates include capital costs (including fixed-price remedial construction) and long-term O&M costs (post-remediation). Overall present worth costs are developed for each alternative assuming a discount rate of 2.8 percent. The duration used for the estimates is a 30-year period.

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

Alternative 3 has the lowest present worth of the two alternatives and capital costs are equivalent to the capital costs for Alternative 2 of the active remedial alternatives because of the presence of the existing groundwater treatment system at LHAAP. Alternative 2 has the highest present worth and capital costs primarily due to the activities associated with the injection phase of in situ chemical oxidation.

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. Both agencies concur with the preferred alternative.

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 (excavation and off-site disposal of soil; plug lines; extraction, in situ chemical oxidation and MNA for intermediate zone groundwater, MNA and LUCs for shallow zone groundwater) is the preferred alternative for LHAAP-29 and is consistent with the intended future use of the site as a national wildlife refuge. This alternative would satisfy the RAOs for the site through the following:

- Contaminated soil and sediment removal with off-site disposal to protect the hypothetical future maintenance worker and ecological receptors and eliminate the soil-to-groundwater pathway
- Inspection, flushing and/or plugging of the TNT wastewater line and flushing and/or plugging the vitrified clay cooling water lines to eliminate potential exposure from residual contamination
- In situ chemical oxidation treatment for intermediate zone VOC groundwater plume to expedite MNA
- MNA to reduce contaminant levels to cleanup levels and confirm the contaminated groundwater remains localized with minimal migration
- LUCs that would ensure protection of human health by preventing exposure until cleanup levels are met

Long-term monitoring and reporting would continue until the cleanup levels are achieved.

The in situ chemical oxidation will lower methylene chloride concentrations in the intermediate zone to make conditions more amenable for MNA of TCE. The selected alternative offers a high degree of long-term effectiveness and can be easily and immediately implemented.

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 §121(b) requirement used to evaluate remedial alternatives. The preferred alternative will 1) be protective of human health and the environment; 2) comply with ARARs; 3) be cost-effective; 4) utilize a permanent solution; and 5) utilize an active treatment as a principal element. The selected remedy addresses the statutory preference for treatment to the maximum extent possible. No source materials constituting principle threats will be addressed within the scope of this action.

The Army intends to present details of the soil excavation plan, groundwater extraction plan, LUCs implementation plan, groundwater monitoring plan, and MNA remedy implementation in the RD for LHAAP-29.

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

Notification that the site is suitable for nonresidential use will accompany all transfer documents and will be recorded in the Harrison County Courthouse. Five-Year Reviews will be performed to document that the remedy remains protective of human health and the environment.

COMMUNITY PARTICIPATION

The U.S. Army, USEPA, and TCEQ provide information regarding LHAAP-29 through public meetings, the Administrative Record file for the facility, and announcements published in the Shreveport Times and Marshall News Messenger newspapers.

The dates for the public comment period, the date, location, 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-29

Jacobs Engineering Group, Inc. (Jacobs), 2001, *Final Remedial Investigation Report for the Group 2 Sites Remedial Investigation (Sites 12, 17, 18/24, 29, and 32) at the Longhorn Army Ammunition Plant, Karnack, Texas*, April.

Jacobs, 2002, *Draft Baseline Human Health and Screening Ecological Risk Assessment for the Group 2 Sites (Sites 12, 17, 18/24, 29, 32, 49, Harrison Bayou and Caddo Lake), Longhorn Army Ammunition Plant, Karnack, Texas*, February.

Plexus Scientific Corporation, 2005, *Final Environmental Site Assessment, Phase I and II Report, Production Areas, Longhorn Army Ammunition Plant, Karnack, Texas, Columbia, Maryland,* February.

Shaw Environmental, Inc. (Shaw), 2007a, *Final Data Gaps Investigation Report, Longhorn Army Ammunition Plant, Karnack, Texas,* April.

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

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Solutions to Environmental Problems, Inc. (STEP), 2005, *Final Plant-Wide Perchlorate Investigation, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, Tennessee,* April.

Texas Commission on Environmental Quality (TCEQ), 2006, *Updated Examples of Standard No. 2, Appendix II, Medium-Specific Concentrations*, March 21, 2006.

U.S. 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.

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—The hazard index is the sum of the hazard quotients for all chemicals to which an individual is exposed. A hazard index value of 1.0 or less indicates that no adverse non-cancer human health effects are expected to occur. Each hazard quotient is a comparison of an estimated chemical intake (dose) with a reference dose level below which adverse health effects are unlikely. Each hazard quotient is expressed as the ratio of the estimated intake (numerator) to the reference dose (denominator). The value is used to evaluate the potential for non-cancer health effects, such as organ damage, from chemical exposures.

Maximum Contaminant Level (MCL)—The MCL 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 an MCL was evaluated by comparing it to its associated MCL.

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
BHHRA	baseline human health risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chemical of concern
DCA	dichloroethane
DCE	dichloroethene
DNT	dinitrotoluene
ECP	environmental condition of property
FFA	Federal Facility Agreement
FS	Feasibility Study
GW-Ind	groundwater MSC for industrial use
GWP-Ind	soil MSC for industrial use based on groundwater protection
HI	hazard index
Jacobs	Jacobs Engineering Group, Inc.
LHAAP	Longhorn Army Ammunition Plant
LTM	long-term monitoring
LUC	land use control
MCL	maximum contaminant level
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
MNA	monitored natural attenuation
MSC	medium-specific concentration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	operation and maintenance
Plexus	Plexus Scientific Corporation
RAO	remedial action objective
RD	remedial design
RI	remedial investigation
ROD	record of decision
Shaw	Shaw Environmental, Inc.
STEP	Solutions to Environmental Problems, Inc.
TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality
TNT	trinitrotoluene
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 LHAAP-29 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 April 19, 2011. If you have questions about the comment period, please contact Dr. Rose M. Zeiler 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

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

MONTHLY MANAGERS' MEETING

AGENDA

DATE:	Monday, 21 March 2011
TIME:	08:30 am.
PLACE:	Teleconference - Call In Number Courtesy of Shaw: 866-797-9304/4155734

Welcome **RMZ**

Action Items
Army
- Provide update on LHAAP-65 and 56.
- Update Schedule for RODs and RDs.

Shaw
- Survey sumps at LHAAP-35/36 – Completed.
- Confirm the exact date of next sampling event in March at GWTP so that EPA can split samples as part of QA. – Completed. EPA was informed about the sampling during the week of March 14th,
- Distribute LHAAP-29 Proposed Plan electronically to RAB and TAG with hard copies to Picken Winters. Completed.
- Update Master Sampling Schedule - LHAAP-12, 16, 18/24 and creek sampling schedule – In progress.
- Evaluate MW22 for potential mounding and breakthrough to the South. Shaw to sample Well 126 for VOCs and perchlorate.

EPA – Topics for Discussion **ST**
- Repair of gauge in Harrison Bayou near GWTP- Update
- RODs, RDs and schedule

Defense Environmental Restoration Program (DERP) PBC Update **SGW**
- Document Status/Environmental Sites (Table)
- LHAAP-29 Proposed Plan Meeting
- Groundwater Treatment Plant
- Groundwater and Surface Water Sampling Schedule Spreadsheet

DERP Total Environmental Restoration Contract Update **Army**
- LHAAP-37/67 RD Status – Comment Responses

MMRP Update **Army**
- Status of MC Data Summary Report
- Approach to MMRP ROD

Review of Schedule	**Army**
IAP Update	**Army**
USFWS Update	**RMZ/PB**

- Environmental Restoration Issues with Transfer Schedule Impact
- USFWS Comments on Documents

Adjourn

Shaw Environmental, Inc.

Subject: **Final Minutes, Monthly Managers Meeting, Longhorn Army Ammunition Plant (LHAAP)**

Location of Meeting: **Teleconference**
Date of Meeting: **March 21, 2011; 8:30AM – 9:30 AM**

Meeting Participants:

BRAC:	Rose M. Zeiler
USACE-Tulsa:	Aaron Williams, John Lambert
Shaw:	Susan Watson, Kay Everett
USEPA Region 6:	Steve Tzhone, Terry Burton
TCEQ:	Fay Duke, Dale Vodak
USGS:	Kent Becher
USFWS:	Paul Bruckwicki, Barry Forsythe

Welcome **Rose M. Zeiler**

Action Item Status:

Army

- Provide update on document review for LHAAP-65 and -56 - *in progress; provided additional supporting documentation on LHAAP-56 to TCEQ. Please advise if additional discussion or information is needed.*

  TCEQ - will review the support documentation for LHAAP-56

- Update Schedule for RODs and RDs. – *coordinate with Shaw and send out today. Will present to community during RAB meeting tomorrow. Steve advised he wants to see prior to distribution.*

Shaw

- Survey sumps at LHAAP-35/36 – *completed. Shaw will bring hard copy to Rose Zeiler for her review. Then it will be submitted to TCEQ for legal review.*
- Confirm the exact date of next sampling event in March at GWTP so that EPA can split samples as part of QA. – *completed. EPA was informed and conducted QC sampling for 5 surface water location and 6 wells during the week of March 14th. The EPA samples were analyzed with 2 week turn-around-time.*
- Distribute LHAAP-29 Proposed Plan electronically to RAB and TAG with hard copies to Pickens Winters. *–completed*
- Update Master Sampling Schedule – LHAAP-12, 16, and 18/24 and creek sampling schedule – *in progress – was emailed to stakeholders after the meeting.*

- Check MW-22 sampling results for potential mounding and breakthrough to the South. Shaw to sample Well 126 for VOCs and perchlorate. – *in progress, will be sampled with the next round of GWTP samples.*

EPA -- Topics for Discussion

- Repair of gauge in Harrison Bayou near GWTP – *Shaw repaired gauge and will utilize to the extent possible.*
- RODs, RDs and schedule – *Steve indicated that EPA HQ would be at Region 6 April 8. He wanted the Draft Final ROD for LHAAP-17 and the Draft ROD for LHAAP-16 available when they arrive. There were a couple comments regarding LHAAP-17 regarding ecological issues but there was no impact in that Sub-area, and the assessment of all areas should be wrapped up this week. There were no problems with LHAAP-17, but an explanation of the ecological issues discovered will be provided.*
- Steve mentioned that the ATSDR can have a health speaker at the next RAB meeting or even earlier if they can work it in. Rose indicated it would be put on the agenda.

Defense Environmental Restoration Program (DERP) PBC Update Susan Watson

Document Status/Environmental Sites

Susan Watson went over the document status/environmental sites table.

- LHAAP-03: Currently addressing TCEQ comments and will be provided by end of week.
- LHAAP-04: Received TCEQ comments on the draft final completion report. Currently addressing regulatory comments. The preliminary draft FS for LHAAP-04 is in Army's review.
- LHAAP-16: The revised draft ROD is in Army's review.
- LHAAP-17: Preliminary draft ROD is being prepared and, as discussed at the last meeting, it was discovered that some of the data was used during the ecological risk assessment had been previously disqualified. An assessment is being conducted on this issue. If this issue impacts LHAAP-17 in any way, it will be communicated swiftly and a reassessment to any decisions made in regards to LHAAP-17 will be expedited.
- LHAAP-18/24: The RTCs for regulatory comments are in Army's review.
- LHAAP-29: Final Proposed Plan was completed and distributed March 15, 2011. The Public Meeting is scheduled for March 22, 2011.
- LHAAP-46: Currently addressing Army comments on the draft Remedial Design for LHAAP-46.
- LHAAP-47: Responses to Army's comments on revised Draft FS for LHAAP-47 have been submitted.
- LHAAP-50: Response to Army comments and responses are in Army's review.
- LHAAP-58: Army comments have been received on the preliminary draft RD for LHAAP-58 and are currently being addressed.
- LHAAP-12 RA(O): Draft RA(O) report is in regulatory review.

Site 29 Proposed Plan Meeting

The Public Meeting for the LHAAP-29 Proposed Plan has been scheduled for March 22, 2011, at 7:00 p.m. Electronic copies of the Proposed Plan were sent to the TAG and RAB and the Marshall Public Library.

Fact sheets for LHAAP-18/24 and 47 as well as for LHAAP-29 Proposed Plan will be provided during the RAB meeting.

Groundwater Treatment Plant
The GWTP is functioning normally.

Groundwater and Surface Water Sampling Schedule Spreadsheet
This document will be populated once the Remedial Design document has gone final. At the present time, the document shows the sampling for perimeter wells, the creek, LHAAP-12, LHAAP-16, and LHAAP-18/24. Semiannual sampling for the perimeter wells (wells 133 and 134) and quarterly creek or surface water sampling for perchlorate are scheduled for March and is ongoing at this time.

Rose asked that a short handout of GWTP data be provided at tomorrow's RAB indicating the volume treated, etc. and other quarterly report results. She also indicated a handout of the quarterly creek/surface water sampling and perimeter well sampling results be provided too. Steve also asked that a column showing the perchlorate action levels to meet be added to the results tables for surface water and perimeter well sampling.

Fay asked that they be sent the surface water/well results prior to being distributed at the RAB.

DERP Total Environmental Restoration Contract Update

LHAAP-37/67 –Status of RD
The RD is being finalized. Army will give an update to the RAB on how they are addressing public comments in the design.

At LHAAP-37/67, there will be a proprietary Army demonstration to help Longhorn costs and a meeting on Wednesday morning with regulators to discuss the process.

MMRP Update

Status of MC Data Summary Report
The MCs were addressed under another IRP no action ROD and with that 2 RODs would be addressing the same thing. Army responded to comments from regulators and agreed to some recommendations including adding 3 perchlorate sampling events at LHAAP-001-R-01 after redeveloping the wells, and one additional perchlorate sampling event at LHAAP-003-R-01 after redeveloping the wells.

Approach to MMRP ROD
The comments on metals need to be resolved separately from the MMRP ROD in order to move the MMRP ROD forward consistent with the approach identified by EPA.. The MMRP ROD will proceed as a no action ROD with limited ground water sampling. The Army will address the path forward for metals separately.

Review of Schedule

There is some danger in the ROD schedule regarding deadlines slipping.

IAP Update

Fay commented on this and Aaron will revise and send back up the chain. They will try to find a way to incorporate the schedule instead of just attaching it.

Rose indicated that the public does not have a feel for what is involved in remediating DNAPL and solvents. From some of the comments received to date, it appears the public thinks that if enough money is thrown into the remediation then successful and complete remediation occurs quickly. She wanted to provide a presentation that explains to the public how DNAPL moves through the subsurface, about residual contamination, and the impacts. Being extremely aggressive does not constitute success when remediating residual DNAPL. Fay said that the public needs to know how it moves through the subsurface, but by presenting in this manner may indicate that DNAPL is found at every site—which it is not. She suggested that discussion be tabled for now. More needs to be explained about being realistic expectations (best use of resources and the nine balancing criteria) and how that keeps any discussion focused.

USFWS Update

Environmental Restoration Issues with Transfer Schedule Impact

The MOA was received from the Army where it had gone to the Regional Office. There was a change to the MMRP mowing portion. There were no environmental issues.

Burning will commence on Friday and continue through the weekend. There is a consideration for the time it takes to isolate the railroad ties (origin and current status discussed during previous meetings) from being burned.

RAB will start at 5:30 PM tomorrow night followed by the public meeting at 7:00 PM.

Meeting Adjourned

Next monthly manager's meeting is teleconference for April 21, 2010.

Action Items

Shaw

- Provide fact sheets for LHAAP-17 and LHAAP-18/24 at the next RAB meeting.
- Update and distribute the Master Sampling Plan.
- Add action levels to Surface Water (Creek) Sampling and Perimeter Well Sampling summary tables and provide to regulators prior to general distribution.
- Provide handouts of information on the operation of the GWTP (i.e. amount of water treated) at the RAB. Provide copy to Army prior to RAB.

EPA

- Follow up with the health department about presenting to the RAB
- Terry Burton to research residual DNAPL and remediation technologies – time versus cost

Shaw® Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
March 22, 2011

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	**Remarks**
1	Draft Final Soil Removal Work Plan, LHAAP-03	11/15/10	x	x	Final	03/31/11	x	x	In progress	Addressing TCEQ comments. In internal review	
2	Draft Final Completion Report, LHAAP-04	05/24/10	x	x	Final	4/15/11	x	x	In progress	Regulatory comments received. RTCs in regulatory review	
3	Preliminary Draft FS, LHAAP-04	2/03/11	x		Draft	4/15/11	x	x		In Army review	
4	Preliminary Draft ROD, LHAAP-16	11/17/10	x		Draft	4/15/11	x	x	In progress	Revised Draft in Army's review	
5	Preliminary Draft Record of Decision, LHAAP-17	9/17/10	x		Draft	04/30/11	x	x	In progress		
6	Draft (Final) Feasibility Study, LHAAP-18/24	5/13/09	x	x	Draft Final	04/30/11	x	x	In progress	Received EPA and TCEQ comments on 8/5/10. Responses in Army review	
7	Final Proposed Plan, LHAAP-29	3/15/11	x	x						Final submitted	
8	Draft Remedial Design, LHAAP-46	10/1/10	x		Draft Final	4/30/11	x	x	In progress	Addressing Army comments	

Shaw® Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
March 22, 2011

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	**Remarks**
9	Revised Draft Final Feasibility Study, LHAAP-47	10/27/10	x		Revised Draft Final to Army	4/15/11	x	x	In progress	Received Army comments. Submitted to regulators 3/11/11.	
10	(Preliminary) Draft Remedial Design, LHAAP-50	12/13/10	x		Draft	04/30/11				In Army review	
11	Draft Remedial Design, LHAAP-58	11/22/10	x		Draft	4/30/11	x	x	In progress	Received Army comments. Preparing responses.	
12	Draft Final LHAAP-12 RAO Report	2/10/11	x	x	Final	5/30/11	x	x		In regulatory review	

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LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD
Karnack, Texas
(479) 635-0110

March 10, 2011

Distribution (one copy each)

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RESTORATION ADVISORY BOARD
LHAAP CLNWR

LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD
Karnack, Texas
(479) 635-0110

Dear LHAAP RAB Member,

The next Restoration Advisory Board (RAB) meeting will be held on Tuesday, March 22, 2011, from 5:30 to 7:00 p.m. at the Karnack Community Center, Karnack, Texas. Following the RAB meeting, a public meeting will be held for the Proposed Plan for LHAAP-29. We hope that you can attend both meetings. If you have any questions, please do not hesitate to contact me.

Shaw Environmental, Inc. (Shaw) is the contractor supporting the U.S. Army environmental restoration activities at the Longhorn Army Ammunition Plant (LHAAP), and will be coordinating the RAB meeting. A tentative agenda for the meeting is attached. If you have additional items for the agenda, please provide to me at rose.zeiler@us.army.mil or by letter at Post Office Box 220, Ratcliff, Arkansas 72951 by 18 March.

Regards,

Rose M. Zeiler

Dr. Rose Zeiler
Department of the Army
Longhorn Army Ammunition Plant
Box 220
Ratcliff, Arkansas 72951

Copy to:
Dawn Orsack, Rick Lowerre; CLI (TAG)
Janetta Coats, Donn Walters; EPA (TAG)

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LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD
Karnack, Texas
(479) 635-0110

AGENDA

DATE:	Tuesday, March 22, 2011
TIME:	5:30 – 7:00 PM
PLACE:	Karnack Community Center, Karnack, Texas

05:30 Welcome and Introduction

05:35 Open items {RMZ}
Charter Revision
Election of Co-Chair

06:00 Highlights of RAB Tour on 26 January

06:05 Defense Environmental Restoration Program (DERP) Performance Based Contract (PBC) Update {Shaw}
-Documents Status/ Environmental Sites
-Groundwater Treatment Plant (GWTP) Update
-Perimeter Well/Surface Water Sampling (Creek) Results and Update

06:25 DERP Total Environmental Restoration Contract Update {RMZ}
-LHAAP-35B(37) and LHAAP-67 RD

06:30 Military Munitions Response Program (MMRP) {USACE}

06:35 Other Environmental Restoration Issues {RMZ}

06:50 Look – Ahead at the Schedule

07:00 Adjourn {RMZ}

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Shaw® Shaw Environmental, Inc.

Subject: **Draft Final Minutes, Quarterly Restoration Advisory Board (RAB) Meeting, Longhorn Army Ammunition Plant (LHAAP)**

Location of Meeting: **Karnack Community Center, Karnack, Texas**

Date of Meeting: **March 22, 2011, 5:30 – 07:00 PM**

Meeting Participants:

LHAAP/BRAC:	Rose M. Zeiler
USAEC:	Marilyn Plitnik
USACE:	Aaron Williams, John Lambert
Shaw Environmental:	Susan Watson, Kay Everett
TCEQ:	Fay Duke
USEPA Region 6:	Steve Tzhone
USGS:	Kent Becher
RAB:	**Present:** Ken Burkhalter, Charles Dixon, Richard LeTourneau, Judy Van Deventer, Tom Walker, Pickens Winters **Absent:** Robert Cargill, Paul Fortune, Carol Fortune, Lee Guice, Judith Johnson, Ted Kurz, Jim Lambright, Nigel Shivers, and E.V. Wilson

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An agenda for the RAB meeting was distributed prior to the meeting.

Welcome – Rose Zeiler
The meeting was called to order.

Open Items – Rose Zeiler

Charter Revision
The RAB Charter and the RAB in general was discussed. EPA has guidelines regarding RAB structure and purpose, but they are used for guidance and are not the rule. Currently, the Longhorn RAB Charter is in revision and the RAB members have requested a continuance

while they review the changes. The RAB represents the whole community and its purpose is to seek and select opinions of everyone. Committees are not recommended because they result in only a few making decisions while the majority may risk losing their voice in issues. Aaron Williams had a RAB Rule link and provided handouts to the group. He indicated that the RAB is funded by environmental restoration funds, monies specifically earmarked for RAB environmental restoration business.

Election of Co-Chair
It was suggested that the co-chair election be delayed until a new charter was adopted.

Defense Environmental Restoration Program (DERP) Performance Based Contract (PBC) Update–Shaw

Document Status/Environmental Sites
Susan Watson distributed copies of the document status table and discussed each site.

- LHAAP-03: Addressing TCEQ comments. LHAAP-03 was a former waste storage pad for a drum of waste paint and located within LHAAP-58.
- LHAAP-04: Regulatory comments have been received on the Draft Final Completion Report for LHAAP-04 and response to comments (RTCs) are in regulatory review. This site is across from the Fire Station and was a former wastewater treatment area. The Preliminary Draft Feasibility Study (FS) for LHAAP-04 (groundwater) is in Army review.
- LHAAP-16: The revised Draft Record of Decision (ROD) for LHAAP-16 is in Army's review.
- LHAAP-17: The preliminary Draft ROD for LHAAP-17 is in progress.
- LHAAP-18/24: Responses to EPA and TCEQ comments on the Draft FS for LHAAP-18/24 are in Army review. A fact sheet is available. This site is under an interim measure which keeps the plume contained and keeps it from migrating off site.
- LHAAP-29: The Final Proposed Plan for LHAAP-29 was submitted. This site was the TNT manufacturing area which consisted of 5 to 6 production lines.
- LHAAP-46: The Preliminary Draft Remedial Design (RD) for LHAAP-46 is currently in progress and Army comments are being addressed.
- LHAAP-47: Received Army comments on the revised Draft Final FS for LHAAP-47 and responses submitted. The revised Draft Final FS submitted to regulators on 3/11/11.
- LHAAP-50: Army comments addressed on the Preliminary Draft RD for LHAAP- 50 and are in Army review.
- LHAAP-58: Army comments received on the Preliminary Draft RD for LHAAP-58 and responses are in preparation.
- LHAAP-12 RA(O): This is a remedial action "operation" to conduct long term monitoring for the interim remedy, which was completed in the 1990s when the landfill was capped. The draft final RA(O) report is in regulatory review.

Groundwater Treatment Plant (GWTP) Update
A power point presentation was given discussing groundwater treatment plant operation. Susan discussed the effluent discharge limit criteria and that in order to discharge treated water

(effluent) to Harrison Bayou, the water quality parameters have to meet specific standards in accordance with a discharge criteria in the Interim ROD. These limits are conservative. She indicated that about 1.4 million gallons of groundwater have been extracted from LHAAP-18/24 and LHAAP-16 and about 2.5 million gallons were processed. Approximately 327,902 gallons of treated water was discharged to the INF pond and about 1.7 million gallons were injected back into LHAAP-18/24. Before treated water is discharged to the creek, the flow in the creek is measured. If there is no flow, the treated water is diverted to the INF pond. Before water is released from the INF pond, samples are collected for sulfates and chloride prior to discharge.
Currently, the GWTP is discharging to Harrison Bayou and reinjecting.

Perimeter Well/Surface Water Sampling Update
Tables were presented to the RAB showing the latest results from surface water sampling. All results were below the cleanup level. The semiannual event for the perimeter wells (wells 133 and 134) was conducted in June; however, results were not back yet at the time of this meeting. The data will be presented at the next RAB meeting.

A question about changing treatment standards was asked. Steve Tzhone explained that treatment standards can change but only after new standards have been issued and a review of all relevant data is conducted. For example, perchlorate had a state action level of 4 parts per billion and now is at 26 parts per billion. In this case, the action level increased, so the levels can increase or decrease as new information is attained. The EPA has an even higher action level than the state for perchlorate. The 5-year reviews provides a regular interval for evaluation of all criteria for determination if updates need to be made regarding emerging contaminant data, new technologies, improvements in laboratory methods, toxicology data changes, and other issues.

DERP Total Environmental Restoration Contract (TERC) Update – Rose Zeiler
LHAAP-35B(37) and LHAAP-67
The RD is currently being drafted and the design monitoring network will confirm the plume is not moving. Some comments regarding additional sampling at several wells are being addressed at the LHAAP-37 (former Chemical Laboratory). The RD states that quarterly monitoring will occur for 2 years, then semiannual for the next 3 years, bringing the sampling schedule to the 5-year review. Antimony and thallium are to be included in the sampling plan and perimeter well sampling southwest of the site are also included in the sampling plan with monitoring of the TCE plume present.

At LHAAP-67 a lot of the same comments were received and are being addressed in the RD. There were concerns with potential contaminant migration from groundwater to surface water. Surface water sampling is being incorporated into the RD.

Military Munitions Response Program (MMRP) Update – USACE
There are two open sites. Aaron indicated that the materials found at these two sites were flares or illuminating devices and not rockets or explosive type material. Much of this determination was based on the historical information available and the munitions clearance previously conducted. Currently the Munitions Construction Data Summary Report consists of

soil and water testing at the site. Some additional data needs to be collected before finalizing the Munitions Construction Data Summary Report. The same CERCLA process will be implemented.

Other Environmental Restoration Issues/Concerns
A discussion on holding the RAB meetings on an evening other than Tuesdays and it was decided that Thursday would be the best evening for which most of the RAB members can attend with fewer conflicts to their schedules. Further discussions and a final agreement will be forthcoming.

Steve discussed the presentation being set up regarding the Public Health Assessment. Steve asked that a RAB member volunteer to collect any health questions from RAB members and the community; then send or bring to Steve at the next meeting. Steve then can forward these questions to the appropriate county health person so they can provide the answers when they come to present at a future RAB meeting. Some of the things the public may look at are disease incidents, healthiness around superfund sites, and incidents of birth defects. A study was conducted when Longhorn was first listed as a Superfund site and the ATSDR periodically updates their report. Steve suggested that the ASTDR can come to an upcoming RAB meeting and make a presentation and answer their questions.

Pickens Winters volunteered to collect the questions and provide at the next RAB meeting. At that time, Steve suggested that they can decide when they would like the ATSDR come and make their presentation and answer their questions.

Look – Ahead at the Schedule
There are certain parts of the schedule that cannot change and there are some parts that can be fairly flexible. Column headings were discussed as different names for the same thing are used from one agency to another.

The next RAB meeting is scheduled for possibly the third week in June 2011. The meeting date is tentative following further discussion with RAB members. [Subsequent correspondence and agreement with RAB members has confirmed that the next meeting date will be June 30, 2011 at 6:30PM.]

Adjourn

January Meeting Attachments and Handouts:
- *Status of Technical Documents PBC*
- *Meeting Agenda*
- *Surface Water (Creek) sample location maps and tables*
- *GWTP Handouts*

Shaw
Shaw Environmental, Inc.

Longhorn Army Ammunition Plant
Restoration Advisory Board Meeting

Location	Karnack Community Center		
Date	22-Mar-2011	5:30 PM	page 1 of 1

Please sign in the space provided or add your name and address on next page if your name does not appear below.

ATTENDEES

Name (printed)	Signature	Organization	Phone	E-mail
RAB Members				
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Ken Burkhalter	Ken Burkhalter	RAB Board Member		kburkhalter@shreve.net
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Judy Vandeventer	Judy VanDeventer	RAB Board Member	903-679-3449	jvandeventer@windstream.net
Tom Walker	Tom Walker	RAB Board Member		twalkercaddolake@gmail.com
E. V. Wilson		RAB Board Member		evw1@valornet.com
Pickens Winters	Pickens Winters	RAB Board Member	903 407-6038	NA
Longhorn Team Members and Community				
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Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
March 22, 2011

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	**Remarks**
1	Draft Final Soil Removal Work Plan, LHAAP-03	11/15/10	x	x	Final	03/31/11	x	x	In progress	Addressing TCEQ comments. In internal review	
2	Draft Final Completion Report, LHAAP-04	05/24/10	x	x	Final	4/15/11	x	x	In progress	Regulatory comments received. RTCs in regulatory review	
3	Preliminary Draft FS, LHAAP-04	2/03/11	x		Draft	4/15/11	x	x		In Army review	
4	Preliminary Draft ROD, LHAAP-16	11/17/10	x		Draft	4/15/11	x	x	In progress	Revised Draft in Army's review	
5	Preliminary Draft Record of Decision, LHAAP-17	9/17/10	x		Draft	04/30/11	x	x	In progress		
6	Draft (Final) Feasibility Study, LHAAP-18/24	5/13/09	x	x	Draft Final	04/30/11	x	x	In progress	Received EPA and TCEQ comments on 8/5/10. Responses in Army review	
7	Final Proposed Plan, LHAAP-29	3/15/11	x	x						Final submitted	
8	Draft Remedial Design, LHAAP-46	10/1/10	x		Draft Final	4/30/11	x	x	In progress	Addressing Army comments	

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Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
March 22, 2011

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	**Remarks**
9	Revised Draft Final Feasibility Study, LHAAP-47	10/27/10	x		Revised Draft Final to Army	4/15/11	x	x	In progress	Received Army comments. Submitted to regulators 3/11/11.	
10	(Preliminary) Draft Remedial Design, LHAAP-50	12/13/10	x		Draft	04/30/11				In Army review	
11	Draft Remedial Design, LHAAP-58	11/22/10	x		Draft	4/30/11	x	x	In progress	Received Army comments. Preparing responses.	
12	Draft Final LHAAP-12 RAO Report	2/10/11	x	x	Final	5/30/11	x	x		In regulatory review	

Army Environmental Command (AEC) Public Affairs Officer (PAO)/ RAB Subject Matter Expert (SME) Review of Revised Charter.

- Suggests sticking to the exact RAB Rule language where possible.
  - EPA guidelines are not the Rule, they simply provide information on setting up a RAB, not the specifics.
  - DoD/EPA developed and agreed to the specifics in the RAB Rule to make sure the RAB focused on the restoration and provided sufficient information/opportunity to comment on the restoration.

Army Environmental Command (AEC) Public Affairs Officer (PAO)/ RAB Subject Matter Expert (SME) Review of Revised Charter.

- Notes that the RAB is an advisory group that:
  - focuses on the environmental issues at hand
  - represents the community and the spirit of the RAB Rule
  - represents and hears the thoughts/input/suggestions of the affected public on environmental issues
- Says membership committee should be abolished because based on her experience it results in a few making decisions and the others losing their voices.

FACT SHEET

Restoration Advisory Board

The U.S. Army is conducting environmental studies and restoration actions at Army installations nationwide under the Installation Restoration Program and Military Munitions Response Program. To keep the public informed and involved in its restoration activities and to provide opportunities for public involvement in its environmental restoration program, Army installations often establish a Restoration Advisory Board (RAB).

The RAB enables the affected community and representatives of government agencies to meet and exchange information about the installation's environmental program. It also provides an opportunity for the community to review progress and participate in dialogue with the decision-makers.

The RAB is an additional community involvement forum for interested people to learn more about the ongoing and future environmental studies and restoration actions at Longhorn Army Ammunition Plant. The RAB will not take the place of current public involvement activities; but will supplement them. RAB members will be responsible for:

- Providing advice on environmental restoration issues to Army installations and regulatory agencies;
- Holding regular meetings, publicly announced and open to the public, at convenient times and locations;
- Reviewing, evaluating and commenting on environmental restoration documents;
- Identifying project requirements;
- Recommending priorities among sites or projects; and

The RAB will include representatives from the Army, U.S. Environmental Protection Agency (USEPA), tribal, and/or state environmental regulatory representatives, and members of the local community. The Installation Co-Chair will be responsible for:

- Ensuring that RAB membership reflects diverse interests within the community;
- Keeping meeting minutes and making them available to interested parties;
- Developing, maintaining and using a mailing list of names and addresses of people who wish to receive information on the restoration program; and,
- Jointly chairing the RAB with a community representative.

Interested citizens who become RAB members should be willing to attend all RAB meetings (which could last between two to four hours each) and devote ample time to review Army environmental restoration documents within a prescribed period voluntarily and without compensation.

For more information on participating in the RAB, or obtaining a community interest survey, contact Longhorn AAP's Site Manager Dr. Rose Zeiler at (479) 635-0110 or by email to rose.zeiler@us.army.mil.

Restoration Advisory Boards (RAB)

Q & A

Q. What is a RAB?
A. A RAB is a stakeholder group that meets on a regular basis to discuss environmental restoration at a specific property that is either currently or was formerly owned by DoD, but where DoD oversees the environmental restoration process. RABs enable people interested in the environmental cleanup at a specific installation to exchange information with representatives of regulatory agencies, the installation, and the community.

While the general public can comment on DoD's environmental restoration program, RABs offer a focused and interactive opportunity to participate in the environmental restoration process.

In most cases, a RAB addresses cleanup activities at one particular installation; however, there is no prohibition on convening a RAB to address cleanup activities at multiple installations, especially when the same community members are involved. A decision to have a RAB address multiple installations should include input from the communities involved as well as the installations and regulators.

Q. What is the purpose of a RAB?
A. A RAB provides the community with the opportunity to become involved in the environmental restoration process at DoD installations either as a RAB member or through attendance at RAB meetings. RABs offer members the opportunity to influence cleanup decisions through discussion and to provide input to the installation decision makers. Because representatives of the environmental agencies overseeing cleanup participate in the RAB, the RAB offers members and the public the opportunity to share their questions, concerns, and ideas with agencies involved in the cleanup.

Q. How is a RAB established?
A. The Department of Defense defined a process for establishing RABs to ensure consistency and fairness among communities and installations. This process defines authority to determine the need to establish a RAB, the criteria by which the need for a RAB is determined, and the actions necessary to form a RAB. A RAB ensures interested individuals and groups from the community have an opportunity to thoughtfully participate in the decision making process of environmental restoration activities in a timely manner.

Q. Who can participate in a RAB?
A. RABs are comprised of individuals from the community who are affected by the installation's environmental restoration activities because they live and/or work in close proximity to the installation. Anyone interested in restoration activities and willing to dedicate their time may participate in RAB meetings, although they may not actually be

a RAB member. RABs also include representatives from the installation and regulatory agencies that oversee cleanup at the installation.

Q. What are the roles and responsibilities of RAB participants?
A. These are defined in Chapter 4 of the RAB Rule Handbook which can be found at http://aec.army.mil/usaec/cleanup/rab-rule.pdf

Q. How does a RAB operate?
A. Each RAB develops its own unique set of operating procedures based on the needs of the RAB and the installation. However, the RAB Rule does provide certain requirements. These requirements include, but are not limited to, developing a mission statement, providing training to members, and updating RAB information in the administrative record.

Q. How does a community or installation know when a RAB has completed its work and is no longer needed?
A. A RAB's work is complete when there are no longer any environmental restoration activities at an installation because the installation has either reached a remedy in place or response complete, or when the community is no longer interested. At that time the RAB should complete the documentation of its activities and begin the process of adjournment.

Q. What happens if a RAB becomes ineffective?
A. A RAB can stop its activities in one of two ways—either by adjourning or dissolving. Dissolution is appropriate when the RAB has become ineffective and is no longer fulfilling the intended purposes of advising and providing community input to the installation and decision makers on environmental restoration projects.

Q. Can an adjourned or dissolved RAB be reestablished?
A. A RAB's work is complete when there are no longer any environmental restoration activities at an installation because the installation has either reached a remedy in place or response complete, or when the community is no longer interested. At that time the RAB should complete the documentation of its activities and begin the process of adjournment.

Q. What happens to RABs at installations that are closing or have been closed under BRAC?
A. An installation may be closed or slated for closure under BRAC. When chosen for closure, DoD generally will transfer ownership of the installation to another person or entity at some point in the future. Because RABs are funded and supported by DoD, the transfer of the installation to a non-DoD entity will affect the continued existence and operation of the RAB.

Q. Where can I find additional information on RABs?
A. http://aec.army.mil/usaec/cleanup/rab-rule.pdf

Can a RAB's mission statement and goals be amended?

Establishing a RAB's mission statement and goals should be one of the first undertakings of a RAB. A mission statement and goals help to focus the RAB and give it direction. Since the RAB members generate the mission statement and goals, they have the ability to change them. The process for changing the mission statement and goals should be one of the items addressed by the operating procedures of the RAB. In all cases, the decision to change these items should be joint. If, after consultation, the installation and community co-chairs determine there is a valid need to alter the mission and goals, then these items may be amended using the process outlined in the operating procedures.

What issues do RABs address?

RABs may only address issues associated with environmental restoration activities. Funding for RABs is received from the Service's Environmental Restoration accounts; therefore, RABs may only discuss environmental restoration topics. If another issue of community interest arises in the course of a RAB's discussions, then the RAB installation co-chair should refer the issue to the appropriate offices or individuals at the installation. Limiting the RABs to discussions of environmental restoration helps to ensure that RABs remain focused and provides maximum opportunity to discuss issues related to environmental restoration activities.

What if I want to discuss other issues?

Individuals hoping to discuss activities other than environmental restoration, such as noise or water quality concerns, should contact the RAB installation co-chair. The co-chair will identify the point of contact (POC) or office responsible for handling the issues of interest and pass along the names of inquirers to the appropriate offices for resolution.

What activities can RABs undertake?

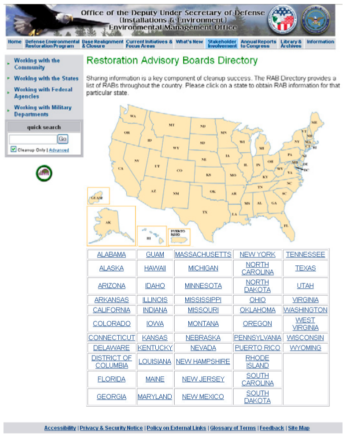
Examples of activities a RAB may undertake are:

- Reviewing and commenting on environmental restoration documents and activities, preliminary assessments, site inspections, remedial investigations and other documents;
- Providing information to the community;
- Receiving input from the community; and
- Obtaining information regarding the schedule, type, and status of environmental restoration activities.

How can I find out about a RAB's activities?

www.

The RAB directory is located on DENIX at https://www.denix.osd.mil/denix/Public/Library/Cleanup/CleanupOfc/stakeholder/rabdirectory.html



DoD maintains records of RAB activities, procedures, and meeting minutes in an information repository (IR). This repository is publicly available and can be found in a local library or other community location. The location of the information repository should be based on information provided by the community. It should be accessible and convenient for the community. To find out where the RAB maintains its IR, contact the POC or co-chairs by browsing the RAB directory online.

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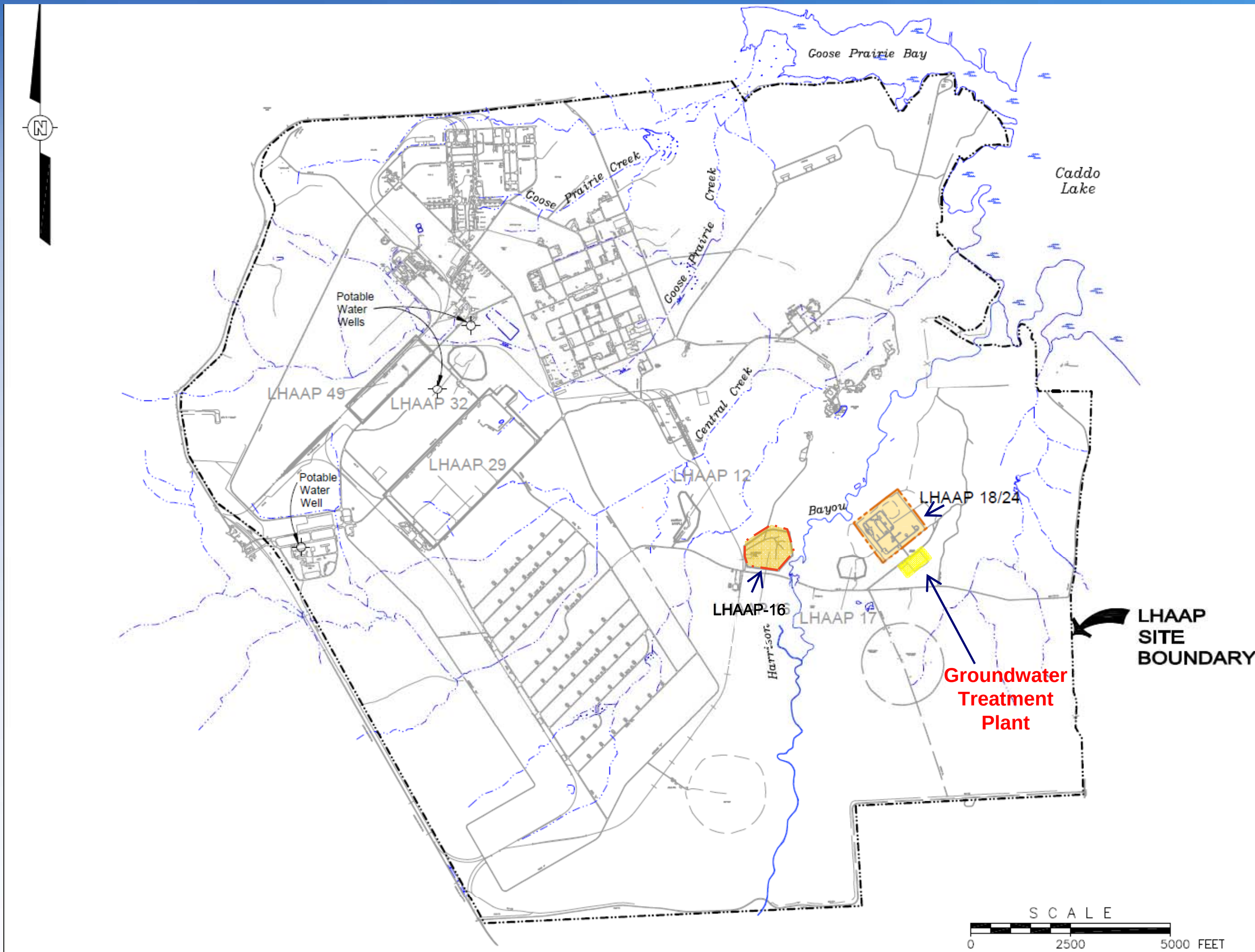
RAB Meeting
LHAAP- 18/24
Groundwater Treatment Plant Operations
Longhorn Army Ammunition Plant
March 22, 2011
5:30 p.m.
Karnack Community Center
Karnack, Texas
2

Where is LHAAP-18/24 Groundwater Treatment Plant?



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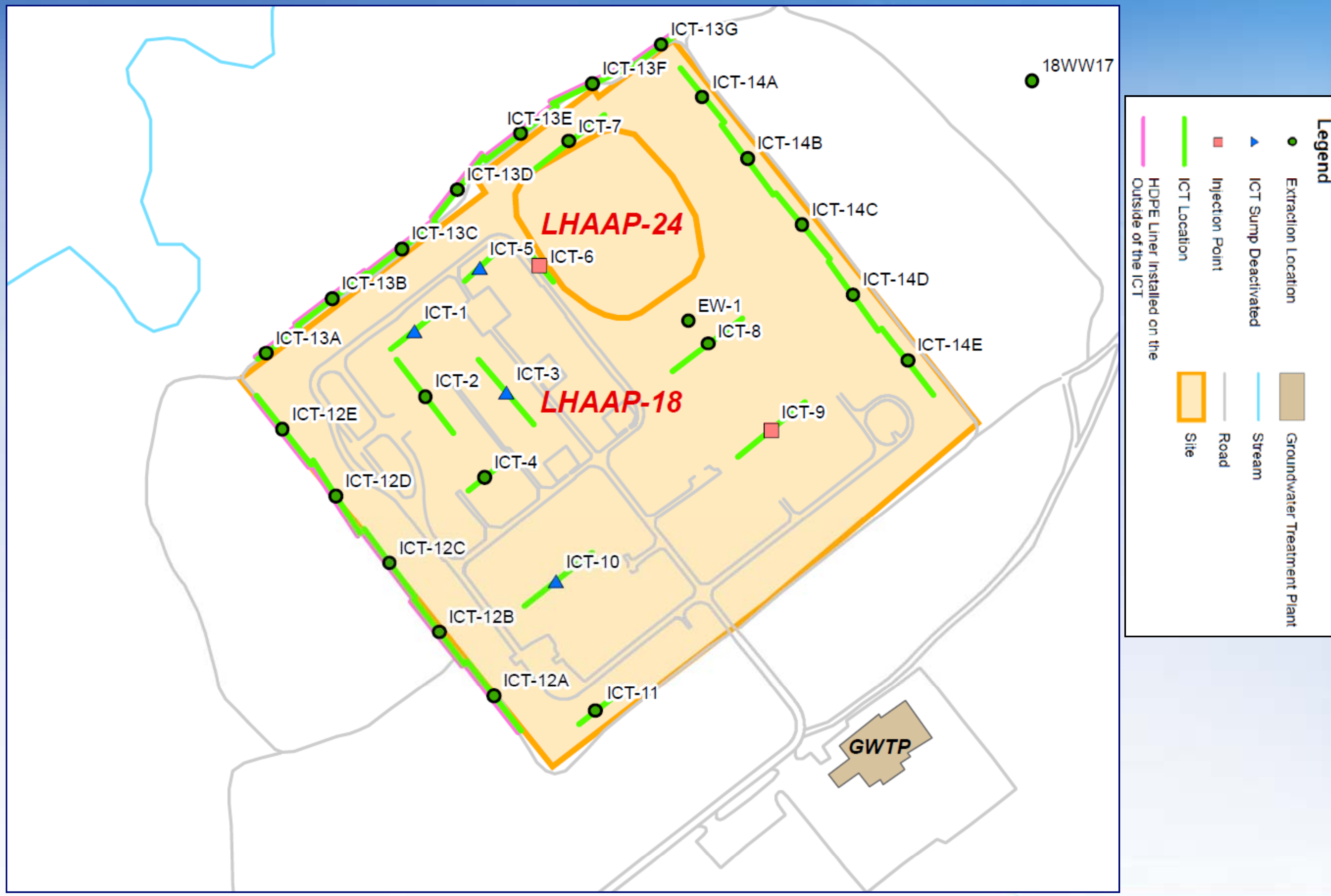
What activities are included as part of groundwater treatment?

- Continuous extraction of groundwater from interceptor collection trenches (ICTs) and extraction wells from LHAAP-18/24 and LHAAP-16
- Evaluation of hydraulic effectiveness of the extraction system by GW monitoring
- Monitoring of treated water to ensure compliance with discharge limitations
- Discharge of treated water to Harrison Bayou

Where are the ICTs and Extraction wells?



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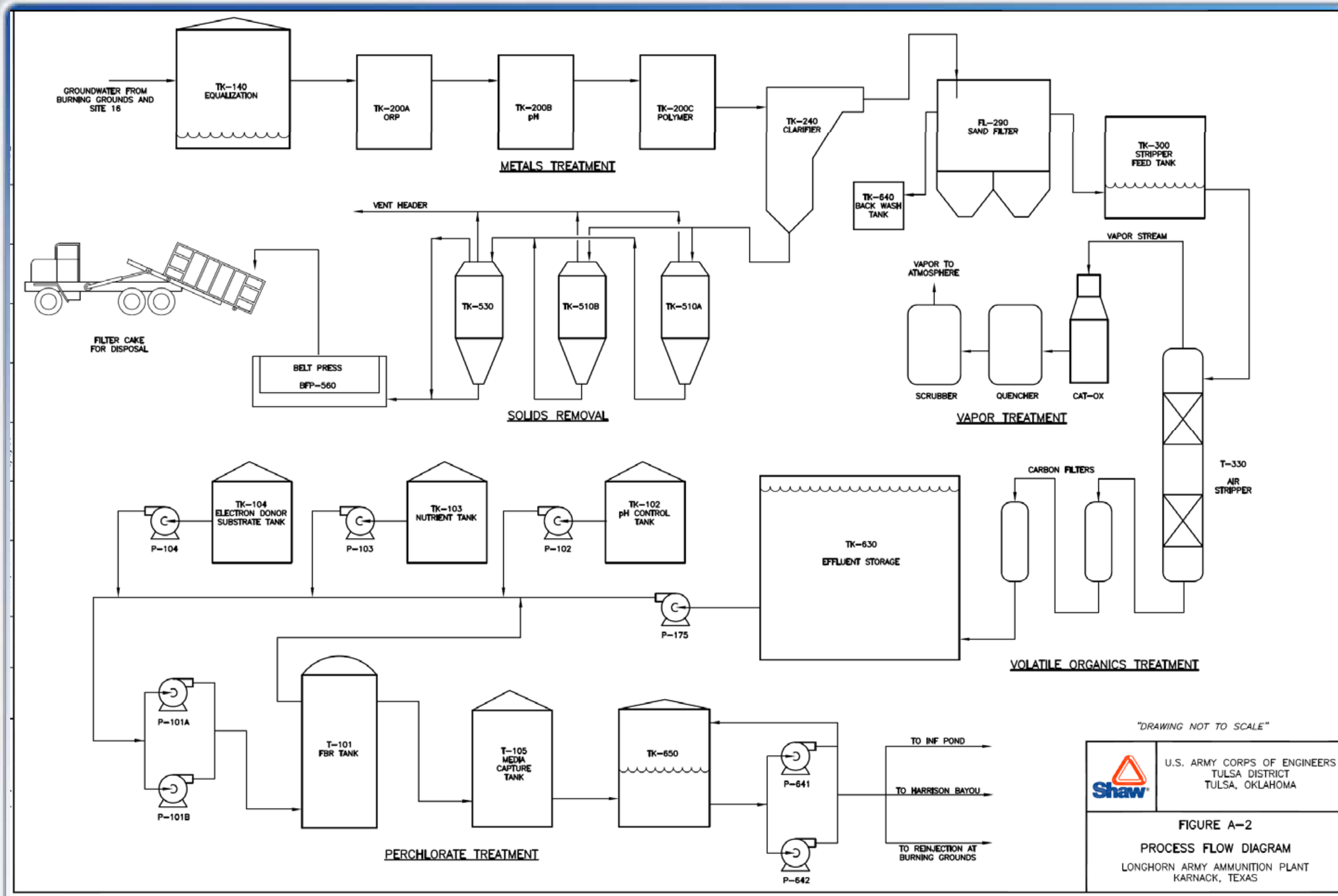
What is treated at the groundwater treatment plant at LHAAP-18/24?

Heavy metals, chlorinated compounds, and perchlorate using precipitation, air stripping, and biological methods, respectively

- Metals : Antimony, arsenic, barium, chromium, manganese, thallium, nickel, silver, selenium, and lead
- VOCs : PCE, TCE and its daughter products, methylene chloride, chloroform, 1,2-dichloroethane (1,2-DCA),1,1,2-trichloroethane
- Perchlorate


GROUNDWATER FROM BURNING GROUNDS AND SITE 16
TK-140 EQUALIZATION
TK-200A ORP
TK-200B pH
TK-200C POLYMER
METALS TREATMENT
TK-240 CLARIFIER
FL-290 SAND FILTER
TK-640 BACK WASH TANK
TK-300 STRIPPER FEED TANK
VENT HEADER
FILTER CAKE FOR DISPOSAL
BELT PRESS BFP-560
TK-530
TK-510B
TK-510A
SOLIDS REMOVAL
VAPOR TO ATMOSPHERE
VAPOR STREAM
SCRUBBER
QUENCHER
CAT-OX
VAPOR TREATMENT
T-330 AIR STRIPPER
CARBON FILTERS
TK-104 ELECTRON DONOR SUBSTRATE TANK
P-104
TK-103 NUTRIENT TANK
P-103
TK-102 pH CONTROL TANK
P-102
TK-630 EFFLUENT STORAGE
P-175
VOLATILE ORGANICS TREATMENT
P-101A
P-101B
T-101 FBR TANK
T-105 MEDIA CAPTURE TANK
TK-650
P-641
P-642
PERCHLORATE TREATMENT
TO INF POND
TO HARRISON BAYOU
TO REINJECTION AT BURNING GROUNDS
"DRAWING NOT TO SCALE"
Shaw
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA
FIGURE A-2
PROCESS FLOW DIAGRAM
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

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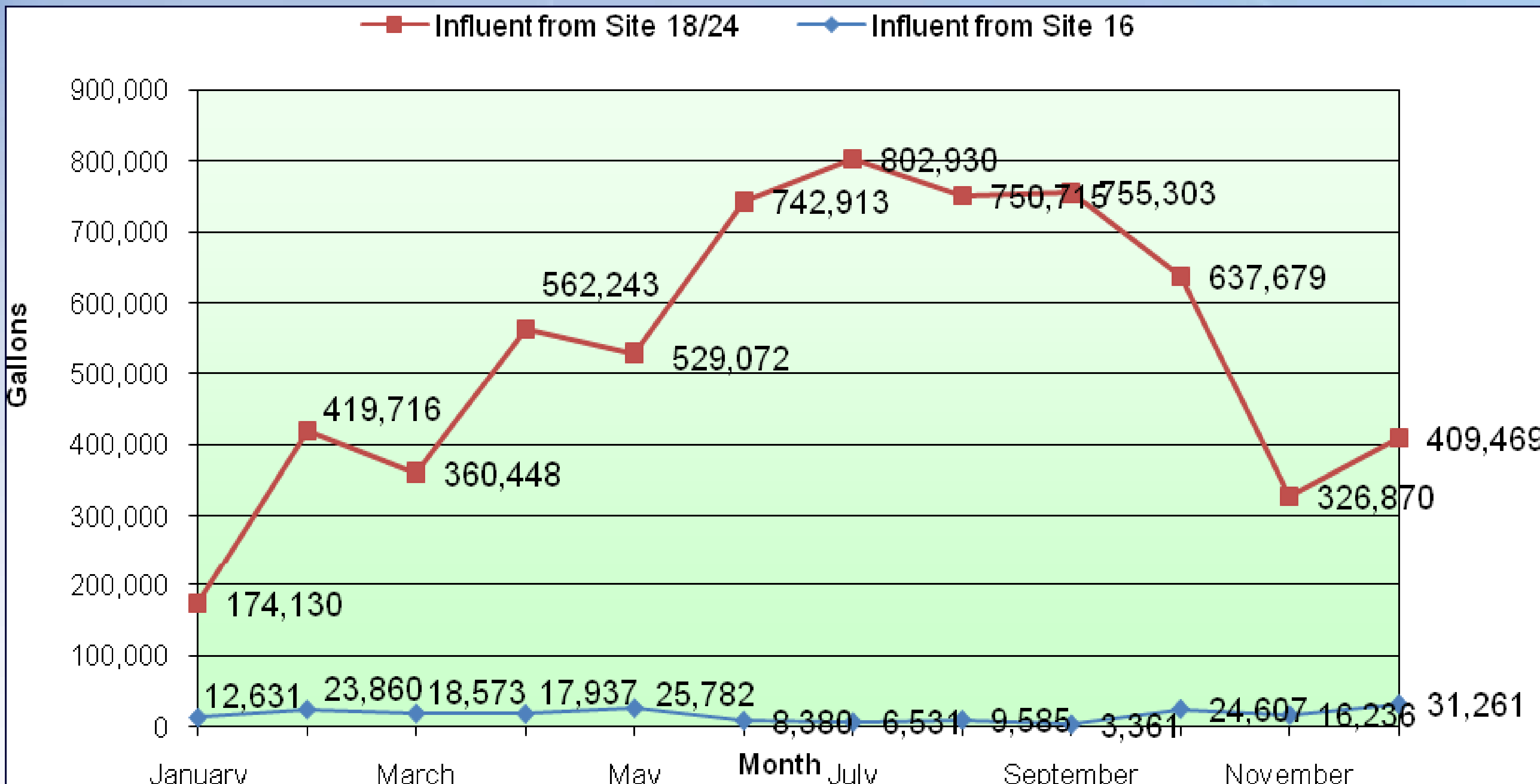
How much water was extracted in the last quarter?

Total of 1,446,185 gallons of water extracted from LHAAP-18/24 and LHAAP-16



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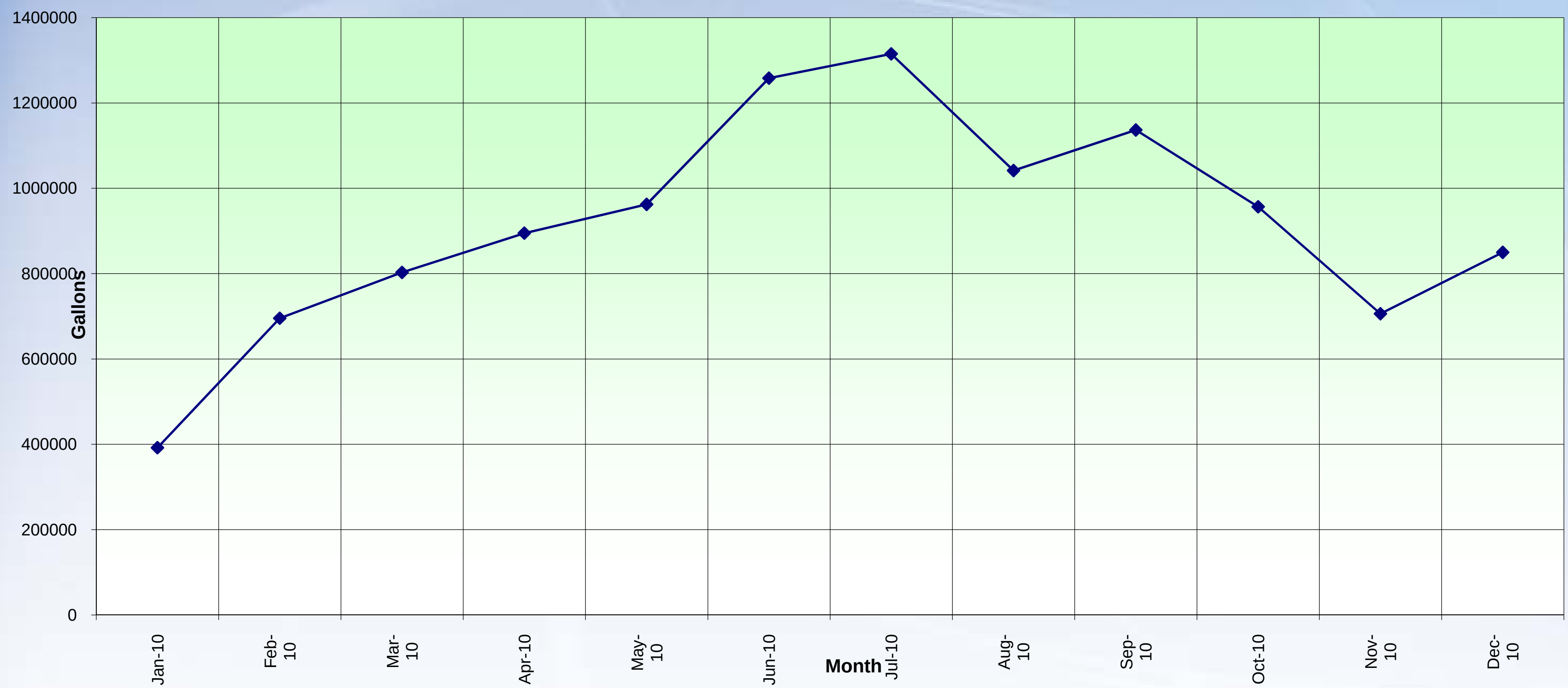
How much water was processed?

Total Treated water last quarter was 2,512,084 gallons (treated water is more than extracted due to added process water and rainwater)



Where and how much treated water was released last quarter?

- Typically treated water is discharged to Harrison Bayou and a portion of it is re-injected at LHAAP-18/24
- Approximately 327,902 gallons of treated water was discharged to the INF pond
- Approximately 1,669,975 gallons were injected at LHAAP-18/24
- 6,742 gallons of treated water was discharged from GWTP to Harrison Bayou on December 1 and 2 when there was enough flow in the bayou

What was the impact of Drought Conditions (beginning in September) to the GWTP operations?

- Interim Remedial Action ROD specifies discharge limits to Harrison Bayou or Central Creek
- Discharge criteria are based on a calculation using flow rate in the creek
- Thus, when no flow in the bayou, treated water is diverted to the INF pond and reinjected at LHAAP-18/24

INF Pond Operations

- When the pond level rose last November, discharge to the INF pond was stopped and a portion of treated water was reinjected at LHAAP-18/24
- Extraction rate was lowered temporarily to alleviate the situation created by drought conditions
- 590,400 gallons of treated water was removed from the INF pond using tanker trucks and sprayed on LHAAP-18/24 and LHAAP-16 from mid-November to the end of December
- Balance of treated water in INF pond was released starting December 29 when Harrison Bayou began having adequate flow

What occurs before we release the water from the INF pond?

- The flow in Harrison Bayou is measured
- Discharge (or effluent) limits are calculated
- A sample is collected for sulfate and chloride prior to discharge
- Water is released only when results are below the discharge criteria

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Current Operations

- Plant is currently operating smoothly and discharging to Harrison Bayou and reinjecting
- A videographer filmed the general sampling procedure for the GWTP on March 15th 2011

Questions?

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LHAAP-35B(37) Chemical Laboratory and LHAAP-67 Aboveground Storage Tanks Farm Remedial Design

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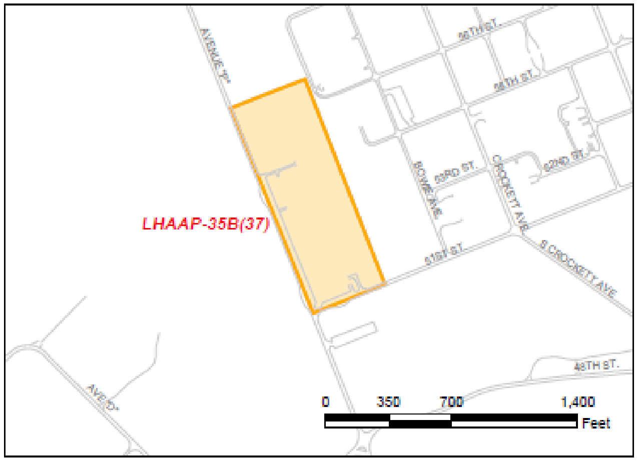
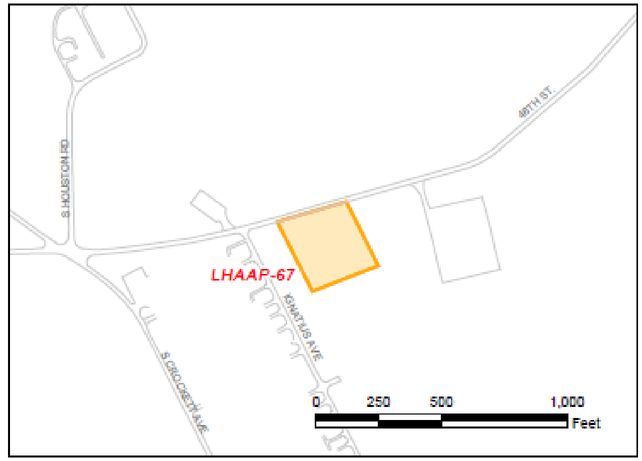




LEGEND

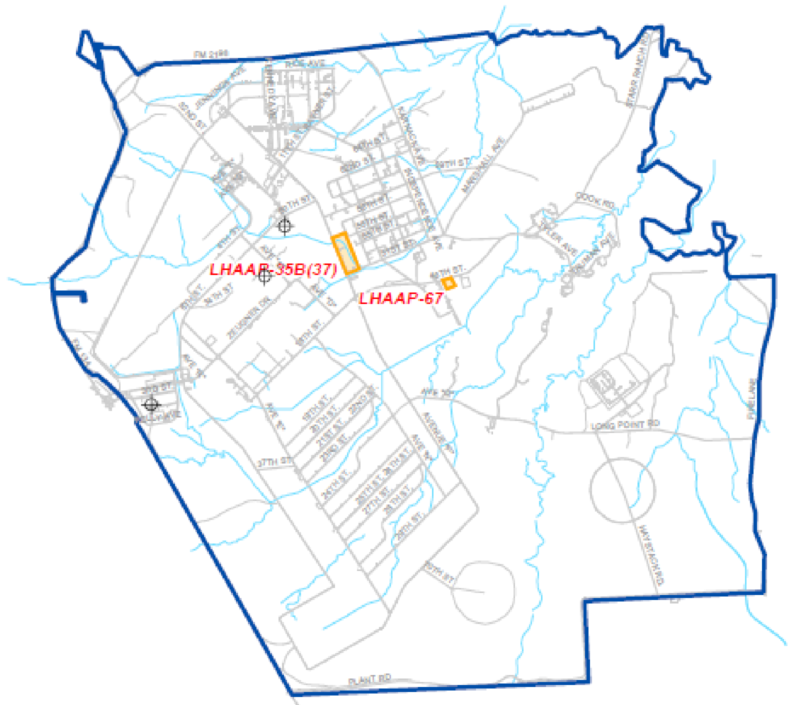
Road

Stream

Site

Approximate LHAAP Boundary

LHAAP Water Supply Well



LEGEND

Approximate LHAAP Boundary

Road

Stream

Site

LHAAP Water Supply Well

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U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 2-2
SITE LOCATION MAP
RECORD OF DECISION
LHAAP-35B(37) AND LHAAP-67, GROUP 4
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

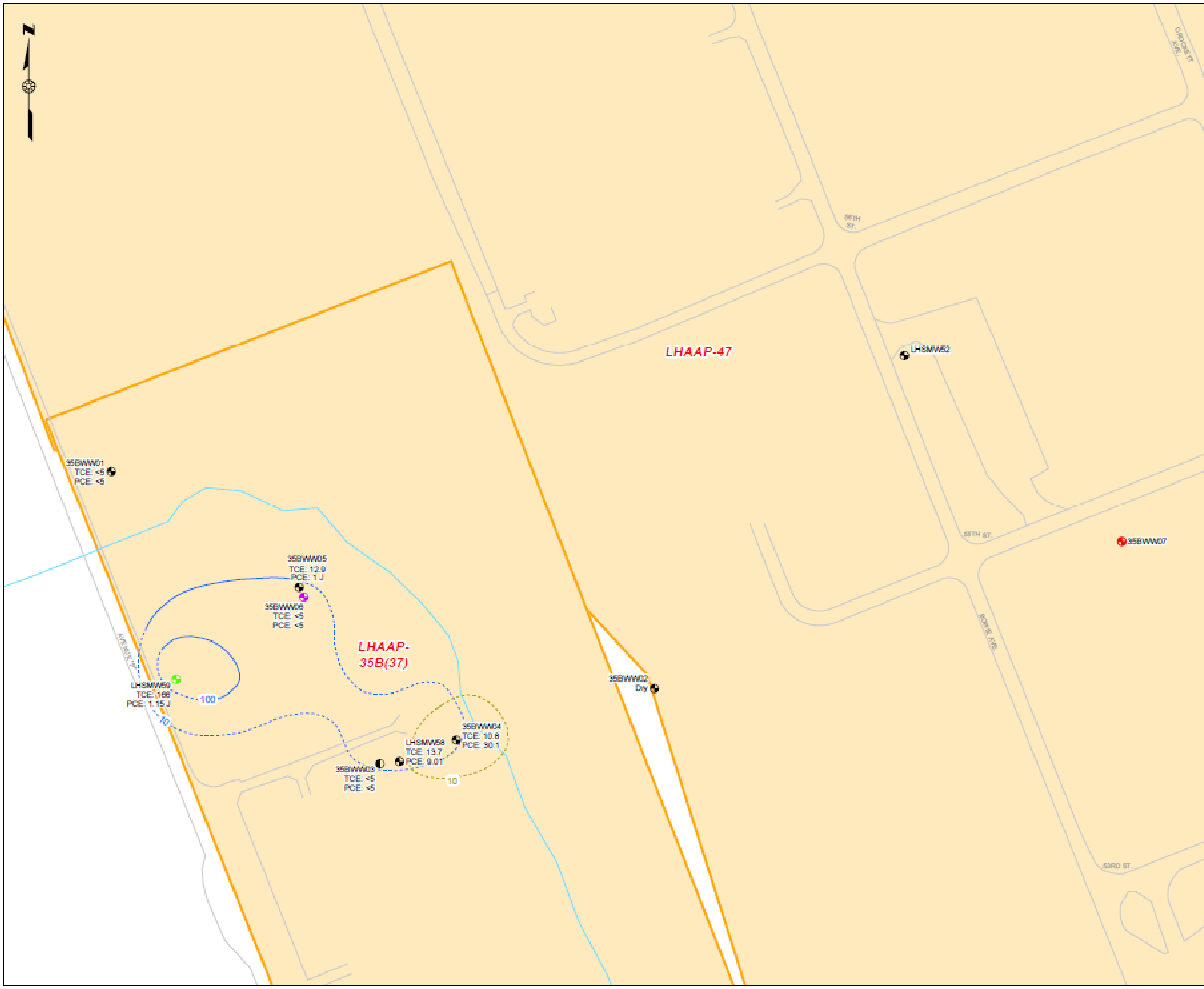
LHAAP-35B(37) Chemical Laboratory

Public Comments

- Army should establish a regular monitoring schedule
- Several wells never sampled antimony & thallium and rationale for not considering as COCs is weak
- Difficult to evaluate effectiveness of Proposed Plan without evaluating the Remedial Design
- Concerns with potential groundwater to surface water pathway

Remedial Design Addressing Comments

- Quarterly monitoring 2 years, semi-annual 3 years & annual to next 5 Year Review
- Antimony & thallium are included in the sampling plan
- Keeping public updated on the Remedial Design details
- Periodic sampling of surface water included in the sampling plan



Legend

- Upper Shallow Zone Monitoring Well
- Lower Shallow Zone Monitoring Well
- Composite Upper And Lower Shallow Zone Monitoring Well
- Intermediate Zone Monitoring Well
- Proposed Upper Shallow Zone Monitoring W
- PCE Concentration Contour
- Inferred PCE Contour
- TCE Concentration Contour
- Inferred TCE Contour
- Stream
- Road
- Site

Notes:

1. Reporting limit (<5) results were considered not detected during contouring.
2. Concentrations reported in μg/L.

0 50 100 200 Feet

U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 5-6
COCs IN UPPER SHALLOW GROUNDWATER
DECEMBER 2006 SAMPLING EVENT
LHAAP-35B(37)
NATURAL ATTENUATION EVALUATION
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

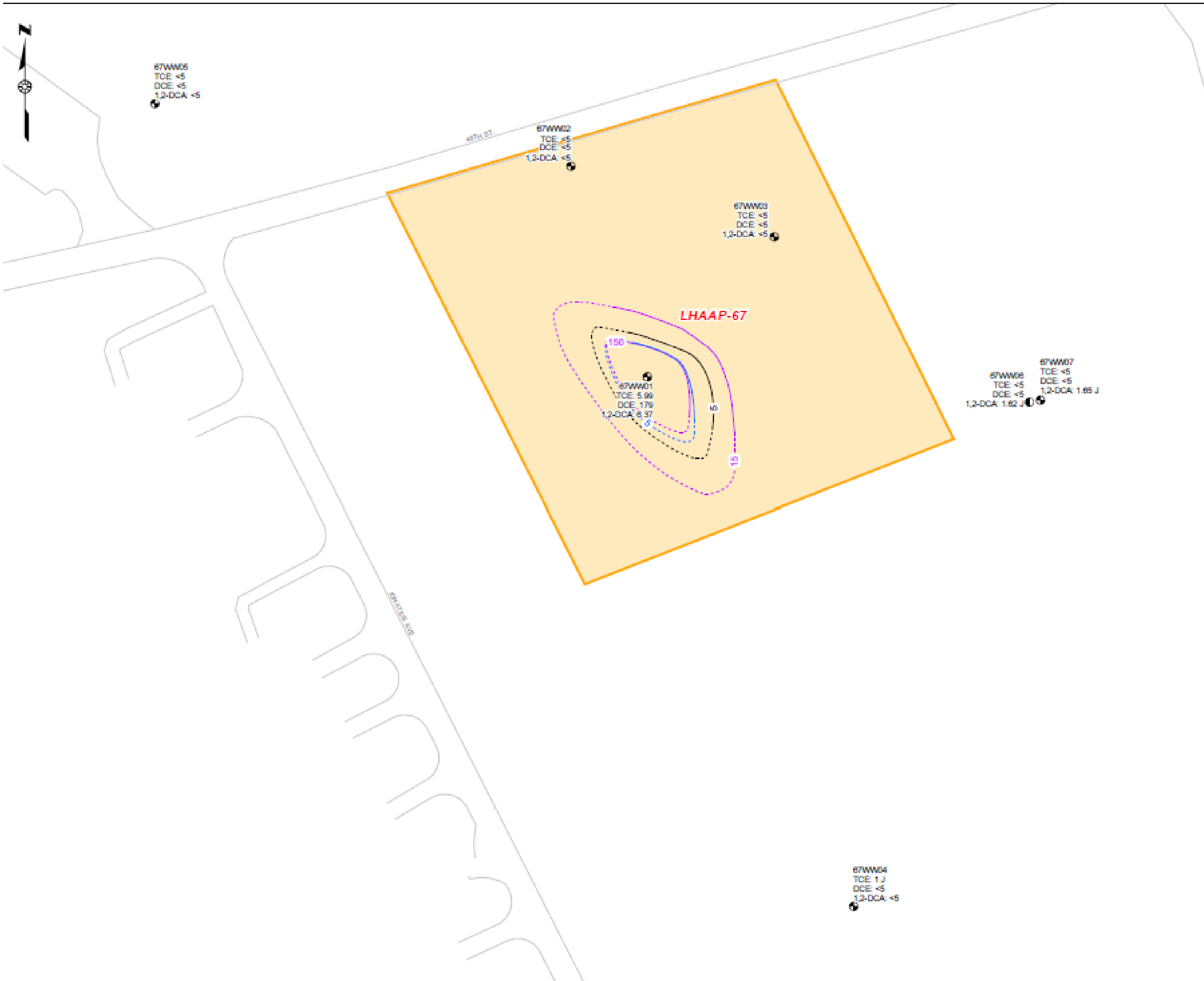
LHAAP-67 Aboveground Storage Tank Farm

Public Comments

- Army should establish a regular monitoring schedule
- Difficult to evaluate effectiveness of Proposed Plan without evaluating the Remedial Design
- Concerns with potential groundwater to surface water pathway

Remedial Design Addressing Comments

- Quarterly monitoring 2 years, semi-annual 3 years & annual to next 5 Year Review
- Keeping public updated on the Remedial Design details
- Periodic sampling of surface water included in the sampling plan



Legend

- Shallow Monitoring Well
- Intermediate Monitoring Well
- 1,2-DCA Concentration Contour
- Inferred 1,2-DCA Contour
- TCE Concentation Contour
- Inferred TCE Contour
- 1,1-DCE Concentration Contour
- Inferred 1,1-DCE Contour
- Road
- Site

Notes:

1. Reporting limit (<5) results were considered not detected during contouring.
2. Concentrations reported in µg/L.

0 35 70 140 Feet

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U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 5-8
COCs IN SHALLOW GROUNDWATER
DECEMBER 2006 SAMPLING EVENT
LHAAP-67
NATURAL ATTENUATION EVALUATION
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

85M102006D

Public Meeting
Proposed Plan

LHAAP- 29 Former TNT Production Area
Longhorn Army Ammunition Plant

March 22, 2011

7:30 p.m.

Karnack Community Center

Karnack, Texas

Why are we here?

- To present an overview of the Proposed Plan and different alternatives considered for environmental cleanup at LHAAP-29
- To present the preferred remedy
- To answer your questions and receive your comments about the plan
- To provide information on how you can comment

For questions during the presentation, please state your name first for the court reporter.

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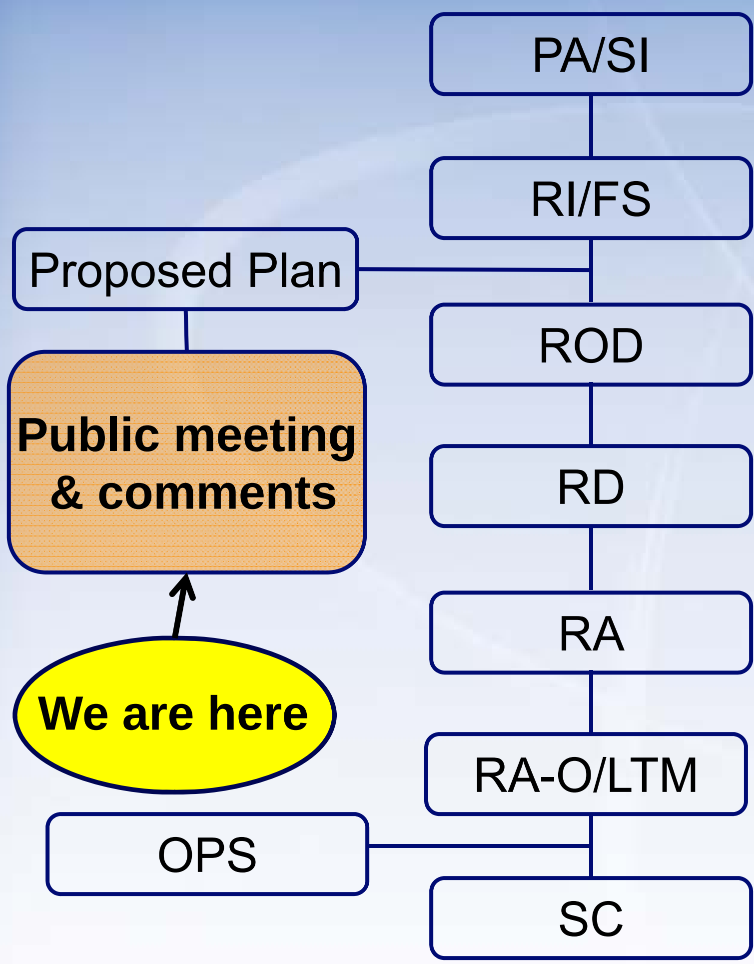
Why is the Proposed Plan Important?

- Part of the regulatory CERCLA process
- Presents the evaluated alternatives and the preferred remedy that was reviewed and accepted by the Army, USEPA, and TCEQ
- Provides an opportunity for the public to comment prior to final remedy selection, which will be documented in the Record of Decision

What is the Process?

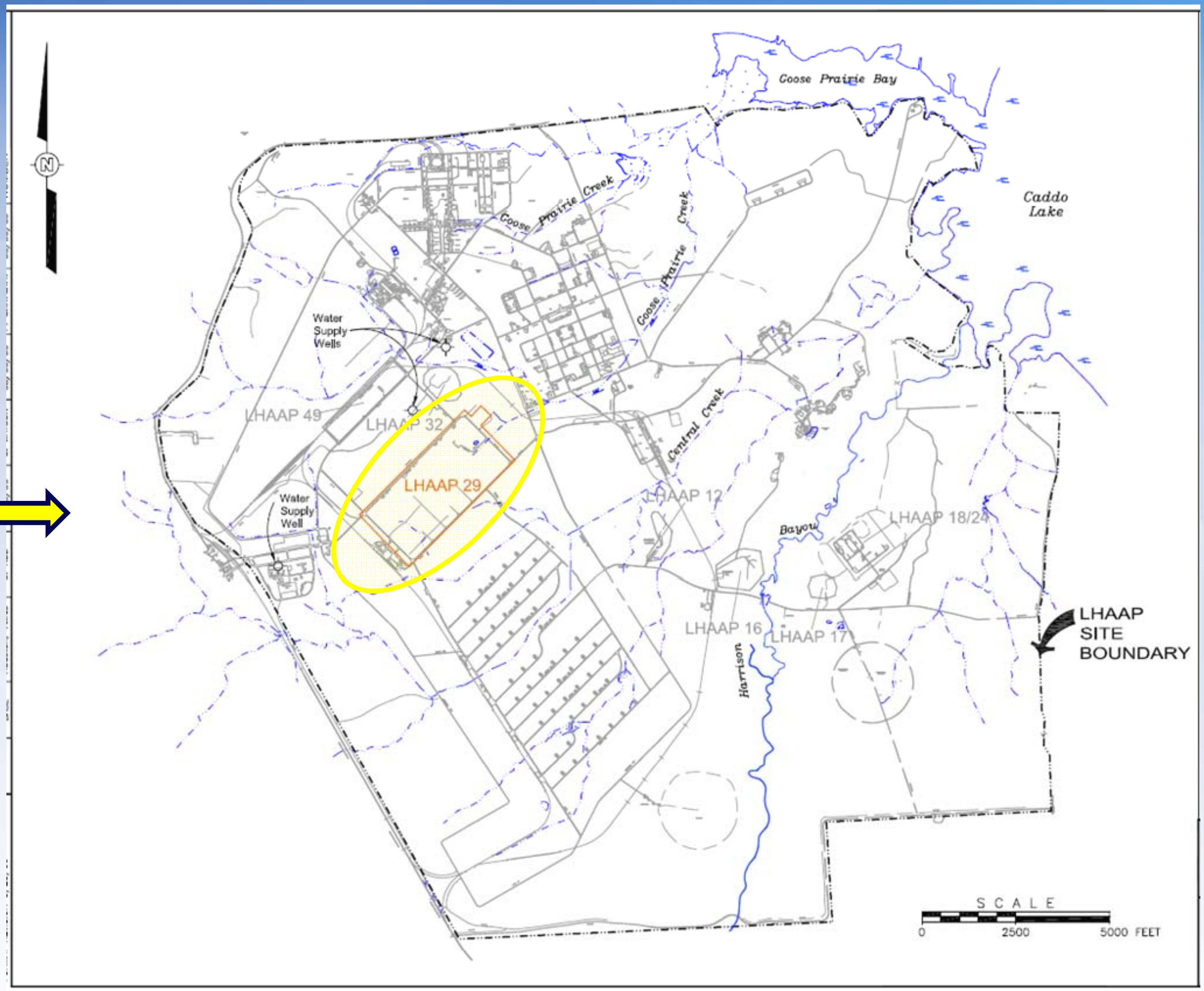
Outline of CERCLA* process for the cleanup of NPL sites



- Preliminary Assessment/Site Investigation (Placed on National Priorities List (NPL) in August 1990)
- Remedial Investigation/Feasibility Study (1992 - 2010) includes risk assessments
- Proposed Plan & Public Comment Period
- Record of Decision
- Remedial Design
- Remedial Action
- Remedial Action – Operations/Long-term Monitoring
- Operating Properly & Successfully
- Site Closure

*Comprehensive Environmental Response, Compensation, and Liability Act

Where is LHAAP-29?



In western-central portion of LHAAP and is approximately 85 acres

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How did we get here?

- Historically LHAAP-29 was used as a TNT manufacturing facility from October 1942 to August 1945
- Explosive compound releases from the manufacturing process of TNT and releases from process tanks and process waste pipelines are suspected contamination sources for soil, groundwater and solid and liquid residue in TNT wastewater lines and cooling water drain lines
- “Soak out” of out of specification rocket motors using methylene chloride occurred at LHAAP-29 between 1959 to mid 1970s

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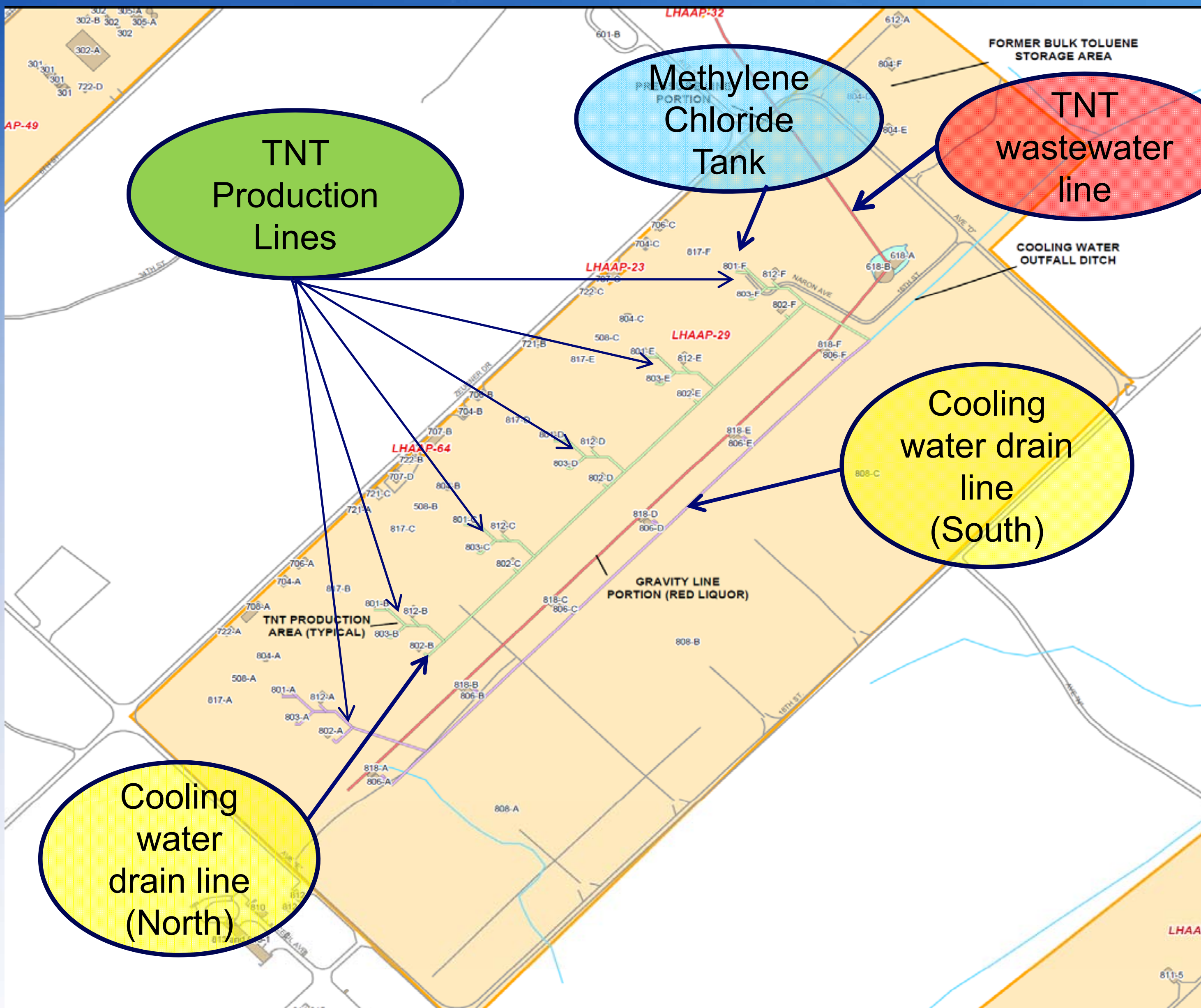

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What investigations have been conducted?

- From 1984 through 2008, investigations were conducted by several contractors and the U.S. Army Corps of Engineers
- Number of samples collected over past investigations
  - Soil/Sediment samples: approximately 320 from 0 to 20 feet bgs
  - Groundwater samples: approximately 250
  - Process line samples: approximately 11

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What are Risk Assessments?

- Use data to evaluate potential risks to receptors
- Risks to human health or the environment outside of the acceptable range are the drivers for remedial action
  - Cancer risk is expressed as a probability; risk acceptable to EPA is in the range of 1×10^{-6} to 1×10^{-4} or 1 in 1,000,000 to 1 in 10,000
  - Non-cancer hazard is expressed as the hazard index (HI); The HI is they sum of the individual hazard quotients (intake dose/reference dose); HI acceptable to EPA is < 1
  - If the risks are acceptable, proposed plan is for no further action
- Exposure depends on current and future land and groundwater use scenarios
  - Use scenario at LHAAP: industrial/recreational (national wildlife refuge)
  - Human receptor at LHAAP: Hypothetical future maintenance worker

Is there Human Health Risk at LHAAP-29?

- Yes. The risk assessment performed in 2002 concluded that soil posed an unacceptable non-cancer hazard and groundwater posed an unacceptable non-cancer hazard and cancer risk under an industrial scenario to a hypothetical future maintenance worker.
- Exposure pathways evaluated for the hypothetical future maintenance worker were based on exposure to the following media under industrial scenario:
  - Soil
  - Groundwater
  - Surface water
  - Sediment

Is there Ecological Risk at LHAAP-29?

- Ecological hazards were found to be acceptable at LHAAP-29; however, elevated concentrations of explosives found at one location at the site posed a threat to small range ecological receptors.
- Explosives (2,4,6-trinotrotoluene [2,4,6-TNT], 2,4-dinitrotoluene [2,4-DNT] and 2,6-DNT) in the soil are considered contaminants of potential ecological concern (COPECs) and pose a risk to ecological receptors due to direct contact and indirect (i.e., dietary) exposure

What are the Remedial Action Objectives (RAOs)?

RAOs are established as part of the Feasibility Study to protect human health and ecological receptors and are as follows:

- Protection of human health by preventing human exposure to the contaminants in the soil, sediment, transite TNT wastewater line, cooling water lines and groundwater
- Protection of human health and the environment by preventing the migration of contaminants to groundwater and surface water from potential sources in soil, sediment, and process lines (TNT wastewater and cooling water)
- Protection of human health and environment by preventing contaminated groundwater from migrating into nearby surface water
- Protection of ecological receptors by preventing exposure to the contaminated soil and sediment
- Return of groundwater to its potential beneficial uses as drinking water, wherever practicable

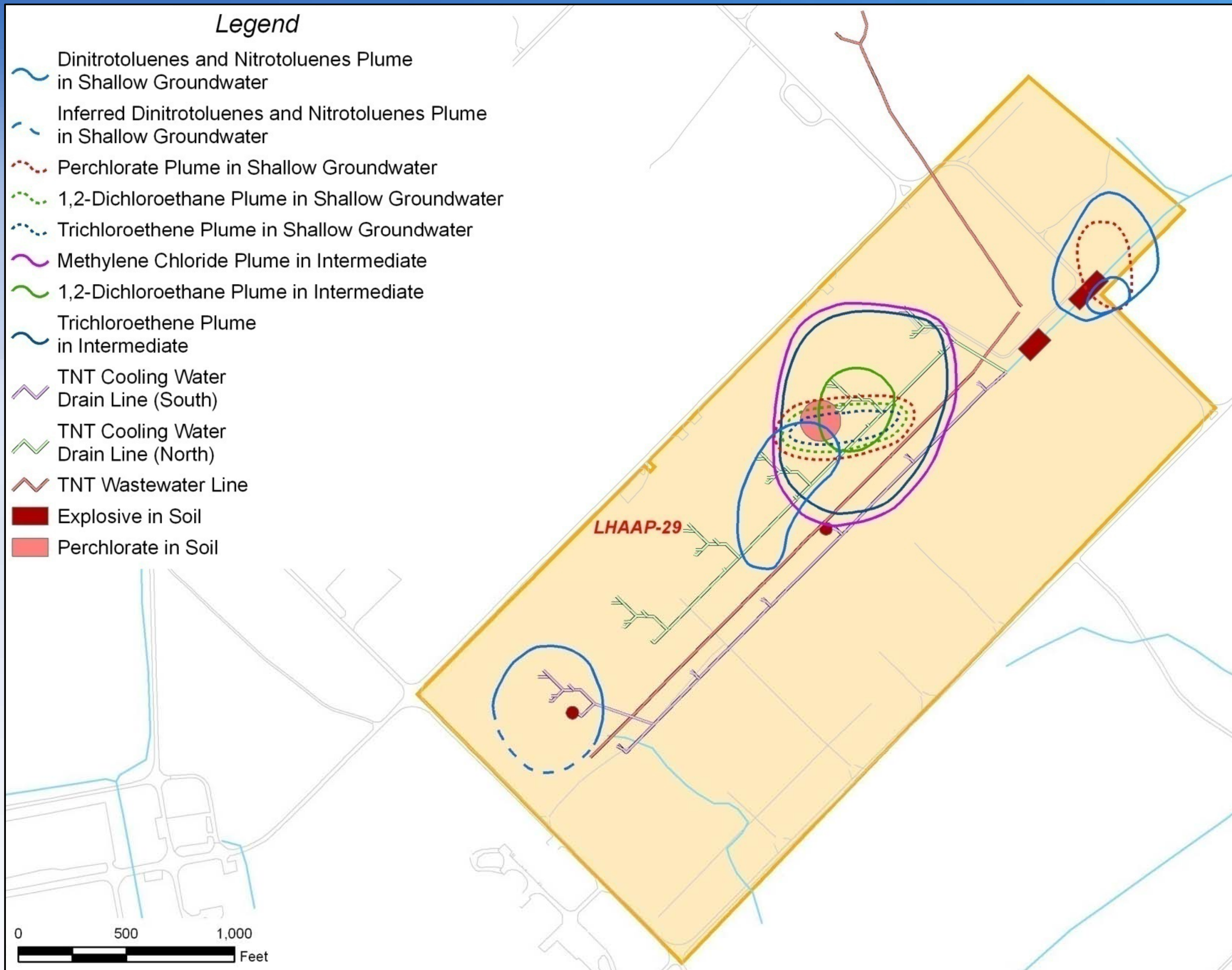
What are Cleanup Levels?

- Cleanup levels are established to meet the remedial action objectives and address potential risk
- Cleanup levels are concentrations for individual chemicals in soil and groundwater above which some remediation or control measures are required

What are the media of concern?

- Explosives in the sediment and surface soils in cooling water outfall ditch contributes to unacceptable human and ecological risk
- Residual explosive compounds in former TNT wastewater lines and cooling water drain lines and manholes have the potential to leach into groundwater
- Perchlorate contaminated soil in the NE portion of the site contribute to non-carcinogenic human health hazard
- Explosives in soil near former process buildings contribute to ecological risk and have the potential for migration into groundwater
- VOCs, explosives and perchlorate in groundwater pose an unacceptable human health hazard

Soil and Groundwater Contamination



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How are Alternatives developed?

Alternatives are developed by combining various technologies to mitigate risk in all affected media (soil, process lines and groundwater)

How are alternatives evaluated?

Alternatives are evaluated based on

EPA'S Nine Guidance Criteria

- **Overall protection** of human health and the environment
- **Compliance** with applicable or relevant and appropriate requirements (ARARs): chemical-specific, location-specific, action-specific
- **Long-term effectiveness** and permanence
- **Reduction** of toxicity, mobility, or volume through treatment
- **Short-term effectiveness**, especially protection of workers and the community during the action
- **Implementability** (availability and reliability of resources)
- **Cost comparability**
- **Agency acceptance** of proposed remedy
- **Community acceptance** of proposed remedy

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Were all alternatives evaluated? Yes.

- All alternatives were evaluated using the nine criteria. Additional information on all alternatives and their evaluation can be found in the Feasibility Study and Proposed Plan
- Outcome of the alternative evaluation is

  Alternative 2 - Preferred Alternative
  - Protects human health and the environment
  - Complies with ARARs
  - Utilizes a permanent solution
  - Utilizes an active treatment as principal element
  - Cost effective

What are components of Alternative 2?

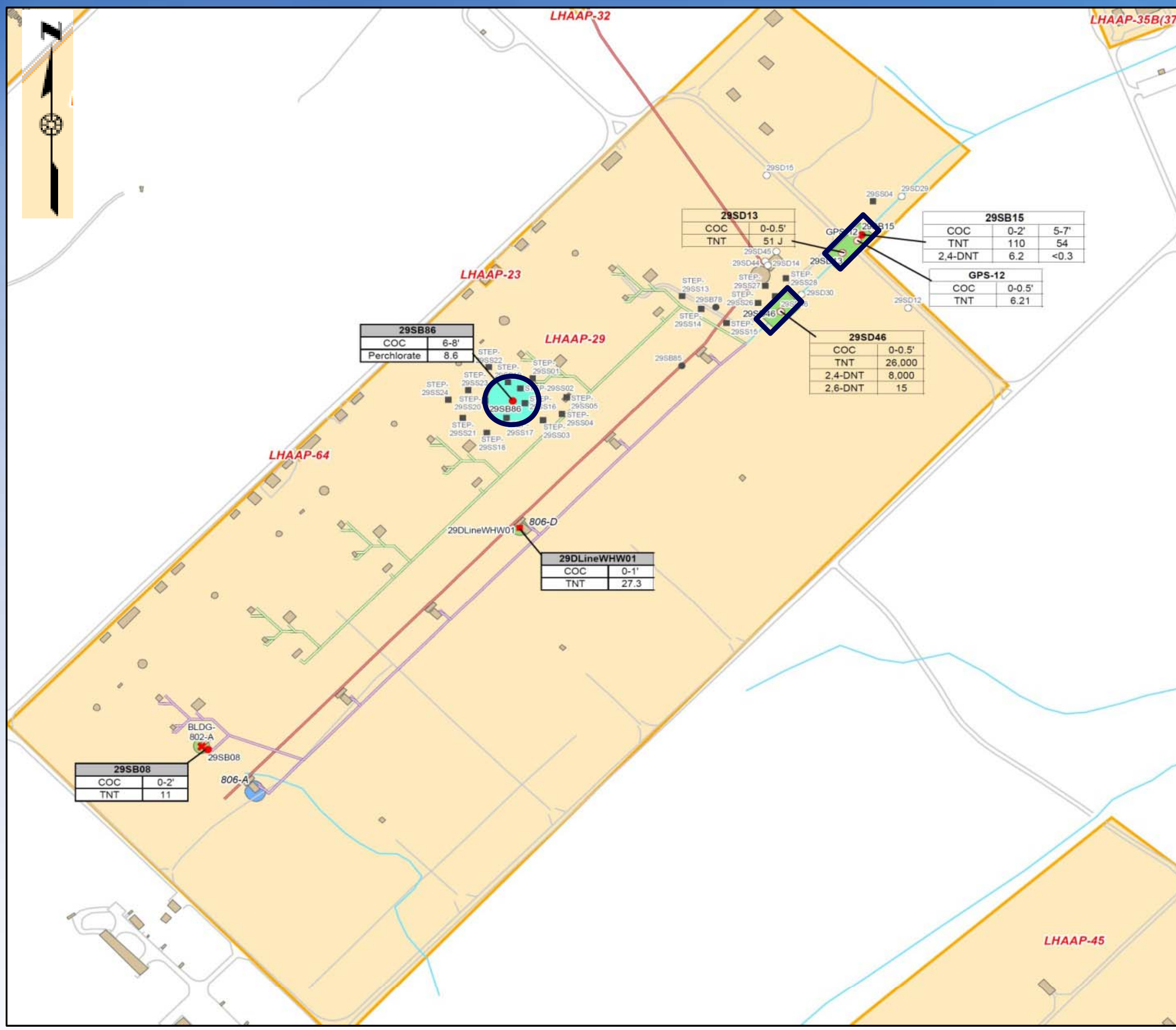
- Excavation to address soil contamination
- Investigation, flushing (if necessary) and plugging of underground process lines
- Monitored Natural Attenuation (MNA) for shallow groundwater zone isolated plumes
- Insitu oxidation and MNA for intermediate groundwater zone contamination


LHAAP-29
Alternative 2
SOIL
03/25/2009
22
Shaw
The Shaw Group Inc.

What are the Chemicals of Concern (COCs) in Soil?

- Perchlorate
- Explosives
  - 2,4,6-TNT
  - 2,4-DNT
  - 2,6-DNT

What is the extent of soil contamination?



LEGEND

Soil Contamination
- Former Building
- Soil Boring
- Sediment
- Surface Soil

Sample Locations
- Surface Soil
- Soil Boring
- Sediment
- Former Building or Concrete Slab
- Site
- TNT Cooling Water Drain Line (South)
- TNT Cooling Water Drain Line (North)
- TNT Wastewater Line
- Stream
- Road

Locations of Excavations

see Section 2.4.1 for estimated excavation areas and volumes
- Explosive
- Perchlorate
- Stained Soil (Plexus)

NOTES:
1. Depths are reported in feet below ground surface.
2. Soil sample concentrations in milligrams per kilogram (mg/kg).
3. All COC concentrations shown on this figure exceed their applicable cleanup levels.
4. TNT - Trinitrotoluene
5. DNT - Dinitrotoluene
6. COC - Contaminant of concern

0 200 400 800 Feet

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What is the proposed remedy for soil?

- Excavation and off-site disposal of contaminated soil
- Insitu technologies were not considered since it does not address the ecological risk
- Estimated amount of soil to be removed is approximately 3,900 cubic yards

LHAAP-29 Alternative 2
Process Lines:
TNT Wastewater Line and
Cooling Water Lines

What is the difference between the process lines?

TNT wastewater line

- The TNT wastewater line carried away process wastewater from the washing process during TNT production (also known as “red water, yellow water, red liquor and yellow liquor”)
- The wastewater went to a pump house at the east end of the site and was pumped to the wastewater treatment plant at LHAAP-32
- The wastewater line was made of transite

Cooling water drain line

- The TNT manufacturing process generated a lot of heat; cold water was used to cool the reaction equipment. It flowed over the equipment and down a drain into the cooling water drain line
- Cooling water discharged to an open ditch at the east end of the site
- The cooling water line was made of vitrified clay

What are the COCs in solid and liquid residue in TNT wastewater lines and cooling water lines

COCs in solid residue in TNT wastewater lines

- 2,4,6-TNT
- 2,4-DNT
- 2,6-DNT
- 2-amino-4,6-DNT
- 4-amino-2,6-DNT

COCs in cooling water drain line liquid/solid

- 2,4,6-TNT
- 2,4-DNT
- 2,6-DNT
- 2-amino-4,6-DNT
- 4-amino-2,6-DNT

What is the proposed remedy for the TNT wastewater line?

- TNT wastewater line is approximately 3 to 4 feet below ground surface
- The line will be flushed
- The rinsate water will be disposed
- The ends will be plugged with a bentonite slurry
- The line will be abandoned in place

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What is the proposed remedy for the cooling water lines?

- The vitrified clay cooling water lines are approximately 3 to 8 feet below ground surface
- Twelve manholes along the lines
- The manholes will be inspected and contents sampled.
- If the contents are hazardous the lines will be flushed, the rinsate will be disposed.
- The inlets and outlets including the manholes will be plugged with a bentonite slurry mix

LHAAP-29 Alternative 2 Groundwater

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What are the groundwater characteristics?

- Shallow zone: 17 to 45 feet bgs
- Intermediate zone: 88 feet bgs
- Deep zone: 155 feet bgs
- Shallow Groundwater Flow: East/southeast
- Intermediate Groundwater Flow: East/northeast
- Both Shallow and Intermediate groundwater contaminated from TNT production process
- Deep groundwater zone is not impacted

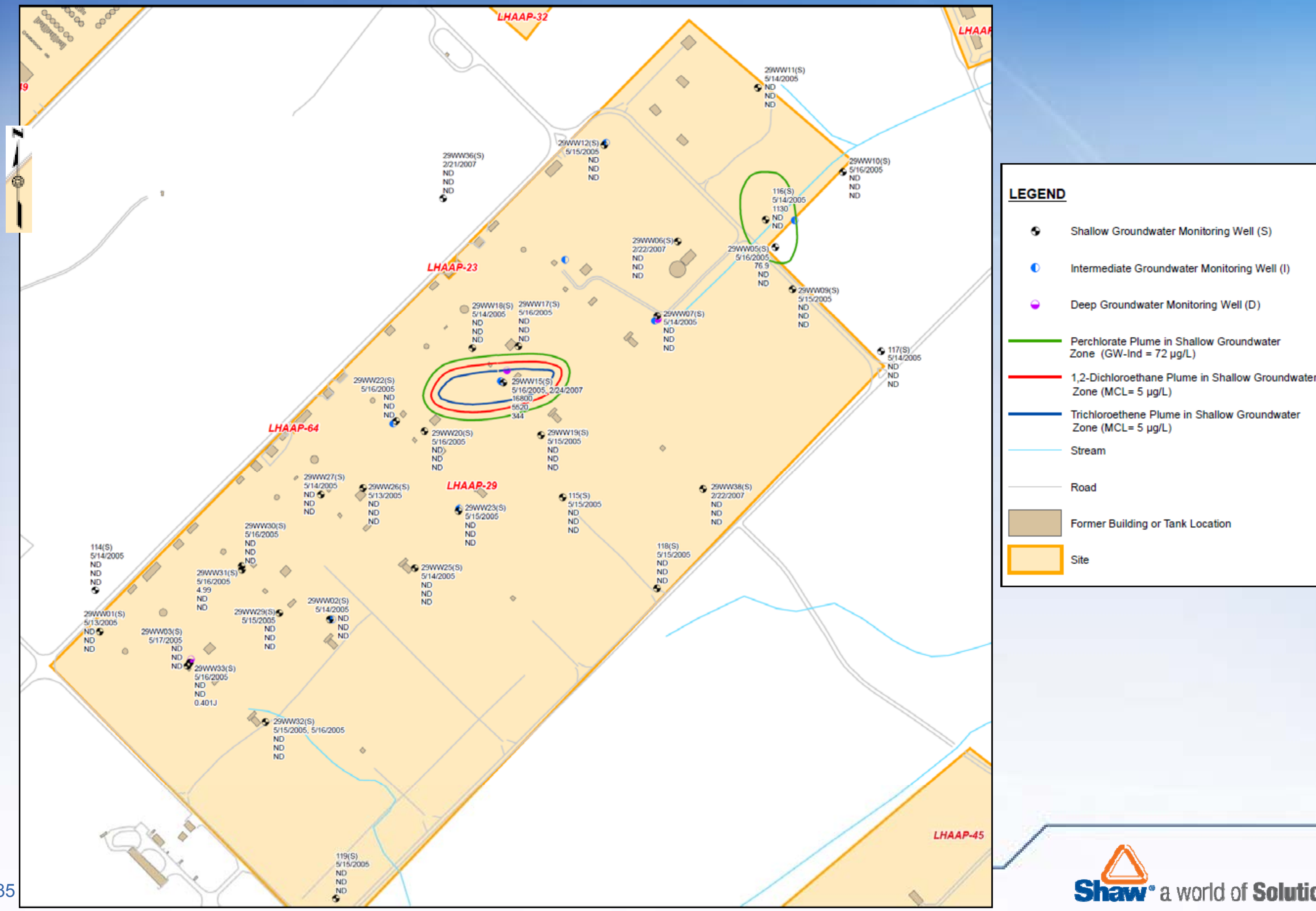
What technologies were evaluated for groundwater?

- **Ex situ treatment**
  - groundwater extraction and treatment at GWTP at LHAAP-18/24
- **In situ treatment**
  - Enhanced bioremediation in most contaminated GW areas
  - Permeable reactive barrier (combination of gravel and various organic media)
  - Insitu chemical oxidation
- **Monitored Natural Attenuation**
- **Land Use Controls**
  - Groundwater use restriction to ensure no withdrawal or use of groundwater beneath for anything other than environmental monitoring and testing

What are the COCs in Shallow Groundwater?

- Perchlorate
- VOCs: 1,2-Dichloroethane (1,2-DCA), 1,1-DCA, Trichloroethene (TCE) and its daughter products (1,2-DCE and Vinyl Chloride)
- Explosives: 2,4-Dinitrotoluene (DNT), 2,6-DNT, 2-Nitrotoluene, 3-Nitrotoluene, 4-Nitrotoluene
- Metals: Arsenic, Mercury and Nickel

What is the extent of VOCs and perchlorate contamination in shallow groundwater?



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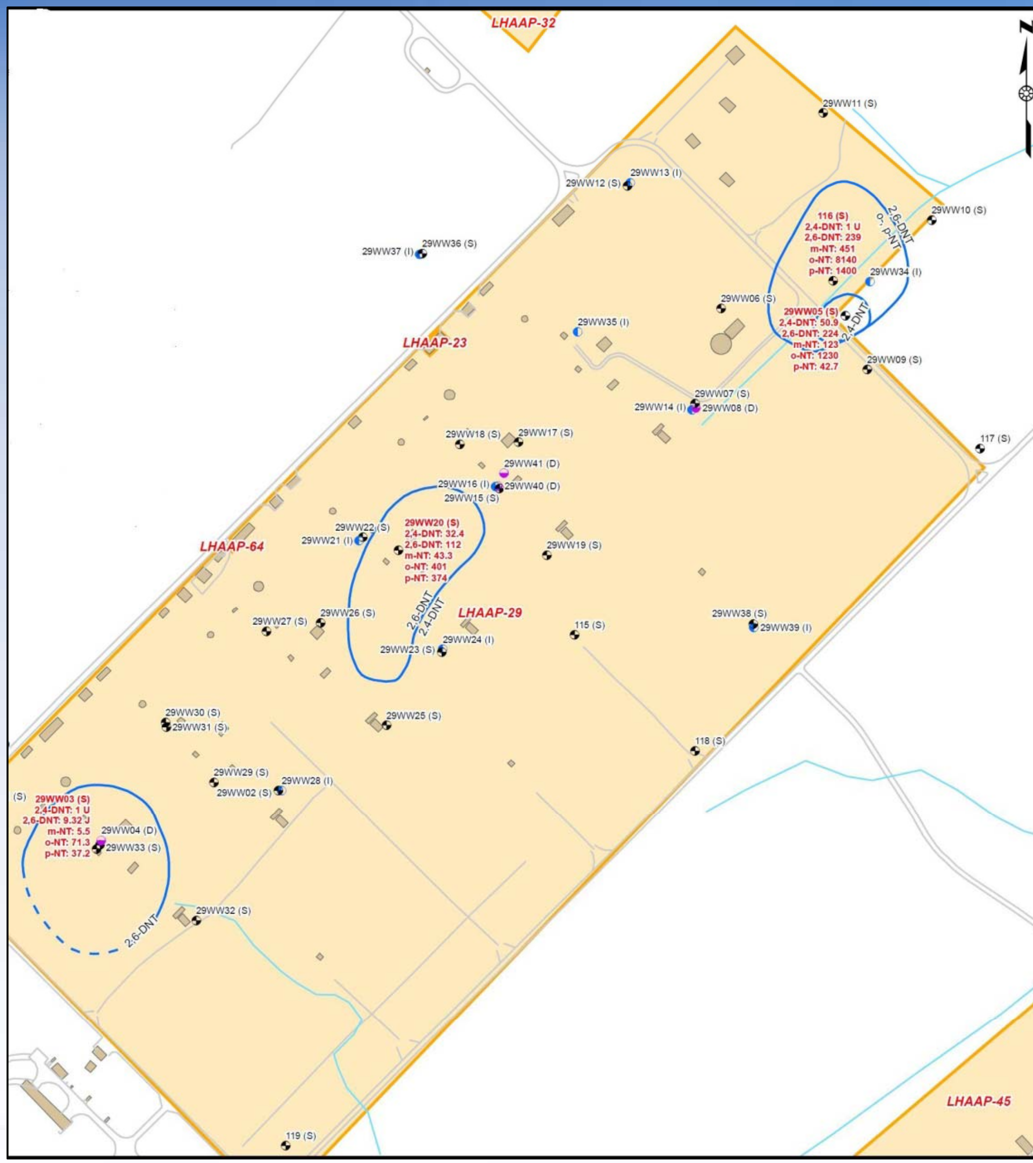
What is the extent of explosives contamination in shallow groundwater?



LEGEND

- Shallow Groundwater Monitoring Well (S)
- Intermediate Groundwater Monitoring Well (I)
- Deep Groundwater Monitoring Well (D)
- COC Plume
- Inferred COC Plume
- Stream
- Road
- Former Building or Tank Location
- Site

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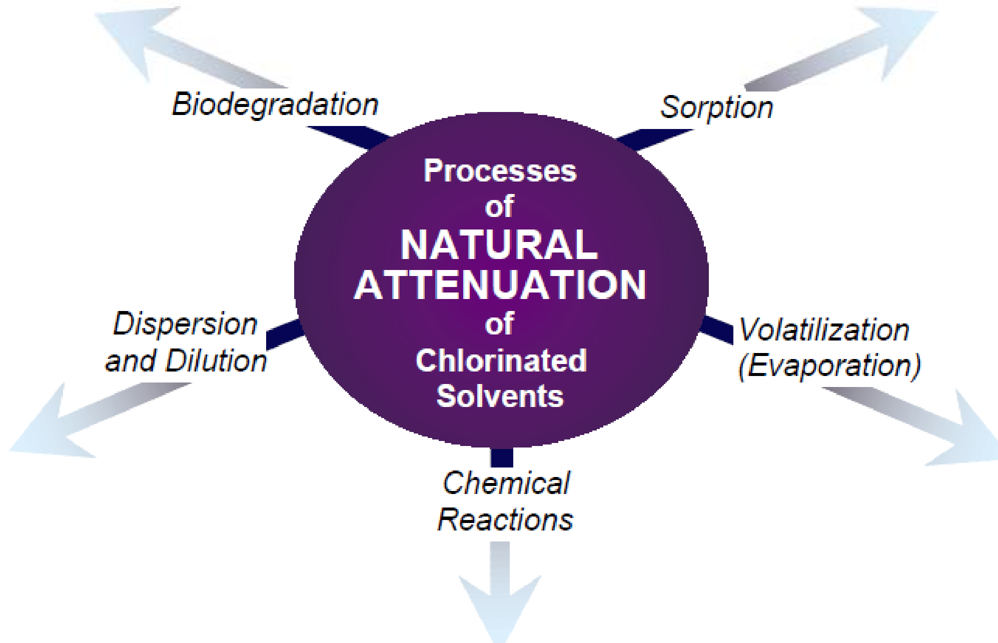
What is the proposed remedy for Shallow Groundwater? Monitored Natural Attenuation (MNA)

What is the MNA?

- Passive treatment
- Natural biological, chemical, and physical processes reduce contaminant mass in groundwater



- Success depends on favorable conditions (e.g. level of dissolved oxygen, pH, groundwater composition)
- Performance monitoring is required

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MNA Performance Monitoring

- Initially, more frequent monitoring will be conducted for the first 10 years
- Monitoring will continue until cleanup goals are met and findings will be reported during CERCLA 5-year reviews

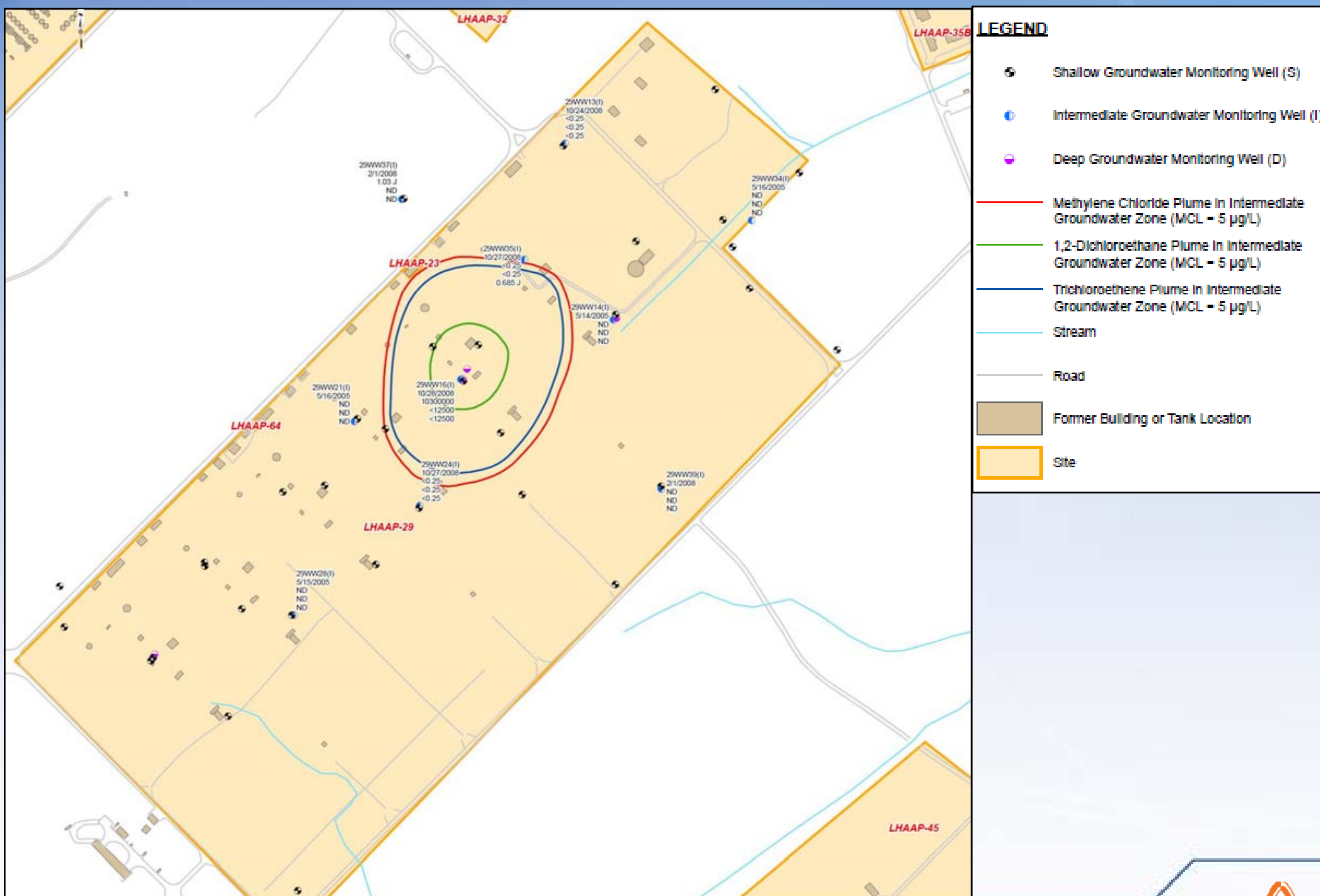
What is the estimated time to achieve cleanup levels in shallow groundwater?

Clean up levels for COCs in shallow groundwater are expected to be met in 70 years based on the attenuation of 1,2-DCA

What are the COCs in Intermediate Groundwater?

- Methylene chloride
- 1,2-DCA
- TCE and its daughter products (1,2-DCE and vinyl chloride)
- Arsenic

What is the extent of VOC contamination in intermediate groundwater?

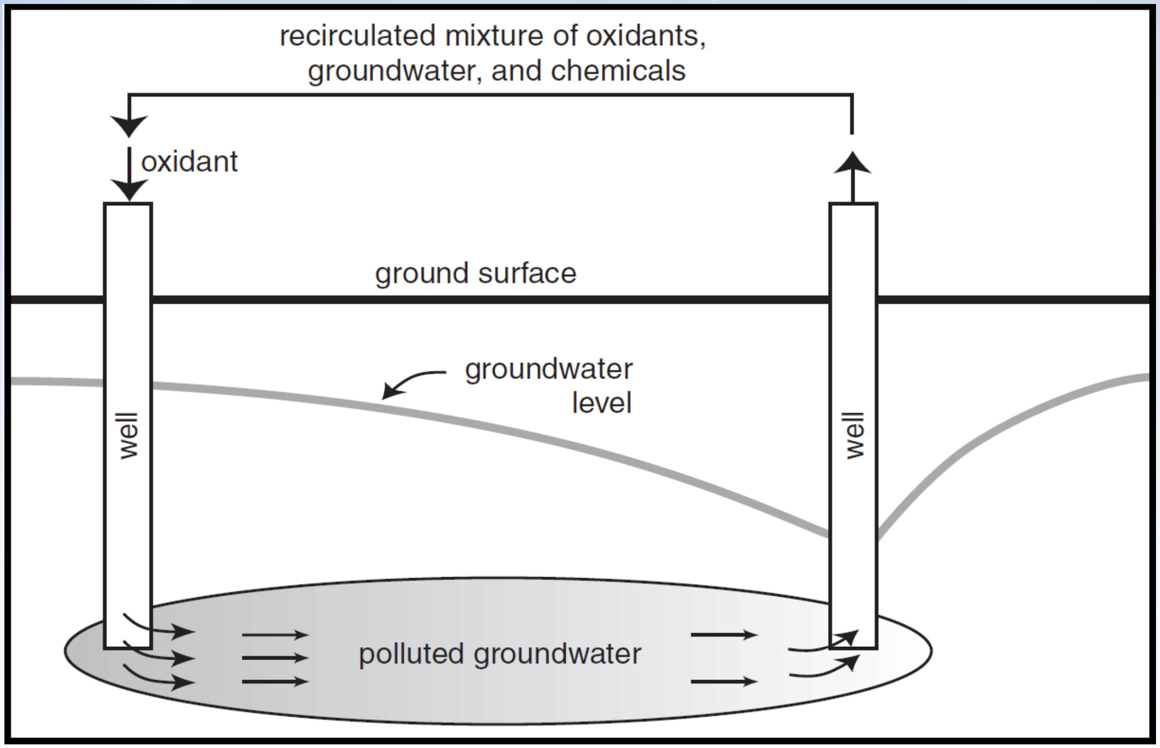


What is the proposed remedy for intermediate groundwater?

- Insitu chemical oxidation to reduce methylene chloride to levels that are amenable to remediation by MNA
- The oxidant destroys the contaminants on contact
- Insitu treatment will be followed by MNA to reduce methylene chloride concentrations to cleanup levels

What is
In situ Chemical Oxidation?

- Active treatment
- Injection of oxidants to destroy pollutants in groundwater (persulfate selected for methylene chloride)



- Change harmful chemicals into harmless ones like water and carbon dioxide

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What is the estimated time to achieve cleanup levels in intermediate groundwater?

Cleanup levels for COCs in the intermediate groundwater are expected to be met in 90 years based on the attenuation of TCE

What alternatives were evaluated as part of the FS?

	Description	Estimated Present Worth
Alt 1	No action as required by CERCLA	$0
Alt 2	**Excavation and Offsite Disposal of soil; Plug Lines; Insitu Chemical Oxidation in Intermediate Zone MNA and LUCs for Groundwater**	**$3,028,000**
Alt 3	Excavation and Offsite Disposal of soil; Plug Lines; Intermediate Zone Groundwater Extraction, MNA and LUCs for Groundwater	$2,918,000

What does estimated present worth mean?

- Estimates are based on feasibility level scoping and are intended to aid in making project evaluations and comparisons among alternatives
- Capital and operating costs are estimated for 30 years
- Estimates have an expected accuracy of -30 to +50 percent
- The present worth for each alternative is calculated using a discount rate

Why Alternative 2 is proposed over the cheaper Alternative 3 ?

Oxidation technology will destroy contaminants and reduce the methylene chloride concentrations faster than pump and treat technology

SUMMARY

Summary of Preferred Remedy

Soil: Excavation and off-site disposal of soil above cleanup levels

TNT wastewater and cooling water lines: Inspect, flush, plug and abandon lines in place

Shallow Groundwater: MNA and LUCs

Intermediate Groundwater: Insitu chemical oxidation followed by MNA and LUCs

Estimated time: 90 years

How does the Preferred Remedy attain remedial action objectives?

- Contaminated soil and sediment removal with off-site disposal will protect the hypothetical future maintenance worker and ecological receptors and eliminate the soil-to-groundwater pathway
- Inspection, flushing and/or plugging of the TNT wastewater line and the vitrified clay cooling water lines will eliminate potential exposure from residual contamination
- Insitu chemical oxidation treatment for intermediate zone VOC groundwater plume will expedite MNA
- MNA will reduce contaminant levels to cleanup levels and confirm the contaminated groundwater remains localized with minimum migration
- LUCs will ensure protection of human health by preventing exposure until cleanup levels are met

Why are you here?

Public opinions and comments help ensure that all factors have been considered in selecting the remedy

How do you comment?

- Proposed Plan and comment forms are available in the Proposed Plan for LHAAP-29 in the Administrative Record at

  Marshall Public Library

  300 S. Alamo Blvd

  Marshall, Texas 75670

  Business Hours:
  Monday – Thursday (10:00 a.m. – 8:00 p.m.)

  Friday – Saturday (10:00 a.m. – 5:30 p.m.)

How do you submit a written comment?

- Send written comments to

  Dr. Rose M. Zeiler
  Site Manager
  Longhorn Army Ammunition Plant
  P.O. Box 220
  Ratcliff, Arkansas, 72951
  Direct No.: (479) 635-0110
  E-mail address: rose.zeiler@us.army.mil
  (Forms are also available here for you to pick up)

- Comments must be post marked by April 19, 2011

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Public Participation

- Public comment period runs through April 19, 2011
- A transcript of tonight's meeting will be posted in the Administrative Record at Marshall Public Library
- Significant public comments will be summarized and addressed as part of the responsiveness summary in the ROD

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Questions or Comments?

Please state your name for the court reporter.

00100062

LONGHORN ARMY AMMUNITION PLANT
PUBLIC MEETING

LHAAP-29 Proposed Plan

Location	Karnack Community Center		
Date	22-Mar-2011	**Time**	7:30 PM

page 1 of 1

ATTENDEES

Name Please Print	Address	Phone	E-mail
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Fay Duke	P.O. Box 13087 Austin TX	512-239-2443	fay.duke@tceq.texas.gov
Stephen Tzhone	U.S. EPA, 1445 Ross Ave, Dallas, TX 75202	214-665-8409	tzhone.stephen@epa.gov
Kent Becher	2775 Altamesa Blvd. Fort Worth, TX 76133	(817) 263-9545	Kdbecher@USGS.gov

PUBLIC MEETING

MARCH 22, 2011

PROPOSED PLAN FOR LHAAP-29

LONGHORN ARMY AMMUNITION PLANT

KARNACK, TEXAS

Reported by:

Leigh G. Walker

Certified Court Reporter

MS. WATSON: I'm Susan Watson. I work for Shaw. We do have a court reporter here tonight. Please remember if you ask a question to state your name first. If you forget to state your name, when you get done we may say, please state your name, just for the court reporter, so you all know. Just try to remember.

We're going to keep passing, going around is the sign-in sheet so please sign in that you attended. We also have the fact sheet on the proposed plan. They are over there on the table. There is a copy that you can look at, the proposed plan, and also of the feasibility study that supports the proposed plan. And then there are blank copies of the comment form if you want to write a comment and mail it in. The e-mail address is also on these sheets. If you just want to pick up the sheet and send in a comment, it's in the back of the proposed plan as well but there are extras here.

If you can't hear me, let me know. Sometimes my voice doesn't carry very well so just let me know if you have a problem hearing me.

So we are here tonight for the public meeting for the proposed plan of, we call it LHAAP, for Longhorn Army Ammunition Plant, 29. It was the former

TNT production area at the Longhorn Army Ammunition Plant. And it shows where it is, but just to kind of give you the big picture on this aerial, this is where it's located.

So why are we here? We're here to present an overview of the proposed plan and the different alternatives considered for the environmental cleanup of LHAAP-29; to present the preferred remedy; to answer your questions and receive your comments about the plan; and to provide information on how you can comment.

And again, for questions during the presentation, they are welcome but please state your names first for the court reporter.

So why is this Proposed Plan important? It is part of the regulatory CERCLA process. It presents the evaluated alternatives and the preferred remedy that was reviewed and accepted by the Army, USEPA, and TCEQ, and it provides an opportunity for the public to comment prior to the final remedy selection which will be documented in the Record of Decision.

And this is the CERCLA process right here. We go through all the assessments. The investigation and feasibility phase went through 2010 for this site and we're right here at Proposed Plan at the public meeting right before the ROD. So it continues on through remedial design and remedial action and the long-term operation eventually getting to site closure.

So where is LHAAP-29? It's there in the western central portion of Longhorn and it's approximately 85 acres.

So how did we get here? Historically, LHAAP-29 was used as a TNT manufacturing facility from October 1942 to August 1945. On the second screen you can see a photo of when it was in production. The explosive compound releases from the manufacturing process of TNT and releases from the process tanks and the process waste pipelines are the suspected contamination sources for the soil, the groundwater, and the solid and liquid residue remaining in the TNT wastewater lines and the cooling water drain lines.

After it was used to produce TNT, it was used for the "soak out" of out of specification rocket motors using methylene chloride, and that occurred between 1959 to the mid 1970s. And the "soak out" was back up in this area.

So here is just a line view of the way it looked. When you see these, you can't really read this, but these along here were the washhouses and over here, this line, so that you can kind of relate between the aerial, and these are kind of our drawings that show, this is what we used to show where the process occurred, where samples were collected, and where contamination is.

So first of all, we have the TNT production lines. There were five active lines and the sixth line was used as a standby line. There was a TNT wastewater line that came directly from the washhouses, and there's one line that's shown in red. There is a cooling water drain line that was to the north, there's one to the south, and then this is where the methylene chloride tank was that came later.

So what investigations have been conducted? From 1984 to 2008, investigations were conducted by several contractors and the U.S. Army Corps of Engineers. With all the investigation, approximately 320 samples were collected of soil and sediment from zero to 20 feet below ground service, about 250 groundwater samples and approximately 11 samples along the process lines.

And the picture here is just one of the monitoring wells at the site.

The data is collected to use to evaluate the risks. So what are risk assessments? The data is used to evaluate the risks of certain receptors, and in this case to human health. So the risk to human health or the environment is when it's outside of acceptable range for EPA. So cancer risk is expressed as a probability. So the risk that is acceptable is in the range of 1 times 10 to the minus 6 to 1 times 10 in the minus 4, or 1 in 1,000,000 to 1 in 10,000.

The non-cancer hazard is expressed as the hazard index, and the hazard index is the sum of the individual hazard quotients which is an intake dose divided by a reference dose. And you add up those for each individual chemical and when that is less than 1 it is acceptable to EPA.

So the exposure depends on the current and future land and groundwater use scenarios. So the use scenario that was evaluated for Longhorn was the industrial/recreational use. And the human receptor was a hypothetical future maintenance worker.

So is there a human health risk at LHAAP-29? Yes, there is.

The risk assessment performed in 2002 concluded that the soil posed an unacceptable non-cancer hazard and the groundwater posed an unacceptable non-cancer hazard and cancer risk. And these are under an industrial scenario, remember, to the hypothetical future maintenance worker. The main contributor is methylene chloride which is in the intermediate groundwater level.

The exposure pathways evaluated for the hypothetical future maintenance worker included soil, groundwater, surface water, and sediment.

Is there ecological risks? The ecological hazards were found to be acceptable; however, there was one area that had very elevated concentrations and it posed a threat to small range ecological receptors. It was explosives; 2,4,6-trinotrotoluene for TNT; 2,4-dinitrotoluene or DNT; and 2,6-DNT. And these are considered -- yes?

MR. DIXON: What was the ecological receptor; is that animal or plant?

MS. WATSON: It is an animal. I don't know the exact animal, but it would be one of the smaller animals that was not long range; in other words, they would stay close to their area.

MR. DIXON: Burrow in the ground?

MS. WATSON: They evaluated all types so the one, I'm not sure exactly which one they called small range ecological receptor, but that's the one that has the threat. I would have to find out and get back with you.

MR. DIXON: Charles Dixon. D-i-x-o-n.

MS. WATSON: So they posed a risk to the ecological receptors due to direct contact and indirect, or dietary exposure. You will see this on a later slide but it's right down here at the end of this cooling water line.

So once we define the risks, you have to establish remedial action objectives. So why are we doing the cleanup?

They are established as part of the feasibility study and they are to protect both human health and ecological receptors. And this lists them as a finding of the feasibility study.

It's the protection of human health by preventing human exposure to the contaminants in the soil, sediment, the transite TNT wastewater line, the cooling waterlines and the groundwater.

The protection of human health and the environment by preventing the migration of contaminants to groundwater and surface water from potential sources in the soil, sediment, and the process lines. And then the protection of human health and the environment by preventing the contaminated groundwater from migrating into the surface water.

The protection of the ecological receptors by preventing exposure to the contaminated soil and sediment. And then the return of the groundwater to its potential beneficial use as drinking water wherever practical.

So once you establish the objectives you also have to establish the cleanup levels, and they are established to meet the remedial action objectives and address the potential risks both to human health and ecological receptors.

So the cleanup levels are concentrations for the individual chemicals in the soil and groundwater above which some remediation or control measures are required. So once these levels are met, the cleanup would be considered complete.

So what are the media of concern? You can see the slide on the left, this shows the soil and groundwater contamination and you can see it looks like there's a lot. There's a lot of little kind of areas at the site. There are explosives in the sediment and surface soils, in the cooling water outfall ditch, which is the little area I showed you at the end. It contributes to both unacceptable human health and ecological risks.

There are residual explosive compounds in the former TNT wastewater lines and cooling water drain lines and the manholes that have the potential to leach into the groundwater.

There's perchlorate contaminated soil in the northeast portion of the site and it contributes to non-carcinogenic or non-cancer human health hazard. There are explosives in the soil near the former process buildings and they contribute to ecological risks and also have the potential for migration into groundwater. And then there's VOCs, explosives and perchlorate in the groundwater that pose an unacceptable human health hazard.

So to get rid of the contamination we have to look at different response actions and we basically develop alternatives. So as we were discussing earlier in the RODS, the alternatives are developed by combining the various technologies to mitigate the risk in all affected media. In this case we have the soil, which includes the sediment, process lines, and groundwater.

So how are they evaluated? The EPA has nine guidance criteria for the evaluation and the alternatives. It's the overall protection of human health in the environment, compliance with applicable or relevant and appropriate requirements, we call those ARARs, and they are chemical-specific, location-specific and action specific.

There's long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness, especially protection of workers and the community during the action.

MR. WINTERS: I have a question. My name is Pickens Winters.

Are those 9 criteria?

MS. WATSON: No.

MS. ZEILER: This is Rose Zeiler. Are the --

COURT REPORTER: I'm sorry, ma'am. I didn't hear your response.

MS. ZEILER: This is Rose Zeiler. There are two criteria that are of similar importance; am I wrong here? They are the first two.

MR. WINTERS: Okay.

MR. LAMBERT: I thought they were all equally weighted. Are they equally weighted?

MS. ZEILER: No.

MR. TZHONE: The primary criteria, there are balancing ones and there are modifying ones. Basically the top five are the primary -- the top four are primary, then the three are balancing the two. But, you know, we could just pull this up.

MS. DUKE: I'll take a crack at it. The first two are what we call special criteria. You have to pass them. There is no -- any remedy we choose must pass the first two criteria, which is protection of human health and compliance with applicable and relevant and appropriate requirements. The other long-term, reduction, short-term, implementability and cost are what they call balancing criteria. So basically, you know, you can have a budget remedy that meets the first two. Then you look at it from the other five criteria to see how it balances out. You know, cost, if it actually meets it, but a cost is so prohibited because it's so expensive and does not return, you know, just the same amount of long-term or short-term, then that's the balancing criteria. Then the other two are what we call modified criteria. If the agency or the state agency doesn't accept it or the community has a problem with it.

COURT REPORTER: I'm sorry. What is your name?

MR. LAMBERT: John Lambert.

MR. TZHONE: Steve Tzhone. That's correct, that's the criteria that we would evaluate all the remedies. But I will say this, that all the remedies that are selected will usually have all of them addressed. You know, I'm not sure that if the state or the community do not accept or have input into the remedy that the EPA would go forward on a remedy. So I just want to, you know, say that. Even though there are different rankings under criteria, the public participation part is very, very strong criteria for EPA to consider.

MR. DIXON: Fay, the balancing criteria, aren't those, no one is more important than the other?

MS. DUKE: I think that's what I was trying to say. I mean, I agree totally with what you said.

MS. WATSON: And just to quickly, because you're putting these together and you're packaging them, if they don't meet the first two they really don't become an alternative, they don't even evaluate them. So I guess given those are always, you know, if they don't meet those two it's not even considered an alternative.

There is a no-action alternative that we are required to evaluate in feasibility studies which means nothing is done.

So, were all the alternatives evaluated?

Yes. They all are evaluated against the nine criteria. And the detailed evaluation if presented in the summary, is presented in the proposed plan.

So I'm not going to go through all the different alternatives and their evaluation criteria because it's fairly complicated. I'm going to jump right to the outcome of the evaluation which was Alternative 2. It's the preferred alternative. And it protects human health and the environment, it complies with the ARARS, it utilizes a permanent solution, it utilizes an active treatment as a principal element and it is cost effective.

So what are the components of Alternative 2? It's excavation to address the soil contamination; it's investigation, flushing if necessary, and plugging of underground process lines. Is there a question? Okay.

Monitored natural attenuation for the shallow groundwater zone isolated plumes, and the in situ oxidation and MNA following that for the intermediate groundwater zone contamination. Yes?

MR. DIXON: Charles Dixon. What do they use for oxidation?

MS. WATSON: We are proposing persulfate based on the studies, specifically for the methylene chloride.

So let me just kind of talk about each part of the media and we're going to start from the top down. We'll start from the soil and this is actually an area kind of near where the tank was for the rocket motor washout.

So what are the chemicals of concern in the soil? There's perchlorate and explosives; the 2, 4,6-TNT; 2,4-DNT; and 2,6-DNT. And this is a combination of both ecological and human health.

This gives you an idea of the extent of the soil contamination. The circular area is the perchlorate and the other areas are explosives with the highest concentration being right here. This is where the cooling water line is going to end up. So this is the highest concentration which is both ecological and human health.

The list of proposed remedy for soil is excavation and offsite disposal of contaminated soil. In situ technologies that try to do some kind of stabilization or something else in situ were not really considered because it really doesn't address the ecological risks. A lot of those remedies might stabilize it but the contact is still there from a human health and ecological standpoint.

The estimated amount of soil to be removed is approximately 3,900 cubic yards, and that's all those spots.

So we start at the surface and now we're going to go down to the process lines. So there's TNT wastewater line and then the cooling waterlines.

So what is the difference between the two process lines? The TNT wastewater line, which is a single line that's red, actually carried away the process wastewater from the washing process during the TNT production. You probably saw the TNT production, the lines were red water, yellow water, red liquor or yellow liquor, and that is this line.

The wastewater went to a pump house at the east end of the site and then there was wastewater treatment there at LHAAP-32, another site. And this wastewater line was made of transite.

And also we have the cooling water drain line. The TNT manufacturing process generated a lot of heat, and basically cold water was passed over that equipment and then it flowed down the drain into the cooling water drain line. These are gravity fed lines that were actually discharged to an open ditch at the east end of the site. That's the location where the highest concentrations are for the ecological and human health. They're there on that, really on the surface of the soil. And this cooling waterline was made of vitrified clay.

So what are the COCs in solid and liquid residue in the TNT wastewater line and cooling water lines? And we did find both, sometimes we see some little residue in liquid. Primarily in the TNT wastewater lines that were the process lines, they had a lot more solids in them. In the cooling water drain lines they are much cleaner and there was liquid with maybe a little bit of solids.

So if you look at the contaminants, they're all explosives, and they happen to be the same which really isn't a surprise based on the process of producing TNT.

So what is the proposed remedy, first of all, for this TNT wastewater process line?

Here's a picture, it's exposed. They were trying to locate the lines. And they also did some sampling of the lines when this picture was taken.

The TNT wastewater line is approximately 3 to 4 feet below the ground surface. What will happen is this line will be flushed because we know that there is residue in it. The rinsate water will be disposed, and then the ends will be plugged with a bentonite slurry, and the line with be abandoned in place. Yes?

MR. LETOURNEAU: Richard LeTourneau. I just had a question about do you know what the diameter of that line is?

MS. WATSON: No, I don't, off the top of my head. The diameter?

MR. LETOURNEAU: Any idea?

MS. ZEILER: I'm pretty sure we have that somewhere.

MR. LETOURNEAU: Is this the line that was made up of the transite?

MS. WATSON: Yes, this is transite.

MR. LETOURNEAU: Is there any industrial history that tells you how big that line might have been in diameter?

MS. WATSON: We do have some old drawings that we can maybe, I'm not exactly sure. I may have to look but I don't know the diameter off the top of my head.

MR. LAMBERT: John Lambert. I think it's 9 or 12 inches but I'm not going to say for sure. I think it was one of those.

MR. LETOURNEAU: That sounds reasonable. I just had one other question. In terms of length of the line from the point that you discovered its existence, is it more economical to plug it with bentonite slurry than it would be to just remove the line?

MS. WATSON: Well, the residue will be flushed out of anything left it in, so it's cleaned of the explosives which you worry about leaching into the groundwater, and then once it is cleaned out then we will just plug it with the bentonite. So economical, it is several thousand feet of pipe that's in the ground.

MR. LETOURNEAU: Of wastewater, of wastewater treatment line?

MS. WATSON: Yes.

MR. LETOURNEAU: The options, and I just wondered, obviously it was one that was looked at because a 9 or 12-inch line isn't very large.

MS. WATSON: Well, you get into removal of transite pipe and other things, because it's transite and other regulations kick in. So from that standpoint, and because of the length of the line. That's why we opted to flush them, plug them wherever the openings are, and then be abandoned in place. These will be surveyed once the action is complete. So these will go, you know, basically going on a deed that these lines are there in place underground.

Do you still have a question?

MR. LETOURNEAU: There's a lot of questions but I don't know that it would do any good to go further with them right now because they're all related to that. That's okay. I'm just trying to understand your process and your thinking.

MS. WATSON: So going on to the proposed remedy for the cooling water lines, these are clay lines and they are approximately 3 to 8 feet below ground surface. They are gravity fed lines that flow basically to surface water. There are 12 manholes along the lines. And what will happen here is these manholes will be inspected and if there are any contents in the manholes they will be sampled. Based on those results, if the contents are hazardous, the lines will be flushed and the rinsate will be disposed. And then the inlets and outlets, including the manholes, will be plugged with a bentonite slurry mix.

If everything is tested along this line and the residue in it, remaining in it, is non-hazardous and it meets the cleanup levels, then obviously there won't be any cleaning of that line. At this point we're not sure, it's got to resampled. And based on the results of the sampling, the appropriate action will be taken.

Any questions? We'll move on.

So on to groundwater. So what are the groundwater characteristics at LHAAP-29? There's actually three zones. There's a shallow groundwater zone that's about 17 to 45 feet below the ground surface, an intermediate zone that's 88 feet below the ground surface, and a deep zone at 155 feet below the ground surface.

The shallow groundwater flows east/southeast primarily, the intermediate is east/northeast. And both the shallow and intermediate groundwater zone are contaminated from the TNT production process. The deep water groundwater zone has not been impacted.

So what were the technologies that we evaluated for the groundwater? There's ex situ treatment, and that would be groundwater extraction and treatment at the groundwater treatment plant. It can handle the methylene chloride. There's in situ treatment which would enhance bioremediation in the most contaminated groundwater areas. A permeable reactive barrier, which is a combination of gravel and organic media. If you can kind of imagine a wall and the water would flow through it, the contaminated water could pass through it. We evaluated that as well as in situ chemical oxidation. And then we've got monitored natural attenuation and then land use control which actually restricts the use of groundwater to ensure there are no withdrawal or use of the groundwater beneath the site for anything other environmental monitoring and testing.

So move on to what the contaminants are. This is in the shallow groundwater. There's perchlorate, there's VOCs, which include the 1,2-DCA, 1,1-DCA, TCE, and its daughter products which include 1,2-DCE and vinyl chloride. The explosives 2,4-DNT, 2,6-DNT, and then there's some nitro toluene, 2, 3 and 4 nitro toluene. And there's some metals which are very isolated, arsenic, mercury and nickel.

So this slide shows the extent of the VOCs and perchlorate in shallow groundwater. If you note where your circle is, the soil and then your perchlorate groundwater is there. So the soil and the source will be removed for the shallow groundwater. And then here are the explosives. You have pretty isolated small areas.

So what is the proposed remedy for the shallow groundwater? It's monitored natural attenuation. So we talk a lot about MNA, but what is it. It is a passive treatment, it's a natural biological, chemical, and physical processes that reduce the contaminant mass in groundwater. Its success depends on favorable conditions such as the level of oxygen, pH and groundwater composition. And performance monitoring is required. That's an integral part.

So what is performance monitoring? Initially, it would be done more frequently, especially for the first 10 years to demonstrate that it is occurring. Then monitoring would still continue all the way until the cleanup goals are met, and the findings would be reported during the CERCLA 5-year reviews.

So what is the estimated time to achieve the cleanup levels in the shallow groundwater? It's expected to take about 70 years, and we look at different chemicals and this is the longest. It's based on the attenuation of 1,2-Dichloroethane.

Now we'll move on to the intermediate groundwater. This is where the most contamination is. This is what is the risk driver. And it's methylene chloride. The other contaminants in the intermediate are 1,2-Dichloroethane and again trichloroethene and its daughter products, and arsenic.

So what is the extent in the intermediate?

You can see it's the largest circle from the left map. And the largest circle, again, is the methylene chloride line.

So what is the proposed remedy for the intermediate groundwater? We're proposing in situ chemical oxidation to reduce the methylene chloride to levels that are amenable to remediation by MNA. So it's not going to clean it all the way up to the cleanup level, but it's going to reduce the concentration so the natural attenuation can take over.

So the oxidant destroys the contaminants on contact and the in situ treatment will be followed by MNA. It's not just the methylene chloride but it also affects the other, like, the dichloroethane as well.

The next is what is in situ chemical oxidation? It is an active treatment, and there's injection of oxidants to destroy the pollutants in the groundwater. Persulfate was selected for the methylene chloride. It changes the harmful chemicals into harmless ones, like water and carbon dioxide. So what happens is that oxygen is injected and you have an extraction well that pulls through the water and it helps pull the oxidant through. Because the oxidant is not something we inject and let set and it continues to treat; it's more contact. So, basically, it does its job and it's gone. It doesn't, you know, hang around, continue for years to keep treating.

So what's the estimated time to achieve a cleanup level? We're expecting it to be about 90 years, and this is based on the attenuation of the trichloroethylene. So, basically, once the methylene chloride concentration are reduced then the conditions should be favorable for all the other chemicals to continue attenuating. So that's what this estimate is based on. Question?

MR. LETOURNEAU: Going back to the groundwater use, whether it's shallow or intermediate, part of the solution is to prohibit the use of groundwater at this place from, you can't use it for drinking.

MS. WATSON: As long as it's contaminated, correct.

MR. LETOURNEAU: Right. Now, does that encompass 85 acres of 29?

MS. WATSON: Okay. 85 acres is the entire rectangle and you can see the largest plume right there in the center. That's where the contamination is.

MS. ZEILER: This is Rose again. I would

like to add that generally, the restriction would encompass more than the actual contamination of water. You must put a buffer area in there.

MR. LETOURNEAU: What's a reasonable expectation for a buffer area?

MS. ZEILER: Generally, lots of times they will conform to the site boundaries if there are no other reasons, but we like to go to some boundary, level surface water feature or something, something that we know will direct the flow lines. Lots of times that would be a physical feature. You go to the nearest physical feature where you have room, you know that's free space, and what we will do is propose those boundaries and have the regulators review it, make sure they agree that what we're projecting is good, and then we will put the restriction on that while remediation takes place.

On the north where the little jog is there you can see the plume right now, sort of off. So for the land use control that boundary would encompass that area. So in this case it would go slightly out beyond even like to here.

MR. LETOURNEAU: Yeah, because the plume is outside the site boundary.

MS. ZEILER: Right.

MR. LETOURNEAU: But how far outside that plume is water unusable for human consumption?

MS. WATSON: It will vary based on the site and it's based on the physical feature so it can be defined.

MR. LETOURNEAU: Is a part of the program coming up with those definitions or leaving it arbitrary until a problem arises?

MS. WATSON: It is part of the remedial design. The land use controls are part of the remedy and so it is part of the design. It will establish, you know, what the land use controls are and it will propose those boundaries. And that design document is reviewed by the regulators and it is approved. It will be surveyed in in accordance --

MR. TZHONE: Is your question is any of the ground water at any of the zones being used for drinking? Is that your question?

MR. LETOURNEAU: No, it's not really that except that the groundwater in my opinion is not necessarily stationary underneath the plume. So the question is not making the decision now to be told later how much is affected, there should be some way to anticipate what that answer is going to be. That answer could be, if I'm hearing this right, it could be 8,000 feet in one direction.

MS. ZEILER: No, no, it's not going to be that situation. Fay, go ahead and talk about the --

MS. DUKE: Basically the exact boundary of the land use control is not identified yet but it's going to be very close, like she said, either at the boundary of the pipe, and during the design these plumes should not move. It should not migrate, and that's what we're going to be looking at. You know, monitor, MNA, monitored natural attenuation, will only work if the plume is not expanding. It has to be stable. And so knowing that the plume is here, so let's say those lines are actual, or were we think the contamination is at, we'll probably set a land use control around the area with a small buffer and also physical markers so you can survey it in. And once that land use control is surveyed in they will get recorded in the county records. They will be monitored all the time.

So once we establish where all the wells are going to be monitored, where the land use control is, because these are all remedies, then from after we approve the design we're going to be monitoring that.

MR. LETOURNEAU: When were the location of these existing plumes established?

MS. DUKE: The existing plume is established based on current wells. Now, as we go into design, more likely than not, we will probably have more levels to better define so we know we're monitoring to make sure that the plume is stable, not migrating offsite or migrating to surface water. So that we will see in the remedial design, we should set that in the remedial design.

MS. WATSON: And the current plumes are designed on data so, I mean, as you saw it, I can't remember when they first, '98 the investigations started and the most current data that we have, I think we actually have some 2010 data. So all that data has been used to design the plan. And we continue monitoring over time. You know, just make sure they're not moving. Remember, the biggest plume will be treated as well, the big one in the center.

So just general overview of the other alternatives that were evaluated as part of the feasibility study process.

Alternative 1 is always a no-action alternative. It's required by CERCLA. It cost zero dollars. Basically you do absolutely nothing. So it never complies with the ARARS, for example. It's never usually typically not protective of human health.

Alternative 2 is the one that we're saying is the preferred. Its estimated present worth is $3,028,000.

In Alternative 3, which is pretty similar to Alternative 2 except for in the intermediate zone instead of doing the oxidation --

MR. WINTERS: Pickens Winters. Is present worth synonymous with cost, what it would cost?

MS. WATSON: Not exactly, and I will explain what that is on the next slide; okay?

MR. WINTERS: Okay.

MS. WATSON: So the main difference between Alternatives 2 and 3 is for the intermediate zone which is where your highest risk is, that's your risk driver. The oxidation would include groundwater extraction because we do have the existing groundwater treatment plan. And its estimated present worth is about $2,918,000.

What does Estimated present worth mean? Basically, they're based on a feasibility level scoping and they are intended basically to aid in making project evaluations and comparisons among the different alternatives.

So, basically, their capital and operating costs are estimated for 30 years. They are expected to have an accuracy of minus 30 to plus 50, so what will it cost to do it. And so then each one of those is calculated using a discount rate. So you look at all the costs out for that 30-year period and then you bring it back to compare it. So it maybe not mean much today, maybe you're spending a lot of money today and hardly anything in the future, so it brings everything back to a consistent level for comparison. That's what it does.

So if you notice Alternative 3 is cheaper so why are we proposing 2 over 3? It's because the oxidation technology will actually destroy the contaminants and it reduces the methylene chloride concentrations faster than the pump and treat technology.

MR. DIXON: Where will the water go that's pumped out after it's treated?

MS. WATSON: The pump and treated, it will go to the existing groundwater treatment plant. It is designed to handle --

MR. DIXON: The other slide shows the groundwater going down and the water is going somewhere.

MS. WATSON: Oh, recirculating somewhat.

Yeah. It basically will be recirculated and then any excess water would be taken into the groundwater treatment area. It doesn't generate a lot of water.

So in summary, the summary of preferred remedy. For the soil, again, is the excavation and off-site disposal of soil. For the wastewater and cooling water lines, we're going to inspect them, test anything in them, flush them, plug and abandon them in place, and then later they will be surveyed and that will be recorded at the county that they were left in place.

For the shallow groundwater, it's monitored natural attenuation and land use control. Intermediate groundwater is the in situ chemical oxidation followed by monitored natural attenuation, and also it will have land use control because it doesn't reach cleanup levels, you know, really fast. And the estimated time is about 90 years.

MR. LETOURNEAU: Not being able to look at all the options right now, were options not used that in some combination had an answer that was lessor than 90 years?

MS. WATSON: No, they all are about 90 years.

MR. LETOURNEAU: So that's a part of the

answer regardless of what you do, 90 years is part of the answer?

MS. WATSON: Yes. Because based on, basically the intermediate groundwater which has really high concentrations of methylene chloride, and also some other contaminants. So no matter what you do there's not a fast solution.

In the feasibility study, you know, it does look at, you know, like all the different technologies that we evaluated using the filtering alternative, it talks about the pros and cons of each one, and if it was retained to use as part of an alternative or why it was eliminated. So all of that is also in the feasibility study.

So how does the preferred remedy attain remedial action objectives? Remember back on the earlier slide we said we have to come up with the objectives of why it's needed. So the contaminated soil and sediment removal with the offsite disposal will protect the hypothetical future maintenance worker in the ecological assessment, and also eliminate the soil to groundwater pathway. Inspection, flushing or plugging of the TNT wastewater line and the cooling water lines eliminate that the future exposure from residual contamination, which is primarily, again, basically contamination to groundwater pathway.

The in situ chemical oxidation treatment is for the intermediate zone VOC groundwater plume, and that also helps expedite the monitored natural attenuation. And then the monitored natural attenuation will then reduce the levels, the cleanup levels, and confirm contaminated groundwater remains localized, it's not going to migrate and it'll basically stay within those bounds that are within the LUC. And then again, the LUC will protect human health by preventing exposure to the water until the cleanup levels are met.

So why are you here? It's because public opinions and comments help ensure that all the factors have been considered in selecting the remedy.

And how do you comment? The proposed plan comment forms are available in the admin record at the library. The library is open every day but Sunday. You can also submit a written comment and you can send these to Rose. And on the cover form that's on the table, again, it has her address as well as her e-mail. And all comments must be postmarked by April 19th, 2011, because that is the end of the 30-day public review period.

So again, the public period runs through April 19th. There will be a transcript of tonight's meeting and it will be posted in the administrative record at the library. The significant comments will be summarized and addressed as part of the responsiveness summary in the record of decision.

So questions tonight, questions that are sent by e-mail or sent my mail, everything gets combined and summarized, because sometimes people have the same comments, and they get addressed, they get answered, and all of that becomes a part of the record of decision.

So any additional questions and comments? Yes?

MS. VANDERVENTER: Judy Vandeventer. Can we get a copy of your slides for tonight or have y'all sent them to us?

MS. WATSON: No, we haven't sent them out to anybody. Sure. Shall we send them out to all members?

MR. LETOURNEAU: Yeah, I would like it.

MS. WATSON: Okay. I think that's it. That's the end of the slide show.

(Whereupon, the meeting was adjourned.)

C E R T I F I C A T E

STATE OF LOUISIANA:
PARISH OF CADDO :

I, Leigh G. Walker, Certified Court Reporter, do hereby certify that the foregoing proceedings were had before me, and that they were reported by me and this is a true and correct record of the proceedings.

I further certify that I am not of counsel or related to or employed by any of the parties to this cause or in any wise interested in the event thereof.

SUBSCRIBED AND SWORN TO on this the 18th day of April, 2011.

Leigh G. Walker

Leigh G. Walker, CCR

OFFICIAL SEAL
LEIGH G. WALKER
Certified Court Reporter
In and for the State of Louisiana
Certificate Number 92210
Certificate expires 12-31-11

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

MONTHLY MANAGERS' MEETING

AGENDA

DATE:	Thursday 21 April 2011
TIME:	08:30 am.
PLACE:	Teleconference - Call In Number Courtesy of Shaw: 866-797-9304/4155734

Welcome — **RMZ**

Action Items
Army
- Provide update on LHAAP-65 and 56.
- Update Schedule for RODs and RDs.

Shaw
-

Shaw
- Provide fact sheets for LHAAP-17 and LHAAP-18/24 at the next RAB meeting.
- Update and distribute the Master Sampling Plan.
- Add action levels to Surface Water (Creek) Sampling and Perimeter Well Sampling summary tables and provide to regulators prior to general distribution.
- Provide handouts of information on the operation of the GWTP (i.e. amount of water treated) at the RAB. Provide copy to Army prior to RAB.

EPA – Topics for Discussion — **ST**
-
- RODs, RDs and schedule
- Follow up with the health department about presenting to the RAB
- Terry Burton to research residual DNAPL and remediation technologies – time versus cost
-

Defense Environmental Restoration Program (DERP) PBC Update — **PS**
- Minutes from April 7 RD Meeting
- Document Status/Environmental Sites (Table)
- LHAAP-29 Proposed Plan Comment Period
- Groundwater Treatment Plant
- Groundwater and Surface Water Sampling Schedule Spreadsheet

DERP Total Environmental Restoration Contract Update — **Army**
- LHAAP-37/67 RD Status – Comment Responses
- Pilot Demonstration at LHAAP-37 Status

MMRP Update — **Army**
- Status of MC Data Summary Report
- Letter to Army from EPA re Approach to MMRP ROD

Review of Schedule **Army**

IAP Update **Army**

USFWS Update **RMZ/PB**

- Environmental Restoration Issues with Transfer Schedule Impact
- USFWS Comments on Documents

Adjourn

Shaw® Shaw Environmental, Inc.

Subject: **Final Minutes, Monthly Managers Meeting, Longhorn Army Ammunition Plant (LHAAP)**

Location of Meeting: **Teleconference**
Date of Meeting: **April 21, 2011; 8:30AM – 9:30 AM**

Meeting Participants:

BRAC:	Rose M. Zeiler
USACE-Tulsa:	Aaron Williams, John Lambert
USAEC-SA:	Marilyn Plitnik
Shaw:	Praveen Srivastav, Susan Watson, Kay Everett, Sowmya Suryanarayanan
USEPA Region 6:	Steve Tzhone
TCEQ:	Fay Duke, Dale Vodak
USGS:	Kent Becher
USFWS:	Paul Bruckwicki

Welcome **Rose M. Zeiler**

Action Item Status
Army

- Provide update on document review for LHAAP-65 and -56 - *in progress; provided additional supporting documentation on LHAAP-56 to TCEQ. Please advise if additional discussion or information is needed.* TCEQ will review the support documentation for LHAAP-56.

- Update Schedule for RODs and Remedial Designs (RDs). – *Coordinate with Shaw and send out today. Will present to community during RAB meeting tomorrow. Steve advised he wants to see prior to distribution.*

Shaw
- Provide fact sheets for LHAAP-17 and LHAAP-18/24 at the next RAB meeting. – *Done; handouts were provided*
- Update and distribute the Master Sampling Plan. – *Done; sent March 21*
- Add action levels to Surface Water (Creek) Sampling and Perimeter Well Sampling summary tables and provide to regulators prior to general distribution. – *Will complete for next issue.*
- Provide handouts of information on the operation of the GWTP (i.e. amount of water treated) at the RAB. Provide copy to Army prior to RAB. – *Done. Presentation of GWTP operations during RAB was highly effective and well presented.*

EPA
- RODs, RDs and schedule - *Steve Tzhone said HQ was satisfied*
- Follow up with the health department about presenting to the RAB – *Steve said that the health department was on board. He expected to get questions from the community through Pickens Winters, one of the RAB members who said that he would gather and provide them to Steve at the next RAB*

- Terry Burton to research residual DNAPL and remediation technologies – time versus cost - *Done*

Defense Environmental Restoration Program (DERP) PBC Update **Praveen Srivastav**

Minutes from April 7 RD Meeting
Minutes were prepared from the April 7 meeting and were distributed April 19, 2011. Topics discussed are currently being incorporated in the RDs for LHAAP-46, -50, and -35A(58).

Document Status/Environmental Sites
Praveen went over the document status/environmental sites table.

- LHAAP-03: Currently preparing EE/CA and Action Memorandum. A public notice will be required for the EE/CA.
- LHAAP-04: Received regulatory comments on the draft final completion report. Currently addressing regulatory comments. The preliminary draft FS for LHAAP-04 is in Army's review.
- LHAAP-16: The revised draft ROD is in Army's review.
- LHAAP-17: Regulatory comments received and response to comments is in Army's review. Rose and Steve said that they will go over some comments in the ROD regarding language changes.
- LHAAP-18/24: The RTCs are in regulatory review as of April 13th.
- LHAAP-29: Preliminary draft ROD is in internal review and would be submitted shortly.
- LHAAP-46: Currently addressing Army comments on the draft Remedial Design. Meeting was held with regulators on April 7, 2011. Document is being revised to address regulatory preliminary comments. Document should be submitted by end of month.
- LHAAP-47: Responses to Army's comments on revised Draft FS for LHAAP-47 have been submitted.
- LHAAP-50: Currently addressing Army comments on the draft Remedial Design. Meeting was held with regulators on April 7, 2011. Document is being revised to address regulatory preliminary comments.
- LHAAP-58: Currently addressing Army comments on the draft Remedial Design. Meeting was held with regulators on April 7, 2011. Document is being revised to address regulatory preliminary comments.
- LHAAP-12 RA(O): Regulatory comments received. The responses to comments are in preparation.

Site 29 Proposed Plan Comment Period
The comment period for the LHAAP-29 Proposed Plan ended April 19, 2011. Several comments have been received and the Responsiveness Summary is currently being prepared.

Groundwater Treatment Plant

- The GWTP is functioning normally and discharging to creek. A line is being installed to the burning ground so that, when necessary, the plant can inject more volume and sprinkle directly at the site.
- The INF pond repair is ongoing. The eradication of the trees has been effective. The trees will be cut down and the stumps ground down. Then, any holes in the cover from tree roots will be repaired.
- Dale Vodak asked about the sediment in the pond. He said that it appeared that space was being lost volumetrically in regards to excessive sediment deposits within the pond.

Groundwater and Surface Water Sampling Schedule Spreadsheet
The document has been updated and distributed.

DERP Total Environmental Restoration Contract Update **Army**

LHAAP-37/67 RD Status – Comment Responses
The Army is currently wrapping up comment responses.

Pilot Demonstration at LHAAP-37 Status
Army is planning to perform a pilot demonstration at LHAAP-35B(37).

MMRP Update **Army**

Status of MC Data Summary Report
The MC Data Summary Report is being updated to include the recent sampling results and to add the historical laboratory reports.

Letter to Army from EPA re Approach to MMRP ROD
Steve said that information from Rich Mayer would be sent by letter on issues regarding metals as a follow up and a question on perchlorate was discussed. EPA agreed with Army's proposed approach for additional sampling for perchlorate and EPA will send a formal letter to document the approval. Additional discussion between EPA and Army is needed to address issues regarding metals.

Review of Schedule **Army**

It appears that the schedule for the LHAAP-18/24 FS will likely have to be moved out. Likewise, the ROD for LHAAP-17 should be completed this month and may have to be moved out. There is some danger in the ROD schedule regarding deadlines slipping.

USFWS Update
Environmental Restoration Issues with Transfer Schedule Impact. *None. Documents are being received.*

Meeting Adjourned
Next monthly manager's meeting is teleconference for May 24, 2011, 9:00AM.

Action Items
Shaw – Add action levels to creek and perimeter sample results tables
EPA – Check for use of isotope studies for MNA evaluation
LHAAP-03 – Check public review requirements for EE/CA and if public meeting (or just public review period) is required for a NFA Proposed Plan and ROD
EPA/Army – Review LHAAP-17 ROD language changes

00100104

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
April 21, 2011

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	**Remarks**
1	Draft Final Soil Removal Work Plan, LHAAP-03	11/15/10	x	x	Final	03/31/11	x	x	In progress	Addressing TCEQ comments. In internal review. The document is on hold pending EE/CA and AM	
2	Preliminary Draft EE/CA, LHAAP-03	05/15/11	x							In preparation	
3	Draft Final Completion Report, LHAAP-04	05/24/10	x	x	Final	5/15/11	x	x	In progress	Regulatory comments received. RTCs in preparation	
4	Preliminary Draft FS, LHAAP-04	2/03/11	x		Draft	5/15/11	x	x		In Army review	
5	Preliminary Draft ROD, LHAAP-16	11/17/10	x		Draft	5/15/11	x	x	In progress	Revised Draft in Army's review	
6	Draft Record of Decision, LHAAP-17	1/26/11	x	x	Final	06/30/11	x	x	In progress	Regulatory comments received. RTCs in Army's review	
7	Draft (Final) Feasibility Study, LHAAP-18/24	5/13/09	x	x	Draft Final	05/30/11	x	x	In progress	RTCs in regulatory review	
8	Final Proposed Plan, LHAAP-29	3/15/11	x	x						Final submitted	

Shaw® Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
April 21, 2011

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	**Remarks**
9	Preliminary Draft ROD, LHAAP-29	4/30/11	x							In preparation	
10	Draft Remedial Design, LHAAP-46	10/1/10	x		Draft Final	4/30/11	x	x	In progress	Addressing Army comments. Meeting held with regulators on 4/7/11. Revising document to address regulatory preliminary comments	
11	Revised Draft Final Feasibility Study, LHAAP-47	10/27/10	x		Revised Draft Final to Army	4/15/11	x	x	In progress	Received Army comments. Submitted response.	
12	(Preliminary) Draft Remedial Design, LHAAP-50	12/13/10	x		Draft	05/15/11			In progress	Addressing Army comments. Meeting held with regulators on 4/7/11. Revising document to address regulatory preliminary comments	
13	Draft Remedial Design, LHAAP-58	11/22/10	x		Draft	5/30/11	x	x	In progress	Addressing Army comments. Meeting held with regulators on 4/7/11. Revising document to address regulatory preliminary comments	
14	Draft Final LHAAP-12 RAO Report	2/10/11	x	x	Final	5/30/11	x	x	In progress	Regulatory comments received. RTCs in preparation	

LONGHORN ARMY AMMUNITION PLANT FY11 TARGETED GPRA GOALS

					Completion Dates										
					Interim Action or Removal Action				Final Action						
Site ID (DSERTS)	RMIS #	DERPMIS		SITE DESCRIPTION	RI/FS or EE/CA	ROD/DD or AM	RA Starts	RA Completions	RI/FS Starts	ROD/DD	RD	RA Completions	Site Construction Completions		
Army Terminology					RI/FS or EE/CA	ROD/DD or AM	RD	RA	RI/FS	ROD/DD	RD	RA	RIP	RA(O)	RC
LHAAP-001	1	1	X	Inert Burning Ground						Jan-98					Jan-98
LHAAP-002	2	2		Vacuum Truck Overnight Parking Lot					Jan-09	Apr-10					Apr-10
LHAAP-003	3	3	XX	Building 722 - Paint Shop					Jan-09	Sep-11			Sep-11		Sep-11
LHAAP-004	4	4	XX	Pilot Waste Water Treatment Plant	Feb-09	Jul-09	Jul-09	Jan-10	May-11	Sep-11	Dec-11	Mar-12	Aug-12	Sep-15	
LHAAP-005	5	5		Power House Boiler Pond											
LHAAP-006	6	6		Building 54F Solvent						Dec-08					Dec-08
LHAAP-007	7	7		Building 50G Drum Processsing						Dec-08					Dec-08
LHAAP-008	8	8		Sewage Treatment Plant		Dec-08				Nov-08					
LHAAP-009	9	9		Building 31-W Drum Storage						Nov-99					
LHAAP-011	11	10	X	Suspected TNT Burial Site at P&Q Avenue						Jan-98					Jan-98
LHAAP-012	12	11	X	Active Landfill		Sep-95		Jul-06		Jul-06	Jun-07	Jun-07	Oct-07	Sep-40	Sep-40
LHAAP-013	13	12	X	Suspected TNT Burial Site Between Active and Old Landfill						Feb-96					
LHAAP-014	14	13	X	Area 54W Burial Site						Feb-96					
LHAAP-015	15	14		Area 49-W Drum Storage						Oct-99					
LHAAP-016	16	15	X	Old Landfill		Sep-95		May-11	Mar-10	May-11	Oct-11	Jan-12	Jun-12	Sep-15	
LHAAP-017	17	16	X	No. 2 Flashing Area Burning Ground					Apr-10	Apr-11	Sep-11	Dec-11	May-12	Sep-15	
LHAAP-018	18	17	X	Burning Ground/Rocket Motor Washout Pond		May-95		Aug-11	Apr-11	Aug-11	Jan-12	Apr-12	Sep-12	Sep-15	
------------	18	38		24X Holding Area											
------------	18	39		25X Washout Pad											
------------	18	40		Air Curtain Destructor											
------------	18	41		Open Burning Cage											
------------	18	42		Open Burning Pan											
------------	18	44		Building 41-X											
------------	18	62		Building 43-X											
LHAAP-019	19	63		Construction Materials Landfill											
LHAAP-023	23	23		Building 707 Storage for PCBs											Sep-00
LHAAP-024	24	43	X	Former Unlined Evaporation Pond		May-95		Aug-11	Apr-11	Aug-11	Jan-12	Apr-12	Sep-12	Sep-15	
LHAAP-027	27	19	X	South Test Area/Bomb Test Area						Jan-98					
LHAAP-029	29	21	X	Former TNT Production Area					Apr-10	Jun-11	Nov-11	Mar-12	Aug-12	Sep-15	
LHAAP-032	32	24	X	Former TNT Waste Disposal Plant						Aug-08					Aug-08
LHAAP-034	34	34		Building 701 - PCB Storage											Jul-00
LHAAP-035	35	35		Process Wastewater Sumps - Various					Apr-09	Oct-10					Oct-10
LHAAP-036	36	36		Explosive Waste Pads					Apr-09	Oct-10					Oct-10
LHAAP-037	37	37	XX	Quality Assurance Laboratory Building 29-A					Sep-08	Jun-10	May-11	Aug-11	Jan-12	Sep-40	Sep-40
LHAAP-045	45	45		Magazine Area											
LHAAP-046	46	46	XX	Plant 2/Pyrotechnic Operation					Jan-10	Sep-10	May-11	Aug-11	Jan-14	Sep-15	
LHAAP-047	47	47	XX	Plant 3/ Produces Hand Signal Assemblies					Apr-11	Aug-11	Jan-12	Apr-12	Sep-12	Sep-15	
LHAAP-048	48	48		Y-Area						Nov-08					
LHAAP-049	29	49	XX	Former Acid Plant						Sep-10			Sep-10		Sep-10
LHAAP-050	50	50	XX	Former Waste Disposal Facility					Jan-10	Sep-10	May-11	Aug-11	Jan-14	Sep-15	
LHAAP-051	51	51		Photographic Laboratory/Building 60-B						Dec-08					Dec-08
LHAAP-052	52	52		Magazine Washout Area											

LONGHORN ARMY AMMUNITION PLANT FY11 TARGETED GPRA GOALS

					Completion Dates										
					Interim Action or Removal Action				Final Action						
Site ID (DSERTS)	RMIS #	DERPMIS		SITE DESCRIPTION	RI/FS or EE/CA	ROD/DD or AM	RA Starts	RA Completions	RI/FS Starts	ROD/DD	RD	RA Completions	Site Construction Completions		
LHAAP-053	53	53		Static Test Area						Nov-08					
LHAAP-054	54	54	X	Ground Signal Test Area						Jan-98	Jan-98				Jan-98
LHAAP-055	55	55		Septic Tanks						Dec-08					Dec-08
LHAAP-056	56	56		Vehicle Wash Rack and Oil/Water Separator											
LHAAP-057	57	57		Rubble Burial Site											
LHAAP-058	58	58	XX	Maintenance Complex					Jan-10	Sep-10	May-11	Aug-11	Jan-14	Sep-15	
LHAAP-059	59	59		Storage Building 725						Sep-08					
LHAAP-060	60	60		Former Storage Building #411 and #714					Aug-08	Dec-08					Dec-08
LHAAP-061	61	61		Potable Water Treatment Sediment Ponds											
LHAAP-063	63	63		Burial Pits											
LHAAP-064	64	64		Transformer Storage Area						Dec-08					Dec-08
LHAAP-065	65	65		Building #209						Sep-12					
LHAAP-066	66	66		Transformer at Building 401						Dec-08					Dec-08
LHAAP-067	67	67	XX	Above Ground Storage Tank					Sep-08	Jun-10	May-11	Aug-11	Jan-12	Sep-40	Sep-40
LHAAP-068	68	68		Building 51-F						Dec-08					Dec-08
LHAAP-069	69	69		Underground Storage Tank											**
LHAAP-070				Loading Dock Magazine Area											Aug-04
LHAAP-071				Oil Spill at Bldg 813											Aug-04
Pistol Range			XX	Pistol Range	Feb-09	Jul-09	Jul-09	Dec-09		Sep-10			Sep-10		Sep-15
LHAAP-001-R-01			XX	South Test Area/Bomb Test Area (MMRP)					Sep-11	Sep-12					Sep-15
LHAAP-002-R-01				Static Test Area (MMRP)						Nov-08					
LHAAP-003-R-01			XX	Ground Signal Test Area (MMRP)					Sep-11	Sep-12					Sep-15

X Site identified in FFA
XX Additional sites identified as NPL

Legend
RI/FS- Remedial Investigation/Feasibility Study
ROD/DD-Record of Decision/Decision Document: Required for interim and final remedial actions, RODs for NPL sites, DDs for non-NPL sites, prepared prior to construction and remedial design phases
RA denotes Army phase completion of Remedial Action Construction.
RA Completions- Remedial Action Complete
Site Construction Completions- Remedy is in Place and Remedial Action Completion Report is Final.
RA(O)-Remedial Action Operation
RC-Response Complete: All cleanup objectives have been met (remediation completed) with the exception of the Long Term Management phase if required
Grey shading indicates phases complete
Yellow shading indicates site requires additional documentation
*** Note: EPA Target shown may not align with Army Phase Completion Terminology.
** indicates future date for a decision document, site has already received concurrence for completion from TCEQ

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

MONTHLY MANAGERS' MEETING

AGENDA

DATE:	Tuesday, May 24, 2011
TIME:	09:00 am.
PLACE:	Teleconference - Call In Number Courtesy of Shaw: 866-797-9304/4155734

Welcome RMZ

Action Items
Army
- Review LHAAP-17 ROD language changes

Shaw
- Add action levels to Surface Water (Creek) Sampling and Perimeter Well Sampling summary tables and provide to regulators prior to general distribution. Completed

EPA – Topics for Discussion ST
- Review LHAAP-17 ROD language changes
- Check for use of isotope studies for MNA evaluation
- LHAAP-03 – Check public review requirements for EE/CA and if public meeting (or just public review period) is required for a NFA Proposed Plan and ROD. Completed

TCEQ

- Provide input on any standards and QC procedures for the chemical specific isotope analysis (CSIA) for MNA

Defense Environmental Restoration Program (DERP) PBC Update PS
- Document Status/Environmental Sites (Table)
- Basewide Ecological Risk Assessment – impact from elimination of ITS data
- Groundwater Treatment Plant
- Groundwater and Surface Water Sampling Schedule Spreadsheet. Next sampling round.
- Installation-wide work plan revision update

DERP Total Environmental Restoration Contract Update Army
- LHAAP-37/67 RD Status – Comment Responses
- Pilot Demonstration at LHAAP-37 Status

MMRP Update Army
- Status of MC Data Summary Report
- Letter to Army from EPA re Approach to MMRP ROD

Review of Schedule **Army**

USFWS Update **RMZ/PB**

- Environmental Restoration Issues with Transfer Schedule Impact
- USFWS Comments on Documents

Adjourn

Shaw® Shaw Environmental, Inc.

Subject: **Final Minutes, Monthly Managers Meeting, Longhorn Army Ammunition Plant (LHAAP)**

Location of Meeting: **Teleconference**
Date of Meeting: **May 24, 2011; 9:00 AM – 10:00 AM**

<u>Meeting Participants:</u>

BRAC:	Rose M. Zeiler
USACE-Tulsa:	Aaron Williams, John Lambert
USAEC-SA:	Marilyn Plitnik
Shaw:	Praveen Srivastav, Susan Watson, Kay Everett, Van Vangala
USEPA Region 6:	Steve Tzhone
TCEQ:	Fay Duke
USFWS:	Paul Bruckwicki

Welcome **Rose M. Zeiler**

Action Item Status
Army

- Review LHAAP-17 ROD Language Changes. – *Done*.

Shaw

- Add action levels to Surface Water (Creek) Sampling and Perimeter Well Sampling summary tables and provide to regulators prior to general distribution. – *Done.*

EPA—Topics for Discussion

- Review LHAAP-17 ROD language changes— *language changes mutually discussed with Army will be highlighted for regulatory review so that language is consistent across the RODs. - Done*
- Check for use of isotope studies for MNA evaluation.—*in progress. (Shaw collected some samples from LHAAP-58 to test chemical specific isotope analysis)*
- LHAAP-03 – Check public review requirements for EE/CA and if public meeting (or just public review period) is required for a NFA Proposed Plan and ROD. – *Just a notification is needed (no meeting) f or the EE/CA. The PP will require a public meeting. Done.*

TCEQ

- Provide input on any standards and QC procedures for the chemical specific isotope analysis (CSIA) for MNA—*No specific guidance is available. Done.*

Defense Environmental Restoration Program (DERP) PBC Update **Praveen Srivastav**

Document Status/Environmental Sites
Praveen went over the document status/environmental sites table.

- LHAAP-03: Currently preparing EE/CA and Action Memorandum. A public notice will be required for the EE/CA.

- LHAAP-04: Received regulatory comments on the draft final completion report. RTCs in Army review. The preliminary draft FS for LHAAP-04 is in Army's review.
- LHAAP-16: ROD - Received BRAC ELD comments and currently addressing.
- LHAAP-17: ROD - Regulatory comments received and RTCs are in Army's review and will send back to Shaw today.
- LHAAP-18/24: The RTCs for the DF FS are in regulatory review as of April 13th.
- LHAAP-29: Preliminary draft ROD is in Army's review as of 5/5/11.
- LHAAP-46: Revised draft remedial design in Army's review as of 5/5/11. The RD will be sent out electronically this week with hard copies to follow next week.
- LHAAP-47: Received TCEQ comments on 5/19/11 for the Revised Draft Final FS. EPA has completed their comments and will send out today.
- LHAAP-50: Remedial design is being revised to address the regulatory meeting comments.
- LHAAP-58: Currently addressing Army comments on the draft Remedial Design. Meeting was held with regulators on April 7, 2011. Document is being revised to address regulatory preliminary comments.
- LHAAP-12 RA(O): TCEQ regulatory comments received. EPA comments are pending.

The timeline for the schedule may shift for LHAAP-17 and -29 RODs. The documents need to go through Army/BRAC legal reviews.

Basewide Ecological Risk Assessment—impact from elimination of ITS data
ITS explosives results from 1993, 1994, and 1995 were disqualified and were supposed to be flagged as unusable in the electronic database Shaw received from the Army, but they were not all flagged. It was recently discovered during development of the remedial designs that this data was used during the ECO evaluation. Shaw is presently reviewing the impact of the unusable data.

- For the Waste Sub Area (LHAAP-17), the impact was not of any significance since = more data was collected after the ECO evaluation and utilized.
- For the Industrial Sub Area that included sites LHAAP-46, -47, -29, and -32, there are more issues since sites LHAAP-29 and -32 have a history of explosives production or waste handling.

In particular, the sites of concern that include LHAAP-29, -32, and -17 are being looked at closely. It was suggested that TCEQ's ECO personnel may want to become involved. Shaw will provide maps to Fay directly. Fay asked that this issue be summarized and send to her the request for support and discussion. There was some ECO risk identified at LHAAP-29 already and an excavation action to mitigate the ECO risk was already planned.

Groundwater Treatment Plant
The GWTP is functioning normally. The installation of a larger diameter line, so the plant can inject more volume and sprinkle on the site rather than send treated discharge water to the pond, is complete. There has not been any water in the creek and the effluent is being injected and sprinkled on LHAAP-18/24. The site did have ½-inch of rain yesterday.

The repairs to the INF pond are proceeding. The trees are being removed and the crew is making sure the tree roots did not go through the liner of the INF pond. So far, no tree roots have penetrated the liner. However, if a repair is needed, the crew is ready to patch.

Steve indicated that Kent had completed a review of the GWTP quarterly reports and will schedule a separate call to discuss. Kent said some issues have not been addressed. Regarding one of Kent's comments, Praveen said that the well in the southeast has historically been not detect and was not on the schedule to be sampled so it had not been sampled in awhile (126). Shaw resampled Well 126 recently and the lab results indicated no detections.

Master Groundwater and Surface Water Sampling Schedule.
The document has been updated and distributed with screening levels added to the tables.

Installation-Wide Work Plan revision update
This document is being updated and is expected to be sent out in June.

DERP Total Environmental Restoration Contract Update **Army**
LHAAP-37/67 RD Status – Comment Responses
The Army is currently wrapping up comment responses.

Pilot Demonstration at LHAAP-37 Status
Army is planning to perform a pilot demonstration at LHAAP-35B(37). They are in the middle of contracting that at present. Steve indicated that he has some correspondence to return to the Army regarding this.

The pilot demonstration is upgradient to LHAAP-47 and -50. The volume doesn't look like it will have a significant impact, but there is some concern that the pilot could impact remedies planned for LHAAP-47. That may have to be determined later.

MRS Update **Army**
Status of MC Data Summary Report
The Army is close to wrapping this up by the first of June.

Letter to Army from EPA re Approach to MRS ROD
Steve will be sending a letter regarding the MC data summary report. John wanted to make sure nothing needed to be changed. John also reiterated that the MRS contract for MC, PP and ROD are also being executed by Shaw, but through a separate contract.

Review of Schedule **Army**
The schedule for the LHAAP-16, -17, -29, and -47 RODs were reviewed. The documentation for LHAAP-16 and -29 will need to be turned around quickly to stay on schedule.

USFWS Update
Environmental Restoration Issues with Transfer Schedule Impact. *None.*
USFWS Comments on Documents. *None.*

Meeting Adjourned
Next monthly manager's meeting is teleconference for June 23, 2011, 1:00 PM.

Action Items
Shaw – Write up on the impacts from the elimination of ITS data on current sites
EPA – Check for use of isotope studies for MNA evaluation
EPA/Army – Review LHAAP-17 ROD language changes

Shaw® Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
May 24, 2011

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2	Preliminary Draft EE/CA, LHAAP-03	06/15/11	x							In preparation	
3	Draft Final Completion Report, LHAAP-04	05/24/10	x	x	Final	5/15/11	x	x	In progress	Regulatory comments received. RTCs in Army's review as of 5/9/11	
4	Preliminary Draft FS, LHAAP-04	2/03/11	x		Draft	5/15/11	x	x		In Army review	
5	Preliminary Draft ROD, LHAAP-16	11/17/10	x		Draft	6/15/11	x	x	In progress	Received BRAC ELD comments. Currently resolving	
6	Draft Record of Decision, LHAAP-17	1/26/11	x	x	Final	06/30/11	x	x	In progress	Regulatory comments received. RTCs in Army's review	
7	Draft (Final) Feasibility Study, LHAAP-18/24	5/13/09	x	x	Draft Final	05/30/11	x	x	In progress	RTCs in regulatory review	
8	Final Proposed Plan, LHAAP-29	3/15/11	x	x						Final submitted	

Shaw® Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
May 24, 2011

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	**Remarks**
9	Preliminary Draft ROD, LHAAP-29	5/5/11	x							In Army's review as of /5/511	
10	Preliminary Draft Remedial Design, LHAAP-46	10/1/10	x		Draft	5/30/11	x	x		Revised Draft in Army's review as of 5/5/11	
11	Revised Draft Final Feasibility Study, LHAAP-47	10/27/10	x		Revised Draft Final	3/11/11	x	x		Received TCEQ comments on 5/19/11	
12	Preliminary Draft Remedial Design, LHAAP-50	6/15/11	x							Revising RD for submittal to Army	
13	Draft Remedial Design, LHAAP-58	6/15/11	x						In progress	Revising RD for submittal to Army	
14	Draft Final LHAAP-12 RAO Report	2/10/11	x	x	Final	6/30/11	x	x	In progress	TCEQ comments received. EPA comments pending	

Master Groundwater Sampling Schedule
Longhorn Army Ammunition Plant

Updated: 05/23/11

				2011												2012											
Site/Well ID	Well description	Last Date Sampled	Next Event*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
LHAAP-12																											
12MW20	on site - near well 24	6/1/10	Jun-11						VOCs												VOCs						
12WW21	on site - downgradient	6/1/10	Jun-11						VOCs												VOCs						
12WW22	compliance northeast	6/1/10	Jun-11						VOCs												VOCs						
12WW23	compliance - northwest	6/1/10	Jun-11						VOCs												VOCs						
12WW24	on site - near source	6/1/10	Jun-11						VOCs												VOCs						
LHAAP-16 (Interim Action)																											
EW-01	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-02	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-03	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-04	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-05	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-06	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-07	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-08	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
LHAAP-17																											
TBD																											
LHAAP-18/24 (Inteirm Action)																											
ICT-2	west, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-4	SW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-7	north, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-8	east, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-11	south, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-12B	SW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-12C	SW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-12D	SW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-12C	SW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-12E	SW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
EW-01	annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-13A	west, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-13B	NW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-13D	NW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-13E	north, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-13F	north, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-14B	NE, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-14C	NE, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-14D	NE, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
18WW07	north	11/10/05	SAN																								
18WW08	north, semi-annual	3/17/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
18WW09	north, semi-annual	03/15/11	Sep-11																								
18WW10	west, semi-annual	3/16/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
18WW11	west, semi-annual	3/16/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
18WW17	east	11/17/05	SAN																								
18WW20	north, semi-annual	3/15/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
18WW21	NE	11/10/05	SAN																								
C-01	south	11/10/05	SAN																								
C-02	NW, semi-annual	3/17/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
C-04	NE, semi-annual	3/14/11	Sep-11																								
C-04A	SAN	5/11/06	SAN																								
C8	east, semi-annual	3/15/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-1	inside CT perimeter	5/11/06	SAN																								
MW-2	inside CT perimeter, semi-annual	3/16/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-3	inside CT perimeter	5/11/06	SAN																								
MW-4	inside CT perimeter	5/11/06	SAN																								
MW-6	inside CT perimeter	5/11/06	SAN																								
MW-9	inside CT perimeter	5/11/06	SAN																								
AWD1	west along CT	5/11/06	SAN																								
AWD3	inside CT perimeter	5/11/06	SAN																								
AWD2	inside CT perimeter	5/11/06	SAN																								
AWD4	north	5/11/06	SAN																								
MW-5	inside CT perimeter	5/11/06	SAN																								
MW-7	inside CT perimeter	5/11/06	SAN																								
MW-8	east, semi-annual	3/17/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-10	west	5/11/06	SAN																								
MW-11	northwest	5/11/06	SAN																								
MW-12	northwest	5/11/06	SAN																								
MW-13	west	5/11/06	SAN																								
MW-14	inside CT perimeter	5/11/06	SAN																								
MW-16	NW, semi-annual	3/16/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-17	west	3/22/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-19	southwest	5/11/06	SAN																								
MW-20	south, semi-annual	3/15/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-21	inside CT perimeter	5/11/06	SAN																								
MW-22	inside CT perimeter, semi-annual	3/17/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-23	inside CT perimeter	5/11/06	SAN																								
MW-101	east	5/11/06	SAN																								
MW-102	south	5/11/06	SAN																								
MW-109	northeast	5/11/06	SAN																								
MW-120	west	5/11/06	SAN																								
MW126	south	3/22/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-129	west, along CT	5/11/06	SAN																								

Master Groundwater Sampling Schedule
Longhorn Army Ammunition Plant

Updated: 05/23/11

Site/Well ID	Well description	Last Date Sampled	Next Event*	2011												2012											
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
C9	south, semi-annual	3/14/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
C-10	south	5/11/06	SAN																								
C6	2100 ft north of site, semi-annual	3/14/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
C3	east, semi-annual	3/14/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
LHAAP-29																											
TBD																											
LHAAP-37																											
TBD																											
LHAAP-46																											
TBD																											
LHAAP-47																											
TBD																											
LHAAP-50																											
TBD																											
LHAAP-35A(58)																											
TBD																											
Creek Sampling (LHAAP-47/50)																											
TBD																											
Perimeter Well Sampling																											
108		9/1/10	Sep-11									P												P			
110		9/1/10	Sep-11									P												P			
111		9/1/10	Sep-11									P												P			
112		9/1/10	Sep-11									P												P			
133		3/10/11	Sep-11			P						P						P						P			
134		3/10/11	Sep-11			P						P						P						P			
Ongoing Creek Sampling (Harrison Bayou & Goose Prairie Creek)																											
HBW-1	Harrison Bayou Water	3/1/11	Jun-11			P			P			P			P			P			P			P			P
HBW-7	Harrison Bayou Water	3/1/11	Jun-11			P			P			P			P			P			P			P			P
HBW-10	Harrison Bayou Water	3/1/11	Jun-11			P			P			P			P			P			P			P			P
GPW-1	Goose Praire Creek Water	3/1/11	Jun-11			P			P			P			P			P			P			P			P
GPW-3	Goose Praire Creek Water	3/1/11	Jun-11			P			P			P			P			P			P			P			P

Notes & abbreviations:

* - Two weeks prior to next sampling event, TCEQ & EPA will be notified of the tentative date. If TCEQ or EPA would like to be onsite, a couple of days priot to sampling, TCEQ & EPA will contacted with a more firm date & time.
TBD - to be determined after remedial design of final remedy
EW- Extraction well
ICT- Interceptor collection trench
NE- northwest
NW- northwest
SW- southwest
CT- Collection trench
SAN- Sample as needed
MNA - MNA parameters (see list below)
VOC - volatile organic compounds (Method 8260)
TM- TM
P- Perchlorate
SVOCs

MNA parameters:
nitrates
nitrites
sulfates
pH
Eh (redox potential)
conductivity
temperature
dissolved oxygen (DO)
ferrous iron (HACH meter in field)
Cl- Chloride
methane
ethane
ethene
inorganic & organic carbon
Dehalococcoides

00100117

FY2011

LONGHORN ARMY AMMUNITION PLANT

Installation Action Plan

Printed 13 June 2011

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Table of Contents

Statement of Purpose

The purpose of the Installation Action Plan (IAP) is to outline the total multiyear cleanup program for an installation. The plan identifies environmental cleanup requirements at each site or area of concern (AOC), and proposes a comprehensive, installation-wide approach, along with the costs and schedules associated with conducting investigations and taking the necessary remedial actions (RA).

In an effort to coordinate planning information between the restoration manager, Base Realignment and Closure (BRAC), the US Army Environmental Command (USAEC), Longhorn Army Ammunition Plant (LHAAP), the executing agencies, the regulatory agencies, and the public, an IAP was completed. The IAP is used to track requirements, schedules, and tentative budgets for all major Army installation cleanup programs.

All site-specific funding and schedule information has been prepared according to projected overall Army funding levels and is, therefore, subject to change.

Acronyms

AEDB-R	Army Environmental Database- Restoration
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirements
AST	Aboveground Storage Tank
BIP	Blow in Place
BRAC	Base Realignment and Closure
BRACO	Base Realignment and Closure Office
CERCLA	Comprehensive Environmental, Response, Compensation and Liability Act
CLI	Caddo Lake Institute
CS	Confirmatory Sampling
cy	cubic yards
DD	Decision Document
DERPMIS	Defense Environmental Restoration Program Management Information System
DoD	Department of Defense
EBS	Environmental Baseline Survey
EE/CA	Engineering Evaluation/Cost Analysis
EOD	Explosive Ordnance Disposal
ER,A	Environmental Restoration, Army (formerly DERA)
ESS	Explosives Safety Submission
FFA	Federal Facilities Agreement
FFS	Focused Feasibility Study
FRA	Final Remedial Action
FS	Feasibility Study
FWS	(US) Fish and Wildlife Service
FY	Fiscal Year
GWTP	Groundwater Treatment Plan
HTRW	Hazardous, Toxic and Radioactive Waste
IAP	Installation Action Plan
INF	Intermediate-Range Nuclear Force
IRA	Interim Remedial Action
IRP	Installation Restoration Program
ISC	Information Systems Command
K	thousand
LAP	Load, Assemble, and Pack
LHAAP	Longhorn Army Ammunition Plant
LTM	Long-Term Management
LUC	Land Use Controls
MC	Munitions Constituents
MEC	Munitions and Explosives of Concern
mm	milimeters
MMRP	Military Munitions Response Program
MNA	Monitored Natural Attenuation
MOA	Memorandum of Agreement
MRSPP	Munitions Response Site Prioritization Protocol
N/A	Not Applicable

Acronyms

NA	No Action
NFA	No Further Action
NPL	National Priorities List
ORIS	Operational Range Inventory - Sustainment
PA	Preliminary Assessment
PBA	Performance-Based Acquisition
PBC	Performance-Based Contract
PCB	Polychlorinated Biphenyls
POL	Petroleum, Oil, and Lubricants
PP	Proposed Plan
ppm	parts per million
Qtr	quarter
RA	Remedial Action
RA(C)	Remedial Action-Construction
RA(O)	Remedial Action - Operation
RAB	Restoration Advisory Board
RC	Response Complete
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RFA	RCRA Facility Assessment
RI	Remedial Investigation
RIP	Remedy-in-Place
RMIS	Restoration Management Information System
ROD	Record of Decision
RRSE	Relative Risk Site Evaluation
RTC	Response to Comments
SI	Site Inspection
SWMU	Solid Waste Management Unit
TAPP	Technical Assistance for Public Participation
TBD	To be determined
TCE	Trichloroethylene
TCEQ	Texas Commission on Environmental Quality
TERC	Total Environmental Restoration Contract
TNT	Trinitrotoluene
TRC	Technical Review Committee
TWC	Texas Water Commission
UEP	Unlined Evaporation Pond
ug/L	micrograms per liter
USACE	US Army Corps of Engineers
USAEC	US Army Environmental Command
USAEHA	US Army Environmental Hygiene Agency
USATHAMA	US Army Toxic and Hazardous Materials Agency (currently called USAEC)
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
USSR	Union of Soviet Socialist Republics

Acronyms

VOC	Volatile Organic Compound
WP	White Phosphorous
WWII	World War II
WWTP	Wastewater Treatment Plant

Installation Information

Installation Locale

Installation Size (Acreage): 8,416.00
City: Marshall
County: Harrison
State: Texas
Other Locale Information

The Longhorn Army Ammunition Plant (LHAAP) is located in central east Texas, in the northeast corner of Harrison County, approximately 14 miles northeast of Marshall, Texas, and 40 miles west of Shreveport, LA. The closed installation currently occupies approximately 1,400 of its original 8,416 acres between State Highway 43 and the western shore of Caddo Lake. The area surrounding LHAAP is primarily rural and consists of forest lands, the small towns of Karnack and Uncertain, Texas, Caddo Lake, and Caddo Lake State Park.

Installation Mission

The LHAAP was an Army Materiel Command installation which the Army declared excess to its needs in July 1997. While active, the installation's mission was the production of trinitrotoluene (TNT) [World War II (WWII) era only], pyrotechnic items, and rocket motors. In 2003, the BRAC Division was tasked with its disposal.

Lead Organization

Base Realignment and Closure Division

Lead Executing Agencies for Installation

US Army Corps of Engineers (USACE), Tulsa District

Regulator Participation

Federal	US Environmental Protection Agency (USEPA), Region VI
State	Texas Commission on Environmental Quality (TCEQ)

National Priorities List (NPL) Status

A score of 40 was recorded on 01-AUG-90.

Final RA(C) Completion Date: 201310

Date for NPL Deletion: TBD

Installation Restoration Advisory Board (RAB)/Technical Review Committee (TRC)/Technical Assistance for Public Participation (TAPP) Status

RAB established 2004

Installation Program Summaries

IRP

Primary Contaminants of Concern: Explosives, Metals, Munitions constituents (MC), Perchlorate, Petroleum, Oil and Lubricants (POL), Volatiles (VOC)

Affected Media of Concern: Groundwater, Sediment, Soil, Surface Water

Installation Information

MMRP

Primary Contaminants of Concern: Explosives

Affected Media of Concern: Groundwater, Soil

Cleanup Program Summary

Installation Historic Activity

The LHAAP was established in October 1942, with the primary mission of producing 2,4,6-TNT flake. Monsanto Chemical Company was the first contract operator of the plant. Production of 2,4,6-TNT continued through WWII until August 1945, when the plant went on standby status until February 1952. From then until 1956, Universal Match Corporation was the contracting operator, producing such pyrotechnic ammunition as photoflash bombs, simulators, hand signals, and tracers for 40 millimeter (mm) ammunition. With the departure of Universal Match Corporation in 1956, Thiokol assumed this responsibility, along with rocket motor production. Production of rocket motors continued to be the primary mission of LHAAP until 1965, when the production of pyrotechnic and illuminating ammunition was re-established.

Prior to 1994 operations consisted of compounding pyrotechnic and propellant mixtures, load, assemble, and pack (LAP) activities, accommodating receipt and shipment of containerized cargo, and maintenance and/or layaway of standby facilities and equipment as they apply to mobilization planning. The installation was also responsible for the static firing and elimination of Pershing I and II rocket motors in compliance with the intermediate-range nuclear force (INF) treaty in effect between the US and the former Union of Soviet Socialist Republics (USSR). In October 1996, a lease in excess of 1,000 of the 8,416 acres was granted to the Caddo Lake Institute (CLI) for biological and ecological studies by local schools and universities.

In July 1997 the plant became inactive and excess to the Army's needs. In July 1998 the Army contracted EarthTech, Inc. to liquidate all personal property and specific installed property. That contract was completed in fiscal year (FY)00. In 1999 the Army contracted with Project Development Corporation to demolish specified structurally unsafe buildings. In 2003 the demolition of all remaining buildings began. The demolition of the power plant was completed in 2009. Only the transformers remaining, all planned demolition has taken place. A memorandum of agreement (MOA) between the Army and the US Fish and Wildlife Service (USFWS), was signed on Oct. 21, 2000 designating an area, consisting of approximately 7,200 acres, for establishment of a wildlife refuge overlay at LHAAP. In October 2002 LHAAP was transferred to the Base Realignment and Closure Office (BRACO) to manage as an excess property. In April 2004, the Army and the USFWS entered into an MOA that set forth the transfer process of LHAAP acreage. Since May 2004, approximately 7,000 LHAAP acres have been transferred to the USFWS. The USFWS manages these acres as the Caddo Lake National Wildlife Refuge within the perimeter fence of the former installation. Although the perimeter fence and gates remain functional, guards are no longer posted since the Army's security contract expired on March 14, 2007. The CLI lease with the Army was transferred to the USFWS with the affected acreage.

On Aug. 9, 1990 the LHAAP was placed on the NPL. After being listed on the NPL, LHAAP, the USEPA, and the Texas Water Commission (TWC) (now called the TCEQ) entered into a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 120 Agreement for remedial activities at LHAAP. The CERCLA Section 120 agreement, referred to as the federal facility agreement (FFA), became effective Dec. 30, 1991. The installation applied for a Resource Conservation and Recovery Act (RCRA) Part A permit.

In February 1992 a RCRA Part B permit was signed. As a result, a RCRA facility assessment (RFA) identified 57 potential sites of concern. Since that time, scrubbing of the list [removal of non-Environmental Restoration, Army (ER,A) eligible sites, redundancies, etc.] has resulted in the current Army Environmental Database - Restoration (AEDB-R) list of 50 sites. In late 2007, the USEPA Region VI clarified their view of the NPL status of LHAAP as consisting of only those sites listed in the FFA and any additional sites with significant contamination. During a meeting between the Army, the USEPA and the TCEQ held in February 2008 at TCEQ headquarters, regulators and the Army agreed on the sites that will be addressed as NPL, including those listed and those considered to be NPL-caliber. The NPL sites are LHAAP-04, LHAAP37, LHAAP-46, LHAAP-47, LHAAP-49, LHAAP-50, LHAAP-58, and LHAAP-67 as well as the following sites which are listed in the FFA: LHAAP-01, LHAAP-11, LHAAP-12, LHAAP-13, LHAAP-14, LHAAP-16, LHAAP-17, LHAAP-18, LHAAP-24, LHAAP-27, LHAAP-29, LHAAP-32, LHAAP-54. The USEPA will continue to provide review and concurrence on documents related to these sites and will co-sign records of decision (RODs). The schedule for each of these sites will be described in this IAP, which will serve as formal documentation of the resolution between the Army and USEPA.

The non-NPL sites will be addressed through CERCLA, with RCRA issues addressed, as necessary, as applicable or relevant and appropriate requirements (ARARs), with the TCEQ as lead regulator. The USEPA will provide review; however, the decision documents (DDs) will be signed by the Army alone with the TCEQ providing a letter of concurrence. In addition to the site listing of the FFA, an installation assessment by the Army in February 1980 and the RFA in April 1988 identified additional potential sites of concern. The information management system used in the early-1990s [Defense Environmental Restoration Program Management Information system (DERPMIS)] identified 59 sites at that time. In the mid-1990s, the tracking system being used at the time [the restoration management information system (RMIS)] was updated to remove duplicate sites, sites contained within other sites, sites that were not a part of the restoration program, and sites that never existed.

Cleanup Program Summary

Presented in Appendix A - LHAAP Environmental Site Status, is the resulting list of the LHAAP environmental sites, both NPL and non-NPL, with the associated DERPMIS and RMIS numbers. Presented with the sites are their current status and completion dates or projected phase completion dates. At the time of IAP preparation, one site (LHAAP-65) was considered in a 'to be determined' (TBD) status (i.e., neither NPL nor non-NPL). Discussions are ongoing to assign a status.

The following sites have been transferred: LHAAP-001, LHAAP-005, LHAAP-009, LHAAP-011, LHAAP-013, LHAAP-014, LHAAP-015, LHAAP-034, LHAAP-045, LHAAP-052, LHAAP-057, LHAAP-061, and LHAAP-063. Site LHAAP-012 has been offered for transfer.

Installation Program Cleanup Progress

IRP

Prior Year Progress: A no further action (NFA) DD was completed for LHAAP-35/36

Future Plan of Action: 1. Remedial action (operations) [RA(O)]/long-term management (LTM) will be implemented for LHAAP-37, LHAAP-46, LHAAP-50, LHAAP-58 and LHAAP-67
2. A ROD will be completed for LHAAP-16, LHAAP-17, LHAAP-18/24, LHAAP-29, and LHAAP-47

MMRP

Prior Year Progress: The MC data summary report is under regulatory review.

Future Plan of Action: A ROD will be completed in FY11. The LTM phase will begin.

5-Year / Periodic Review Summary

5-Year / Periodic Review Summary

Status	Begin Date	End Date	End FY
Complete	200706	200706	2007
Complete	200206	200206	2002
Planned	201206	201206	2012

Last Completed 5-Year / Periodic Review Details

Associated ROD/DD Name	Sites
BURNING GROUND #3(LHAAP-018 & LHAAP-024)	LHAAP-018, LHAAP-024
CAPPING LANDFILLS 12 & 16	LHAAP-012, LHAAP-016

Results Interim RODs are satisfactory

Actions Implement Final RODs

Plans MNA

Recommendations and Implementation Plans:
N/A

Land Use Control (LUC) Summary

LUC title: LHAAP-037 & 067 GW

Site(s): LHAAP-067

ROD/DD title: Final ROD LHAAP-035B (037) & LHAAP-067

Location of LUC

LHAAP-037 and LHAAP-067 groundwater

Land Use Restriction: Media specific restriction - prohibit use of groundwater for consumption or domestic purposes, Media specific restriction - restrict drinking water well installation, Media specific restriction - restrict withdrawal or use of groundwater for agricultural/irrigation purposes

Types of Engineering Controls: None

Types of Institutional Controls: Restrictions on Groundwater Withdrawal

Date in Place: 201110

Modification Date: N/A

Date Terminated: N/A

Inspecting Organization: USACE District

Record of LUC: Master Plan or Equivalent

Documentation Date: N/A

LUC Enforcement: Annual Inspections, 5 Year Reviews

Contaminants: VOC

Additional Information

N/A

LUC title: LUC for LHAAP-012 Capping

Site(s): LHAAP-012

ROD/DD title: LHAAP-12 Final ROD

Location of LUC

Site LHAAP-012

Land Use Restriction: Landfill restriction - Prohibit activities that would impact the LF cap (or cover system) and drainage system, Landfill restriction - Prohibit excavation on LF cap or cover system, Media specific restriction - prohibit use of groundwater for consumption or domestic purposes, Media specific restriction - restrict drinking water well installation, Media specific restriction - restrict withdrawal or use of groundwater for agricultural/irrigation purposes

Types of Engineering Controls: Fences, Signs

Types of Institutional Controls: Deed Restrictions, Dig Permits

Date in Place: 200706

Modification Date: N/A

Date Terminated: N/A

Inspecting Organization: USACE District

Record of LUC: Master Plan or Equivalent

Documentation Date: 200706

LUC Enforcement: Annual Inspections, 5 Year Reviews

Contaminants: VOC

Additional Information

N/A

Parcel Summary

Summary of Parcel Prioritization and Transfer Strategy

Parcel Name: Burning Ground (FWS)
Parcel Size: 380.00
Associated Sites: LHAAP-017, LHAAP-016, LHAAP-024, LHAAP-018
Transfer Date: 201307
Current Land Use: Other (under remediation)
Future Land Use: Recreational
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: USFWS
Other Issues Affecting Transfer: N/A

Parcel Name: Debris Landfill
Parcel Size: 13.00
Associated Sites:
Transfer Date: 201207
Current Land Use: Industrial
Future Land Use: Recreational
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: N/A
Other Issues Affecting Transfer: N/A

Parcel Name: East FIA I (FWS)
Parcel Size: 182.00
Associated Sites:
Transfer Date: 200708
Current Land Use: Recreational
Future Land Use: Other (N/A)
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: USFWS
Other Issues Affecting Transfer: N/A

Parcel Summary

Parcel Name: East FIA II(FWS)
Parcel Size: 175.00
Associated Sites: PBC Longhorn
Transfer Date: 200909
Current Land Use: Industrial
Future Land Use: Recreational
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: USFWS
Other Issues Affecting Transfer: N/A

Parcel Name: Fire House (FWS)
Parcel Size: 2.98
Associated Sites:
Transfer Date: 200705
Current Land Use: Recreational
Future Land Use: Other (N/A)
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: USFWS
Other Issues Affecting Transfer: N/A

Parcel Name: Ground Signal Test (FWS)
Parcel Size: 80.00
Associated Sites: LHAAP-003-R-01
Transfer Date: 201301
Current Land Use: Other (Under remediation)
Future Land Use: Recreational
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: USFWS
Other Issues Affecting Transfer: N/A

Parcel Summary

Parcel Name: LANDFILL 12 (FWS)
Parcel Size: 51.00
Associated Sites: LHAAP-012
Transfer Date: 201210
Current Land Use: Industrial
Future Land Use: Recreational
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: USFWS
Other Issues Affecting Transfer: Land Use Control/maintenance costs

Parcel Name: Pistol Range (FWS)
Parcel Size: 1.00
Associated Sites: PBC Longhorn
Transfer Date: 201210
Current Land Use: Other (under remediation)
Future Land Use: Recreational
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: USFWS
Other Issues Affecting Transfer: N/A

Parcel Name: Production Area II
Parcel Size: 467.00
Associated Sites: PBC Longhorn
Transfer Date: 201302
Current Land Use: Other (Under remediation)
Future Land Use: Recreational
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: USFWS
Other Issues Affecting Transfer: N/A

Parcel Summary

Parcel Name: Production Area Ia (FWS)
Parcel Size: 456.72
Associated Sites: PBC Longhorn
Transfer Date: 200708
Current Land Use: Residential
Future Land Use: Other (N/A)
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: USFWS
Other Issues Affecting Transfer: N/A

Parcel Name: Production Area Ib (FWS)
Parcel Size: 107.59
Associated Sites: PBC Longhorn
Transfer Date: 200701
Current Land Use: Recreational
Future Land Use: Other (N/A)
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: USFWS
Other Issues Affecting Transfer: N/A

Parcel Name: South Test/Bomb (FWS)
Parcel Size: 72.00
Associated Sites: LHAAP-001-R-01
Transfer Date: 201301
Current Land Use: Other (Under remediation)
Future Land Use: Recreational
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: USFWS
Other Issues Affecting Transfer: N/A

Parcel Summary

Parcel Name: Static Test (FWS)
Parcel Size: 55.00
Associated Sites:
Transfer Date: 201210
Current Land Use: Other (Under remediation)
Future Land Use: Recreational
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: USFWS
Other Issues Affecting Transfer: N/A

Parcel Name: Y Area (FWS)
Parcel Size: 17.00
Associated Sites:
Transfer Date: 201210
Current Land Use: Other (Under remediation)
Future Land Use: Recreational
Encumbrances: N/A
Leases/Permits/Licenses: N/A
Transfer Strategy: Transfer to Other Federal Agencies
Recipient Organization: USFWS
Other Issues Affecting Transfer: N/A

LONGHORN ARMY AMMUNITION PLANT

Non-BRAC Excess
Installation Restoration Program

IRP Summary

Installation Total Army Environmental Database-Restoration (AEDB-R) Sites/Closeout Sites Count: 48/39

Installation Site Types with Future and/or Underway Phases

1 Above Ground Storage Tank
(LHAAP-067)
2 Burn Area
(LHAAP-017, LHAAP-018)
1 Contaminated Ground Water
(PBC Longhorn)
2 Landfill
(LHAAP-012, LHAAP-016)
1 Surface Impoundment/Lagoon
(LHAAP-024)
2 Waste Lines
(LHAAP-029, LHAAP-050)

Most Widespread Contaminants of Concern

Explosives, Metals, Munitions constituents (MC), Perchlorate, Petroleum, Oil and Lubricants (POL), Volatiles (VOC)

Media of Concern

Groundwater, Sediment, Soil, Surface Water

Completed Remedial Actions (Interim Remedial Actions / Final Remedial Actions (IRA/FRA))

Site ID	Site Name	Action	Remedy	FY	Cost
LHAAP-018	BURNING GROUND/WASHOUT POND(SWMU 18)	IRA	REMOVAL	1997	TBD
LHAAP-024	FORMER UNLINED EVAP POND (SWMU 24)	IRA	CAPPING	1997	TBD
LHAAP-024	FORMER UNLINED EVAP POND (SWMU 24)	IRA	REMOVAL	1997	TBD
LHAAP-012	ACTIVE LANDFILL (SWMU 12)	IRA	CAPPING	2005	$5.0 K
LHAAP-016	OLD LANDFILL (SWMU 16)	IRA	CAPPING	2005	$14.0 K
LHAAP-012	ACTIVE LANDFILL (SWMU 12)	FRA	NATURAL ATTENUATION	2007	TBD
LHAAP-012	ACTIVE LANDFILL (SWMU 12)	FRA	INSTITUTIONAL CONTROLS	2007	TBD
PBC Longhorn	PBC at Longhorn	FRA	OTHER	2007	TBD
LHAAP-067	ABOVE GROUND STORAGE TANK	FRA	NATURAL ATTENUATION	2008	TBD
LHAAP-035	SUMPS (145) VARIOUS	FRA	WASTE REMOVAL - SOILS	2009	TBD
LHAAP-018	BURNING GROUND/WASHOUT POND(SWMU 18)	IRA	GROUND WATER TREATMENT	2011	TBD
LHAAP-024	FORMER UNLINED EVAP POND (SWMU 24)	IRA	GROUND WATER TREATMENT	2011	TBD

Duration of IRP

Year of IRP Inception: 197906

Estimated Date for Remedy-In-Place (RIP)/Response Complete (RC): 201310/204109

Date of IRP completion including Long Term Management (LTM): 204109

IRP Contamination Assessment

Contamination Assessment Overview

In early 2008 the installation-wide ecological risk assessment was completed. Work currently being conducted under a performance-based contract (PBC) includes conducting additional sampling activities at several sites and finalizing outstanding feasibility studies (FSs) and engineering evaluations/cost analyses (EE/CAs), with proposed plans (PPs) and a ROD to follow during calendar year 2011. Regulatory concurrence was obtained for reports recommending no action for these 11 sites: LHAAP-06, LHAAP-07, LHAAP-23, LHAAP-35, LHAAP-36, LHAAP-51, LHAAP-55, LHAAP-60, LHAAP-64, LHAAP-66, and LHAAP-68.

In 2008 DDs were signed for sites LHAAP-6, 7, 48, 51, 55, 60, 64, 66, and 68. Also in 2008 the FSs were completed for all applicable total environmental restoration contract (TERC) sites including the three TERC NPL sites (LHAAP-32, LHAAP-37, and LHAAP-67) and a ROD document was signed for TERC NPL site LHAAP-32 in 2008. No action DDs were signed in 2008 for the remaining TERC sites (LHAAP-8, LHAAP-48, LHAAP-53, and LHAAP-59) and in 2010 the RODs were signed for LHAAP-37, LHAAP-46, LHAAP-49, LHAAP-50, LHAAP-58, LHAAP-67 and Pistol Range.

Sediment samples collected by the Army from Caddo Lake near the mouths of two branches of Goose Prairie Creek indicated elevated lead and mercury concentrations. The sampling locations are outside of the installation boundary. In 2004 an investigation of contaminants in fish tissue from three Caddo Lake sites, one of which is upgradient at Clinton Lake, was funded by the USEPA Region 6 and performed by the TCEQ Region 5. It concluded that mercury was present at elevated levels from all three sites, dioxin was also present, but highest at Clinton Lake (a lake upstream from LHAAP), and pesticides, polychlorinated biphenyls (PCBs) and perchlorate were not detected in either edible fish fillets or whole fish.

Approximately 7,000 acres of the plant have transferred to the USFWS and are being operated as the Caddo Lake National Wildlife Refuge. The remaining acreage is also expected to transfer to the USFWS as restoration activities are completed.

Cleanup Exit Strategy

As RODs are finalized and remedial designs (RDs) and RAs are implemented, long-term remedial action (operation) (RA(O)) and monitoring will continue until ramp-down.

Ramp-down/exit strategies at the sites will continue to be based on human and environmental exposure.

IRP Previous Studies

Year	Title	Author	Date
1979			
	Assessment of Contaminant Migration, Longhorn Army Ammunition Plant	Robert H. Balter Co	APR-1979
1980			
	Installation Assessment of Longhorn Army Ammunition Plant, Report No. 150	U.S. Army Toxic and Hazardous Materials Agency	FEB-1980
	Land Disposal Study No. 38-26-0104-81, LHAAP, 23 January - 8 February 1980	USAEHA	MAY-1980
1981			
	Wastewater Engineering Special Study No. 32-62-0182-82	Wastewater Engineering Special Study No. 32-62-0182-82	SEP-1981
1983			
	Phase II, Hazardous Waste Management Special Study No. 39-26-0147-83, DARCOM Open-Burning/Open-Detonation Grounds Evaluation, LHAAP, 31 July - 3 August 1981	USAEHA	SEP-1983
1984			
	Closure of Unlined Evaporation Pond	Kindle, Stone and Associates	JUN-1984
	Longhorn Army Ammunition Plant Contamination Survey, Contract # DAAA09-78-C-3004,	Environmental Protection Systems, Inc	JUN-1984
1986			
	Closure Report, Unlined Evaporation Pond, Longhorn Army Ammunition Plant	Army Corps of Engineers, Tulsa	JUN-1986
1994			
	Interim Risk Assessment for Burning Ground 3 & Unlined Evaporation Pond Sites (18 & 24)	Army Corps of Engineers, Tulsa	JAN-1994
	Soil and Groundwater Background Concentration Study	Army Corps of Engineers, Tulsa	MAY-1994
	Remedial Investigation /Feasibility Study Report for Areas 13 & 14	Army Corps of Engineers, Tulsa	JUN-1994
	Draft Final Workplan Addendum Soil and Groundwater Background Concentration Study	Army Corps of Engineers, Tulsa	JUN-1994
1995			
	Final Soil Background Concentration Report (Revised)	Army Corps of Engineers, Tulsa	MAR-1995
	Groundwater Background Concentration Report	Army Corps of Engineers, Tulsa	MAY-1995
	Final HydroGeologic Assessment Report	Army Corps of Engineers, Tulsa	MAY-1995
	Final Prop Plan of Action for Sites 13 & 14	Army Corps of Engineers, Tulsa	JUN-1995
	Groundwater Sampling Results-May 95, Interim Remedial Action-Phase III, Burning Ground 3 and UEP, LHAAP 18 & 24	Army Corps of Engineers, Tulsa	JUN-1995
	Remedial Investigation/Feasibility Study Report for Sites 13 & 14	Army Corps of Engineers, Tulsa	JUN-1995
	Final Record of Decision for Early Interim Remedial Action at Landfill Sites 12 & 16	Army Corps of Engineers, Tulsa	JUL-1995
1996			

IRP Previous Studies

Year	Title	Author	Date
1996			
	Final Work Plan for Phase III Interim Remedial Action at Burning Ground 3	Army Corps of Engineers, Tulsa	JAN-1996
	Group 4 Baseline Risk Assessment Work Plan	Army Corps of Engineers, Tulsa	FEB-1996
	Final Project Work Plans, Interim Remedial Action Landfills 12 & 16 Caps	Army Corps of Engineers, Tulsa	JUN-1996
	Group 4 Sumps Groundwater Monitoring Quarterly Report	Army Corps of Engineers	JUN-1996
	Draft Final Design Analysis Report for the Site 16 Time Critical Removal Action	Army Corps of Engineers	JUN-1996
	Draft Final Comprehensive Chemical Data Acquisition Plan for the RI/FS	Army Corps of Engineers, Tulsa	JUL-1996
	Draft Final Field Summary Report for the Phase II, Group 2 Sites Remedial Investigation	Army Corps of Engineers, Tulsa	JUL-1996
	Treatment Simulation and Toxicity Testing Results of Site 16 Groundwater	Army Corps of Engineers, Tulsa	AUG-1996
	Final Project Construction Drawings, Interim Remedial Action, Landfill 12 & 16 Caps	Army Corps of Engineers, Tulsa	AUG-1996
1997			
	Final Remedial Investigation Report Group 1 Sites (Sites 1, 11, 27, and XX) and Vol. 2 Baseline Risk Assessment	Army Corps of Engineers, Tulsa	APR-1997
1998			
	Final Record of Decision for Early Interim Remedial Action at Group 1 Sites	Army Corps of Engineers, Tulsa	FEB-1998
	Group 2 Final Workplan	Army Corps of Engineers, Tulsa	MAR-1998
	Environmental Baseline Study	Army Corps of Engineers, Tulsa	APR-1998
	Group 4 Final Workplan	Army Corps of Engineers, Tulsa	JUL-1998
2000			
	Site 16 Risk Assessment	Army Corps of Engineers, Tulsa	MAR-2000
	Hazardous and Medical Waste Study - Response Complete Verification and Relative Risk Site Evaluation for the Longhorn Army Ammunition Plant	USACHPPM	JUL-2000
	Final Site 16 Remedial Investigation Report	Army Corps of Engineers, Tulsa	OCT-2000
2001			
	Final Remedial Investigation Report for Group 2 Sites	Jacobs Engineering Group, Inc	APR-2001
	Baseline Risk Assessment: Human Health for Site 16 Landfill Remedial Investigation and Feasibility Study	Jacobs Engineering Group, Inc	JUN-2001
	Final Ecological Risk Assessment: Supplement to Site 16 Landfill Remedial Investigation Report	Jacobs Engineering Group, Inc	OCT-2001
2002			
	Final Group 4 Sites Remedial Investigation Report (Sites 35A, 35B, 46, 47, 48, 50, 60, and Goose Prairie Creek)	Jacobs Engineering Group, Inc	JAN-2002
	Final Group 4 Sites Remedial Investigation Addendum (Sites 04, 08, 67, and Hydrocarbon Study)	Jacobs Engineering Group, Inc	FEB-2002
	Final Group 2 Sites Remedial Investigation Report Addendum (Site 49)	Jacobs Engineering Group, Inc	FEB-2002

IRP Previous Studies

2002

Title	Author	Date
Final Feasibility Study for Site 16	Jacobs Engineering Group, Inc	MAR-2002
Final Five-Year Review for Sites 18 & 24 (Burning Ground No. 3), Site 16 (Old Landfill), and Site 12 (Sanitary Landfill)	Complete Environmental Service	AUG-2002
Group 2 Sites Baseline Human Health and Screening Ecological Risk Assessment (Sites 12, 17, 18/24, 29, 32, 49, Harrison Bayou, and Caddo Lake)	Jacobs Engineering Group, Inc	AUG-2002

2004

Title	Author	Date
Final Installation-Wide Background Study Workplan	Shaw Environmental and Infrastructure	JAN-2004
Final Groundwater Data Gaps Investigation Workplan (Groups 2 and 4)	Shaw Environmental and Infrastructure	FEB-2004
Final Technical Memorandum: Modeling Approach for Derivation of Soil and Groundwater Concentrations Protective of Surface Water and Sediment	Shaw Environmental and Infrastructure	MAR-2004
Final Sediment Sampling Report for Caddo Lake and Clinton Lake	Shaw Environmental and Infrastructure	APR-2004
Final Environmental Condition of Property I	Shaw Environmental and Infrastructure	MAY-2004
Final Background Soil Study Report	Shaw Environmental and Infrastructure	JUL-2004
Final Evaluation of LHAAP-45 Surface Soil Analytical Data	Shaw Environmental and Infrastructure	SEP-2004
Final Groundwater Data Gaps Investigation Workplan (Groups 2 and 4), Addenda 1 and 2	Shaw Environmental and Infrastructure	SEP-2004
Final Environmental Condition of Property II	Army Corps of Engineers, Tulsa	NOV-2004

2005

Title	Author	Date
Final Site 12 Feasibility Study	Shaw Environmental and Infrastructure	JAN-2005
Final Environmental Site Assessment Phase I and II Report	Plexus Scientific Corporation	FEB-2005
Final Feasibility Report for Site 12 Addendum (Revision 2)	Shaw Environmental and Infrastructure	MAR-2005
Final Proposed Plan for Landfill 12 (LHAAP-12),	Shaw Environmental and Infrastructure	MAR-2005
Final Project Report Plant-Wide Perchlorate Investigation	Solutions To Environmental Problems (STEP)	APR-2005
Final Site Inspection Report for the Military Munitions Response Program	Engineering-Environmental Management, Inc	JUN-2005
Final Feasibility Study for LHAAP-67 (Aboveground Storage Tank Farm),	Shaw Environmental and Infrastructure	AUG-2005
Final Feasibility Study for LHAAP-35B (37) (Chemical Laboratory)	Shaw Environmental and Infrastructure	OCT-2005
Final Site Evaluation Report for LHAAP-32 (Former Waste TNT Disposal Plant)	Shaw Environmental and Infrastructure	NOV-2005

2006

Title	Author	Date
Final Installation-Wide Work Plan	Shaw Environmental and Infrastructure	JAN-2006
Decision Documentation for LHAAP-03 (Wastewater	Shaw Environmental and	JAN-2006

IRP Previous Studies

	Title	Author	Date
2006			
	Collection At Paint Shop), LHAAP-06 (Building 54F), and LHAAP-23 (Building 707-C Storage Area for PCBs),	Infrastructure	
	Final Work Plan for Engineering Evaluation / Cost Analysis for Military Munitions Response Program	CAPE	MAR-2006
	Final Background Surface Water and Sediment Study Report	Shaw Environmental and Infrastructure	JUL-2006
	Draft Final Proposed Plan, LHAAP-37 & 67	Shaw Environmental and Infrastructure	JUL-2006
	Final Record of Decision, LHAAP-12	US Army	JUL-2006
	Remainder of PBC docs that have been submitted :	Workplans; Summary report for 46 and pistol range (Draft); Evaluation Report for 02 (Draft)	SEP-2006
	Draft Final Site Evaluation Report, LHAAP-02; Work Plan Addenda for LHAAP-04, 07, 46, 51, 35/36, 29, Pistol Range, and Chromium Specification;	Shaw Environmental and Infrastructure	SEP-2006
	Draft Final Evaluation of Monitored Natural Attenuation, LHAAP-12, 37 & 67	Shaw Environmental and Infrastructure	DEC-2006
2007			
	Final Groundwater Monitoring Report Sites 12 and 16 (spring 2003, spring 2004 and winter 2004)	ALL Consulting	JAN-2007
	Final Modeling Report,Derivation of Soil and Groundwater Concentrations Protective of Surface Water and Sediment, Rev. 01	Shaw Environmental and Infrastructure	FEB-2007
	Final LHAAP-12 Well Abandonment and Installation Report Groundwater, Data Gaps Investigation Groups 2 and 4	Shaw Environmental, Inc.	APR-2007
	Final Site Evaluation Report, LHAAP-48 & 53	Shaw Environmental and Infrastructure	APR-2007
	Final Addendum 11 Monitored Natural Attenuation Sampling LHAAP-16, -17, -29, -46, -47, -50, 35A(58), Final Installation-Wide Work Plan	Shaw Environmental, Inc.	MAY-2007
	Legal Notice - Industrial Solid Waste Notice of Land Use Controls at LHAAP-12	Rose Zeiler, LHAAP Site Manager	JUN-2007
	Final Results of Modeling for Natural Attenuation of Trichloroethene at LHAAP-12	Shaw Environmental, Inc.	JUN-2007
	Evaluation of Perimeter Well Data for Use as Groundwater Background	Shaw Environmental, Inc.	JUN-2007
	Final Natural Attenuation Evaluation LHAAP-12, LHAAP-35B(37) and LHAAP-67 (Report and Appendix A)	Shaw Environmental, Inc.	JUN-2007
	Remedial Design Addendum Landfill 12 (LHAAP-12)	Shaw Environmental, Inc.	JUN-2007
	Baseline Ecological Risk Assessment Surface Water Sampling Plan for Goose Prairie Creek, Revision 01	Shaw Environmental, Inc.	JUL-2007
	Final Results of Modeling for Natural Attenuation of Chlorinated Solvents in Groundwater at LHAAP-35B(37) & 67	Shaw Environmental, Inc.	JUL-2007
	Final LHAAP-59 Site Investigation Report	Shaw Environmental, Inc.	AUG-2007
	Draft Final Second Five year review Report, LHAAP-12, 16, 18 & 24	Shaw Environmental, Inc.	AUG-2007
	Memorandum: Supplemental Groundwater Activities at LHAAP-37	Shaw Environmental, Inc.	SEP-2007

IRP Previous Studies

Year	Title	Author	Date
2007			
	Final Landfill 12 (LHAAP-12) Operating Properly and Successfully Demonstration Report	Shaw Environmental, Inc.	SEP-2007
	Memorandum: Analysis of Soil Samples Collected from LHAAP-59 on September 14, 2007	Shaw Environmental, Inc.	OCT-2007
	Final Installation-Wide Baseline Ecological Risk Assessment Vols. I & II	Shaw Environmental, Inc.	NOV-2007
	Final Site Investigation Report: LHAAP-06, 07, 51, 55, 64, 66 and 68 (rev 1)	Shaw Environmental, Inc.	DEC-2007
2008			
	Final Proposed Plan, LHAAP-08	Shaw Environmental, Inc.	JAN-2008
	Final Data Evaluation Report Chemical Concentrations in soil Samples Associated with LHAAP-35/36 Sumps	Shaw Environmental, Inc.	JAN-2008
	Final Proposed Plan, LHAAP-32	Shaw Environmental, Inc.	JAN-2008
	Final Proposed Plan, LHAAP-48 & 53	Shaw Environmental, Inc.	JAN-2008
	Draft Final LHAAP-32 Record of Decision	Shaw Environmental, Inc.	MAR-2008
	Draft Final LHAAP-08, 48 & 53 Decision Document	Shaw Environmental, Inc.	MAR-2008
	Final Decision Document, LHAAP-6, 7, 51, 55, 64, 66 and 68	Shaw Environmental, Inc.	JUL-2008
	Final LHAAP-32 Record of Decision	Shaw Environmental, Inc.	AUG-2008
	Final LHAAP-59 Decision Document	Shaw Environmental, Inc.	SEP-2008
	Final Five-Year Review Second Five-Year Revise Report for LHAAP-12, 16 and 18/24	Shaw Environmental Inc.	SEP-2008
	Final LHAAP-60 Decision Document	Shaw Environmental, Inc.	OCT-2008
	Final LHAAP-8, 48, 53 and 002-R Decision Document	Shaw Environmental, Inc.	NOV-2008
2009			
	Draft Site Evaluation Report and Soil Removal Report for LHAAP-49	Shaw Environmental, Inc.	JAN-2009
	Draft Final LHAAP-37/67 Record of Decision	Shaw Environmental, Inc.	JAN-2009
	Final Site Investigation Report, LHAAP-2	Shaw Environmental, Inc.	JAN-2009
	Final Engineering Evaluation/Cost Analysis, Former Pistol Range	Shaw Environmental, Inc.	FEB-2009
	Final Engineering Evaluation/Cost Analysis, LHAAP-4	Shaw Environmental, Inc.	MAR-2009
2010			
	Final Proposed Plan, LHAAP-46	Shaw Environmental, Inc.	JAN-2010
	Final Completion Report Non-Time-Critical Removal Action at the Former Pistol Range	Shaw Environmental, Inc.	JAN-2010
	Final Proposed Plan, LHAAP-35A(58)	Shaw Environmental, Inc.	JAN-2010
	Final Proposed Plan, LHAAP-50	Shaw Envronmental, Inc.	JAN-2010
	Final Proposed Plan, Former Pistol Range	Shaw Environmental, Inc.	JAN-2010
	Final Proposed Plan, LHAAP-49	Shaw Environmental, Inc.	JAN-2010
	Final Proposed Plan, LHAAP-17	Shaw Environmental, Inc.	MAY-2010
	Final Record of Decision, LHAAP-37/67	US Army	JUN-2010
	Final Decision Document, LHAAP-02	Shaw Environmental, Inc.	JUL-2010
	Final Record of Decision, LHAAP-49	Shaw Environmental, Inc.	AUG-2010

IRP Previous Studies

2010

Title	Author	Date
Final Record of Decision, Pistol Range	Shaw Environmental, Inc.	AUG-2010
Final Record of Decision, LHAAP-46	Shaw Environmental, Inc.	SEP-2010
Final Record of Decision, LHAAP-50	Shaw Environmental, Inc.	SEP-2010
Final Record of Decision, LHAAP-35A(58)	Shaw Environmental, Inc.	SEP-2010
Final Proposed Plan, LHAAP-16	Shaw Environmental, Inc.	SEP-2010
Final Decision Document, LHAAP-35/36	Shaw Environmental, Inc.	OCT-2010

LONGHORN ARMY AMMUNITION PLANT

Non-BRAC Excess

Installation Restoration Program
Site Descriptions

Site ID: LHAAP-012
Site Name: ACTIVE LANDFILL (SWMU 12)

STATUS

Parcel: LANDFILL 12 (FWS) (51 acres)

Regulatory Driver: CERCLA
RRSE: HIGH

Contaminants of Concern: Volatiles (VOC)

Media of Concern: Groundwater

Phases	Start	End
PA	197906	198705
SI	197906	198705
RI/FS	199008	200607
RD	200509	200706
IRA	199509	200509
RA(C)	200509	200706
RA(O)	200509	204109

RIP Date: 200706

RC Date: 204109

SITE DESCRIPTION

Landfill 12 (previously called the active landfill), consisting of seven acres, was used for the disposal of non-hazardous industrial waste. The landfill had been used intermittently since 1963. Continuous use of the landfill began around 1978. Although the back section had been closed, the front section of the landfill continued to be used until its closure in March 1994. Site inspections (SIs) conducted in 1993 concluded that an early interim remedial action (IRA) (landfill cap) was necessary to reduce further contamination to the groundwater. In 1997 the cap was completed, using treated soils from LHAAP-18 as subgrade fill. Cap maintenance started in 1998, and in 2002 the first five-year review was completed. The second five-year review was completed in 2008.

In 2002 the remedial investigation (RI) was completed. Groundwater analysis showed that some metals, chlorides, VOCs, explosive compounds, and low levels of perchlorate were present. Surface water and sediment sample analysis showed similar contamination. Low levels of perchlorate were also detected in the soils. In three groundwater sampling rounds conducted in February 2003, February 2004, and December 2004, perchlorate was not detected with reporting limits of four micrograms per liter (ug/L) in the first two rounds, and only detected twice when a method with a lower reporting limit (0.2 ug/L) was used. Chromium in groundwater is now believed to be related to stainless steel well casings. In January 2006 the 12 wells with stainless steel casings and screen were removed. In 2006, five new wells were installed for long-term monitoring using polyvinyl chloride casing and screen. Results of subsequent groundwater sampling supported the postulation that the stainless steel casing in the monitoring wells was the source of the chromium.

In 2005 the feasibility study (FS) was finalized. The recommended final remedy is monitored natural attenuation (MNA) with land use controls (LUC) consisting of cap protective provisions and groundwater restrictions. In August 2006 sampling to support MNA began. The PP addressed human and ecological risk. The ROD has been signed (July 2006), and in June 2007 the RD addendum was signed. The surrounding sediment and surface water were evaluated as part of the plant-wide ecological risk assessment and no chemicals of concern were identified.

Post-performance-based acquisition (PBA) (FY15 and out-years) actions will include MNA with LUC consisting of cap protective provisions and groundwater restrictions.

CLEANUP/EXIT STRATEGY

As a part of RA(O), cap maintenance, MNA, and five-year reviews will be funded under the PBA through August 2015. Post-PBA

Site ID: LHAAP-012
Site Name: ACTIVE LANDFILL (SWMU 12)

activities will be limited to long-term RA(O) and five-year reviews to monitor MNA progress and any new site information.

Site ID: LHAAP-016
Site Name: OLD LANDFILL (SWMU 16)

STATUS

Parcel: Burning Ground (FWS) (380 acres)

Regulatory Driver: CERCLA
RRSE: HIGH

Contaminants of Concern: Perchlorate, Volatiles (VOC)

Media of Concern: Groundwater, Soil, Surface Water

Phases	Start	End
PA	197906	198705
SI	197906	198705
RI/FS	199008	201003
RD	200508	201105
IRA	199410	200509
RA(C)	200508	201201
RA(O)	200508	203109
LTM	203109	204109

RIP Date: 201201

RC Date: 203109

SITE DESCRIPTION

Landfill 16 (formally called the old landfill), consisting of about 22 acres, was originally used to dispose of products generated from the TNT wastewater treatment plant (WWTP); however, a variety of waste was disposed of in the landfill until the 1980s. This waste may have included burned rocket motor casings, substandard TNT, barrels of chemicals, oil, paint, scrap iron and wood. VOCs and metals above action levels have been found in the soil, surface water and groundwater around the site. Low levels of explosive compounds were detected in the groundwater.

SIs conducted in 1993 concluded that an early IRA (landfill cap) was necessary to reduce further contamination to the groundwater. The cap was completed in 1998, using treated soils from LHAAP-18 as subgrade fill. In late-1997, as part of the treatability study, eight extraction wells were installed to prevent contaminated groundwater from impacting Harrison Bayou. This system is still in operation; however, extracted water volume is low. Groundwater extracted from the Landfill 16 containment system is piped to the LHAAP-18 Groundwater Treatment Plant (GWTP).

Perchlorate was first detected in groundwater at this site in 2000. Volatiles and perchlorate have been detected in the surface water of Harrison Bayou.

In 2002 the RI was completed along with a five-year review. In March 2002 a final interim FS for Site 16 was issued. Under the PBC, a draft FS addendum to the March 2002 interim FS was submitted in February 2007. The FS was finalized in March 2010. A preliminary MNA evaluation was completed in 2007. The second five-year review was completed in 2008. The proposed plan was finalized September 2010. Quarterly surface water sampling of the Harrison Bayou area has not shown significant contamination.

An environmental security technology certification program research and development project for enhanced in situ bioremediation (VOCs, perchlorate and explosives in groundwater) was started in 2003 and continued to 2008.

Ecological concerns most likely will be addressed with the final remedy at this site.

Post-PBA actions will include RA(O) and groundwater monitoring.

CLEANUP/EXIT STRATEGY

Site ID: LHAAP-016
Site Name: OLD LANDFILL (SWMU 16)

This site is being addressed under a PBA through August 2015. Actions to be completed before the PBA ends are completion of primary documents (ROD and RD), and accomplishment of RIP. The PP complete in 2010 and RD to be completed in 2011 selected the following remedies for this site: passive biobarriers, in situ bioremediation and MNA for groundwater, and LTM. At this time, it is expected that the post-PBA long-term RA(O) and LTM will involve monitoring MNA with maintenance of the cap and LUC.

Site ID: LHAAP-017
Site Name: NO 2 FLASHING AREA BRN GROUND(SWMU 17)

STATUS

Parcel: Burning Ground (FWS) (380 acres)

Regulatory Driver: CERCLA
RRSE: HIGH

Contaminants of Concern: Explosives, Perchlorate, Volatiles (VOC)

Media of Concern: Groundwater, Soil

Phases	Start	End
PA	197906	198705
SI	197906	198705
RI/FS	199008	201003
RD	200508	201104
RA(C)	200508	201112
RA(O)	200508	201609
LTM	201609	202209

RIP Date: 201112

RC Date: 201609

SITE DESCRIPTION

This site (about 500 by 600 feet) was used to burn bulk TNT, photoflash powder, and reject material from Universal Match Corporation's production processes. From 1959 until 1980 the site was operated as a burning ground. In 1959 buildings razed at Site 29 (the former TNT production area) were burned at Burning Ground No. 2/Flashing Area (LHAAP-17). This site is situated about 400-500 feet southwest of Burning Ground No. 3.

In 1984 waste residues were removed and the area grassed over. Volatiles and explosive compounds were found in the groundwater. Explosive compounds were found in the soil. In 2000 perchlorate was detected at this site [in groundwater at 300 parts per million (ppm), but less in soil].

In 2002 the RI was completed and a draft FS was prepared. In 2004 additional data gap studies were completed. A revised draft FS was submitted in 2009 by the PBC and the FS was finalized in 2010. The PP was finalized in May 2010.

A research and development project for enhanced in situ-bioremediation (VOCs, perchlorate and explosives in soil and groundwater) was started in 2002 and completed in 2004. Results indicate that perchlorate contamination was reduced. An additional intermediate well was installed at the site in February 2008.

Post-PBA actions during LTM will involve monitoring of MNA.

CLEANUP/EXIT STRATEGY

This site is being addressed under a PBA through August 2015. The remedy selected for this site is groundwater extraction, followed by MNA for groundwater, and excavation and disposal for soil. Tasks to be completed before August 2015 are completion of primary documents (ROD and RD), and accomplishment of RIP. At this time, it is expected that the post-PBC long-term RA(O) and LTM will involve monitoring of MNA.

Site ID: LHAAP-018
Site Name: BURNING GROUND/WASHOUT POND(SWMU 18)

STATUS

Parcel: Burning Ground (FWS) (380 acres)

Regulatory Driver: CERCLA
RRSE: HIGH

Contaminants of Concern: Metals, Perchlorate, Volatiles (VOC)

Media of Concern: Groundwater, Soil, Surface Water

Phases	Start	End
PA	197906	198705
SI	197906	198705
RI/FS	199008	201102
RD	200508	201201
IRA	199503	201108
RA(C)	200508	201209
RA(O)	200508	203109
LTM	203109	204109

RIP Date: 201209

RC Date: 203109

SITE DESCRIPTION

This site, also known as Burning Ground No. 3 (34.5 acres), began operations in 1955. It was used for the treatment, storage, and disposal of solid and liquid explosives, pyrotechnics, and combustible solvent wastes by open burning, open detonation, and burial. The unlined evaporation pond (UEP) (LHAAP-024) was constructed in 1963 within Burning Ground No. 3. Explosive compounds, VOCs, and metals were detected in the soils and groundwater. In 1998 perchlorate was detected in the groundwater. In 1986 sludge from the UEP was removed and the area was capped. Quarterly monitoring has been conducted at the site since closure of the UEP.

In May 1995 an IRA ROD was signed. This IRA addressed soil and shallow groundwater contamination. In 1997, 30,000 cubic yards (cy) of soil were excavated and treated. The treated soil was used as fill in LHAAP-012 and -016. A GWTP, with approximately 5,000 feet of interception collection trenches, has been installed to control migration of contaminated groundwater. After treatment the extracted groundwater is discharged into Harrison Bayou. In 1999 perchlorate was detected at this site and a fluidized bed reactor treatment system was installed.

In 2002 the RI was completed, followed by a draft FS. In September 2007 the PBC contractor began an optimization pilot study for the groundwater extraction system with a report completed in February 2009.

Post-PBA actions during LTM are expected to include monitoring of MNA.

CLEANUP/EXIT STRATEGY

This site is being addressed under a PBA through August 2015. The remedy being considered for this site is optimization of the groundwater extraction system, bioaugmentation, and MNA. Tasks to be completed before August 2015 are completion of primary documents (FS, PP, ROD, RD) and accomplishment of RIP and continued RA(O).

The final remedy has not been selected yet for this site. At this time, the post-PBC long-term RA(O) and LTM are expected to include groundwater extraction and bioremediation.

Site ID: LHAAP-024
Site Name: FORMER UNLINED EVAP POND (SWMU 24)

STATUS

Parcel: Burning Ground (FWS) (380 acres)

Regulatory Driver: CERCLA
RRSE: HIGH

Contaminants of Concern: Metals, Perchlorate, Volatiles (VOC)

Media of Concern: Groundwater, Soil

Phases	Start	End
PA	199005	199005
SI	199005	199008
RI/FS	199008	201102
RD	200508	201201
IRA	199503	201108
RA(C)	200508	201209
RA(O)	200508	203109
LTM	203109	204109

RIP Date: 201209

RC Date: 203109

SITE DESCRIPTION

This three-acre UEP was constructed in 1963 within Burning Ground No. 3. Explosive compounds, VOCs, and metals were detected in the soils and groundwater. In 1999, perchlorate was detected in the groundwater. In 1986, sludge from the UEP was removed and the area was capped. Quarterly monitoring has been conducted at the site since closure of the UEP.

In May 1995, an IRA ROD was signed. This IRA addressed soil and shallow groundwater contamination. In 1997, 30,000 cy of soil was excavated and treated. The treated soil was used as fill in LHAAP-012 and LHAAP-016. A GWTP, with approximately 5,000 feet of interception collection trenches, has been installed to control migration of contaminated groundwater. After treatment, the extracted groundwater is discharged into Harrison Bayou. In 1999 perchlorate was detected at this site and in 2001 a fluidized bed reactor treatment system was installed.

In 2002 the RI was completed, followed by a draft FS. In September 2007 the PBC contractor began an optimization study for the groundwater extraction system with a report on the results completed February 2009.

Post-PBA actions are currently expected to involve monitoring of MNA.

CLEANUP/EXIT STRATEGY

This site is being addressed under a PBA through August 2015. As with LHAAP-18, the remedy being considered for this site is optimization of the groundwater extraction system, bioaugmentation and MNA. Tasks to be completed before August 2015 are completion of primary documents (FS, PP, ROD, RD) and accomplishment of RIP and continued RA(O).

The final remedy has not been selected yet for this site but the post-PBC long-term RA(O) and LTM are expected to include groundwater extraction and bioremediation.

00100152

Site ID: LHAAP-029
Site Name: FORMER TNT PRODUCTION AREA(SWMU 29)

STATUS

Parcel: NONE

Regulatory Driver: CERCLA
RRSE: HIGH

Contaminants of Concern: Munitions constituents (MC), Perchlorate, Volatiles (VOC)

Media of Concern: Groundwater, Sediment, Soil, Surface Water

Phases	Start	End
PA	197906	198705
SI	197906	198705
RI/FS	199008	201003
RD	200508	201107
RA(C)	200508	201204
RA(O)	200508	204009

RIP Date: 201204

RC Date: 204009

SITE DESCRIPTION

The former TNT production area consisting of about 85 acres, was in operation from April 1943 to August 1945 as a six-line plant, with a supporting acid plant. The plant produced 180 million kilograms of TNT throughout the period of operation. A bulk toluene storage area, servicing the TNT production area, was located adjacent to the production area. The TNT wastewater (red water) from the production of the TNT was sent through wooden pipelines to a storage tank and pump house, and then to the TNT WWTP (LHAAP-032). Cooling water (blue water) from the production area ran through main lines and into an open ditch. In 1959, the structures, except for the foundations, were demolished and removed. Through the late-1980s a portion of the northeast corner of the site (approximately two acres) was used for the washout of Pershing 1 and 2 rocket motor casings using trichloroethylene (TCE) and methylene chloride.

Explosive compounds have been detected in the soil, surface water, sediment, and groundwater samples. High concentrations of VOCs (including TCE and methylene chloride) have been detected in the groundwater with the highest concentrations in the intermediate hydrostratigraphic unit, and methylene chloride, dense non-aqueous phase liquid is suspected. In 2000 perchlorate was first detected in the soil and in the groundwater (at 88 ppm) at this site.

In 2002 the RI was completed and this site is included in the group 2 draft FS. In FY05 field sampling for soils was conducted. In FY06, six wells were installed and sampled. Sediment samples were also collected from waste lines and outfall ditches. A revised draft FS was submitted by the PBC in 2008 and was finalized in 2010.

LHAAP-49, the former acid plant (also known as former acid storage), was originally funded under LHAAP-29 due to the association in plant function. This was the location where acids were received and prepared for use in the TNT manufacturing process. The final site evaluation was finalized in 2009 and the ROD was finalized in 2010.

CLEANUP/EXIT STRATEGY

This site is being addressed under a PBA through August 2015. The remedy being considered for this site is in situ groundwater remediation followed by MNA, and excavation and disposal for soil and sediments. Tasks to be completed before August 2015 are completion of primary documents (PP, ROD, RD), and accomplishment of RIP. The final remedy has not been selected yet for this site. At this time, the post-PBA RA(O) is expected to involve monitoring MNA and LUC.

Site ID: LHAAP-050
Site Name: FORMER WASTE DISPOSAL FACILITY

STATUS

Parcel: NONE

Regulatory Driver: CERCLA
RRSE: HIGH

Contaminants of Concern: Metals, Perchlorate, Volatiles (VOC)

Media of Concern: Groundwater, Soil

Phases	Start	End
PA	199005	199008
SI	199506	199707
RI/FS	199801	201001
RD	200508	201102
RA(C)	200508	201310
RA(O)	200508	204009

RIP Date: 201310

RC Date: 204009

SITE DESCRIPTION

This site of about one acre received wastewater from the sumps at Plants 2 and 3 from 1955 to the early-1970s. Washout of ammonium perchlorate containers was also performed on this site.

Volatiles and perchlorate were detected in the soil samples. VOCs, metals and perchlorate were detected in groundwater.

In 2002 the RI was completed and the FS was finalized in 2010. The ROD was finalized in 2010. The VOCs and perchlorates in groundwater pose an unacceptable risk. In 2004 an additional data gap sampling was completed and in February 2008 an additional shallow well was installed downgradient of this site.

CLEANUP/EXIT STRATEGY

This site is being addressed under a PBA through August 2015. The remedy selected for this site is augmented MNA for groundwater, and excavation and disposal for soil. Tasks to be completed before August 2015 are completion of primary documents (RD), and accomplishment of RIP. The final remedy has been selected for this site. At this time, it is expected that the post-PBA RA(O) will involve monitoring MNA and LUC.

Site ID: LHAAP-067
Site Name: ABOVE GROUND STORAGE TANK

STATUS

Parcel: NONE

Regulatory Driver: CERCLA
RRSE: MEDIUM

Contaminants of Concern: Petroleum, Oil and Lubricants (POL), Volatiles (VOC)

Media of Concern: Groundwater, Soil

Phases	Start	End
PA	199005	199008
SI	199809	199906
RI/FS	200110	200809
RA(C)	200609	200809
RA(O)	200609	204109

RIP Date: 200809

RC Date: 204109

SITE DESCRIPTION

This site consisted of seven aboveground storage tanks (ASTs) containing Number 2 fuel oil, kerosene or solvents. The ASTs had earthen dikes sufficient to contain a potential spill. Motor fuel tanks were registered with the state and have been removed. Central Creek runs to the south of this site.

In 2001 VOCs (TCE, 1,1-dichloroethene, 1,2-dichloroethane, 1,1,2-trichloroethane) were detected in the groundwater. The data indicates that the impact is limited.

In 2002 the RI was completed and in 2004 additional sampling was conducted, with the final FS completed in August 2005. The ROD was finalized in 2010. The RD is being drafted in 2010.

CLEANUP/EXIT STRATEGY

A final ROD was signed in 2010. The remedy includes MNA and groundwater restrictions. RA(O) will be under the PBA until 2015. Post-PBA costs will be limited to long-term RA(O) and five-year reviews to monitor MNA progress and any new site information.

Site ID: PBC Longhorn
Site Name: PBC at Longhorn

STATUS

Parcel: Pistol Range (FWS) (1 acres),East FIA II(FWS) (175 acres),Production Area II (467 acres),Production Area Ib (FWS) (107.59 acres),Production Area Ia (FWS) (456.72 acres)

Regulatory Driver: CERCLA

RRSE: LOW

Contaminants of Concern: Explosives, Metals, Perchlorate, Volatiles (VOC)

Media of Concern: Groundwater

Phases	Start	End
PA	200501	200503
RD	200504	200508
RA(C)	200508	200709
RA(O)	200508	201604

RIP Date: 200709

RC Date: 201604

SITE DESCRIPTION

The PBC was awarded in September 2005 to Shaw Environmental. The goal was to achieve RIP by September 2007; however delays were encountered that prevented this. The following is the 2011 status of the sites.

- LHAAP-02: Vacuum Truck Overnight Parking Lot-NFA DD signed in 2010
- LHAAP-03: Building 722 Paint Shop-Draft Final Soil Removal Work Plan under review in 1st quarter (Qtr) 2011
- LHAAP-04: Pilot Wastewater Treatment Plant-Draft FS in progress in 1st Qtr 2011
- LHAAP-06: Building 54F Solvent-NFA DD signed in 2008
- LHAAP-07: Bldg 50G Drum Processing-NFA DD signed in 2008
- LHAAP-16: Old Landfill (Solid Waste Management Unit (SWMU) 16)-Draft ROD under review in the 1st Qtr 2011
- LHAAP-17: No. 2 Flashing Area/Burning Ground (SWMU 17)-Draft ROD under review in the 1st Qtr 2011
- LHAAP-18: Burning Ground/Washout Pond (SWMU 18)-Draft FS under review in the 1st Quarter 2011
- LHAAP-23: Building 707-C Storage Area for PCBs-Regulator approval received for No Action in 2006
- LHAAP-24: Former Unlined Evaporation Pond (SWMU 24)-Draft FS under review in the 1st Qtr 2011
- LHAAP-29: Former TNT Production Area (SWMU 29)-Draft PP under review in the 1st Qtr 2011
- LHAAP-35: Sumps (145) Various-NFA DD signed in 2010, Army seeking resolution for LHAAP-65
- LHAAP-36: Explosive Waste Pads (27)-NFA DD signed in 2010
- LHAAP-46: Plant 2/Pyrotechnic Operation-ROD signed in 2010
- LHAAP-47: Plant 3 Area, Solid Rocket Fuel Motor Production-Draft focused feasibility study (FFS) under review in the 1st Qtr 2011
- LHAAP-49: Former Acid Storage Area-NFA ROD signed in 2010
- LHAAP-50: Former Waste Disposal Facility-ROD signed in 2010
- LHAAP-51 Photographic Laboratory Building 60B-NFA DD signed in 2008
- LHAAP-55 Septic Tanks-NFA DD signed in 2008
- LHAAP-58: Maintenance Complex-ROD signed in 2010
- LHAAP-60: Former Storage Building 411 & 714-NFA DD signed in 2008
- LHAAP-64 Transformer Storage (Southwest Building of 707-B)-NFA DD signed in 2008
- LHAAP-66 Transformer at Building 401-NFA DD signed in 2008
- LHAAP-68: Mobile Storage Tank Parking Area-NFA DD signed in 2008
- Pistol Range-NFA ROD signed in 2010

Site ID: PBC Longhorn
Site Name: PBC at Longhorn

CLEANUP/EXIT STRATEGY

These sites are being addressed under a PBA through August 2015. Any follow-on actions will be funded under a separate contract mechanism.

IRP Site Closeout (No Further Action) Summary

Site ID	Site Name	NFA Date	Documentation
LHAAP-001	INERT BURNING GROUNDS (SWMU 1)	199801	ROD for NFA - signed January 1998 (Group 1). Seven wells (104, 01MW01, 01MW02, 01MW03, 01MW04, 01MW05, 01WW01) are present that need to be abandoned. The property has been transferred to the USFWS.
LHAAP-002	VACCUM TRUCK OVERNITE PARKING LOT	198705	Closure to be obtained under PBC. Final SI completed in 2009. A no action Decision Document signed in July 2010.
LHAAP-003	BUILDING 722-PAINT SHOP	198705	Closure to be obtained under PBC. Preparing RTCs to Draft Final SI. RC projected for June 2011.
LHAAP-004	LHAAP PILOT WASTEWATER TREATMENT PLANT	198705	Phase I investigation 1994; Closure of Sumps - completed 1998; WWTP Closed on 9/27/99; RI - completed February 2002; Closure to be obtained under PBC. Perchlorate contamination in soil. Well abandonment of five wells (LHSMW01, LHSMW02, 04WW01, 04WW02, 04WW03) to be performed under PBC. RC projected for September 2015.
LHAAP-005	POWER HOUSE BOILER POND	198705	RCRA Closure under NPDES Permit (1999). No further action planned. The property has been transferred to the USFWS.
LHAAP-006	BUILDING 54F SOLVENT	198705	Closure to be obtained under PBC. Final SI report completed in December 2007. A no action decision document signed in 2008.
LHAAP-007	BUILDING 50G DRUM PROCESSING	198705	Closed on 11/27/00; Under investigation. Closure to be obtained under PBC. Final SI report completed December 2007. A no action decision document was signed in 2008.
LHAAP-008	SEWAGE TREATMENT PLANT	198705	RCRA Closure (for the sludge drying beds but not the plant); FS completed. Closure to be obtained under current TERC. Proposed Plan finalized January 2008. NA decision document was signed in 2008. Although no remedy is being implemented, industrial use notification to be recorded in county and five-year reviews will be conducted. LTM/RAO to be handled under PBC through 2015. Two wells (08WW01, 08WW02) to be abandoned under PBC.
LHAAP-009	BUILDING 31-W DRUM STORAGE	198705	RCRA Closure, Closed on 11/18/99; (Complete Environmental Services, October 1999, Final Closure Report,

IRP Site Closeout (No Further Action) Summary

Site ID	Site Name	NFA Date	Documentation
			Hazardous Waste Storage Area 31-W RCRA Permit 50195 Unit No. 001). No further remedial action planned. Transferred to USFWS May 2004.
LHAAP-011	SUS TNT BURIAL SITE AT AVE P&Q(SWMU 11)	199801	ROD for NFA - signed January 1998 (Group 1); Transferred to the USFWS May 2004. Three wells (11WW01, 11WW02, 11WW03) are present that need to be abandoned.
LHAAP-013	SUS TNT BET ACTIVE&OLD LANDFILL(SWMU 13)	199512	RI/FS - completed June 1995; PP - June 1995; ROD for NFA - signed February 1996(Group 3); Transferred to the USFWS May 2004. One well (13WW01) is present on this site that needs to be abandoned.
LHAAP-014	AREA 54 BURIAL GRND (SWMU 14)	199512	RI/FS - completed June 1995; PP - June 1995; ROD for NFA - signed February 1996 (Group 3); Transferred to the USFWS May 2004. One well (14WW01) is present on this site that needs to be abandoned.
LHAAP-015	AREA 49W DRUM STORAGE	198705	RCRA closure. Closed on 10/14/99; (Complete Environmental Services, October 1999, Final Closure Report, Hazardous Waste Storage Area 49-W RCRA Permit 50195 Unit No. 002). No further remedial action planned. Transferred to USFWS May 2004.
LHAAP-019	CONSTRUCTION MATERIALS LANDFILL	198705	PA/SI - NFA; DD Required; Landfill Closure Report finalized in 2010. Post Closure Care Plan includes 5 years of post closure inspections and maintenance of the landfill cap.
LHAAP-023	BUILDING 707-STORAGE AREA PCBS	198705	RCRA closure. Closed on 11/27/2000. No further action planned. Regulator concurrence of decision documentation provided in letters (USEPA Feb. 16, 2006; TCEQ May 1, 2006).
LHAAP-027	SOUTH TEST AREA/BOMB TEST AREA(SWMU 27)	199801	ROD for NFA - signed January 1998 (Group 1). Site currently being evaluated under MMRP as site LHAAP-001-R-01. Final MRRP EE/CA completed October 2007. Removal action was completed in November 2008. ROD is expected to be signed in January 2011. Six wells (131, 132, 27WW01, 27WW02, 27WW03, 27WW04) are present that need to be abandoned.
LHAAP-032	FORMER TNT WASTEWATER PLT(SWMU 32)	200809	ROD for NFA - signed September 2008

IRP Site Closeout (No Further Action) Summary

Site ID	Site Name	NFA Date	Documentation
LHAAP-034	BUILDING 701 PCB STORAGE	198705	PA/SI - NFA; RCRA Closure; Closed on 7/14/00; No further remedial action planned. Transferred to the USFWS May 2004
LHAAP-035	SUMPS (145) VARIOUS	200908	Closure to be obtained under PBC. Decision Document for NFA signed October 2010.
LHAAP-036	EXPLOSIVE WASTE PADS (27)	198705	Closure to be obtained under PBC. Decision Document for NFA signed in October 2010.
LHAAP-037	CHEMICAL LABORATORY WASTE PAD	199008	RI - completed in February 2002 (Group 4). Site originally funded under LHAAP-35 (Group 4 sites). Closure to be obtained under current TERC. Proposed plan was presented in June 2008. A ROD was signed in June 2010. LTM/RAO to be handled under PBC through 2015. Eight wells (LHSMW58, 35BWW01, 35BWW02, 35BWW03, 35BWW04, 35BWW05, 35BWW06, 35BWW07 and 35BWW08) are currently at site. 35BWW07 was installed in LHAAP-47 to define extent of LHAAP-37 GW plume.
LHAAP-039	25X WASHOUT PAD	199008	PP - September 1994; Combined with LHAAP-18/24 IRA - Capping Site 18 1986; IRA - Soil Removal and Capping 1986; LTM - Groundwater Monitoring System Installed 1989;
LHAAP-045	MAGAZINE AREA	200409	PA/SI NFA; USEPA concurrence letter for NFI dated Aug. 18, 2004. No further action planned. The property has been transferred to the USFWS.
LHAAP-051	PHOTOGRAPHIC LABORATORY/BLDG #60B	199008	PA/SI NFA; Closure to be handled under PBC. Additional sampling performed under PBC with SI report completed December 2007. Decision document was signed in 2008.
LHAAP-052	MAGAZINE AREA WASHOUT	199805	PA/SI NFA; USEPA NFI letter dated May 18, 1998 (Group 5). No further remedial action planned. The property has been transferred to the USFWS.
LHAAP-053	STATIC TEST AREA	200809	A no action decision document signed in 2008.
LHAAP-054	GRD SIGNAL TEST AREA (LHAAP-XX)	199801	ROD for NFA - signed January 1998 (Group 1). Site currently being evaluated under MMRP as site LHAAP-003-R-01. MMRP EE/CA completed October 2007. Removal action was completed in November

IRP Site Closeout (No Further Action) Summary

Site ID	Site Name	NFA Date	Documentation
			2008. ROD is expected to be signed in January 2011. Two monitoring wells (127,128) are present that need to be abandoned.
LHAAP-055	SEPTIC TANK (10)	199008	PA/SI NFA; Closure to be handled under PBC. Additional sampling performed under PBC with SI report completed December 2007. A no action decision document was signed in 2008.
LHAAP-057	RUBBLE BURIAL SITE	199008	PA/SI NFA; No further remedial action planned. Transferred to the USFWS May 2004.
LHAAP-058	MAINTENANCE COMPLEX	199506	RI - completed in February 2002. Closure to be handled under PBC. Final ROD was signed in September 2010. RC projected for September 2015.
LHAAP-060	FORMER STORAGE BUILDING #411 & #714	200402	RI - completed in February 2002; Closure to be handled under PBC. A decision document was signed in December 2008.
LHAAP-061	POTABLE WTP SEDIMENT POND	199008	No Further Investigation is required. No further action planned. The property has been transferred to the USFWS.
LHAAP-063	BURIAL PITS	199805	PA/SI NFA; No further remedial action planned. Letter of concurrence from USEPA dated May 18, 1998;(Group 5) Transferred to the USFWS May 2004
LHAAP-064	TRANSFORMER STORAGE	199506	PA/SI NFA; Closure to be handled under PBC. Additional sampling performed under PBC with SI report in completed December 2007. A no action decision document was signed in 2008.
LHAAP-066	TRANSFORMER AT BLDG 401	199506	PA/SI NFA; Closure to be handled under PBC. Additional sampling performed under PBC with SI report completed December 2007. A no action decision document was signed in 2008.
LHAAP-068	MOBILE STORAGE TANK PARKING AREA	199008	Closure to be handled under PBC. Additional sampling performed under PBC with SI report completed December 2007. A no action decision document was signed in 2008.
LHAAP-069	SERVICE STATION UST'S	199306	Corrected under RCRA Guidelines. No further remedial action planned.
LHAAP-070	LOADING DOCK-MAGAZINE AREA	199506	PA/SI NFA; USEPA concurrence letter for NFI dated Aug. 18, 2004; No further remedial action planned. Transferred to the USFWS May 2004.

IRP Site Closeout (No Further Action) Summary

Site ID	Site Name	NFA Date	Documentation
LHAAP-071	OIL SPILL, BLDG 813	199506	PA/SI NFA; Remedial action taken; No further remedial action planned. USEPA concurrence letter for NFI dated Aug. 18, 2004. Transferred to the USFWS May 2004.

IRP Schedule

Date of IRP Inception: 197906

Past Phase Completion Milestones

1984

PA	(LHAAP-001 - INERT BURNING GROUNDS (SWMU 1))
SI	(LHAAP-001 - INERT BURNING GROUNDS (SWMU 1))

1987

PA	(LHAAP-071 - OIL SPILL, BLDG 813, LHAAP-002 - VACCUM TRUCK OVERNITE PARKING LOT, LHAAP-006 - BUILDING 54F SOLVENT, LHAAP-011 - SUS TNT BURIAL SITE AT AVE P&Q(SWMU 11), LHAAP-012 - ACTIVE LANDFILL (SWMU 12), LHAAP-013 - SUS TNT BET ACTIVE&OLD LANDFILL(SWMU 13), LHAAP-014 - AREA 54 BURIAL GRND (SWMU 14), LHAAP-016 - OLD LANDFILL (SWMU 16), LHAAP-017 - NO 2 FLASHING AREA BRN GROUND(SWMU 17), LHAAP-018 - BURNING GROUND/WASHOUT POND(SWMU 18), LHAAP-027 - SOUTH TEST AREA/BOMB TEST AREA(SWMU 27), LHAAP-029 - FORMER TNT PRODUCTION AREA(SWMU 29), LHAAP-032 - FORMER TNT WASTEWATER PLT(SWMU 32), LHAAP-035 - SUMPS (145) VARIOUS)
RFA	(LHAAP-070 - LOADING DOCK-MAGAZINE AREA, LHAAP-003 - BUILDING 722-PAINT SHOP, LHAAP-004 - LHAAP PILOT WASTEWATER TREATMENT PLANT, LHAAP-005 - POWER HOUSE BOILER POND, LHAAP-007 - BUILDING 50G DRUM PROCESSING, LHAAP-008 - SEWAGE TREATMENT PLANT, LHAAP-009 - BUILDING 31-W DRUM STORAGE, LHAAP-015 - AREA 49W DRUM STORAGE, LHAAP-019 - CONSTRUCTION MATERIALS LANDFILL, LHAAP-023 - BUILDING 707-STORAGE AREA PCBS, LHAAP-034 - BUILDING 701 PCB STORAGE, LHAAP-036 - EXPLOSIVE WASTE PADS (27))
CS	(LHAAP-036 - EXPLOSIVE WASTE PADS (27), LHAAP-019 - CONSTRUCTION MATERIALS LANDFILL, LHAAP-023 - BUILDING 707-STORAGE AREA PCBS, LHAAP-034 - BUILDING 701 PCB STORAGE)
SI	(LHAAP-011 - SUS TNT BURIAL SITE AT AVE P&Q(SWMU 11), LHAAP-012 - ACTIVE LANDFILL (SWMU 12), LHAAP-013 - SUS TNT BET ACTIVE&OLD LANDFILL(SWMU 13), LHAAP-014 - AREA 54 BURIAL GRND (SWMU 14), LHAAP-016 - OLD LANDFILL (SWMU 16), LHAAP-017 - NO 2 FLASHING AREA BRN GROUND(SWMU 17), LHAAP-018 - BURNING GROUND/WASHOUT POND(SWMU 18), LHAAP-027 - SOUTH TEST AREA/BOMB TEST AREA(SWMU 27), LHAAP-029 - FORMER TNT PRODUCTION AREA(SWMU 29), LHAAP-032 - FORMER TNT WASTEWATER PLT(SWMU 32), LHAAP-035 - SUMPS (145) VARIOUS)

1990

SI	(LHAAP-054 - GRD SIGNAL TEST AREA (LHAAP-XX), LHAAP-024 - FORMER UNLINED EVAP POND (SWMU 24))
ISC	(LHAAP-069 - SERVICE STATION UST'S)
PA	(LHAAP-045 - MAGAZINE AREA, LHAAP-050 - FORMER WASTE DISPOSAL FACILITY, LHAAP-052 - MAGAZINE AREA WASHOUT, LHAAP-054 - GRD SIGNAL TEST AREA (LHAAP-XX), LHAAP-060 - FORMER STORAGE BUILDING #411 & #714, LHAAP-061 - POTABLE WTP SEDIMENT POND, LHAAP-063 - BURIAL PITS, LHAAP-067 - ABOVE GROUND STORAGE TANK, LHAAP-068 - MOBILE STORAGE TANK PARKING AREA, LHAAP-024 - FORMER UNLINED EVAP POND (SWMU 24))
RFA	(LHAAP-037 - CHEMICAL LABORATORY WASTE PAD, LHAAP-039 - 25X WASHOUT PAD, LHAAP-051 - PHOTOGRAPHIC LABORATORY/BLDG #60B, LHAAP-053 - STATIC TEST AREA, LHAAP-055 - SEPTIC TANK (10), LHAAP-057 - RUBBLE BURIAL SITE, LHAAP-058 - MAINTENANCE COMPLEX, LHAAP-064 - TRANSFORMER STORAGE, LHAAP-066 - TRANSFORMER AT BLDG 401)

1995

CS	(LHAAP-058 - MAINTENANCE COMPLEX, LHAAP-064 - TRANSFORMER STORAGE, LHAAP-066 - TRANSFORMER AT BLDG 401, LHAAP-070 - LOADING DOCK-MAGAZINE AREA)
SI	(LHAAP-071 - OIL SPILL, BLDG 813)

1996

RI/FS	(LHAAP-013 - SUS TNT BET ACTIVE&OLD LANDFILL(SWMU 13), LHAAP-014 - AREA 54 BURIAL GRND (SWMU 14))

IRP Schedule

1997	
SI	(LHAAP-050 - FORMER WASTE DISPOSAL FACILITY, LHAAP-060 - FORMER STORAGE BUILDING #411 & #714)
1998	
RI/FS	(LHAAP-054 - GRD SIGNAL TEST AREA (LHAAP-XX), LHAAP-001 - INERT BURNING GROUNDS (SWMU 1), LHAAP-011 - SUS TNT BURIAL SITE AT AVE P&Q(SWMU 11), LHAAP-027 - SOUTH TEST AREA/BOMB TEST AREA(SWMU 27))
SI	(LHAAP-052 - MAGAZINE AREA WASHOUT, LHAAP-063 - BURIAL PITS)
1999	
SI	(LHAAP-067 - ABOVE GROUND STORAGE TANK)
2004	
RI/FS	(LHAAP-060 - FORMER STORAGE BUILDING #411 & #714)
SI	(LHAAP-045 - MAGAZINE AREA)
2005	
IRA	(LHAAP-012 - ACTIVE LANDFILL (SWMU 12), LHAAP-016 - OLD LANDFILL (SWMU 16))
PA	(PBC Longhorn - PBC at Longhorn)
RD	(PBC Longhorn - PBC at Longhorn)
2006	
RI/FS	(LHAAP-012 - ACTIVE LANDFILL (SWMU 12))
2007	
RA(C)	(PBC Longhorn - PBC at Longhorn, LHAAP-012 - ACTIVE LANDFILL (SWMU 12))
RI/FS	(LHAAP-032 - FORMER TNT WASTEWATER PLT(SWMU 32))
RD	(LHAAP-012 - ACTIVE LANDFILL (SWMU 12))
2008	
RA(C)	(LHAAP-067 - ABOVE GROUND STORAGE TANK)
LTM	(LHAAP-053 - STATIC TEST AREA, LHAAP-032 - FORMER TNT WASTEWATER PLT(SWMU 32))
RI/FS	(LHAAP-067 - ABOVE GROUND STORAGE TANK)
2009	
RA(C)	(LHAAP-035 - SUMPS (145) VARIOUS)
RI/FS	(LHAAP-035 - SUMPS (145) VARIOUS)
RD	(LHAAP-035 - SUMPS (145) VARIOUS)
RA(O)	(LHAAP-035 - SUMPS (145) VARIOUS)
2010	
RI/FS	(LHAAP-050 - FORMER WASTE DISPOSAL FACILITY, LHAAP-016 - OLD LANDFILL (SWMU 16), LHAAP-017 - NO 2 FLASHING AREA BRN GROUND(SWMU 17), LHAAP-029 - FORMER TNT PRODUCTION AREA(SWMU 29))

Projected Phase Completion Milestones

See attached schedule

IRP Schedule

Projected Record of Decision (ROD)/Decision Document (DD) Approval Dates

Site ID	Site Name	ROD/DD Title	ROD/DD Date
LHAAP-017	NO 2 FLASHING AREA BRN GROUND(SWMU 17)	Flashing Area/Burning Grnd No 2:LHAAP-17	20110630

Final RA(C) Completion Date: 201310

Schedule for Next Five-Year Review: 2012

Estimated Completion Date of IRP at Installation (including LTM phase): 204109

LONGHORN ARMY AMMUNITION PLANT IRP Schedule

= phase underway

SITE ID	SITE NAME	PHASE	FY12	FY13	FY14	FY15	FY16	FY17+
LHAAP-012	ACTIVE LANDFILL (SWMU 12)	RA(O)						
SITE ID	SITE NAME	PHASE	FY12	FY13	FY14	FY15	FY16	FY17+
LHAAP-016	OLD LANDFILL (SWMU 16)	RA(C)						
		RA(O)						
		LTM						
SITE ID	SITE NAME	PHASE	FY12	FY13	FY14	FY15	FY16	FY17+
LHAAP-017	NO 2 FLASHING AREA BRN GROUND(SWMU 17)	RA(C)						
		RA(O)						
		LTM						
SITE ID	SITE NAME	PHASE	FY12	FY13	FY14	FY15	FY16	FY17+
LHAAP-018	BURNING GROUND/WASHOUT POND(SWMU 18)	RD						
		RA(C)						
		RA(O)						
		LTM						
SITE ID	SITE NAME	PHASE	FY12	FY13	FY14	FY15	FY16	FY17+
LHAAP-024	FORMER UNLINED EVAP POND (SWMU 24)	RD						
		RA(C)						
		RA(O)						
		LTM						
SITE ID	SITE NAME	PHASE	FY12	FY13	FY14	FY15	FY16	FY17+
LHAAP-029	FORMER TNT PRODUCTION AREA(SWMU 29)	RA(C)						
		RA(O)						
SITE ID	SITE NAME	PHASE	FY12	FY13	FY14	FY15	FY16	FY17+
LHAAP-050	FORMER WASTE DISPOSAL FACILITY	RA(C)						
		RA(O)						
SITE ID	SITE NAME	PHASE	FY12	FY13	FY14	FY15	FY16	FY17+
LHAAP-067	ABOVE GROUND STORAGE TANK	RA(O)						
SITE ID	SITE NAME	PHASE	FY12	FY13	FY14	FY15	FY16	FY17+
PBC Longhorn	PBC at Longhorn	RA(O)						

00100166

LONGHORN ARMY AMMUNITION PLANT

Non-BRAC Excess

Military Munitions Response Program

MMRP Summary

Installation Total Army Environmental Database-Restoration (AEDB-R) Sites/Closeout Sites Count: 3/1

Installation Site Types with Future and/or Underway Phases

1 Explosive Ordnance Disposal Area
(LHAAP-003-R-01)

1 Unexploded Munitions/Ordnance
(LHAAP-001-R-01)

Most Widespread Contaminants of Concern

Explosives

Media of Concern

Groundwater, Soil

Completed Remedial Actions (Interim Remedial Actions / Final Remedial Actions (IRA/FRA))

Site ID	Site Name	Action	Remedy	FY	Cost
LHAAP-001-R-01	SOUTH TEST AREA / BOMB TEST AREA	IRA	INSTITUTIONAL CONTROLS	2009	TBD
LHAAP-001-R-01	SOUTH TEST AREA / BOMB TEST AREA	IRA	UXO CLEARANCE	2009	TBD

Duration of MMRP

Year of MMRP Inception: 200202

Estimated Date for Remedy-In-Place (RIP)/Response Complete (RC): 201109/201109

Date of MMRP completion including Long Term Management (LTM): 201709

MMRP Contamination Assessment

Contamination Assessment Overview

In May 2003 the Phase 3 Army range inventory was completed at LHAAP. The inventory identified three sites as eligible for the Military Munitions Response Program (MMRP). The Phase 3 inventory serves as the preliminary assessment (PA) under CERCLA. In June 2005 an SI was completed. An engineering evaluation/cost analysis (EE/CA) was finalized on the three sites in October 2007. The EE/CA indicated that no Department of Defense (DoD) action was required for LHAAP-002-R-01. An interim removal action was funded for the two other sites and was completed in 2009. In March 2008 an explosives safety submission (ESS) was finalized for the three sites.

Cleanup Exit Strategy

Five-year reviews are planned for both sites. These five-year reviews will ensure that the site is inspected, LUCs are still in place and that any new data regarding the condition of the site is reviewed.

MMRP Previous Studies

Year	Title	Author	Date
2001			
	U.S. Army Active/Inactive Range Inventory, Longhorn AAP	Army Materiel Command	AUG-2001
2002			
	CTT Range Inventory		JAN-2002
2003			
	Phase 3 Army Range Inventory at Longhorn Army Ammunition Plant	e2M	MAY-2003
2005			
	Final Site Inspection Report, Military Munitions Response Program Site Inspection, Munitions Response Sites	e2M	JUN-2005
2006			
	Final Work Plan Engineering Evaluation/Cost Analysis at the Longhorn Army Ammunition Plant	CAPE	MAR-2006
	Draft Operational Range Inventory Sustainment (ORIS) for Longhorn AAP	US Army	NOV-2006
2007			
	Final Engineering Evaluation/Cost Analysis at the Longhorn Army Ammunition Plant	CAPE	OCT-2007
2008			
	Final Explosives Safety Submission - Munitions and Explosives of Concern Removal Action	USACE, Huntsville	FEB-2008
	Final Work Plan for MEC Removal Action at Former LHAAP LHAAP-001-R(Site 27) and LHAAP-003-R(Site 54)	EOD Technology, Inc.	JUL-2008
2009			
	Final Site-specific Final Report for MEC Removal Action, LHAAP-001-R(Site 27) and LHAAP-003-R(Site 54)	EOD Technology, Inc.	SEP-2009

LONGHORN ARMY AMMUNITION PLANT

Non-BRAC Excess

Military Munitions Response Program
Site Descriptions

Site ID: LHAAP-001-R-01
Site Name: SOUTH TEST AREA / BOMB TEST AREA

STATUS

Parcel: South Test/Bomb (FWS) (72 acres)

Regulatory Driver: CERCLA
MRSPP Score: 04

Contaminants of Concern: Explosives

Media of Concern: Groundwater, Soil

Phases	Start	End
PA	200202	200305
SI	200402	200506
RI/FS	200503	201109
IRA	200710	200904
LTM	201109	201709

RIP Date: N/A

RC Date: 201109

SITE DESCRIPTION

This site is approximately 79 acres. It is also known as environmental site LHAAP-027 and is located southeast of Avenue P and the magazine area, at the end of 70th street, near the southern boundary of LHAAP. The site was constructed in 1954 and used by Universal Match Corporation to test photoflash bombs that were produced at the facility until about 1956. The bombs were tested by exploding them in the air over an elevated, semi-elliptical earthen test pad. Bombs awaiting testing were apparently stored in three earth-covered concrete bunkers. The bombs tested were 150-pound M120/M120A photoflash bombs, filled with photoflash powder and containing a black powder booster charge for bursting the bomb with a timed nose fuse.

The location of the site, for this purpose, was not ideally suited to the task, as fragments from this testing landed beyond the installation boundary. By June 1954, static testing of photoflash bombs had been discontinued because of the possibility of damage and injuries beyond the installation boundary. During the late-1950s, illuminating signal devices were also demilitarized within pits at this site. During the early-1960s, leaking production items were demilitarized in the area. The May 1997 Final RI Report for Group I Sites indicates approximately 52,000 one-half and one-pound photoflash cartridges were demilitarized at the site in the early-1980s.

In 1982 investigations included installation and sampling of two wells and three shallow soil samples. Explosives, metals, chloride and sulfate were detected above background levels in the soil samples. In January 1998, an NFA ROD was signed by the USEPA, based upon the site-specific risk analysis for human and ecological exposure to the contaminants of potential concern for the site.

In 2004 the explosive ordnance disposal (EOD) division at Fort Polk blew in place (BIP) one 155 mm white phosphorous (WP) round. The identification of this round as a live 155 mm WP round is suspect. Plexus, in the 2005 Environmental Baseline Survey (EBS) (page 46), states that "Confirmatory Sampling (CS) WP operations at LHAAP were assembly and packout operations only; no loading of these materials was conducted at the site. The WP rounds were stored and worked in the east line area of Plant 2 [US Army Toxic and Hazardous Materials Agency (USATHAMA), 1980]." Testing of the payload at LHAAP would not be part of the mission, since it was not manufactured at Longhorn. Others indicate that it was a 105 or 81 mm smoke round.

A reported demolition site was identified on the northwest perimeter of this site. This was added to the investigation. In FY08 an EE/CA report was completed, approved and signed. In October 2007 the report was finalized. An IRA has been funded with the final Explosives Safety Submission (ESS) completed in March 2008. The removal action was completed in 2009. Five-year reviews will be required following the removal action.

CLEANUP/EXIT STRATEGY

Site ID: LHAAP-001-R-01
Site Name: SOUTH TEST AREA / BOMB TEST AREA

Five-year reviews are planned for this site. These five-year reviews will ensure that the site is inspected and that any new data regarding the condition of the site is reviewed. The LUCs are in place and will be formally enforced upon ROD signature.

Site ID: LHAAP-003-R-01
Site Name: GROUND SIGNAL TEST AREA

STATUS

Parcel: Ground Signal Test (FWS) (80 acres)

Regulatory Driver: CERCLA
MRSPP Score: 04

Contaminants of Concern: Explosives

Media of Concern: Groundwater, Soil

Phases	Start	End
PA	200202	200305
SI	200402	200506
RI/FS	200503	201109
IRA	200710	200904
LTM	201109	201709

RIP Date: N/A

RC Date: 201109

SITE DESCRIPTION

This site, also known as environmental site LHAAP-054, encompasses approximately 80 acres and is located in the southeastern portion of LHAAP. Starting in April 1963 the site was used intermittently for aerial and on-ground testing and destruction of a variety of devices, including red phosphorus smoke wedges, infrared flares, illuminating 60 and 81 mm mortar shells, illuminating 40 to 155 mm cartridges, button bombs, and various types of explosive simulators. The site was also used intermittently over a 20-year period for testing and burnout of rocket motors from Nike-Hercules, Pershing, and Sergeant missiles. Around 1970, one of the Sergeant rocket motors exploded in an excavated pit near the center of the site. Debris was reportedly placed in the resulting crater and backfilled. From late-1988 through 1991, the site was also used for burnout of rocket motors in Pershing missiles destroyed in accordance with the INF Treaty between the US and the former Soviet Union. In January 1998 an NFA ROD for Hazardous, Toxic and Radioactive Waste (HTRW) under CERCLA was signed. The site is currently undeveloped.

In December 2004, the EOD unit at Fort Polk BIP 105 mm and 81 mm rounds. In FY08 an EE/CA report was completed, approved and signed. In October 2007 the report was finalized. An IRA has been funded with the final ESS completed in March 2008. The removal action was completed in 2009. Five-year reviews will be required following the removal action.

CLEANUP/EXIT STRATEGY

Five-year reviews are planned for this site. These five-year reviews will ensure that the site is inspected and that any new data regarding the condition of the site is reviewed. The LUCs are in place and will be formally enforced upon ROD signature.

MMRP Site Closeout (No Further Action) Summary

Site ID	Site Name	NFA Date	Documentation
LHAAP-002-R-01	STATIC TEST AREA	200811	A no action decision document signed in 2008.

MMRP Schedule

Date of MMRP Inception: 200202

Past Phase Completion Milestones

2003	
PA	(LHAAP-001-R-01 - SOUTH TEST AREA / BOMB TEST AREA, LHAAP-002-R-01 - STATIC TEST AREA, LHAAP-003-R-01 - GROUND SIGNAL TEST AREA)
2005	
SI	(LHAAP-001-R-01 - SOUTH TEST AREA / BOMB TEST AREA, LHAAP-002-R-01 - STATIC TEST AREA, LHAAP-003-R-01 - GROUND SIGNAL TEST AREA)
2008	
RI/FS	(LHAAP-002-R-01 - STATIC TEST AREA)
2009	
IRA	(LHAAP-001-R-01 - SOUTH TEST AREA / BOMB TEST AREA, LHAAP-003-R-01 - GROUND SIGNAL TEST AREA)

Projected Phase Completion Milestones

See attached schedule

Projected Record of Decision (ROD)/Decision Document (DD) Approval Dates

To Be Determined

Final RA(C) Completion Date:

Schedule for Next Five-Year Review: 2012

Estimated Completion Date of MMRP at Installation (including LTM phase): 201709

00100176

LONGHORN ARMY AMMUNITION PLANT MMRP Schedule

= phase underway

SITE ID	SITE NAME	PHASE	FY12	FY13	FY14	FY15	FY16	FY17+
LHAAP-001-R-0	SOUTH TEST AREA / BOMB TEST AREA	LTM						

SITE ID	SITE NAME	PHASE	FY12	FY13	FY14	FY15	FY16	FY17+
LHAAP-003-R-0	GROUND SIGNAL TEST AREA	LTM						

Community Involvement

Technical Review Committee (TRC): 199203

Community Involvement Plan (Date Published): 200309

Restoration Advisory Board (RAB): RAB established 2004

RAB Adjournment Date:

RAB Adjournment Reason:

Additional Community Involvement Information

While the Army leads the Installation Restoration Program (IRP) at LHAAP, a close working relationship with the regulatory community has been developed. The local public community has been involved in the past through the TRC process.

In April 1996 and in 1998 formation of a RAB was attempted; however, community involvement in the TRC process was determined to be sufficient for community needs. In September 2004, in response to public notices and private mailings, a group of citizens attended a RAB-interest meeting. Enthusiastic support resulted in the first RAB meeting in December 2004. It was well attended. The RAB has created its own symbol, finalized its charter, and elected a co-chair. The RAB meets quarterly and public meetings are held for each PP. These will continue as needed.

Administrative Record is located at

Longhorn Army Trailer
Groundwater Treatment Plant Compound
Highway 134 and Spur 449
Karnack, TX 75661

Information Repository is located at

Marshall Texas Library
300 South Alamo
Marshall, TX 756

Current Technical Assistance for Public Participation (TAPP): 199909

TAPP Title: Grnd/surf water migration

Current Technical Assistance for Public Participation (TAPP): 200103

TAPP Title: TAPP2

Potential TAPP: N/A

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

MONTHLY MANAGERS' MEETING

AGENDA

DATE:	Thursday, June 23, 2011
TIME:	02:00 pm.
PLACE:	Teleconference - Call In Number Courtesy of Shaw: 866-797-9304/4155734

Welcome **RMZ**

Action Items
Shaw
- Write up on the impacts from the elimination of ITS data on current sites

EPA **ST**
- Check for use of isotope studies for MNA evaluation

Defense Environmental Restoration Program (DERP) PBC Update **PS**
- Document Status/Environmental Sites (Table)
- Basewide Ecological Risk Assessment – impact from elimination of disqualified ITS data
- Groundwater Treatment Plant
- LHAAP-18/24 FS alternative modification
- Groundwater and Surface Water Sampling Schedule Spreadsheet. Next sampling round.
- Installation-wide work plan revision update

DERP Total Environmental Restoration Contract Update **Army**
- LHAAP-37/67 RD Revised – Regulator Review
- Pilot Demonstration at LHAAP-37 Status

MMRP Update **Army**
- Status of MC Data Summary Report and Path Forward
- Tentative Schedule for ROD

Review of Schedule **Army**

USFWS Update **RMZ/PB**
- Environmental Restoration Issues with Transfer Schedule Impact
- USFWS Comments on Documents

Adjourn

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Subject:	**Final Minutes, Monthly Managers Meeting, Longhorn Army Ammunition Plant (LHAAP)**
Location of Meeting:	**Teleconference**
Date of Meeting:	**June 23, 2011; 2:00 PM – 3:30 PM**

Meeting Participants:

BRAC:	Rose M. Zeiler
USACE-Tulsa:	Aaron Williams, John Lambert
USAEC-SA:	Marilyn Plitnik
Shaw:	Susan Watson, Kay Everett
USEPA Region 6:	Steve Tzhone
TCEQ:	Fay Duke, Dale Vodak
USGS:	Kent Becher
USFWS:	Paul Bruckwicki

Welcome **Rose M. Zeiler**

Action Item Status
Shaw

- Write up on the impacts from the elimination of ITS data on current sites. – *Is in Army review.*

EPA—Topics for Discussion

- Check for use of isotope studies for MNA evaluation.—*EPA's conclusion is it is difficult to document this method and the evaluation of results since it is more complex. If we do go forward with isotope analysis, use caution and keep using standard analytical methods and data evaluation procedures.*

Defense Environmental Restoration Program (DERP) PBC Update **Susan Watson**

Document Status/Environmental Sites
Susan went over the document status/environmental sites table.

- LHAAP-03: Currently preparing EE/CA.
- LHAAP-04: Received regulatory comments on the draft final completion report. RTCs in regulatory review. The preliminary draft FS for LHAAP-04 is in Army's review.
- LHAAP-16: ROD – Draft ROD is in regulators' review.
- LHAAP-17: ROD – The Draft ROD is with the regulators. Aaron indicated some ARARs are being discussed with the regulators. EPA discussed that perchlorate maybe a possible hazardous waste or hazard substance. Once received, EPA will forward additional information to the Army.
- LHAAP-18/24: The RTCs for the DF FS are in regulatory review as of April 13th. A call to discuss the FS regarding alternative modifications was made. Steve was okay with recirculation and a modification for recirculation only is acceptable; however, a treatability study was not approved. The current system must be evaluated first and too much time is needed to construct and get everyone's input. A pilot study can only be run after the ROD is approved

- LHAAP-29: Preliminary draft ROD- Received Army comments, preparing responses.
- LHAAP-46: The RD is in regulatory review.
- LHAAP-47: Regulatory comments received and addressed. RTCs are in regulatory review as of 6/16/11 and Steve indicated that responses looked okay except for the metals part. EPA will submit comments next week.
- LHAAP-50: Remedial design is being revised to address the regulatory meeting comments and will be sent to Army.
- LHAAP-58: The revised RD is in Army review.
- LHAAP-12 RA(O): TCEQ regulatory comments received. EPA comments are pending.

Basewide Ecological Risk Assessment—impact from elimination of ITS data is in Army's review.

Groundwater Treatment Plant
The GWTP is functioning normally. No tree roots were found growing through the liner. All the trees growing at the edge of the INF pond have been removed.

The sprinkler system is in operation with discharged water being sprinkled onto LHAAP-18/24 because there is no water in the creeks. The crew will continue checking to confirm that there is no overland flow caused by the sprinklers.

LHAAP-18/24 FS Alternative Modification
See LHAAP-18/24 discussion above.

Groundwater and Surface Water Sampling Schedule Spreadsheet.
EPA has received their results from some of the split samples collected. The sampling schedule was updated and distributed.

Installation-Wide Work Plan revision update
The revisions were complete and an updated Health and Safety Plan was sent to the GWTP. Fay indicated that they had not seen the Sample Analysis Plan and that regulators had not been given the opportunity to review this document. The work plan document can be found on the stakeholders' portal (with some amendments) and was in use from the beginning of the contract period. Site-specific addenda work plans were prepared as site work progressed. The current updates to the original document were the incorporation of internal safety policies that have been instituted prior to original publication of the document and the update to personnel and contact information changes. The sampling method for perchlorate was discussed with regulators when data detection limits were found to be not responsive to current needs and it was learned a more suitable method became available. During this update, the SAP was reviewed and the new method was added to the SAP. Fay said the SAP would have to be approved by the TCEQ/EPA. TCEQ and Shaw would check their files for a formal letter or correspondence of concurrence for the original SAP.

General – Dale Vodak requested a periodic list of acronyms or that the acronyms be defined in the minutes.

DERP Total Environmental Restoration Contract Update **Army**
LHAAP-37/67 RD Status – Comment Responses
The hardcopy was submitted and Fay indicated she would wrap this up before taking leave. Steve requested a couple more copies.

Pilot Demonstration at LHAAP-37 Status

The pilot demonstration is on track.

MMRP Update
Army
Status of MC Data Summary Report and Path Forward
The MC Data Summary Report is in regulatory review and a public notice will be published as soon as the document is approved. They are planning for the public meeting to be July 21. They looked at the 1st or 3rd week for choices to hold the meeting.

Tentative Schedule for ROD
Army is planning on a minimum of 4 RODs to be signed this FY.

Review of Schedule **Army**
The schedule for the LHAAP-16, -17, -29, and -47 RODs were reviewed. The documentation for LHAAP-16 and -29 will need to be turned around quickly to stay on schedule.

USFWS Update
Environmental Restoration Issues with Transfer Schedule Impact. *None.*
USFWS Comments on Documents. *None.*
Paul Bruckwicki indicated that he has been unable to log into the portal. Issues appear to stem from functionality and compatibility of the systems. Paul told the group that USFWS wrestled an alligator out of the settling pond. They said it was about 8 foot long and found in about 9 feet of water.

Meeting Adjourned
Next monthly manager's meeting is teleconference for July 21; time and date is tentative on when the public meeting will be held.

Action Items
Shaw –
- Check to see if regulator concurrence on QA/QC procedures were obtained for SAP
- Re-request access for Paul Bruckwicki to portal.

EPA Forward perchlorate waste information onto Army

EPA/Army – Review LHAAP-17 ROD ARAR language changes

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Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
June 23, 2011

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	**Remarks**
1	Draft Final Soil Removal Work Plan, LHAAP-03									On hold until EE/CA and AM are completed.	
2	Preliminary Draft EE/CA, LHAAP-03	06/30/11	x							In preparation	
3	Draft Final Completion Report, LHAAP-04	05/24/10	x	x	Final	7/15/11	x	x	In progress	Regulatory comments received. RTCs in regulatory review	
4	Preliminary Draft FS, LHAAP-04	2/03/11	x		Draft	7/15/11	x	x		In Army review	
5	Draft ROD, LHAAP-16	06/21/11	x	x	Draft Final	7/21/11	x	x		In regulatory review	
6	Draft Record of Decision, LHAAP-17	1/26/11	x	x	Final	07/30/11	x	x	In progress	Regulatory/ Army resolving comments	
7	Draft (Final) Feasibility Study, LHAAP-18/24	5/13/09	x	x	Draft Final	07/30/11	x	x	In progress	RTCs in regulatory review	
8	Preliminary Draft ROD, LHAAP-29	5/5/11	x		Draft	6/24/11	x	x	In progress	Received Army comments. Preparing responses	

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Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
June 23, 2011

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	**Remarks**
9	Draft Remedial Design, LHAAP-46	05/31/11	x	x						In regulatory review	
10	Revised Draft Final Feasibility Study, LHAAP-47	10/27/10	x		Revised Draft Final	7/15/11	x	x		Received regulatory comments. RTCs in regulatory review as of 6/16/11	
11	Draft Remedial Design, LHAAP-50	7/15/11	x							Revising RD for submittal to Army for concurrence	
12	Draft Remedial Design, LHAAP-58	7/15/11	x							Revised RD in Army's review	
13	Draft Final LHAAP-12 RAO Report	2/10/11	x	x	Final	6/30/11	x	x	In progress	TCEQ comments received. EPA comments pending	

Master Groundwater Sampling Schedule
Longhorn Army Ammunition Plant

Updated: 06/22/11

				2011												2012											
Site/Well ID	Well description	Last Date Sampled	Next Event*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
LHAAP-12																											
12MW20	on site - near well 24	6/7/11	Jun-12						VOCs												VOCs						
12WW21	on site - downgradient	6/7/11	Jun-12						VOCs												VOCs						
12WW22	compliance northeast	6/7/11	Jun-12						VOCs												VOCs						
12WW23	compliance - northwest	6/7/11	Jun-12						VOCs												VOCs						
12WW24	on site - near source	6/7/11	Jun-12						VOCs												VOCs						
LHAAP-16 (Interim Action)																											
EW-01	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-02	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-03	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-04	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-05	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-06	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-07	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
EW-08	NE, annual	2/16/11	Feb-12		VOCs,P												VOCs,P										
LHAAP-17																											
TBD																											
LHAAP-18/24 (Inteirm Action)																											
ICT-2	west, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-4	SW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-7	north, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-8	east, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-11	south, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-12B	SW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-12C	SW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-12D	SW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-12C	SW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-12E	SW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
EW-01	annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-13A	west, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-13B	NW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-13D	NW, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-13E	north, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-13F	north, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-14B	NE, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-14C	NE, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
ICT-14D	NE, annual	2/21/11	Feb-12		VOCs,Cl,P												VOCs,Cl,P										
18WW07	north	11/10/05	SAN																								
18WW08	north, semi-annual	3/17/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
18WW09	north, semi-annual	03/15/11	Sep-11																								
18WW10	west, semi-annual	3/16/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
18WW11	west, semi-annual	3/16/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
18WW17	east	11/17/05	SAN																								
18WW20	north, semi-annual	3/15/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
18WW21	NE	11/10/05	SAN																								
C-01	south	11/10/05	SAN																								
C-02	NW, semi-annual	3/17/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
C-04	NE, semi-annual	3/14/11	Sep-11																								
C-04A	SAN	5/11/06	SAN																								
C8	east, semi-annual	3/15/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-1	inside CT perimeter	5/11/06	SAN																								
MW-2	inside CT perimeter, semi-annual	3/16/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-3	inside CT perimeter	5/11/06	SAN																								
MW-4	inside CT perimeter	5/11/06	SAN																								
MW-6	inside CT perimeter	5/11/06	SAN																								
MW-9	inside CT perimeter	5/11/06	SAN																								
AWD1	west along CT	5/11/06	SAN																								
AWD3	inside CT perimeter	5/11/06	SAN																								
AWD2	inside CT perimeter	5/11/06	SAN																								
AWD4	north	5/11/06	SAN																								
MW-5	inside CT perimeter	5/11/06	SAN																								
MW-7	inside CT perimeter	5/11/06	SAN																								
MW-8	east, semi-annual	3/17/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-10	west	5/11/06	SAN																								
MW-11	northwest	5/11/06	SAN																								
MW-12	northwest	5/11/06	SAN																								
MW-13	west	5/11/06	SAN																								
MW-14	inside CT perimeter	5/11/06	SAN																								
MW-16	NW, semi-annual	3/16/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-17	west	3/22/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-19	southwest	5/11/06	SAN																								
MW-20	south, semi-annual	3/15/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-21	inside CT perimeter	5/11/06	SAN																								
MW-22	inside CT perimeter, semi-annual	3/17/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-23	inside CT perimeter	5/11/06	SAN																								
MW-101	east	5/11/06	SAN																								
MW-102	south	5/11/06	SAN																								
MW-109	northeast	5/11/06	SAN																								
MW-120	west	5/11/06	SAN																								
MW126	south	3/22/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
MW-129	west, along CT	5/11/06	SAN																								

Master Groundwater Sampling Schedule
Longhorn Army Ammunition Plant

Updated: 06/22/11

				2011												2012											
Site/Well ID	Well description	Last Date Sampled	Next Event*	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
C9	south, semi-annual	3/14/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
C-10	south	5/11/06	SAN																								
C6	2100 ft north of site, semi-annual	3/14/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
C3	east, semi-annual	3/14/11	Sep-11			VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM						VOCs,Cl,P,TM			
LHAAP-29																											
TBD																											
LHAAP-37																											
TBD																											
LHAAP-46																											
TBD																											
LHAAP-47																											
TBD																											
LHAAP-50																											
TBD																											
LHAAP-35A(58)																											
TBD																											
Creek Sampling (LHAAP-47/50)																											
TBD																											
Perimeter Well Sampling																											
108		9/1/10	Sep-11									P												P			
110		9/1/10	Sep-11									P												P			
111		9/1/10	Sep-11									P												P			
112		9/1/10	Sep-11									P												P			
133		3/10/11	Sep-11			P						P						P						P			
134		3/10/11	Sep-11			P						P						P						P			
Ongoing Creek Sampling (Harrison Bayou & Goose Prairie Creek)																											
HBW-1	Harrison Bayou Water	6/11-dry	Sep-11			P			P			P			P			P			P			P			P
HBW-7	Harrison Bayou Water	6/11-dry	Sep-11			P			P			P			P			P			P			P			P
HBW-10	Harrison Bayou Water	6/11-dry	Sep-11			P			P			P			P			P			P			P			P
GPW-1	Goose Praire Creek Water	6/11-dry	Sep-11			P			P			P			P			P			P			P			P
GPW-3	Goose Praire Creek Water	6/11-dry	Sep-11			P			P			P			P			P			P			P			P

Notes & abbreviations:

* - Two weeks prior to next sampling event, TCEQ & EPA will be notified of the tentative date. If TCEQ or EPA would like to be onsite, a couple of days priot to sampling, TCEQ & EPA will contacted with a more firm date & time.
TBD - to be determined after remedial design of final remedy
EW- Extraction well
ICT- Interceptor collection trench
NE- northwest
NW- northwest
SW- southwest
CT- Collection trench
SAN- Sample as needed
MNA - MNA parameters (see list below)
VOC - volatile organic compounds (Method 8260)
TM- TM
P- Perchlorate
SVOCs

MNA parameters:
nitrates
nitrites
sulfates
pH
Eh (redox potential)
conductivity
temperature
dissolved oxygen (DO)
ferrous iron (HACH meter in field)
Cl- Chloride
methane
ethane
ethene
inorganic & organic carbon
Dehalococcoides

00100187

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RESTORATION ADVISORY BOARD
Karnack, Texas
(479) 635-0110

June 24, 2011

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June 24, 2011, page 2

Dear LHAAP RAB Member,

Enclosed is the revised agenda for the next Restoration Advisory Board (RAB) meeting to be held on Thursday, June 30, 2011, from 6:30 to 8:00 p.m. at the Karnack Community Center. Tom Lederle, Chief of the BRAC Industrial Branch, will attend the meeting and will be available to address transfer questions immediately after adjournment of the RAB meeting. If you have additional items for the agenda, please provide to me at rose.zeiler@us.army.mil.

Regards,

Rose M. Zeiler

Dr. Rose Zeiler
Department of the Army
Longhorn Army Ammunition Plant
Box 220
Ratcliff, Arkansas 72951

Copy to:
Dawn Orsack, Rick Lowerre; CLI (TAG)
Janetta Coats, Donn Walters; EPA (TAG)

00100189

LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD
Karnack, Texas
(479) 635-0110

AGENDA

DATE:	Thursday, June 30, 2011
TIME:	6:30 – 8:00 PM
PLACE:	Karnack Community Center, Karnack, Texas

06:30 Welcome and Introduction

06:35 Open items {RMZ}
Charter Revision
Election of Co-Chair
Collection of Health Questions for EPA

07:05 Defense Environmental Restoration Program (DERP) Performance Based Contract (PBC) Update {Shaw}
-Documents Status/ Environmental Sites
-Groundwater Treatment Plant (GWTP) Update
-Field Sampling Update for Remedial Design at LHAAP-46
-Perimeter Well/Surface Water Sampling (Creek) Results and Update
-Discussion of Laura Olah's Comment for LHAAP-29

07:25 DERP Total Environmental Restoration Contract Update {RMZ}
-LHAAP-35B(37) and LHAAP-67 RD
-Demonstration Project

07:30 Military Munitions Response Program (MMRP) {USACE}
Proposed Plan Public Meeting

07:35 Other Environmental Restoration Issues {RMZ}

07:50 Look Ahead at the Schedule

08:00 Adjourn {RMZ}

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Subject:	**Draft Final Minutes, Quarterly Restoration Advisory Board (RAB) Meeting, Longhorn Army Ammunition Plant (LHAAP)**
Location of Meeting:	**Karnack Community Center, Karnack, Texas**
Date of Meeting:	**June 30, 2011, 6:30 – 08:00 PM**

Meeting Participants:

LHAAP/BRAC:	Rose M. Zeiler
USACE:	Aaron Williams, John Lambert
Shaw Environmental:	Praveen Srivastav, Kay Everett
TCEQ:	Dale Vodak
USEPA Region 6:	Steve Tzhone
USGS:	Kent Becher
RAB:	**Present:** Ken Burkhalter, Charles Dixon, Carol Fortune, Paul Fortune, Judith Johnson, Ted Kurz, Richard LeTourneau, Nigel Shivers, Judy Van Deventer, Tom Walker **Absent:** Robert Cargill, Lee Guice, Jim Lambright, E.V. Wilson, and Pickens Winters

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An agenda for the RAB meeting was distributed prior to the meeting.

Welcome – Rose Zeiler
The meeting was called to order.

Open Items – Rose Zeiler

Charter Revision/Election of Co-Chair
The meeting opened with a discussion of what the RAB does and how it is governed by its charter and the importance of conducting charter revisions, since many of the RAB meeting policies currently do not follow the existing charter. Changes and updates to the current

charter are needed to satisfy the present policies being implemented are agreeable among the members. Judy Van Deventer offered to look into the changes proposed and asked about the color coding on the document. The green changes were made by RAB members and the yellow changes by the Army. Rose indicated that initially the Longhorn Charter stated that board members would rotate every two years, but members are staying longer and forgoing co-chair elections so those types of changes would have to be captured in the revised document because the RAB is violating its Charter as written.

Collection of Health Questions for EPA

Mr. Pickens Winters had offered to collect questions from the community and present to the EPA at tonight's meeting; however, Mr. Winters contacted the Army Co-Chair prior to tonight's meeting and indicated that he had not received any questions and that he would be unable to attend the meeting tonight. Steve suggested this issue be left open and have someone from the Texas State Health Department come at a later date. Perhaps some questions would come up by then.

Defense Environmental Restoration Program (DERP) Performance Based Contract (PBC) Update–Shaw

Document Status/Environmental Sites

Copies of the document status table were distributed and Praveen Srivastav discussed each site.

- LHAAP-03: LHAAP-03 was a former waste storage pad for a drum of waste paint and located within LHAAP-58. Has been put on hold until additional documentation is available. It was also determined that an EE/CA is being prepared for this site. Public participation in the form of a public meeting is also planned.
- LHAAP-04: This site is across from the Fire Station and was a former wastewater treatment area. During a soil removal action, contamination was found in the groundwater so a Feasibility Study was developed. The draft is in Army review. Response to comments for the soil removal action closure report is in regulatory review.
- LHAAP-16: The revised Draft Record of Decision (ROD) for LHAAP-16 is in regulatory review.
- LHAAP-17: The preliminary Draft ROD for LHAAP-17 is in comment resolution.
- LHAAP-18/24: Responses to EPA and TCEQ comments on the Draft Final FS for LHAAP-18/24 are in Army review.
- LHAAP-29: The preliminary draft ROD is in progress. Comments from the Army are currently being addressed. This site was the TNT manufacturing area which consisted of 5 to 6 production lines.
- LHAAP-46: The Draft RD for LHAAP-46 is currently in regulatory review.
- LHAAP-47: Responses to regulatory comments on the revised Draft Final FS are in regulatory review as of 6/16/11.
- LHAAP-50: Revising RD for submittal to Army for concurrence.
- LHAAP-58: The revised RD is in Army review. LHAAP-58 was the old shops area.
- LHAAP-12 RA(O): This is a remedial action "operation" to conduct long term monitoring for the interim remedy, which was completed in the 1990s when the landfill was capped. LHAAP-12 was the old sanitary landfill. The draft final RA(O) report is in regulatory review; EPA comments are pending.

Paul Fortune asked about public comments made on LHAAP-16 and if the public were going to get the responses to their questions and comments. Rose said that the regulators are looking at them now and then the responses would be sent. Paul also said that he wanted a personal response for all that made comments or asked questions. Rose said that could be done and Paul indicated that he wanted personal responses for the last few sites, too, such as LHAAP-46, LHAAP-50, and LHAAP-58.

Groundwater Treatment Plant (GWTP) Update

Currently, the GWTP is discharging to the sprinkler systems because Harrison Bayou is dry. There are now two areas set up that can sprinkle the effluent water. A discussion ensued over the history at LHAAP-18/24. At one time, the pond was emptied, soil was removed and replaced with clean fill and then capped. Paul F. asked what criteria made them send water to LHAAP-16 or to the burning ground. Originally there was an evaporation pond located at LHAAP-18/24. It was normal operating procedure at the time.

Many criteria went into the decision regarding projection of the time it would take to clean up the sites including restoration issues, plume migration occurring or not, and other points. Army would be involved however long it takes. The contaminants here are “sinkers” or DNAPLs and are hard to find. The contaminant moved along fractured shale and in fine-grained materials, leaving a residual mass that is difficult to remove in one swift action.

There are plans being developed for LHAAP-29. It is to be stressed that the Army is obligated to clean up these sites and the liability is on the Army. Every five years, all of these sites are reevaluated to assess if the remedy in place is working or not. If it is not working or not working well and another cost effective option is available, the Army with approval of the regulators, would institute another remedy. It was asked who put together the specs regarding the remedial goals for these contracts. Corps of Engineers/Army puts the bid specifications together and issues the RFI.

Perimeter Well/Surface Water Sampling (Creek) Results and Update

No surface water samples were collected because of the dry conditions. The next sampling perimeter well sampling event is scheduled for September.

Field Sampling Update for Remedial Design at LHAAP-46

The wells have been completed and sampling is taking place to help define the plume.

Discussion of Laura Olah’s Comment for LHAAP-29

There have been several questions and comments regarding the DNT isomers. Paul Fortune read the isomer comment submitted by Laura Olah from Wisconsin. Charles Dixon said that his daughter is a chemist and he asked her about the isomer comment. She told him that all isomers test similarly and would react similarly, in other words, would behave the same way. Steve said he has sent this issue up to EPA headquarters and it is being followed up. He reminded everyone that Texas does not have standards in place for these isomers.

A comment was made regarding an oral history from Wyatt Moore on a publication he wrote about Caddo Lake that described some past spills made that made its way to Caddo Lake.

Charles Dixon also suggested that the lines at LHAAP-29 be removed. He said why leave a known pollutant. Rose said the lines have been there for 65 years. And the area where there were explosives was a very small area. She reminded everyone that Longhorn only produced TNT for about 4-5 years before that production line was abandoned, still in the 1940s.

Praveen said that n-trinitrotoluene naturally degrades and DNT degrades rapidly. TCE and MC do not degrade as fast. The transite pipe was cleaned when it was abandoned. The flushing and confirmation sampling of the lines were planned to be executed in segments to confirm that each segment (and ultimately the entire line) is flushed clean. Charles said that seemed reasonable procedure. Paul said that if the lines were dug up, you wouldn't have to worry about them anymore and they wouldn't pose a possible danger to someone else in the future.

Several comments regarding the underground lines at LHAAP-29 were received during the comment period and have been addressed in the Responsiveness Summary for the LHAAP-29 ROD, which is undergoing regulatory review.

DERP Total Environmental Restoration Contract (TERC) Update – Rose Zeiler
LHAAP-35B(37) and LHAAP-67 RD

Demonstration Project
The bio-plug field demonstration is still following schedule. The implementation of the RD is on hold while they implement this new technology in hopes that it would reduce TCE and reduce long term costs.

The Bio-Plug is like a mini reactor. It will treat a small area—they will use about 500 bio-plug locations and get the material to where it is needed. It will treat approximately a 2 acre site and the nutrient injection is approximately 2 gallons/day/well. The estimated time to reach remedial goals is within 2 years after commencement of system operation. Smaller scale tests have been done and it was seen to be aerobic instead of anaerobic. The time to recover is estimated from 6 months to 1 year.

Military Munitions Response Program (MMRP) Update – USACE
There have been handouts on past investigations provided. The proposed plan was finalized and sent out Tuesday in addition to the Data Summary. The ROD will be a no further action for WP and perchlorate. A ROD is required because these two areas are NPL sites. During the 2009 EPA sampling event, results indicated one sample slightly above the state value for perchlorate, and the Army's sample of the same was slightly below it.

LUCs are documented for the MMRP sites. Surface clearance was conducted in both locations a few years back. The South Test Area was an open burning and exploding ordinance area. These were surface test areas and no underground testing took place. The LUC will restrict digging in the areas and there are warning signs on the perimeter. Safety pamphlets and a video explaining MEC hazards and safety at the MMRP sites were provided to USFWS in conjunction with the Removal Action.

The public meeting is being planned for July 21, 2011. The public comment period begins July 13 and ends August 13, 2011. The notification went into the paper yesterday. Both sites cover about 79 acres each. There is no groundwater or soil contamination.

Other Environmental Restoration Issues/Concerns
Steve said that Richard Pruitt indicated that the Discovery and PBS channels may be interested in airing the documentary he has been working on.

Look Ahead at the Schedule
There are 4 RODs and 5 RDs expected by the end of September.

The next RAB meeting is scheduled for possibly the first week in October 2011. The meeting date is tentative following further discussion with RAB members. *[Subsequent correspondence has confirmed that the next meeting date will be September 15, 2011 at 6:30PM.]*

Adjourn

March Meeting Attachments and Handouts:
- *Status of Technical Documents PBC*
- *Meeting Agenda*
- *Groundwater Treatment Plant Handout*

Acronyms

ASTDR	Agency for Toxic Substances and Disease Registry
DERP	Defense Environment Response Program
DNT	dinitrotoluene
EE/CA	Engineering Evaluation/Cost Analysis
FS	Feasibility Study
GWTP	Groundwater Treatment Plant
MMRP	military munitions response program
PBC	Performance Based Contract
RA(O)	Remedial Action Operations
RD	Remedial Design
RFI	Request for Information
ROD	Record of Decision

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Longhorn Army Ammunition Plant
Restoration Advisory Board Meeting

Location	Karnack Community Center
Date	30-Jun-2011 6:30 PM **page 1 of** 2

Please sign in the space provided or add your name and address on next page if your name does not appear below.

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Longhorn Army Ammunition Plant
Restoration Advisory Board Meeting

Location	Karnack Community Center			
Date	30-Jun-2011	6:30 PM	**page 2 of 2**	

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Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
June 23, 2011

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	**Remarks**
1	Draft Final Soil Removal Work Plan, LHAAP-03									On hold until EE/CA and AM are completed.	
2	Preliminary Draft EE/CA, LHAAP-03	06/30/11	x							In preparation	
3	Draft Final Completion Report, LHAAP-04	05/24/10	x	x	Final	7/15/11	x	x	In progress	Regulatory comments received. RTCs in regulatory review	
4	Preliminary Draft FS, LHAAP-04	2/03/11	x		Draft	7/15/11	x	x		In Army review	
5	Draft ROD, LHAAP-16	06/21/11	x	x	Draft Final	7/21/11	x	x		In regulatory review	
6	Draft Record of Decision, LHAAP-17	1/26/11	x	x	Final	07/30/11	x	x	In progress	Regulatory/ Army resolving comments	
7	Draft (Final) Feasibility Study, LHAAP-18/24	5/13/09	x	x	Draft Final	07/30/11	x	x	In progress	RTCs in regulatory review	
8	Preliminary Draft ROD, LHAAP-29	5/5/11	x		Draft	6/24/11	x	x	In progress	Received Army comments. Preparing responses	

Shaw® Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
June 23, 2011

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	**Remarks**
9	Draft Remedial Design, LHAAP-46	05/31/11	x	x						In regulatory review	
10	Revised Draft Final Feasibility Study, LHAAP-47	10/27/10	x		Revised Draft Final	7/15/11	x	x		Received regulatory comments. RTCs in regulatory review as of 6/16/11	
11	Draft Remedial Design, LHAAP-50	7/15/11	x							Revising RD for submittal to Army for concurrence	
12	Draft Remedial Design, LHAAP-58	7/15/11	x							Revised RD in Army's review	
13	Draft Final LHAAP-12 RAO Report	2/10/11	x	x	Final	6/30/11	x	x	In progress	TCEQ comments received. EPA comments pending	

Perchlorate Results for Creek Sampling

Longhorn Army Ammunition Plant, Karnack, Texas

Creek Sample ID	GW-Res	Mar 2008	Jun 2008	Sep 2008	Dec 2008	May 2009	July 2009	Aug 2009	Sep 2009	Dec 2009	Mar 2010	Jun 2010	Sep 2010	Dec 2010	Mar 2011	Jun 2011
GPW-1	26	27	0.5U	0.5U	0.22U	16	4U	NS	1.2U	3.7	1.3J	0.6U	dry	0.1U	8.7	dry
GPW-3	26	21.9	9.42	1.1	0.22U	8.9	4U	NS	0.6U	2.8	1.8J	0.6U	dry	0.199J	0.673	dry
HBW-1	26	0.5U	0.5U	0.5U	0.22U	0.55U	4U	NS	1.5U	0.275U	1.5U	0.6U	dry	0.1U	0.2U	dry
HBW-7	26	0.5U	0.5U	0.5U	0.22U	0.55U	4U	24*	1.2U	0.275U	1.5U	0.6U	dry	0.1U	0.2U	dry
HBW-10	26	0.5U	0.5U	0.5U	0.22U	0.55U	4U	NS	1.5U	0.275U	1.2U	0.6U	dry	0.1U	0.2U	dry

NOTES:

all units in micrograms/liter (µg/L)

* One sample taken during GWTP shutdown

U undetected

J approximate value present below normal reporting limit

GW-Res groundwater medium-specific concentration for residential use

NS not sampled

GP is Goose Prairie Creek

HB is Harrison Bayou

W is surface water

Creek Conditions for last four sampling events:

September 2010 conditions: All creek sampling locations were dry in September.

December 2010 conditions: GP sampling locations some water but no visible flow; HB sampling locations plenty of water volume but very little flow

March 2011 conditions: GP sampling locations slow flow; HB sampling locations fairly good flow

June 2011 conditions: All creek sampling locations were dry in June.

Perchlorate Results for Perimeter Well Sampling
Longhorn Army Ammunition Plant, Karnack, Texas

Well ID	GW Res	Sep 2006	May 2007	Aug 2007	Dec 2007	Mar 2008	Sep 2008	May 2009	Sep 2009	Mar 2010	Sep 2010	Mar 2011
LHPMW108	26	10 U		0.5U			2.5 U		1.2U		3.0U	
LHPMW110	26	10 U		10U			5.0 U		6.0U		dry	
LHPMW111	26	4 U		0.5U			0.5 U		0.30U		dry	
LHPMW112	26	5 U		3U			2.0 U		0.30U		3.0U	
LHPMW133	26	1.08	1 U	1.09	0.5 U	0.5 U	0.5 U	0.47 J	0.32J	0.30U	0.32J	0.59
LHPMW134	26	0.708 J	1 U	0.949 J	0.5 U	0.5 U	0.829 J	0.40 J	0.30U	0.30U	0.45J	0.636

NOTES:
all units in µg/L

µg/L migrograms/liter
U undetected
J Present below normal reporting limit but greater than or equal to the MDL and the concentration is an approximate value.
L Result biased low.
MDL method detection limit

RAB Requested Changes to the Charter that cannot be incorporated due to regulations prescribed in the RAB Rule:

- Section 2- Cannot delete language stating RAB discussions are limited to environmental restoration activities at LHAAP. RAB Rule regulation clearly specifies RAB is only to discuss environmental restoration issues
- Section 3- Cannot reference other RAB guidance documents as a substitute to the RAB Rule- Must follow the Rule
- Section 4.3- RAB expert advises that it is a conflict of interest for Community Nominating Committee to nominate Community Co-Chair when the Community Co-Chair appointed the Nominating Committee- for that reason language should be left as Community Co-Chair is elected by a majority vote of the RAB community
- Section 4.4- RAB Membership Committee deleted, RAB expert advises that any nominations should be based on the majority opinion of all community RAB members- not select group
- Section 4.4- Must retain language that the BRAC Division Industrial Branch Chief will make the final judgment/selection for new member candidates- per the RAB Rule the installation retains ultimate decision making authority
- Section 4.6- Cannot add Community Co-Chair in decision to request member to resign- per the RAB Rule the Community Co-Chair does not have decision making authority
- Section 4.9- Deleted this section, RAB expert advises that any nominations should be based on the majority opinion of all community RAB members and avoid creating groups that could potentially take away the voice of other members
- Section 6- No revision- the RAB Rule clearly states that the responsible installation commander will have the authority to adjourn the RAB, with input from other agencies and interested parties

LONGHORN ARMY AMMUNTION PLANT (LHAAP)
RESTORATION ADVISORY BOARD

DRAFT
GUIDELINES AND OPERATING PROCEDURES

1. Mission Statement

The mission of the Longhorn Army Ammunition Plant Restoration Advisory Board, hereafter referred to as the RAB or Board, is to promote community awareness and obtain constructive community review and comments on DERA environmental restoration activities at the Longhorn Army Ammunition Plant.

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2. Purpose and Function

The purpose and function of the RAB is to:

- Act as a forum for the discussion and exchange of information about environmental restoration activities at LHAAP between agencies and the community (topics other than environmental restoration activities will be referred to the appropriate offices);
- Disseminate information about environmental restoration activities at LHAAP to the community;
- Ensure opinions about environmental restoration reflect the diverse interests within the community; and
- Provide an opportunity for stakeholders to review the progress and participate in a dialogue with the decision makers.

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The RAB discussions are limited to environmental restoration activities at the Longhorn Army Ammunition Plant. The RAB is not a replacement for other types of community outreach and participation required by law, regulation, or policy. All recommendations relating to environmental restoration activities at LHAAP provided by the RAB will be considered, including advice given that represents the minority view of members. Because the Department of Defense does not intend for Federal Advisory Committee Act (FACA) requirements to apply to RABs, consensus is not a prerequisite for RAB recommendations. Advice is provided by each individual rather than as a group.

3. Basis and Authority

The basis and authority for the RAB is the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), primarily Sections 120(a), 120(f), and 121(f) and 10 USC 2705 enacted by 211 of SARA. To the extent feasible, the activities of the RAB are to be conducted in accordance with the regulation~~guidance~~ prescribed~~stated~~ in the Restoration Advisory Board Rule ~~Handbook~~ issued by the Office of the Secretary of Defense, May~~February~~ 12, 2006~~7~~ and the Management Guidance for the Defense Environmental Restoration Program (DERP), September 2001 for any sites under DERP.

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4. Membership

4.1. Community Members

Community membership of the RAB is voluntary and shall adequately reflect the diverse community interests regarding the environmental restoration activities at LHAAP ~~Longhorn Army Ammunition Plant~~. Unless the RAB decides to change the balance and diversity of its initial membership (requires Board consensus), the RAB will consist of members who reside or who work in Harrison County and surrounding areas, and individuals and groups directly impacted and having a vested interest in the environmental restoration activities at Longhorn Army Ammunition Plant. Community interests may include, but are not limited to:

- local residents
- business community
- homeowners association
- ~~All~~ local environmental groups
- environmental justice groups (low income and minority groups)
- ~~All~~ local officials
- health officials
- ~~Interested community~~ senior citizens associations ~~and groups~~
- civic groups

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The RAB community membership will maintain diversity and balance in regard to gender, age, race /ethnicity, type of employment, neighborhood, expertise, income, and education levels. Members are expected to attend and actively participate in regular meetings and be prepared to comment on documents and proposals.

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4.2. Permanent Members

Permanent standing members of the RAB, not subject to rotation or term limits above, include representatives from the Army, U.S. EPA Region 6, and Texas Commission on Environmental Quality.

4.3 Appointment / Election of Board Officers

The RAB shall be co-chaired by the ~~Longhorn Army Ammunition Plant (~~LHAAP~~)~~ Site Manager, appointed by the Army, and a RAB community member. The Community Co-Chair shall be elected by a majority vote of the RAB community members. The Community Co-Chair may serve one or more terms, including consecutive terms, if approved by the RAB community members. The Community Co-Chair may choose to resign his or her chair without affecting his or her RAB

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membership. If the Community Co-Chair is unable to attend a RAB meeting, he or she will designate another community member of the RAB to carry out the Community Co-Chairs duties at that meeting. If the LHAAP Co-Chair is unable to attend a RAB meeting, he or she will designate someone to carry out the LHAAP Co-Chair's duties at that meeting.

4.4 Nomination and Selection of RAB Members

Candidates for new RAB members may be presented at any time by current RAB community members. ~~I~~individuals interested in participating in the RAB must submit a completed RAB Application Form to the Co-chairs~~LHAAP Site Manager (Army Co-chair)~~ in order to be eligible for selection. The community RAB members~~Membership Committee~~ may, by a two-thirds majority vote, nominate replacement and new RAB members. The BRAC Division Industrial Branch Chief will make the final judgment/selection based on the diversity of all candidates.

4.5 No Compensation

Members shall serve without compensation. All expenses incidental to travel and document review shall be borne by the respective members of their organizations.

4.6 Attendance

Members are expected to attend all RAB meetings. RAB members must be present to provide input~~vote~~ on any and all topics. If a member fails to attend two consecutive meetings, the LHAAP~~ or the Community~~ RAB Co-Chair may ask for justifications and may ask the member to resign.

4.7 Terms

Members of the RAB shall serve terms of two years or more, to be determined by the Board. To maintain a constructive dialogue, the total RAB membership should be limited, but the decision on any specific limits will be determined by the LHAAP RAB Co-Chair based on the need for appropriate representation and diversity.~~shall not exceed 15 community members. If membership reaches capacity a rotation will be implemented to allow new members to participate. The rotation would limit terms to two years. The RAB community membership rotation schedule shall maintain the balance and diversity necessary for a successful RAB.~~ This policy may~~will~~ be reviewed annually. Members of the RAB may choose to fill any vacancies as they occur, seeking candidates from the community as needed based on the process set forth in Sections 4.3 and 4.4.~~. A decision on the filling of vacancies should be made by the Membership Committee within 60 days, and selected in accordance with Section 4.4.~~

4.8 Resignation or Removal of Community Members

4.8.1. Any member who determines he or she is unable to continue to participate fully may submit a resignation in writing to either of the Board Co-Chairs. Resigning

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Comment [m1]: Removed one year term

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Comment [m2]: Removed language to replace half of RAB members each year

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members may nominate new members to replace them, and then chosen in accordance with section 4.4. New community membership must continue to reflect the diversity of community interests.

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4.8.2. The community RAB members in attendance may, by a two-thirds majority vote, remove a community member prior to the expiration of his or her term, if that person is determined to be ineffective or detrimental to the progress of the RAB. The vote to remove a community member shall be taken at the meeting following the one at which the removal was proposed.

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~~4.9 Membership Committee~~

~~The RAB Membership Committee shall be formed by RAB members at the time this charter is ratified. RAB members, by a two-thirds majority vote, will nominate and approve this committee which can be any size. Additions to this committee can be made at any time using the two-thirds majority voting process. Departing or resigning members will be replaced in accordance with section 4.7. Membership Committee members must be present at the RAB to cast a vote concerning membership.~~

5. STRUCURE AND OPERATING PROCEDURES

5.1 Meetings will be scheduled on a regular basis and will be open to the public. It is anticipated that meetings will be held on a quarterly basis or as needed. Each meeting will have a purpose and agenda. The agenda items will be compiled by the Co-Chairs. The LHAAP Co-Chair should coordinate with the Community Co-Chair and RAB community members to prepare an agenda prior to each RAB meeting. The development of the agenda should proceed as follows: ~~To encourage public attendance and RAB participation, meetings will be held at convenient times and locations. Meeting notice will be provided to the public.~~

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1) Members should suggest topics for the agenda at the meeting immediately prior to the meeting for which the agenda is developed. Topics for other future meetings can also be suggested at that time.
2) The Site Manager/Co-Chair shall prepare and provide a proposed meeting agenda to all RAB members at least two weeks prior to the meeting.
3) RAB members may request additional items they wish to include as soon as possible after receipt of the meeting agenda. The LHAAP Co-Chair will make every effort to include those items in the current agenda, or will make sure they are on the agenda for the next meeting. Any revisions to the agenda will be provided to all RAB members at least one week before the meeting, if possible.
4) The agenda for each meeting will include time for late-breaking news and, if time allows, for discussion of LHAAP environmental issues not included on the agenda, but of interest to RAB members. Other changes to the agenda may be made at the meeting due to time constraints or the necessity to provide time critical information.

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To encourage public attendance and RAB participation, meetings will be held at convenient times and locations. Meeting notice will be provided to all RAB members and the public by the LHAAP Co-Chair. Notice to non-RAB members shall be provided to anyone who asks to be on the mailing list, the Harrison County Judge, and to any grantee for a current EPA Technical Assistance Grant. Notice of the meeting and notice that it is a public meeting shall also be provided at the same time to the Marshall News Messenger.

5.2 The Longhorn Army Ammunition Plant Co-Chair will be responsible for notifying all members of scheduled meetings and providing logistical support.

5.3 The LHAAP Co-Chair will be responsible for preparing meeting minutes, including a list of attendees. Before the conclusion of the RAB meeting, the Co-Chairs will query members present for specific concerns and advisory comments. The concerns and comments will be set forth in the meeting minutes to include the RAB's desired methodology for a response. The concerns will remain as open items at following RAB meetings until the issues are resolved. Meeting minutes shall summarize the topics discussed at the RAB meetings; these will be concise summaries rather than verbatim transcripts to facilitate effective communication.

5.4 The meeting minutes will be reviewed by the RAB members and at the next scheduled RAB meeting, the Co-Chair(s) shall call for any corrections. The RAB will approve the minutes with the corrections noted.

5.4 The RAB shall develop, maintain, and use a mailing list of names and addresses of interested parties, who wish to receive information about environmental restoration activities at LHAAP. Information on RAB meetings and other RAB activities open to the public will be provided to the interested parties in a timely manner.

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5.5 Community members will be asked to review and comment on various environmental restoration documents. RAB members may~~should~~ submit written comments to the Community Co-Chair on the subject documents within the time frame specified. The Community Co-Chair shall consolidate comments from the RAB community members and provide them to the LHAAP Co-Chair. The LHAAP Co-Chair will ensure that a written response is provided to the RAB in a timely manner.

5.6 RAB members who desire to speak to the media should speak only on their own behalf. The official spokesperson(s) for the RAB are the Community and the LHAAP Co-Chairs. It is the responsibility of the Community and the LHAAP Co-Chairs to convey to the media ~~only~~ the facts of the environmental restoration activities ~~discussed~~ at the RAB. The c~~C~~ommunity RAB members may appoint a spokesperson ~~Co-Chair~~ to~~may~~ speak on behalf of the majority of members to the media ~~on behalf of the RAB members and may~~ to convey to the media ~~only~~ the opinions/concerns held by the majority of the RAB members. ~~If the community Co-Chair conveys to the~~

~~media opinions/concerns not held by the majority of the RAB, he/she is not speaking for the RAB, but is expressing a personal opinion.~~

5.7 Board members will not make personal attacks or derogatory remarks during the meetings. Repeated offenses will result in a recommendation for removal of the offending party from the RAB by the Co-Chairs.

5.8 Training may be available for RAB ~~and~~ community members when requested. The Co-Chairs~~LHAAP Site Manager~~ will provide information on what is expected of a RAB in accordance with the RAB Rule and to assist RAB members in gaining an understanding of LHAAP-specific environmental and health issues.

5.9 The RAB will explore all available avenues for resolving disputes. ~~In cases where communication becomes tangled and members doubt the sincerity of one another, the best solution is to discuss these concerns within the RAB.~~

5.10 Records of RAB activities, procedures, and meeting minutes shall be maintained in the Marshall Public Library.

6. RAB Adjournment

Appropriate circumstances for adjournment include program completion or inadequate sustained community interest. The LHAAP Co-Chair shall discuss potential adjournment and consider input from the Board and other stakeholders as appropriate prior to reaching a decision concerning RAB adjournment. If the RAB members decide they do not want to adjourn, the members may agree to decrease the frequency of RAB meetings rather than to adjourn. These guidelines shall expire without further action by the RAB or any other party upon the effective date of adjournment.

7. RAB Dissolution

Appropriate circumstances for dissolution are when a RAB is operating inefficiently or is not fulfilling its intended purpose. When this occurs, the BRAC Division Industrial Branch Chief will make a concerted attempt to resolve the issues that impact the RAB's effectiveness. If unsuccessful, the BRAC Division Industrial Branch Chief may elect to dissolve the RAB. In the event that the BRAC Division Industrial Branch Chief elects to dissolve the RAB, the BRAC Division Industrial Branch Chief shall follow steps outlined in section 10.7.5 of the Management Guidance for the DERP.

8. Effective Date

The effective date of these Guidelines shall be the date of approval by the Board and signed by the LHAAP Co-Chair and Community Co-Chair.

____________________ ___________
LHAAP Co-Chair Date

______________________ _____________
Community Co-Chair Date

00100209

Shaw® Shaw Environmental, Inc.

Date: June 30, 2011

Project No.:133363

TRANSMITTAL LETTER:

To: Mr. Aaron Williams

Address: US Army Corps of Engineers - Tulsa
CESWT-PP-M
1645 South 101st East Ave
Tulsa, Oklahoma 74128

Re: Final Munitions Constituents Data Summary Report for South Test Area/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R
Longhorn Army Ammunition Plant

Contract No. W912QR-04-D-0027/DS02

For: Review_____ As Requested_____ Approval_____ Corrections_____ Submittal_____ Other X____

Item No:	*No. of Copies*	*Date:*	*Document Title*
1	2	June 2011	**Final Munitions Constituents Data Summary Report for South Test/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R, Longhorn Army Ammunition Plant, Karnack, Texas**

Aaron,
Enclosed are two copies of the above-named document. Copies have been distributed as indicated below. Please call with any questions or comments.

Sincerely:

John Elliott
Project Manager

CC: **Distribution List:**
Mr. J. Lambert – USACE, Tulsa (sent to A. Williams for distribution)
Ms. M. Plitnik – USAEC
Ms. Rose Zeiler – BRAC-LHAAP
Mr. S. Tzhone – EPA Region 6 (2)
Ms. F. Duke– TCEQ, Austin (2)
Mr. D. Vodak– TCEQ, Tyler
Mr. P. Bruckwicki– U.S. Fish and Wildlife Service

1401 Enclave Parkway, Suite 250, Houston, Texas 77077 *Phone: (281) 531-3100/Fax: (281) 531-3136*

DEPARTMENT OF THE ARMY
LONGHORN ARMY AMMUNITION PLANT
POST OFFICE BOX 220
RATCLIFF, AR 72951

June 30, 2011

DAIM-ODB-LO

Ms. Fay Duke (MC-136)
SSDAT/Superfund Section
Remediation Division
Texas Commission on Environmental Quality
12100 Park 35 Circle, Bldg D
Austin, TX 78753

Re: Final Munitions Constituents Data Summary Report, South Test Area/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R
Longhorn Army Ammunition Plant, Karnack, Texas, June 2011
SUP 126

Dear Ms. Duke,

The above-referenced document is being transmitted to you for your records.

The point of contact for this action is the undersigned. I ask that John Elliott, Shaw's Project Manager be copied on any communications related to the project. I may be contacted at 479-635-0110, or by email at rose.zeiler@us.army.mil.

Sincerely,

Rose M. Zeiler

Rose M. Zeiler, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
S. Tzhone, USEPA Region 6, Dallas, TX
D. Vodak, TCEQ, Tyler, TX
P. Bruckwicki, Caddo Lake NWR, TX
J. Lambert, USACE, Tulsa District, OK
A. Williams, USACE, Tulsa District, OK
M. Plitnik, USAEC, TX
J. Elliott, Shaw, Houston, TX (for project files)

DEPARTMENT OF THE ARMY
LONGHORN ARMY AMMUNITION PLANT
POST OFFICE BOX 220
RATCLIFF, AR 72951

June 30, 2011

DAIM-ODB-LO

Mr. Stephen Tzhone
US Environmental Protection Agency
Superfund Division (6SF-AT)
1445 Ross Avenue
Dallas, TX 75202-2733

Re: Final Munitions Constituents Data Summary Report, South Test Area/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R
Longhorn Army Ammunition Plant, Karnack, Texas, June 2011

Dear Mr. Tzhone,

The above referenced document is being transmitted to you for your records.

The point of contact for this action is the undersigned. I ask that John Elliott, Shaw's Project Manager, be copied on any communications related to the project. I may be contacted at 479-635-0110, or by email at rose.zeiler@us.army.mil.

Sincerely,

Rose M. Zeiler

Rose M. Zeiler, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
F. Duke, TCEQ, Austin, TX
D. Vodak, TCEQ, Tyler, TX
P. Bruckwicki, Caddo Lake NWR, TX
J. Lambert, USACE, Tulsa District, OK
A. Williams, USACE, Tulsa District, OK
M. Plitnik, USAEC, TX
J. Elliott, Shaw – Houston, TX (for project files)

00100212

FINAL
MUNITIONS CONSTITUENTS DATA SUMMARY REPORT SOUTH TEST AREA/BOMB TEST AREA, LHAAP-001-R AND GROUND SIGNAL TEST AREA, LHAAP-003-R LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS

Prepared for

U.S. Army Corps of Engineers
Tulsa District
1645 South 101st Avenue
Tulsa, Oklahoma

Prepared by

Shaw Environmental, Inc.
1401 Enclave Parkway, Suite 250
Houston, Texas 77077

Contract No. W912BV-07-D-2004, Task Order No. 0007
Shaw Project No. 133363

June 2011

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Acronyms and Abbreviations

BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	chemical of potential concern
CSM	conceptual site model
DNT	dinitrotoluene
DOD	Department of Defense
e^2M	engineering-environmental Management
Ebasco	Ebasco Services, Inc.
EE/CA	Engineering Evaluation/Cost Analysis
EPS	Environmental Protection Systems, Inc.
GW-Ind	groundwater MSC for industrial use
GWP-Ind	soil MSC for industrial use based on groundwater protection
HMX	high-molecular-weight RDX
HRR	historic records review
HTRW	hazardous, toxic, and radioactive waste
IRP	Installation Restoration Program
LHAAP	Longhorn Army Ammunition Plant
MC	munitions constituents
MCL	maximum contaminant level
MEC	munitions and explosives of concern
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mm	millimeter
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting explosive hazard
MRS	Munitions Response Sites
MSC	medium-specific concentration
NFA	no further action
OB/OD	open burn/open detonation
PCB	polychlorinated biphenyls
RDX	royal demolition explosive (hexahydro-1,3,5-trinitro-1,3,5-triazine)
RI	remedial investigation
ROD	Record of Decision
SI	site inspection
STEP	Solutions to Environmental Problems

Acronyms and Abbreviations (continued)

SVOC	semivolatile organic compound
TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality
TNT	2,4,6-trinitrotoluene
USACE	U.S. Army Corps of Engineers
USAEC	U.S Army Environmental Center
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
WP	white phosphorus

1.0 Introduction

This Munitions Constituent (MC) data summary was prepared by Shaw Environmental, Inc. for the U.S. Army Corps of Engineers (USACE), Tulsa District, under Contract No. W912BV-07-D-2004, Task Order No. 0007, and presents a compilation of MC data from previous investigations at Munitions Response Sites (MRS) Site 27 – South Test Area/Bomb Test Area (LHAAP-001-R) and Site 54 – Ground Signal Test Area (LHAAP-003-R) at the former Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas (**Figure 1-1**). This MC data summary for LHAAP-001-R and LHAAP-003-R was developed in response to the regulatory request that all MC data collected for the two MRS sites be compiled in one stand alone document. This report was generated based on information presented in previous investigations. It is noted that the MC Summary resummarizes metals and explosives, as well as other constituent data that were used to characterize risk for the IRP No Further Action (NFA) Record of Decision (ROD) that was approved in 1998 for both sites. Although the non-MC data is not relevant to the MC data set, it is included here because it is not easily extracted from the original data sets and evaluations. Perchlorate data for environmental media were collected at the two sites after the 1998 ROD was signed.

Data summary tables from previous investigation reports are attached to this report. The following conservative comparison criteria were utilized for evaluation of the data:

- Soil and sediment: Texas Commission on Environmental Quality (TCEQ) soil medium-specific concentrations (MSC) for industrial use based on groundwater protection (GWP-Ind) values. The GWP-Ind values were utilized instead of the soil MSC as a more conservative comparison criteria.
- Groundwater: maximum contaminant levels (MCLs) and, where not available, TCEQ groundwater MSC for industrial use (GW-Ind)
- Surface water: MCLs and, where not available, Texas surface water quality standards since Caddo Lake is a drinking water source

Although this MC data summary confirms the determination of no risk to human health or the environment in soil as identified in the Engineering Evaluation/Cost Analysis (EE/CA) (CAPE, 2007), additional groundwater sampling conducted by EPA in 2009 resulted in some uncertainty with regard to MC in groundwater (USEPA, 2010). Both metals and perchlorate were detected above screening levels by EPA, although the single exceedance of the perchlorate GW-Ind in a well at LHAAP-001-R was not confirmed by U.S. Army's split sample result. USEPA, TCEQ, and U.S. Army have agreed to address the metals constituents in the groundwater as stated in the U.S. Army letter dated March 10, 2011 under the 1998 IRP RODs (U.S. Army, 2011, USEPA, 2011).

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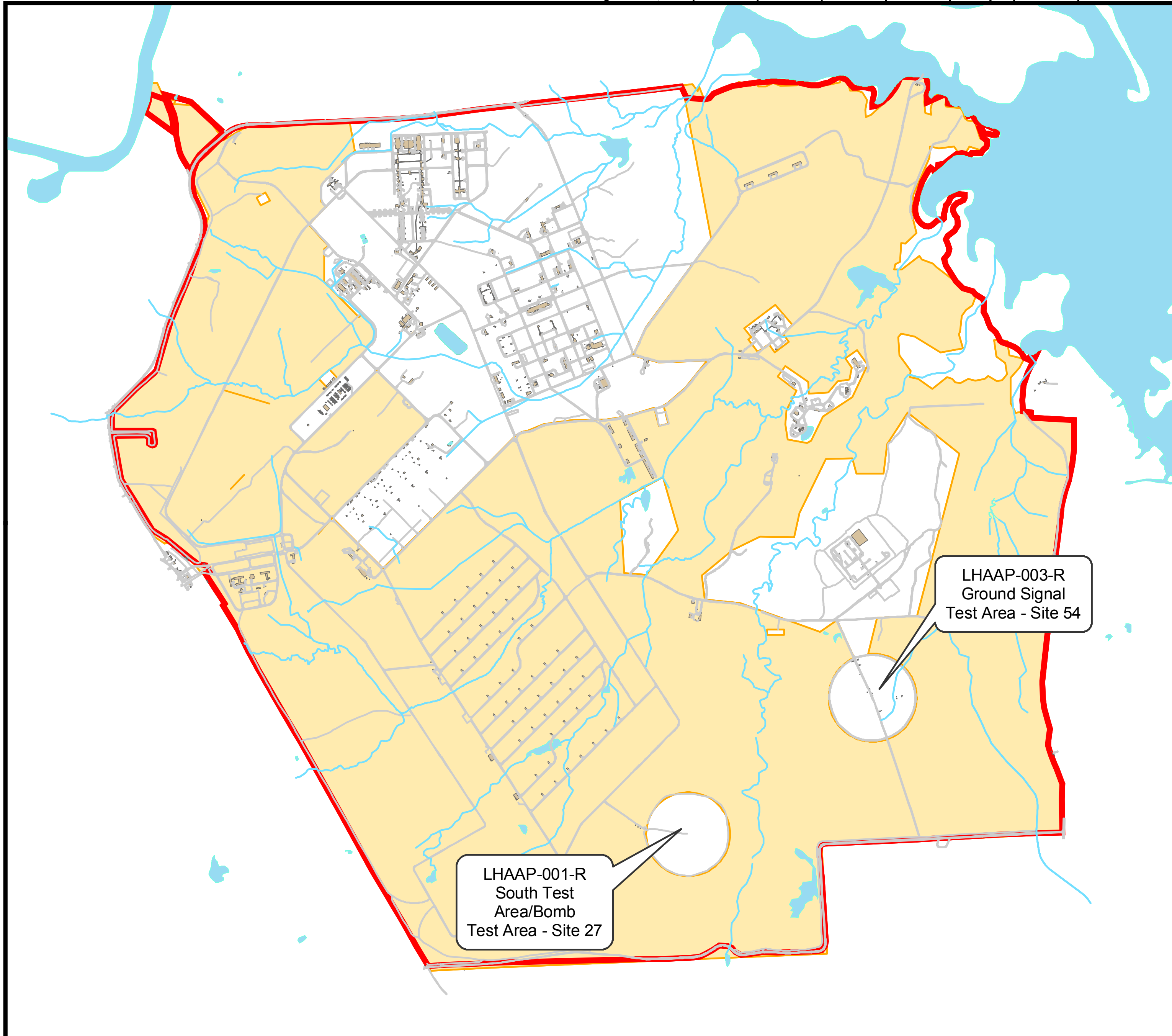

Legend

- Stream
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U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 1-1
MC DATA SUMMARY SITES
LHAAP-001-R and LHAAP-003-R

Longhorn Army Ammunition Plant
Karnack, Texas

2.0 The South Test Area/Bomb Test Area, LHAAP-001-R

2.1 Site Description and History

The Site 27 – South Test Area/Bomb Test Area (LHAAP-001-R) is approximately 79 acres and located southeast of Avenue P and the magazine area at the end of 70th Street, near the southern boundary of LHAAP (**Figure 1-1**). The site was identified in the U.S. Army Closed, Transferring, and Transferred Range/Site Inventory as 6.75 acres in size; however, a 1981 aerial photograph, historical records, a site visit, and a teleconference on 17 May and 18 May 2005 between USACE and U.S. Army Environmental Center (USAEC) indicate the site should be 79 acres including Demolition Sub Areas 1, 2 and 3.

The South Test Area/Bomb Test Area is co-located with the Installation Restoration Program (IRP) site LHAAP-27 for which a NFA ROD under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) for Hazardous, Toxic, and Radioactive Waste (HTRW) was signed with regulatory concurrence in January 1998 (USACE, 1998).

The South Test Area/Bomb Test Area site was constructed in 1954 and used by Universal Match Corporation for testing M120A1 photoflash bombs produced at the facility until about 1956. The bombs were tested by exploding them in the air over an elevated, semi-elliptical earthen test pad. Bombs awaiting testing were stored in three earth-covered concrete bunkers. The bombs tested were 150-pound M120/M120A photoflash bombs filled with photoflash powder and containing a black powder booster charge for bursting the bomb and a timed nose fuze.

During the late 1950s, illuminating signal devices were also demilitarized within pits excavated in the vicinity of the test pad at the site. During the early 1960s, leaking production items such as XM40E5 "button bombs" may have been demilitarized by detonation in the South Test Area/Bomb Test Area (LHAAP-001-R) or the Ground Signal Test Area (LHAAP-003-R). The XM40E5 was a small (approximately 1- by 1.25-inch) anti-intrusion mine also referred to as a "Gravel" Mine, which exploded on impact. Leaking white phosphorus (WP) munitions were disposed of in this area, although no primary source documentation concerning this effort was located. Occasional leaking WP munitions were burned at the site as a demilitarization activity. Other sources indicate that possibly 3- to 4-pound canisters of WP were demilitarized in the vicinity of the test pad. The 1984 LHAAP Contamination Survey (Environmental Protection Systems, Inc. [EPS], 1984) stated the area has been relatively inactive since the early 1960s and no disposal or testing activities were carried out in this area.

Based on the visual confirmation of Munitions and Explosives of Concern (MEC), the South Test Area/Bomb Test Area was identified as an MEC area of concern. Based on the potential presence of WP and to address the WP data gap, the South Test Area/Bomb Test Area was also identified as a MC area of concern.

2.2 Previous Environmental Investigations

Environmental media including soil, groundwater, surface water, and sediment have been sampled and analyzed to identify potential contamination, including site-related MC. Investigations were conducted during the environmental contamination survey, multiple phases of the remedial investigation (RI), basewide perchlorate investigation, contaminants investigation, site inspection (SI), and the EE/CA. The on-site sample locations are shown on **Figures 2-1** and **2-2**. **Tables 2-1, 2-2,** and **2-3** provide the maximum concentrations of contaminants in soil, groundwater, surface water, and sediment, respectively, at the site. Data summary tables from previous investigation reports are included in **Appendix A**. In response to U.S. Environmental Protection Agency's (USEPA) comments on the Draft MC Summary Report, tables listing all parameters analyzed for each previous sampling event, including associated analytical methods and detection limits, are also included in **Appendix A**.

2.2.1 Environmental Contamination Survey

In 1982, the site was investigated by EPS for U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) (EPS, 1984).

2.2.1.1 Soil Investigation

Three surface soil samples (0401, 0402, and 0403) were collected and analyzed for metals, explosives, and anions. Chromium and lead were detected at maximum concentrations of 16.3 and 26.3 milligrams per kilograms (mg/kg) which exceeds their GWP-Ind values of 10 and 1.5 mg/kg, respectively. All other metals were detected at concentrations lower than their respective GWP-Ind values and at levels similar to background values. 2,4,6- trinitrotoluene (TNT) was detected in the surface soil samples from locations 0401 and 0402 at concentrations of 10,150 and 4,610 micrograms per kilogram (µg/kg), respectively. The TNT concentration of 10,150 µg/kg at sample location 0401 exceeded the GWP-Ind value of 5,100 µg/kg. Reference **Appendix A**, Pages A-1 and A-2, Tables 11-1 and 11-1b, respectively.

2.2.1.2 Groundwater Investigation

Two monitoring wells (MW-131 and MW-132) were installed and groundwater samples were collected from the wells. The water samples from both wells were analyzed for metals, explosives, and anions. In addition, groundwater from well MW-131 was analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and pesticides. Except for cadmium and thallium, all other metals were detected at concentrations lower than their respective GW-Ind values or the MCLs. Cadmium and thallium were detected at maximum concentrations of 0.009 and 0.1 milligrams per liter (mg/L) above their MCL of 0.005 and

0.002 mg/L, respectively. Ethylene glycol and di-n-butylphthalate were the only SVOCs detected at concentrations of 24 and 52 micrograms per liter (µg/L), respectively, in well MW-131. Both detected SVOCs were below their respective GW-Ind values. Phthalates are a common laboratory contaminant. No VOCs or explosives were detected. Reference **Appendix A**, Pages A-17 and A-18 through A-21, Tables 11-6 and 11-6b, respectively.

2.2.2 Phase I Remedial Investigation

In 1993, Ebasco Services, Inc. (Ebasco), completed a Phase I RI. Soil, groundwater, surface water, and sediment samples were collected during the RI activities (Ebasco, 1993).

2.2.2.1 Soil Investigation

Ten borings, 27SB30 through 27SB39, were completed at the site and 20 soil samples were collected from the borings. Soil samples were collected from several depth intervals ranging from the surface to 8 feet below the ground surface (bgs). In addition, four surface soil samples (SS01 through SS04) were collected from the four cratered areas west of the test pad to identify contaminants from detonated explosives. All soil samples were analyzed for metals, VOCs, SVOCs, explosives, and anions. Additionally, samples from six borings were analyzed for pesticides and herbicides.

Soil analytical results indicated that three metals; arsenic, chromium, and lead at maximum concentrations of 2.3, 22.2, and 9 mg/kg were detected in soil samples at above their respective GWP-Ind values of 1, 10, and 1.5 mg/kg, respectively. Except for two phthalates; bis(2-ethylhexyl)phthalate and di-n-butylphthalate detected in a few soil samples and at concentrations that were lower than their respective GWP-Ind values, no other SVOCs were detected. Phthalates are a common laboratory contaminant. No VOCs, explosives, pesticides, or herbicides were detected. Reference **Appendix A**, Pages A-4 through A-8 and A-9 through A-11, Tables 11-2 and 11-2b, respectively.

2.2.2.2 Groundwater Investigation

Groundwater samples were collected from existing monitoring wells MW-131 and MW-132. Groundwater from the wells was analyzed for metals, VOCs, SVOCs, explosives, and anions. Groundwater analytical results indicated that barium was the only metal detected at 0.25 mg/L. This concentration is well below the barium MCL of 2 mg/L. No VOCs, SVOCs, or explosives were detected. Reference **Appendix A**, Pages A-17 and A-18 through A-21, Tables 11-6 and 11-6b, respectively.

In addition, ten groundwater grab samples (27GG30 through 27GG39) were collected from the soil borings. Samples were collected from the borings to obtain preliminary field screening data for potential contaminants in groundwater underlying the site. Groundwater grab samples were analyzed for explosives, anions, total organic halogens, and total organic carbon. Analytical results indicated that nitrobenzene and royal demolition explosive [(hexahydro-1,3,5-trinitro-1,3,5-triazine) (RDX)] at concentrations of 6.58 and 18.4 µg/L, respectively, were detected in sample 27GG33, collected from the boring located in the cratered hillocks west of the test pad. Both nitrobenzene and RDX were detected at concentrations that were below their respective GW-Ind values of 51.1 and 3,100 µg/L, respectively. Reference **Appendix A**, Page A-22, Paragraph 1.

2.2.2.3 Surface Water and Sediment Investigation

Four surface water and four sediment samples were collected from site drainage ditch locations (SW/SD03 and SW/SD04) (**Figure 2-1**) and Harrison Bayou (SW/SD02 and SW/SD05) (**Figure 2-2**). Surface water and sediment samples were analyzed for metals, VOCs, SVOCs, explosives, and anions. Results indicated that metals were detected sporadically in both surface water and sediment samples. The two metals detected in surface water, barium and lead, were both at concentrations that were below comparison criteria. Out of the seven metals detected in sediment samples, only three metals: arsenic, barium, and lead were detected at maximum concentrations of 1.1, 254, and 9 mg/kg that were above their respective GWP-Ind values of 1, 200, and 1.5 mg/kg, respectively. Except for di-n-butylphthalate in two of the sediment samples at concentrations lower than the GWP-Ind, all other SVOCs were below detection limits in both surface water and sediment samples. Phthalates are a common laboratory contaminant. No VOCs or explosives were detected in surface water and sediment samples. Reference **Appendix A**, Pages A-24, A-25 through A-27, A-28, and A-29 through A-31, Tables 11-8, 11-8b, 11-9, and 11-9b, respectively.

2.2.3 Phase II Remedial Investigation

In 1994, Sverdrup completed a Phase II RI. Soil and groundwater samples were collected from the site (Sverdrup, 1995).

2.2.3.1 Soil Investigation

Because explosives were detected in a groundwater grab sample from boring 27SB33, four additional soil borings were installed in the vicinity and completed as monitoring wells (27WW01 through 27WW04). A total of 12 soil samples were collected from the soil borings. Soil samples were analyzed for metals, explosives, and anions. Arsenic, barium, chromium, and lead were detected at maximum concentrations of 5.2, 639, 15.4, and 12.6 mg/kg that were above their respective GWP-Ind values of 1, 200, 10, and 1.5 mg/kg, respectively. No explosives were detected. In addition, three surface soil samples (27SS21, 27SS22, and 27SS23) were collected and analyzed for chromium and mercury. Only chromium was detected at a maximum concentration of 10.6 mg/kg (27SS21), slightly above the GWP-Ind value of 10 mg/kg in the surface soil samples. Reference **Appendix A**, Pages A-12, A-13, and A-14, Tables 11-3, 11-4 and 11-4b, respectively.

2.2.3.2 Groundwater Investigation

Groundwater samples were collected from each of the newly installed monitoring wells. The water samples were analyzed for metals, SVOCs, explosives, and anions. All metals were detected at concentrations below their respective MCLs. No explosives or SVOCs were detected. Reference **Appendix A**, Pages A-22 and A-23, Tables 11-7 and 11-7b, respectively.

2.2.4 Risk Assessment

In 1997 USACE conducted a baseline risk assessment to support site management decisions for the site. Potential human health and ecological impacts resulting from contaminant releases at the site in the absence of remediation were evaluated. Chemicals of potential concern (COPCs) evaluated included metals present in both site soils and ditch sediments. COPCs in groundwater included metals within background ranges and below drinking water standards except for nickel that exceeded its MCL. No organics were detected in any medium at the site. For human health evaluation, carcinogenic risk estimates were well within the acceptable range at 1×10^{-7} and 3×10^{-5} for current recreational and future industrial land uses, respectively. Non-cancer hazard indices were below the critical value of 1.0 at 1×10^{-2} (current land use) and 6×10^{-1} (future industrial land use). Despite elevated concentrations of nickel in groundwater, exposure to this metal via groundwater ingestion was a minor contributor to overall non-carcinogenic risk (hazard quotient of 0.13). Based on these results, no unacceptable risks to human health were identified for the South Test Area/Bomb Test Area (USACE, 1997).

Screening-level ecological risks for the site were driven solely by metals present in soil at concentrations approximating background values. Four metals: barium, chromium, lead, and nickel were identified as main contributors to screening level risk estimates. Based on these conservative analyses, no ecological concerns were associated with the site and further ecological evaluations and remediation are unwarranted.

2.2.4.1 Supplemental Soil Sampling and Risk Characterization

In August 1996, the USACE collected surface soil samples from nine locations (RASS27-01 through RASS27-09) in support of the risk assessment for the site. The nine surface soil samples were collected from an elevated “pad” area formerly used in testing photo flash bombs at the site. The area covers approximately one-third of an acre and is located in the vicinity of former soil boring 0402 (**Figure 2-1**). As the area represents a potential location for accumulation of surface contaminants, the primary objective was to evaluate this limited area as a potential “hot spot” for human exposure and to evaluate the potential for explosives, in particular TNT, in surface soils at this location. Additionally, these samples were collected to evaluate the similarity between chemical concentrations in 0- to 6-inch-soil-depths and slightly deeper depths utilized in original risk evaluations and expansions of the numbers of metals used in risk characterization. The soil samples were analyzed for explosives including 2,4,6-TNT. In addition, samples from four locations (RASS27-02, RASS27-04, RASS27-06, and RASS27-08) were analyzed for 11 metals (arsenic, barium, cadmium, chromium, lead, mercury, nickel, selenium, silver, antimony, and thallium). In February 1997, surface soil samples were collected at the four locations (RASS27-02, RASS27-04, RASS27-06, and RASS27-08) and analyzed for 12 metals (aluminum, beryllium, calcium, cobalt, copper, iron, potassium, manganese, magnesium, strontium, vanadium and zinc). The sampling was initiated to support additional human health risk characterization for a limited area identified during the original risk assessment results as a potential "hot spot" area for human exposure.

Soil analytical results (**Appendix A**, Page A-44, Table 4A-1) indicated that metals including arsenic (13.1 mg/kg), beryllium (1.16 mg/kg), and chromium (36.3 mg/kg) were detected at concentrations that were generally higher than those of previous sampling events and above their respective GWP-Ind values, while barium (123 mg/kg) and nickel (2.41 mg/kg) levels were lower than those of previous sampling events and lower than their respective GWP-Ind values of 200 and 204.4 mg/kg, respectively. Vanadium was detected at a maximum concentration of 72.4 mg/kg, slightly above the GWP-Ind value of 72 mg/kg. No explosive compounds were detected in any soil samples from the area. Reference **Appendix A**, Pages A-15 and A-16, Tables 11-5 and 11-5b, respectively.

While risk calculations based on the additional sampling at the limited site area were higher than original estimates for the site as a whole, all estimates were within acceptable risk ranges. For human health evaluation, carcinogenic risk estimates of 3×10^{-6} and 5×10^{-5} were obtained for current recreational and future industrial land uses, respectively. Non-cancer hazard indices were below the critical value of 1.0 at 9×10^{-2} (current land use) and 9×10^{-1} (future industrial land use). The additional risk evaluation substantiated conclusions of the original assessment and failed to support the need for site remediation for protection of human health (USACE, 1997).

Based on the results of the investigations and the risk assessment, a no further action ROD under CERCLA for HTRW was signed with regulatory concurrence in January of 1998 for LHAAP-001-R.

2.2.5 Perchlorate Investigation

2.2.5.1 Soil

In May and October 2000, a total of 26 soil samples were collected from 13 soil borings (27SB01 through 27SB13) and analyzed for perchlorate (Solutions to Environmental Problems [STEP], 2005). Two samples were collected from each boring from two depth intervals: 0 to 0.5 feet and 1 to 2 feet bgs. Perchlorate was detected in only one of the 26 soil samples at a concentration of 28.9 µg/kg, a level lower than the GWP-Ind value of 7,200 µg/kg. Reference **Appendix A**, Pages A-32 and A-34, Tables 1-17 and 1-18b, respectively.

2.2.5.2 Groundwater

During three consecutive quarterly sampling events, groundwater samples were collected from existing shallow monitoring wells to determine whether perchlorate contamination had occurred in the underlying groundwater as a result of past historical activities. The six monitoring wells are located in areas with the highest potential for impact from site activities and in the direction of flow across the site from west to east toward Harrison Bayou. During the first quarter (April to May 2000), four groundwater samples were collected from four existing monitoring wells (MW-131, MW-132, 27WW01, 27WW04). Perchlorate was detected in two of the wells, 27WW01 and 27WW04 at concentrations of 52.6 and 16.4 µg/L, respectively. Both levels were below the GW-Ind value of 72 µg/L. No MCL exists for perchlorate. Perchlorate concentrations were below detection limits in all the six monitoring wells sampled during the second quarter (August through October 2000). During the third quarter, January through February 2001, perchlorate was not detected in the groundwater samples collected from three sampled wells, MW-131, 27WW01, and 27WW04. Reference **Appendix A**, Pages A-33 and A-34, Tables 1-18 and 1-18b, respectively.

2.2.6 U.S. Fish and Wildlife Investigation

In March 2003, U.S. Fish and Wildlife Service (USFWS) conducted an investigation at the former LHAAP facility to determine contaminant levels in soil and sediment (USFWS, 2003). Soil samples were collected from five locations (FWS-55, FWS-56, FWS-58, FWS-63, and FWS-201) within the South Test Area/Bomb Test Area. Soil analytical results indicated that metals and SVOCs were detected at low concentrations, and the site was not included as one of the areas requiring further evaluation. Perchlorate was not detected above the reporting limit. Reference **Appendix A**, Pages A-35 through A-37 and A-38 through A-43, Tables 2 and 2b, respectively.

2.2.7 Military Munitions Response Program Site Inspection

Between 2002 and 2004, a Military Munitions Response Program (MMRP) SI was conducted for the South Test Area/Bomb Test Area to determine the presence or absence of MEC and/or MC at the site which may have remained from activities conducted by the Department of Defense (DOD) during operations of the MRS, and may pose a threat to human health and/or the environment (engineering-environmental Management [e^2M], 2005).

Results of the historical records review (HRR) and a visual site inspection verified MEC presence at the site. Possible sources areas for MEC and MC identified during the SI included the following:

- Testing areas associated with the various suspected ordnance types.

- A Demolition Area located within the footprint of the South Test Area/Bomb Test Area. This area was reportedly designed for detonation of dangerous/unserviceable ammunition.
- Spent flares, a 155 millimeter (mm) WP projectile, shrapnel from photoflash bombs, and ordnance related scrap found on the site during site visits.

The SI identified a data gap in earlier soil sampling in that although demilitarization activities including open pit burning and explosive detonation were conducted at the site, no analysis for the munitions constituent WP was performed at the site. The SI recommended that further investigation be conducted to address the identified data gap.

2.2.8 Engineering Evaluation/Cost Analysis

In 2007, an EE/CA was conducted to facilitate completion of a non-time critical removal action of MEC at the site (CAPE, 2007). Field activities conducted during the EE/CA characterized MEC and addressed the MC data gaps at the site. Soil samples were collected within the South Test Area/Bomb Test Area to determine if evidence of WP existed, and to determine the presence of MC in areas where MC was most likely to exist based on the heaviest Material Potentially Presenting Explosive Hazard (MPPEH) concentrations or historical detonations. One soil sample was collected near the center of the open burn/open detonation area. A second soil sample was collected in a scarred area identified as the photo flash cartridge disposal area in the historical review. Both areas are located near locations where MPPEH items were recovered during the field investigations. In addition, pre- and post-detonation samples were collected in association with explosive demolition of MPPEH recovered during the field activities. Soil samples were collected from 0 to 6-inches bgs. Analytical results indicated that no WP and MC constituents (1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4,6-TNT, 2,4-dinitrotoluene [DNT], 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-DNT, 4-nitrotoluene, high-molecular-weight RDX [HMX], nitrobenzene, RDX, and tetryl) were identified at concentrations above detection limits in any soil samples at the site. In addition, there was no indication of the presence of MC in any of the pre- or post-detonation samples. The removal action objective of protection of human health from MC at unacceptable concentrations had been achieved as demonstrated by the soil analytical results. Reference **Appendix A**, Page A-45, Table 3.

2.2.9 October 2009 Groundwater Confirmation Sampling

2.2.9.1 USEPA Region 6 Confirmation Sampling

In October 2009, USEPA collected additional groundwater samples from the existing six monitoring wells (MW-131, MW-132, 27WW01 through 27WW04) to confirm groundwater conditions at the site. The groundwater was analyzed for metals, explosives and perchlorate. Groundwater analytical results indicated that except for 2-amino-4,6-DNT, no other explosives were detected in the groundwater samples. 2-amino-4,6-DNT was detected in monitoring well 27WW04 at a concentration of 0.14J µg/L, which is well below the GW-Ind value of 17.03 µg/L. Perchlorate was detected in three wells, MW-132, 27WW02, and 27WW03 at concentrations of 2.6, 3.2, and 76 µg/L, respectively. Perchlorate detected in monitoring well 27WW03 was slightly above the GW-Ind value of 72 µg/L.

Except for beryllium, chromium, and manganese, all other metals were detected at concentrations lower than their respective MCLs or GW-Ind values. Beryllium was detected at concentrations of 0.00454 mg/L in well 27WW02 and 0.0251 mg/L in well 27WW03 and chromium was detected at a concentration of 0.122 mg/L in well 27WW02 above their respective MCLs of 0.004 and 0.1 mg/L, respectively. Manganese was detected at a concentration of 24.8 mg/L in well 27WW03 above the GW-Ind value of 14.3 mg/L. Reference **Appendix A**, Pages A-46 through A-47 and A-48, Tables A-1 and A-1b, respectively.

2.2.9.2 U.S. Army Confirmation Split Sampling

The U.S. Army collected split samples at the same time that the USEPA collected additional groundwater samples from the existing six monitoring wells (MW-131, MW-132, and 27WW01 through 27WW04). The groundwater was analyzed for metals, explosives and perchlorate. Groundwater analytical results indicated that no explosives were detected in any of the groundwater samples. Perchlorate was detected in two of the wells, 27WW02 and 27WW03, at concentrations of 3.4 and 50 µg/L, respectively. Both levels were below the GW-Ind value of 72 µg/L.

Except for beryllium, chromium, and manganese, all other metals were detected at concentrations lower than their respective MCLs or GW-Ind values. Beryllium and chromium were detected at concentrations of 0.0194 in well 27WW03 and 0.119 mg/L in well 27WW02 above their MCLs of 0.004 and 0.1 mg/L, respectively. Manganese was detected at a concentration of 27.9 mg/L in well 27WW03 above the GW-Ind value of 14.3 mg/L. Reference **Appendix A**, Pages A-49 through A-50 and A-51, Tables A-2 and A-2b, respectively.

USEPA Region 6 groundwater confirmation analytical results were comparable to the U.S. Army split sample results. Although the USEPA detected one explosive in one groundwater sample, whereas the U.S. Army did not, the explosive was at an estimated concentration that was well below its GW-Ind value. The three metals that were detected at concentrations above their respective MCLs or GW-Ind values were detected by both USEPA and U.S. Army in the same wells and at comparable concentrations. Perchlorate was also detected at comparable concentrations in both USEPA and U.S. Army samples.

2.3 Media Investigation Summary and Contaminant Assessment

Data presented in previous investigations and the risk assessment for the site indicate that compounds detected in soil, groundwater, surface water, and sediment pose no risk to human health or the environment.

2.3.1 Soil

Between 1982 and 2003 a total of 86 surface and subsurface soil samples were collected for characterization of constituents of concern in the soil at the site. Samples were collected from all areas of the site with special emphasis on likely source areas; the open pit burning and explosive detonation area and the test pad area formerly used in testing photo flash bombs. Eight metals including aluminum (10,300 mg/kg), arsenic (13.1 mg/kg), barium (639 mg/kg), beryllium (1.16 mg/kg), cadmium (21 mg/kg), chromium (36.3 mg/kg), lead (26.3 mg/kg), and vanadium (72.4 mg/kg) were detected at levels above their respective GWP-Ind values, all other metals were detected at concentrations below their GWP-Ind values and approximating background values. Despite the common detection of metals during the multiple sampling events, none of the metals was determined to have an unacceptable risk to human health or the environment.

Although in 1982, 2,4,6-TNT was detected in two surface soil samples, no explosives were detected in any of the surface or subsurface soil samples collected in subsequent multiple sampling events at the site. The presence of explosives, the most likely contaminant at the site was not confirmed.

Except for the detection of bis(2-ethyhexyl)phthalate and di-n-butyl phthalate in a limited number of soil samples, and at concentrations lower than GWP-Ind values, other SVOCs were not detected in soil samples. Phthalates are common plasticizers, and a common laboratory contaminant. No VOCs, pesticides, or herbicides were detected.

Eighteen of the surface soil samples (0 to 0.5 feet) and 13 subsurface soil samples (1 to 2 feet) were analyzed for perchlorate at the 18 locations indicated on **Figure 2-1**. The sample locations are spread across the entire site. Perchlorate was detected in one of the 31 samples. The concentration was 28.9 µg/kg, well below the GWP-Ind value of 7,200 µg/kg.

An additional two soil samples were collected during the EE/CA field activities (2006) to determine the presence of WP and if MC existed in areas where MC was likely to exist based on heaviest MPPEH: near the center of the open burn/open detonation area and a scarred area previously noted as photo flash cartridge disposal area. No WP or MC was identified in the soil samples and there was no indication of the presence of MC in any pre- or post-detonation samples.

Table 2-4 presents the media investigation summary including the number of soil samples collected during each sampling event.

2.3.2 Groundwater

From 1982 through 2001, a total of 24 groundwater samples were collected from monitoring wells and an additional 10 water samples were grab samples collected from soil borings installed at the site for identification of constituents of concern in the underlying groundwater. Groundwater analytical results from multiple sampling events indicated that cadmium and thallium, were the only metals detected above their MCLs. Despite the common detection of metals during the multiple sampling events, none of the metals was determined to have an unacceptable risk to human health or the environment.

In October 2009, groundwater samples were collected from six monitoring wells by both the USEPA and the U.S. Army for confirmation of groundwater conditions at the site. Initial detections of cadmium and thallium above their MCLs were not confirmed by the sampling. Except for beryllium, chromium and manganese, all the other metals were detected at concentrations below their respective MCLs or GW-Ind values.

Except for a single detection each of ethylene glycol and di-n-butyl phthalate during the initial sampling event in 1982, there were no detections of VOCs or SVOCs in groundwater samples in subsequent sampling events. Phthalates are a common laboratory contaminant. No pesticides were detected.

In 1993, explosives nitrobenzene, and RDX, were detected in one groundwater grab sample collected from a boring located west of the test pad, but at levels below their respective GW-Ind values. To further investigate the potential for explosive contamination in the area, four wells were installed and sampled. No explosives were detected in any soil or groundwater samples collected from the newly installed wells.

The USEPA groundwater confirmation sampling detected the presence of 2-amino-4,6-DNT in only one well at a concentration of 0.14 J µg/L, well below the GW-Ind value of 17.03 µg/L. No explosives were detected in any of the six U.S. Army split samples. Reference **Appendix A**, Pages A-49 and A-50, Table A-2. Both the previous and the October 2009 data indicate that explosives, the most likely contaminants at the site, are not of concern in the South Test Area/Bomb Test Area.

Sixteen of the groundwater samples were collected from 6 wells from April 2000 through February 2001. Perchlorate was detected in two of four wells during the first quarter sampling event, with a maximum concentration of 52.6 µg/L, below the GW-Ind value of 72 µg/L. The initial detections of perchlorate in groundwater were not confirmed in subsequent sampling. During the second and third quarter sampling events, no perchlorate was detected in any of the samples. Perchlorate was also not detected in October 2009 in the two wells with perchlorate detections in the April-May 2000 first quarter sampling event.

Perchlorate was detected in three of the wells during the October 2009 sampling event. In monitoring well 27WW03, the USEPA analytical results indicated that perchlorate was detected at a concentration of 76 µg/L, slightly above the GW-Ind value of 72 µg/L. The U.S. Army analytical results indicated that perchlorate was detected in the same monitoring well (27WW03) at a concentration of 50 µg/L, a level below the GW-Ind value of 72 µg/L.

Table 2-4 presents the media investigation summary including the number of groundwater samples collected during each sampling event.

2.3.3 Surface Water and Sediment

A total of four surface water and four sediment samples were collected from drainage ditch locations and Harrison Bayou. Metals were detected sporadically in both surface water and sediment samples. All metals were below comparison criteria in surface water. Except for arsenic, barium, and lead that were detected in sediment samples at concentrations above their respective GWP-Ind, other metals were detected at low concentrations approximating background values. Except for di-n-butylphthalate in two of the sediment samples and at concentrations below comparison criteria, all other SVOCs were below detection limits in both surface water and sediment samples. Phthalates are a common laboratory contaminant. No VOCs or explosives were detected in surface water or sediment samples.

Table 2-4 presents the media investigation summary including the number of surface and sediment samples collected during the RI. Summary results from the Final Installation-Wide Baseline Ecological Risk Assessment (BERA) (Shaw, 2007) indicated that perchlorate was not selected as a final constituent of potential ecological concern because all estimated receptor ecological effects quotient were less than 1 and there was no evidence of a perchlorate source area.

2.4 Conclusion

With the exception of the 2009 EPA groundwater sampling, the results of the multiple investigations presented above indicated that no contaminants of concern were identified in soil, groundwater, surface water, and sediments at the site. The human health risk assessment evaluation of potential migration pathways for potential receptors indicated that carcinogenic risk estimates were within the acceptable range at 1×10^{-7} and 3×10^{-5} for current recreational and future industrial land uses, respectively. Non-cancer hazard indices were below the critical value of 1.0 at 1×10^{-2} (current land use) and 6×10^{-1} (future industrial land use). Based on the evaluation, no unacceptable risks to human health were identified for the site. The screening-level ecological risk evaluation indicated that there are no ecological concerns associated with the site and that further evaluations and remediation are unwarranted. Summary results from the Final Installation-Wide BERA (Shaw, 2007) indicated that perchlorate was not selected as a final constituent of potential ecological concern because all estimated receptor ecological effects quotient were less than 1 and there was no evidence of a perchlorate source area. In addition, no WP or MC was identified in any soil samples and there was no indication of the presence of MC in any pre- or post-detonation samples. Results from the October 2009 confirmation sampling, further confirms that explosives are not a concern at the site. Therefore, this MC data summary confirms the determination of no risk to human health or the environment as identified in the EE/CA for the South Test Area/Bomb Test Area, LHAAP-001-R.

For perchlorate, the soil data is spread across the entire site. Perchlorate was detected in one of 31 samples, at a concentration of 28.9 µg/kg, well below the GWP-Ind value of 7,200 µg/kg. The groundwater data was collected from 6 locations that characterize the flow in and from the area of highest potential impact. A total of 16 groundwater samples were collected from 6 wells from April 2000 through February 2001. Two initial detections of perchlorate (27WW01 and 27WW04), both below the GW-Ind value of 72 µg/L, were not confirmed in the subsequent sampling events nor during the October 2009 USEPA and U.S. Army confirmation sampling event. Perchlorate was detected in three other monitoring wells (MW-132, 27WW02, and 27WW03) during the October 2009 sampling event. In two of the monitoring wells (MW-132 and 27WW02) perchlorate was at concentrations well below the GW-Ind value. In the third monitoring well (27WW03), the USEPA analytical results indicated that perchlorate was detected at a concentration of 76 µg/L slightly above the GW-Ind value of 72 µg/L. The USEPA detection was an estimated value from a diluted sample and elevated reporting limit using analytical method 314 (ion chromatography). For the same monitoring well, the U.S. Army split sample results indicated that perchlorate was at a concentration of 50 µg/L, a level below the GW-Ind value of 72 µg/L. The U.S. Army used analytical method 6850 for detection of perchlorate in this well which is the preferred method due to mass spectrometry's superior selectivity for the perchlorate ion. The U.S. Army result reflects closely previous detected levels for the site. Historically, the maximum detected perchlorate concentration at the site was 52.6 µg/L in well 27WW01 which is comparable to the level detected in monitoring well 27WW03. During the August-October 2000 sampling event, perchlorate was below the detection limit in monitoring well 27WW03. No well has seen repeat detections of perchlorate at the site. The two monitoring wells that have had the highest detections of perchlorate, 27WW01 and 27WW03 at 56.2 and 50 µg/L, respectively, are the farthest up-gradient wells within the open burn/open detonation (OB/OD) area. The wells 27WW02 and 27WW04, that are located down-gradient (north-northeast of 27WW01 and 27WW03), have been with no detection of perchlorate with the exception of one detection each at 3.4 µg/L (2009) and 16.4 µg/L (2000), respectively.

All previous soil data from across the site indicate that there is no known source of perchlorate in soil and therefore, there is no potential source of perchlorate contamination to the underlying groundwater. Furthermore, historical data trends show that the previous groundwater perchlorate detections were not duplicated in the same wells by subsequent sampling, indicating that the detections are single isolated occurrences. The single exceedance of the GW-Ind of 72 µg/L was an estimated result from a diluted sample and was not confirmed by U.S. Army's split sample result. U.S. Army's data support the conclusion that perchlorate is not a contaminant of concern at the South Test Area/Bomb Test Area. However, to address the uncertainty arising from the exceedance of the perchlorate GW-Ind in 27WW03 in USEPA's data set, it is recommended that limited sampling for perchlorate be conducted. USEPA, TCEQ. and U.S. Army have agreed to address the 2009 metals exceedances in the groundwater under a path separate from the MMRP. U.S. Army will address the metals constituents in the groundwater as stated in the U.S. Army letter dated March 10, 2011 under the 1998 IRP ROD (U.S. Army, 2011).

Table 2-1
Summary of Detected Constituents in Soil
South Test Area/Bomb Test Area, LHAAP-001-R

Analyte Detected	Maximum Concentration	TCEQ GWP-Ind
SVOCs (µg/kg)		
Di-n-butylphthalate *	2,610	1,000,000
Bis(2-ethylhexyl)phthalate *	380	600
Explosives (µg/kg)		
2,4,6-TNT	10,150	5,100
Metals (mg/kg)		
Aluminum	10,300	10,220
Arsenic	13.1	1
Barium	639	200
Beryllium	1.16	0.4
Cadmium	21	0.5
Calcium	809	NA
Chromium	36.3	10
Copper	41.1	130
Iron	70,000	NA
Lead	26.3	1.5
Magnesium	635	NA
Manganese	223	1431
Mercury	0.08	0.2
Nickel	18.6	204.4
Potassium	513	NA
Selenium	0.83	5
Strontium	16.8	6132
Vanadium	72.4	72
Zinc	41.3	3066
Perchlorate (µg/kg)	28.9	7200

Notes and Abbreviations:

*common laboratory contaminant

GWP-Ind - soil MSC for industrial use based on groundwater protection

mg/kg - milligrams per kilogram

NA - Not Available

SVOC - semivolatile organic compound

TCEQ - Texas Commission on Environmental Quality

TNT - trinitrotoluene

µg/kg - micrograms per kilogram

Table 2-2
Summary of Detected Constituents in Groundwater
South Test Area/Bomb Test Area, LHAAP-001-R

Analyte Detected	Maximum Concentration		TCEQ GW-Ind	MCL
	US Army	USEPA		
VOCs (µg/L)				
Ethylene glycol	24		204,400	
SVOC (µg/L)				
Di-n-butylphthalate *	52		10,220	
Explosives (µg/L)				
Nitrobenzene**	6.58		51.1	
RDX**	18.4		3100	
2- Amino-4,6-dinitrotoluene		0.14 J	17.03	
Metals (mg/L)				
Aluminum	7.32		102.2	
Antimony		0.000134 J		0.006
Arsenic	0.006			0.01
Barium	0.25			2
Berryllium	0.0194	0.0251		0.004
Cadmium	0.009			0.005
Chromium	0.119	0.122		0.1
Cobalt	1.17		6.132	
Copper	0.0108			1.3
Lead	0.016			0.015
Manganese	27.9		14.3	
Nickel	0.49		2.044	
Selenium	0.00692			0.5
Silver		0.000289	0.511	
Strontium	2.64		61.32	
Thallium	0.1			0.002
Vanadium		0.00236 J	0.715	
Zinc	0.254		30.66	
Perchlorate (µg/L)	52.6	76	72	

Notes and Abbreviations:

* common laboratory contaminant

** detected in one grab sample 27GG33

GW-Ind - groundwater MSC for industrial use

J - estimated results detected above the method detection limit but below the reporting limit

MCL - maximum contaminant level

mg/L - milligrams per liter

SVOC - semivolatile organic compound

TCEQ - Texas Commission on Environmental Quality

µg/L - micrograms per liter

USEPA - U.S. Environmental Protection Agency

VOC - volatile organic compound

Table 2-3
Summary of Detected Constituents in Surface Water and Sediments
South Test Area/Bomb Test Area, LHAAP-001-R and Harrison Bayou

Analyte Detected	Maximum Concentration South Test Area/ Bomb Test Area	Maximum Concentration Harrison Bayou	TCEQ GWP-Ind	MCL
Surface Water				
Metals (mg/L)				
Barium	0.29	0.12		2
Lead	0.015	ND		0.015
Sediments				
SVOCs (µg/L)				
Di-n-butylphthalates *	2,170	1,760	10,200	
Metals (mg/kg)				
Arsenic	1.1	1.1	1	
Barium	254	91.8	200	
Chromium	5.2	4.6	10	
Lead	8	9	1.5	
Mercury	ND	0.03	0.2	
Nickel	3.9	6	204.4	
Selenium	0.2	ND	5	

Notes and Abbreviations:

*common laboratory contaminant

GWP-Ind - soil MSC for industrial use based on groundwater protection

MCL - maximum contaminant level

mg/kg - milligrams per kilogram

mg/L - milligrams per lit

ND - not detected

SVOC - semivolatile organic compound

TCEQ - Texas Commission on Environmental Quality

µg/L - micrograms per liter

Table 2-4
Media Investigation Summary
South Test Area/Bomb Test Area, LHAAP-001-R

Investigated By	Date	Medium Investigated	Number of Samples	Analytical Parameters	Sample ID
EPS	1982	soil - surface	3	metals, explosives, anions	0401 through 0403
		groundwater - wells	2	metals, explosives, anions, organics, pesticides/PCBs	MW131 and MW132
EBASCO	1993	soil - 10 borings	20	metals, VOCs, SVOCs, explosives, anions	Borings 27SB30 through 27SB39
		soil - surface	4	metals, VOCs, SVOCs, explosives, anions	27SS01 through 27SS04
		groundwater - grab from borings	10	explosives, anions, total organic halogens, TOC	27GG30 through27GG39
		groundwater - wells	2	metals, VOCs, SVOCs, explosives, anions	MW131 and MW132
		surface water	4	metals, VOCs, SVOCs, explosives, anions	27SW02 through 27SW05
		sediment	4	metals, VOCs, SVOCs, explosives, anions	27SD02 through 27SD05
SVERDRUP	1994	soil - surface	3	chromium, mercury	27SS21 through 27SS23
		soil - monitoring well borings	12	metals, explosives, anions	27WW01 through 27WW04
		groundwater - wells	4	metals, SVOCs, explosives, anions	27WW01 through 27WW04
USACE	1996/97	soil - surface	9	explosives + 11 metals	RASS27-01 through RASS27-09
		soil - surface	4	12 metals	RASS27-02,RASS27-04, RASS27-06, RASS27-08
STEP	2000/01	soil - 13 borings	26	perchlorate	27SB01 through 27SB13
	1st Quarter	groundwater - wells	4	perchlorate	MW131, MW132, 27WW01, 27WW04
	2nd Quarter	groundwater - wells	6	perchlorate	MW131, MW132, 27WW01 through 27WW04
	3rd Quarter	groundwater - wells	3	perchlorate	MW131, 27WW01, 27WW04
	4th Quarter	groundwater - wells	3	perchlorate	MW131, 27WW01, 27WW04
USFWS	2003	soil	5	metals, SVOCs, pesticides, PCBs, perchlorate	55, 56, 58, 63, 201
CAPE	2006	soil	2	MC (explosives), WP	BTA-27-LHAAP-001-RS-01A, BTA-27-LHAAP-002-RS-01B
USEPA	October 2009	groundwater - wells	6	metals, explosives, perchlorate	131-05, 132-06, 27WW-01-01, 27WW-02-02, 27WW-03-03, 27WW-04-04
U.S. ARMY	October 2009	groundwater - wells	6	metals, explosives, perchlorate	131-05, 132-06, 27WW-01-01, 27WW-02-02, 27WW-03-03, 27WW-04-04

Notes and Abbreviations:

MC - munitions constituents
PCB - polychlorinated biphenyl
SVOC - semivolatile organic compound
TOC - total organic carbon
VOC - volatile organic compound
WP - white phosphorus

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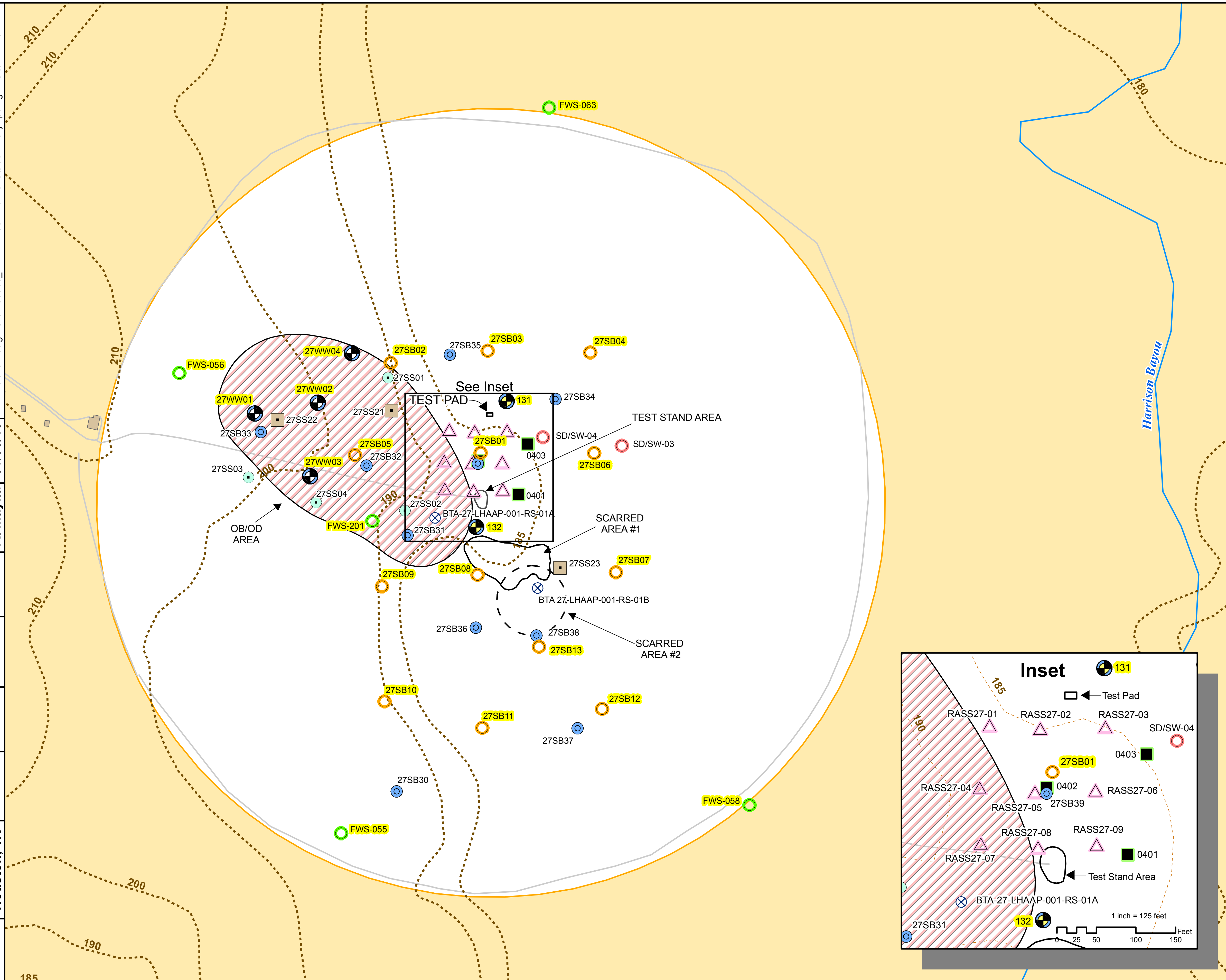

LEGEND

- SHALLOW SOIL SAMPLE, (EPS, 1982)
- MONITORING WELL, (EPS, 1982)
- MONITORING WELL, (SVERDRUP, 1994)
- MONITORING WELL, (USEPA, US ARMY, 2009)
- SOIL BORING, (EBASCO, 1993)
- SURFACE SOIL SAMPLE, (EBASCO, 1993)
- SURFACE SOIL SAMPLE, (SVERDRUP, 1994)
- SURFACE SOIL SAMPLE, (USACE, 1996/97)
- SURFACE WATER/SEDIMENT, (EBASCO, 1993)
- SOIL SAMPLE, (SVERDRUP, 2000) (STEP, 2005)
- SOIL SAMPLE, (USFWS, 2003)
- SOIL SAMPLE, (CAPE, 2006)
- Contours
- Road
- Stream
- Test Pad
- Test Stand Area
- Scarred Area #1
- Scarred Area #2
- OB/OD Area
- Building
- Caddo Lake National Wildlife Refuge

Note: The locations of perchlorate samples for all media are highlighted to present the wide coverage of perchlorate samples.

1 inch = 250 feet

0 125 250 500 Feet

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FIGURE 2-1
SITE MAP WITH
SAMPLING LOCATIONS
SOUTH TEST AREA / BOMB TEST AREA
LHAAP-001-R
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

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Houston, TX	B. Grod 01/06/10	N. Olson 01/06/10	A. Mayila 01/06/10	T:\Divisions\Design\GIS\133363_LHAAP\DocMxd\McDataSummaryRpt\Fig2-1Site27.mxd

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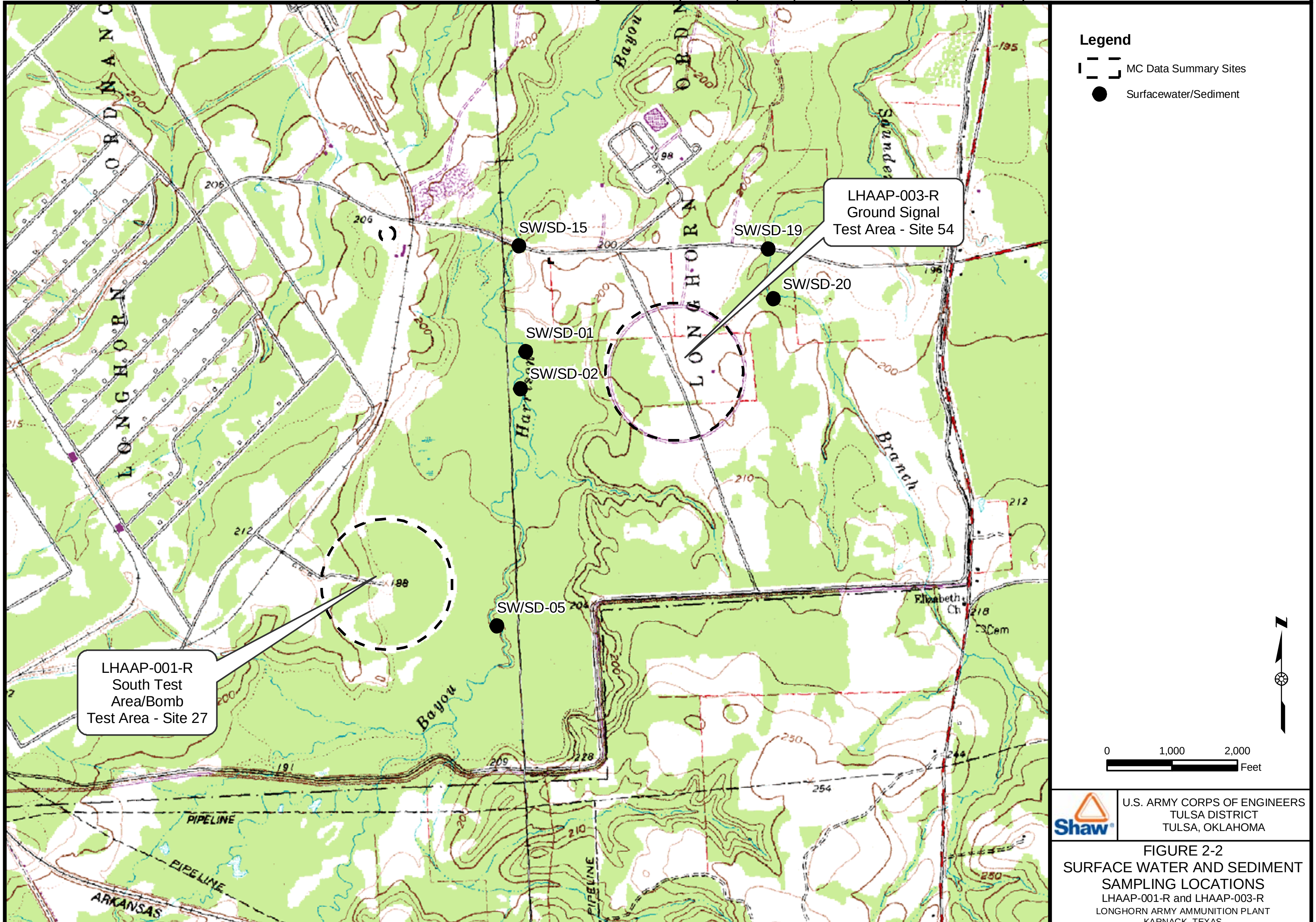

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TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 2-2
SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS
LHAAP-001-R and LHAAP-003-R
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

3.0 The Ground Signal Test Area, LHAAP-003-R

3.1 Site Description and History

The Site 54 – Ground Signal Test Area (LHAAP-003-R) encompasses approximately 80 acres and is located in the southeastern portion of LHAAP. The site is accessed by an asphalt road (Haystack Road) that intersects Long Point Road just east of its intersection with Avenue Q (**Figure 1-1**). The site is currently undeveloped and has become overgrown with woody vegetation.

The Ground Signal Test Area is co-located with the IRP site LHAAP-54 for which a NFA ROD under CERCLA for HTRW was signed with regulatory concurrence in January 1998 (USACE, 1998).

This area was used intermittently starting in April 1963 for aerial and on-ground testing and destruction of a variety of devices, including pyrotechnic signal devices, red phosphorus smoke wedges, infrared flares, illuminating 60 and 81 mm mortar shells, illuminating 40 to 155 mm cartridges, button bombs, and various types of explosive simulators. The site was also used intermittently over a 20-year period for testing and burn-out of rocket motors from Nike-Hercules, Pershing, and Sergeant missiles. Around 1970, a Sergeant rocket motor reportedly exploded in an excavated pit near the center of the site, however, later MEC clearance to depth in the area found no rocket motor. Debris was reportedly placed in the resulting crater and backfilled. From late 1988 through 1991, the site was also used for burn-out of rocket motors in Pershing missiles destroyed in accordance with the Intermediate-Range Nuclear Forces Treaty between the U.S. and the former Soviet Union. Occasionally, leaking WP munitions were burned at the site as a demilitarization activity.

The Ground Signal Test Area was identified as a MEC area of concern based on the reported presence of MEC. Because of the potential presence of WP and to address the WP data gap, the Ground Signal Test Area was also identified as a MC area of concern.

3.2 Previous Environmental Investigations

Environmental media including soil, groundwater, surface water, and sediment have been sampled and analyzed to identify potential MC contamination. Investigations were conducted during the environmental contamination survey, multiple phases of the RI, basewide perchlorate investigation, SI, and the EE/CA. The onsite sample locations are shown on **Figures 3-1** and **2-2**. **Tables 3-1**, **3-2**, and **3-3** provide the maximum concentrations of contaminants in soil, groundwater, surface water, and sediment, respectively, at the site. Data summary tables from previous investigation reports are included in **Appendix B**. In response to USEPA's comments on the Draft MC Summary Report, tables listing all parameters analyzed for each previous sampling event including associated analytical methods and detection limits are also included in **Appendix B**,

3.2.1 Environmental Contamination Survey

In 1982, the site was investigated by EPS for USATHAMA (EPS, 1984).

3.2.1.1 Soil Investigation

Three surface soil samples (0501, 0502, and 0503) were collected and analyzed for metals, explosives, and anions. Metals were detected at low concentrations similar to background values and below their respective GWP-Ind values. No explosives were detected. Reference **Appendix B**, Pages B-1 and B-2, Tables 10-1 and 10-1b, respectively.

3.2.1.2 Groundwater Investigation

Two monitoring wells (MW-127 and MW-128) were installed and groundwater samples were collected from the wells. The water samples from both wells were analyzed for metals, explosives, and anions. In addition, groundwater from well MW-128 was analyzed for VOCs and SVOCs. Cadmium and thallium were detected at maximum concentrations of 0.01and 0.14 mg/L, above their MCLs of 0.005 and 0.002 mg/L, respectively. No VOCs, SVOCs, or explosives were detected. Reference **Appendix B**, Pages B-18 and B-19 through B-22, Tables 10-5 and 10-5b, respectively.

3.2.2 Phase I Remedial Investigation

In 1993, Ebasco completed a Phase I RI. Soil, groundwater, surface water, and sediment samples were collected during the RI activities (Ebasco, 1993).

3.2.2.1 Soil Investigation

Seven borings were completed at the site and 15 soil samples were collected from the borings. Boring XXSB15 was completed within the rocket motor testing blast area. Borings XXSB16, XXSB17, and XXSB18 were completed near the southern boundary, in the eastern portion, and in the western part of the site, respectively. Borings XXSB19, XXSB20, and XXSB21, were completed in the former mortar test area, the north western portion of the site, and the northeastern part of the site, respectively. Soil samples were collected from several depth intervals ranging from the surface to 18 bgs. Soil samples were analyzed for metals, VOCs, SVOCs, explosives, and anions.

Soil analytical results indicated that acetone at a concentration of 10,300 µg/kg in the sample collected from boring XXSB19 at a depth interval of 2.5 to 5 feet bgs and trichloroethene (TCE) at a concentration of 42 µg/kg in a sample collected from boring XXSB17 at a depth interval of 5 to 7 feet bgs were the only VOCs detected. Acetone and TCE concentrations were below their respective GWP-Ind values of 9.2 $x10^6$, and 500 µg/kg, respectively. Except for di-n-butyl phthalate that was detected at levels below the GWP-Ind value, all other SVOCs were below detection limits. Arsenic, chromium, and lead were detected at maximum concentrations of 6, 15.9, and 11 mg/kg above their GWP-Ind values of 1, 10, and 1.5 mg/kg, respectively. All other metals were detected at concentrations below their respective GWP-Ind values in all soil samples. No explosives were detected. Reference **Appendix B**, Pages B-3 through B-5 and B-6 through B-8, Tables 10-2 and 10-2b, respectively.

3.2.2.2 Groundwater Investigation

Groundwater samples were collected from the two already existing monitoring wells MW-127 and MW-128. Groundwater from the wells was analyzed for metals, VOCs, SVOCs, explosives, and anions. Groundwater analytical results indicated that no VOCs, SVOCs, or explosives were detected. No elevated metal levels were reported in either well; the initially (1982) detected elevated values of cadmium and thallium above comparison criteria in well MW-127 were not confirmed by the RI sampling event in 1993. Reference **Appendix B**, Pages B-18 and B-19 through B-22, Tables 10-5 and 10-5b, respectively.

In addition, six groundwater grab samples were collected from six of the seven borings which yielded water (XXSB15 through XXSB17 and XXSB19 through XXSB21). Samples were collected from the borings to obtain preliminary field screening data for potential contaminants in groundwater underlying the site. Groundwater grab samples were analyzed for VOCs, explosives, anions, total organic halogens, and total organic carbon. Analytical results indicated that VOCs and explosives were not detected.

3.2.2.3 Surface Water and Sediment Investigation

Seven surface water and seven sediment samples were collected from collocated site drainage ditch locations (SW/SD16, SW/SD17, and SW/SD18) (**Figure 3-1**), Harrison Bayou (SW/SD01 and SW/SD15), and Saunders Branch (SW/SD19 and SW/SD20) (**Figure 2-2**). Surface water and sediment samples were analyzed for metals, VOCs, SVOCs, explosives, and anions. Results indicated that metals were detected sporadically in both surface water and sediment samples. The two detected (barium and lead) metals were below GW-Ind values in surface water samples. Except for arsenic and lead, all other metals were below GWP-Ind values in all sediment samples. Arsenic concentrations ranged from 0.9 to 3.5 mg/kg, above the GWP-Ind value of 1 mg/kg, and lead concentrations ranged from 4 to 9 mg/kg, above the GWP-Ind value of 1.5 mg/kg. Except for bis(2-ethylhexyl)phthalate in four sediment samples and di-n-butylphthalate in two of the sediment samples, all other SVOCs were below detection limits in both surface water and sediment samples. Detected concentrations for the two phthalate analytes did not exceed respective GWP-Ind values of 600 and 1,000,000 µg/kg. Phthalates are a common laboratory contaminant. No VOCs or explosives were detected in surface water or sediment samples. Reference **Appendix B**, Pages B-23, B-24 through B-26, B-27, and B-31 through B-33, Tables 10-6, 10-6b, 10-7 and 10-7b, respectively.

3.2.3 Phase II Remedial Investigation

In 1994, Sverdrup completed a Phase II RI. Soil and groundwater samples were collected and a soil gas survey conducted at the site (Sverdrup, 1995).

3.2.3.1 Soil Investigation

One soil boring, XXSB01, was completed in the immediate vicinity of boring XXSB19 and three soil samples collected from the boring for confirmation of the elevated acetone levels detected during the Phase I RI activities. Soil samples were analyzed for VOCs. No acetone was detected in the soil samples collected from the boring. Methylene chloride at a concentration of 18 µg/kg was detected in the soil sample collected from the depth interval of 0 to 2 feet bgs, a concentration below the GWP-Ind value of 38,000 µg/kg. Methylene chloride is a common laboratory contaminant. Reference **Appendix B**, Page B-5 and B-9, Tables 10-3 and 10-3b, respectively.

An active soil gas survey was conducted in the immediate vicinity of boring XXSB19 to further investigate potential VOC contamination in the area. Soil gas samples were collected from five sampling points (XXSG01 through XXSG05) and analyzed on site for acetone, methylene chloride, and TCE. Results of the soil gas survey indicated that acetone, methylene chloride, and TCE were all below detection limits. Reference **Appendix B**, Page B-27, Paragraph 10.2.2.

3.2.3.2 Groundwater Investigation

One groundwater grab sample was collected from the newly installed boring XXSB01. The sample was analyzed for VOCs, SVOCs, and explosives. Acetone was the only VOC that was detected at a concentration of 17 µg/L, well below the GW-Ind of 92,000 µg/L. Acetone was also detected in the trip blank at a similar concentration. Acetone is a common laboratory contaminant and sampling device decontamination agent. No SVOCs or explosives were detected. Reference **Appendix B**, Page B-27, Paragraph 10.2.2 and Pages B-28 through B-30, Table B-3.

3.2.4 Additional Investigations

3.2.4.1 Soil Investigation

In August 1996, the USACE collected surface soil samples from two locations in support of the risk assessment for the site; RASSXX-01 located within the former motor blast area and RASSXX-02 located within the nearby mortar test area. The soil samples were analyzed for VOCs and 11 metals (arsenic, barium, cadmium, chromium, lead, mercury, nickel, selenium, silver, antimony, and thallium). Analytical results indicated that metals arsenic, chromium, and lead were detected at RASSXX-01 at maximum concentrations of 32.8, 28.9, and 11 mg/kg, above their respective GWP-Ind values of 1, 10, and 1.5 mg/kg, respectively. Cadmium was detected at RASSXX-02 at a maximum concentration of 5.42 mg/kg, above the GWP-Ind value of 0.5 mg/kg. Reference **Appendix B**, Page B-10 and B-11 through B-17, Tables 10-4 and 10-4b, respectively.

3.2.4.2 Risk Assessment

In 1997, USACE conducted a baseline risk assessment to support site management decisions for the site. Potential human health and ecological impacts resulting from contaminant releases at the site in the absence of remediation were evaluated. COPCs evaluated included metals present in both site soils and ditch sediments. COPCs in groundwater included metals within background ranges and below drinking water standards. For human health evaluation, conservative carcinogenic risk estimates of 3×10^{-7} and 2×10^{-6} were obtained for current recreational and future industrial land uses, respectively. Hazard indices were well below the critical value of 1.0 at 2×10^{-2} (current land use) and 1×10^{-1} (future industrial land use). Based on these results, no unacceptable risks to human health were identified for the Ground Signal Test Area (USACE, 1997).

Screening-level ecological risks for the site were driven solely by metals present in soil at concentrations approximating background values. Two metals; chromium and nickel, were identified as main contributors to screening level risk estimates. Based on these conservative analyses, no ecological concerns were associated with the site and further ecological evaluations and remediation are unwarranted. (Shaw, 2007)

3.2.4.3 Supplemental Soil Sampling and Risk Characterization

Following a review of the initial RI data (Phase I and II RI) and human health and ecological risk characterization based on RI results, limited additional surface soil sampling was conducted at the site in February 1997 (USACE, 1997). The sampling was initiated to support additional human health risk characterization for a limited area identified during the original risk assessment results as a potential “hot spot” area for human exposure.

Additional surface soil samples were collected from two adjacent locations (RASSXX-01 and RASSXX-02); the same locations sampled previously in 1996 (**Figure 3-1**). The samples were analyzed for SVOCs, explosives, pesticides, and polychlorinated biphenyls (PCBs). A sample from RASSXX-02 was also analyzed for 12 metals (aluminum, beryllium, calcium, cobalt, copper, iron, potassium, magnesium, manganese, strontium, vanadium, and zinc). Soil analytical results (**Appendix B**, Page B-44, Table 5A-1) indicated that metals were detected at concentrations that were generally higher [arsenic (73.8 mg/kg), cadmium (6.95 mg/kg), and lead 24 (mg/kg)] than those of previous sampling events and above their respective GWP-Ind values, and provided justification for further evaluation of the potential “hot spot” area. No VOCs, SVOCs, explosives, pesticide, or PCBs were detected in the surface soil samples. Reference

Appendix B, Pages B-10, B-44, and B-11 through 17, Tables 10-4, Table 5A-1 and 10-4b, respectively.

Further supplemental risk characterization was conducted for a potential "hot spot" area at the site and to expand the list of parameters for risk evaluation. While risk calculations based on the additional sampling at the limited site area were higher than original estimates for the site as a whole, all estimates were within acceptable risk ranges. For human health evaluation, carcinogenic risk estimates of 6×10^{-6} and 4×10^{-5} were obtained for current recreational and future industrial land uses, respectively. Non-cancer hazard indices were below the critical value of 1.0 at 2×10^{-1} (current land use) and 6×10^{-1} (future industrial land use). The additional risk evaluation substantiated conclusions of the original assessment and failed to support the need for site remediation for protection of human health (USACE, 1997).

Based on the results of the investigations and the risk assessment, a NFA ROD under CERCLA for HTRW was signed in January of 1998 for LHAAP-003-R.

3.2.5 Perchlorate Investigation

Between May 2000 and February 2001, during three consecutive quarterly sampling events, groundwater samples were collected from three existing shallow monitoring wells to determine whether perchlorate contamination had occurred in the underlying groundwater as a result of past historical activities (STEP, 2005). The wells are located adjacent to the three surface water features that drain the entire Ground Signal Test Area. Because the shallow groundwater flow pattern is heavily influenced by surface flow in this climate, the wells represent groundwater from the entire site. During the first quarter (April and May 2000), perchlorate was detected at concentrations of 26.8, 20.4, and 22.7 µg/L, in groundwater samples collected from monitoring wells MW-127, MW-128, and 18WW16, respectively. The detections were below the GW-Ind value of 72 µg/L. No MCL exists for perchlorate. Perchlorate concentrations were below detection limits in the three monitoring wells during the second quarter (August through October 2000). During the third quarter, January through February 2001, perchlorate was detected in only one groundwater sample collected from well 18WW16 at a concentration of 8 µg/L, well below the GW-Ind of 72 µg/L. No perchlorate was detected in the water samples from wells MW-127 and MW-128. Groundwater samples were also collected from Geoprobe points (GPSAS54-01, GPSAS54-02, and GPSAS54-03) installed in June 2001. Perchlorate was below detection limits in all three grab samples. Reference **Appendix B**, Pages B-34 and B-35, Tables 1-32 and 1-32b, respectively.

3.2.6 U.S. Fish and Wildlife Investigation

In March 2003, USFWS conducted an investigation at the former LHAAP facility to determine contaminant levels in soil and sediment (USFWS, 2003). Soil samples were collected from two locations (FWS-95 and FWS-223) within the Ground Signal Test Area. These two locations are along the surface drainage that flows toward Saunders Branch on the east side of the area. Soil analytical results indicated that metals were detected at low concentrations confirming previous findings. Perchlorate was not detected. Reference **Appendix B**, Pages B-36 through B-37 and B-38 through B-43, Tables 2 and 2b, respectively.

3.2.7 Military Munitions Response Program Site Inspection

Between 2002 and 2004, a MMRP SI was conducted for the Ground Signal Test Area to determine the presence or absence of MEC and/or MC at the site which may have remained from activities conducted by the DOD during operations of the MRS, and may pose a threat to human health and/or the environment (e^2M, 2005).

Results of the HRR and a visual site inspection verified MEC presence at the site. Possible source areas for MEC and MC identified during the SI included testing areas associated with the various suspected ordnance types, a confirmed mortar impact area on site with numerous unidentified ordnance item shapes on the surface and outside the mortar berm, a site reportedly used for the testing and burn-out of Pershing and Sergeant rocket motor, and areas associated with past demilitarization activities. In addition, a Sergeant rocket motor reportedly exploded at the site around 1970 and debris was reportedly placed in the resulting crater and backfilled. It was also reported that occasionally WP munitions were burned at the site. It appears that most of the items tested at this location were statically fired and observed for adequate illumination and burn time and not launched by a weapons system.

The SI identified a data gap in earlier soil sampling in that demilitarization activities were conducted at the site and occasionally demolition and burning of WP munitions were performed. No analysis for the munitions constituent WP was performed at the site. The SI recommended that further investigation be conducted to address the identified data gap.

3.2.8 Engineering Evaluation/Cost Analysis

In 2007, an EE/CA was conducted to facilitate completion of a non-time critical removal action of MEC at the site (CAPE, 2007). Field activities conducted during the EE/CA characterized MEC and addressed the MC data gap at the site. Soil samples were collected within the Ground Signal Test Area to determine if evidence of WP existed, and to determine the presence of MC in areas where MC was most likely to exist based on the heaviest MPPEH concentrations or historical detonations. One soil sample was collected within the area identified as the mortar firing range. A second soil sample was collected in a scarred area identified as the Rocket Motor Area in the historical review. In addition, pre- and post-detonation samples were collected in association with explosive demolition of MPPEH recovered during the field activities. Soil samples were collected from 0 to 6 inches bgs. Analytical results indicated that no WP and MC constituents (1,3,5-trinitrobenzene, 1,3-dinitrobenzene, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 4-amino-2,6-DNT, 4-nitrotoluene, HMX, nitrobenzene, RDX, and tetryl) were identified at concentrations above detection limits in any soil samples at the site. In addition, there was no indication of the presence of MC in any of the pre- or post-detonation samples. The removal action objective of protection of human health from MC at unacceptable concentrations had been achieved as demonstrated by the soil analytical results. Reference **Appendix B**, Page B-45, Table 3.

3.2.9 October 2009 Groundwater Confirmation Sampling

3.2.9.1 USEPA Region 6 Confirmation Sampling

In October 2009, the USEPA collected additional groundwater samples from the existing four monitoring wells (MW-127, MW-128, 18WW01 and 18WW16) to confirm groundwater conditions at the site. The groundwater was analyzed for metals, explosives and perchlorate. Groundwater analytical results indicated that except for 2-amino-4,6-DNT and 3-nitrotoluene, no other explosives were detected in the groundwater samples. 2-amino-4,6-DNT was detected in two monitoring wells at concentrations of 0.22 µg/L in monitoring well MW-127 and 0.30 µg/L in monitoring well MW-128, below the GW-Ind value of 17.03 µg/L. 3-nitrotoluene was detected in monitoring well MW-128 at a concentration of 0.24J µg/L below the GW-Ind value of 1,022 µg/L. Perchlorate was detected in only one of the monitoring wells, 18WW16, at a concentration of 4.6 µg/L, a level well below the GW-Ind value of 72 µg/L.

Except for chromium, all other metals were detected at concentrations lower than their respective MCLs or GW-Ind values. Chromium was detected at a concentration of 6.62 mg/L in monitoring well 18WW16 above the MCL of 0.1 mg/L. Reference **Appendix B**, Pages B-46 through B-47 and Page B-48, Tables B-1 and B-1b, respectively.

3.2.9.2 U.S. Army Confirmation Split Sampling

In October 2009, the U.S. Army collected spilt samples at the same time that the USEPA collected additional groundwater samples from the existing four monitoring wells (MW-127, MW-128, 18WW01 and 18WW16). The groundwater was analyzed for metals, explosives and perchlorate. Groundwater analytical results indicated that no explosives were detected in any of the groundwater samples. Perchlorate was detected in monitoring well 18WW16 at a concentration of 5.4 µg/L, a level well below the GW-Ind value of 72 µg/L.

Except for arsenic and chromium, all other metals were detected at concentrations lower than their respective MCLs or GW-Ind values. Arsenic and chromium were detected in monitoring well 18WW16 at concentrations of 0.019 and 31.7 mg/L above their MCL of 0.01 and 0.1 mg/L, respectively. Reference **Appendix B,** Pages B-49 through B-50 and B-51, Tables B-2 and B-2b, respectively.

USEPA Region 6 groundwater confirmation analytical results were comparable to the U.S. Army split sample results. Although the USEPA detected two explosives in the groundwater samples, whereas the U.S. Army did not, the explosive were at concentrations that were well below their GW-Ind values. Chromium was the only metal that was detected by both agencies at a concentration above the MCL. Arsenic was detected by only the U.S. Army above the MCL. Perchlorate was detected by both USEPA and U.S. Army in the same monitoring well at comparable concentrations that were lower than the GW-Ind value of 72 µg/L.

3.3 Media Investigation Summary and Contaminant Assessment

Data presented in previous investigations and the risk assessment for the site indicate that compounds detected in soil, groundwater, surface water, and sediment pose no risk to human health or the environment.

3.3.1 Soil

Between 1982 and 2003, a total of 27 surface and subsurface soil samples were collected for characterization of constituents of concern in the soil at the site. Samples were collected from all areas of the site with special emphasis on likely source areas; the former motor blast area and the nearby mortar test area. Five metals including arsenic (73.8 mg/kg), barium (904 mg/kg), cadmium (6.95 mg/kg), chromium (28.9 mg/kg), and lead (24 mg/kg), were detected at concentrations above their respective GWP-Ind values. All other metals were detected at levels approximating background values and below the comparison criteria. Despite the common detection of metals during the multiple sampling events, none of the metals was determined to have an unacceptable risk to human health or the environment.

Except for a single detection each of acetone at 10,300 µg/kg, TCE at 42 µg/kg, and methylene chloride at 18 µg/kg, there were no detections of other VOCs in soil samples. The detected VOC concentrations were below comparison criteria. Soil samples from one soil boring completed in the immediate vicinity of where acetone was detected, and the results of an active soil gas survey to further investigate the presence of acetone, TCE, and methylene chloride indicated that the VOCs were below detection limits. Acetone is a common laboratory contaminant and cleaning agent for sampling equipment. Di-n-butyl phthalate was the only SVOC detected in the soil samples at levels below the comparison criteria. Phthalates are common plasticizers and were found in method blanks. No explosives, pesticides, or PCBs were detected in soil samples.

An active soil gas survey was conducted in the immediate vicinity of the boring XXSB19 where acetone was detected to further investigate potential VOC contamination in the area. Soil gas samples were collected from five sampling points and analyzed on site for acetone, methylene chloride, and TCE. Results of the soil gas survey indicated that acetone, methylene chloride, and TCE were all below detection limits.

Two of the surface soil samples were collected along a surface water feature draining the eastern portion of the site and analyzed for perchlorate. Both samples were non-detect for perchlorate.

An additional two soil samples were collected during the EE/CA field activities (2006) to determine the presence of WP and if MC existed in areas where MC was likely to exist based on heaviest MPPEH; the mortar firing area and the Rocket Motor Area. No WP or MC was identified in any soil samples and there was no indication of the presence of MC in any pre- or post-detonation samples.

Table 3-4 presents the media investigation summary including the number of soil samples collected during each sampling event.

3.3.2 Groundwater

From 1982 through 2001, a total of 13 groundwater samples were collected from monitoring wells and an additional 10 water samples were grab samples collected from soil borings installed at the site for identification of constituents of concern in the underlying groundwater. Groundwater analytical results from multiple sampling events indicated that cadmium and thallium were detected in groundwater above their respective MCLs in the initial sampling (1982), however, the concentrations were not reproducible in subsequent sampling events. Despite the common detection of metals during the multiple sampling events, none of the metals was determined to have an unacceptable risk to human health or the environment.

In October 2009, groundwater samples were collected from four monitoring wells by both the USEPA and the U.S. Army for confirmation of groundwater conditions at the site. Initial detections (1982) of cadmium and thallium above their MCLs were not confirmed by the sampling. Except for arsenic and chromium, all the other metals were detected at concentrations below their respective MCLs or GW-Ind values.

Except for a single detection of acetone in a grab sample collected in 1994 at a concentration of 17 µg/L, well below the GW-Ind of 92,000 µg/L, there were no detections of VOCs in other groundwater samples. Acetone was also detected at a similar concentration in the trip blank. SVOCs or explosives were not detected.

The October 2009 USEPA groundwater confirmation sampling detected the presence of 2-amino-4,6-DNT and 3-nitrotoluene. Both explosives were detected at concentrations well below their respective GW-Ind values. No explosives were detected in any of the four U.S. Army split samples. Reference **Appendix B**, Pages B-49 through 50 and B-51, Tables B-2 and B-2b, respectively. Both the previous and the October 2009 data indicate that explosives, the most likely contaminants at the site, are not of concern in the Ground Signal Test Area.

Twelve of the groundwater samples were collected from three locations and analyzed for perchlorate during four quarters from April 2000 to June 2001. Perchlorate was detected at a maximum concentration of 26.8 µg/L during the first quarter sampling event, a level well below the GW-Ind value of 72 µg/L. No MCL exists for perchlorate. During the second quarter sampling event, perchlorate was not detected in any of the water samples. Perchlorate was detected during the third quarter sampling event in one well at 8 µg/L, which is well below the GW-Ind of 72 µg/L and not at all during the fourth quarter event. During the October 2009 sampling event, perchlorate was detected in monitoring well 18WW16 at a concentration of 5.4 µg/L, a level well below the GW-Ind value of 72 µg/L.

Table 3-4 presents the media investigation summary including the number of groundwater samples collected during each sampling event.

3.3.3 Surface Water and Sediment

A total of seven surface water and seven sediment samples were collected from drainage ditch locations, Harrison bayou, and Saunders Branch. Metals were detected sporadically in both surface water and sediment samples. All metals were below comparison criteria in surface water samples. Arsenic and lead were the only metals detected above their respective GWP-Ind values in sediment samples. All other metals were detected at concentrations below comparison criteria and approximating background values. Except for bis(2-ethylhexyl)phthalate in four sediment samples and di-n-butylphthalate in two of the sediment samples and at concentrations that were below comparison criteria, all other SVOCs were below detection limits in both surface water and sediment samples. Phthalates are a common laboratory contaminant. No VOCs or explosives were detected in surface water or sediment samples.

3.4 Conclusion

With the exception of the 2009 EPA groundwater sampling, the results of the multiple investigations presented above indicated that no contaminants of concern were identified in soil, groundwater, surface water, and sediments at the site. The human health risk assessment evaluation of potential migration pathways for potential receptors indicated that carcinogenic risk estimates were within the acceptable range at 6×10^{-6} and 4×10^{-5} for current recreational and future industrial land uses, respectively. Non-cancer hazard indices were below the critical value of 1.0 at 2×10^{-1} (current land use) and 6×10^{-1} (future industrial land use). Based on the evaluation, no unacceptable risks to human health were identified for the site. The screening-level ecological risk evaluation indicated that there are no ecological concerns associated with the site and that further evaluations and remediation are unwarranted. In addition, no WP or MC was identified in any soil samples and there was no indication of the presence of MC in any pre or post-detonation samples. Results from the October 2009 sampling detected two explosives at levels well below the risk-based criteria, further confirming that explosives are not a concern at the site. Therefore, this MC data summary confirms the determination of no risk to human health or the environment as identified in the EE/CA for LHAAP-003-R.

For perchlorate, soil sampling conducted along a surface water feature draining much of the site was non-detect. Additionally, three groundwater wells and the three geoprobe points placed strategically along flow paths that fully characterize the groundwater from the entire site were sampled for perchlorate. The results indicate that perchlorate was previously (2000 through 2001) detected in only three samples out of 12 and at concentrations below risk-based screening levels. During the October 2009 confirmation sampling, perchlorate was detected in only one out of the four monitoring wells at a concentration comparable with previous results and well below the screening criteria. This, together with the fact that no explosives were detected in any of the previous sampling conducted at the site, and that the October 2009 sampling detected explosives at levels below the risk-based criteria, supports a conclusion that perchlorate and explosives are not contaminants of concern at the Ground Signal Test Area.

USEPA, TCEQ, and U.S. Army have agreed to address the 2009 metals exceedances in the groundwater under a path separate from the MMRP. U.S. Army will address the metals constituents in the groundwater as stated in the Army letter dated March 10, 2011 under the 1998 IRP RODs (U.S. Army, 2011).

Table 3-1
Summary of Detected Constituents in Soil
Ground Signal Test Area, LHAAP-003-R

Analyte Detected	Maximum Concentration	TCEQ GWP-Ind
VOCs (µg/kg)		
Acetone	10,300	9.2 x10^6
Trichloroethene	42	500
Methylene chloride *	18	38,000
SVOCs (µg/kg)		
Di-n-butylphthalate	2,790 B	10,000
Metals (mg/kg)		
Aluminum	8,050	10,220
Arsenic	73.8	1
Barium	904	200
Cadmium	6.95	0.5
Calcium	621	NA
Chromium	28.9 J	10
Cobalt	3.21	NA
Copper	6.21	130
Iron	13,500	NA
Lead	24	1.5
Magnesium	826	NA
Manganese	567	1431
Mercury	0.06	0.2
Nickel	43	204.4
Potassium	484	NA
Selenium	1.2	5
Strontium	18.9	6132
Thallium	0.2	0.2
Vanadium	24.3	72
Zinc	17.6	3066

Notes and Abbreviations:

* common laboratory contaminant
B - found in the method blanks
J - estimated value
GWP-Ind - soil MSC for industrial use based on groundwater protection
mg/kg - milligrams per kilogram
NA - Not Available
SVOC - semivolatile organic compound
TCEQ - Texas Commission on Environmental Quality
µg/kg - micrograms per kilogram
VOC - volatile organic compound

Table 3-2
Summary of Detected Constituents in Groundwater
Ground Signal Test Area, LHAAP-003-R

Analyte Detected	Maximum Concentration		TCEQ GW-Ind	MCL
	US Army	USEPA		
VOC (µg/L)				
Acetone	17*		92,000	
Explosives (µg/L)				
2- Amino-4,6-dinitrotoluene		0.3	17.03	
3-Nitrotoluene		0.24 J	1,022	
Metals (mg/L)				
Aluminum	2.04		102.2	
Antimony	0.00335 J			0.006
Arsenic	0.019			0.01
Barium	0.647			2
Beryllium	0.000818 J			0.004
Cadmium	0.01			0.005
Chromium	31.7			0.1
Cobalt	0.043		6.132	
Copper	1.06			1.3
Lead	0.011			0.015
Manganese	2.02		14.3	
Nickel	1.89		2.044	
Selenium	0.019			0.05
Silver		0.000235 J	0.511	
Strontium	4.12		61.32	
Thallium	0.14			0.002
Vanadium		0.00172 J	0.715	
Zinc	0.28		30.66	
Perchlorate (µg/L)	26.8		72	

Notes and Abbreviations:

* detected in a grab sample but also detected in the trip blank at the same concentration

GW-Ind - groundwater MSC for industrial use

J - estimated results detected above the method detection limit but below the reporting limit

MCL - maximum contaminant level

mg/L - milligrams per liter

TCEQ - Texas Commission on Environmental Quality

µg/L - micrograms per liter

USEPA - U.S. Environmental Protection Agency

VOC - volatile organic compound

Table 3-3
Summary of Detected Constituents in Surface Water and Sediments
Ground Signal Test Area, LHAAP-003-R, Harrison Bayou and Saunders Branch

Analyte Detected	Maximum Concentration				
	Ground Signal Test Area	Harrison Bayou	Saunders Branch	TCEQ GWP-Ind	MCL
Surface Water (mg/L)					
Barium	0.23	0.13	0.43		2
Lead	ND	ND	0.011		0.015
Sediments					
SVOCs (µg/kg)					
Bis(2-ethylhexyl)phthalate *	443	369	421	600	
Di-n-butylphthalate *	669	ND	ND	10,000	
Metals (mg/kg)					
Arsenic	1.9	2.4	3.5	1	
Barium	64.1	126	39.6	200	
Chromium	9.8	5.5	4.4	10	
Lead	7	9	8	1.5	
Mercury	0.03	0.03	0.03	0.2	
Nickel	5.1	14.7	4	204.4	
Selenium	0.4	0.3	0.3	5	

Notes and Abbreviations:

*common laboratory contaminant

GWP-Ind - soil MSC for industrial use based on groundwater protection

MCL - maximum contaminant level

mg/kg - milligrams per kilogram

mg/L - milligrams per lit

ND - not detected

SVOC - semivolatile organic compound

TCEQ - Texas Commission on Environmental Quality

µg/kg - micrograms per kilogram

Table 3-4
Media Investigation Summary
Ground Signal Test Area, LHAAP-003-R

Investigated By	Date	Medium Investigated	Number of Samples	Analytical Parameters	Sample ID
EPS	1982	soil - surface	3	metals, explosives, anions	0501 through 0503
		groundwater - wells	2	metals, explosives, anions, VOCs, and SVOCs	MW127 and MW128
EBASCO	1993	soil - 7 borings	15	metals, VOCs, SVOCs, explosives, anions	Borings XXSB15 through XXSB21
		groundwater - grab from borings	6	VOCs, explosives, anions, total organic halogens, TOC	XXGG15 throughXXGG18, XXGG20 and
		groundwater - wells	2	metals, VOCs, SVOCs, explosives, anions	MW127 and MW128
		surface water	7	metals, VOCs, SVOCs, explosives, anions	XXSW01, XXSW15 through XXSW20
		sediment	7	metals, VOCs, SVOCs, explosives, anions	XXSD01, XXSD15 through XXSD20
SVERDRUP	1994	soil - boring	3	VOCs	XXSB01
		soil - gas sampling points	5	VOCs	XXSG01, XXSG03 through XXSG05, XXSG07
		groundwater - grab from boring	1	VOCs, SVOCs, explosives	XXGG01
USACE	1996/97	soil - surface	4	(2) VOCs + 11 metals; (2) SVOCs, pesticides, PCBs; (1) 12 metals, explosives	RASSXX-01, RASSXX-02
STEP	2000/01				
	1st Quarter	groundwater - wells	3	perchlorate	MW127, MW128, 18WW16
	2nd Quarter	groundwater - wells	3	perchlorate	MW127, MW128, 18WW16
	3rd Quarter	groundwater - wells	3	perchlorate	MW127, MW128, 18WW16
	3rd Quarter	groundwater - grab	3	perchlorate	GPSAS54-01 through GPSAS54-03
USFWS	2003	soil	2	metals, SVOCs, pesticides, PCBs, perchlorate	95, 223
CAPE	2006	soil	2	MC (explosives), WP	BTA-54-LHAAP-001-RS-01A, BTA-54-LHAAP-001-RS-01B
USEPA	October 2009	groundwater - wells	4	metals, explosives, perchlorate	127-09, 128-10, 18WW-01-07, 18WW-16-08
U.S. ARMY	October 2009	groundwater- wells	4	metals, explosives, perchlorate	127-09, 128-10, 18WW-01-07, 18WW-16-08

Notes and Abbreviations:

MC - munitions constituents

PCB - polychlorinated biphenyl

SVOC - semivolatile organic compound

TOC - total organic carbon

VOC - volatile organic compound

WP - white phosphorus

00100256

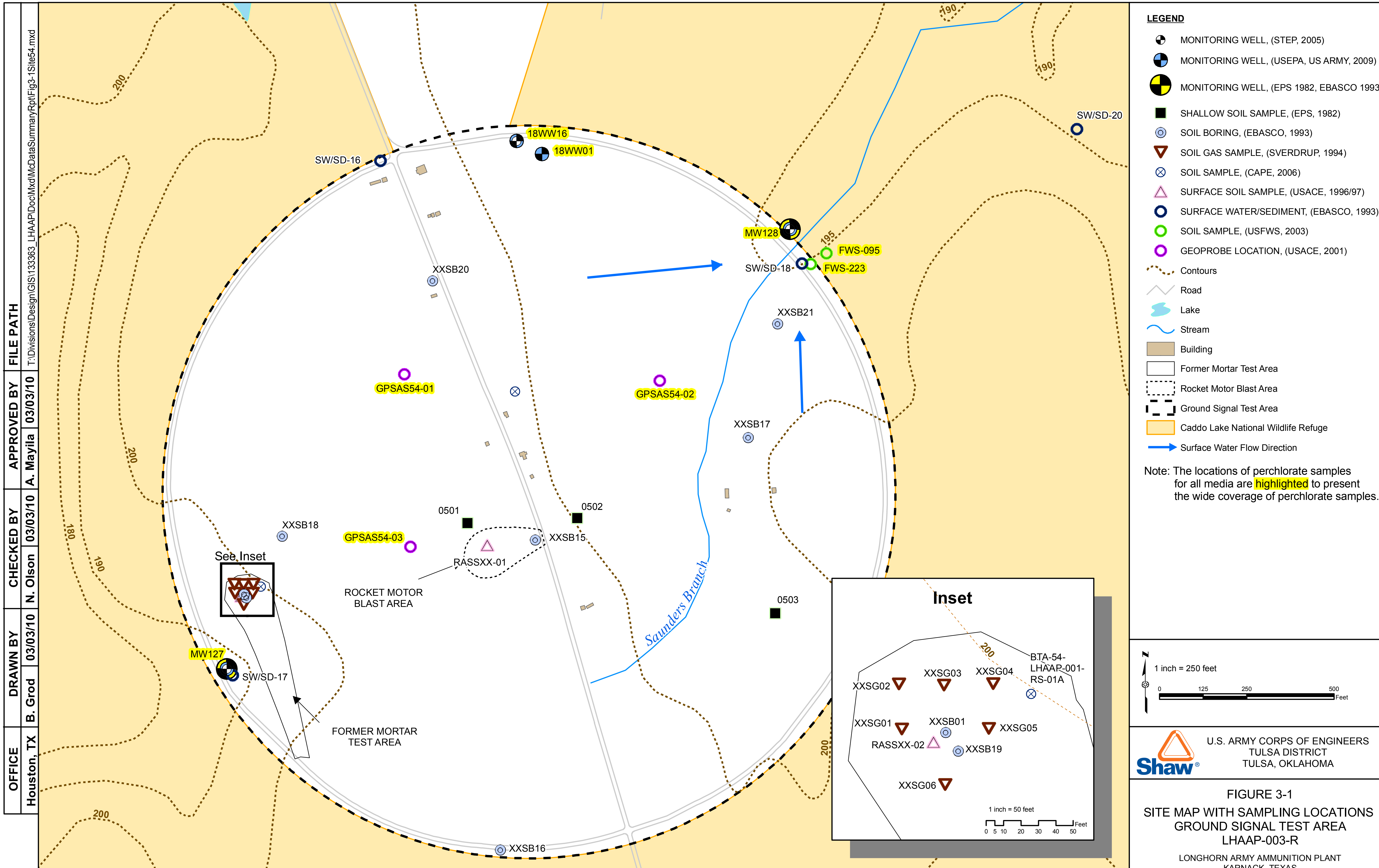

FIGURE 3-1
SITE MAP WITH SAMPLING LOCATIONS
GROUND SIGNAL TEST AREA
LHAAP-003-R
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

4.0 Conceptual Site Model

During the EE/CA a conceptual site model (CSM) was developed to provide a summary of the MC sources, potential pathways for MC exposure, and potential receptors to MC at the MRS sites. Since surface soil did not identify the presence of MC at LHAAP-001-R and LHAAP-003-R, there is no source area and there is not a complete pathway for MC. It is noted that perchlorate was detected once above the GW-Ind in a well at LHAAP-001-R by USEPA, although U.S. Army's split sample result was below the GW-Ind.

Based on MC data summary results and the determination of an incomplete pathway (since there is no MC at the surface), the MC Source-Receptor CSM presented in the EE/CA is accurate and is included as **Figure 4-1** in this report. In addition, the successful MEC removal action at LHAAP-001-R and LHAAP-003-R provides protection of human safety from explosive hazards to the extent practicable rendering the exposure pathway for MEC items an incomplete pathway as shown on **Figure 4-2**.

MC SOURCE-RECEPTOR CONCEPTUAL SITE MODEL

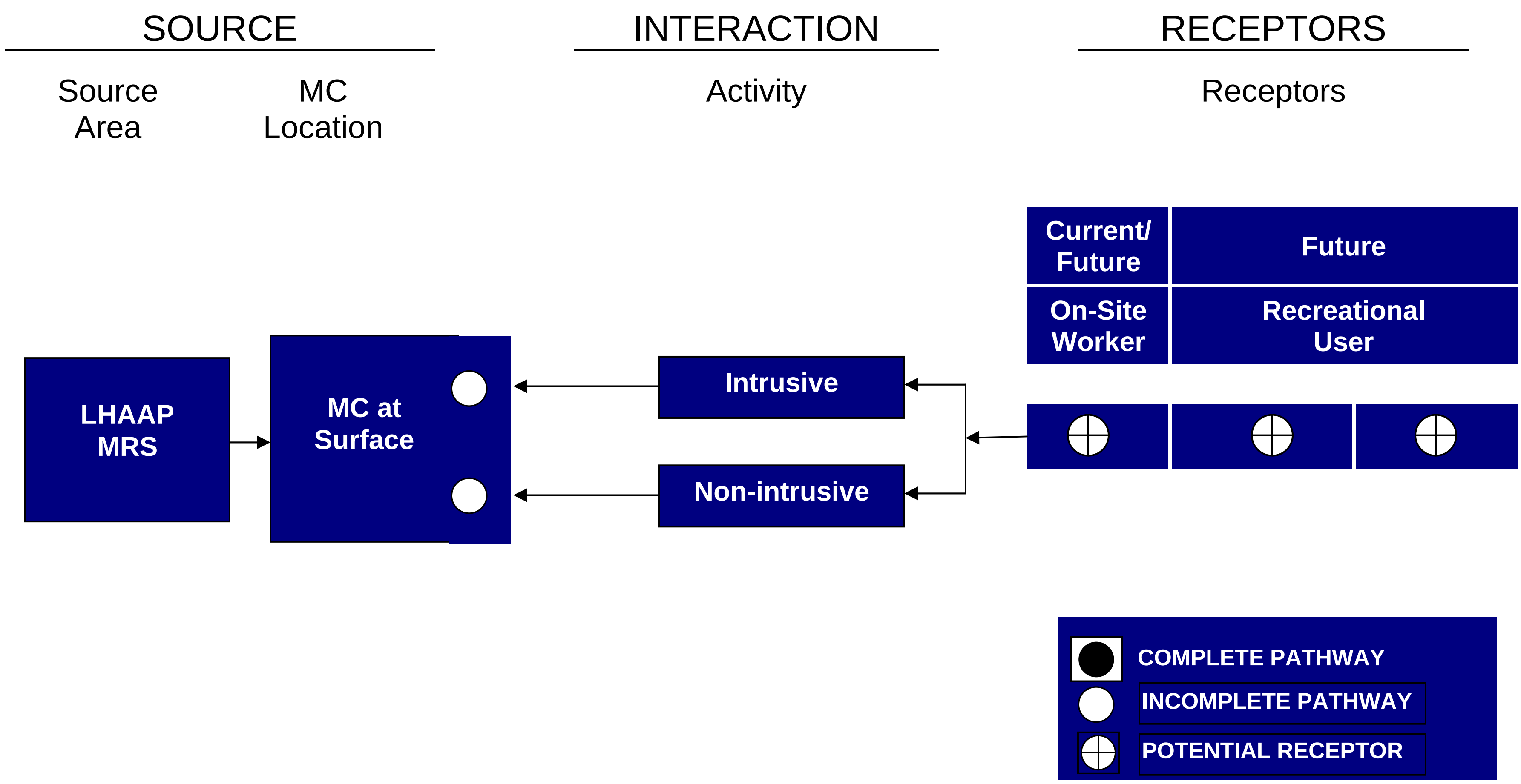

Figure 4-1

MEC SOURCE-RECEPTOR
CONCEPTUAL SITE MODEL

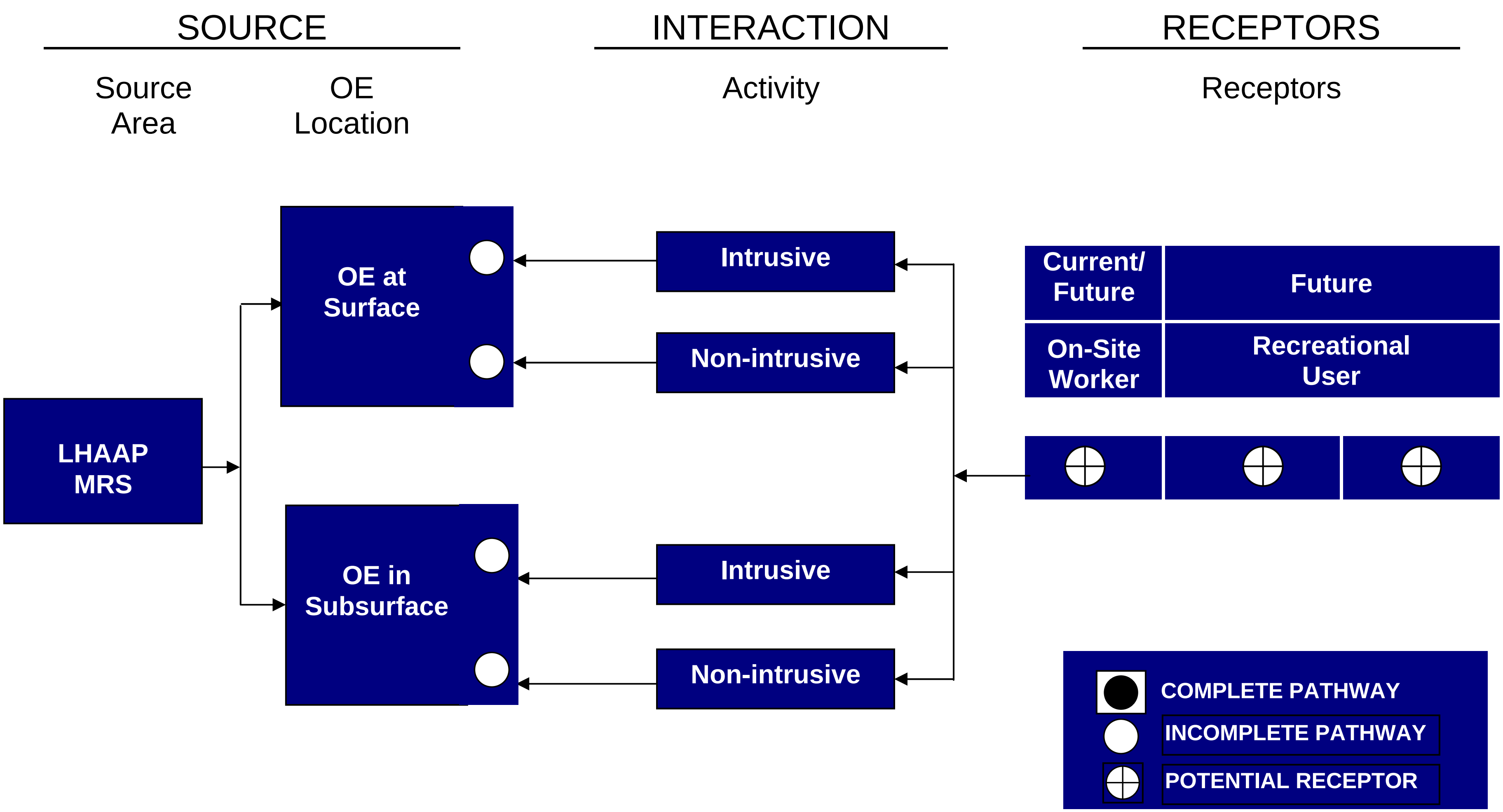

Figure 4-2

5.0 References.

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Appendix A

LHAAP-001-R Data Summary Tables

APPENDIX A
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Table 11-1
Site 27 - South Test Area
EPS Surface Soil Analytical Summary (1982)

Parameter(s)	Units	Sample 0401	Sample 0402	Sample 0403	TCEQ GWP-Ind
		EPS			
Explosives	ug/kg	<DL	<DL	<DL	
TNT	ug/kg	10150	4610	<DL	5,100
Aluminum	mg/kg	1100	1386	1426	10,220
Barium	mg/kg	87	136.6	57.2	200
Chromium	mg/kg	16.3	12.3	10.3	10
Lead	mg/kg	25.5	26.3	24.6	1.5
Manganese	mg/kg	90	199.2	137.5	1421
Strontium	mg/kg	5	9	4.3	6
Copper	mg/kg	2.7	41.1	2.8	130
Zinc	mg/kg	8.1	17.4	9.2	3,066
Nickel	mg/kg	1	4	2.2	204
Fluoride	mg/kg	6	5	6	
Nitrate/Nitrite	mg/kg	15.8	22.3	0.96	
Sulfate	mg/kg	38.2	37.5	33.25	

Table 11-1b
Surface Soil Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(1982)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EPS	1982	Soil	***Metals***	EPS Method		
			Aluminum	1N	0.36	µg/g
			Arsenic	1J	0.3	µg/g
			Antimony	1J	0.76	µg/g
			Barium	1J	0.99	µg/g
			Beryllium	1N	0.5	µg/g
			Cadmium	1N	0.5	µg/g
			Chromium	1N	0.6	µg/g
			Copper	1N	0.5	µg/g
			Lead	1J	0.89	µg/g
			Manganese	1N	0.25	µg/g
			Mercury	2D	2.7	µg/g
			Nickel	1N	0.5	µg/g
			Selenium	1J	0.5	µg/g
			Silver	1N	0.5	µg/g
			Strontium	1N	0.5	µg/g
			Thallium	1N	3	µg/g
			Zinc	1N	0.5	µg/g
			Explosives			
			1,3-dinitrobenzene	7W	0.5	µg/g
			2,4,6-trinitrotoluene	7W	0.73	µg/g
			1,3,5-trinitrobenzene	7W	0.71	µg/g
			2,4 dinitrotoluene	7W	0.5	µg/g
			2,6-dinitrotoluene	7W	0.61	µg/g
			Nitrobenzene	7W	1.15	µg/g
			Anions			
			Nitrates	7U	5	µg/g
			Nitrites	7U	5	µg/g
			Sulfates	7U	25	µg/g
			Chloride	7U	7	µg/g
			Fluoride	7U	5	µg/g
			Chromate	7U	5	µg/g
			Thiocynate	7U	10	µg/g
			Cyanide	7U	5	µg/g

Note(s):

µg/g - micrograms per gram

Table 11-1 (continued)
Site 27 - South Test Area
Ebasco Surface Soil Analytical Summary (1993)

018722

Parameter	Units	Sample SS01	Sample SS02	Sample SS03	Sample SS04	TAEGR Cnd D-Cted
		Ebasco				
Volatiles	ug/kg	<DL	<DL	<DL	<DL	
Semivolatiles	ug/kg	<DL	<DL	<DL	<DL	
Di-n-butylphthalate	ug/kg	2180	<DL	2610	<DL	1600,000
Bis(2-ethylhexyl) phthalate	ug/kg	360	380	360	<DL	600
Explosives	ug/kg	<DL	<DL	<DL	<DL	5,100
Arsenic	mg/kg	0.9	0.7	0.9	0.8	1
Barium	mg/kg	71.7	140	168	80.1	200
Chromium	mg/kg	3.8	2.3	3.9	5.7	10
Lead	mg/kg	5	2	7	7	1.5
Mercury	mg/kg	<DL	0.02	0.02	<DL	0.2
Nickel	mg/kg	1.8	2.5	3	2.9	204.4
Selenium	mg/kg	<DL	0.2	0.2	0.3	5
Nitrate/Nitrite	mg/kg	2.24	2.14	2.05	<DL	
Sulfate	mg/kg	40	30		80	
pH	pH	5.6	6	5.6	5.2	
Conductivity	umhos/cm	98	90	43	30	

018723

Table 11-2
Site 27 - South Test Area
Ebasco Soil Analytical Summary (1993)

Parameter	Units	Boring 27SB30		Boring 27SB31		[illegible]
		0-2'	3-7'	0-2'	5-9'	
Volatiles	ug/kg	<DL	<DL	<DL	<DL	
Semivolatiles	ug/kg	<DL	<DL	<DL	<DL	
Di-n-butylphthalate	ug/kg	443	<DL	<DL	<DL	1,000,000
Bis(2-ethylhexyl) phthalate	ug/kg	332	<DL	<DL	<DL	600
Explosives	ug/kg	<DL	<DL	<DL	<DL	5,100
Arsenic	mg/kg	1.3	1.2	1.1	2	1
Barium	mg/kg	131	54.3	60.8	19.2	200
Chromium	mg/kg	8.2	1.6	3.4	6.9	10
Lead	mg/kg	9	5	6	5	1.5
Mercury	mg/kg	0.02	0.03	0.03	0.02	0.2
Nickel	mg/kg	6.1	1.9	2.6	2.4	204.4
Selenium	mg/kg	0.3	<DL	<DL	0.2	5
Chloride	mg/kg	576	487	44	310	
Nitrate/Nitrite	mg/kg	<DL	<DL	1.05	<DL	
Sulfate	mg/kg	5400	6600	300	2100	
pH	pH	5.7	8.3	5.6	5.8	
Conductivity	umhos/cm	2520	1850	41	525	

018724

Table 11-2 (continued)
Site 27 - South Test Area
Ebasco Soil Analytical Summary (1993)

Parameter	Units	Boring 27SB32		Boring 27SB33		TCEQ GWP-Ind
		0-2'	8-10'	0-2'	5-7'	
Volatiles	ug/kg	<DL	<DL	<DL	<DL	
Semivolatiles	ug/kg	<DL	<DL	<DL	<DL	
Explosives	ug/kg	<DL	<DL	<DL	<DL	
Arsenic	mg/kg	1.4	1.8	1.7	1.3	1
Barium	mg/kg	47.7	42.5	58	14	200
Chromium	mg/kg	5.9	5.8	4.1	8.8	10
Lead	mg/kg	7	6	5	5	1.5
Mercury	mg/kg	0.08	0.04	0.03	0.02	0.2
Nickel	mg/kg	5.6	2.9	2.1	1.7	204A
Selenium	mg/kg	<DL	0.2	<DL	0.3	5
Chloride	mg/kg	133	399	44	310	
Nitrate/Nitrite	mg/kg	1.07	0.5	1.01	1.02	
Sulfate	mg/kg	540	300		190	
pH	pH	5.4	4.7	5.7	4.8	
Conductivity	umhos	193	1680	28	390	

018725

Table 11-2 (continued)
Site 27 - South Test Area
Ebasco Soil Analytical Summary (1993)

Parameter	Units	Boring 27[illegible]		Boring 27[illegible]		TCEQ GW/P-Ind
		0-[illegible]	[illegible]	0-2	[illegible]	
Volatiles	ug/kg	<DL	<DL	<DL	<DL	
Semivolatiles	ug/kg	<DL	<DL	<DL	<DL	
Pesticides/Herbicides	ug/kg	<DL	<DL	<DL	<DL	
Explosives	ug/kg	<DL	<DL	<DL	<DL	5100
Arsenic	mg/kg	1.1	1.7	1.1	1.1	1
Barium	mg/kg	38.1	9.8	33.7	26.3	200
Chromium	mg/kg	5.9	7.2	5.6	3.5	10
Lead	mg/kg	4	7	5	4	1.5
Mercury	mg/kg	0.02	<DL	0.03	<DL	0.2
Selenium	mg/kg	<DL	0.2	0.3	<DL	5
Nickel	mg/kg	4	3.5	1.4	1.6	204.4
Chloride	mg/kg	222	576	222	399	
Nitrate/Nitrite	mg/kg	1.49	0.66	<DL	<DL	
Sulfate	mg/kg	280	340	260	270	
pH	pH	5.4	4.6	4.7	4.7	
Conductivity	umhos/cm	1320	2280	1250	1690	

018726

Table 11-2 (continued)
Site 27 - South Test Area
Ebasco Soil Analytical Summary (1993)

Parameter	Units	Boring 27SB36		Boring 27SB37		TCEA GWP-Ind
		(0-2')	(0-2')	(0-2')	(5-7')	
Volatiles	ug/kg	<DL	<DL	<DL	<DL	
Semivolatiles	ug/kg	<DL	<DL	<DL	<DL	
Pesticides/Herbicides	ug/kg	<DL	<DL	<DL	<DL	
Explosives	ug/kg	<DL	<DL	<DL	<DL	
Arsenic	mg/kg	0.9	0.4	0.8	0.7	1
Barium	mg/kg	151	46.3	54.7	47.6	200
Chromium	mg/kg	6.8	4.3	4.2	3.2	10
Lead	mg/kg	7	5	5	4	1.6
Mercury	mg/kg	0.02	0.02	0.02	0.02	0.7
Nickel	mg/kg	4	3.1	3.8	2.9	2004
Selenium	mg/kg	0.2	<DL	<DL	<DL	5
Chloride	mg/kg	1110	310	1290	931	
Nitrate/Nitrite	mg/kg	<DL	<DL	<DL	<DL	
Sulfate	mg/kg	4700	3900	5400	5800	
pH	pH	8.8	9.1	8.9	9	
Conductivity	umhos/cm	5260	1270	5170	3380	

00100272

018727

Table 11-2 (continued)
Site 27 - South Test Area
Ebasco Soil Analytical Summary (1993)

Parameter	Units	Boring 27(S)B38		Boring 27(S)B39		TCEQ GW?-Ind
		0-2'	4-6'	0-2'	15-17'	
Volatiles	ug/kg	<DL	<DL	<DL	<DL	
Semivolatiles	ug/kg	<DL	<DL	<DL	<DL	
Di-n-butylphthalate	ug/kg	<DL	<DL	<DL	513	
Pesticides/Herbicides	ug/kg	<DL	<DL	<DL	<DL	5,100
Explosives	ug/kg	<DL	<DL	<DL	<DL	
Arsenic	mg/kg	0.7	0.5	2.3	0.6	1
Barium	mg/kg	27.3	49.4	41.8	6.1	200
Chromium	mg/kg	6	5.3	22.2	<DL	10
Lead	mg/kg	5	4	5	6	1.5
Mercury	mg/kg	0.05	<DL	0.03	<DL	0.2
Nickel	mg/kg	<DL	2.6	<DL	<DL	204.4
Selenium	mg/kg	0.2	<DL	<DL	<DL	5
Chloride	mg/kg	310	665	<DL	487	
Nitrate/Nitrite	mg/kg	<DL	<DL	<DL	<DL	
Sulfate	mg/kg	4000	5600	<DL	4900	
pH	pH	7.5	8.4	6.5	6.6	
Conductivity	umhos/cm	908	2590	135	226	

Table 11-2b
Soil Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(1993)

Investigated By /Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Soil - borings/surface soil				
			Metals			
			Arsenic	7060	0.1	mg/kg
			Antimony	6010	1	mg/kg
			Barium	6010	1	mg/kg
			Cadmium	6010	1	mg/kg
			Chromium	6010	1	mg/kg
			Lead	7421	1	mg/kg
			Mercury	7470/7471	0.01	mg/kg
			Nickel	6010	1	mg/kg
			Selenium	7740	0.1	mg/kg
			Silver	6010	1	mg/kg
			Thallium	7841	0.2	mg/kg
			VOCs			
			1,1,1-Trichloroethane	8240	5	µg/kg
			1,1,2,2-Tetrachloroethane	8240	5	µg/kg
			1,1,2-Trichloroethane	8240	5	µg/kg
			1,1-Dichloroethane	8240	5	µg/kg
			1,1-Dichloroethene	8240	5	µg/kg
			1,2-Dichloroethane	8240	5	µg/kg
			1,2-Dichloroethene	8240	5	µg/kg
			1,2-Dichloropropane	8240	5	µg/kg
			2-Butanone	8240	50	µg/kg
			2-Chloroethylvinylether	8240	10	µg/kg
			2-Hexanone	8240	50	µg/kg
			4-Methyl-2-pentanone	8240	50	µg/kg
			Acetone	8240	100	µg/kg
			Benzene	8240	5	µg/kg
			Bromodichloromethane	8240	5	µg/kg
			Bromoform	8240	5	µg/kg
			Bromomethane	8240	10	µg/kg
			Carbon disulfide	8240	5	µg/kg
			Carbon tetrachloride	8240	5	µg/kg
			Chlorobenzene	8240	5	µg/kg
			Chloroethane	8240	10	µg/kg
			Chloroform	8240	5	µg/kg
			Chloromethane	8240	10	µg/kg
			Chlorodibromomethane	8240	5	µg/kg
			Ethylbenzene	8240	5	µg/kg
			Methylene chloride	8240	5	µg/kg
			Styrene	8240	5	µg/kg
			Tetrachloroethene	8240	5	µg/kg
			Toluene	8240	5	µg/kg
			Trichloroethene	8240	5	µg/kg
			Vinyl acetate	8240	50	µg/kg
			Vinyl chloride	8240	10	µg/kg
			Xylenes	8240	5	µg/kg
			cis-1,3-Dichloropropene	8240	5	µg/kg
			trans-1,3-Dichloropropene	8240	5	µg/kg

Table 11-2b
Soil Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(1993)

Investigated By /Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Soil - borings/surface soil				
			SVOCs			
			1,2,4-Trichlorobenzene	8270	330	µg/kg
			1,2-Dichlorobenzene	8270	330	µg/kg
			1,3-Dichlorobenzene	8270	330	µg/kg
			1,4-Dichlorobenzene	8270	330	µg/kg
			2,4,5-Trichlorophenol	8270	1650	µg/kg
			2,4,6-Trichlorophenol	8270	330	µg/kg
			2,4-Dichlorophenol	8270	330	µg/kg
			2,4-Dimethylphenol	8270	330	µg/kg
			2,4-Dinitrophenol	8270	1650	µg/kg
			2,4-Dinitrotoluene	8270	330	µg/kg
			2,6-Dinitrotoluene	8270	330	µg/kg
			2-Chloronaphthalene	8270	330	µg/kg
			2-Chlorophenol	8270	330	µg/kg
			2-Methylnaphthalene	8270	330	µg/kg
			2-Methylphenol	8270	330	µg/kg
			2-Nitroaniline	8270	1650	µg/kg
			2-Nitrophenol	8270	330	µg/kg
			3,3-Dichlorobenzidine	8270	650	µg/kg
			3-Nitroaniline	8270	1650	µg/kg
			4-Bromophenylphenylether	8270	330	µg/kg
			4-Chloro-3-methylphenol	8270	650	µg/kg
			4-Chloroaniline	8270	650	µg/kg
			4-Chlorophenylphenylether	8270	330	µg/kg
			4-Methylphenol	8270	330	µg/kg
			4-Nitroaniline	8270	1650	µg/kg
			4-Nitrophenol	8270	1650	µg/kg
			4,6-Dinitro-2-methylphenol	8270	1650	µg/kg
			Acenaphthene	8270	330	µg/kg
			Acenaphthylene	8270	330	µg/kg
			Anthracene	8270	330	µg/kg
			Benzo(a)anthracene	8270	330	µg/kg
			Benzo(a)pyrene	8270	330	µg/kg
			Benzo(b)fluoranthene	8270	330	µg/kg
			Benzo(g,h,i)perylene	8270	330	µg/kg
			Benzo(k)fluoranthene	8270	330	µg/kg
			Benzoic acid	8270	1650	µg/kg
			Benzyl alcohol	8270	650	µg/kg
			Butylbenzylphthalate	8270	330	µg/kg
			Chrysene	8270	330	µg/kg
			Dibenzo(a,h)anthracene	8270	330	µg/kg
			Dibenzofuran	8270	330	µg/kg
			Di-n-butylphthalate	8270	330	µg/kg
			Diethylphthalate	8270	330	µg/kg
			Dimethylphthalate	8270	330	µg/kg
			Fluoranthene	8270	330	µg/kg
			Fluorene	8270	330	µg/kg
			Hexachlorobenzene	8270	330	µg/kg
			Hexachlorobutadiene	8270	330	µg/kg

Table 11-2b
Soil Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(1993)

Investigated By /Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Soil - borings/surface soil				
			Hexachlorocyclopentadiene	8270	330	µg/kg
			Hexachloroethane	8270	330	µg/kg
			Indeno(1,2,3-c,d)pyrene	8270	330	µg/kg
			Isophorone	8270	330	µg/kg
			Naphthalene	8270	330	µg/kg
			Nitrobenzene	8270	330	µg/kg
			Pentachlorophenol	8270	1650	µg/kg
			Phenanthrene	8270	330	µg/kg
			Phenol	8270	330	µg/kg
			Pyrene	8270	330	µg/kg
			bis(2-Chloroethoxy)methane	8270	330	µg/kg
			bis(2-Chloroethyl)ether	8270	330	µg/kg
			bis(2-Chloroisopropyl)ether	8270	330	µg/kg
			bis(2-Ethylhexyl)phthalate	8270	330	µg/kg
			di-n-Octylphthalate	8270	330	µg/kg
			n-Nitrosodi-n-propylamine	8270	330	µg/kg
			n-Nitrosodiphenylamine	8270	330	µg/kg
			Explosives			
			HMX	8330	0.5	mg/kg
			RDX	8330	0.5	mg/kg
			1,3,5-TNB	8330	0.25	mg/kg
			1,3-DNB	8330	0.25	mg/kg
			Tetryl	8330	0.5	mg/kg
			Nitrobenzene	8330	0.26	mg/kg
			2,4,6-TNT	8330	0.25	mg/kg
			2,6-DNT	8330	0.25	mg/kg
			2,4-DNT	8330	0.25	mg/kg
			2-Nitrotoluene	8330	0.25	mg/kg
			4-Nitrotoluene	8330	0.25	mg/kg
			3-Nitrotoluene	8330	0.25	mg/kg
			Anions			
			Nitrate-Nitrite Nitrogen	353.3	0.1	mg/kg
			Chloride	9052	10	mg/kg
			Sulfate	9038	10 - 20	mg/kg

Note(s):

µg/kg - micrograms per kilogram

mg/kg - milligrams per kilogram

SVOC - semivolatile organic compound

VOC - volatile organic compound

00100276

18728

During the Phase 2 field investigation conducted by Sverdrup in 1994, four soil borings (27WW01 through 27WW04) were drilled in the vicinity of 27SB33 and completed as monitoring wells. Three surface soil samples (27SS21, 27SS22, and 27SS23) were collected from 0.0 to 0.5 feet using a stainless steel hand auger. The three surface soil samples were analyzed for chromium and mercury.

No explosives were detected in the Phase 2 soil samples. No volatiles or semivolatiles were tested. Results of the surface soil samples are given in Table 11-3 and results of the soil borings are given in Table 11-4.

Table 11-3
Site 27 - South Test Area
Sverdrup Surface Soil Analytical Summary (1994)

Parameter	Units	Sample 27SS21	Sample 27SS22	Sample 27SS23	TCEQ GWP-Ind
		Sverdrup			
Chromium	mg/kg	10.6	7.8	5.6	10
Mercury	mg/kg	<DL	<DL	<DL	0.2

Table 11-4
Site 27 - South Test Area
Sverdrup Soil Analytical Summary (1994)

Parameter	Units	Well 27WW01				TCEQ GWP-Ind
		0-2.5	6-7	10-12	[illegible]	
Explosives	ug/kg	<DL	<DL	<DL	<DL	
Arsenic	mg/kg	2.5	5.2	3.2	3.4	1
Barium	mg/kg	1.05	86.1	23.8	72.8	200
Chromium	mg/kg	13.3	13.6	9	15.4	10
Lead	mg/kg	9	10	6.5	12.6	1.5
Nickel	mg/kg	8.4	8.3	5.2	18.6	2044
Chloride	mg/kg	<DL	<DL	<DL	22.2	
Nitrate/Nitrite	mg/kg	0.75	0.81	0.82	0.99	
Sulfate	mg/kg	<DL	<DL	16.4	54.4	

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Table 11-4 (continued)
Site 27 - South Test Area
Sverdrup Soil Analytical Summary (1994)

Parameter	Units	Well 27AW02 0-2	Well 27AW02 [illegible]	Well 27AW03 0-2	Well 27AW03 3-5	Well 27AW03 8-10	TCLQ GWP-Ind
Explosives	µg/kg	<DL	<DL	<DL	<DL	<DL	
Arsenic	mg/kg	1.3	1.5	1.1	1.5	2.1	1
Barium	mg/kg	105	148	84.6	54.3	23	200
Chromium	mg/kg	6.9	9.6	8.2	8.5	7.1	0.2
Lead	mg/kg	6	7.1	6.7	5.4	4.9	1.5
Nickel	mg/kg	3.3	6.6	3.8	4.7	5.1	204.4
Chloride	mg/kg	49.8	<DL	<DL	22.6	30.4	
Nitrate/Nitrite	mg/kg	0.64	0.88	0.82	0.54	0.55	
Sulfate	mg/kg	41.5	<DL	<DL	26.3	26.7	

Table 11-4
Site 27 - South Test Area
Sverdrup Soil Analytical Summary (1994)

Parameter	Units	Well 27AW04 0-2	Well 27AW04 3-5	Well 27AW04 8-10	TCLQ GWP-Ind
Explosives	µg/kg	<DL	<DL	<DL	
Arsenic	mg/kg	2.3	1.8	1.1	1
Barium	mg/kg	104	639	65.8	200
Chromium	mg/kg	6.2	9.8	6	10
Lead	mg/kg	7.7	6.1	4.5	1.5
Nickel	mg/kg	3.9	10	9.4	204.4
Chloride	mg/kg	<DL	6322	485	
Nitrate/Nitrite	mg/kg	1.6	1.9	2.6	
Sulfate	mg/kg	314	498	354	

Table 11-4b
Soil Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(1994)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
SVERDRUP	1994	Soil - surface	chromium	6010	NA	
			mercury	7470/7471	0.12	mg/kg
		Soil - monitoring well borings	***Metals***			
			Arsenic	7060	NA	
			Antimony	6010	1.1 - 1.3	mg/kg
			Barium	6010	NA	
			Cadmium	6010	0.56 - 0.63	mg/kg
			Chromium	6010	NA	
			Lead	7421	NA	
			Mercury	7470/7471	0.11 - 0.13	mg/kg
			Nickel	6010	NA	
			Selenium	7740	0.56 - 1.24	mg/kg
			Silver	6010	1.1 - 1.3	mg/kg
			Thallium	7841	0.55 - 1.2	mg/kg
			Explosives			
			1,3-DNB	8330	0.5 - 0.628	mg/kg
			RDX	8330	0.5 - 0.628	mg/kg
			1,3,5-TNB	8330	0.7 - 0.879	mg/kg
			2,4,6-TNT	8330	0.594 - 0.628	mg/kg
			2,4-DNT	8330	0.594 - 0.628	mg/kg
			2,6-DNT	8330	0.594 - 0.628	mg/kg
			HMX	8330	0.9 - 1.13	mg/kg
			Nitrobenzene	8330	0.6 - 0.754	mg/kg
			o-Nitrotoluene	8330	0.9 - 1.13	mg/kg
			3-Nitrotoluene	8330	0.9 - 1.13	mg/kg
			p-Nitrotoluene	8330	1.1 - 1.38	mg/kg
			Tetryl	8330	1.9 - 2.39	mg/kg
			2-Amino dinitrotoluene	8330	0.9 - 1.13	mg/kg
			4-Amino-2,6- dinitrotoluene	8330	1.1 - 1.38	mg/kg
			Anions			
			Nitrate-Nitrite-Nitrogen	353.3	NA	
			Chloride	9052	5.6 - 12.54	mg/kg
			Sulfate	9038	5.6 - 6.1	mg/kg

Note(s):
mg/kg - milligrams per kilogram
NA - Not available

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Table 11-5
Site 27 - South Test Area
Tulsa District Corps of Engineers (1996/97)
Surface Soil Analytical Summary

Parameter	Units	RASS27-01	RASS27-02	RASS27-03	RASS27-04	RASS27-05	RASS27-06	RASS27-07	RASS27-08	RASS27-09	TCEQ GWP-Ind
Explosives	ug/kg	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	<DL	5,100
Aluminum	mg/kg	NT	10300	NT	5390	NT	4350	NT	8360	NT	10,200
Antimony	mg/kg	NT	<DL	NT	<DL	NT	<DL	NT	<DL	NT	
Arsenic	mg/kg	NT	13.1	NT	6.08	NT	11.6	NT	7.81	NT	1
Barium	mg/kg	NT	82.6	NT	123	NT	112	NT	69.5	NT	200
Beryllium	mg/kg	NT	1.16	NT	<DL	NT	<DL	NT	<DL	NT	0.4
Cadmium	mg/kg	NT	21	NT	8.54	NT	14.7	NT	9.04	NT	0.5
Calcium	mg/kg	NT	554	NT	392	NT	809	NT	787	NT	NA
Chromium	mg/kg	NT	30.9	NT	15.2	NT	36.3	NT	21.4	NT	10
Cobalt	mg/kg	NT	<DL	NT	<DL	NT	<DL	NT	<DL	NT	
Copper	mg/kg	NT	18.70	NT	6.94	NT	7.69	NT	5.65	NT	130
Iron	mg/kg	NT	70,000	NT	45,400	NT	23,200	NT	21,800	NT	NA
Lead	mg/kg	NT	17.0	NT	18.0	NT	15.0	NT	11.0	NT	1.5
Magnesium	mg/kg	NT	310	NT	187	NT	308	NT	635	NT	NA
Manganese	mg/kg	NT	204	NT	137	NT	223	NT	135	NT	1431
Mercury	mg/kg	NT	<DL	NT	<DL	NT	<DL	NT	<DL	NT	0.2
Nickel	mg/kg	NT	<DL	NT	2.41	NT	<DL	NT	<DL	NT	2044
Potassium	mg/kg	NT	302	NT	150	NT	235	NT	513	NT	NA
Selenium	mg/kg	NT	0.83	NT	0.71	NT	0.66	NT	<DL	NT	5
Silver	mg/kg	NT	<DL	NT	<DL	NT	<DL	NT	<DL	NT	
Strontium	mg/kg	NT	<DL	NT	<DL	NT	<DL	NT	16.8	NT	6132
Thallium	mg/kg	NT	<DL	NT	<DL	NT	<DL	NT	<DL	NT	
Vanadium	mg/kg	NT	72.4	NT	50.7	NT	25.6	NT	27.5	NT	72
Zinc	mg/kg	NT	41.3	NT	19.6	NT	19.6	NT	22.4	NT	3066

NT = Not tested.

Table 11-5b
Soil Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(1996/1997)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
USACE	Aug-96	Soil - Surface				
			Metals			
			Arsenic	7060	2.58 - 2.74	mg/kg
			Antimony	6010	10.3 - 10.9	mg/kg
			Barium	6010	2.06 - 2.19	mg/kg
			Cadmium	6010	2.06 - 2.19	mg/kg
			Chromium	6010	2.06 - 2.19	mg/kg
			Lead	7421	2	mg/kg
			Mercury	7471	0.124 - 0.131	mg/kg
			Nickel	6010	2.06 - 2.19	mg/kg
			Selenium	7740	0.52 - 0.55	mg/kg
			Silver	6010	2.10 - 10.3	mg/kg
			Thallium	6010	15.5 - 16.4	mg/kg
			Explosives			
			HMX	8330	0.9	mg/kg
			RDX	8330	0.5	mg/kg
			1,3,5-TNB	8330	0.7	mg/kg
			1,3-DNB	8330	0.5	mg/kg
			Tetryl	8330	1.9	mg/kg
			Nitrobenzene	8330	0.6	mg/kg
			2,4,6-TNT	8330	0.5	mg/kg
			2,6-DNT	8330	0.5	mg/kg
			2,4-DNT	8330	0.5	mg/kg
			2-Nitrotoluene	8330	0.9	mg/kg
			4-Nitrotoluene	8330	1.1	mg/kg
			3-Nitrotoluene	8330	0.9	mg/kg
			2-Am-DNT	8330	0.9	mg/kg
			4-Am-DNT	8330	1.1	mg/kg
USACE	Feb-97	Soil - Surface	***Metals***			
			Aluminum	6010	24.9 - 30.7	mg/kg
			Beryllium	6010	0.62 - 0.77	mg/kg
			Calcium	6010	62.2 - 76.8	mg/kg
			Cobalt	6010	2.49 - 3.07	mg/kg
			Copper	6010	1.24 - 1.54	mg/kg
			Iron	6010	12.4 - 15.4	mg/kg
			Potassium	6010	124 -154	mg/kg
			Magnesium	6010	12.4 - 15.4	mg/kg
			Manganese	6010	1.24 - 1.54	mg/kg
			Strontium	6010	12.4 - 15.4	mg/kg
			Vanadium	6010	2.49 - 3.07	mg/kg
			Zinc	6010	3.73 - 4.61	mg/kg

Note(s):

mg/kg - milligrams per kilogram

USACE - U.S. Army Corps of Engineers

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Table 11-6
Site 27 - South Test Area
Groundwater Analytical Summary
EPS (1982) and Ebasco (1993)

Parameter	Units	Well 131		Well 132		MCL	TCEQ GW-Ind
		11/82	3/93	11/82	3/93		
Volatiles	ug/l	<DL	<DL	NT	<DL		
Semivolatiles	ug/l	<DL	<DL	NT	<DL		
Di-n-butylphthalate	ug/l	52	<DL	NT	<DL		10,220
Ethylene glycol	ug/l	24	<DL	NT	<DL		204,400
Pesticides	ug/l	<DL	NT	NT	NT		
Explosives	ug/l	<DL	<DL	<DL	<DL		
Barium	mg/l	0.048	0.25	0.053	0.09	2	
Chromium	mg/l	<DL	<DL	0.015	<DL	0.1	
Lead	mg/l	<DL	<DL	0.016	<DL	0.015	
Nickel	mg/l	0.053	<DL	0.102	<DL		0.644
Aluminum	mg/l	0.222	NT	0.232	NT		102.2
Cadmium	mg/l	0.001	<DL	0.009	<DL	0.005	
Strontium	mg/l	1.34	NT	2.64	NT		61.32
Thallium	mg/l	0.08	<DL	0.1	<DL	0.002	
Chloride	mg/l	27850	306	10330	1700		
Fluoride	mg/l	1	NT	1	NT		
Nitrate/Nitrite	mg/l	<DL	<DL	<DL	0.01		
Sulfate	mg/l	216.6	121	337	780		

NT = Not tested.

Table 11-6b
Groundwater Analytical Methods and Detection Limits
South Test Area LHAAP-001-R
1982 and 1993

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EPS	1982	groundwater -wells		EPS Method		
			Metals			
			Aluminum	1M	10	µg/L
			Arsenic	1B	6	µg/L
			Antimony	1B	10.2	µg/L
			Barium	1B	11.4	µg/L
			Beryllium	1M	10	µg/L
			Cadmium	1B	0.28	µg/L
			Chromium	1B	6.64	µg/L
			Copper	1M	23.9	µg/L
			Lead	1B	7.49	µg/L
			Manganese	1M	12.1	µg/L
			Mercury	1D	1.3	µg/L
			Nickel	1M	30	µg/L
			Selenium	1B	6	µg/L
			Silver	1M	10	µg/L
			Strontium	1M	25	µg/L
			Thallium	1M	50	µg/L
			Zinc	1M	27.1	µg/L
			Organics			
			Benzene	2J	1	µg/L
			Chloroform	2J	1	µg/L
			Trichloroethene	2J	1	µg/L
			Trichloroethane	NA	NA	
			Trichlororomethane	NA	NA	
			Pentachlorophenol	1X	2	µg/L
			o-chlorophenol	1X	0.7	µg/L
			2,4-dichlorophenol	1X	1	µg/L
			Pentane	NA	NA	
			Di-N-Butyl-phthalate	1Z	2	µg/L
			Dibutylphthalate	NA	NA	
			Dichloromethane	NA	NA	
			Diethylphthalate	1Z	2	µg/L
			Nitrobenzene	1Z	1	µg/L
			1,1-bicyclohexyl	NA	NA	
			Glycine,N-acetyl-Ntrifluoroacetyl)methylester	NA	NA	
			2-(1,1-dimethylethoxyl)-ethanol	NA	NA	
			1-bromo-2-methoxy-cyclopentane	NA	NA	
EPS	1982	groundwater -wells	***Explosives***			
			1,3-dinitrobenzene	7V	1.68	µg/L
			2,4,6-trinitrotoluene	7V	1.46	µg/L
			1,3,5-trinitrobenzene	7V	1.08	µg/L
			2,4 dinitrotoluene	7V	0.89	µg/L
			2,6-dinitrotoluene	7V	1.2	µg/L
			Nitrobenzene	7V	0.76	µg/L
			Pesticides/PCBs			
			p,p-DDT	2F	0.05	µg/L
			Dieldrin	2F	0.09	µg/L
			Alpha-BHC	2F	0.09	µg/L
			Heptachlor	2F	0.05	µg/L
			Lindane	2F	0.09	µg/L
			Toxaphene	2F	4	µg/L
			PCB 1016	2F	0.6	µg/L
			PCB 1260	2F	1	µg/L

Table 11-6b
Groundwater Analytical Methods and Detection Limits
South Test Area LHAAP-001-R
1982 and 1993

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EPS	1982	groundwater -wells	***Anions***			
			Nitrate	2P	500	µg/L
			Nitrite	2P	250	µg/L
			Phosphate	2P	125	µg/L
			Sulfates	2P	580	µg/L
			Chloride	2P	500	µg/L
			Fluoride	2P	500	µg/L
			Chromate	2P	500	µg/L
			Thiocyanate	2P	500	µg/L
			Cyanide	2P	600	µg/L
EBASCO	1993	groundwater	***Metals***			
			Arsenic	7060	0.01	mg/L
			Antimony	6010	0.005	mg/L
			Barium	6010	0.01	mg/L
			Cadmium	6010	0.005	mg/L
			Chromium	6010	0.05	mg/L
			Lead	7421	0.005	mg/L
			Mercury	7470/7471	0.001	mg/L
			Nickel	6010	0.05	mg/L
			Selenium	7740	0.01	mg/L
			Silver	6010	0.01	mg/L
			Thallium	7841	0.002	mg/L
			VOCs			
			1,1,1-Trichloroethane	8240	5	µg/L
			1,1,2,2-Tetrachloroethane	8240	5	µg/L
			1,1,2-Trichloroethane	8240	5	µg/L
			1,1-Dichloroethane	8240	5	µg/L
			1,1-Dichloroethene	8240	5	µg/L
			1,2-Dichloroethane	8240	5	µg/L
			1,2-Dichloroethene	8240	5	µg/L
			1,2-Dichloropropane	8240	5	µg/L
			2-Butanone	8240	50	µg/L
			2-Chloroethylvinylether	8240	10	µg/L
			2-Hexanone	8240	50	µg/L
			4-Methyl-2-pentanone	8240	50	µg/L
			Acetone	8240	100	µg/L
			Benzene	8240	5	µg/L
			Bromodichloromethane	8240	5	µg/L
			Bromoform	8240	5	µg/L
			Bromomethane	8240	10	µg/L
			Carbon disulfide	8240	5	µg/L
			Carbon tetrachloride	8240	5	µg/L
			Chlorobenzene	8240	5	µg/L
			Chloroethane	8240	10	µg/L
			Chloroform	8240	5	µg/L
			Chloromethane	8240	10	µg/L
			Chlorodibromomethane	8240	5	µg/L
			Ethylbenzene	8240	5	µg/L
			Methylene chloride	8240	5	µg/L
			Styrene	8240	5	µg/L
			Tetrachloroethene	8240	5	µg/L
			Toluene	8240	5	µg/L
			Trichloroethene	8240	5	µg/L
			Vinyl acetate	8240	50	µg/L
			Vinyl chloride	8240	10	µg/L

Table 11-6b
Groundwater Analytical Methods and Detection Limits
South Test Area LHAAP-001-R
1982 and 1993

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	groundwater	***VOCs (continued)***			
			Xylenes	8240	5	µg/L
			cis-1,3-Dichloropropene	8240	5	µg/L
			trans-1,3-Dichloropropene	8240	5	µg/L
			SVOCs			
			1,2,4-Trichlorobenzene	8270	10	µg/L
			1,2-Dichlorobenzene	8270	10	µg/L
			1,3-Dichlorobenzene	8270	10	µg/L
			1,4-Dichlorobenzene	8270	10	µg/L
			2,4,5-Trichlorophenol	8270	50	µg/L
			2,4,6-Trichlorophenol	8270	10	µg/L
			2,4-Dichlorophenol	8270	10	µg/L
			2,4-Dimethylphenol	8270	10	µg/L
			2,4-Dinitrophenol	8270	50	µg/L
			2,4-Dinitrotoluene	8270	10	µg/L
			2,6-Dinitrotoluene	8270	10	µg/L
			2-Chloronaphthalene	8270	10	µg/L
			2-Chlorophenol	8270	10	µg/L
			2-Methylnaphthalene	8270	10	µg/L
			2-Methylphenol	8270	10	µg/L
			2-Nitroaniline	8270	50	µg/L
			2-Nitrophenol	8270	10	µg/L
			3,3-Dichlorobenzidine	8270	20	µg/L
			3-Nitroaniline	8270	50	µg/L
			4-Bromophenylphenylether	8270	10	µg/L
			4-Chloro-3-methylphenol	8270	20	µg/L
			4-Chloroaniline	8270	20	µg/L
			4-Chlorophenylphenylether	8270	10	µg/L
			4-Methylphenol	8270	10	µg/L
			4-Nitroaniline	8270	50	µg/L
			4-Nitrophenol	8270	50	µg/L
			4,6-Dinitro-2-methylphenol	8270	50	µg/L
			Acenaphthene	8270	10	µg/L
			Acenaphthylene	8270	10	µg/L
			Anthracene	8270	10	µg/L
			Benzo(a)anthracene	8270	10	µg/L
			Benzo(a)pyrene	8270	10	µg/L
			Benzo(b)fluoranthene	8270	10	µg/L
			Benzo(g,h,i)perylene	8270	10	µg/L
			Benzo(k)fluoranthene	8270	10	µg/L
			Benzoic acid	8270	50	µg/L
			Benzyl alcohol	8270	20	µg/L
			Butylbenzylphthalate	8270	10	µg/L
			Chrysene	8270	10	µg/L
			Dibenzo(a,h)anthracene	8270	10	µg/L
			Dibenzofuran	8270	10	µg/L
			Di-n-butylphthalate	8270	10	µg/L
			Diethylphthalate	8270	10	µg/L
			Dimethylphthalate	8270	10	µg/L
			Fluoranthene	8270	10	µg/L
			Fluorene	8270	10	µg/L
			Hexachlorobenzene	8270	10	µg/L
			Hexachlorobutadiene	8270	10	µg/L
			Hexachlorocyclopentadiene	8270	10	µg/L
			Hexachloroethane	8270	10	µg/L
			Indeno(1,2,3-c,d)pyrene	8270	10	µg/L

Table 11-6b
Groundwater Analytical Methods and Detection Limits
South Test Area LHAAP-001-R
1982 and 1993

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	groundwater	***SVOCs (continued)***			
			Isophorone	8270	10	µg/L
			Naphthalene	8270	10	µg/L
			Nitrobenzene	8270	10	µg/L
			Pentachlorophenol	8270	50	µg/L
			Phenanthrene	8270	10	µg/L
			Phenol	8270	10	µg/L
			Pyrene	8270	10	µg/L
			bis(2-Chloroethoxy)methane	8270	10	µg/L
			bis(2-Chloroethyl)ether	8270	10	µg/L
			bis(2-Chloroisopropyl)ether	8270	10	µg/L
			bis(2-Ethylhexyl)phthalate	8270	10	µg/L
			di-n-Octylphthalate	8270	10	µg/L
			n-Nitrosodi-n-propylamine	8270	10	µg/L
			n-Nitrosodiphenylamine	8270	10	µg/L
			Explosives			
			HMX	8330	0.1	µg/L
			RDX	8330	0.1	µg/L
			1,3,5-TNB	8330	0.1	µg/L
			1,3-DNB	8330	0.1	µg/L
			Tetryl	8330	0.1	µg/L
			Nitrobenzene	8330	0.1	µg/L
			2,4,6-TNT	8330	0.1	µg/L
			2,6-DNT	8330	0.1	µg/L
			2,4-DNT	8330	0.1	µg/L
			2-Nitrotoluene	8330	0.1	µg/L
			4-Nitrotoluene	8330	0.1	µg/L
			3-Nitrotoluene	8330	0.1	µg/L
			Anions			
			Nitrate-Nitrite Nitrogen	353.3	0.01	mg/L
			Direct Total Phenol	9065	0.1	mg/L
			Chloride	9252	1	mg/L
			Sulfate	9038	1 - 30	mg/L
			TOC	9060	1	mg/L

Note(s):
µg/L - micrograms per liter
mg/L - milligrams per liter
NA - not available
PCB - polychlorinated biphenyl
SVOC - semivolatile organic compound
TOC - total organic carbon
VOC - volatile organic compound

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Table 11-7
Site 27 - South Test Area
Groundwater Analytical Summary - Sverdrup Wells (1994)

Parameters	Units	Well 27WW01	Well 27WW02	Well 27WW03	Well 27WW04	MCL	TCEQ GW-Ind
Semivolatiles	ug/l	<DL	<DL	<DL	<DL		
Explosives	ug/l	<DL	<DL	<DL	<DL		
Arsenic	mg/l	0.006	<DL	<DL	<DL	0.01	
Barium	mg/l	0.097	0.046	0.017	0.05	2	
Chromium	mg/l	0.053	0.026	0.01	0.025	0.1	
Nickel	mg/l	0.13	0.23	0.12	0.37		2.044
Chloride	mg/l	2340	3700	2.7	2200		
Nitrate/Nitrite	mg/l	0.06	0.08	1.17	0.24		
Sulfate	mg/l	1250	1800	2.4	1700		

Phase 1 groundwater investigations consisted of collecting groundwater grab samples from the 10 soil borings drilled. The purpose of collecting groundwater grab samples was to obtain preliminary field screening data of potential groundwater contaminants. The most significant findings from the analysis of groundwater grab samples was the detection of nitrobenzene (6.58 ug/l) and RDX (18.4 ug/l) in the sample from 27GG33, located in the cratered hillocks west of the test pad. Sample 27GG38 contained elevated nitrate at 3.31 mg/l and 27GG37 contained elevated sulfate, chloride, and nitrate. A data table summarizing the results of all groundwater grab samples is shown in Appendix D.

Based on the explosives found in grab sample 27GG33, four monitoring wells, 27WW01 through 27WW04, were installed during the Phase 2 field investigation at the locations shown on Figure 11-1. Well 27WW01 was installed approximately 10 feet from 27SB33, and wells 27WW02 and 27WW03 were installed to the east of the boring. Well 27WW04 was installed downgradient of the other three wells. The maximum screen length used was 10 ft.

The wells were purged a minimum of five well volumes and sampled once field parameters stabilized. No explosives or semivolatiles were found. Volatiles were not tested. Nickel, nitrate, and chloride were detected at elevated levels in most of the samples. Results of these analyses are given in Table 11-7.

Table 11-7b
Groundwater Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(1994)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
SVERDRUP	1994	groundwater-wells	***Metals***			
			Arsenic	7060	0.005	mg/L
			Antimony	6010	0.01	mg/L
			Barium	6010	0.02	mg/L
			Cadmium	6010	0.01	mg/L
			Chromium	6010	0.02	mg/L
			Lead	7421	0.02 - 0.1	mg/L
			Mercury	7470/7471	0.0002	mg/L
			Nickel	6010	NA	
			Selenium	7740	0.005 - 0.02	mg/L
			Silver	6010	0.02	mg/L
			Thallium	7841	0.05	mg/L
			SVOCs			
			NA	NA	NA	
			Explosives			
			1,3-DNB	8330	0.2 - 0.3	µg/L
			RDX	8330	0.6 - 0.9	µg/L
			1,3,5-TNB	8330	0.5 - 0.75	µg/L
			2,4,6-TNT	8330	0.7 - 1.05	µg/L
			2,4-DNT	8330	0.5 - 0.75	µg/L
			2,6-DNT	8330	0.5 - 0.75	µg/L
			HMX	8330	0.4 - 0.6	µg/L
			Nitrobenzene	8330	0.6 - 0.9	µg/L
			o-Nitrotoluene	8330	0.4	µg/L
			3-Nitrotoluene	8330	0.4 - 0.6	µg/L
			p-Nitrotoluene	8330	0.4	µg/L
			Tetryl	8330	0.4 - 0.6	µg/L
			2-Amino dinitrotoluene	8330	0.5 - 0.75	µg/L
			4-Amino-2,6- dinitrotoluene	8330	0.6 - 0.9	µg/L
			Anions			
			Nitrate	353.3	NA	
			Chloride	9056/325.3	NA	
			Sulfate	9056/375.4	NA	

Note(s):

µg/L - micrograms per liter

mg/L - milligrams per liter

NA - not available

18734

11.1.3 Surface Water and Sediment Investigations

Four sediment and 4 surface water samples were collected during the Phase 1 remedial investigation. No explosives or volatiles were found in the sediment samples. Two of the sediments contained di-n-butylphthalate. Most samples contained low levels of metals and anions. Lead was detected in surface water sample 27SW03 at 0.015 mg/l. Barium, chloride, nitrate, and sulfate were found in low levels in these samples. No volatiles, semivolatiles, or explosives were found. Results are given in Tables 11-8 and 11-9.

No surface water or sediment samples were collected during the Phase 2 field investigation.

Table 11-8
Site 27 - South Test Area
Sediment Analytical Summary (1993)

Parameters	Units	Sample 27SD02	Sample 27SD03	Sample 27SD04	Sample 27SD05
Volatiles	ug/kg	<DL	<DL	<DL	<DL
Semi-volatiles	ug/kg	<DL	<DL	<DL	<DL
Di-n-butylphthalate	ug/kg	<DL	2170	<DL	1760
Explosives	ug/kg	<DL	<DL	<DL	<DL
Arsenic	mg/kg	1.1	0.9	1.1	0.7
Barium	mg/kg	91.8	43.5	254	39
Chromium	mg/kg	4.6	1.9	5.2	2.4
Lead	mg/kg	9	8	5	4
Mercury	mg/kg	0.03	<DL	<DL	<DL
Nickel	mg/kg	6	3	3.9	2.8
Selenium	mg/kg	<DL	0.2	<DL	<DL
Chloride	mg/kg	44	<DL	<DL	<DL
Nitrate/Nitrite	mg/kg	2.26	2.17	<DL	2.36
Sulfate	mg/kg	40	40	50	30
pH	pH	6.3	5.2	5.6	6.4
Conductivity	umhos/cm	170	51	197	123

Table 11-8b
Sediment Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(1993)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Sediment	***Metals***			
			Arsenic	7060	0.1	mg/kg
			Antimony	6010	1	mg/kg
			Barium	6010	1	mg/kg
			Cadmium	6010	1	mg/kg
			Chromium	6010	1	mg/kg
			Lead	7421	1	mg/kg
			Mercury	7470/7471	0.01	mg/kg
			Nickel	6010	1	mg/kg
			Selenium	7740	0.1	mg/kg
			Silver	6010	1	mg/kg
			Thallium	7841	0.2	mg/kg
			VOCs			
			1,1,1-Trichloroethane	8240	5	µg/kg
			1,1,2,2-Tetrachloroethane	8240	5	µg/kg
			1,1,2-Trichloroethane	8240	5	µg/kg
			1,1-Dichloroethane	8240	5	µg/kg
			1,1-Dichloroethene	8240	5	µg/kg
			1,2-Dichloroethane	8240	5	µg/kg
			1,2-Dichloroethene	8240	5	µg/kg
			1,2-Dichloropropane	8240	5	µg/kg
			2-Butanone	8240	50	µg/kg
			2-Chloroethylvinylether	8240	10	µg/kg
			2-Hexanone	8240	50	µg/kg
			4-Methyl-2-pentanone	8240	50	µg/kg
			Acetone	8240	100	µg/kg
			Benzene	8240	5	µg/kg
			Bromodichloromethane	8240	5	µg/kg
			Bromoform	8240	5	µg/kg
			Bromomethane	8240	10	µg/kg
			Carbon disulfide	8240	5	µg/kg
			Carbon tetrachloride	8240	5	µg/kg
			Chlorobenzene	8240	5	µg/kg
			Chloroethane	8240	10	µg/kg
			Chloroform	8240	5	µg/kg
			Chloromethane	8240	10	µg/kg
			Chlorodibromomethane	8240	5	µg/kg
			Ethylbenzene	8240	5	µg/kg
			Methylene chloride	8240	5	µg/kg
			Styrene	8240	5	µg/kg
			Tetrachloroethene	8240	5	µg/kg
			Toluene	8240	5	µg/kg
			Trichloroethene	8240	5	µg/kg
			Vinyl acetate	8240	50	µg/kg
			Vinyl chloride	8240	10	µg/kg
			Xylenes	8240	5	µg/kg
			cis-1,3-Dichloropropene	8240	5	µg/kg
			trans-1,3-Dichloropropene	8240	5	µg/kg

Table 11-8b
Sediment Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(1993)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Sediment	***SVOCs***			
			1,2,4-Trichlorobenzene	8270	330	µg/kg
			1,2-Dichlorobenzene	8270	330	µg/kg
			1,3-Dichlorobenzene	8270	330	µg/kg
			1,4-Dichlorobenzene	8270	330	µg/kg
			2,4,5-Trichlorophenol	8270	1650	µg/kg
			2,4,6-Trichlorophenol	8270	330	µg/kg
			2,4-Dichlorophenol	8270	330	µg/kg
			2,4-Dimethylphenol	8270	330	µg/kg
			2,4-Dinitrophenol	8270	1650	µg/kg
			2,4-Dinitrotoluene	8270	330	µg/kg
			2,6-Dinitrotoluene	8270	330	µg/kg
			2-Chloronaphthalene	8270	330	µg/kg
			2-Chlorophenol	8270	330	µg/kg
			2-Methylnaphthalene	8270	330	µg/kg
			2-Methylphenol	8270	330	µg/kg
			2-Nitroaniline	8270	1650	µg/kg
			2-Nitrophenol	8270	330	µg/kg
			3,3-Dichlorobenzidine	8270	650	µg/kg
			3-Nitroaniline	8270	1650	µg/kg
			4-Bromophenylphenylether	8270	330	µg/kg
			4-Chloro-3-methylphenol	8270	650	µg/kg
			4-Chloroaniline	8270	650	µg/kg
			4-Chlorophenylphenylether	8270	330	µg/kg
			4-Methylphenol	8270	330	µg/kg
			4-Nitroaniline	8270	1650	µg/kg
			4-Nitrophenol	8270	1650	µg/kg
			4,6-Dinitro-2-methylphenol	8270	1650	µg/kg
			Acenaphthene	8270	330	µg/kg
			Acenaphthylene	8270	330	µg/kg
			Anthracene	8270	330	µg/kg
			Benzo(a)anthracene	8270	330	µg/kg
			Benzo(a)pyrene	8270	330	µg/kg
			Benzo(b)fluoranthene	8270	330	µg/kg
			Benzo(g,h,i)perylene	8270	330	µg/kg
			Benzo(k)fluoranthene	8270	330	µg/kg
			Benzoic acid	8270	1650	µg/kg
			Benzyl alcohol	8270	650	µg/kg
			Butylbenzylphthalate	8270	330	µg/kg
			Chrysene	8270	330	µg/kg
			Dibenzo(a,h)anthracene	8270	330	µg/kg
			Dibenzofuran	8270	330	µg/kg
			Di-n-butylphthalate	8270	330	µg/kg
			Diethylphthalate	8270	330	µg/kg
			Dimethylphthalate	8270	330	µg/kg
			Fluoranthene	8270	330	µg/kg
			Fluorene	8270	330	µg/kg
			Hexachlorobenzene	8270	330	µg/kg
			Hexachlorobutadiene	8270	330	µg/kg

Table 11-8b
Sediment Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(1993)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Sediment	***SVOCs (continued)***			
			Hexachlorocyclopentadiene	8270	330	µg/kg
			Hexachloroethane	8270	330	µg/kg
			Indeno(1,2,3-c,d)pyrene	8270	330	µg/kg
			Isophorone	8270	330	µg/kg
			Naphthalene	8270	330	µg/kg
			Nitrobenzene	8270	330	µg/kg
			Pentachlorophenol	8270	1650	µg/kg
			Phenanthrene	8270	330	µg/kg
			Phenol	8270	330	µg/kg
			Pyrene	8270	330	µg/kg
			bis(2-Chloroethoxy)methane	8270	330	µg/kg
			bis(2-Chloroethyl)ether	8270	330	µg/kg
			bis(2-Chloroisopropyl)ether	8270	330	µg/kg
			bis(2-Ethylhexyl)phthalate	8270	330	µg/kg
			di-n-Octylphthalate	8270	330	µg/kg
			n-Nitrosodi-n-propylamine	8270	330	µg/kg
			n-Nitrosodiphenylamine	8270	330	µg/kg
			Explosives	8330		
			HMX	8330	0.5	mg/kg
			RDX	8330	0.5	mg/kg
			1,3,5-TNB	8330	0.25	mg/kg
			1,3-DNB	8330	0.25	mg/kg
			Tetryl	8330	0.5	mg/kg
			Nitrobenzene	8330	0.26	mg/kg
			2,4,6-TNT	8330	0.25	mg/kg
			2,6-DNT	8330	0.25	mg/kg
			2,4-DNT	8330	0.25	mg/kg
			2-Nitrotoluene	8330	0.25	mg/kg
			4-Nitrotoluene	8330	0.25	mg/kg
			3-Nitrotoluene	8330	0.25	mg/kg
			Anions			
			Nitrate-Nitrite Nitrogen	353.3	0.1	mg/kg
			Chloride	9052	10	mg/kg
			Sulfate	9038	10	mg/kg

Note(s):

µg/kg - micrograms per kilogram

mg/kg - milligrams per kilogram

SVOC - semivolatile organic compound

VOC - volatile organic compound

Table 11-9
Site 27 - South Test Area
Surface Water Analytical Summary (1993)

Parameter	Units	Sample 27SW02	Sample 27SW03	Sample 27SW04	Sample 27SW05	MCL
Volatiles	ug/l	<DL	<DL	<DL	<DL	
Semi-volatiles	ug/l	<DL	<DL	<DL	<DL	
Explosives	ug/l	<DL	<DL	<DL	<DL	
Barium	mg/l	0.11	0.29	0.11	0.12	2
Lead	mg/l	<DL	0.015	<DL	<DL	0.015
Chloride	mg/l	27.5	15.1	48.7	30.1	
Nitrate/Nitrite	mg/l	0.29	0.33	0.28	0.2	
Sulfate	mg/l	40	40	50	30	

11.2 NATURE AND EXTENT OF CONTAMINATION

11.2.1 Explosives

During the Phase 1 Remedial Investigation, explosives were detected only in groundwater grab sample 27GG33. As a result, four new wells were installed in the vicinity of boring 27SB33 to further evaluate the potential for explosives contamination in the area. No explosives were detected in any of the soil or groundwater samples collected from the four new wells. The explosives found in the 1982 work by EPS have not been found in any other surface or subsurface soil samples. The presence of explosives, the most likely contaminant at the site, is not confirmed.

11.2.2 Volatile and Semivolatile Organics

No volatiles were found in any soil or water sample. With the exception of the one sample of ethylene glycol, only low concentrations of phthalates were found. These are common plasticizers and are more likely to be indicators of laboratory contamination than site contamination, especially at these concentrations. There is no indication of volatiles or semivolatiles at the site.

Table 11-9b
Surface Water Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(1993)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Surface water	***Metals***			
			Arsenic	7060	0.01	mg/L
			Antimony	6010	0.005	mg/L
			Barium	6010	0.01	mg/L
			Cadmium	6010	0.005	mg/L
			Chromium	6010	0.05	mg/L
			Lead	7421	0.005	mg/L
			Mercury	7470/7471	0.001	mg/L
			Nickel	6010	0.05	mg/L
			Selenium	7740	0.01	mg/L
			Silver	6010	0.01	mg/L
			Thallium	7841	0.002	mg/L
			VOCs			
			1,1,1-Trichloroethane	8240	5	μg/L
			1,1,2,2-Tetrachloroethane	8240	5	μg/L
			1,1,2-Trichloroethane	8240	5	μg/L
			1,1-Dichloroethane	8240	5	μg/L
			1,1-Dichloroethene	8240	5	μg/L
			1,2-Dichloroethane	8240	5	μg/L
			1,2-Dichloroethene	8240	5	μg/L
			1,2-Dichloropropane	8240	5	μg/L
			2-Butanone	8240	50	μg/L
			2-Chloroethylvinylether	8240	10	μg/L
			2-Hexanone	8240	50	μg/L
			4-Methyl-2-pentanone	8240	50	μg/L
			Acetone	8240	100	μg/L
			Benzene	8240	5	μg/L
			Bromodichloromethane	8240	5	μg/L
			Bromoform	8240	5	μg/L
			Bromomethane	8240	10	μg/L
			Carbon disulfide	8240	5	μg/L
			Carbon tetrachloride	8240	5	μg/L
			Chlorobenzene	8240	5	μg/L
			Chloroethane	8240	10	μg/L
			Chloroform	8240	5	μg/L
			Chloromethane	8240	10	μg/L
			Chlorodibromomethane	8240	5	μg/L
			Ethylbenzene	8240	5	μg/L
			Methylene chloride	8240	5	μg/L
			Styrene	8240	5	μg/L
			Tetrachloroethene	8240	5	μg/L
			Toluene	8240	5	μg/L
			Trichloroethene	8240	5	μg/L
			Vinyl acetate	8240	50	μg/L
			Vinyl chloride	8240	10	μg/L
			Xylenes	8240	5	μg/L
			cis-1,3-Dichloropropene	8240	5	μg/L
			trans-1,3-Dichloropropene	8240	5	μg/L

Table 11-9b
Surface Water Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(1993)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Surface water	***SVOCs***			
			1,2,4-Trichlorobenzene	8270	10	µg/L
			1,2-Dichlorobenzene	8270	10	µg/L
			1,3-Dichlorobenzene	8270	10	µg/L
			1,4-Dichlorobenzene	8270	10	µg/L
			2,4,5-Trichlorophenol	8270	50	µg/L
			2,4,6-Trichlorophenol	8270	10	µg/L
			2,4-Dichlorophenol	8270	10	µg/L
			2,4-Dimethylphenol	8270	10	µg/L
			2,4-Dinitrophenol	8270	50	µg/L
			2,4-Dinitrotoluene	8270	10	µg/L
			2,6-Dinitrotoluene	8270	10	µg/L
			2-Chloronaphthalene	8270	10	µg/L
			2-Chlorophenol	8270	10	µg/L
			2-Methylnaphthalene	8270	10	µg/L
			2-Methylphenol	8270	10	µg/L
			2-Nitroaniline	8270	50	µg/L
			2-Nitrophenol	8270	10	µg/L
			3,3-Dichlorobenzidine	8270	20	µg/L
			3-Nitroaniline	8270	50	µg/L
			4-Bromophenylphenylether	8270	10	µg/L
			4-Chloro-3-methylphenol	8270	20	µg/L
			4-Chloroaniline	8270	20	µg/L
			4-Chlorophenylphenylether	8270	10	µg/L
			4-Methylphenol	8270	10	µg/L
			4-Nitroaniline	8270	50	µg/L
			4-Nitrophenol	8270	50	µg/L
			4,6-Dinitro-2-methylphenol	8270	50	µg/L
			Acenaphthene	8270	10	µg/L
			Acenaphthylene	8270	10	µg/L
			Anthracene	8270	10	µg/L
			Benzo(a)anthracene	8270	10	µg/L
			Benzo(a)pyrene	8270	10	µg/L
			Benzo(b)fluoranthene	8270	10	µg/L
			Benzo(g,h,i)perylene	8270	10	µg/L
			Benzo(k)fluoranthene	8270	10	µg/L
			Benzoic acid	8270	50	µg/L
			Benzyl alcohol	8270	20	µg/L
			Butylbenzylphthalate	8270	10	µg/L
			Chrysene	8270	10	µg/L
			Dibenzo(a,h)anthracene	8270	10	µg/L
			Dibenzofuran	8270	10	µg/L
			Di-n-butylphthalate	8270	10	µg/L
			Diethylphthalate	8270	10	µg/L
			Dimethylphthalate	8270	10	µg/L
			Fluoranthene	8270	10	µg/L
			Fluorene	8270	10	µg/L
			Hexachlorobenzene	8270	10	µg/L
			Hexachlorobutadiene	8270	10	µg/L

Table 11-9b
Surface Water Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(1993)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Surface water	***SVOCs (continued)***			
			Hexachlorocyclopentadiene	8270	10	µg/L
			Hexachloroethane	8270	10	µg/L
			Indeno(1,2,3-c,d)pyrene	8270	10	µg/L
			Isophorone	8270	10	µg/L
			Naphthalene	8270	10	µg/L
			Nitrobenzene	8270	10	µg/L
			Pentachlorophenol	8270	50	µg/L
			Phenanthrene	8270	10	µg/L
			Phenol	8270	10	µg/L
			Pyrene	8270	10	µg/L
			bis(2-Chloroethoxy)methane	8270	10	µg/L
			bis(2-Chloroethyl)ether	8270	10	µg/L
			bis(2-Chloroisopropyl)ether	8270	10	µg/L
			bis(2-Ethylhexyl)phthalate	8270	10	µg/L
			di-n-Octylphthalate	8270	10	µg/L
			n-Nitrosodi-n-propylamine	8270	10	µg/L
			n-Nitrosodiphenylamine	8270	10	µg/L
			Explosives			
			HMX	8330	0.1	µg/L
			RDX	8330	0.1	µg/L
			1,3,5-TNB	8330	0.1	µg/L
			1,3-DNB	8330	0.1	µg/L
			Tetryl	8330	0.1	µg/L
			Nitrobenzene	8330	0.1	µg/L
			2,4,6-TNT	8330	0.1	µg/L
			2,6-DNT	8330	0.1	µg/L
			2,4-DNT	8330	0.1	µg/L
			2-Nitrotoluene	8330	0.1	µg/L
			4-Nitrotoluene	8330	0.1	µg/L
			3-Nitrotoluene	8330	0.1	µg/L
			Anions			
			Nitrate-Nitrite Nitrogen	353.3	0.01	mg/L
			Chloride	9052	1	mg/L
			Sulfate	9038	1	mg/L

Note(s):

µg/L - micrograms per liter
mg/L - milligrams per liter
SVOC - semivolatile organic compound
VOC - volatile organic compound

1.6.11 Site 27 (Southeast Test Area)

Soil samples were collected at Site 27 in May and October 2000, and the analytical results are provided in Table 1-17. Groundwater samples were collected from four of the six monitoring wells at Site 27 during the April/May 2000 sampling event; from all six wells during the August/September/October 2000 sampling event; and from three monitoring wells in the January/February 2001 sampling event. Analytical results for the groundwater samples are presented in Table 1-18.

PERCHLORATE

Table 1-17 Summary of Soil Sample Results at Site 27

TCEQ GWP-Ind 7,200

NO MCL

Sample Location	Date Collected	Result (µg/kg)	RL (µg/kg)	MDL (µg/kg)	Start Depth (feet)	End Depth (feet)
27SD01	5/30/2000	28.9	5.44	5.44	0	0.5
	5/30/2000	<5.54 U	5.54	5.54	1	2
27SB02	10/4/2000	<23 U	23	9.5	0	0.5
	10/4/2000	<22 U	22	9.3	1	2
27SB03	10/4/2000	<22 U	22	9.3	0	0.5
	10/4/2000	<23 U	23	9.6	1	2
27SB04	10/4/2000	<22 U	22	9	0	0.5
	10/4/2000	<21 U	21	8.9	1	2
27SB05	10/4/2000	<21 U	21	8.9	0	0.5
	10/4/2000	<21 U	21	8.9	1	2
27SB06	10/4/2000	<22 U	22	9.1	0	0.5
	10/4/2000	<22 U	22	9.2	1	2
27SB07	10/4/2000	<22 U	22	9.3	0	0.5
	10/4/2000	<22 U	22	9.1	1	2
27SB08	10/4/2000	<24 U	24	9.9	0	0.5
	10/4/2000	<24 U	24	9.8	1	2
27SB09	10/4/2000	<22 U	22	9.1	0	0.5
	10/4/2000	<23 U	23	9.5	1	2
27SB10	10/4/2000	<23 U	23	9.6	0	0.5
	10/4/2000	<23 U	23	9.6	1	2
27SB11	10/4/2000	<24 U	24	9.8	0	0.5
	10/4/2000	<24 U	24	9.8	1	2
27SB12	10/4/2000	<23 U	23	9.5	0	0.5
	10/4/2000	<23 U	23	9.7	1	2
27SB13	10/4/2000	<22 U	22	9.1	0	0.5
	10/4/2000	<22 U	22	9	1	2

µg/kg = micrograms per kilogram
MDL = method detection limit
RL = reporting limit
U = not detected

Table 1-18 Summary of Groundwater Sample Results at Site 27

Sample Location	April-May 2000 Event (µg/L)	Aug/Sept/Oct 2000 Event (µg/L)	Jan - Feb 2001 Event (µg/L)
131	<1 U	<4 U	<0.71 U
132	<1 U	<8 U	NS
27WW01	**52.6**	<16 U	<3.6 U
27WW02	NS	<16 U	NS
27WW03	NS	<16 U	NS
27WW04	**16.4**	<16 U	<2.8 U

Bold values exceed 4 µg/L
< = Indicates the result was less than the corresponding reporting limit.
µg/L = micrograms per liter
NS = not sampled
U = not detected

TCE @
[illegible]
72 µg/L

No MCL

~~1.6.12 Site 29 (TNT Production Area)~~

~~Soil samples were collected at Site 29 in May 2000. The analytical results for the soil samples are contained in Table 1-19. Groundwater samples were collected from five monitoring wells at Site 27 during the April/May 2000 sampling event; from all 16 wells during the August/September/October 2000 sampling event; and from nine monitoring wells in the January/February 2001 sampling event. The analytical results for the groundwater samples are presented in Table 1-20.~~

~~**Table 1-19 Summary of Soil Sample Results at Site 29**~~

Sample Location	Date Collected	Result (µg/kg)	Reporting Limit (µg/kg)	Method Detection Limit (µg/kg)	Start Depth (feet)	End Depth (feet)
29SB77	5/31/2000	34.8	6.08	6.08	0	0.5
	5/31/2000	24.5	5.95	5.95	1	2
29SB78	5/31/2000	115 J	6.31	6.31	0	0.5
	5/31/2000	57.6	6.36	6.36	1	2

µg/kg = micrograms per kilogram
J = estimated value

Table 1-18b
Groundwater and Soil Analytical Methods and Detection Limits
South Test Area LHAAP-001-R
(2000/2001)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
STEP	2000/2001	soil - borings	perchlorate	HPLC/300.1	5.54 - 24	µg/kg
		groundwater - wells	perchlorate	HPLC/300.1	1 - 16	µg/L

Note(s):

µg/kg - micrograms per kilogram

µg/L - micrograms per liter

Table 2. Results of metals analysis in mg/kg dry weight for soil/sediment samples collected from 200 sites at Caddo Lake National Wildlife Refuge in 2003 (Note - dl is the analytical detection limit and bdl is below the analytical detection limit).

Analyte	Site 50	Site 51	Site 52	Site 53	Site 54.	Site 55	Site 56	Site 57	Site 58	REQ GMP-30d
Aluminum	3030.00	5295.00	3378.00	1674.00	8474.00	3143.00	4050.00	3435.00	3560.00	10,220
dl	10.5	10.6	10.8	10.7	10.8	10.8	10.8	10.9	10.8	
Arsenic	1.30	1.65	2.11	1.08	2.12	0.92	1.83	1.03	1.18	1
dl	0.52	0.53	0.54	0.54	0.54	0.54	0.54	0.54	0.54	
Barium	132.00	117.00	38.00	71.20	216.00	66.50	149.00	38.40	41.10	200
dl	1.05	1.06	1.08	1.07	1.08	1.08	1.08	1.09	1.08	
Beryllium	0.35	0.56	0.29	0.37	1.07	0.45	0.50	0.26	0.33	0.4
dl	0.21	0.21	0.22	0.21	0.22	0.22	0.22	0.22	0.22	
Boron	2.40	3.19	bdl	bdl	bdl	bdl	2.64	bdl	bdl	
dl	2.10	2.12	2.15	2.14	2.15	2.16	2.16	2.17	2.15	
Cadmium	bdl	bdl	bdl	bdl	0.38	bdl	bdl	bdl	bdl	0.5
dl	0.26	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	
Chromium	4.97	7.28	14.60	6.26	9.33	4.73	8.06	5.75	6.10	10
dl	1.05	1.06	1.08	1.07	1.08	1.08	1.08	1.09	1.08	
Copper	2.08	2.67	1.48	1.75	6.95	1.39	3.45	1.50	1.59	130
dl	0.52	0.53	0.54	0.54	0.54	0.54	0.54	0.54	0.54	
Iron	3345.00	5537.00	7285.00	2760.00	11,863.00	3615.00	4643.00	5395.00	4872.00	NA
dl	10.5	10.6	10.8	10.7	10.8	10.8	10.8	10.9	10.8	
Lead	11.00	11.60	7.84	11.90	14.30	9.10	12.10	7.16	7.87	105
dl	2.10	2.12	2.15	2.14	2.15	2.16	2.16	2.17	2.15	
Magnesium	300.00	311.00	199.00	117.00	1820.00	224.00	291.00	250.00	225.00	NA
dl	10.5	10.6	10.8	10.7	10.8	10.8	10.8	10.9	10.8	
Manganese	1021.00	599.00	214.00	485.00	1086.00	48.80	787.00	261.00	315.00	1431
dl	1.05	1.06	1.08	1.07	1.08	1.08	1.08	1.09	1.08	
Mercury	0.047	0.031	bdl	0.039	0.043	0.028	0.029	0.040	0.027	0.2
dl	0.024	0.024	0.026	0.015	0.025	0.021	0.019	0.020	0.018	
Molybdenum	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
dl	1.05	1.06	1.08	1.07	1.08	1.08	1.08	1.09	1.08	
Nickel	4.29	4.47	2.87	2.22	13.90	2.63	4.60	2.29	2.48	204.4
dl	1.05	1.06	1.08	1.07	1.08	1.08	1.08	1.09	1.08	
Selenium	bdl	bdl	bdl	0.62	bdl	bdl	bdl	bdl	bdl	5
dl	0.52	0.53	0.54	0.54	0.54	0.54	0.54	0.54	0.54	
Silver	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
dl	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.20	0.19	
Strontium	12.70	8.87	4.64	4.54	44.90	4.13	15.00	6.69	3.01	6132
dl	0.52	0.53	0.54	0.54	0.54	0.54	0.54	0.54	0.54	
Vanadium	10.80	12.40	15.30	9.66	12.20	9.36	12.10	9.68	9.16	72
dl	0.52	0.53	0.54	0.54	0.54	0.54	0.54	0.54	0.54	
Zinc	13.10	10.10	8.29	7.33	45.40	8.23	16.70	10.20	9.78	[illegible]
dl	5.24	5.30	5.38	5.36	5.38	5.40	5.40	5.43	5.38	

Table 2 (continued). Results of metals analysis in mg/kg dry weight for soil/sediment samples collected from 200 sites at Caddo Lake National Wildlife Refuge in 2003 (Note - dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	Site 59	Site 60	Site 61	Site 62	Site 63	Site 64	Site 65	Site 66	Site 67
Aluminum	6379.00	17,400.00	2647.00	3336.00	4301.00	10,272.00	9531.00	10,429.00	3290.00
dl	10.60	10.40	10.80	10.80	10.80	10.40	10.80	10.60	11.10
Arsenic	2.86	4.24	0.85	1.67	2.63	1.73	2.44	4.02	2.71
dl	0.53	0.52	0.54	0.54	0.54	0.52	0.54	0.53	0.55
Barium	135.00	316.00	71.20	129.00	102.00	180.00	404.00	142.00	55.90
dl	1.06	1.04	1.08	1.08	1.08	1.04	1.08	1.06	1.11
Beryllium	0.78	1.68	0.32	0.50	0.92	0.88	0.62	0.91	0.51
dl	0.21	0.21	0.22	0.22	0.22	0.21	0.22	0.21	0.22
Boron	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	2.13	2.08	2.15	2.17	2.15	2.08	2.17	2.13	2.21
Cadmium	0.30	bdl	bdl	bdl	bdl	bdl	0.32	bdl	bdl
dl	0.27	0.26	0.27	0.27	0.27	0.26	0.27	0.27	0.28
Chromium	7.78	18.30	3.56	5.13	6.24	14.20	11.70	13.70	9.48
dl	1.06	1.04	1.08	1.08	1.08	1.04	1.08	1.06	1.11
Copper	4.70	8.79	2.51	4.39	3.85	9.56	7.26	6.83	4.37
dl	0.53	0.52	0.54	0.54	0.54	0.52	0.54	0.53	0.55
Iron	9953.00	21,940.00	3031.00	4067.00	7165.00	9308.00	14,940.00	13,729.00	7996.00
dl	10.60	10.40	10.80	10.80	10.80	10.40	10.80	10.60	11.10
Lead	17.00	22.00	6.02	10.30	12.90	16.70	20.00	11.70	7.39
dl	2.13	2.08	2.15	2.17	2.15	2.08	2.17	2.13	2.21
Magnesium	800.00	1596.00	411.00	331.00	435.00	874.00	1424.00	1347.00	771.00
dl	10.60	10.40	10.80	10.80	10.80	10.40	10.80	10.60	11.10
Manganese	1003.00	1812.00	294.00	903.00	793.00	472.00	2400.00	814.00	123.00
dl	1.06	1.04	1.08	1.08	1.08	1.04	1.08	1.06	1.11
Mercury	0.058	0.070	0.041	0.039	0.042	0.047	0.065	0.037	bdl
dl	0.025	0.025	0.018	0.021	0.019	0.019	0.019	0.020	0.016
Molybdenum	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	1.06	1.04	1.08	1.08	1.08	1.04	1.08	1.06	1.11
Nickel	8.04	24.30	3.66	5.24	5.86	12.10	23.20	6.03	1.98
dl	1.06	1.04	1.08	1.08	1.08	1.04	1.08	1.06	1.11
Selenium	bdl	0.62	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.53	0.52	0.54	0.54	0.54	0.52	0.54	0.53	0.55
Silver	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl
dl	0.19	0.19	0.19	0.20	0.19	0.19	0.20	0.19	0.20
Strontium	22.90	34.30	14.60	13.30	22.20	29.80	52.40	30.60	22.10
dl	0.53	0.52	0.54	0.54	0.54	0.52	0.54	0.53	0.55
Vanadium	15.00	26.70	6.11	7.08	12.90	19.10	20.70	18.40	12.10
dl	0.53	0.52	0.54	0.54	0.54	0.52	0.54	0.53	0.55
Zinc	25.80	31.60	12.40	13.40	11.30	33.30	48.20	44.20	20.40
dl	5.32	5.19	5.38	5.42	5.38	5.19	5.42	5.32	5.54

TCEQ COMP-Ind
10,220
1
200
0.4
0.5
10
130
NA
1.5
NA
1431
0.2
204.4
5
613.2
72
306

00100301

Table 2 (continued). Results of metals analysis in mg/kg dry weight for soil/sediment samples collected from 200 sites at Caddo Lake National Wildlife Refuge in 2003 (Note - dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	Site 194	Site 195	Site 196	Site 197	Site 198	Site 199	Site 200	Site 201	Site 202	TCEQ GWP-Ind
Aluminum	3617.00	4296.00	4396.00	6144.00	9552.00	4643.00	8892.00	5649.00	2937.00	10,220
dl	10.20	10.40	10.00	10.30	10.20	10.00	10.40	10.30	10.00	
Arsenic	1.13	1.47	3.87	2.17	1.04	2.71	0.60	1.71	0.86	1
dl	0.51	0.52	0.50	0.52	0.51	0.50	0.52	0.52	0.50	
Barium	109.00	108.00	198.00	164.00	55.40	47.70	26.60	263.00	46.90	200
dl	0.21	0.21	0.20	0.21	0.21	0.20	0.21	0.21	0.20	
Beryllium	0.56	0.37	0.84	1.15	0.66	1.01	0.31	0.48	bdl	0.4
dl	0.21	0.21	0.20	0.21	0.21	0.20	0.21	0.21	0.20	
Boron	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
dl	2.05	2.08	2.01	2.07	2.05	2.00	2.08	2.06	2.00	
Cadmium	bdl	bdl	0.27	bdl	bdl	0.44	bdl	bdl	bdl	0.5
dl	0.26	0.26	0.25	0.26	0.26	0.25	0.26	0.26	0.25	
Chromium	5.87	9.35	14.00	10.10	11.30	9.84	10.40	11.80	4.93	10
dl	1.02	1.04	1.00	1.03	1.02	1.00	1.04	1.03	1.00	
Copper	1.18	1.68	2.23	2.36	4.00	1.98	1.77	13.80	1.16	130
dl	0.51	0.52	0.50	0.52	0.51	0.50	0.52	0.52	0.50	
Iron	4343.00	4604.00	11,640.00	7135.00	6771.00	8798.00	2755.00	3991.00	2493.00	NA
dl	10.20	10.40	10.00	10.30	10.20	10.00	10.40	10.30	10.00	
Lead	17.00	12.20	15.80	14.10	21.60	20.10	12.60	11.40	10.90	1.5
dl	2.05	2.08	2.01	2.07	2.05	2.00	2.08	2.06	2.00	
Magnesium	341.00	343.00	384.00	501.00	514.00	269.00	232.00	515.00	185.00	NA
dl	10.20	10.40	10.00	10.30	10.20	10.00	10.40	10.30	10.00	
Manganese	1198.00	924.00	2285.00	3160.00	398.00	417.00	17.80	69.10	870.00	1431
dl	1.02	1.04	1.00	1.03	1.02	1.00	1.04	1.03	1.00	
Mercury	0.055	0.054	0.055	0.077	0.061	0.038	0.043	0.031	0.045	0.2
dl	0.023	0.023	0.020	0.022	0.022	0.021	0.020	0.021	0.020	
Molybdenum	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
dl	1.02	1.04	1.00	1.03	1.02	1.00	1.04	1.03	1.00	
Nickel	5.35	5.52	7.34	11.10	4.98	4.59	2.07	4.79	2.24	204.4
dl	1.02	1.04	1.00	1.03	1.02	1.00	1.04	1.03	1.00	
Selenium	bdl	bdl	bdl	0.53	bdl	0.65	bdl	bdl	bdl	5
dl	0.51	0.52	0.50	0.52	0.51	0.50	0.52	0.52	0.50	
Silver	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
dl	0.18	0.19	0.18	0.19	0.18	0.18	0.19	0.19	0.18	
Strontium	11.30	12.60	36.70	12.20	14.40	6.36	12.60	17.00	5.81	6132
dl	0.51	0.52	0.50	0.52	0.51	0.50	0.52	0.52	0.50	
Vanadium	11.30	12.20	24.50	16.30	19.20	23.00	8.88	9.30	8.56	72
dl	0.51	0.52	0.50	0.52	0.51	0.50	0.52	0.52	0.50	
Zinc	12.90	18.80	28.20	21.80	21.60	17.10	17.30	80.30	6.63	3066
dl	5.12	5.19	5.02	5.17	5.12	5.00	5.19	5.15	5.00	

Table 2b
Soil Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(2003)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
USFWS	2003	Soil				
			Metals			
			Aluminum	Texas A & M University Method Codes 001, 004, 006	10.3 - 10.8	mg/kg
			Arsenic	Texas A & M University Method Codes 001, 004, 007	0.52 - 0.54	mg/kg
			Barium	Texas A & M University Method Codes 001, 004, 006	0.21 - 1.08	mg/kg
			Beryllium	Texas A & M University Method Codes 001, 004, 006	0.21 - 0.22	mg/kg
			Boron	Texas A & M University Method Codes 001, 004, 006	2.06 - 2.16	mg/kg
			Cadmium	Texas A & M University Method Codes 001, 004, 006	0.26 - 0.27	mg/kg
			Chromium	Texas A & M University Method Codes 001, 004, 006	1.03 - 1.08	mg/kg
			Copper	Texas A & M University Method Codes 001, 004, 006	0.52 - 0.54	mg/kg
			Iron	Texas A & M University Method Codes 001, 004, 006	10.3 - 10.8	mg/kg
			Lead	Texas A & M University Method Codes 001, 004, 006	2.06 - 2.16	mg/kg
			Magnesium	Texas A & M University Method Codes 001, 004, 006	10.3 - 10.8	mg/kg
			Manganese	Texas A & M University Method Codes 001, 004, 006	1.03 - 1.08	mg/kg
			Mercury	Texas A & M University Method Codes 001, 004, 008	0.018 - 0.021	mg/kg
			Molybdenum	Texas A & M University Method Codes 001, 004, 006	1.03 - 1.08	mg/kg
			Nickel	Texas A & M University Method Codes 001, 004, 006	1.03 - 1.08	mg/kg
			Selenium	Texas A & M University Method Codes 001, 004, 007	0.52 - 0.54	mg/kg
			Silver	Texas A & M University Method Codes 001, 004, 039	0.19	mg/kg
			Strontium	Texas A & M University Method Codes 001, 004, 006	0.52 - 0.54	mg/kg
			Vanadium	Texas A & M University Method Codes 001, 004, 006	0.52 - 0.54	mg/kg
			Zinc	Texas A & M University Method Codes 001, 004, 006	5.15 - 5.40	mg/kg
			SVOCs			
			1,2,4-Trichlorobenzene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			1,2-Dichlorobenzene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			1,3-Dichlorobenzene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			1,4-Dichlorobenzene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg

Table 2b
Soil Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(2003)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
USFWS	2003	Soil				
			1-Chloronaphthalene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			1-Naphthylamine	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2,3,4,6-Tetrachlorophenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2,4,5-Trichlorophenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2,4,6-Trichlorophenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2,4-Dichlorophenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2,4-Dimethylphenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2,4-Dinitrophenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2,4-Dinitrotoluene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2,6-Dichlorophenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2,6-Dinitrotoluene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2-Chloronaphthalene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2-Chlorophenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2-Methylphenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2-Naphthylamine	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2-Nitroaniline	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2-Nitrophenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2-Picoline	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			2-Methylnaphthalene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			3,3-Dichlorobenzidine	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			3-Methylcholanthrene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			3-Nitroaniline	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			4,6-Dinitro-2-methylphenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			4-Aminobiphenyl	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			4-Bromophenylphenylether	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg

Table 2b
Soil Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(2003)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
USFWS	2003	Soil				
			4-Chloro-3-methylphenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			4-Chloroaniline	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			4-Chlorophenylphenylether	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			4-Methylphenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			4-Nitrophenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			7,12-	Texas A & M University Method	0.0315-0.0416	mg/kg
			Acentophenone	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Aniline	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Benzidine	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Benzo(a)anthracene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Benzoic acid	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Benzyl alcohol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			bis(2-Chloroethoxy)methane	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			bis(2-Chloroethyl)ether	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			bis(2-Ethylhexyl)phthalate	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			bis(2-Chloroisopropyl)ether	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Butylbenzylphthalate	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Carbazole	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Di-n-butylphthalate	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Di-n-Octylphthalate	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Dibenzo(a,h)anthracene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Diben(a,j)acridine	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Dibenzofuran	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Diethylphthalate	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Dimethylphthalate	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Diphenylamine	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg

Table 2b
Soil Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(2003)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
USFWS	2003	Soil				
			Ethyl methanesulfonate	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Hexachlorobutadiene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Hexachlorocyclopentadiene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Hexachloroethane	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Isophorone	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Methyl methanesulfonate	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			N-nitroso-di-n-propylamine	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			N-nitrosopiperidine	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Nitrobenzene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Pentachlorobenzene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Pentachloronitrobenzene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Pentachlorophenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Phenacetin	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Phenol	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Pronamide	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			A,a-dimethylphenylamine	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Acenaphthalene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Acenaphthene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Anthracene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Benzo(a)pyrene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Benzo(b)fluoranthene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Benzo(g,h,i)perylene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Benzo(k)fluoranthene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Chrysene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Fluoranthene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg

Table 2b
Soil Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(2003)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
USFWS	2003	Soil				
			Fluorene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Indeno(1,2,3-c,d)pyrene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			n-Nitrosodiphenylamine	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Naphthalene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			p-Dimethylaminoazobenzene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Phenanthrene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
			Pyrene	Texas A & M University Method Code 031	0.0315-0.0416	mg/kg
				Texas A & M University Method Code 031		
			Pesticides/PCBs			
			1,2,3,4-tetrachlorobenzene	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			1,2,4,5-tetrachlorobenzene	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Aldrin	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Hexachlorobenzene	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Heptachlor	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Alpha BHC	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Alpha chlordane	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Beta BHC	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			cis-nonachlor	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			delta-BHC	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Dieldrin	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Endosulfan II	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Endrin	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			gamma-BHC (Lindane)	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			gamma chlordane	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Heptachlor epoxide	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Mirex	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg

Table 2b
Soil Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(2003)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
USFWS	2003	Soil				
			o,p-DDD	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			o,p-DDE	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			o,p-DDT	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			oxychlordane	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			p,p-DDD	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			p,p-DDE	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			p,p-DDT	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Pentachloro-anisole	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Toxaphene	Texas A & M University Method Code 031	0.000315 - 0.00208	mg/kg
			Trans-nonachlor	Texas A & M University Method Code 031	0.000315 - 0.000416	mg/kg
			Total PCBs	Texas A & M University Method Code 031	0.000315 - 0.00208	mg/kg
			Perchlorate	EPA Method 314.0 Modified	8	µg/kg

Note(s):

µg/kg - micrograms per kilogram

mg/kg - milligrams per kilogram

PCB - polychlorinated biphenyls

SVOC - semivolatile oranic compound

VOC - volatile organic compound

Table 4A-1. Chemicals Detected in Soils[1]
Site 27 Addendum, Longhorn Army Ammunition Plant

Chemical	Frequency of Detection	Sample Quantitation Limits	Range of Detected Concentrations	Background Range[2]
Metals (mg/Kg)				
Arsenic	4/4	--	6.08-13.1	2.3-29.7
Barium	4/4	--	69.5-123	35.1-287
Cadmium	4/4	--	8.54-21.0	1.25
Chromium	4/4	--	15.2-36.3	3.2-22.8
Nickel	1/4	2.06-2.11	2.41	1.5-6.3
Lead	4/4	--	11-18	2.6-17.4
Selenium	3/4	0.52	0.66-0.83	0.5
Aluminum	4/4	--	4,350-10,300	1,270-20,700
Beryllium	1/4	0.62-0.66	1.16	NA[3]
Calcium	4/4	--	392-809	124-1,090
Copper	4/4	--	5.65-18.7	0.88-6.7
Iron	4/4	--	21,800-70,000	2,450-31,000
Potassium	4/4	--	150-513	133-481
Magnesium	4/4	--	187-635	68.4-474
Manganese	4/4	--	135-223	10.9-2,330
Strontium	1/4	12.5-15.4	16.8	2.3-13.3
Vanadium	4/4	--	25.6-72.4	NA[3]
Zinc	4/4	--	19.6-41.3	3.4-16.2

[1] 0 to 6-inch depth.
[2] Range of detected concentrations in surface (0-0.5 feet) soils from Final Soil Background Concentration Report, Longhorn Army Ammunition Plant, (USACE 1995b).
[3] Not available.

Table 3
Soil Analytical Medthods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(CAPE 2006)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
CAPE	2006	Soil	MC (explosives), WP	SW-846 Method 7580	0.519 - 0.535	µg/kg

Note(s):

µg/kg - micrograms per kilogram

MC - munitions constituents

WP - white phosphorus

Table A - 1
USEPA Region 6 Confirmation Sampling
Groundwater Analytical Results Summary
South Test Area/Bomb Test Area, LHAAP-001-R
October 2009

			Location Code	MW-131	MW-132	27WW01	27WW02	27WW03	27WW04
			Sample No.	GW-131-05	GW-132-06	GW-27WW-01-01	GW-27WW-02-02	GW-27WW-03-03	GW-27WW-04-04
			Sample Date	23-Oct-09	23-Oct-09	22-Oct-09	22-Oct-09	23-Oct-09	22-Oct-09
Parameter	Units	MCL	TCEQ GW-Ind	Result	Result	Result	Result	Result	Result
Metals									
Aluminum	mg/L		102.2	0.157	0.0048 J	<0.050	0.118B	6.56	0.0136 J,B
Antimony	mg/L	0.006		<0.001	<0.001	<0.001	0.000134 J	<0.001	<0.001
Arsenic	mg/L	0.01		0.0017	0.0024	0.00164	0.00157	0.00208	0.00149
Barium	mg/L	2		0.118	0.0522	0.0233	0.0203	0.0337	0.0268
Beryllium	mg/L	0.004		0.0000860 J	0.0000840 J	0.0000440 J	0.00454	0.0251	0.000340 J
Cadmium	mg/L	0.005		0.000116 J	0.0000460 J	0.00191	0.00114	0.00336	0.000327 J
Calcium	mg/L			214	28	476	400	384	398
Chromium	mg/L	0.1		0.00119	0.000481 J	0.00692	0.122	0.0161	0.0285
Cobalt	mg/L		6.132	0.0229	0.014	0.0566	0.134	0.73	0.213
Copper	mg/L	1.3		0.00144 B	0.00205 B	0.00296	0.0045	0.00463 B	0.00352
Iron	mg/L			2.48 B	1.430 B	0.650B	0.507B	0.0842B	0.759B
Lead	mg/L	0.015		0.000212 J	0.0000670 J	0.000014 J,B	0.0000960 J,B	0.0012	0.00013 J, B
Magnesium	mg/L			106	157	318	314	308	325
Manganese	mg/L		14.3	0.00378	0.482	7.5	2.17	24.8	9.01
Nickel	mg/L		2.044	0.0312	0.0187	0.167 B	0.288B	0.291	0.301 B
Potassium	mg/L			1.510J	2.58 J	8.52 J	4.86 J	9.59 J	1.59 J
Selenium	mg/L	0.05		0.00436	0.00558	0.00542	0.00503	0.00287	0.00363
Silver	mg/L		0.511	0.000012 J, B	<0.001	<0.001	<0.001	0.000289 J, B	<0.001
Sodium	mg/L			406	1140	1060	1040	1350	981
Thallium	mg/L	0.002		0.0000140 J	0.0000230 J	0.0000490 J	0.000232 J	0.000188 J	0.0000780 J
Vanadium	mg/L			0.00155 B	0.00236B	0.000222 J	<0.001	0.000662 J, B	0.000746 J
Zinc	mg/L		30.66	0.001UB	0.0081 J,B	0.0377	0.165	0.141 B	0.0855
Perchlorate	µg/L		72	<5.0 G	2.6B*, G	<5.0 G	3.2 B*, G	76 Q	<5.0G

00100310

00100311

Table A - 1
USEPA Region 6 Confirmation Sampling
Groundwater Analytical Results Summary
South Test Area/Bomb Test Area, LHAAP-001-R
October 2009

			Location Code	MW-131	MW-132	27WW01	27WW02	27WW03	27WW04
			Sample No.	GW-131-05	GW-132-06	GW-27WW-01-01	GW-27WW-02-02	GW-27WW-03-03	GW-27WW-04-04
			Sample Date	23-Oct-09	23-Oct-09	22-Oct-09	22-Oct-09	23-Oct-09	22-Oct-09
Parameter	Units	MCL	TCEQ GW-Ind	Result	Result	Result	Result	Result	Result
Explosives									
HMX	µg/L		5110	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
RDX	µg/L		26	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
1,3,5- TNB	µg/L		3066	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-DNB	µg/L		10.22	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Tetryl	µg/L		1022	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Nitrobenzene	µg/L		51.1	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
2,4,6- TNT	µg/L		51.1	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
4-ADNT	µg/L		17.03	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2-ADNT	µg/L		17.03	<0.20	<0.20	<0.20	<0.20	<0.20	0.14J
2,6-DNT	µg/L		0.42	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
2,4-DNT	µg/L		0.42	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
2-Nitrotoluene	µg/L		1022	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
4-Nitrotoluene	µg/L		1022	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
3-Nitrotoluene	µg/L		1022	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40

Notes and Abbreviations:

Bolded and shaded - Level above the MCL or TCEQ GW-Ind value

B - analyte was detected in the associated method blank

B* - estimated results; result is less than the reporting limit of 5 µg/L

G - elevated reporting limit; the reporting limit is elevated due to matrix interference

GW-Ind - groundwater MSC for industrial use

J - estimated results detected above the method detection limit but below the reporting limit

MCL - maximum contaminant level

ug/L - micrograms per liter

mg/L - milligrams per liter

Q - elevated reporting limit; the reporting limit is elevated due to high analyte levels

Table A-1b
Groundwater Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(2009)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
USEPA	October 2009	Groundwater - wells	***Metals***			
			Aluminum	6020	50	µg/L
			Antimony	6020	1	µg/L
			Arsenic	6020	1	µg/L
			Barium	6020	1	µg/L
			Beryllium	6020	1	µg/L
			Cadmium	6020	1	µg/L
			Calcium	6020	20000 - 40000	µg/L
			Chromium	6020	1	µg/L
			Cobalt	6020	1	µg/L
			Copper	6020	1	µg/L
			Iron	6020	50	µg/L
			Lead	6020	1	µg/L
			Magnesium	6020	20000 - 40000	µg/L
			Manganese	6020	100	µg/L
			Nickel	6020	1	µg/L
			Potassium	6020	20000 - 40000	µg/L
			Selenium	6020	1	µg/L
			Sodium	6020	20000 - 40000	µg/L
			Thallium	6020	1	µg/L
			Vanadium	6020	1	µg/L
			Zinc	6020	10	µg/L
			Explosives			
			HMX	8330	0.4	µg/L
			RDX	8330	0.2	µg/L
			1,3,5-TNB	8330	1	µg/L
			1,3-DNB	8330	0.4	µg/L
			Tetryl	8330	0.2	µg/L
			Nitrobenzene	8330	0.4	µg/L
			2,4,6-TNT	8330	0.4	µg/L
			4-ADNT	8330	0.2	µg/L
			2-ADNT	8330	0.2	µg/L
			2,6-DNT	8330	0.2	µg/L
			2,4-DNT	8330	0.4	µg/L
			2-Nitrotoluene	8330	0.4	µg/L
			4-Nitrotoluene	8330	1	µg/L
			3-Nitrotoluene	8330	0.4	µg/L
			Perchlorate	EPA Method	5	µg/L

Note(s):

µg/L - micrograms per liter

USEPA - U.S. Environmental Protection Agency

Table A - 2
U.S. Army Confirmation Split Sampling
Groundwater Analytical Results Summary
South Test Area/Bomb Test Area, LHAAP-001-R
October 2009

			Location Code	MW-131		MW-132		27WW01		27WW02		27WW03		27WW04	
			Sample No.	GW-131-05-091023		GW-132-06-091023		GW-27WW-01-01-091022		GW-27WW-02-02-091022		GW-27WW-03-03-091023		GW-27WW-04-04-091022	
			Sample Date	23-Oct-09		23-Oct-09		22-Oct-09		22-Oct-09		23-Oct-09		22-Oct-09	
Parameter	Units	MCL	TCEQ GW-Ind	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Metals															
Aluminum	mg/L		102.2	0.138		0.0107	J B	0.018	U	0.156		7.32		0.0207	J B
Antimony	mg/L	0.006		0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U
Arsenic	mg/L	0.01		0.00147	J B	0.00266	J B	0.00328	J B	0.00401	J B	0.00347	J B	0.0023	J B
Barium	mg/L	2		0.113		0.0477		0.0235		0.0209		0.0367		0.0249	
Beryllium	mg/L	0.004		0.0003	U	0.0003	U	0.0003	U	0.00381		0.0194		0.000448	J
Cadmium	mg/L	0.005		0.0006	U	0.0006	U	0.00178	J	0.00105	J	0.00319		0.0006	U
Calcium	mg/L			201		252		433		385		390		359	
Chromium	mg/L	0.1		0.00196	J B	0.00147	J B	0.00572	J B	0.119		0.0231		0.0209	
Cobalt	mg/L		6.132	0.0203		0.0127		0.0572		0.174		1.17		0.212	
Copper	mg/L	1.3		0.00208	J	0.0005	U	0.00221	J	0.00385	J	0.0108		0.003	J
Iron	mg/L			2.17		1.36		0.833		0.658		0.29	J B	0.767	
Lead	mg/L	0.015		0.00041	J	0.0004	U	0.000542	J	0.000446	J	0.00173	J	0.0004	J
Magnesium	mg/L			109		148		302		326		359		302	
Manganese	mg/L		14.3	3.95		0.511		7.44		2.92		27.9		8.71	
Nickel	mg/L		2.044	0.0298		0.0164		0.175		0.396		0.49		0.318	
Potassium	mg/L			1.38		1.59		7.06		3.96		7.3		1.23	
Selenium	mg/L	0.05		0.0025	U	0.0025	U	0.0025	U	0.00293	J	0.00692		0.0025	U
Silver	mg/L		0.511	0.0007	U	0.0007	U	0.0007	U	0.0007	U	0.0007	U	0.0007	U
Sodium	mg/L			403		1030		971		1050		1630		880	
Thallium	mg/L	0.002		0.0008	U	0.0008	U	0.0008	U	0.0008	U	0.0013	J	0.0008	U
Zinc	mg/L		30.66	0.00569	J B	0.00598	J B	0.0435		0.226		0.254		0.0936	

Table A - 2
U.S. Army Confirmation Split Sampling
Groundwater Analytical Results Summary
South Test Area/Bomb Test Area, LHAAP-001-R
October 2009

			Location Code	MW-131		MW-132		27WW01		27WW02		27WW03		27WW04	
			Sample No.	GW-131-05-091023		GW-132-06-091023		GW-27WW-01-01-091022		GW-27WW-02-02-091022		GW-27WW-03-03-091023		GW-27WW-04-04-091022	
			Sample Date	23-Oct-09		23-Oct-09		22-Oct-09		22-Oct-09		23-Oct-09		22-Oct-09	
Parameter	Units	MCL	TCEQ GW-Ind	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Explosives															
1,3,5-Trinitrobenzene	µg/L		3066	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
1,3-Dinitrobenzene	µg/L		10.22	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
2,4,6-Trinitrotoluene	µg/L		51.1	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
2,4-Dinitrotoluene	µg/L		0.42	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
2,6-Dinitrotoluene	µg/L		0.42	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
2-Amino-4,6-dinitrotoluene	µg/L		17.03	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
2-Nitrotoluene	µg/L		1022	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
3-Nitrotoluene	µg/L		1022	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
4-Amino-2,6-dinitrotoluene	µg/L		17.03	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
4-Nitrotoluene	µg/L		1022	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
HMX	µg/L		5110	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
Nitrobenzene	µg/L		51.1	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
RDX	µg/L		26	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
Tetryl	µg/L		1022	0.12	U	0.1	U	0.14	U	0.18	U	0.14	U	0.18	U
Perchlorate	µg/L		72	0.062	U	0.062	U	0.062	U	3.4		50		0.062	U

Notes and Abbreviations:

Bolded and shaded - level above the MCL or TCEQ GW-Ind value

B - analyte was detected in associated method blank

GW-Ind - groundwater MSC for industrial use

J - estimated results detected above the method detection limit but below the reporting limit

MCL - maximum contaminant level

mg/L - milligrams per liter

ug/L - micrograms per liter

U - Not detected. The method detection limit is provided.

00100314

Table A-2b
Groundwater Analytical Methods and Detection Limits
South Test Area/Bomb Test Area, LHAAP-001-R
(2009)

Investigated By/ Sampling Event	Date	Medium	Analytical Parameters	Analytical Method	Detection Limits	Units
US Army	October 2009	Groundwater - wells	***Metals***			
			Aluminum	6020	0.01 - 1.0	mg/L
			Antimony	6020	0.005	mg/L
			Arsenic	6020	0.005	mg/L
			Barium	6020	0.005	mg/L
			Beryllium	6020	0.002	mg/L
			Cadmium	6020	0.002	mg/L
			Calcium	6020	5 - 50	mg/L
			Chromium	6020	0.005	mg/L
			Cobalt	6020	0.005	mg/L
			Copper	6020	0.005	mg/L
			Iron	6020	0.2	mg/L
			Lead	6020	0.005	mg/L
			Magnesium	6020	0.2 - 20	mg/L
			Manganese	6020	0.005 - 0.5	mg/L
			Nickel	6020	0.005 - 0.1	mg/L
			Potassium	6020	0.2	mg/L
			Selenium	6020	0.005	mg/L
			Silver	6020	0.005	mg/L
			Sodium	6020	0.2 - 20	mg/L
			Thallium	6020	0.002	mg/L
			Zinc	6020	0.005	mg/L
			Explosives			
			HMX	8330	0.000330 - 0.000594	mg/L
			RDX	8330	0.000330 - 0.000594	mg/L
			1,3,5-TNB	8330	0.000330 - 0.000594	mg/L
			1,3-DNB	8330	0.000330 - 0.000594	mg/L
			Tetryl	8330	0.000330 - 0.000594	mg/L
			Nitrobenzene	8330	0.000330 - 0.000594	mg/L
			2,4,6-TNT	8330	0.000330 - 0.000594	mg/L
			4-ADNT	8330	0.000330 - 0.000594	mg/L
			2-ADNT	8330	0.000330 - 0.000594	mg/L
			2,6-DNT	8330	0.000330 - 0.000594	mg/L
			2,4-DNT	8330	0.000330 - 0.000594	mg/L
			2-Nitrotoluene	8330	0.000330 - 0.000594	mg/L
			4-Nitrotoluene	8330	0.000330 - 0.000594	mg/L
			3-Nitrotoluene	8330	0.000330 - 0.000594	mg/L
			Perchlorate	EPA Method 314.0	0.2	µg/L

Note(s):

µg/L - micrograms per liter

mg/L - milligrams per liter

Appendix B

LHAAP-003-R Data Summary Tables

APPENDIX B
LHAAP-003-R

Page No.	Table No.	Reference
B-1 B-2	Table 10-1 Table 10-1b	Environmental Protection Systems, Inc (EPS) 1984, *Longhorn Army Ammunition Plant Contamination Survey,* June.
B-3 B-6	Table 10-2 Table 10-2b	Ebasco Services, Inc (Ebasco), 1993, *Sampling and Data Results Report, Site LH27, Remedial Investigation, Longhorn Army Ammunition Plant,* Volume VI, March.
B-5 B-9	Table 10-3 Table 10-3b	Sverdrup Environmental, Inc (SVERDRUP), 1994, *Sampling and Data Results Report: Laboratory Report, Remedial Investigation Sites II, I, XX, 27, Longhorn Army Ammunition Plant, Karnack, Texas*, Volume I, November.
B-10	Table 10-4	U.S. Army Corps of Engineers (USACE), Tulsa District, 1997, *Remedial Investigation Report, Group 1 Sites (Sites 11, 1, XX, 27), Longhorn Army Ammunition Plant, Karnack, Texas*, Volume I, May.
B-11	Table 10-4b	U.S. Army Corps of Engineers (USACE), Southwestern Division Laboratory, 1996, *Results of Chemical Analyses of Soil Samples, Signal Test Area (XX), Longhorn Army Ammunition Plant,* November. U.S. Army Corps of Engineers (USACE), Southwestern Division Laboratory, 1997, *Results of Chemical Analyses of Soil Samples, SignalTest Area (XX), Longhorn Army Ammunition Plant,* March.
B-18 B-19 B-23 B-24 B-27	Table 10-5 Table 10-5b Table 10-6 Table 10-6b Table 10-7	Environmental Protection Systems, Inc (EPS) 1984, *Longhorn Army Ammunition Plant Contamination Survey,* June. Ebasco Services, Inc (Ebasco), 1993, *Sampling and Data Results Report, Site LH27, Remedial Investigation, Longhorn Army Ammunition Plant,* Volume VI, March.
B-28	Table B-3	Sverdrup Environmental, Inc (SVERDRUP), 1994, *Sampling and Data Results Report: Laboratory Report, Remedial Investigation Sites II, I, XX, 27, Longhorn Army Ammunition Plant, Karnack, Texas*, Volume I, November.
B-31	Table 10-7b	Ebasco Services, Inc (Ebasco), 1993, *Sampling and Data Results Report, Site LH27, Remedial Investigation, Longhorn Army Ammunition Plant,* Volume VI, March.
B-34 B-35	Table 1-32 Table 1-32b	Solution to Environmental Problems (STEP), 2005, *Plant-wide Perchlorate Investigation, Longhorn Army Ammunition Plant, Karnack, Texas*, April.

APPENDIX B (*continued*)
LHAAP-003-R

Page No.	Table No.	Reference
B-36 B-38	Table 2 Table 2b	U.S. Fish and Wildlife Service (USFWS), 2003, *Contaminant Investigation of Northern, Central, and Eastern Portions of Caddo Lake National Wildlife Refuge, Texas*, November.
B-44	Table 5A-1	U.S. Army Corps of Engineers (USACE), Tulsa District, 1997, *Remedial Investigation Report, Group 1 Sites (Sites 11, 1, XX, 27), Longhorn Army Ammunition Plant, Karnack, Texas*, Volume II, May.
B-45	Table 3	CAPE, 2007, *Engineering Evaluation/Cost Analysis, Longhorn Army Ammunition Plant, Karnack, Texas*, Final, October.
B-46	Table B-1	Groundwater Analytical Results Summary Table provided by the USEPA from the October 2009 Groundwater Confirmation Sampling.
B-48	Table B-1b	Booz Allen Hamilton Inc., 2009, *Analytical Report, Longhorn Army Ammunition Plant*, November.
B-49	Table B-2	Groundwater Analytical Results Summary Table from the October 2009 Groundwater Confirmation Sampling by the U.S. Army
B-51	Table B-2b	ALS Laboratory Group USA, 2009, *Analytical Report, Longhorn Army Ammunition Plant*, November

interval in boring XXSB01. Neither acetone nor any other volatile organic compounds were reported. Analytical results from XXSB01 are shown in Table 10-3.

In August 1996, the Tulsa District Corps of Engineers collected surface soil samples from two locations in support of the risk analysis to be performed at this site. Both samples were analyzed for volatile organic compounds and 11 metals (arsenic, barium, cadmium, chromium, lead, mercury, nickel, selenium, silver, antimony, and thallium). In February 1997, surface soil samples were taken at the same two locations. Samples from both locations were analyzed for semi-volatile organic compounds and pesticides/PCBs. A sample from RASSXX-02 was also analyzed for 12 metals (aluminum, beryllium, calcium, cobalt, copper, iron, potassium, magnesium, manganese, strontium, vanadium and zinc). Analytical results from surface soil samples collected by the Tulsa District Corps of Engineers are presented in Table 10-4.

No explosives, pesticides, volatile organics or semivolatile organic compounds were detected. Elevated concentrations of arsenic and chromium were detected.

Table 10-1
Site XX - Ground Signal Test Area
EPS Surface Soil Analytical Summary (1982)

Parameter	Units	Sample Name/Date [illegible]			TCEQ GWP-Ind µg/kg
		[illegible] 0501 [illegible]	[illegible] 0502 [illegible]	[illegible] 0503 [illegible]	
		[illegible]	[illegible]	[illegible]	
Explosives	ug/kg	<DL	<DL	<DL	5,100,000
Nitrate	ug/kg	8.0	7.41	<DL	
Sulfate	ug/kg	61.93	28.83	41.04	
Chloride	ug/kg	5.0	<DL	<DL	
Fluoride	ug/kg	6.0	6.0	<DL	
Aluminum	ug/kg	1128.6	1105.5	3.6	10,220,000
Barium	ug/kg	227.8	165.8	61.0	200,000
Chromium	ug/kg	8.4	9.2	9.4	10,000
Lead	ug/kg	27.6	26.5	26.6	1,500
Manganese	ug/kg	742	499.5	140.8	1,431,000
Strontium	ug/kg	9.4	11.8	3.9	6,132,000
Copper	ug/kg	3.3	2.7	2.0	130,000
Zinc	ug/kg	6.3	10.1	11.1	3066,000
Nickel	ug/kg	4.0	5.0	4.0	204,000

Table 10-1b
Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1982)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EPS	1982	Soil	***Metals***	EPS Method		
			Aluminum	1N	0.36	µg/g
			Arsenic	1J	0.3	µg/g
			Antimony	1J	0.76	µg/g
			Barium	1J	0.99	µg/g
			Beryllium	1N	0.5	µg/g
			Cadmium	1N	0.5	µg/g
			Chromium	1N	0.6	µg/g
			Copper	1N	0.5	µg/g
			Lead	1J	0.89	µg/g
			Manganese	1N	0.25	µg/g
			Mercury	2D	2.7	µg/g
			Nickel	1N	0.5	µg/g
			Selenium	1J	0.5	µg/g
			Silver	1N	0.5	µg/g
			Strontium	1N	0.5	µg/g
			Thallium	1N	3	µg/g
			Zinc	1N	0.5	µg/g
			Explosives			
			1,3-dinitrobenzene	7W	0.5	µg/g
			2,4,6-trinitrotoluene	7W	0.73	µg/g
			1,3,5-trinitrobenzene	7W	0.71	µg/g
			2,4 dinitrotoluene	7W	0.5	µg/g
			2,6-dinitrotoluene	7W	0.61	µg/g
			Nitrobenzene	7W	1.15	µg/g
			Anions			
			Nitrates	7U	5	µg/g
			Nitrites	7U	5	µg/g
			Sulfates	7U	25	µg/g
			Chloride	7U	7	µg/g
			Fluoride	7U	5	µg/g
			Chromate	7U	5	µg/g
			Thiocyanate	7U	10	µg/g
			Cyanide	7U	5	µg/g

Note(s):

µg/g - micrograms per gram

019710

Table 10-2
Site XX- Ground Signal Test Area
Ebasco Subsurface Soil Analytical Summary (1993)

Parameter	Units	Boring XXSB16		Boring XXSB16				TCEQ GWP-Ind
		0.0-2.0	5.0-7.0	0.0-3.0	3.0-7.0	10.0-14.0	16.0-18.0	
Volatiles	ug/kg	<DL	<DL	<DL	<DL	<DL	<DL	
Semivolatiles	ug/kg	<DL	<DL	<DL	<DL	<DL	<DL	
Di-n-butyl phthalate	ug/kg	517B	428B	674B	649B	753B	1310B	1,000,000
Explosives	ug/kg	<DL	<DL	<DL	<DL	<DL	<DL	5100
Arsenic	mg/kg	3	2	4	5	2.1	2	1
Barium	mg/kg	44	42	20.2	54.3	31.8	32.5	200
Chromium	mg/kg	4.9	<DL	6.3	8.6	8.8	14.8	10
Lead	mg/kg	6	4	6	11	7	9	1.5
Mercury	mg/kg	<DL	<DL	0.03	<DL	0.06	<DL	0.2
Nickel	mg/kg	2.8	2.4	2.1	11.1	13.3	27.8	204.4
Selenium	mg/kg	0.3	<DL	0.2	0.2	<DL	1.2	5
Thallium	mg/kg	<DL	<DL	<DL	0.2	<DL	0.2	
Nitrate/Nitrite	mg/kg	0.9	6.72	5.33	2.81	<DL	5.82	
Sulfate	mg/kg	990	5700	4500	5300	4600	4100	
pH	pH	5.7	6.8	5.7	6.4	5.9	5.9	
Conductivity	umhos/cm	44	70	38	59	27	920	

018711

Table 10-2 (con't)
Site XX- Ground Signal Test Area
Ebasco Subsurface Soil Analytical Summary (1993)

Parameter	Units	Boring XXSB17		Boring SB18	Boring XXSB19		TCEQ GWP-Ind
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Volatiles	ug/kg	<DL	<DL	<DL	<DL	<DL	
TCB	ug/kg	<DL	42	<DL	<DL	<DL	500
Acetone	ug/kg	<DL	<DL	<DL	<DL	10300	9.2x10^4
Semivolatiles	ug/kg	<DL	<DL	<DL	<DL	<DL	
Di-n- butyl phthalate	ug/kg	1820B	1850B	<DL	1810B	1830B	1,000,000
Explosives	ug/kg	<DL	<DL	<DL	<DL	<DL	5100
Arsenic	mg/kg	5	2	3	3	6	1
Barium	mg/kg	66.7	100	28.2	37.6	26.6	200
Chromium	mg/kg	13.5	9.3	12.9	11.4	14.2	10
Lead	mg/kg	7	5	6	5	5	1.5
Mercury	mg/kg	<DL	0.06	0.03	0.03	0.04	0.2
Nickel	mg/kg	4.5	10.1	2.8	5.9	21.3	204.4
Selenium	mg/kg	0.1	<DL	0.3	0.1	<DL	5
Chloride	mg/kg	<DL	<DL	<DL	<DL	310	
Nitrate/Nitrite	mg/kg	<DL	8.75	0.56	<DL	5.74	
Sulfate	mg/kg	820	5100	150	4900	820	
pH	pH	6.1	6.7	7.9	5.9	5.4	
Conductivity	umhos/cm	33	50	71	195	1520	

00100323

018712

Table 10-2 (con't)
Site XX- Ground Signal Test Area
Ebasco Subsurface Soil Analytical Summary (1993)

Parameter	Units	Boring XXSB20		Boring XXSB21		TCEQ GWP-Ind
		0-2(ft)	2.5-5.0	0-2.5	2.5-5.0	
Volatiles	ug/kg	<DL	<DL	<DL	<DL	
Semivolatiles	ug/kg	<DL	<DL	<DL	<DL	
Di-n-butylphthalate	ug/kg	2080B	2790B	2270B	2390B	1,000,000
Explosives	ug/kg	<DL	<DL	<DL	<DL	5,100
Arsenic	mg/kg	4	2	1	1.9	1
Barium	mg/kg	57.2	52.4	48.5	48.8	200
Chromium	mg/kg	15.9	9.9	5.9	7.2	10
Lead	mg/kg	4	5	5	6	1.5
Nickel	mg/kg	5.8	4.4	4.1	4.1	204.4
Selenium	mg/kg	0.1	<DL	<DL	<DL	5
Nitrate/Nitrite	mg/kg	1.5	1	1.1	1	
Sulfate	mg/kg	3800	4400	500	400	
pH	pH	5.9	5.4	5.9	5.7	
Conductivity	umhos/cm	195	1520	36	29	

Table 10-3
Site XX - Ground Signal Test Area
Sverdrup Subsurface Soil Analytical Summary (1994)

Parameter	Units	Boring XXSB01			TCEQ GWP-Ind
		0-2	4-5	9-10	
Volatiles	ug/kg	<DL	<DL	<DL	
Methylene chloride	ug/kg	18	<DL	<DL	58,000

Table 10-2b
Soil Sampling Analytical Methods and Detections Limits
Gound Signal Test Area, LHAAP-003-R
(1993)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Soil - borings	***Metals***			
			Arsenic	7060	1	mg/kg
			Antimony	6010	1	mg/kg
			Barium	6010	1	mg/kg
			Cadmium	6010	1	mg/kg
			Chromium	6010	1	mg/kg
			Lead	7421	1	mg/kg
			Mercury	7470/7471	0.01	mg/kg
			Nickel	6010	1	mg/kg
			Selenium	7740	0.1	mg/kg
			Silver	6010	1	mg/kg
			Thallium	7841	0.2	mg/kg
			VOCs			
			1,1,1-Trichloroethane	8240	5	µg/kg
			1,1,2,2-Tetrachloroethane	8240	5	µg/kg
			1,1,2-Trichloroethane	8240	5	µg/kg
			1,1-Dichloroethane	8240	5	µg/kg
			1,1-Dichloroethene	8240	5	µg/kg
			1,2-Dichloroethane	8240	5	µg/kg
			1,2-Dichloroethene	8240	5	µg/kg
			1,2-Dichloropropane	8240	5	µg/kg
			2-Butanone	8240	50	µg/kg
			2-Chloroethylvinylether	8240	10	µg/kg
			2-Hexanone	8240	50	µg/kg
			4-Methyl-2-pentanone	8240	50	µg/kg
			Acetone	8240	100	µg/kg
			Benzene	8240	5	µg/kg
			Bromodichloromethane	8240	5	µg/kg
			Bromoform	8240	5	µg/kg
			Bromomethane	8240	10	µg/kg
			Carbon disulfide	8240	5	µg/kg
			Carbon tetrachloride	8240	5	µg/kg
			Chlorobenzene	8240	5	µg/kg
			Chloroethane	8240	10	µg/kg
			Chloroform	8240	5	µg/kg
			Chloromethane	8240	10	µg/kg
			Chlorodibromomethane	8240	5	µg/kg
			Ethylbenzene	8240	5	µg/kg
			Methylene chloride	8240	5	µg/kg
			Styrene	8240	5	µg/kg
			Tetrachloroethene	8240	5	µg/kg
			Toluene	8240	5	µg/kg
			Trichloroethene	8240	5	µg/kg
			Vinyl acetate	8240	50	µg/kg
			Vinyl chloride	8240	10	µg/kg
			Xylenes	8240	5	µg/kg
			cis-1,3-Dichloropropene	8240	5	µg/kg
			trans-1,3-Dichloropropene	8240	5	µg/kg

Table 10-2b
Soil Sampling Analytical Methods and Detections Limits
Gound Signal Test Area, LHAAP-003-R
(1993)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Soil - borings	***SVOCs***			
			1,2,4-Trichlorobenzene	8270	330	µg/kg
			1,2-Dichlorobenzene	8270	330	µg/kg
			1,3-Dichlorobenzene	8270	330	µg/kg
			1,4-Dichlorobenzene	8270	330	µg/kg
			2,4,5-Trichlorophenol	8270	1650	µg/kg
			2,4,6-Trichlorophenol	8270	330	µg/kg
			2,4-Dichlorophenol	8270	330	µg/kg
			2,4-Dimethylphenol	8270	330	µg/kg
			2,4-Dinitrophenol	8270	1650	µg/kg
			2,4-Dinitrotoluene	8270	330	µg/kg
			2,6-Dinitrotoluene	8270	330	µg/kg
			2-Chloronaphthalene	8270	330	µg/kg
			2-Chlorophenol	8270	330	µg/kg
			2-Methylnaphthalene	8270	330	µg/kg
			2-Methylphenol	8270	330	µg/kg
			2-Nitroaniline	8270	1650	µg/kg
			2-Nitrophenol	8270	330	µg/kg
			3,3-Dichlorobenzidine	8270	650	µg/kg
			3-Nitroaniline	8270	1650	µg/kg
			4-Bromophenylphenylether	8270	330	µg/kg
			4-Chloro-3-methylphenol	8270	650	µg/kg
			4-Chloroaniline	8270	650	µg/kg
			4-Chlorophenylphenylether	8270	330	µg/kg
			4-Methylphenol	8270	330	µg/kg
			4-Nitroaniline	8270	1650	µg/kg
			4-Nitrophenol	8270	1650	µg/kg
			4,6-Dinitro-2-methylphenol	8270	1650	µg/kg
			Acenaphthene	8270	330	µg/kg
			Acenaphthylene	8270	330	µg/kg
			Anthracene	8270	330	µg/kg
			Benzo(a)anthracene	8270	330	µg/kg
			Benzo(a)pyrene	8270	330	µg/kg
			Benzo(b)fluoranthene	8270	330	µg/kg
			Benzo(g,h,i)perylene	8270	330	µg/kg
			Benzo(k)fluoranthene	8270	330	µg/kg
			Benzoic acid	8270	1650	µg/kg
			Benzyl alcohol	8270	650	µg/kg
			Butylbenzylphthalate	8270	330	µg/kg
			Chrysene	8270	330	µg/kg
			Dibenzo(a,h)anthracene	8270	330	µg/kg
			Dibenzofuran	8270	330	µg/kg
			Di-n-butylphthalate	8270	330	µg/kg
			Diethylphthalate	8270	330	µg/kg
			Dimethylphthalate	8270	330	µg/kg
			Fluoranthene	8270	330	µg/kg
			Fluorene	8270	330	µg/kg
			Hexachlorobenzene	8270	330	µg/kg
			Hexachlorobutadiene	8270	330	µg/kg

Table 10-2b
Soil Sampling Analytical Methods and Detections Limits
Gound Signal Test Area, LHAAP-003-R
(1993)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Soil - borings	***SVOCs (continued)***			
			Hexachlorocyclopentadiene	8270	330	µg/kg
			Hexachloroethane	8270	330	µg/kg
			Indeno(1,2,3-c,d)pyrene	8270	330	µg/kg
			Isophorone	8270	330	µg/kg
			Naphthalene	8270	330	µg/kg
			Nitrobenzene	8270	330	µg/kg
			Pentachlorophenol	8270	1650	µg/kg
			Phenanthrene	8270	330	µg/kg
			Phenol	8270	330	µg/kg
			Pyrene	8270	330	µg/kg
			bis(2-Chloroethoxy)methane	8270	330	µg/kg
			bis(2-Chloroethyl)ether	8270	330	µg/kg
			bis(2-Chloroisopropyl)ether	8270	330	µg/kg
			bis(2-Ethylhexyl)phthalate	8270	330	µg/kg
			di-n-Octylphthalate	8270	330	µg/kg
			n-Nitrosodi-n-propylamine	8270	330	µg/kg
			n-Nitrosodiphenylamine	8270	330	µg/kg
			Explosives			
			HMX	8330	0.5	mg/kg
			RDX	8330	0.5	mg/kg
			1,3,5-TNB	8330	0.25	mg/kg
			1,3-DNB	8330	0.25	mg/kg
			Tetryl	8330	0.5	mg/kg
			Nitrobenzene	8330	0.26	mg/kg
			2,4,6-TNT	8330	0.25	mg/kg
			2,6-DNT	8330	0.25	mg/kg
			2,4-DNT	8330	0.25	mg/kg
			2-Nitrotoluene	8330	0.25	mg/kg
			4-Nitrotoluene	8330	0.25	mg/kg
			3-Nitrotoluene	8330	0.25	mg/kg
			Anions			
			Nitrate-Nitrite Nitrogen	353.3	0.01-0.05	mg/kg
			Sulfate	9038	50-300	mg/kg
			Chloride	9052	+	mg/kg

Note(s):

µg/kg - micrograms per kilogram

mg/kg - milligrams per kilogram

SVOC - semivolatile organic compound

VOC - volatile organic compound

Table 10-3b
Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(SVERDRUP 1994)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
SVERDRUP	1994	Soil - boring	***VOCs***			
			1,1,1-Trichloroethane	8240	6	µg/kg
			1,1,2,2-Tetrachloroethane	8240	6	µg/kg
			1,1,2-Trichloroethane	8240	6	µg/kg
			1,1-Dichloroethane	8240	6	µg/kg
			1,1-Dichloroethene	8240	6	µg/kg
			1,2-Dichloroethane	8240	6	µg/kg
			1,2-Dichloropropane	8240	6	µg/kg
			1,2,3-Trichloropropane	8240	12	µg/kg
			1,4-Dichloro-2-butene	8240	12	µg/kg
			2-Butanone	8240	12	µg/kg
			Ethene (2 chloroethoxyl)-	8240	12	µg/kg
			2-Hexanone	8240	12	µg/kg
			4-Methyl-2-pentanone	8240	12	µg/kg
			Acetone	8240	12	µg/kg
			Acrolein	8240	60	µg/kg
			Acrylonitrile	8240	60	µg/kg
			Benzene	8240	6	µg/kg
			Bromodichloromethane	8240	6	µg/kg
			Bromoform	8240	6	µg/kg
			Bromomethane	8240	12	µg/kg
			Carbon disulfide	8240	6	µg/kg
			Carbon tetrachloride	8240	6	µg/kg
			Chlorobenzene	8240	6	µg/kg
			Chloroethane	8240	12	µg/kg
			Chloroform	8240	6	µg/kg
			Chloromethane	8240	12	µg/kg
			cis-1,3-Dichloropropene	8240	6	µg/kg
			Dibromomethane	8240	6	µg/kg
			Dibromochloromethane	8240	6	µg/kg
			Dichlorodifluoromethane	8240	6	µg/kg
			Ethylbenzene	8240	6	µg/kg
			Ethyl methacrylate	8240	6	µg/kg
			Iodomethane	8240	12	µg/kg
			Methylene chloride	8240	12	µg/kg
			Styrene	8240	6	µg/kg
			Tetrachloroethene	8240	6	µg/kg
			Toluene	8240	6	µg/kg
			Total Xylenes	8240	6	µg/kg
			1,2-Dichloroethylene	8240	6	µg/kg
			trans-1,3-Dichloropropene	8240	6	µg/kg
			Trichloroethene	8240	6	µg/kg
			Trichlorofluoromethane	8240	6	µg/kg
			Vinyl acetate	8240	12	µg/kg
			Vinyl chloride	8240	12	µg/kg

Note(s):

µg/kg - micrograms per kilogram

VOC - volatile organic compound

018713

Table 10-4
Site XX - Ground Signal Test Area
Tulsa District Corps of Engineers (1996/97)
Surface Soil Analytical Summary

Parameter	Units	RASSXX01	RASSXX02	TCEQ GW IB std
Explosives	ug/kg	<DL	<DL	
Pesticides	mg/kg	<DL	<DL	
Volatile Organics	ug/kg	<DL	<DL	
Semivolatiles	mg/kg	<DL	<DL	
Aluminum	mg/kg	4670	8050	10,220
Antimony	mg/kg	<DL	<DL	
Arsenic	mg/kg	32.8	4.33	1
Barium	mg/kg	88.1	92.2	200
Beryllium	mg/kg	<DL	<DL	0.4
Cadmium	mg/kg	3.63	5.42	0.5
Calcium	mg/kg	332	621	NA
Chromium	mg/kg	28.9	14.3	10
Cobalt	mg/kg	3.21	<DL	
Copper	mg/kg	3.70	6.21	130
Iron	mg/kg	6,970	13,500	NA
Lead	mg/kg	11.0	9	1.5
Magnesium	mg/kg	243	826	NA
Manganese	mg/kg	567	37.8	1431
Mercury	mg/kg	<DL	<DL	0.2
Nickel	mg/kg	10.6	15	204.4
Potassium	mg/kg	281	484	NA
Selenium	mg/kg	<DL	<DL	5
Silver	mg/kg	<DL	<DL	
Strontium	mg/kg	<DL	18.9	6137
Thallium	mg/kg	<DL	<DL	
Vanadium	mg/kg	20.6	24.3	72
Zinc	mg/kg	9.17	17.6	3066

Table 10-4b
USACE Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1996/1997)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USACE	1996/97	Soil - surface	***Metals***			
			Arsenic	7060	0.596 - 58.7[a]	mg/kg
			Antimony	6010	1.1 - 1.2	mg/kg
			Barium	6010	2.22 - 2.38	mg/kg
			Cadmium	6010	2.22 - 2.38	mg/kg
			Chromium	6010	2.22 - 2.38	mg/kg
			Lead	7421	2	mg/kg
			Mercury	7471	0.133 - 0.143	mg/kg
			Nickel	6010	2.22 - 2.38	mg/kg
			Selenium	7740	0.55 -0.60	mg/kg
			Silver	6010	2.22 - 2.38	mg/kg
			Thallium	6010	0.6	mg/kg
			Explosives			
			HMX	8330	0.9	mg/kg
			RDX	8330	0.5	mg/kg
			1,3,5-TNB	8330	0.7	mg/kg
			1,3-DNB	8330	0.5	mg/kg
			Tetryl	8330	1.9	mg/kg
			Nitrobenzene	8330	0.6	mg/kg
			2,4,6-TNT	8330	0.5	mg/kg
			2,6-DNT	8330	0.5	mg/kg
			2,4-DNT	8330	0.5	mg/kg
			2-Nitrotoluene	8330	0.9	mg/kg
			4-Nitrotoluene	8330	1.1	mg/kg
			3-Nitrotoluene	8330	0.9	mg/kg
			2-Am-DNT	8330	0.9	mg/kg
			4-Am-DNT	8330	1.1	mg/kg
			VOCs			
			1,1,1-Trichloroethane	8260	5.54 -5.96	µg/kg
			1,1,2,2-Tetrachloroethane	8260	5.54 -5.96	µg/kg
			1,1,2-Trichloroethane	8260	5.54 -5.96	µg/kg
			1,1-Dichloroethane	8260	5.54 -5.96	µg/kg
			1,1-Dichloroethene	8260	5.54 -5.96	µg/kg
			1,2-Dichloroethane	8260	5.54 -5.96	µg/kg
			1,2-Dichloropropane	8260	5.54 -5.96	µg/kg
			2-Butanone	8260	111 - 119	µg/kg
			2-Chloroethylvinylether	8260	11.1 - 11.9	µg/kg
			2-Hexanone	8260	55.4 - 59.6	µg/kg
			4-Methyl-2-pentanone	8260	111 - 119	µg/kg
			Acetone	8260	22.2 - 23.8	µg/kg
			Acrylonitrile	8260	5.54 -5.96	µg/kg

Table 10-4b
USACE Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1996/1997)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USACE	1996/97	Soil - surface	*VOCs (continued)*			
			Benzene	8260	5.54 -5.96	µg/kg
			Bromobenzene	8260	5.54 -5.96	µg/kg
			Bromochloromethane	8260	5.54 -5.96	µg/kg
			Bromodichloromethane	8260	5.54 -5.96	µg/kg
			Bromoform	8260	5.54 -5.96	µg/kg
			Bromomethane	8260	5.54 -5.96	µg/kg
			Carbon disulfide	8260	5.54 -5.96	µg/kg
			Carbon tetrachloride	8260	5.54 -5.96	µg/kg
			Chlorobenzene	8260	5.54 -5.96	µg/kg
			Chloroethane	8260	5.54 -5.96	µg/kg
			Chloroform	8260	5.54 -5.96	µg/kg
			2-Chlorotoluene	8260	5.54 -5.96	µg/kg
			3-Chlorotoluene	8260	5.54 -5.96	µg/kg
			Chloromethane	8260	5.54 -5.96	µg/kg
			Dibromochloromethane	8260	5.54 -5.96	µg/kg
			1,2-Dibromo-3-chloropropane	8260	27.7 - 29.8	µg/kg
			1,2-Dibromoethane	8260	5.54 -5.96	µg/kg
			1,2-Dichlorobenzene	8260	5.54 -5.96	µg/kg
			1,3-Dichlorobenzene	8260	5.54 -5.96	µg/kg
			1,4-Dichlorobenzene	8260	5.54 -5.96	µg/kg
			trans-1,4-Dichloro-2-butene	8260	111 - 119	µg/kg
			2,2-Dichloropropane	8260	5.54 -5.96	µg/kg
			1,1-Dichloropropene	8260	5.54 -5.96	µg/kg
			1,3-Dichloropropane	8260	5.54 -5.96	µg/kg
			cis-1,2-Dichloroethene	8260	5.54 -5.96	µg/kg
			trans-1,2-Dichloroethene	8260	5.54 -5.96	µg/kg
			Dibromomethane		5.54 -5.96	µg/kg
			Ethylbenzene	8260	5.54 -5.96	µg/kg
			Iodomethane	8260	5.54 -5.96	µg/kg
			Methylene chloride	8260	5.54 -5.96	µg/kg
			Styrene	8260	5.54 -5.96	µg/kg
			1,1,1,2-Tetrachloroethane	8260	5.54 -5.96	µg/kg
			Tetrachloroethene	8260	5.54 -5.96	µg/kg
			Toluene	8260	5.54 -5.96	µg/kg
			1,2,3-Trichlorobenzene	8260	5.54 -5.96	µg/kg
			1,2,4-Trichlorobenzene	8260	5.54 -5.96	µg/kg
			Trichloroethene	8260	5.54 -5.96	µg/kg
			Trichlorofluoromethane	8260	5.54 -5.96	µg/kg
			1,2,3-Trichloropropane	8260	5.54 -5.96	µg/kg
			1,3,5-Trimethylbenzene	8260	5.54 -5.96	µg/kg

Table 10-4b
USACE Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1996/1997)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USACE	1996/97	Soil - surface	***VOCs (continued)***			
			1,2,4-Trimethylbenzene	8260	5.54 -5.96	µg/kg
			Vinyl acetate	8260	55.4 - 59.6	µg/kg
			Vinyl chloride	8260	2.22 - 2.38	µg/kg
			m,p-Xylenes	8260	5.54 -5.96	µg/kg
			o-Xylenes	8260	5.54 -5.96	µg/kg
			cis-1,3-Dichloropropene	8260	5.54 -5.96	µg/kg
			trans-1,3-Dichloropropene	8260	5.54 -5.96	µg/kg
USACE	February 1997	Soil	***Metals***			
			Aluminum	6010	26.5 - 27.9	mg/kg
			Beryllium	6010	0.66 - 0.70	mg/kg
			Calcium	6010	66.1 - 69.7	mg/kg
			Cobalt	6010	2.65 - 2.79	mg/kg
			Copper	6010	1.32 - 1.39	mg/kg
			Iron	6010	13.2 - 13.9	mg/kg
			Magnesium	6010	13.2 - 13.9	mg/kg
			Manganese	6010	1.32 - 1.39	mg/kg
			Potassium	6010	132 - 139	mg/kg
			Strontium	6010	13.2 - 13.9	mg/kg
			Vanadium	6010	2.65 - 2.79	mg/kg
			Zinc	6010	3.97 - 4.18	mg/kg
			VOCs			
			1,1,1-Trichloroethane	8260	6.78	µg/kg
			1,1,2,2-Tetrachloroethane	8260	6.78	µg/kg
			1,1,2-Trichloroethane	8260	6.78	µg/kg
			1,1-Dichloroethane	8260	6.78	µg/kg
			1,1-Dichloroethene	8260	6.78	µg/kg
			1,2-Dichloroethane	8260	6.78	µg/kg
			1,2-Dichloropropane	8260	6.78	µg/kg
			2-Butanone	8260	136	µg/kg
			2-Chloroethylvinylether	8260	13.6	µg/kg
			2-Hexanone	8260	67.8	µg/kg
			4-Methyl-2-pentanone	8260	136	µg/kg
			Acetone	8260	27.1	µg/kg
			Acrylonitrile	8260	6.78	µg/kg
			Benzene	8260	6.78	µg/kg
			Bromobenzene	8260	6.78	µg/kg
			Bromochloromethane	8260	6.78	µg/kg
			Bromodichloromethane	8260	6.78	µg/kg
			Bromoform	8260	6.78	µg/kg
			Bromomethane	8260	6.78	µg/kg

Table 10-4b
USACE Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1996/1997)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USACE	February 1997	Soil	*VOCs (continued)*			
			Carbon disulfide	8260	6.78	µg/kg
			Carbon tetrachloride	8260	6.78	µg/kg
			Chlorobenzene	8260	6.78	µg/kg
			Chloroethane	8260	6.78	µg/kg
			Chloroform	8260	6.78	µg/kg
			2-Chlorotoluene	8260	6.78	µg/kg
			3-Chlorotoluene	8260	6.78	µg/kg
			Chloromethane	8260	6.78	µg/kg
			Dibromochloromethane	8260	6.78	µg/kg
			1,2-Dibromo-3-chloropropane	8260	33.9	µg/kg
			1,2-Dibromoethane	8260	6.78	µg/kg
			1,2-Dichlorobenzene	8260	6.78	µg/kg
			1,3-Dichlorobenzene	8260	6.78	µg/kg
			1,4-Dichlorobenzene	8260	6.78	µg/kg
			trans-1,4-Dichloro-2-butene	8260	136	µg/kg
			2,2-Dichloropropane	8260	6.78	µg/kg
			1,1-Dichloropropene	8260	6.78	µg/kg
			1,3-Dichloropropane	8260	6.78	µg/kg
			cis-1,2-Dichloroethene	8260	6.78	µg/kg
			trans-1,2-Dichloroethene	8260	6.78	µg/kg
			Dibromomethane		6.78	µg/kg
			Ethylbenzene	8260	6.78	µg/kg
			Iodomethane	8260	6.78	µg/kg
			Methylene chloride	8260	6.78	µg/kg
			Styrene	8260	6.78	µg/kg
			1,1,1,2-Tetrachloroethane	8260	6.78	µg/kg
			Tetrachloroethene	8260	6.78	µg/kg
			Toluene	8260	6.78	µg/kg
			1,2,3-Trichlorobenzene	8260	6.78	µg/kg
			1,2,4-Trichlorobenzene	8260	6.78	µg/kg
			Trichloroethene	8260	6.78	µg/kg
			Trichlorofluoromethane	8260	6.78	µg/kg
			1,2,3-Trichloropropane	8260	6.78	µg/kg
			1,3,5-Trimethylbenzene	8260	6.78	µg/kg
			1,2,4-Trimethylbenzene	8260	6.78	µg/kg
			Vinyl acetate	8260	67.8	µg/kg
			Vinyl chloride	8260	6.78	µg/kg
			m,p-Xylenes	8260	6.78	µg/kg
			o-Xylenes	8260	6.78	µg/kg
			cis-1,3-Dichloropropene	8260	6.78	µg/kg
			trans-1,3-Dichloropropene	8260	6.78	µg/kg

Table 10-4b
USACE Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1996/1997)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USACE	February 1997	Soil	***SVOCs***			
			1,2,4-Trichlorobenzene	8270	0.437 - 0.460	mg/kg
			1,2-Dichlorobenzene	8270	0.437 - 0.460	mg/kg
			1,3-Dichlorobenzene	8270	0.437 - 0.460	mg/kg
			1,4-Dichlorobenzene	8270	0.437 - 0.460	mg/kg
			2,3,4,6-Tetrachlorophenol	8270	0.437 - 0.460	mg/kg
			2,4,5-Trichlorophenol	8270	2.18 - 2.30	mg/kg
			2,4,6-Trichlorophenol	8270	0.437 - 0.460	mg/kg
			2,4-Dichlorophenol	8270	0.437 - 0.460	mg/kg
			2,4-Dimethylphenol	8270	0.437 - 0.460	mg/kg
			2,4-Dinitrophenol	8270	2.18 - 2.30	mg/kg
			2,4-Dinitrotoluene	8270	0.437 - 0.460	mg/kg
			2,6-Dinitrotoluene	8270	0.437 - 0.460	mg/kg
			2-Chloronaphthalene	8270	0.437 - 0.460	mg/kg
			2-Chlorophenol	8270	0.437 - 0.460	mg/kg
			2-Methylphenol	8270	0.437 - 0.460	mg/kg
			2-Nitroaniline	8270	2.18 - 2.30	mg/kg
			2-Nitrophenol	8270	0.437 - 0.460	mg/kg
			2-Methylnaphthalene	8270	0.437 - 0.460	mg/kg
			3,3-Dichlorobenzidine	8270	0.437 - 0.460	mg/kg
			3-Methylcholanthrene	8270	0.437 - 0.460	mg/kg
			3-Nitroaniline	8270	2.18 - 2.30	mg/kg
			4,6-Dinitro-2-methylphenol	8270	2.18 - 2.30	mg/kg
			4-Bromophenylphenylether	8270	0.437 - 0.460	mg/kg
			4-Chloro-3-methylphenol	8270	0.860 - 0.907	mg/kg
			4-Chloroaniline	8270	0.437 - 0.460	mg/kg
			4-Chlorophenylphenylether	8270	0.437 - 0.460	mg/kg
			4-Methylphenol	8270	0.437 - 0.460	mg/kg
			4-Nitroaniline	8270	2.18 - 2.30	mg/kg
			4-Nitrophenol	8270	1.06 - 1.12	mg/kg
			Benzo(a)anthracene	8270	0.437 - 0.460	mg/kg
			Benzoic acid	8270	1.06 - 1.12	mg/kg
			Benzyl alcohol	8270	0.860 - 0.907	mg/kg
			bis(2-Chloroethoxy)methane	8270	0.437 - 0.460	mg/kg
			bis(2-Chloroethyl)ether	8270	0.437 - 0.460	mg/kg
			bis(2-Ethylhexyl)phthalate	8270	0.437 - 0.460	mg/kg
			bis(2-Chloroisopropyl)ether	8270	0.437 - 0.460	mg/kg
			Butylbenzylphthalate	8270	0.437 - 0.460	mg/kg
			Carbazole	8270	0.437 - 0.460	mg/kg
			Di-n-butylphthalate	8270	0.437 - 0.460	mg/kg
			Di-n-Octylphthalate	8270	0.437 - 0.460	mg/kg

Table 10-4b
USACE Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1996/1997)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USACE	February 1997	Soil	***SVOCs (continued)***			
			Dibenzo(a,h)anthracene	8270	0.437 - 0.460	mg/kg
			Dibenzofuran	8270	0.437 - 0.460	mg/kg
			Diethylphthalate	8270	0.437 - 0.460	mg/kg
			Dimethylphthalate	8270	0.437 - 0.460	mg/kg
			Ethyl methanesulfonate	8270	0.437 - 0.460	mg/kg
			Hexachlorobenzene	8270	0.437 - 0.460	
			Hexachlorobutadiene	8270	0.437 - 0.460	mg/kg
			Hexachlorocyclopentadiene	8270	0.437 - 0.460	mg/kg
			Hexachloroethane	8270	0.437 - 0.460	mg/kg
			Isophorone	8270	0.437 - 0.460	mg/kg
			N-nitroso-di-n-propylamine	8270	0.437 - 0.460	mg/kg
			Nitrobenzene	8270	0.437 - 0.460	mg/kg
			Pentachlorobenzene	8270	0.437 - 0.460	mg/kg
			Pentachlorophenol	8270	2.18 - 2.24	mg/kg
			Phenol	8270	0.437 - 0.460	mg/kg
			Acenaphthalene	8270	0.437 - 0.460	mg/kg
			Acenaphthene	8270	0.437 - 0.460	mg/kg
			Anthracene	8270	0.437 - 0.460	mg/kg
			Benzo(a)pyrene	8270	0.437 - 0.460	mg/kg
			Benzo(b)fluoranthene	8270	0.437 - 0.460	mg/kg
			Benzo(g,h,i)perylene	8270	0.437 - 0.460	mg/kg
			Benzo(k)fluoranthene	8270	0.437 - 0.460	mg/kg
			Chrysene	8270	0.437 - 0.460	mg/kg
			Fluoranthene	8270	0.437 - 0.460	mg/kg
			Fluorene	8270	0.437 - 0.460	mg/kg
			Indeno(1,2,3-c,d)pyrene	8270	0.437 - 0.460	mg/kg
			n-Nitrosodiphenylamine	8270	0.437 - 0.460	mg/kg
			Naphthalene	8270	0.437 - 0.460	mg/kg
			Phenanthrene	8270	0.437 - 0.460	mg/kg
			Pyrene	8270	0.437 - 0.460	mg/kg
			Pesticides			
			Aldrin	3540/8081	5	µg/kg
			Heptachlor	3540/8081	5	µg/kg
			Alpha BHC	3540/8081	5	µg/kg
			Chlordane	3540/8081	5	µg/kg
			Beta BHC	3540/8081	10	µg/kg
			delta-BHC	3540/8081	5	µg/kg
			Dieldrin	3540/8081	10	µg/kg
			Alpha Endosulfan	3540/8081	5	µg/kg
			Beta Endosulfan	3540/8081	10	µg/kg

Table 10-4b
USACE Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1996/1997)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USACE	February 1997	Soil	***Pesticides (continued)***			
			Endosulfan Sulfate	3540/8081	10	µg/kg
			Endrin	3540/8081	10	µg/kg
			Endrin Aldehyde	3540/8081	10	µg/kg
			gamma-BHC	3540/8081	5	µg/kg
			Heptachlor epoxide	3540/8081	5	µg/kg
			4,4--DDD	3540/8081	10	µg/kg
			4,4--DDE	3540/8081	10	µg/kg
			4,4--DDT	3540/8081	10	µg/kg
			Toxaphene	3540/8081	75	µg/kg
			Methoxylchlor	3540/8081	20	mg/kg
			PCBs			
			Aroclor 1016	8080	0.132 - 0.139	mg/kg
			Aroclor 1221	8080	0.132 - 0.139	mg/kg
			Aroclor 1232	8080	0.132 - 0.139	mg/kg
			Aroclor 1242	8080	0.132 - 0.139	mg/kg
			Aroclor 1248	8080	0.132 - 0.139	mg/kg
			Aroclor 1254	8080	0.132 - 0.139	mg/kg
			Aroclor 1260	8080	0.132 - 0.139	mg/kg

Note(s):

[a] - dilution factor of 100

µg/kg - micrograms per kilogram

mg/kg - milligrams per kilogram

PCB - polychlorinated biphenyl

SVOC - semivolatile organic compound

USACE - U.S. Army Corps of Engineers

VOC - volatile organic compound

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Table 10-5
Site XX - Ground Signal Test Area
Groundwater Analytical Summary (1982 and 1983)

Parameter	Units	Well MW-127		Well MW-128		MCL	TCEQ GW-Ind
		1982	March 1993	1982	March 1993		
Volatiles	ug/l	<DL*	<DL*	<DL	<DL		
Semivolatiles	ug/l	<DL*	<DL*	<DL	<DL		
Explosives	ug/l	<DL	<DL	<DL	<DL		
Aluminum	mg/l	0.037	<DL	0.353	<DL		102.2
Barium	mg/l	0.046	0.11	0.0515	<DL	2	
Cadmium	mg/l	0.01	<DL	0.005	<DL	0.005	
Chromium	mg/l	0.012	<DL	<DL	<DL	0.1	
Lead	mg/l	<DL	0.011	<DL	0.011	0.015	
Manganese	mg/l	1.86	<DL	1.086	<DL		14.308
Nickel	mg/l	0.157	0.05	0.082	<DL		2.044
Strontium	mg/l	3.36	<DL	4.12	<DL		61.32
Thallium	mg/l	0.14	<DL	0.11	<DL	0.002	
Sulfate	mg/l	1622	1200	559	330		
Chloride	mg/l	832	527	1000	873		
Fluoride	mg/l	1	<DL	<DL	<DL		

* This table erroneously shows well MW-127 as being sampled for VOCs and SVOCs when according to the EPS 1982 Report text, the well was not sampled.

Table 10-5b
Groundwater Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
1982 and 1993

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EPS	1982	Groundwater -wells	***Metals***			
			Aluminum	1M	10	µg/L
			Arsenic	1B	6	µg/L
			Antimony	1B	10.2	µg/L
			Barium	1B	11.4	µg/L
			Beryllium	1M	10	µg/L
			Cadmium	1B	0.28	µg/L
			Chromium	1B	6.64	µg/L
			Copper	1M	23.9	µg/L
			Lead	1B	7.49	µg/L
			Manganese	1M	12.1	µg/L
			Mercury	1D	1.3	µg/L
			Nickel	1M	30	µg/L
			Selenium	1B	6	µg/L
			Silver	1M	10	µg/L
			Strontium	1M	25	µg/L
			Thallium	1M	50	µg/L
			Zinc	1M	27.1	µg/L
			Organics			
			Benzene	2J	1	µg/L
			Chloroform	2J	1	µg/L
			Trichloroethylene	2J	1	µg/L
			Pentachlorophenol	1X	2	µg/L
			o-chlorophenol	1X	0.7	µg/L
			2,4-dichlorophenol	1X	1	µg/L
			Tetrahydrofuran	NA	NA	
			Dibutylphthalate	NA	NA	
			Dichloromethane	NA	NA	
			Diethylphthalate	1Z	2	µg/L
			Nitrobenzene	1Z	1	µg/L
			2-(1,1-dimethylethoxyl)-ethanol	NA	NA	
			Explosives			
			1,3-dinitrobenzene	7V	1.68	µg/L
			2,4,6-trinitrotoluene	7V	1.46	µg/L
			1,3,5-trinitrobenzene	7V	1.08	µg/L
			2,4 dinitrotoluene	7V	0.89	µg/L
			2,6-dinitrotoluene	7V	1.2	µg/L
			Nitrobenzene	7V	0.76	µg/L
			Anions			
			Nitrate	2P	500	µg/L
			Nitrite	2P	250	µg/L
			Phosphate	2P	125	µg/L
			Sulfates	2P	580	µg/L
			Chloride	2P	500	µg/L
			Fluoride	2P	500	µg/L
			Chromate	2P	500	µg/L
			Thiocyanate	2P	500	µg/L
			Cyanide	2P	600	µg/L

Table 10-5b
Groundwater Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
1982 and 1993

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Groundwater	***Metals***			
			Arsenic	7060	0.01	mg/L
			Antimony	6010	0.005	mg/L
			Barium	6010	0.01	mg/L
			Cadmium	6010	0.005	mg/L
			Chromium	6010	0.05	mg/L
			Lead	7421	0.005	mg/L
			Mercury	7470/7471	0.001	mg/L
			Nickel	6010	0.05	mg/L
			Selenium	7740	0.01	mg/L
			Silver	6010	0.01	mg/L
			Thallium	7841	0.002	mg/L
			VOCs			
			1,1,1-Trichloroethane	8240	5	µg/L
			1,1,2,2-Tetrachloroethane	8240	5	µg/L
			1,1,2-Trichloroethane	8240	5	µg/L
			1,1-Dichloroethane	8240	5	µg/L
			1,1-Dichloroethene	8240	5	µg/L
			1,2-Dichloroethane	8240	5	µg/L
			1,2-Dichloroethene	8240	5	µg/L
			1,2-Dichloropropane	8240	5	µg/L
			2-Butanone	8240	50	µg/L
			2-Chloroethylvinylether	8240	10	µg/L
			2-Hexanone	8240	50	µg/L
			4-Methyl-2-pentanone	8240	50	µg/L
			Acetone	8240	100	µg/L
			Benzene	8240	5	µg/L
			Bromodichloromethane	8240	5	µg/L
			Bromoform	8240	5	µg/L
			Bromomethane	8240	10	µg/L
			Carbon disulfide	8240	5	µg/L
			Carbon tetrachloride	8240	5	µg/L
			Chlorobenzene	8240	5	µg/L
			Chloroethane	8240	10	µg/L
			Chloroform	8240	5	µg/L
			Chloromethane	8240	10	µg/L
			Chlorodibromomethane	8240	5	µg/L
			Ethylbenzene	8240	5	µg/L
			Methylene chloride	8240	5	µg/L
			Styrene	8240	5	µg/L
			Tetrachloroethene	8240	5	µg/L
			Toluene	8240	5	µg/L
			Trichloroethene	8240	5	µg/L
			Vinyl acetate	8240	50	µg/L
			Vinyl chloride	8240	10	µg/L
			Xylenes	8240	5	µg/L
			cis-1,3-Dichloropropene	8240	5	µg/L
			trans-1,3-Dichloropropene	8240	5	µg/L

Table 10-5b
Groundwater Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
1982 and 1993

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Groundwater	***SVOCs***			
			1,2,4-Trichlorobenzene	8270	10	µg/L
			1,2-Dichlorobenzene	8270	10	µg/L
			1,3-Dichlorobenzene	8270	10	µg/L
			1,4-Dichlorobenzene	8270	10	µg/L
			2,4,5-Trichlorophenol	8270	50	µg/L
			2,4,6-Trichlorophenol	8270	10	µg/L
			2,4-Dichlorophenol	8270	10	µg/L
			2,4-Dimethylphenol	8270	10	µg/L
			2,4-Dinitrophenol	8270	50	µg/L
			2,4-Dinitrotoluene	8270	10	µg/L
			2,6-Dinitrotoluene	8270	10	µg/L
			2-Chloronaphthalene	8270	10	µg/L
			2-Chlorophenol	8270	10	µg/L
			2-Methylnaphthalene	8270	10	µg/L
			2-Methylphenol	8270	10	µg/L
			2-Nitroaniline	8270	50	µg/L
			2-Nitrophenol	8270	10	µg/L
			3,3-Dichlorobenzidine	8270	20	µg/L
			3-Nitroaniline	8270	50	µg/L
			4-Bromophenylphenylether	8270	10	µg/L
			4-Chloro-3-methylphenol	8270	20	µg/L
			4-Chloroaniline	8270	20	µg/L
			4-Chlorophenylphenylether	8270	10	µg/L
			4-Methylphenol	8270	10	µg/L
			4-Nitroaniline	8270	50	µg/L
			4-Nitrophenol	8270	50	µg/L
			4,6-Dinitro-2-methylphenol	8270	50	µg/L
			Acenaphthene	8270	10	µg/L
			Acenaphthylene	8270	10	µg/L
			Anthracene	8270	10	µg/L
			Benzo(a)anthracene	8270	10	µg/L
			Benzo(a)pyrene	8270	10	µg/L
			Benzo(b)fluoranthene	8270	10	µg/L
			Benzo(g,h,i)perylene	8270	10	µg/L
			Benzo(k)fluoranthene	8270	10	µg/L
			Benzoic acid	8270	50	µg/L
			Benzyl alcohol	8270	20	µg/L
			Butylbenzylphthalate	8270	10	µg/L
			Chrysene	8270	10	µg/L
			Dibenzo(a,h)anthracene	8270	10	µg/L
			Dibenzofuran	8270	10	µg/L
			Di-n-butylphthalate	8270	10	µg/L
			Diethylphthalate	8270	10	µg/L
			Dimethylphthalate	8270	10	µg/L
			Fluoranthene	8270	10	µg/L
			Fluorene	8270	10	µg/L
			Hexachlorobenzene	8270	10	µg/L

Table 10-5b
Groundwater Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
1982 and 1993

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Groundwater	***SVOCs (continued)***			
			Hexachlorobutadiene	8270	10	µg/L
			Hexachlorocyclopentadiene	8270	10	µg/L
			Hexachloroethane	8270	10	µg/L
			Indeno(1,2,3-c,d)pyrene	8270	10	µg/L
			Isophorone	8270	10	µg/L
			Naphthalene	8270	10	µg/L
			Nitrobenzene	8270	10	µg/L
			Pentachlorophenol	8270	50	µg/L
			Phenanthrene	8270	10	µg/L
			Phenol	8270	10	µg/L
			Pyrene	8270	10	µg/L
			bis(2-Chloroethoxy)methane	8270	10	µg/L
			bis(2-Chloroethyl)ether	8270	10	µg/L
			bis(2-Chloroisopropyl)ether	8270	10	µg/L
			bis(2-Ethylhexyl)phthalate	8270	10	µg/L
			di-n-Octylphthalate	8270	10	µg/L
			n-Nitrosodi-n-propylamine	8270	10	µg/L
			n-Nitrosodiphenylamine	8270	10	µg/L
			Explosives			
			HMX	8330	0.1	µg/L
			RDX	8330	0.1	µg/L
			1,3,5-TNB	8330	0.1	µg/L
			1,3-DNB	8330	0.1	µg/L
			Tetryl	8330	0.1	µg/L
			Nitrobenzene	8330	0.1	µg/L
			2,4,6-TNT	8330	0.1	µg/L
			2,6-DNT	8330	0.1	µg/L
			2,4-DNT	8330	0.1	µg/L
			2-Nitrotoluene	8330	0.1	µg/L
			4-Nitrotoluene	8330	0.1	µg/L
			3-Nitrotoluene	8330	0.1	µg/L
			Anions			
			Nitrate-Nitrite Nitrogen	353.3	0.01-0.2	mg/L
			Chloride	9052	1	mg/L
			Sulfate	9038	1-30	mg/L
			Total Phenols Direct	9065	0.1	mg/L
			Total Organic Carbon	9060	1	mg/L
			Total Organic Halogens	9020	5	mg/L

Note(s):
µg/L - micrograms per liter
mg/L - milligrams per liter
NA - not available
VOC - volatile organic compound
SVOC - semivolatile organic compound

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Table 10-6
Site XX - Ground Signal Test Area
Sediment Analytical Summary (1993)

Parameter	Units	SD-013	SD-15	SD-16	SD-17	SD-18	SD-19	SD-20	TLEQ GWP-Ind
Volatiles	ug/kg	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
Semivolatiles	ug/kg	<DL	<DL	<DL	<DL	<DL	<DL	<DL	
Bis(2-ethylhexyl)phthalate	ug/kg	369	<DL	<DL	443	434	<DL	421	600
Di-n-butylphthalate	ug/kg	<DL	<DL	<DL	669	554	<DL	<DL	1,000,000
Explosives	ug/kg	<DL	<DL	<DL	<DL	<DL	<DL	<DL	5100
Arsenic	mg/kg	2.4	1	1.9	1.8	2	3.5	0.9	1
Barium	mg/kg	126	29.8	64.1	23.3	48.4	27.5	39.6	200
Chromium	mg/kg	5.5	4.1	9.8	3.5	5.8	<DL	4.4	10
Lead	mg/kg	9	5	7	4	6	8	6	1.5
Mercury	mg/kg	0.03	0.03	0.03	0.01	0.01	0.01	0.03	0.2
Nickel	mg/kg	14.7	3.7	5.1	2.6	3.1	3.1	4	20.4
Selenium	mg/kg	0.3	0.1	0.4	0.1	0.2	0.3	0.1	5
Chloride	mg/kg	<DL	44	<DL	<DL	<DL	<DL	44	
Sulfate	mg/kg	30	40	230	30	30	30	40	
pH	pH	7.3	5.6	6	5.7	5.8	6.3	5.8	
Conductivity	umhos/cm	115	88	37	25	53	62	98	

Table 10-6b
Sediment Sampling Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1993)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Sediment	***Metals***			
			Arsenic	7060	0.5	mg/kg
			Antimony	6010	1	mg/kg
			Barium	6010	1	mg/kg
			Cadmium	6010	1	mg/kg
			Chromium	6010	1	mg/kg
			Lead	7421	1	mg/kg
			Mercury	7470/7471	0.01	mg/kg
			Nickel	6010	1	mg/kg
			Selenium	7740	0.1	mg/kg
			Silver	6010	1	mg/kg
			Thallium	7841	0.2	mg/kg
			VOCs			
			1,1,1-Trichloroethane	8240	5	µg/kg
			1,1,2,2-Tetrachloroethane	8240	5	µg/kg
			1,1,2-Trichloroethane	8240	5	µg/kg
			1,1-Dichloroethane	8240	5	µg/kg
			1,1-Dichloroethene	8240	5	µg/kg
			1,2-Dichloroethane	8240	5	µg/kg
			1,2-Dichloroethene	8240	5	µg/kg
			1,2-Dichloropropane	8240	5	µg/kg
			2-Butanone	8240	50	µg/kg
			2-Chloroethylvinylether	8240	10	µg/kg
			2-Hexanone	8240	50	µg/kg
			4-Methyl-2-pentanone	8240	50	µg/kg
			Acetone	8240	100	µg/kg
			Benzene	8240	5	µg/kg
			Bromodichloromethane	8240	5	µg/kg
			Bromoform	8240	5	µg/kg
			Bromomethane	8240	10	µg/kg
			Carbon disulfide	8240	5	µg/kg
			Carbon tetrachloride	8240	5	µg/kg
			Chlorobenzene	8240	5	µg/kg
			Chloroethane	8240	10	µg/kg
			Chloroform	8240	5	µg/kg
			Chloromethane	8240	10	µg/kg
			Chlorodibromomethane	8240	5	µg/kg
			Ethylbenzene	8240	5	µg/kg
			Methylene chloride	8240	5	µg/kg
			Styrene	8240	5	µg/kg
			Tetrachloroethene	8240	5	µg/kg
			Toluene	8240	5	µg/kg
			Trichloroethene	8240	5	µg/kg
			Vinyl acetate	8240	50	µg/kg
			Vinyl chloride	8240	10	µg/kg
			Xylenes	8240	5	µg/kg
			cis-1,3-Dichloropropene	8240	5	µg/kg
			trans-1,3-Dichloropropene	8240	5	µg/kg

Table 10-6b
Sediment Sampling Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1993)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Sediment	***SVOCs***			
			1,2,4-Trichlorobenzene	8270	330	µg/kg
			1,2-Dichlorobenzene	8270	330	µg/kg
			1,3-Dichlorobenzene	8270	330	µg/kg
			1,4-Dichlorobenzene	8270	330	µg/kg
			2,4,5-Trichlorophenol	8270	1650	µg/kg
			2,4,6-Trichlorophenol	8270	330	µg/kg
			2,4-Dichlorophenol	8270	330	µg/kg
			2,4-Dimethylphenol	8270	330	µg/kg
			2,4-Dinitrophenol	8270	1650	µg/kg
			2,4-Dinitrotoluene	8270	330	µg/kg
			2,6-Dinitrotoluene	8270	330	µg/kg
			2-Chloronaphthalene	8270	330	µg/kg
			2-Chlorophenol	8270	330	µg/kg
			2-Methylnaphthalene	8270	330	µg/kg
			2-Methylphenol	8270	330	µg/kg
			2-Nitroaniline	8270	1650	µg/kg
			2-Nitrophenol	8270	330	µg/kg
			3,3-Dichlorobenzidine	8270	650	µg/kg
			3-Nitroaniline	8270	1650	µg/kg
			4-Bromophenylphenylether	8270	330	µg/kg
			4-Chloro-3-methylphenol	8270	650	µg/kg
			4-Chloroaniline	8270	650	µg/kg
			4-Chlorophenylphenylether	8270	330	µg/kg
			4-Methylphenol	8270	330	µg/kg
			4-Nitroaniline	8270	1650	µg/kg
			4-Nitrophenol	8270	1650	µg/kg
			4,6-Dinitro-2-methylphenol	8270	1650	µg/kg
			Acenaphthene	8270	330	µg/kg
			Acenaphthylene	8270	330	µg/kg
			Anthracene	8270	330	µg/kg
			Benzo(a)anthracene	8270	330	µg/kg
			Benzo(a)pyrene	8270	330	µg/kg
			Benzo(b)fluoranthene	8270	330	µg/kg
			Benzo(g,h,i)perylene	8270	330	µg/kg
			Benzo(k)fluoranthene	8270	330	µg/kg
			Benzoic acid	8270	1650	µg/kg
			Benzyl alcohol	8270	650	µg/kg
			Butylbenzylphthalate	8270	330	µg/kg
			Chrysene	8270	330	µg/kg
			Dibenzo(a,h)anthracene	8270	330	µg/kg
			Dibenzofuran	8270	330	µg/kg
			Di-n-butylphthalate	8270	330	µg/kg
			Diethylphthalate	8270	330	µg/kg
			Dimethylphthalate	8270	330	µg/kg
			Fluoranthene	8270	330	µg/kg
			Fluorene	8270	330	µg/kg
			Hexachlorobenzene	8270	330	µg/kg

Table 10-6b
Sediment Sampling Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1993)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Sediment	***SVOCs (continued)***			
			Hexachlorobutadiene	8270	330	µg/kg
			Hexachlorocyclopentadiene	8270	330	µg/kg
			Hexachloroethane	8270	330	µg/kg
			Indeno(1,2,3-c,d)pyrene	8270	330	µg/kg
			Isophorone	8270	330	µg/kg
			Naphthalene	8270	330	µg/kg
			Nitrobenzene	8270	330	µg/kg
			Pentachlorophenol	8270	1650	µg/kg
			Phenanthrene	8270	330	µg/kg
			Phenol	8270	330	µg/kg
			Pyrene	8270	330	µg/kg
			bis(2-Chloroethoxy)methane	8270	330	µg/kg
			bis(2-Chloroethyl)ether	8270	330	µg/kg
			bis(2-Chloroisopropyl)ether	8270	330	µg/kg
			bis(2-Ethylhexyl)phthalate	8270	330	µg/kg
			di-n-Octylphthalate	8270	330	µg/kg
			n-Nitrosodi-n-propylamine	8270	330	µg/kg
			n-Nitrosodiphenylamine	8270	330	µg/kg
			Explosives			
			HMX	8330	0.5	mg/kg
			RDX	8330	0.5	mg/kg
			1,3,5-TNB	8330	0.25	mg/kg
			1,3-DNB	8330	0.25	mg/kg
			Tetryl	8330	0.5	mg/kg
			Nitrobenzene	8330	0.26	mg/kg
			2,4,6-TNT	8330	0.25	mg/kg
			2,6-DNT	8330	0.25	mg/kg
			2,4-DNT	8330	0.25	mg/kg
			2-Nitrotoluene	8330	0.25	mg/kg
			4-Nitrotoluene	8330	0.25	mg/kg
			3-Nitrotoluene	8330	0.25	mg/kg
			Anions			
			Nitrate-Nitrite Nitrogen	353.3	0.1	mg/kg
			Chloride	9052	10	mg/kg
			Sulfate	9038	10-50	mg/kg

Note(s):
µg/kg - micrograms per kilogram
mg/kg - milligrams per kilogram
VOC - volatile organic compound
SVOC - semivolatile organic compound

Table 10-7
Site XX - Ground Signal Test Area
Surface Water Analytical Summary (1993)

18717

TCEQ MCL
GW-Ind.

Parameter	Units	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Volatiles	ug/l	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Semivolatiles	ug/l	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Explosives	ug/l	<DL	<DL	<DL	<DL	<DL	<DL	<DL
Barium	mg/l	0.11	0.13	0.07	0.06	0.23	0.43	0.09
Lead	mg/l	<DL	<DL	<DL	<DL	<DL	0.006	0.011
Chloride	mg/l	28.4	31.0	2.6	2.6	2.6	2.6	9.7
Nitrate/Nitrite	mg/l	0.04	<DL	0.30	0.09	<DL	<DL	<DL
Sulfate	mg/l	32	29	2.0	5.0	<DL	<DL	4.0

2
0.015

10.2 NATURE AND EXTENT OF CONTAMINATION

10.2.1 Explosives

No explosives were detected in any sample collected at Site XX from any sample medium.

10.2.2 Volatile and Semivolatile Organics

Acetone was detected in two samples at Site XX. It was detected at a concentration of 10,300 ug/kg in a subsurface soil sample obtained from the 2.5 to 5.0-ft sampling interval in soil boring XXSB19, and at a concentration of 17 ug/l in groundwater grab sample XXGG01 from the soil boring adjacent to XXSB19. The water sample was accompanied by a contaminated travel blank. The blank contained acetone at 17 ug/l and indicated a problem in sampling or shipping. The acetone at these locations was thoroughly investigated by soil boring XXSB01 and 5 soil gas samples, all of which were clean. This sample of acetone must represent either a sampling or a laboratory problem. TCE was present in one isolated subsurface soil sample collected from the 5-7 ft sampling interval in soil boring XXSB17 on the eastern portion of the site and methylene chloride was detected at a concentration of 18 ug/kg in one subsurface soil sample collected between a depth of 0-2 ft in soil boring XXSB01. The only semivolatiles found were di-n-butyl phthalate and bis(2-ethylhexyl)phthalate. These common plasticizers were either qualified with a B (found in the method blanks) or were found in very low concentrations. No contamination by volatile or semivolatile organics is demonstrated.

Table B-3
Groundwater Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(SVERDRUP 1994)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
SVERDRUP	1994	Groundwater - grab from boring	*VOCs*			
			1,1,1-Trichloroethane	8240	5	µg/L
			1,1,2,2-Tetrachloroethane	8240	5	µg/L
			1,1,2-Trichloroethane	8240	5	µg/L
			1,1-Dichloroethane	8240	5	µg/L
			1,1-Dichloroethene	8240	5	µg/L
			1,2-Dichloroethane	8240	5	µg/L
			1,2-Dichloropropane	8240	5	µg/L
			1,2,3-Trichloropropane	8240	5	µg/L
			1,4,Dichloro-2-butene	8240	10	µg/L
			2-Butanone	8240	10	µg/L
			Ethene (2 chloroethoxyl)-	8240	10	µg/L
			2-Hexanone	8240	10	µg/L
			4-Methyl-2-pentanone	8240	10	µg/L
			Acetone	8240	100	µg/L
			Acrolein	8240	50	µg/L
			Acrylonitrile	8240	50	µg/L
			Benzene	8240	5	µg/L
			Bromodichloromethane	8240	5	µg/L
			Bromoform	8240	5	µg/L
			Bromomethane	8240	10	µg/L
			Carbon disulfide	8240	5	µg/L
			Carbon tetrachloride	8240	5	µg/L
			Chlorobenzene	8240	5	µg/L
			Chloroethane	8240	10	µg/L
			Chloroform	8240	5	µg/L
			Chloromethane	8240	10	µg/L
			cis-1,3-Dichloropropene	8240	5	µg/L
			Dibromomethane	8240	5	µg/L
			Dibromochloromethane	8240	5	µg/L
			Dichlorodifluoromethane	8240	5	µg/L
			Ethylbenzene	8240	5	µg/L
			Ethyl methacrylate	8240	5	µg/L
			Iodomethane	8240	10	µg/L
			Methylene chloride	8240	10	µg/L
			Styrene	8240	5	µg/L
			Tetrachloroethene	8240	5	µg/L
			Toluene	8240	5	µg/L
			Total Xylenes	8240	5	µg/L
			1,2-Dichloroethylene	8240	5	µg/L
			trans-1,3-Dichloropropene	8240	5	µg/L
			Trichloroethene	8240	5	µg/L
			Trichlorofluoromethane	8240	5	µg/L
			Vinyl acetate	8240	10	µg/L
			Vinyl chloride	8240	10	µg/L
			SVOCs			
			1-Chloronaphthalene	8270	10	µg/L
			1,2,4-Trichlorobenzene	8270	10	µg/L
			1,2-Dichlorobenzene	8270	10	µg/L
			1,2-Diphenylhydrazine	8270	50	µg/L
			1,3-Dichlorobenzene	8270	10	µg/L
			1,4-Dichlorobenzene	8270	10	µg/L
			2,4,5-Trichlorophenol	8270	10	µg/L
			2,4,6-Trichlorophenol	8270	10	µg/L
			2,4-Dichlorophenol	8270	10	µg/L
			2,4-Dimethylphenol	8270	10	µg/L
			2,4-Dinitrophenol	8270	50	µg/L
			2,4-Dinitrotoluene	8270	10	µg/L
			2,6-Dinitrotoluene	8270	10	µg/L

Table B-3
Groundwater Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(SVERDRUP 1994)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
SVERDRUP	1994	Groundwater - grab from boring	***SVOCs (continued)***			
			2-Chloronaphthalene	8270	10	µg/L
			2-Chlorophenol	8270	10	µg/L
			2-Methylnaphthalene	8270	10	µg/L
			2-Methylphenol	8270	25	µg/L
			2-Nitroaniline	8270	50	µg/L
			2-Nitrophenol	8270	10	µg/L
			m-Cresol	8270	10	µg/L
			3-Nitroaniline	8270	25	µg/L
			4,6-Dinitro-o-cresol	8270	25	µg/L
			4-Bromophenylphenylether	8270	10	µg/L
			4-Chloroaniline	8270	10	µg/L
			4-Chlorophenylphenylether	8270	10	µg/L
			4-Chloro-3-methylphenol	8270	10	µg/L
			4-Methylphenol	8270	10	µg/L
			4-Nitroaniline	8270	25	µg/L
			4-Nitrophenol	8270	10	µg/L
			Acenaphthene	8270	10	µg/L
			Acenaphthylene	8270	10	µg/L
			Anthracene	8270	10	µg/L
			Benzoic acid	8270	10	µg/L
			Benzo(a)anthracene	8270	10	µg/L
			Benzo(a)pyrene	8270	10	µg/L
			Benzo(b)fluoranthene	8270	10	µg/L
			Benzo(g,h,i)perylene	8270	10	µg/L
			Benzo(k)fluoranthene	8270	10	µg/L
			Benzyl alcohol	8270	10	µg/L
			bis(2-Chloroethoxy)methane	8270	10	µg/L
			bis(2-Chloroethyl)ether	8270	10	µg/L
			bis(2-Chloroisopropyl)ether	8270	10	µg/L
			bis(2-Ethylhexyl)phthalate	8270	10	µg/L
			Butylbenzylphthalate	8270	10	µg/L
			Chrysene	8270	10	µg/L
			Dibenzofuran	8270	10	µg/L
			Dibenzo(a,h)anthracene	8270	10	µg/L
			Diethylphthalate	8270	10	µg/L
			Dimethylphthalate	8270	10	µg/L
			Di-n-butylphthalate	8270	10	µg/L
			di-n-Octylphthalate	8270	10	µg/L
			Diphenylamine	8270	20	µg/L
			Fluorene	8270	10	µg/L
			Fluoranthene	8270	10	µg/L
			Hexachlorobenzene	8270	10	µg/L
			Hexachlorobutadiene	8270	10	µg/L
			Hexachlorocyclopentadiene	8270	10	µg/L
			Hexachloroethane	8270	10	µg/L
			Indeno(1,2,3-c,d)pyrene	8270	10	µg/L
			Isophorone	8270	10	µg/L
			Naphthalene	8270	10	µg/L
			Nitrobenzene	8270	10	µg/L
			n-Nitrosodi-n-propylamine	8270	10	µg/L
			n-Nitrosodiphenylamine	8270	10	µg/L
			Pentachlorophenol	8270	25	µg/L
			Phenanthrene	8270	10	µg/L
			Phenol	8270	10	µg/L
			Pyrene	8270	10	µg/L
			Explosives			
			1,3-DNB	8330	0.2	µg/L
			RDX	8330	0.6	µg/L
			1,3,5-TNB	8330	0.5	µg/L
			2,4,6-TNT	8330	0.7	µg/L

Table B-3
Groundwater Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(SVERDRUP 1994)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
SVERDRUP	1994	Groundwater - grab from boring	***Explosives (continued)***			
			2,4-DNT	8330	0.5	µg/L
			2,6-DNT	8330	0.5	µg/L
			HMX	8330	0.6	µg/L
			Nitrobenzene	8330	0.6	µg/L
			o-Nitrotoluene	8330	0.6	µg/L
			3-Nitrotoluene	8330	0.4	µg/L
			p-Nitrotoluene	8330	0.4	µg/L
			Tetryl	8330	0.4	µg/L
			2-Amino dinitrotoluene	8330	0.5	µg/L
			4-Amino-2,6- dinitrotoluene	8330	0.6	µg/L

Note(s):

µg/L - micrograms per liter

SVOC - semivolatile organic compound

VOC - volatile organic compound

Table 10-7b
Surface Water Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1993)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Surface Water	***Metals***			
			Arsenic	7060	0.01	mg/L
			Antimony	6010	0.005	mg/L
			Barium	6010	0.01	mg/L
			Cadmium	6010	0.005	mg/L
			Chromium	6010	0.05	mg/L
			Lead	7421	0.005	mg/L
			Mercury	7470/7471	0.001	mg/L
			Nickel	6010	0.05	mg/L
			Selenium	7740	0.05	mg/L
			Silver	6010	0.01	mg/L
			Thallium	7841	0.01	mg/L
			VOCs			
			1,1,1-Trichloroethane	8240	5	µg/L
			1,1,2,2-Tetrachloroethane	8240	5	µg/L
			1,1,2-Trichloroethane	8240	5	µg/L
			1,1-Dichloroethane	8240	5	µg/L
			1,1-Dichloroethene	8240	5	µg/L
			1,2-Dichloroethane	8240	5	µg/L
			1,2-Dichloroethene	8240	5	µg/L
			1,2-Dichloropropane	8240	5	µg/L
			2-Butanone	8240	50	µg/L
			2-Chloroethylvinylether	8240	10	µg/L
			2-Hexanone	8240	50	µg/L
			4-Methyl-2-pentanone	8240	50	µg/L
			Acetone	8240	100	µg/L
			Benzene	8240	5	µg/L
			Bromodichloromethane	8240	5	µg/L
			Bromoform	8240	5	µg/L
			Bromomethane	8240	10	µg/L
			Carbon disulfide	8240	5	µg/L
			Carbon tetrachloride	8240	5	µg/L
			Chlorobenzene	8240	5	µg/L
			Chloroethane	8240	10	µg/L
			Chloroform	8240	5	µg/L
			Chloromethane	8240	10	µg/L
			Chlorodibromomethane	8240	5	µg/L
			Ethylbenzene	8240	5	µg/L
			Methylene chloride	8240	5	µg/L
			Styrene	8240	5	µg/L
			Tetrachloroethene	8240	5	µg/L
			Toluene	8240	5	µg/L
			Trichloroethene	8240	5	µg/L
			Vinyl acetate	8240	50	µg/L
			Vinyl chloride	8240	10	µg/L
			Xylenes	8240	5	µg/L
			cis-1,3-Dichloropropene	8240	5	µg/L
			trans-1,3-Dichloropropene	8240	5	µg/L

Table 10-7b
Surface Water Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1993)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Surface Water	***SVOCs***			
			1,2,4-Trichlorobenzene	8270	10-12.5	µg/L
			1,2-Dichlorobenzene	8270	10-12.5	µg/L
			1,3-Dichlorobenzene	8270	10-12.5	µg/L
			1,4-Dichlorobenzene	8270	10-12.5	µg/L
			2,4,5-Trichlorophenol	8270	50-62.5	µg/L
			2,4,6-Trichlorophenol	8270	10-12.5	µg/L
			2,4-Dichlorophenol	8270	10-12.5	µg/L
			2,4-Dimethylphenol	8270	10-12.5	µg/L
			2,4-Dinitrophenol	8270	50-62.5	µg/L
			2,4-Dinitrotoluene	8270	10-12.5	µg/L
			2,6-Dinitrotoluene	8270	10-12.5	µg/L
			2-Chloronaphthalene	8270	10-12.5	µg/L
			2-Chlorophenol	8270	10-12.5	µg/L
			2-Methylnaphthalene	8270	10-12.5	µg/L
			2-Methylphenol	8270	10-12.5	µg/L
			2-Nitroaniline	8270	50-62.5	µg/L
			2-Nitrophenol	8270	10-12.5	µg/L
			3,3-Dichlorobenzidine	8270	20-25	µg/L
			3-Nitroaniline	8270	50-62.5	µg/L
			4-Bromophenylphenylether	8270	10-12.5	µg/L
			4-Chloro-3-methylphenol	8270	20-25	µg/L
			4-Chloroaniline	8270	20-25	µg/L
			4-Chlorophenylphenylether	8270	10-12.5	µg/L
			4-Methylphenol	8270	10-12.5	µg/L
			4-Nitroaniline	8270	50-62.5	µg/L
			4-Nitrophenol	8270	50-62.5	µg/L
			4,6-Dinitro-2-methylphenol	8270	50-62.5	µg/L
			Acenaphthene	8270	10-12.5	µg/L
			Acenaphthylene	8270	10-12.5	µg/L
			Anthracene	8270	10-12.5	µg/L
			Benzo(a)anthracene	8270	10-12.5	µg/L
			Benzo(a)pyrene	8270	10-12.5	µg/L
			Benzo(b)fluoranthene	8270	10-12.5	µg/L
			Benzo(g,h,i)perylene	8270	10-12.5	µg/L
			Benzo(k)fluoranthene	8270	10-12.5	µg/L
			Benzoic acid	8270	50-62.5	µg/L
			Benzyl alcohol	8270	20-25	µg/L
			Butylbenzylphthalate	8270	10-12.5	µg/L
			Chrysene	8270	10-12.5	µg/L
			Dibenzo(a,h)anthracene	8270	10-12.5	µg/L
			Dibenzofuran	8270	10-12.5	µg/L
			Di-n-butylphthalate	8270	10-12.5	µg/L
			Diethylphthalate	8270	10-12.5	µg/L
			Dimethylphthalate	8270	10-12.5	µg/L
			Fluoranthene	8270	10-12.5	µg/L
			Fluorene	8270	10-12.5	µg/L
			Hexachlorobenzene	8270	10-12.5	µg/L

Table 10-7b
Surface Water Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(1993)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
EBASCO	1993	Surface Water	***SVOCs (continued)***			
			Hexachlorobutadiene	8270	10-12.5	µg/L
			Hexachlorocyclopentadiene	8270	10-12.5	µg/L
			Hexachloroethane	8270	10-12.5	µg/L
			Indeno(1,2,3-c,d)pyrene	8270	10-12.5	µg/L
			Isophorone	8270	10-12.5	µg/L
			Naphthalene	8270	10-12.5	µg/L
			Nitrobenzene	8270	10-12.5	µg/L
			Pentachlorophenol	8270	50-62.5	µg/L
			Phenanthrene	8270	10-12.5	µg/L
			Phenol	8270	10-12.5	µg/L
			Pyrene	8270	10-12.5	µg/L
			bis(2-Chloroethoxy)methane	8270	10-12.5	µg/L
			bis(2-Chloroethyl)ether	8270	10-12.5	µg/L
			bis(2-Chloroisopropyl)ether	8270	10-12.5	µg/L
			bis(2-Ethylhexyl)phthalate	8270	10-12.5	µg/L
			di-n-Octylphthalate	8270	10-12.5	µg/L
			n-Nitrosodi-n-propylamine	8270	10-12.5	µg/L
			n-Nitrosodiphenylamine	8270	10-12.5	µg/L
			Explosives			
			HMX	8330	0.1	µg/L
			RDX	8330	0.1	µg/L
			1,3,5-TNB	8330	0.1	µg/L
			1,3-DNB	8330	0.1	µg/L
			Tetryl	8330	0.1	µg/L
			Nitrobenzene	8330	0.1	µg/L
			2,4,6-TNT	8330	0.1	µg/L
			2,6-DNT	8330	0.1	µg/L
			2,4-DNT	8330	0.1	µg/L
			2-Nitrotoluene	8330	0.1	µg/L
			4-Nitrotoluene	8330	0.1	µg/L
			3-Nitrotoluene	8330	0.1	µg/L
			Anions			
			Nitrate-Nitrite Nitrogen	353.3	0.01	
			Chloride	9052	1	
			Sulfate	9038	1	

Note(s):

µg/L - micrograms per liter

mg/L - milligrams per liter

SVOC - semivolatile organic compound

VOC - volatile organic compound

1.6.21 Site 54 (Ground Signal Test Area)

Groundwater samples were collected from all three monitoring wells at Site 54 during the April/May and August/September/October 2000, and the January/February 2001 sampling events. Groundwater samples were also collected from three Geoprobe® points installed during June 2001. The analytical results for the groundwater samples are presented in Table 1-32.

PERCHLORATE
TCEQ GW-Ind
72 µg/L

Table 1-32 Summary of Groundwater Sample Results at Site 54

Sample Location	April/May 2000 Event (µg/L)	Aug/Sep/Oct 2000 Event (µg/L)	Jan/Feb 2001 Event (µg/L)	April/June 2001 Event (µg/L)
127	26.8	<4 U	<1.7 U	NS
128	20.4	<8 U	<1.7 U	NS
18WW16	22.7	<8 U	8	NS
GPSAS54-01	NS	NS	NS	<4 U
GPSAS54-02	NS	NS	NS	<40 U
GPSAS54-03	NS	NS	NS	<40 U

No MCL

Bold values exceed 4 µg/L
< = Indicates the result was less than the corresponding reporting limit.
µg/L = micrograms per liter
NS = not sampled
U = not detected

1.6.22 Site 67

Groundwater samples were collected from all four monitoring wells at Site 67 during the December 2000 sampling event. Perchlorate was not detected in any of the groundwater samples at concentrations greater than the reporting limit of 3 µg/L.

Table 1-32b
Groundwater Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(2000/2001)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
STEP	2000/2001	Groundwater - wells	Perchlorate	HPLC/300.1	1.7 -8	µg/L
		Groundwater - grab	Perchlorate	HPLC/300.1	4 - 40	µg/L

Note(s):
µg/L - micrograms per liter

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Table 2 (continued). Results of metals analysis in mg/kg dry weight for soil/sediment samples collected from 200 sites at Caddo Lake National Wildlife Refuge in 2003 (Note - dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	Site 221	Site 222	Site 223	Site 224	Site 225	Site 226	Site 227	Site 228	Site 229	TCEQ GWP-Ind
Aluminum	2268.00	6978.00	4333.00	7927.00	6885.00	17,010.00	17,790.00	8673.00	3291.00	103220
dl	10.20	10.70	10.70	10.70	10.20	10.50	10.40	10.00	10.70	
Arsenic	0.60	5.30	1.29	1.11	1.00	5.22	3.14	1.91	1.82	1
dl	0.51	0.54	0.54	0.54	0.51	0.53	0.52	0.50	0.53	
Barium	37.60	1526.00	75.70	103.00	174.00	228.00	219.00	177.00	134.00	200
dl	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.21	
Beryllium	0.24	1.00	0.39	1.38	0.43	1.73	1.46	1.19	0.61	2.4
dl	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.20	0.21	
Boron	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
dl	2.03	2.14	2.14	2.14	2.05	2.11	2.08	2.01	2.14	
Cadmium	bdl	bdl	bdl	bdl	bdl	bdl	0.29	bdl	bdl	0.5
dl	0.25	0.27	0.27	0.27	0.26	0.26	0.26	0.25	0.27	
Chromium	5.98	11.20	6.92	9.38	12.80	19.00	18.70	11.50	11.60	10
dl	1.02	1.07	1.07	1.07	1.02	1.05	1.04	1.00	1.07	
Copper	0.98	7.31	1.81	5.10	12.20	9.86	22.10	5.17	2.43	130
dl	0.51	0.54	0.54	0.54	0.51	0.53	0.52	0.50	0.53	
Iron	2643.00	14,850.00	3074.00	6048.00	4540.00	24,320.00	13,520.00	11,160.00	7092.00	NA
dl	10.20	10.70	10.70	10.70	10.20	10.30	10.40	10.00	10.70	
Lead	9.29	9.22	7.83	18.10	78.70	30.50	30.40	17.70	12.60	1.5
dl	2.03	2.14	2.14	2.14	2.05	2.11	2.08	2.01	2.14	
Magnesium	119.00	2503.00	256.00	655.00	543.00	967.00	964.00	712.00	266.00	NA
dl	10.20	10.70	10.70	10.70	10.20	10.50	10.40	10.00	10.70	
Manganese	151.00	193.00	394.00	238.00	135.00	2351.00	1089.00	2820.00	969.00	1431
dl	1.02	1.07	1.07	1.07	1.02	1.05	1.04	1.00	1.07	
Mercury	bdl	0.042	0.025	0.058	0.15	0.12	0.12	0.093	0.037	0.2
dl	0.021	0.022	0.020	0.023	0.021	0.025	0.028	0.024	0.023	
Molybdenum	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
dl	1.02	1.07	1.07	1.07	1.02	1.05	1.04	1.00	1.07	
Nickel	2.39	6.99	4.55	12.10	7.06	17.10	18.00	14.40	6.35	2044
dl	1.02	1.07	1.07	1.07	1.02	1.05	1.04	1.00	1.07	
Selenium	bdl	bdl	bdl	bdl	bdl	bdl	0.60	bdl	bdl	5
dl	0.51	0.54	0.54	0.54	0.51	0.53	0.52	0.50	0.53	
Silver	bdl	bdl	bdl	bdl	0.68	bdl	0.23	bdl	bdl	
dl	0.18	0.19	0.19	0.19	0.18	0.19	0.19	0.18	0.19	
Strontium	1.73	26.10	7.12	19.30	16.40	23.20	29.30	22.20	13.20	6132
dl	0.51	0.54	0.54	0.54	0.51	0.53	0.52	0.50	0.53	
Vanadium	7.74	11.00	11.70	15.50	14.40	30.80	29.30	21.60	16.60	72
dl	0.51	0.54	0.54	0.54	0.51	0.53	0.52	0.50	0.53	
Zinc	16.10	37.60	9.69	18.40	22.10	130.00	161.00	33.40	19.70	3066
dl	5.09	5.36	5.36	5.36	5.12	5.26	5.19	5.02	5.34	

Table 2 (continued). Results of metals analysis in mg/kg dry weight for soil/sediment samples collected from 200 sites at Caddo Lake National Wildlife Refuge in 2003 (Note - dl is the analytical detection limit; and bdl is below the analytical detection limit).

Analyte	Site 95	Site 96	Site 97	Site 98	Site 99	Site 100	Site 101	Site 102	Site 103	TCEQ CON-TIAL
Aluminum	4487.00	1471.00	2296.00	4604.00	2199.00	6923.00	1983.00	3486.00	5140.00	10,200
dl	10.20	10.40	10.10	10.30	10.80	10.30	10.10	10.20	10.10	
Arsenic	0.79	1.23	1.38	2.97	1.35	2.38	2.06	2.03	2.47	1
dl	0.51	0.52	0.51	0.52	0.54	0.52	0.51	0.51	0.51	
Barium	43.50	53.90	35.10	170.00	35.60	89.80	89.10	71.90	112.00	200
dl	1.02	1.04	1.01	1.03	1.08	1.05	1.01	1.02	1.01	
Beryllium	bdl	0.35	bdl	0.77	0.28	0.77	0.42	0.63	0.68	0.4
dl	0.20	0.21	0.20	0.21	0.22	0.21	0.20	0.20	0.20	
Boron	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
dl	2.03	2.08	2.03	2.07	2.15	2.09	2.02	2.04	2.02	
Cadmium	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.5
dl	0.25	0.26	0.25	0.26	0.27	0.26	0.25	0.26	0.25	
Chromium	2.49	7.37	7.73	14.90	8.02	20.20	14.90	14.60	15.20	110
dl	1.02	1.04	1.01	1.03	1.08	1.05	1.01	1.02	1.01	
Copper	0.83	1.40	0.96	3.23	0.86	3.12	1.65	1.55	2.25	130
dl	0.51	0.52	0.51	0.52	0.54	0.32	0.51	0.51	0.51	
Iron	4861.00	3543.00	4139.00	11,919.00	4139.00	10,467.00	7116.00	6109.00	9267.00	NA
dl	10.20	10.40	10.10	10.30	10.80	10.50	10.10	10.20	10.10	
Lead	6.40	7.95	7.00	12.30	7.18	13.50	9.64	10.70	10.40	15
dl	2.03	2.08	2.03	2.07	2.15	2.09	2.02	2.04	2.02	
Magnesium	121.00	106.00	144.00	326.00	131.00	360.00	189.00	223.00	274.00	NA
dl	10.20	10.40	10.10	10.30	10.80	10.50	10.10	10.20	10.10	
Manganese	577.00	543.00	268.00	721.00	346.00	715.00	477.00	641.00	532.00	1481
dl	1.02	1.04	1.01	1.03	1.08	1.05	1.01	1.02	1.01	
Mercury	0.019	0.023	0.020	0.044	0.018	0.028	0.025	0.028	0.028	0.2
dl	0.019	0.016	0.015	0.019	0.018	0.014	0.019	0.017	0.014	
Molybdenum	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	1.47	
dl	1.02	1.04	1.01	1.03	1.08	1.05	1.01	1.02	1.01	
Nickel	1.93	2.62	2.09	6.17	2.53	5.91	3.84	4.41	3.62	28.4
dl	1.02	1.04	1.01	1.03	1.08	1.05	1.01	1.02	1.01	
Selenium	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	5
dl	0.51	0.52	0.51	0.52	0.54	0.52	0.51	0.51	0.51	
Silver	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
dl	0.18	0.19	0.18	0.19	0.19	0.19	0.18	0.18	0.18	
Strontium	5.76	3.91	3.34	12.00	3.39	7.79	7.89	4.73	8.41	6132
dl	0.51	0.52	0.51	0.52	0.54	0.52	0.51	0.51	0.51	
Vanadium	4.50	8.08	11.70	20.50	9.31	21.40	13.50	14.70	21.50	72
dl	0.51	0.52	0.51	0.52	0.54	0.52	0.51	0.51	0.51	
Zinc	bdl	6.92	6.16	25.50	5.59	12.50	8.47	8.91	13.20	30600
dl	5.08	5.21	5.07	5.17	5.38	5.23	5.05	5.10	5.05	

Table 2b
Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(2003)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USFWS	2003	Soil	***Metals***			
			Aluminum	Texas A & M University Method Codes 001, 004, 006	10.20-10.70	mg/kg
			Arsenic	Texas A & M University Method Codes 001, 004, 007	0.51 - 0.54	mg/kg
			Barium	Texas A & M University Method Codes 001, 004, 006	0.21 - 1.02	mg/kg
			Beryllium	Texas A & M University Method Codes 001, 004, 006	0.20 - 0.21	mg/kg
			Boron	Texas A & M University Method Codes 001, 004, 006	2.03 - 2.14	mg/kg
			Cadmium	Texas A & M University Method Codes 001, 004, 006	0.25 - 0.27	mg/kg
			Chromium	Texas A & M University Method Codes 001, 004, 006	1.02 - 1.07	mg/kg
			Copper	Texas A & M University Method Codes 001, 004, 006	0.51 - 0.54	mg/kg
			Iron	Texas A & M University Method Codes 001, 004, 006	10.20-10.70	mg/kg
			Lead	Texas A & M University Method Codes 001, 004, 006	2.03 - 2.14	mg/kg
			Magnesium	Texas A & M University Method Codes 001, 004, 006	10.20 - 10.70	mg/kg
			Manganese	Texas A & M University Method Codes 001, 004, 006	1.02 - 1.07	mg/kg
			Mercury	Texas A & M University Method Codes 001, 004, 008	0.019 - 0.20	mg/kg
			Molybdenum	Texas A & M University Method Codes 001, 004, 006	1.02 - 1.07	mg/kg
			Nickel	Texas A & M University Method Codes 001, 004, 006	1.02 - 1.07	mg/kg
			Selenium	Texas A & M University Method Codes 001, 004, 007	0.51 - 0.54	mg/kg
			Silver	Texas A & M University Method Codes 001, 004, 039	0.18 - 0.19	mg/kg
			Strontium	Texas A & M University Method Codes 001, 004, 006	0.51 - 0.54	mg/kg
			Vanadium	Texas A & M University Method Codes 001, 004, 006	0.51 - 0.54	mg/kg
			Zinc	Texas A & M University Method Codes 001, 004, 006	5.08 - 5.36	mg/kg
			SVOCs			
			1,2,4-Trichlorobenzene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			1,2-Dichlorobenzene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			1,3-Dichlorobenzene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			1,4-Dichlorobenzene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg

Table 2b
Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(2003)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USFWS	2003	Soil	***SVOCs (continued)***			
			1-Chloronaphthalene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			1-Naphthylamine	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2,3,4,6-Tetrachlorophenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2,4,5-Trichlorophenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2,4,6-Trichlorophenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2,4-Dichlorophenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2,4-Dimethylphenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2,4-Dinitrophenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2,4-Dinitrotoluene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2,6-Dichlorophenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2,6-Dinitrotoluene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2-Chloronaphthalene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2-Chlorophenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2-Methylphenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2-Naphthylamine	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2-Nitroaniline	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2-Nitrophenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2-Picoline	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			2-Methylnaphthalene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			3,3-Dichlorobenzidine	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			3-Methylcholanthrene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			3-Nitroaniline	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			4,6-Dinitro-2-methylphenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			4-Aminobiphenyl	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			4-Bromophenylphenylether	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			4-Chloro-3-methylphenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg

Table 2b
Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(2003)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USFWS	2003	Soil	***SVOCs (continued)***			
			4-Chloroaniline	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			4-Chlorophenylphenylether	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			4-Methylphenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			4-Nitroaniline	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			4-Nitrophenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			7,12-dimethylbenz(a)anthracene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Acentophenone	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Aniline	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Benzidine	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Benzo(a)anthracene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Benzoic acid	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Benzyl alcohol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			bis(2-Chloroethoxy)methane	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			bis(2-Chloroethyl)ether	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			bis(2-Ethylhexyl)phthalate	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			bis(2-Chloroisopropyl)ether	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Butylbenzylphthalate	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Carbazole	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Di-n-butylphthalate	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Di-n-Octylphthalate	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Dibenzo(a,h)anthracene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Diben(a,j)acridine	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Dibenzofuran	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Diethylphthalate	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Dimethylphthalate	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg

Table 2b
Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(2003)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USFWS	2003	Soil	*SVOCs (continued)*			
			Diphenylamine	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Ethyl methanesulfonate	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Hexachlorobutadiene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Hexachlorocyclopentadiene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Hexachloroethane	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Isophorone	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Methyl methanesulfonate	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			N-nitroso-di-n-propylamine	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			N-nitrosopiperidine	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Nitrobenzene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Pentachlorobenzene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Pentachloronitrobenzene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Pentachlorophenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Phenacetin	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Phenol	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Pronamide	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			A,a-dimethylphenylamine	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Acenaphthalene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Acenaphthene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Anthracene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Benzo(a)pyrene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Benzo(b)fluoranthene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Benzo(g,h,i)perylene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Benzo(k)fluoranthene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Chrysene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Fluoranthene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg

Table 2b
Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(2003)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USFWS	2003	Soil	***SVOCs (continued)***			
			Fluorene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Indeno(1,2,3-c,d)pyrene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			n-Nitrosodiphenylamine	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Naphthalene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			p-Dimethylaminoazobenzene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Phenanthrene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Pyrene	Texas A & M University Method Code 031	0.0348-0.0374	mg/kg
			Pesticides/PCBs			
			1,2,3,4-tetrachlorobenzene	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			1,2,4,5-tetrachlorobenzene	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Aldrin	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Hexachlorobenzene	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Heptachlor	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Alpha BHC	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Alpha chlordane	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Beta BHC	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			cis-nonachlor	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			delta-BHC	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Dieldrin	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Endosulfan II	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Endrin	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			gamma-BHC	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			gamma chlordane	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Heptachlor epoxide	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Mirex	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg

Table 2b
Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(2003)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USFWS	2003	Soil	***Pesticides/PCBs (continued)***			
			o,p-DDD	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			o,p-DDE	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			o,p-DDT	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			oxychlordane	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			p,p-DDD	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			p,p-DDE	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			p,p-DDT	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Pentachloro-anisole	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Toxaphene	Texas A & M University Method Code 004	0.00171 - 0.00187	mg/kg
			Trans-nonachlor	Texas A & M University Method Code 004	0.000343 - 0.000373	mg/kg
			Total PCBs	Texas A & M University Method Code 004	0.00171 - 0.00187	mg/kg
			Perchlorate	EPA Method 314.0 Modified	8	µg/kg

Note(s):
µg/kg - micrograms per kilogram
EPA - U.S. Environmental Protection Agency
mg/kg - micrograms per kilogram
PCB - polychlorinated biphenyl
SVOC - semivolatile organic compound
USFWS - U.S. Fish and Wildlife Service

Table 5A-1. Chemicals Detected in Soils[1]
Site XX Addendum, Longhorn Army Ammunition Plant

Chemical	Frequency of Detection[2]	Sample Quantitation Limits	Range of Detected Concentrations	Background Range[3]
Metals (mg/Kg)				
Arsenic	3/3	--	4.33-73.8	2.3-29.7
Barium	3/3	--	88.1-904	35.1-287
Cadmium	3/3	--	3.63-6.95	1.25
Chromium	3/3	--	12.3-28.9J	3.2-22.8
Lead	3/3	--	9-24.0	2.6-17.4
Nickel	3/3	--	10.6-43.0	1.5-6.3
Aluminum	3/3	--	2,690-8,050	1,270-20,700
Calcium	3/3	--	250-621	124-1,090
Cobalt	1/3	2.65-2.79	3.21	1.5-19.1
Copper	3/3	--	3.19-6.21	0.88-6.7
Iron	3/3	--	3,570-13,500	2,450-31,000
Potassium	3/3	--	142-484	133-481
Magnesium	3/3	--	162-826	68.4-474
Manganese	3/3	--	37.8-567	10.9-2,330
Strontium	1/3	13.6-13.9	18.9	2.3-13.3
Vanadium	3/3	--	10.8-24.3	NA[4]
Zinc	3/3	--	6.85-17.6	3.4-16.2

[1] 0 to 6-inch depth.
[2] Includes quality control duplicate sample.
[3] Range of detected concentrations in surface (0-0.5 feet) soils from Final Soil Background Concentration Report, Longhorn Army Ammunition Plant, (USACE 1995b).
[4] Not available.

Table 3
Soil Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(CAPE 2006)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
CAPE	2006	Soil	MC (explosives), WP	SW-846 Method 7580	0.519 - 0.535	µg/kg

Note(s):

µg/kg - micrograms per kilogram

MC - munitions constituents

WP - white phosphorus

Table B - 1
USEPA Region 6 Confirmation Sampling
Groundwater Analytical Results Summary
Ground Signal Test Area, LHAAP-003-R
October 2009

			Location Code	18WW-01-07	18WW-16-08	MW-127-09	MW-128-10
			Sample No.	GW-18WW-01-07	GW-18WW-16-08	GW-127-09	GW-128-10
			Sample Date	24-Oct-09	24-Oct-09	24-Oct-09	24-Oct-09
Parameter	Units	MCL	TCEQ GW-Ind	Result	Result	Result	Result
Metals							
Aluminum	mg/L		102.2	0.0116 J	0.273	0.151	0.00151 J
Antimony	mg/L	0.006		<0.001	0.000440 J	<0.001	<0.001
Arsenic	mg/L	0.01		0.001	0.00392	0.00238	0.00609
Barium	mg/L	2		0.588	0.134	0.02	0.0308
Beryllium	mg/L	0.004		0.0000150 J	0.0001 J	0.0000620 J	0.0000760 J
Cadmium	mg/L	0.005		0.000498 J	0.00253	0.0000870 J	0.0000170 J
Calcium	mg/L			10.3 J	176	158	116
Chromium	mg/L	0.1		0.0584	6.62	0.000962 J	0.0029
Cobalt	mg/L		6.132	0.00197	0.0208	0.0315	0.00205
Copper	mg/L	1.3		0.00339 B	0.106B	0.00220B	0.00105 B
Iron	mg/L			3.49 B	21.8 B	18 B	1.590 B
Lead	mg/L	0.015		0.000763 J	0.000360 J	0.000308 J	0.0000420 J
Magnesium	mg/L			5.41 J	120	95.7	73.5
Manganese	mg/L		14.3	0.15	0.252	1.88	1.41
Nickel	mg/L		2.044	0.306	1.27	0.0294	0.00809
Potassium	mg/L			2.33 J	3.93 J	3.75 J	5.04 J
Selenium	mg/L	0.05		0.000658 J	0.0147	0.00269	0.00275
Silver			0.511	0.00004 J, B	0.000235 J, B	<0.001	<0.001
Sodium	mg/L			205	556	397	704
Thallium	mg/L	0.002		<0.001	0.0000360 J	0.0000830 J	<0.001
Vanadium	mg/L		0.715	<0.001	<0.001	0.000864 J,B	0.00172 B
Zinc	mg/L		30.66	0.0703 B	0.0466 B	0.0286 B	0.00333 J,B
Perchlorate	µg/L		72	<1.0	4.6 B*, G	<5.0 G	<5.0 G

00100364

Table B - 1
USEPA Region 6 Confirmation Sampling
Groundwater Analytical Results Summary
Ground Signal Test Area, LHAAP-003-R
October 2009

			Location Code	18WW-01-07	18WW-16-08	MW-127-09	MW-128-10
			Sample No.	GW-18WW-01-07	GW-18WW-16-08	GW-127-09	GW-128-10
			Sample Date	24-Oct-09	24-Oct-09	24-Oct-09	24-Oct-09
Parameter	Units	MCL	TCEQ GW-Ind	Result	Result	Result	Result
Explosives							
HMX	µg/L		5110	<0.40	<0.40	<0.40	<0.40
RDX	µg/L		26	<0.20	<0.20	<0.20	<0.20
1,3,5- TNB	µg/L		3066	<1.0	<1.0	<1.0	<1.0
1,3-DNB	µg/L		10.22	<0.40	<0.40	<0.40	<0.40
Tetryl	µg/L		1022	<0.20	<0.20	<0.20	<0.20
Nitrobenzene	µg/L		51.1	<0.40	<0.40	<0.40	<0.40
2,4,6- TNT	µg/L		51.1	<0.40	<0.40	<0.40	<0.40
4-ADNT	µg/L		17.03	<0.20	<0.20	<0.20	<0.20
2-ADNT	µg/L		17.03	<0.20	<0.20	0.22 COL	0.30
2,6-DNT	µg/L		0.42	<0.20	<0.20	<0.20	<0.20
2,4-DNT	µg/L		0.42	<0.40	<0.40	<0.40	<0.40
2-Nitrotoluene	µg/L		1022	<0.40	<0.40	<0.40	<0.40
4-Nitrotoluene	µg/L		1022	<1.0	<1.0	<1.0	<1.0
3-Nitrotoluene	µg/L		1022	<0.40	<0.40	<0.40	0.24 J, COL

Notes and Abbreviations:

Bolded and shaded - level above the MCL or TCEQ GW-Ind value

B - analyte was detected in the associated method blank

B* - estimated results; result is less than the reporting limit of 5 µg/L

COL - more than 40% RPD between primary and confirmation detector results; the lower of the two results is reported

G - elevated reporting limit; the reporting limit is elevated due to matrix interference

GW-Ind - groundwater MSC for industrial use

J - estimated results detected above the method detection limit but below the reporting limit

MCL - maximum contaminant level

mg/L - milligrams per liter

ug/L - micrograms per liter

Q - elevated reporting limit; the reporting limit is elevated due to high analyte levels

00100365

Table B-1b
Groundwater Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(USEPA 2009)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
USEPA	October 2009	Groundwater - wells	***Metals***	6020		
			Aluminum	6020	50	µg/L
			Antimony	6020	1	µg/L
			Arsenic	6020	1	µg/L
			Barium	6020	1	µg/L
			Beryllium	6020	1	µg/L
			Cadmium	6020	1	µg/L
			Calcium	6020	20000 - 40000	µg/L
			Chromium	6020	1	µg/L
			Cobalt	6020	1	µg/L
			Copper	6020	1	µg/L
			Iron	6020	50	µg/L
			Lead	6020	1	µg/L
			Magnesium	6020	20000 - 40000	µg/L
			Manganese	6020	100	µg/L
			Nickel	6020	1	µg/L
			Potassium	6020	20000 - 40000	µg/L
			Selenium	6020	1	µg/L
			Sodium	6020	20000 - 40000	µg/L
			Thallium	6020	1	µg/L
			Vanadium	6020	1	µg/L
			Zinc	6020	10	µg/L
			Explosives			
			HMX	8330	0.4	µg/L
			RDX	8330	0.2	µg/L
			1,3,5-TNB	8330	1	µg/L
			1,3-DNB	8330	0.4	µg/L
			Tetryl	8330	0.2	µg/L
			Nitrobenzene	8330	0.4	µg/L
			2,4,6-TNT	8330	0.4	µg/L
			4-ADNT	8330	0.2	µg/L
			2-ADNT	8330	0.2	µg/L
			2,6-DNT	8330	0.2	µg/L
			2,4-DNT	8330	0.4	µg/L
			2-Nitrotoluene	8330	0.4	µg/L
			4-Nitrotoluene	8330	1	µg/L
			3-Nitrotoluene	8330	0.4	µg/L
			Perchlorate	EPA Method	5	µg/L

Note(s):

µg/L - micrograms per liter

USEPA - U.S. Environmental Protection Agency

00100367

Table B - 2
U.S. Army Confirmation Split Sampling
Groundwater Analytical Results Summary
Ground Signal Test Area, LHAAP-003-R
October 2009

			Location Code	18WW-01-07		18WW-16-08		MW-127-09		MW-128-10	
			Sample No.	GW-18WW-01-07-091024		GW-18WW-16-08-091024		GW-127-09-091024		GW-128-10-091024	
			Sample Date	24-Oct-09		24-Oct-09		24-Oct-09		24-Oct-09	
Parameter	Units	MCL	TCEQ GW-Ind	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Metals											
Aluminum	mg/L		102.2	0.0155	J B	2.04		0.194	J	0.00942	J B
Antimony	mg/L	0.006		0.0005	U	0.00335	J	0.0005	U	0.0005	U
Arsenic	mg/L	0.01		0.0009	U	0.019		0.00193	J	0.00304	J
Barium	mg/L	2		0.647		0.189		0.0242		0.0355	
Beryllium	mg/L	0.004		0.0003	U	0.000818	J	0.0003	U	0.0003	U
Cadmium	mg/L	0.005		0.0006	U	0.003986		0.0006	U	0.0006	U
Calcium	mg/L			9.86		169		149		123	
Chromium	mg/L	0.1		0.054		31.7		0.00166	J	0.00283	J B
Cobalt	mg/L		6.132	0.00202	J	0.043		0.0343		0.00105	J
Copper	mg/L	1.3		0.00234	J	1.06		0.00155	J	0.00136	J
Iron	mg/L			3.23		136		19.2		1.17	
Lead	mg/L	0.015		0.000702	J	0.00385	J	0.00058	J	0.000533	J
Magnesium	mg/L			5.7		114		98.6		75.2	
Manganese	mg/L		14.3	0.171		0.548		2.02		1.62	
Nickel	mg/L		2.044	0.338		1.89		0.0345		0.0058	
Potassium	mg/L			2.28		4.37		3.35		4.66	
Selenium	mg/L	0.05		0.0025	U	0.019		0.0025	U	0.0025	U
Silver				0.0007	U	0.0007	U	0.0007	U	0.0007	U
Sodium	mg/L			222		427		441		638	
Thallium	mg/L	0.002		0.0008	U	0.0012	J	0.0008	U	0.0008	U
Zinc	mg/L		30.66	0.0339		0.28		0.0344		0.00622	J B

Table B - 2
U.S. Army Confirmation Split Sampling
Groundwater Analytical Results Summary
Ground Signal Test Area, LHAAP-003-R
October 2009

			Location Code	18WW-01-07		18WW-16-08		MW-127-09		MW-128-10	
			Sample No.	GW-18WW-01-07-091024		GW-18WW-16-08-091024		GW-127-09-091024		GW-128-10-091024	
			Sample Date	24-Oct-09		24-Oct-09		24-Oct-09		24-Oct-09	
Parameter	Units	MCL	TCEQ GW-Ind	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Explosives											
1,3,5-Trinitrobenzene	µg/L		3066	0.12	U	0.1	U	0.22	U	0.12	U
1,3-Dinitrobenzene	µg/L		10.22	0.12	U	0.1	U	0.22	U	0.12	U
2,4,6-Trinitrotoluene	µg/L		51.1	0.12	U	0.1	U	0.22	U	0.12	U
2,4-Dinitrotoluene	µg/L		0.42	0.12	U	0.1	U	0.22	U	0.12	U
2,6-Dinitrotoluene	µg/L		0.42	0.12	U	0.1	U	0.22	U	0.12	U
2-Amino-4,6-dinitrotoluene	µg/L		17.03	0.12	U	0.1	U	0.22	U	0.12	U
2-Nitrotoluene	µg/L		1022	0.12	U	0.1	U	0.22	U	0.12	U
3-Nitrotoluene	µg/L		1022	0.12	U	0.1	U	0.22	U	0.12	U
4-Amino-2,6-dinitrotoluene	µg/L		17.03	0.12	U	0.1	U	0.22	U	0.12	U
4-Nitrotoluene	µg/L		1022	0.12	U	0.1	U	0.22	U	0.12	U
HMX	µg/L		5110	0.12	U	0.1	U	0.22	U	0.12	U
Nitrobenzene	µg/L		51.1	0.12	U	0.1	U	0.22	U	0.12	U
RDX	µg/L		26	0.12	U	0.1	U	0.22	U	0.12	U
Tetryl	µg/L		1022	0.12	U	0.1	U	0.22	U	0.12	U
Perchlorate	µg/L		72	0.062	U	5.4		0.062	U	0.062	U

Notes and Abbreviations:

Bolded and shaded - level above the MCL or TCEQ GW-Ind value

B - analyte was detected in associated method blank

GW-Ind - groundwater MSC for industrial use

J - estimated results detected above the method detection limit but below the reporting limit

MCL - maximum contaminant level

mg/L - milligrams per liter

ug/L - micrograms per liter

U - Not detected. The method detection limit is provided.

00100368

Table B-2b
Groundwater Analytical Methods and Detection Limits
Ground Signal Test Area, LHAAP-003-R
(2009)

Investigated By	Date	Medium Investigated	Analytical Parameters	Analytical Method	Detection Limits	Units
U.S. ARMY	October 2009	Groundwater - wells	***Metals***			
			Aluminum	6020	0.01 - 0.2	mg/L
			Antimony	6020	0.005	mg/L
			Arsenic	6020	0.005	mg/L
			Barium	6020	0.005	mg/L
			Beryllium	6020	0.002	mg/L
			Cadmium	6020	0.002	mg/L
			Calcium	6020	0.5	mg/L
			Chromium	6020	0.005 - 0.5	mg/L
			Cobalt	6020	0.005	mg/L
			Copper	6020	0.005	mg/L
			Iron	6020	0.2	mg/L
			Lead	6020	0.005	mg/L
			Magnesium	6020	0.2	mg/L
			Manganese	6020	0.005 - 0.25	mg/L
			Nickel	6020	0.005 - 0.1	mg/L
			Potassium	6020	0.2	mg/L
			Selenium	6020	0.005	mg/L
			Silver	6020	0.005	mg/L
			Sodium	6020	0.2 - 20	mg/L
			Thallium	6020	0.002	mg/L
			Zinc	6020	0.005	mg/L
			Explosives			
			HMX	8330	0.000330 - 0.000924	mg/L
			RDX	8330	0.000330 - 0.000924	mg/L
			1,3,5-TNB	8330	0.000330 - 0.000924	mg/L
			1,3-DNB	8330	0.000330 - 0.000924	mg/L
			Tetryl	8330	0.000330 - 0.000924	mg/L
			Nitrobenzene	8330	0.000330 - 0.000924	mg/L
			2,4,6-TNT	8330	0.000330 - 0.000924	mg/L
			4-ADNT	8330	0.000330 - 0.000924	mg/L
			2-ADNT	8330	0.000330 - 0.000924	mg/L
			2,6-DNT	8330	0.000330 - 0.000924	mg/L
			2,4-DNT	8330	0.000330 - 0.000924	mg/L
			2-Nitrotoluene	8330	0.000330 - 0.000924	mg/L
			4-Nitrotoluene	8330	0.000330 - 0.000924	mg/L
			3-Nitrotoluene	8330	0.000330 - 0.000924	mg/L
			Perchlorate	EPA Method 314.0	0.2	μg/L

Note(s):

μg/L - micrograms per liter

mg/L - milligrams per liter

00100370

Shaw® Shaw Environmental, Inc.

Date: June 30, 2011

Project No.: 133363

TRANSMITTAL LETTER:

To: Mr. Aaron Williams

Address: US Army Corps of Engineers - Tulsa
CESWT-PP-M
1645 South 101st East Ave
Tulsa, Oklahoma 74128

Re: Final Proposed Plan for South Test Area/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R
Longhorn Army Ammunition Plant

Contract No. W912QR-04-D-0027/DS02

For: Review____ As Requested____ Approval____ Corrections____ Submittal____ Other X____

Item No:	*No. of Copies*	*Date:*	*Document Title*
1	2	June 2011	**Final Proposed Plan for South Test/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R, Longhorn Army Ammunition Plant, Karnack, Texas**

Aaron,
Enclosed are two copies of the above-named document. Copies have been distributed as indicated below. Please call with any questions or comments.

Sincerely: KD for
John Elliott
Project Manager

CC: **Distribution List:**
Mr. J. Lambert – USACE, Tulsa (sent to A. Williams for distribution)
Ms. M. Plitnik – USAEC
Ms. Rose Zeiler – BRAC-LHAAP
Mr. S. Tzhone – EPA Region 6 (2)
Ms. F. Duke– TCEQ, Austin (2)
Mr. D. Vodak– TCEQ, Tyler
Mr. P. Bruckwicki– U.S. Fish and Wildlife Service

00100371

DEPARTMENT OF THE ARMY
LONGHORN ARMY AMMUNITION PLANT
POST OFFICE BOX 220
RATCLIFF, AR 72951

June 30, 2011

DAIM-ODB-LO

Mr. Stephen Tzhone
US Environmental Protection Agency
Superfund Division (6SF-AT)
1445 Ross Avenue
Dallas, TX 75202-2733

Re: Final Proposed Plan for South Test Area/Bomb Test Area, LHAAP-001-R and
Ground Signal Test Area, LHAAP-003-R
Longhorn Army Ammunition Plant, Karnack, Texas, June 2011

Dear Mr. Tzhone,

The above referenced document is being transmitted to you for your records.

The point of contact for this action is the undersigned. I ask that John Elliott, Shaw's Project Manager, be copied on any communications related to the project. I may be contacted at 479-635-0110, or by email at rose.zeiler@us.army.mil.

Sincerely,

Rose M. Zeiler

Rose M. Zeiler, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
F. Duke, TCEQ, Austin, TX
D. Vodak, TCEQ, Tyler, TX
P. Bruckwicki, Caddo Lake NWR, TX
J. Lambert, USACE, Tulsa District, OK
A. Williams, USACE, Tulsa District, OK
M. Plitnik, USAEC, TX
J. Elliott, Shaw – Houston, TX (for project files)

00100372

DEPARTMENT OF THE ARMY
LONGHORN ARMY AMMUNITION PLANT
POST OFFICE BOX 220
RATCLIFF, AR 72951

June 30, 2011

DAIM-ODB-LO

Ms. Fay Duke (MC-136)
SSDAT/Superfund Section
Remediation Division
Texas Commission on Environmental Quality
12100 Park 35 Circle, Bldg D
Austin, TX 78753

Re: Final Proposed Plan for South Test Area/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R
Longhorn Army Ammunition Plant, Karnack, Texas, June 2011
SUP 126

Dear Ms. Duke,

The above-referenced document is being transmitted to you for your records.

The point of contact for this action is the undersigned. I ask that John Elliott, Shaw's Project Manager be copied on any communications related to the project. I may be contacted at 479-635-0110, or by email at rose.zeiler@us.army.mil.

Sincerely,

Rose M. Zeiler

Rose M. Zeiler, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
S. Tzhone, USEPA Region 6, Dallas, TX
D. Vodak, TCEQ, Tyler, TX
P. Bruckwicki, Caddo Lake NWR, TX
J. Lambert, USACE, Tulsa District, OK
A. Williams, USACE, Tulsa District, OK
M. Plitnik, USAEC, TX
J. Elliott, Shaw, Houston, TX (for project files)

00100373

FINAL

PROPOSED PLAN FOR SOUTH TEST AREA/BOMB TEST AREA, LHAAP-001-R AND GROUND SIGNAL TEST AREA, LHAAP-003-R

ISSUED BY: U.S. ARMY

Longhorn Army Ammunition Plant
Karnack, Texas

June 2011

THE U.S ARMY ANNOUNCES PROPOSED PLAN FOR LHAAP-001-R and LHAAP-003-R

In this Proposed Plan the U.S. Army documents a removal action of munitions and explosives of concern (MEC) conducted in 2008 under Army's removal authority and presents its proposal for limited groundwater monitoring at the Munitions Response Sites (MRS) LHAAP-001-R, South Test Area/Bomb Test Area and LHAAP-003-R, Ground Signal Test Area at Longhorn Army Ammunition Plant (LHAAP) in addition to the land use controls (LUCs) already in place as a result of the 2008 removal action. Those LUCs were identified in an Action Memorandum signed by the U.S. Army in 2007 and include restrictions against intrusive activities including digging; signage at the perimeter of the sites; and education programs for future refuge visitors, staff, and volunteers (EODT Technology, Inc. [EODT], 2009).

Throughout the proposed plan for these two MRS, the term munitions constituents (MC), refers to the data gap constituent of white phosphorous (WP) and the emerging contaminant perchlorate. The U.S. Army, regulators, and project stakeholders met in 2005 for technical planning meetings and agreed that metals and explosives were addressed with the No Further Action (NFA) Record of Decisions (RODs) signed in 1998 for Installation Restoration Program Sites LHAAP-27 and -54 which are co-located with LHAAP-001-R and LHAAP-003-R, respectively.

The primary purpose of the Proposed Plan is to facilitate public involvement in the remedy selection process. The Proposed Plan provides the public with basic background information about MRS LHAAP-001-R and LHAAP-003-R, documents the 2008 removal action, confirms the LUCs included with the removal action and recommends that limited groundwater monitoring for perchlorate be conducted to verify protection of human health and the environment.

The U.S. Army is issuing this Proposed Plan for public review, comment, and participation to fulfill part of its public participation responsibilities under Sections 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

Dates to remember:
MARK YOUR CALENDER

PUBLIC COMMENT PERIOD:
July 13, 2011 to August 13, 2011
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-001-R and LHAAP-003-R. Oral and written comments will be accepted at the meeting. The meeting will be held on July 21, 2011 from 6:00 p.m. to 7:30 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-001-R and LHAAP-003-R, please contact:
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and Hazardous Substances Pollution Contingency Plan (NCP). This Proposed Plan summarizes information that can be found in greater detail in the Site Inspection (SI) Report, the Engineering Evaluation/Cost Analysis (EE/CA), the Action Memorandum, the MC Data Summary Report, the Munitions and Explosives of Concern (MEC) Removal Action Report, the Installation-Wide Baseline Ecological Risk Assessment (BERA), and other supporting documents that are contained in the Administrative Record for LHAAP-001-R and LHAAP-003-R. 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-001-R and LHAAP-003-R, and also to review and comment on the recommendation for limited groundwater monitoring for perchlorate in association with the LUCs 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 Longhorn AAP Federal Facilities Agreement.

SITE BACKGROUND

LHAAP is located in central-east Texas in the northeastern corner of Harrison County **(Figure 1)**. The installation occupies nearly 8,416 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.

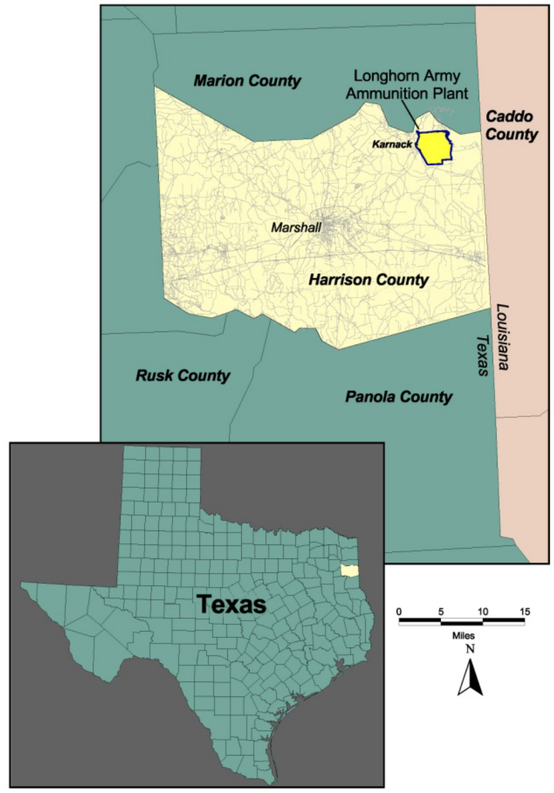

Figure 1 Location of the Longhorn Army Ammunition Plant Harrison County, Texas

Caddo Lake, a large freshwater lake situated on the Texas-Louisiana border, 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 management as the Caddo Lake National Wildlife Refuge. The property transfer process is continuing as restoration is implemented at individual sites.

Due to releases of chemicals from operation and maintenance activities at the former facility, LHAAP was placed on the National Priorities List (NPL) on August 9,

1990. Activities to remediate contamination associated with the listing of LHAAP as a NPL 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.

The two MRS discussed in this Proposed Plan have been identified to have potential environmental concerns.

A site description, site characteristics, and a summary of site risks are provided below separately for each MRS, followed by a recommendation for the sites.

LHAAP-001-R

LHAAP-001-R, known as Site 27, South Test Area/Bomb Test Area is approximately 79 acres located southeast of Avenue P and the magazine area at the end of 70th Street, near the southern boundary of LHAAP (**Figure 2**).

The site was identified in the U.S. Army Closed, Transferring, and Transferred Range/Site Inventory as 6.75 acres in size; however, a 1981 aerial photograph, historical records, a site visit, and a teleconference on 17 May and 18 May 2005 between U.S. Army Corps of Engineers (USACE) and U.S. Army Environmental Center (USAEC) indicated the site should be 79 acres including Demolition Sub Areas 1, 2, and 3.

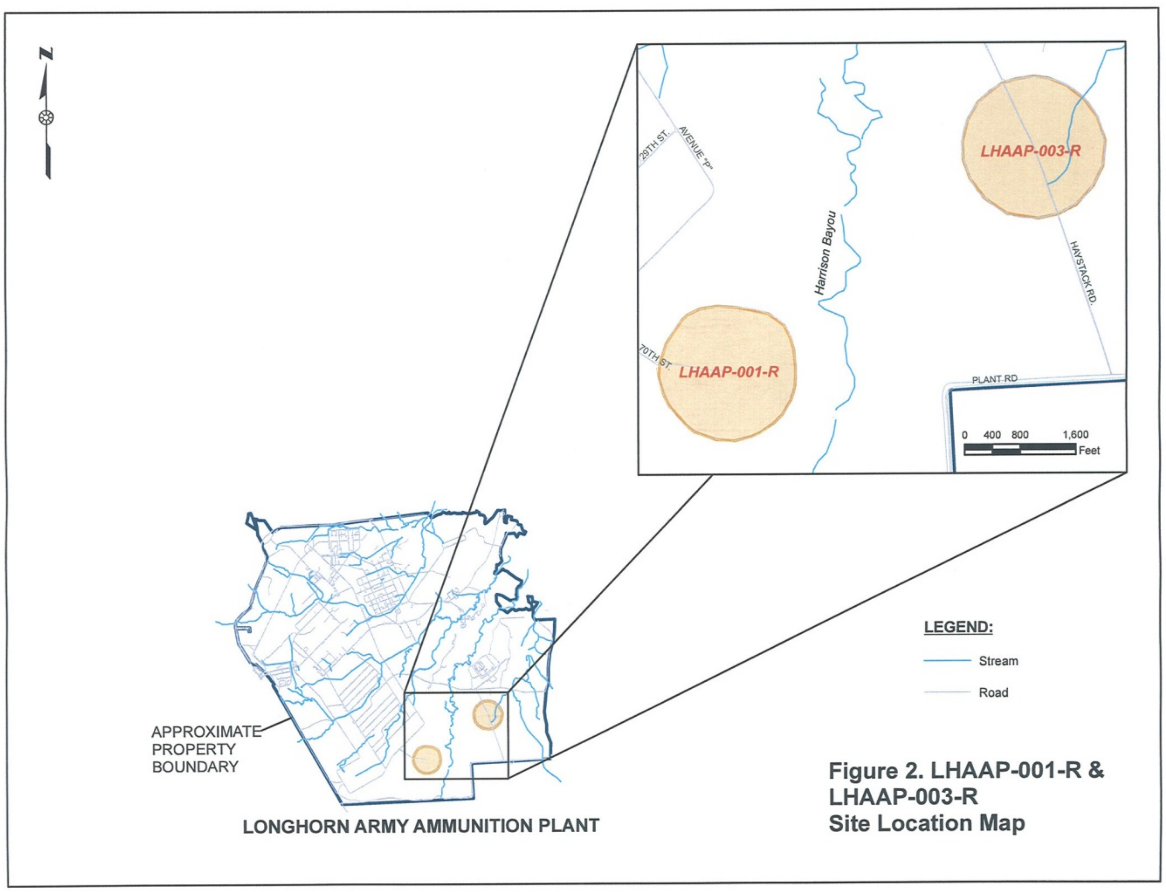

Figure 2. LHAAP-001-R & LHAAP-003-R Site Location Map

The South Test Area/Bomb Test Area is co-located with the Installation Restoration Program (IRP) site LHAAP-27 for which a NFA ROD under CERCLA for Hazardous, Toxic, and Radioactive Waste (HTRW) was signed with regulatory concurrence in January 1998 (USACE, 1998).

The LHAAP-001-R site was constructed in 1954 and used by Universal Match Corporation for testing M120A1 photoflash bombs produced at the facility until about 1956. The bombs were tested by exploding them in the air over an elevated, semi-elliptical earthen test pad. Bombs awaiting testing were stored in three earth-covered concrete bunkers. The bombs tested were 150-pound M120/M120A photoflash bombs filled with photoflash powder and containing a black powder booster charge and a timed nose fuze.

During the late 1950s, illuminating signal devices were also demilitarized within pits excavated in the vicinity of the test pad at the site also known as the suspected Open Burn/Open Detonation (OB/OD) area. During the early 1960s, leaking production items such as XM40E5 "button bombs" may have been demilitarized by detonation in the South Test Area/Bomb Test Area (LHAAP-001-R) or the Ground Signal Test Area (LHAAP-003-R). The XM40E5 was a small (approximately 1- by 1.25-inch) anti-intrusion mine also referred to as a "Gravel" Mine, which exploded on impact. Leaking WP munitions were supposedly disposed of in this area although no primary source documentation concerning this effort was located. Occasional leaking WP munitions were burned at the site as a demilitarization activity. Other sources indicate that possibly 3- to 4- pound canisters of WP were demilitarized in the vicinity of the test pad. The 1984 LHAAP Contamination Survey (Environmental Protection Systems, Inc. [EPS], 1984) stated the area has been relatively inactive since the early 1960s and no disposal or testing activities were carried out in this area.

The South Test Area/Bomb Test Area was identified as a MEC area of concern based on the visual confirmation of MEC. Because of the potential presence of WP and to address the WP data gap, the South Test Area/Bomb Test Area was also identified as a WP area of concern.

LHAAP-001-R SITE CHARACTERISTICS

The surface features at LHAAP-001-R include a deteriorated asphalt and gravel road running from the entrance to the test pad. Concrete bunkers and the site of the demolished former observation building are located alongside the road about halfway between the entrance and the test pad. A circular, 50-foot wide fire lane with a 2,000-foot diameter is centered at the test pad. Since the observation building has been demolished, the site is currently overgrown with brush and small trees. Formerly cleared areas in the vicinity of the test pad and alongside the access road are also overgrown with vegetation. The topography slopes gently to the east and surface water runoff from the hillside flows generally to the southeast and into Harrison Bayou. Groundwater at the site was encountered between 7 and 9 feet below ground surface (bgs). Groundwater is topographically controlled with a general flow direction to the east toward the floodplain of Harrison Bayou.

LHAAP-001-R is co-located with the IRP site LHAAP-27. Between 1982 and 1996 several investigations were conducted in a phased approach to determine the nature and extent of contamination at LHAAP-27. Media investigated included soil, groundwater, surface water and sediment (USACE, 1997).

Perchlorate was identified as an emerging contaminant and perchlorate data for environmental media were collected after the ROD was signed. Twenty six (26) soil samples (13 surface and 13 subsurface soil samples) were collected and analyzed for perchlorate from 13 soil borings across the site. Perchlorate was detected in only one of the 26 soil samples at a concentration well below the TCEQ soil medium-specific concentration (MSC) for industrial use based on the State of Texas groundwater protection (GWP-Ind) value of 7,200 micrograms per liter (µg/L).

During three consecutive quarterly groundwater sampling events (April 2000 through February 2001), sixteen groundwater samples were collected from six existing shallow monitoring wells to determine whether perchlorate was present in the underlying groundwater as a result of past historical activities. The six monitoring wells are located in areas with the highest potential for impact from site activities and in the direction of flow across the site from west to east toward Harrison Bayou. Perchlorate was detected in two of the four wells during the first quarter sampling event, with a maximum concentration below the groundwater MSC for industrial use (GW-Ind) value of 72 µg/L. The initial detections of perchlorate in groundwater were not confirmed in subsequent sampling. During the second and third quarter sampling events, no perchlorate was detected in any of the samples (STEP, 2005).

In October 2009, USEPA collected additional groundwater samples from the existing six monitoring wells to confirm groundwater conditions at the site. Perchlorate was detected in three wells with only one of the three above the GW-Ind value of 72 µg/L at a concentration of 76 µg/L. The USEPA's perchlorate detection of 76 µg/L was an estimate from a diluted sample. The U.S. Army collected split samples at the same time that the USEPA collected samples from the six monitoring wells. Perchlorate was detected in two wells for the Army split samples, with a maximum concentration below the GW-Ind value of 72 µg/L (Shaw, 2011).

In March 2003, USFWS conducted an investigation at the former LHAAP facility to determine contaminant levels in soil and sediment (USFWS, 2003). Soil samples were collected from five locations within LHAAP-001-R. Soil analytical results indicated that metals and semivolatile organic compounds were detected at low concentrations, but not above screening levels. Perchlorate was not detected above the reporting limit.

Between 2002 and 2004, a MMRP SI was conducted for LHAAP-001-R to determine the presence or absence of MEC and/or MC at the site which may have remained from activities conducted by the Department of Defense (DOD) during operations of the MRS. The SI verified MEC presence at the site (e^2M, 2005).

The SI identified a data gap in earlier soil sampling, in that, although demilitarization activities including open pit burning and explosive detonation were conducted at the site, no analysis for the munitions constituent WP was performed at the site. The SI recommended that further investigation be conducted to address the identified data gap.

In 2007, an EE/CA was conducted to facilitate completion of a non-time critical removal action of MEC at the site (CAPE, 2007a). Field activities conducted during the EE/CA characterized MEC and addressed the WP data gap at the site. Twenty-one (21) MEC and Material Potentially Presenting Explosive Hazard (MPPEH) items were recovered at the surface or within the top 6 inches of the soil. The items were clustered within an area suspected of the use of OB/OD activities. The OB/OD area is approximately 14 acres in size.

Based on the heaviest MPPEH concentrations or historical detonations, soil samples were collected within LHAAP-001-R to determine if evidence of WP existed in areas where MC were most likely to exist. One soil sample was collected near the center of the OB/OD area. A second soil sample was collected in a scarred area identified as the photo flash cartridge disposal area in the historical review. Both areas are near locations where MPPEH items were recovered during the field investigations. In addition, pre- and post-detonation samples were collected in association with explosive demolition of MPPEH recovered during the field activities. Soil samples were collected from 0 to 6-inches bgs. Analytical results indicated that WP and explosives were not identified at concentrations above detection limits in any soil samples at the site. In addition, there was no indication of the presence of WP or explosives in any of the pre- or post-detonation samples.

The EE/CA recommended surface and subsurface removal of MEC items with LUCs to reduce the risk within LHAAP-001-R (CAPE, 2007b). The surface removal was for the entire site, whereas the subsurface removal was for the suspected OB/OD area.

Between August and November 2008, a MEC removal action was conducted and LUCs were developed (EODT, 2009). Surface clearance of approximately 65 acres and subsurface clearance to the depth of detection in the approximately 14-acre OB/OD Area was performed at LHAAP-001-R. A total of 384 MEC/MPPEH items and 14 inert items were located and destroyed and a total of 22,139 pounds of munitions debris (MD) and 1,876 pounds of cultural debris (CD) were removed during the course of surface and subsurface clearance. In addition, LUCs were developed that included restrictions against intrusive activities including digging; signage at the perimeter of the site; and an education program for future refuge visitors, staff, and volunteers (EODT, 2009). The Land Use Control Plan for LHAAP-001-R is Appendix I of the removal action work plan (EODT, 2008).

SUMMARY OF LHAAP-001-R 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 (MOA) (U.S. Army, 2004) between the USFWS and the U.S. Army. The MOA documents the transfer process of 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.

Human Health Risks

As part of the EE/CA, a streamlined risk evaluation was conducted for MEC at LHAAP-001-R to address risks to human safety related to the presence of potential explosive hazards. During the EE/CA investigation activities, no WP was identified at detectable concentrations in any soil samples collected and there was no indication of the presence of MC in any pre- or post-detonation samples. Therefore, there is no risk associated with WP.

Additional sampling conducted by the USEPA in 2009 resulted in a detection of perchlorate at a concentration of 76 µg/L, slightly above the GW-Ind of 72 µg/L in one well. The result was an estimate from a diluted sample. The U.S. Army's split sample for the same well indicated that perchlorate was detected at a concentration of 50 µg/L, below the GW-Ind. The U.S. Army result is consistent with previous detected levels for the site and therefore there was no need to evaluate risk associated with perchlorate because there was no exceedance of the GW-Ind.

The risk factors associated with MEC items were categorized into three classes: MEC factors, site characteristics factors, and human factors. MEC factors are related to the type of MEC, the sensitivity, the quantity (density) and the depth. Site characteristic factors include the accessibility and stability of areas where MEC items are located. Human factors are related to the population density and population activities.

During the EE/CA field activities, the MEC items that were recovered at LHAAP-001-R were mostly clustered in the former OB/OD area. Taking all risk factors into consideration, the baseline risk assessment indicated moderate MEC risk to human health for LHAAP-001-R.

The surface MEC removal action located and removed MEC items thereby reducing the risk to the future land user. The subsurface removal action located, excavated and removed MEC or MPPEH items to a depth consistent with the expected future land use and with the significant refuge activities (hunting, fishing, wildlife observation, wildlife photography, wildlife education, and wildlife interpretation), all of which are non-intrusive. The subsurface removal provided an effective solution for reducing risk of exposure by reducing the potential for any direct contact with MEC or MPPEH.

Consistent with the recommendations of the EE/CA and the Action Memorandum (U.S. Army, 2007), LUCs were identified, designed, and implemented for the site to promote ongoing protection of human safety against potential explosive hazards that might remain in the subsurface.

Texas Administrative Code requires that the LUCs identified in the Action Memorandum for the protection of human health and safety be filed in the county records. Additionally, monitoring in the form of Five-Year Reviews will serve to ensure that the LUCs are specified, implemented, monitored, reported on, and enforced. The reviews will also serve to document that the use of the site remains consistent with the industrial/recreational use scenario evaluated in the risk assessment.

Ecological Risk

The ecological risk for LHAAP-001-R was addressed in the installation-wide BERA (Shaw, 2007). 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. Conclusions for individual sites and the potential for detected chemicals to adversely affect the environment were made in the context of the overall conclusions of the sub-area in which the site falls. Site LHAAP-001-R lies within the Low Impact Sub-Area, and the BERA concluded that no unacceptable risk was present in the Low Impact Sub-Area (Shaw, 2007).

Summary results from the BERA (Shaw, 2007) indicated that perchlorate was not selected as a final constituent of potential ecological concern because all estimated receptor ecological effects quotient were less than 1 and there was no evidence of a perchlorate source area. In addition, during the EE/CA, no WP or explosives were identified in any soil samples and there was no indication of the presence of explosives in any pre or post-detonation samples confirming the determination of no risk to the environment for LHAAP-001-R.

LHAAP-003-R

LHAAP-003-R, known as Site 54, the Ground Signal Test Area encompasses approximately 80 acres and is located in the southeastern portion of LHAAP (**Figure 2**).

LHAAP-003-R was used intermittently starting in April 1963 for aerial and on-ground testing and destruction of a variety of devices, including pyrotechnic signal devices, red phosphorus smoke wedges, infrared flares, illuminating 60 and 81 millimeters (mm) mortar shells, illuminating 40 to 155 mm cartridges, button bombs, and various types of explosive simulators. The site was also used intermittently over a 20-year period for testing and burn-out of rocket motors from Nike-Hercules, Pershing, and Sergeant missiles. Around 1970, a Sergeant rocket motor reportedly exploded in an excavated pit near the center of the site, however, later MEC clearance to depth in the area found no rocket motor. Debris was reportedly placed in the resulting crater and backfilled. From late 1988 through 1991, the site was also used for burn-out of rocket motors in Pershing missiles destroyed in accordance with the Intermediate-Range Nuclear Forces Treaty between the U.S. and the former Soviet Union. Occasionally, leaking WP munitions were burned at the site as a demilitarization activity.

The Ground Signal Test Area was identified as a MEC area of concern based on the reported presence of MEC. Because of the potential presence of WP and to address the WP data gap, the Ground Signal Test Area was also identified as a WP area of concern.

LHAAP-003-R SITE CHARACTERISTICS

Surface features at LHAAP-003-R include an asphalt road (Haystack Road) that intersects Long Point Road just east of its intersection with Avenue Q. The site is currently undeveloped and has become overgrown with woody vegetation.

The site is located within the watersheds of Saunders Branch and Harrison Bayou. Both Saunders Branch and Harrison Bayou flow into Caddo Lake. Surface water runoff from the site is towards drainage ditches located alongside the circular dirt road forming the outer margin of the site. The ditches converge to the northeast and the southwest directing surface water to Saunders Branch and Harrison Bayou, respectively.

The depth to groundwater at the site averages about 15 feet bgs with some seasonal fluctuations. The regional groundwater flow direction is to the north-northeast toward Caddo Lake; however, during periods of high precipitation the groundwater flow direction in the southwestern portion of the site diverts to the northwest towards Harrison Bayou.

LHAAP-003-R is co-located with the IRP site LHAAP-54. Between 1982 and 1996 several investigations were conducted in a phased approach to determine the nature and extent of contamination at LHAAP-54. Media investigated included soil, groundwater, surface water and sediment. Based on the results of the investigations and the risk assessment conducted for the site, a NFA ROD under CERCLA for HTRW was signed with regulatory concurrence in January 1998 (USACE, 1998).

Perchlorate was identified as an emerging contaminant and perchlorate data for environmental media was collected after the ROD was signed. Between May 2000 and June 2001, during four quarterly sampling events, twelve groundwater samples were collected from three existing shallow monitoring wells and three geoprobe points to determine whether perchlorate was present in the underlying groundwater as a result of past historical activities (STEP, 2005). The monitoring wells and geoprobe points are located adjacent to the three surface water features that drain the entire Ground Signal Test Area. Because the shallow groundwater flow pattern reflects surface topography, groundwater samples from these wells represent groundwater from the entire site. Perchlorate was detected during the first quarter sampling event at a maximum concentration that was well below the GW-Ind value of 72 µg/L. During the second quarter sampling event, perchlorate was not detected in any of the water samples. Perchlorate was detected during the third quarter sampling event in one well at a concentration that was well below the GW-Ind value and not at all during the fourth quarter event.

In October 2009, USEPA collected additional groundwater samples from the existing four monitoring wells to confirm groundwater conditions at the site. Perchlorate was detected in only one well at a concentration that was well below the GW-Ind value of 72 µg/L. The U.S. Army collected split samples at the same time that the USEPA collected samples from the four monitoring wells. Perchlorate was detected in one well for the U.S. Army split samples at a concentration well below the GW-Ind value of 72 µg/L.

In March 2003, USFWS conducted an investigation at the former LHAAP facility to determine contaminant levels in soil and sediment (USFWS, 2003). Soil samples were collected from two locations within the Ground Signal Test Area. These two locations are along the surface drainage that flows toward Saunders Branch on the east side of the site. Soil analytical results indicated that metals were detected at low concentrations confirming previous findings. Perchlorate was not detected.

Between 2002 and 2004, a MMRP SI was conducted for LHAAP-003-R to determine the presence or absence of MEC and/or MC at the site which may have remained from activities conducted by the DOD during operations of the MRS. The SI verified MEC presence at the site (e^{2}M, 2005). Possible source areas for MEC and MC identified during the SI included: testing areas associated with the various suspected ordnance types; a confirmed mortar impact area on site with numerous unidentified ordnance item shapes on the surface and outside the mortar berm; a site reportedly used for the testing and burn-out of Pershing and Sergeant rocket motors; and areas associated with past demilitarization activities. In addition, a Sergeant rocket motor reportedly exploded at the site around 1970 and debris was reportedly placed in the resulting crater and backfilled. It was also reported that occasionally WP munitions were burned at the site. It appears that most of the items tested at this location were statically fired and observed for adequate illumination and burn time and were not launched by a weapons system.

The SI identified a data gap in earlier soil sampling, in that, although demilitarization activities were conducted at the site and occasionally demolition and burning of WP munitions were performed, no analysis for the munitions constituent WP was performed at the site. The SI recommended that further investigation be conducted to address the identified data gap.

In 2007, an EE/CA was conducted to facilitate completion of a non-time critical removal action of MEC at the site (CAPE, 2007a). Field activities conducted during the EE/CA characterized MEC and addressed the WP data gap at the site. Fourteen (14) MEC and MPPEH items were recovered at the surface or within the top 6 inches of the soil. The items were clustered within the former Mortar Test Area.

Based on the heaviest MPPEH concentrations or historical detonations, soil samples were collected within LHAAP-003-R to determine if evidence of WP existed in areas where MC were most likely to exist. One soil sample was collected within the area identified as the mortar firing range. A second soil sample was collected in a scarred area identified as the Rocket Motor Area in the historical review. In addition, pre- and post-detonation samples were collected in association with explosive demolition of MPPEH recovered during the field activities. Soil samples were collected from 0 to 6-inches bgs. Analytical results indicated that WP and explosives were not identified at concentrations above detection limits in any soil samples at the site. In addition, there was no indication of the presence of WP or explosives in any of the pre- or post-detonation samples.

The EE/CA recommended surface clearance of MEC items with LUCs to reduce the risk within LHAAP-003-R.

Between August and November 2008, MEC removal action was conducted and LUCs were developed (EODT, 2009). Surface clearance was performed at LHAAP-003-R. A total of 12 MEC/MPPEH items and one inert item were located and destroyed and 6,880 pounds of MD and 5,981 pounds of CD were removed during the course of surface clearance. In addition, LUCs were designed that include restrictions against intrusive activities including digging; signage at the perimeter of the site; and education programs for future refuge visitors, staff, and volunteers (EODT, 2009). The Land Use Control Plan for LHAAP-003-R is Appendix I of the removal action work plan (EODT, 2008).

SUMMARY OF LHAAP-003-R 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 MOA (U.S. Army, 2004) between the USFWS and the U.S. Army. The MOA documents the transfer process of 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.

Human Health Risks

As part of the EE/CA, a streamlined risk evaluation was conducted for MEC at LHAAP-003-R to address risks to human safety related to the presence of potential explosive hazards. During the EE/CA investigation activities, no WP was identified at detectable concentrations in any soil samples collected and there was no indication of the presence of MC in any pre or post-detonation samples. Therefore, there is no risk associated with WP.

The additional groundwater sampling conducted by the USEPA and U.S. Army in 2009 indicated that perchlorate was detected in one well at a concentration well below the GW-Ind, and therefore there was no need to evaluate risk associated with perchlorate.

The risk factors associated with MEC items were categorized into three classes: MEC factors, site characteristics factors, and human factors. MEC factors are related to the type of MEC, the sensitivity, the quantity (density) and the depth. Site characteristic factors include the accessibility and stability of areas where MEC items are located. Human factors are related to the population density and population activities.

During the EE/CA field activities, MEC items that were recovered at LHAAP-003-R were mostly clustered in the former Mortar Test Area. Taking all risk factors into consideration, the baseline risk assessment indicated low MEC risk to human health for LHAAP-003-R. The surface MEC removal action located and removed MEC items thereby reducing the risk to the future land user.

Consistent with the recommendations of the EE/CA and the Action Memorandum (U.S. Army, 2007), LUCs were identified, designed, and implemented for the site to promote ongoing protection of human safety against potential explosive hazards that may remain at the site in the subsurface.

Texas Administrative Code requires that the LUCs identified in the Action Memorandum for the protection of human health and safety be filed in the county. Additionally, monitoring in the form of Five-Year Reviews will serve to confirm that the LUCs are specified, implemented, monitored, reported on, and enforced. The reviews will also serve to document that the use of the site remains consistent with the industrial/recreational use scenario evaluated in the risk assessment.

Ecological Risk

The ecological risk for LHAAP-003-R was addressed in the installation-wide BERA (Shaw, 2007). 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 for individual sites and the potential for detected chemicals to adversely affect the environment were made in the context of the overall conclusions of the sub-area in which the site falls. Site LHAAP-003-R lies within the Low Impact Sub-Area, and the BERA concluded that no unacceptable risk was present in the Low Impact Sub-Area (Shaw, 2007).

In addition, during the EE/CA, no WP or explosives were identified in any soil samples and there was no indication of the presence of WP or explosives in any pre or post-detonation samples confirming the determination of no risk to the environment for LHAAP-003-R.

RECOMMENDATION

In addition to the LUCs already in place as a result of the 2008 removal action, limited groundwater monitoring for perchlorate is proposed for both LHAAP-001-R and LHAAP-003-R. The purpose of the additional monitoring is to confirm perchlorate levels in groundwater are below the GW-Ind. Furthermore, implementation, maintenance, inspection, reporting and enforcement of the LUCs will continue to promote the ongoing protection of human safety against explosive hazards that may have remained at the sites in the subsurface.

The details of the LUCs are presented in the Land Use Control Plan provided in the Final Work Plan for the MEC Removal Action at the Former Longhorn Army Ammunition Plant, LHAAP-001-R (Site 27) and LHAAP-003-R (Site 54) (EODT, 2008).

Because there are no unacceptable risks and groundwater monitoring and the appropriate LUCs have been implemented, no remediation alternatives or Remedial Action Objectives are required. If after three rounds of groundwater sampling at LHAAP-001-R and one round of groundwater sampling at LHAAP-003-R the results that are evaluated on or before the first five year review indicate detections at levels below the GW-Ind value of 72 µg/L for perchlorate, groundwater monitoring will cease and the wells will be plugged and abandoned.

The LUCs for these two sites include restrictions for intrusive activities including digging, posting unexploded ordnance (UXO) warning signs around the perimeter of the MRS, continuing the existing UXO education programs provided to authorized workers (i.e., USFWS's staff) and refuge visitors, and only allowing future public uses that are consistent with the "big six" activities (i.e., hunting, fishing, wildlife observation, wildlife photography, wildlife education, and wildlife interpretation). The LUCs will accompany all transfer documents and will be recorded in the Harrison County Courthouse. Five-Year Reviews will be performed to document that LUCs remain protective of human health and safety for MRS LHAAP-001-R and LHAAP-003-R.

COMMUNITY PARTICIPATION

The U.S. Army, USEPA, and TCEQ provide information regarding LHAAP-001-R and LHAAP-003-R through public meetings and the Administrative Record file for the facility. The public is encouraged to gain a more comprehensive understanding of the 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-001-R and LHAAP-003-R

CAPE, 2007a, *Final Engineering Evaluation/Cost Analysis, Longhorn Army Ammunition Plant, Karnack, Texas,* Final, October.

CAPE, 2007b, *Final Engineering Evaluation/Cost Analysis Action Memorandum Revision 1, Longhorn Army Ammunition Plant, Karnack, Texas,* Signed by Thomas Lederle, BRAC Division, ACSIM, United States Army, 5 December.

engineering-environmental Management (e^2M), 2005, *Final Site Inspection Report, Military Munitions Response Program, Longhorn Army Ammunition Plant, Texas*, Final, June.

Environmental Protection Systems, Inc. (EPS), 1984, *Longhorn Army Ammunition Plant Contamination Survey,* June.

EODT Technology, Inc., (EODT), 2008, *Final Work Plan for the MEC Removal Action at the Former Longhorn Army Ammunition Plant, LHAAP-001-R (Site 27) and LHAAP-003-R (Site 54), Karnack, Texas, July*

EODT Technology, Inc., (EODT), 2009, *Final Site Specific Final Report for the MEC Removal Action at the Former Longhorn Army Ammunition Plant, LHAAP-001-R (Site 27) and LHAAP-003-R (Site 54), Karnack, Texas,* September.

Shaw Environmental, Inc. (Shaw), 2007*, Installation-Wide Baseline Ecological Risk Assessment, Volume 1: Step 3 Report, Longhorn Army Ammunition Plant, Karnack, Texas*, Houston, Texas, November.

Shaw, 2011, *Munitions Constituents Data Summary Report, South Test Area/Bomb Test Area, LHAAP-001-R and Ground Signal Test Area, LHAAP-003-R, Longhorn Army Ammunition Plant, Karnack, Texas*, Houston, Texas, June.

Solutions to Environmental Problems (STEP), 2005, *Plant-wide Perchlorate Investigation, Longhorn Army Ammunition Plant, Karnack, Texas*, April.

U.S. 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.

U.S. Army, 2007, *Action Memorandum for Three Munitions Response Sites: South Test Area/Bomb Test Area, Static Test Area, and Ground Signal Test Area, Longhorn Army Ammunition Plant, Karnack, Texas,* August. Signed 5 December 2007 by Thomas E. Lederle.

U.S. Army Corps of Engineers (USACE), Tulsa District, 1997, *Remedial Investigation Report, Group 1 Sites (Sites 11, 1, XX, 27), Longhorn Army Ammunition Plant, Karnack, Texas,* Volumes I and II, May.

(USACE, Tulsa District, 1998, *Record of Decision at Group 1 Sites (Sites 11, 1, XX, 27), Longhorn Army Ammunition Plant, Karnack, Texas*, January.

U.S. Fish and Wildlife Service (USFWS), 2003, *Contaminant Investigation of Northern, Central, and Eastern Portions of Caddo Lake National Wildlife Refuge, Texas,* November.

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.

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 — A major environmental category that surrounds or contacts 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.

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 no assumption of no action). The assessment contributes to decisions regarding appropriate response alternatives.

ACRONYMS and ABBREVIATIONS

bgs	below ground surface
BERA	Baseline Ecological Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CD	cultural debris
DOD	Department of Defense
EE/CA	Engineering Evaluation/Cost Analysis
FFA	Federal Facility Agreement
GW-Ind	groundwater MSC for industrial use
GWP-Ind	soil MSC for industrial use based on groundwater protection
HTRW	hazardous, toxic, and radioactive waste
IRP	Installation Restoration Program
LHAAP	Longhorn Army Ammunition Plant
LUC	Land Use Control
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
µg/L	micrograms per liter
mm	millimeters
MMRP	Military Munitions Response Program
MOA	Memorandum of Agreement
MPPEH	material potentially presenting explosive hazard
MRS	Munitions Response Sites
MSC	medium-specific concentrations
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	no further action
NPL	National Priorities List
OB/OD	Open Burn/Open Detonation
ROD	Record of Decision
SI	site inspection
TCEQ	Texas Commission on Environmental Quality
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Center
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UXO	unexploded ordnance
WP	white phosphorus

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for LHAAP-001-R and LHAAP-003-R 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 the site.

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 August 13, 2011. If you have questions about the comment period, please contact Dr. Rose M. Zeiler 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

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

MONTHLY MANAGERS' MEETING

AGENDA

DATE:	Thursday, July 21, 2011
TIME:	4:00 pm.
PLACE:	Longhorn Army Ammunition Plant Trailer (Or use the Call In Number Courtesy of Shaw: 866-797-9304/4155734)

Welcome **RMZ**

Action Items

Army
- Review LHAAP-17 ROD ARAR language changes

EPA
- Check to see if regulator concurrence on QA/QC procedures were obtained for SAP
- Forward perchlorate waste information onto Army
- Review LHAAP-17 ROD ARAR language changes

TCEQ
- Check to see if regulator concurrence on QA/QC procedures were obtained for SAP

Shaw
- Write up on the impacts from the elimination of ITS data on current sites
- Installation-wide work plan update/approval
- Responses to public comments
- Prepare an acronym list and distribute
- Re-request access for Paul Bruckwicki to portal.

Defense Environmental Restoration Program (DERP) PBC Update **PS**
- Document Status/Environmental Sites (Table)
- Basewide Ecological Risk Assessment – impact from elimination of disqualified ITS data
- Groundwater Treatment Plant
- LHAAP-18/24 FS alternative modification
- Groundwater and Surface Water Sampling Schedule Spreadsheet. Next sampling round.

DERP Total Environmental Restoration Contract Update **Army**
- LHAAP-37/67 RD Revised – Regulator Review
- Pilot Demonstration at LHAAP-37 Status

MMRP Update **Army**
- Public Meeting for Proposed Plan July 21st
- Tentative Schedule for ROD
- Update IRP Metals Issue

DNT Isomers

Review of Schedule	**Army**
IAP Availability	**AW**
USFWS Update	**RMZ/PB**

- Environmental Restoration Issues with Transfer Schedule Impact
- USFWS Comments on Documents

Adjourn

Shaw® Shaw Environmental, Inc.

Subject:	**Draft Final Minutes, Monthly Managers Meeting, Longhorn Army Ammunition Plant (LHAAP)**
Location of Meeting:	**Longhorn – Army Trailer**
Date of Meeting:	**July 21, 2011; 4:00 PM – 5:30 PM**

Meeting Participants:

BRAC:	Rose M. Zeiler
USACE-Tulsa:	Aaron Williams, John Lambert
USAEC-SA:	Marilyn Plitnik
Shaw:	By telephone: Praveen Srivastav, Susan Watson, Kay Everett
USEPA Region 6:	Steve Tzhone, Rich Mayer
TCEQ:	Fay Duke, Dale Vodak
USGS:	Kent Becher
USFWS:	Paul Bruckwicki

Welcome **Rose M. Zeiler**

Action Item Status
Army

- Review LHAAP-17 ROD ARAR language changes- *completed.*

EPA—Topics for Discussion

- Check to see if regulator concurrence on QA/QC procedures were obtained for SAP
- Forward perchlorate waste information on to Army
- Review LHAAP-17 ROD ARAR language changes - *completed.*

TCEQ

- Check to see if regulator concurrence on QA/QC procedures were obtained for SAP

Shaw

- Write up on the impacts from the elimination of ITS data on current sites – *memo was completed and submitted to Army; Fay asked about the sites impacted by this. Praveen indicated that sites impacted would be those that had use or manufacture of nitrotoluenes as part of their operations. There may be some impact to LHAAP-29 and possibly LHAAP-47 since there were limited samples remaining. LHAAP-17 was an area that accepted some explosive waste, but it would not be impacted because Shaw collected soil samples in 2010 that replace ITS data. The whole BERA would not be revised, just some tables and text to discuss any new samples collected to fill the data gap.*
- Installation-wide work plan update/approval – *uploaded to Portal; Susan indicated that the emerging contaminant perchlorate pushed changes to methodology and subsequently the SAP which was reviewed by stakeholders when it was determined the previous perchlorate method did not meet project needs and was not adequate. TCEQ stated that a formal submission of the SAP for regulatory review was required.*
- Responses to public comments – *discussion about submitting personalized responses to the public came from a request from the RAB; Army provided personal responses for past*

proposed plans but in this case will send each individual who commented a personal transmittal letter with a copy of the approved Responsiveness Summary from the respective ROD, since LHAAP-16 and LHAAP-29 have received a lot of similar comments.

- Prepare an acronym list and distribute – *an acronym list will be pulled out of a documents and passed out for RAB and Manager's Meetings*
- Re-request access for Paul Bruckwicki to portal – *completed and Paul indicated that he received the link for access to the portal.*

Defense Environmental Restoration Program (DERP) PBC Update Praveen Srivastav

Document Status/ Environmental Sites (Table)

- LHAAP-03: The soil removal work plan is on hold until the EE/CA and AM are completed.
- LHAAP-04: Response to comments for the Draft Final Completion Report for LHAAP-04 is in regulatory review. The preliminary draft FS is in Army review.
- LHAAP-16: ROD – Draft ROD is in progress.
- LHAAP-17: ROD – The Draft Final ROD is in progress.
- LHAAP-18/24: The RTCs for the DF FS are in regulatory review. EPA comments received 7/15/11 and TCEQ comments are pending. Fay indicated she would get comments in by Monday.
- LHAAP-29: Draft ROD is in progress.
- LHAAP-46: The RD is in regulatory review.
- LHAAP-47: Regulatory comments were resolved. The final is in preparation.
- LHAAP-50: The revised RD is in Army's review.
- LHAAP-58: The revised RD is in Army review.
- LHAAP-12 RA(O): TCEQ regulatory comments received. EPA comments are pending.

Basewide Ecological Risk Assessment—impact from elimination of ITS data is in Army's review. The whole BERA will not be revised. An errata can be provided that would provide the necessary changes. Some additional samples may need to be collected to fill in data gaps. The collection of samples would be relatively quick.

Groundwater Treatment Plant
The GWTP is functioning normally and treated 698,000 gallons in June and discharging to the burning ground (via sprinkler system). There were no major problems and all repairs to INF pond liner have been completed.

The sprinkler system is in operation with discharged water being sprinkled onto LHAAP-18/24 because there is no water in the creek. The crew will continue checking to confirm that there is no overland flow caused by the sprinklers.

LHAAP-18/24 FS Alternative Modification
Regarding the alternative modification, it was decided to leave the FS the way it is and that any changes to the system can be handled in the RD.

Groundwater and Surface Water Sampling Schedule Spreadsheet.
The sampling schedule was updated and distributed. There were no changes from last month.

DERP Total Environmental Restoration Contract Update **Army**
LHAAP-37/67 RD Revised– in Regulator Review

Pilot Demonstration at LHAAP-37 Status
Marilyn indicated that the pilot demonstration is on track.

MMRP Update
Army
Public Meeting for Proposed Plan July 21st
Information handouts for these sites were provided as handouts during the last RAB meeting. The MC Data Summary Report is in regulatory review and a public notice will be published as soon as the document is approved. They are planning for the public meeting to be July 21. They looked at the 1st or 3rd week for choices to hold the meeting.

Tentative Schedule for ROD
The ROD for the MMRP is on schedule.

Update IRP Metals
Nothing was discussed.

DNT Isomers
Steve asked Army to sample for the explosive isomers that were mentioned in a comment received during the LHAAP-29 public comment period indicating that this was to be considered a formal request from EPA. He said this was not the only site the group that originated the comment has contacted. He thinks the community may be energetic regarding this issue. Steve suggested some verbiage to use in the responsiveness summary and a discussion regarding the risk and the 5 year review periods followed. Fay said there is no regulatory driver and no promulgated concentration, and that there is no published toxicity on the isomers. Rose stated that there are significant differences between Longhorn and Badger AAP, where this issue was initially brought up. She said that Longhorn produced TNT for only about 3-4 years over 65 years ago at the end of the war effort, the TNT plume is shallow, small and contained on site. A discussion regarding the isomer issue, risk or non-risk, the 5-year evaluations followed, and possible emerging policy followed.

Review of Schedule **Army**
Steve asked that Army send in a revised scheduled accompanied by a letter of explanation to EPA (Mr. Sanchez) regarding which RODs and RDs would be finalized this FY.

IAP Availability
Aaron indicated he sent the IAP and the IAP will be part of the Administrative Record.

USFWS Update
Environmental Restoration Issues with Transfer Schedule Impact. *None.*
USFWS Comments on Documents. *None.*

Meeting Adjourned
Next monthly manager's meeting is a teleconference; time and date is tentative. The next RAB is tentatively set for October because of the Labor Day holiday weekend

Acronyms

AM	*Action Memorandum*
DNT	*Dinitrotoluene*
EE/CA	*Engineering Evaluation/Cost Analysis*
FS	*Feasibility Study*
GWTP	*Groundwater Treatment Plant*
IAP	*Installation Action Program*
IRP	*Installation Restoration Program*
MC	*Munitions Constituents*
MMRP	*Military Munitions*
QA/QC	*Quality Assurance/Quality Control*
RA(O)	*Remedial Action Operations*
RD	*Remedial Design*
ROD	*Record of Decision*
RTC	*Response to Comments*
SAP	*Sampling Analysis Plan*
USFWS	*US Fish and Wildlife Service*

Action Items

EPA—Topics for Discussion

- Check to see if regulator concurrence on QA/QC procedures were obtained for SAP
- Forward perchlorate waste information on to Army

TCEQ

- Check to see if regulator concurrence on QA/QC procedures were obtained for SAP

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Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
July 21, 2011

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	**Remarks**
1	Draft Final Soil Removal Work Plan, LHAAP-03									On hold until EE/CA and AM are completed.	
2	Preliminary Draft EE/CA, LHAAP-03	06/30/11	x							In preparation	
3	Draft Final Completion Report, LHAAP-04	05/24/10	x	x	Final	7/15/11	x	x	In progress	Regulatory comments received. RTCs in regulatory review	
4	Preliminary Draft FS, LHAAP-04	2/03/11	x		Draft	7/15/11	x	x		In Army review	
5	Draft ROD, LHAAP-16	06/21/11	x	x	Draft Final	7/30/11	x	x	In progress		
6	Draft Final Record of Decision, LHAAP-17	1/26/11	x	x	Final	07/30/11	x	x	In progress		
7	Draft (Final) Feasibility Study, LHAAP-18/24	5/13/09	x	x	Draft Final	07/30/11	x	x	In progress	RTCs in regulatory review. EPA comments received 7/15/11. TCEQ comments pending.	
8	Draft ROD, LHAAP-29	6/27/11	x		Draft	8/15/11	x	x	In progress		

Shaw® Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
July 21, 2011

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	**Remarks**
9	Draft Remedial Design, LHAAP-46	05/31/11	x	x						In regulatory review	
10	Revised Draft Final Feasibility Study, LHAAP-47	10/27/10	x		Revised Draft Final	7/15/11	x	x		Regulatory comments resolved. Final in preparation.	
11	Draft Remedial Design, LHAAP-50	6/21/11	x							Revised RD in Army's review	
12	Draft Remedial Design, LHAAP-58	7/15/11	x							Revised RD in Army's review	
13	Draft Final LHAAP-12 RAO Report	2/10/11	x	x	Final	6/30/11	x	x	In progress	TCEQ comments received. EPA comments pending	

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MILITARY MUNITIONS RESPONSE PROGRAM PROPOSED PLAN

PUBLIC MEETING

JULY 21, 2011

6:00 P.M.

****

IN ATTENDANCE:

Ms. Agnes Mayila
Shaw Environmental & Infrastructure Group

Dr. Rose M. Zeiler
United States Army
Site Manager, Long Horn Army Ammunitions Plant

Mr. Kent Belcher, USGS
Ms. Fay Duke, TCEQ
Mr. John Lambert, USACE Tulsa
Mr. Richard LaTourneau, RAB
Mr. Rich Mayer, USEPA
Ms. Marilyn Plitnik, USAEC
Mr. Stephen Tzhone, EPA
Mr. Tom Walker, RAB
Mr. Aaron Williams, USACE Tulsa

P R O C E E D I N G S

July 21, 2011

6:04 p.m.

DR. ZEILER: Good evening everyone. Thank you for coming. This is a public meeting for our two MMRP sites also known as Sites 27 and 54. Their MMRP titles are LHAAP-001-R for the South Test Area/Bomb Test Area...

MS. MAYILA: That's the one.

DR. ZEILER: And LHAAP-R-003 for the Signal Test Area right there. I think that Ms. Shaw has a presentation for you this evening, and I think you've all gotten your handouts; so, I'm going to hand it over to Agnes to start. And, please, if you have questions during her presentation, just raise your hand or just speak out. I'm sure she'll be happy to answer.

Make sure you sign in on the sheet. This is your opportunity to make public comments and have your comments written into the record. So, you can either write them or state them publicly.

This is Agnes Mayila with Shaw Environmental and she's going to be giving the presentation.

MS. MAYILA: Thank you, Rose. As Rose said, we are going to be discussing on two MMRP sites also known as Munitions Response Sites. It's the South Test Area, LHAAP-001-R, and the Ground Signal Test area also known as LHAAP-003-R.

Yes, turn off the lights. Maybe you can see.

Why are we here? The purpose of this public meeting is to present an overview of the proposed plan for the munitions response sites, the South Test Area, LHAAP-001-R, and the Ground Signal Test Area, LHAAP-003-R. We are also presenting the prepared recommendation for the two sites. We are here to answer your questions and seek your comments about the plan; and if you want to submit your comments later to provide new information on how you -- you can -- you can comment and put in your comments.

If you have -- if you have questions during the presentation, please state your name first for the court reporter and then ask your question. And if you can speak loud, she -- she has asked that you please speak loud so she can hear and record.

Why is the proposed plan important? It's because it's part of the regular CERCLA process for the Military Munitions Response Program, and it's consistent with the CERCLA process. It also presents the recommendation for the two sites. This recommendation has been reviewed and accepted by the Army, the USEPA, and the TCEQ. It also provides an opportunity for you to comment before we finalize the recommendation in the record of decision.

What is the CERCLA process? For the clean-up sites, the National Priority List sites, usually, it begins with a preliminary assessment and site investigation for the hazardous toxic and radioactive sites. And these two sites, the MMRP sites, they are co-located with LHAAP-27 and LHAAP-54 which are hazardous toxic and radioactive waste sites.

The preliminary assessment and site investigation was done and LHAAP was placed on the NPL in August of 1990. So the MMRP equivalent is the site inspection which was done in 2002 to 2004. Then following the PA/SI is the remedial investigation and feasibility study, which for the two sites that are co-located with these MMRP sites was conducted between 1986 and 1996; and then equivalent for the MMRP sites is the EE/CA, which included the streamlined risk assessment for munitions and explosives of concern, which was done in 2007.

Following the remedial investigation and feasibility study for the HTRW sites, there was a proposed plan and a public comment period in 1997 for those two HTRW sites; and following the public comment and the proposed plan, a record of decision for no further action was made for the two sites: LHAAP-27 and 54.

And for the MRS sites, we are right here. After we finished the site inspection and did the EE/CA, we are right here. And that's why we're here today, to be able to present the proposed plan and to have a meeting where you can give us your comments.

What's the location of these two sites? The South Test Area is located on the southern portion of Long Horn and it's approximately 79 acres. The Ground Signal Test Area is located on the southeastern portion and it's approximately 80 acres. This is where this LHAAP-001-R is co-located with LHAAP-27, and the Ground Signal Test Area is co-located with LHAAP-54.

Now, how did we get here? For the South Test Area, it was constructed in 1954 and was used for testing photoflash bombs until 1956, and was used for demilitarization within pits that were excavated near the test pad. During the early 1960s, leaking production items may have been demilitarized by detonation in the area. It is also reported that leaking white phosphorus was disposed in the area although there has been no primary source of documentation found.

Since 1960, the area has been very -- has been inactive. And for the Ground Test Signal Area, starting in 1963, it was used for aerial and on-ground testing and destruction of devices, which several devices that included smoke wedges, infared flares, mortar shells, button bombs, and different types of explosive simulators.

It was used intermittently over a 20-year period for testing and burn-out of rocket motors. And from 1988 through 1991, it was used for burn-out of rocket motors in Pershing missiles in accordance with a treaty that was between the U.S. and the former Soviet Union. Occasionally, leaking white phosphorus munitions were also burned at the site.

What are the investigations that have been conducted at these two sites? As stated earlier, they are co-located with LHAAP-27 and 54, and between 1982 and 1996 there were several investigations that were conducted to determine the nature and extent of contamination at the two HTRW sites. Soil, groundwater, surface water and sediment were -- data was collected from those media, and based on the results of the investigation and the risk assessment conducted for those sites, a no further action record of decision under CERCLA were signed with concurrence in January of 1998 for the two HTRW sites.

Soon after, perchlorate was identified as an emerging contaminant and data was collected for soil and ground water after the ROD was signed for these sites. Then from 2002 to 2007, investigations relating to the MMRP were conducted at Long Horn, and as a result of those investigations, the two sites, the South Test Area and the Ground Signal Test Area, were designated Munitions Response Sites. And the investigations were conducted to determine the presence or absence of the munitions and explosives of concern, or munitions constituents, which included white phosphorus and perchlorate.

In 2009, the USEPA collected additional ground water samples from the monitoring wells that are existing to confirm ground water conditions at the two Munitions Response Sites. At the same time, the U.S. Army collected split samples from both sites.

These -- this is the South Test Area, and all the points that are here are the sampling locations, areas where data has been collected from different media. And that's the Ground Signal Test Area and the different locations where samples have been collected.

What were the investigation findings for the South Test Area also known as the LHAAP-001-R?

Investigations verified that there was presence of munitions and explosives of concern at the site and recommended surface and subsurface removal of the MEC items with land use controls in order to reduce the risk within the site. Analytical results indicated that there was no white phosphorus in any of the soil samples that were collected from the site, and there was no indication of the presence of munitions constituents in any pre- or post-detonation samples.

Perchlorate was initially detected in two wells with a maximum concentration that was below the medium specific concentration for industrial use which is a value of 72 micrograms per liter. The initial detections of perchlorate were not confirmed in subsequent sampling.

In 2009, the USEPA conducted ground water sampling and perchlorate was detected in three wells with one of the three wells above the ground water industrial value of 72 micrograms per liter. It was at a concentration of 76 micrograms per liter. The USEPA detection was an estimate from a diluted sample.

The U.S. Army had collected split samples at the same time that the USEPA collected samples from the site and perchlorate was detected in two wells for the Army split samples with a maximum concentration that was below the ground water industrial value of 72 micrograms per liter. The perchlorate results from the Army were consistent with historical results at the site.

What were the investigation findings for LHAAP-003-R? Again, the investigations verified that MEC was present and recommended surface clearance of MEC items with land use control to reduce the risks within the site. Analytical results indicated that no white phosphorus was identified in any soil samples and there was no indication of presence of munitions constituents in any pre- or post-detonation samples.

During all sampling events prior to 2009, perchlorate was either not detected or it was at a maximum concentration that was below the medium specific concentration for the ground water industrial value of 72 micrograms per liter. And for both the USEPA and the U.S. Army results, perchlorate was detected in only one well and at a concentration that was well below the industrial value of 72 micrograms per liter.

Were any actions taken after these investigations? Yes. Between August and November of 2008, a MEC removal action was conducted. We're talking about LHAAP-001-R. Surface clearance of approximately 65 acres and subsurface removal to a depth of detection in approximately 14 acres, especially in the open burn, open detonation area, was performed and a total of 384 munitions and explosives of concern or materials that potentially present explosive hazards were removed, 14 inert items and a total of about approximately 22,000 pounds of munitions debris, a total of 1900 pounds of cultural debris. And then land use controls were developed that included restrictions against intrusive activities which includes digging, placing signs at the perimeter of the site, educating future refuge visitors, staff, and volunteers.

The locations at this South Test Area are shown by the little circles where items were removed. And some of the items that -- a picture of the items -- some of the items that were removed are shown on the inset.

Was there any action taken at LHAAP-003-R? About the same time that action took place on -- on the other site, munitions and explosives of concern removal action was conducted and there was surface clearance at the site. A total of 12 munition and explosives of concern and materials potentially presenting explosive hazards were located and destroyed, one inert item was located and destroyed, and a total of about 6,900 pounds of munitions debris were removed and about 6,000 pounds of cultural debris was removed. Land use controls were also developed for the site including restrictions against intrusive activities including digging, signage at the perimeter of the sites, education programs for refuge visitors, staff, and volunteers.

Again, the marked areas is where items were removed, and an inset of the picture of the items removed.

Now, what are risk assessments? The data that is collected at the site is used to evaluate potential risks to receptors. Risks to human health or the environment outside of the acceptable range are usually the drivers for remedial action. Cancer risk is expressed as a probability. Non-cancer hazard is expressed at the hazard index. And if the risks are acceptable, the proposed plan is for no further action; but if the risk is not acceptable, then it drives the sites to remedial action.

Exposure depends on current and future land and ground water use scenarios. Because Long Horn is a national wildlife refuge, the scenario is for an industrial recreational use, and human receptors and hypothetical future maintenance workers.

The risks associated with MEC items are categorized into three classes: MEC factors; that is, the type of MEC, the sensitivity of the MEC, the quantity, the depth of which the MEC is located, the site characteristics factors, the accessibility of the site, stability of the areas where the MEC items are located, and the human factors. That's the population density and the population activities that will be taking place at the site.

Is there human health risk at LHAAP-001-R? Because there was no white phosphorus identified at detectable concentrations in soil samples that were collected from the site and there was no indication of the presence of munitions constituents in any pre- or post-detonation samples, there is no risk associated with white phosphorus. And although the munitions constituents data summary confirms the determination of no risk to human health or the environment in soils as identified in the Engineering Evaluation and Cost Analysis, additional ground water sampling conducted by the USEPA in the year 2009 resulted in some uncertainty with regard to munitions constituents in ground water. Both metals and perchlorate were detected above screening levels, although the single exceedance of the perchlorate ground water in one well was not confirmed by the U.S. Army's split sample result.

The streamlined risk evaluation indicated for LHAAP-001-R that there was moderate MEC risk to human health. However, the surface MEC removal action reduced the risk to the future land user. The subsurface removal provided an effective solution for reducing risk of exposure by reducing the potential for any direct contact with MEC or materials potentially presenting explosive hazard.

And the LUCs that were identified, designed, and implemented for the site promote ongoing protection of human safety against potential explosive hazards that might have remained in the subsurface.

Is there human health risk at LHAAP-003-R? Because, again, there was no white phosphorus identified at detectable concentrations in any soil samples and there was no indication of the presence of munitions of -- munitions constituents in any pre- or post-detonation samples, there's no risk associated with white phosphorus. And in all the sampling events, perchlorate was detected at concentrations well below the ground water industrial value of 72 micrograms per liter; therefore, there was no need to evaluate risk associated with perchlorate at the site.

The streamlined risk assessment indicated there was low MEC risk to human health. The surface removal -- the surface MEC removal action located and removed MEC items thereby reducing the risk to future land users. The LUCs that were identified, designed, and implemented for the site are promoting ongoing protection of human safety against potential explosive hazards that might have remained in the subsurface.

Is there ecological risk at both sites, LHAAP-001-R, LHAAP-003-R? No. The BERA concluded that there was no unacceptable risk in the Low Impact Sub-Area where these two sites are located. And summary results from the BERA indicated perchlorate was not selected as a final constituent of potential ecological concern because all estimated receptor ecological effects quotients were less than one. There was no evidence of a perchlorate source area. There were no white phosphorus or explosives identified in any soil samples. There was no indication of the presence of explosives in any pre- or post-detonation samples confirming the determination of no risk to the environment of LHAAP-001-R and LHAAP-003-R.

What are the recommendations? In addition to the land use controls already in place as a result of the 2008 MEC removal action, limited ground water monitoring for perchlorate is proposed for LHAAP-001-R and LHAAP-003-R. The purpose of the additional monitoring is to confirm perchlorate levels in ground water are below the ground water industrial value of 72 micrograms per liter.

Furthermore, implementation, maintenance, inspection, reporting, and enforcement of the LUCs will continue to promote the ongoing protection of human safety against explosive hazards that might remain at the site in the subsurface. Because there are no unacceptable risks and ground water monitoring and the appropriate LUCs have been implemented, no remediation alternatives or Remedial Action Objectives are required.

If after three rounds of ground water sampling at LHAAP-001-R and one round of ground water sampling at LHAAP-003-R, the results that are evaluated on or before the first five-year review indicate detections at levels below the ground water industrial value of 72 -- of 72 micrograms per liter for perchlorate, groundwater monitoring will cease and the wells will be plugged and abandoned.

Why are we here? Why are you here? Because your opinion and comments will help ensure that all factors have been considered in making the recommendation.

How do you comment? The proposed plan and comment forms are available in the proposed plan for the two sites in the administrative record at the Marshall

Public Library with the address below and the business hours below, and you can submit a written comment and send it to the address -- to Dr. Rose M. Zeiler who is the site manager for Long Horn Army Ammunition Plant at the shown address and e-mail. All comments must be post-marked by August 13, 2011. I will leave this at the end so you can write it down if you need to.

The public comment period will run through August 13, 2011, and a transcript of tonight's meeting will be posted in the administrative record at Marshall Public Library. Significant public comments will be summarized and addressed as part of the responsiveness summary in the record of decision.

If you have questions or comments, please state your name first for the court reporter and we'll be glad to answer your questions.

DR. ZEILER: I know you feel like you've been through this before, some of you have, you went through that whole eco thing with public comments, but this is wrapping it up finally so the EPA can sign the document, too. Because the eco removal action, that action area, that decision document was signed by Army --

THE REPORTER: Can you speak up, please? I'm sorry.

DR. ZEILER: Okay. I'm sorry.

The former action was considered an interim action, and the decision document for that interim action was signed only by Army because it was interim. And so this record of decision is the final decision, the one that EPA co-signs with the Army. That's why we're back here hearing the same thing, but this is the final wrap-up.

MR. LATOURNEAU: I have a question.

DR. ZEILER: Yes, sir.

MR. LATOURNEAU: Richard LaTourneau. Is the -- as far as we know and what's been heard from either the Army or Shaw or the regulatory agencies, is the Department of Interior in agreement with this recommendation?

DR. ZEILER: I'll have to answer that question.

MR. LATOURNEAU: Okay.

DR. ZEILER: They have, and it's my understanding that they are. And, in fact, we had several meetings when we scoped this work and got their input. And their input, I actually have a letter stating that this use is consistent with the Big Six activities that Fish and Wildlife allows at the refuge. And the Big Six Activities are all non-intrusive activities. And they include -- I can't name all of them, but they're bird-watching or -- and wildlife watching, educational programs. There might be hunting, I think is one of them. There's like --

MS. MAYILA: Yes.

DR. ZEILER: -- six big recommendations. I have a letter.

MR. LATOURNEAU: I'm just really trying to discern for myself whether -- unlike some other areas that recommendations were contested, and they were vocally contested, has there been any local contesting of this -- this plan?

DR. ZEILER: Well, I want to make my remarks first and then I'll answer that question. We're here talking about a CERCLA environmental process and not a transfer one, and your question is really a transfer one but I'm going to answer it anyway. Yes. I've never heard any disagreement at all with this plan. But again, that's a transfer question, not an environmental one, so...

MR. LATOURNEAU: My last question would be after this process is accepted and signed off on, and in the future and in -- in five-year intervals, I understand that there will be some re-testing -- or there will be some monitoring of the plans.

Did the land use restrictions -- is there any anticipation that land use restrictions will change in the future?

DR. ZEILER: Any time we do a five-year review, land use restrictions are considered a remedy, too. They have to be re-evaluated at every five-year interval for protectiveness. So, yes, they'll be evaluated. If they are found not to be protective or in any way deficient, then either remedial action, corrective action. But they have to -- it has to be addressed by review.

MR. LATOURNEAU: Under the current plan, as you understand it, activities like -- just for instance -- bird-watching and hunting, which -- which includes human trespass in this area, they would be permitted?

DR. ZEILER: Oh, yeah. That -- and when we first scoped the work under the MMRP, that program, you're required to do what are called technical planning --

MR. LAMBERT: Technical process planning.

DR. ZEILER: We had two or three of them. The first one was at Fort Worth District because that's who was implementing the work up here, and Fish and Wildlife attended those. They were part of every planning meeting that we had on this. They traveled to

Fort Worth for that one.

THE REPORTER: I'm sorry?

DR. ZEILER: They traveled to Fort Worth for that one, and there were two. I -- I know for sure one following that. I think there were three all together, but it's been a long time. They were noted as a stakeholder through the whole process. And, in fact, we coordinated with them on the proposed future use of those sites so that we have an idea of what the rest of them might be and the Big Six non-intrusive activities were -- the letter I have from Mark on the activities that would be permitted in this site.

MR. LATOURNEAU: Okay. Thank you.

MR. TZHONE: Steve Tzhone with EPA. The LUCs and the Big Six activities, and also the five-year review, is also provided under the recommendations. It talks about what the LUC restrictions are, and it talks about what the Big Six activities that -- that are allowed are, and also it says that five-year reviews will be performed to document that the LUCs remain protective, and that's a process that we go through.

DR. ZEILER: Part of those LUCs include education programs, and the two educational programs were an outcome of this effort which have already been transmitted to Fish and Wildlife, is a video, a safety video, that can be presented to any refuge user, visitor, and it gives a -- like a lesson in how to identify what to do if you come upon something you think might be an explosive ammunition. And then the second thing is a pamphlet that does the same thing, essentially, that the video does except you can kind of pass it out. Those are the two education controls.

Any questions?

Richard, those are good questions.

Anything else? No. Okay.

Well, if you want to continue looking or browsing at these or asking questions generally of this, that's just fine. We'll all be here.

And I think, Agnes, that concludes your formal presentation, right?

MS. MAYILA: Yes.

DR. ZEILER: Okay. She'll be here --

MS. MAYILA: Yeah. The posters are put there for more information. They summarize basically what we have put in the proposed plan in a nutshell; so, just kind of look through those as well.

DR. ZEILER: And that's the same thing that they have, right?

MS. MAYILA: Yes.

DR. ZEILER: Is it the same?

MS. MAYILA: Yes.
DR. ZEILER: Okay. We handed out something similar like this -- or passed out at the last meeting --
MS. MAYILA: Yes.
DR. ZEILER: -- too.
And if you guys want to see the video at the next meeting on safety, we can present that.
THE REPORTER: I can't -- excuse me.
MS. MAYILA: Rose, can you speak up?
DR. ZEILER: I'm sorry.
The video -- the next safety video for Long Horn is actually posted on the ESOH. That's the Army's website, Environmental, Safety, and Occupational Health website as one of -- because it was a very good video. So we had a good contractor presenting that -- or making that. Whoever they got to make the video did a great job; so, just kind of wanted to pass it around.
In fact, didn't somebody from Hawaii just ask for a copy of that?
MR. LAMBERT: Yeah. Yeah, they did.
DR. ZEILER: You can either see it on that website or I can bring it to the next RAB and show it to everybody.
Okay. Well, we can browse around now.

MS. MAYILA: And there is water at the back.

* * * * *

DR. ZEILER: This public meeting for the two MMRP sites is over.

{Public meeting adjourned at 6:41 p.m.}

COUNTY OF HARRISON
STATE OF TEXAS

REPORTER'S CERTIFICATION

I, Jill E. McFadden, Certified Shorthand Reporter in and for the State of Texas, hereby certify that this transcript is a true record of the proceedings.

Subscribed and sworn to on this the 10th day of August, 2011.

JILL E. McFADDEN, CSR 3392
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